For Suzanne

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Decaan	Prof. dr. Marc Boone, Universiteit Gent
Rector	Prof. dr. Anne De Paepe, Universiteit Gent

Nederlandse vertaling:
Potten, persen, personen en grond. De rol van overzeese export en lokale consumptie in de ontwikkeling van de wijn- en olijfteelt in centraal Adriatisch Italië (250 v.C.-200 n.C.)

Traduzione italiana:
Contenitori, torchi, persone e terra. Il ruolo dell'esportazione oltremare e del consumo locale nello sviluppo della viticoltura e dell'oleocoltura nell'Italia centrale adriatica (250 a.C.-200 d.C.)

Kaftinformatie: Monte Torto di Osimo, Roman olive press (photo author)

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UNIVERSITEIT GENT

Faculteit Letteren & Wijsbegeerte

Dimitri Van Limbergen

Pots, presses, people and land

The role of overseas export and local consumption demand in the development of viticulture and oleoculture in central Adriatic Italy (250 BC-AD 200)

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Il ruolo dell'esportazione oltremare e del consumo locale nello sviluppo della viticoltura e dell'oleocoltura nell'Italia centrale adriatica (250 a.C-200 d.C.)

Il Direttore di tesi, Prof.ssa Maria Letizia Gualandi
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Acknowledgements

The roots of this work go back all the way to an encounter I had with Frank Vermeulen at the beginning of 2007. In his capacity as a professor of Roman archaeology at Ghent University, I had written him to express my desire for embarking on a PhD endeavour in Roman economics and agriculture. Despite him not knowing me – I had obtained my Master's degree a few years earlier at the Catholic University of Leuven – he kindly responded my email and agreed to meet at his office in Ghent, where we could have an introductory chat and talk about some potential lines of research. As I had written a master thesis on late antique wine and oil production, he eventually proposed that I could work on similar topics for the central Adriatic area of Italy, where he had an ongoing survey- and excavation project in one of the river valleys of central Marche. Not knowing what I was getting myself into, I enthusiastically said yes and thanked him for his trust.

Thus began my long quest for funding opportunities. This journey initially started in Ghent with an unsuccessful application for a FWO doctoral scholarship, but quickly moved towards Italy, where I obtained a one-year research grant at the Collegio dei Fiamminghi in Bologna. Following this experience, I was able to combine a few short-term jobs in Belgium with two study stays at the Academia Belgica in Rome, funded in turn by said institute and by the Belgian Historical Institute in Rome (BHIR). I owe immense gratitude to all the people that were responsible for granting me these awards, as they gave me the chance to re-enter – and to hang onto – the world of academic archaeology and to quietly get a firmer grip with the subject of Roman viticulture and oleoculture under the best imaginable conditions. Ultimately, this led to the obtainment of a doctoral research grant at Pisa University at the beginning of 2011, which turned into a Joint Doctorate with Ghent University from 2012 onwards.

Throughout my time of grant- and job-hopping, Frank Vermeulen never ceased to support me and I can sincerely say that without his efforts this thesis would not have seen the light of day. His continuing belief in my capacities stimulated me more than once to keep going – even if sometimes I was ready to throw in the towel – and I am thankful that

he ultimately decided to become the co-advisor of my thesis. Besides offering some invaluable help on the redaction of this work, he also gave me the time and space to satisfyingly finish it in Ghent, for which I am grateful.

Several persons have been important during my stay in Pisa. Lucia Faedo repeatedly helped me find my way into the administrative tangles of the department. Maria Letizia Gualandi kindly accepted to be my advisor and I thank her for the granted confidence and freedom that allowed me to conduct my research in all liberty and independency. Warm thanks also go to Marinella Pasquinucci, who first introduced me to the academic environment of Pisa University and whose door was always open for a supportive talk, or for brainstorming on the struggles of my PhD, whether or not on the occasion of a nice lunch at Rossini's. I am also indebted to Simonetta Menchelli for her expertise and collegiality, and for her willingness to read some of the most important parts of my thesis with great enthusiasm and a critical eye.

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Completing this PhD has proven to be a work of many years. In the process, I have lived or stayed in four countries, eight cities and as many – if not more – rooms, apartments and houses. I have visited innumerable libraries and institutions, museums, monuments and archaeological sites, as well as bars and restaurants. In one way or the other, all these places and the people working in them have made this journey into the fond and rewarding experience that it has ultimately become. Unsurprisingly, however, this instability has also had certain effects on my personal life and keeping in touch with family and friends was more than once a challenging task. Unfortunately, life also literally 'goes on' while doing a PhD and I have lost both my father and my stepfather, and all of my grandparents. They may not have been able to witness the completion of this work, but they all have made me into the person I am today, so I think I can say that at least their 'work' has not been lost.

But amidst all this vagabonding, I have also met many wonderful people who have become the closest of friends. Jonas – who I first met during my stay at the Collegio in Bologna – turned out to be a great partner in crime and someone who was always there

when moments of all kinds of difficulty arose. I can only hope that I can do the same for him. Yann, who introduced me to Italy and its many absurdities, was a loyal accomplice on numerous nocturnal chat sessions in Bologna's finest bars. François, our "Neapolitan Belgian", was always prepared to listen and to give advice during one of our many cappuccinos or lunches at Maurizio's. Pamela, who I first became acquainted with in her disguise as the librarian of the Academia Belgica in Rome, quickly revealed herself as a caring and unconditional friend, whose Calabrian stubbornness proved more than once fundamental. And finally Charles, whose sporadic interventions over the years as a tower of strength have evolved into what I hope is a blossoming friendship.

The "Academia Belgica group" – as it is commonly referred to – holds a special place in my heart too. The list of names is long, but some deserve to be mentioned in person: Delphine, Peter, Rob, Bruno, Sadi, Laurence, Bastien, Gabriel, and Emma; all have in their own personal and unique way enriched the road towards this moment, and I profoundly hope that our paths will keep crossing in the future. I would also like to express my gratitude to the staff members of the Academia – in particular Rocco, Pina, Jerope, Barbara, Marco and Dianne – who have made my stays in Rome both memorable and heart-warming. A final word of thanks also goes to some of my – new and old – colleagues at Ghent University, who immediately made me feel at home and made those final months of thesis tweaking all the more pleasant.

One of the reasons for this work lying in front of you is undoubtedly my mother, who always tried to give me the best possible home and education, even if the circumstances were often not ideal. Despite the fact that I was away from Belgium for most of the time in the last couple of years, her love and support were a constant inspiration.

Last, but certainly not least, I feel enormously fortunate to have encountered my girlfriend Jessy during the last year of my doctorate. Being the strong woman that she is, she literally moved my life in a better direction, both personally and professionally. I look very much forward to spending time with her without the turmoil of finishing a PhD.

Abstract

The link between demography and agriculture in economies preceding the industrialisation era is a widely acknowledged feature of historical studies focusing on 13th-19th century Europe. But despite Bruce W. Frier's almost desperate call for the deeper integration of population issues in Roman scholarship, a recent contribution by Neville Morley could do little more but to address the general lack thereof in socio-economic studies on classical antiquity. However, the work of Walter Scheidel is a good reminder of how such constraints necessarily must have cast their shadow on the agro-economic developments in many parts of the Roman Empire.

Despite this notion, interpretative models of Italy's economy in the Roman period – and in particular those concerning the Italian wine and oil industry – have to a great extent stressed the importance of the volumes of food transported over longer distances; i.e. on extra-regional or even extra-Italian levels. As a result of this rather one-sided point of view, archaeological proxy indicators for the economic performance of the Italian wine and oil sector – in the first place amphorae and press installations – have been studied almost exclusively from said perspective. In contrast, there has been nearly no attention for how the developments in these two categories of archaeological evidence might relate to local events, such as population dynamics and their associated food resources.

This thesis set out to explore these issues for the central Adriatic area of Italy in the Late Republic and the Early/High Empire (ca. 250 BC-AD 200). The phraseology 'central Adriatic' is here used to delineate an area of ca. 11,600 km² that comprises the Marche region and the northern part of Abruzzo (Abruzzo Teramano). It is situated between the Apennine hills and the central Adriatic coast and is characterised by a comb-shaped geomorphologic structure in the form of a series of parallel river valleys descending towards the sea. In Roman times, this area mainly coincided with the fifth administrative district of emperor Augustus' *Provincia Italia* (*Picenum*), while the most northern section was part of the sixth *Regio* (*Ager Gallicus*).

In order to tackle this topic, I first examined two of the main proxy indicators for commercial wine and oil production – amphorae (Chapter 1) and presses (Chapter 2) – in order to see which patterns emerged. Next, an attempt was made to reconstruct urban

(and rural) demographic patterns through time on the basis of the available structural remains (Chapter 3). With said population figures in mind, both a consumption (Chapter 4) and a land requirement model (Chapter 5) were then outlined through the use of ancient textual accounts and comparative evidence from pre-industrial central Adriatic Italy. Finally, these models were then compared with the size of the study area in order to assess what portion of the local agricultural produce in cereals, wine and olive oil was consumed by the country- and urban dwellers in the region, and to which extent possible surpluses could be absorbed by consumption groups further afield over time.

The model that was built as such over the course of five chapters was thus set-up from one point of view; i.e. with the intention of creating an interpretative framework for evaluating the possible impact of local demographic conditions on the evolution of the wine and oil business in central Adriatic Italy between Late Republican and Early/High Imperial times. The main question was hereby whether regional demographic developments had anything to do with the diminishing exports of wine in amphorae from the Augustan period onwards, as well with the minimal involvement of the area in the Mediterranean oil trade in the entire studied time period. This model was essentially constructed through an in-depth reading of the archaeological evidence regarding wine/oil production and transport; and by positioning the changes in this evidence against a theoretical population/land model inspired by the archaeological record.

On the condition that all these calculations with regard to population dynamics, food intakes and agricultural productivity have provided us with a useful scale with which to explore the possible effects of lower and higher population levels on the wine and oil trade in this area, it would seem that the conditions for the prosperity of the latter were more favourable in the Late Republican period than in the Early/High Imperial one. Indeed, there is a high degree of probability that between 40 and 85% of all land in the study area – i.e. all aggregate land and not actual agricultural land – was not needed for local food requirements in the former period. On the other hand, if local land requirements – and particular local cereal requirements – rose as significantly as has been implied, and if this increase was mainly met by local production, the effects would have been as such that the amount of land available for export-oriented wine and oil production was reduced until 67 to 5% of the total territory when population- and consumption levels both reached their theoretical peak in the High Imperial period.

In other words, in the first case, Roman farmers found themselves in a very favourable position with ample space for expanding and intensifying vine plantations in the wider Adriatic coastal area by selecting good viticultural lands from which maximum profits could be obtained. As such, these circumstances would have allowed for the area to participate to the full in the wider phenomenon of extra-regional wine commerce in the Late Republican period. It is this on-going intensification and expansion process that we see so well reflected in the amphorae evidence discussed in the first chapter. In the second case, however, matters were rather different, with population pressure in town

and country rendering it unlikely that in the 1st and 2nd century AD large amounts of local wine and oil could be exported on an annual basis towards external markets. This is not to say that such developments would have actually stopped the existing commercial wine and oil trade, but under such circumstances the scale of this trade was bound to be much more modest, with a major portion of the surpluses being traded towards the towns in the region.

Taking into account some of the patterns that have been examined in chapters 1 and 2, such a process would actually bode well with an increasing co-existence of amphorae and barrels – with the latter eventually becoming the only carriers for wine (and oil?) in the central Adriatic area – and with the main chronological trends individuated in the press evidence; i.e. continuing wine and oil production on a substantial scale in the 1st-2nd century AD. Indeed, the 1st century AD numeral peak in the latter evidence – and the only minimal decrease in numbers in the following century – seemingly portends the ongoing vitality of a business, whose manufacturing process became more visible in the archaeological record than its distribution modii because of a major shift in market focus. This seems especially the case for olive oil production and containerization. In fact, while the available amphora evidence indicates minimal involvement of the study area in the overseas oil trade in the first two centuries of the Common Era – and even less so in the preceding centuries – about half of the product-identified presses in the area turned out to have been producing olive oil in the first place. If we take the theoretical oil needs by the urban population – in particular those proposed for the Early/High Imperial period, which could have been as high as two million litres – as a major incentive for their existence, much of this oil probably circulated in perishable skin containers, and not in amphorae.

Finally, the constructed model also stresses how we should be open to interpreting the evolution of commercial viticulture and oleoculture in the area not as an isolated phenomenon, but rather as part of a much wider agrarian system, whose evolution was determined by local events in general, and by its capacity to sustain the local population in particular, especially with regard to cereal requirements.

The main aim of this thesis has been to stimulate the debate on the fundamental modifications that shaped central Italian agriculture in the period under consideration. Admittedly, the speculative component of the story line that has been set-out is considerable, but it was never the intention to claim historical exactitude. Instead, I have argued that the cross-fertilisation between the amphora evidence, the press remains and the reconstructed population/land model implies that at least 'something' happened in the course of the 1st-2nd century AD that significantly reshaped the central Adriatic wine and oil sector; and that said 'something' may somehow be linked to developments in intra-regional demography and food supply, rather than merely to the disappearance of the provincial markets.

This thesis was concluded with an epilogue, in which I have suggested that those changes may have comprised an increase in the distribution of *arbustum* (a typical extensive way of cultivating the vine by the Romans in central-northern Italy) and low-density olive orchards in the area in the Early/High Imperial period.

List of Abbreviations

AAAd	*Antichità Altoadriatiche*
AAlpi	*Archeologia delle Alpi*
AC	*Archeologia Classica*
ACalc	*Archeologia e Calcolatori*
Acme	*Annali della Facoltà di Lettere e Filosofia dell'Università degli Studi di Milano*
ActaArchHung	*Acta Archeologica Academiae Scientiarum Hungaricae*
AEspA	*Archivo Español de Arqueología*
AgrHist	*Agricultural History*
AIEGL	*Association Internationale d'Épigraphie Grecque et Latine*
AISCOM	*Associazione Italiana per lo Studio e la Conservazione del Mosaico*
AJA	*American Journal of Archaeology*
AJPA	*American Journal of Physical Anthropology*
AMediev	*Archaeologia Medievale*
AmJAncHist	*American Journal of Ancient History*
AmJEnolVitic	*American Journal of Enology and Viticulture*
AnnBari	*Annali della Facoltà di Lettere e Filosofia dell'Università degli Studi di Bari*
AnnÉconSocCiv	*Annales: Économie, sociétés, civilisations*
Ann Geogr.	*Annales de Géographie*
Ann. Stat. Ital.	*Annuario Statistica Italiana*
AntAfr	*Antiquités Africaines*
AntCl	*L'Antiquité Classique*
Antiquity	*Antiquity. A Quarterly Review of Archaeology*
APort	*O Arqueólo Português*
AquilNost	*Aquileia Nostra. Bollettino dell'Associazione Nazionale per Aquileia*
ArchAntrEtn	*Archivio per l'Antropologia e l'Etnologia*
ArchMaMe	*Archeologia Maritima Mediterranea*
ArchPrehistLev	*Archivo de Prehistoria Levantina*
Arch. Veneto	*Archivio Veneto*
ASAtene	*Annuario della Scuola Archeologica di Atene e delle missioni italiane in Oriente*
ASubacq	*Archeologia Subacquea. Studi, ricerche e documenti*
ASubacqSuppl	*Archeologia Subacquea. Supplemento al Bollettino d'Arte*
Athenaeum	*Athenaeum. Studi di Letteratura e Storia dell'Antichità*
AtSMarche	*Atti e Memorie della Deputazione di Storia Patria per le Marche. Ancona*
ATTA	*Atlante Tematico di Topografia Antica*

AttiAcRov	*Atti della Accademia Roveretana degli Agiati. Contributi della Classe di Scienze Umane, di Lettere ed Arti*
Atti CESDIR	*Atti del Centro Studi e Documentazione sull'Italia Romana*
Atti Inch. Jac.	*Atti della Giunta per l'Inchiesta agraria e sulle condizioni della classe agricola*
AttiMemBologna	*Atti e Memorie. Deputazione di Storia Patria per le Province di Romagna*
AttiMemIstria	*Atti e Memorie della Società istriana di archeologia e storia patria*
AttiMusTrieste	*Atti dei Civici Musei di Storia ed Arte di Trieste*
AttiVenezia	*Atti. Istituto Veneto di Scienze, Lettere e Arti*
AVen	*Archeologia Veneta*
AVes	*Arheoloski Vestnik*
BA	*Bollettino di Archeologia (On Line)*
BABesch	*Bulletin Antieke Beschaving. Annual Papers on Classical Archaeology*
BAH	
BAMaroc	*Bulletin d'Archéologie Marocaine*
BAnnMusFerr	*Bolletino Annuale. Musei Ferraresi*
BArch	*Bulletin Archéologique*
BarIntSer	*British Archaeological Reports. International Series*
BASOR	*Bulletin of the American Schools of Oriental Research*
BayVgBl	*Bayerische Vorgeschichtsblätter*
BBelgRom	*Bulletin de l'Institut Historique Belge de Rome*
BCH	*Bulletin de Correspondance Hellénique*
BdA	*Bollettino d'Arte*
BeitrRBFÖ	*Beiträge zur Römerzeitlichen Bodenforschung in Österreich*
BMusPadova	*Bollettino del Museo Civico di Padova*
BollSocGeogr	*Bollettino della Società Geografica Italiana*
Britannia	*A Journal of Romano-British and Kindred Studies*
BS	*Bilan Scientifique*
BSA	*The Annual of the British School at Athens*
BSR	*Papers of the British School at Rome*
BTCGI	*Bibliografia Topografica della Colonizzazione Greca in Italia e nelle Isole Tirreniche*
BTorino	*Bollettino della Società Piemontese di Archeologia e Belle Arti*
Carinthia I	*Carinthia I. Geschichtliche und volkskundliche Beiträge zur Heimatkunde Kärntens*
CahGlotz	*Cahiers du Centre Gustave Glotz*
CAS	*Cahiers d'Archéologie Subaquatique*
Catena	*Catena. An Interdisciplinary Journal of Soil Science – Hydrology – Geomorphology focusing on Geoecology and Landscape Evolution*
CCRH	*Les Cahiers du Centre de Recherches Historiques*
CEFR	*Collection de l'École Française de Rome*
Chiron	*Chiron. Mitteilungen der Kommission für Alte Geschichte und Epigraphik des Deutschen Archäologischen Instituts*
CIL	*Corpus Inscriptionum Latinarum*
CivPad	*Civiltà Padana. Archeologia e Storia del Territorio*
ClQ	*The Classical Quarterly*
CuadCastellon	*Cuadernos de prehistoria y arqueologia castellonense*
Curr. Anthropol.	*Current Anthropology*
DAT	*Documenti dell'Abruzzo Teramano*

DialA	*Dialoghi di Archeologia*
DocStudForlimpopoli	Forlimpopoli. Documenti e Studi
EAA	*Enciclopedia dell'Arte Antica Classica e Orientale*
EC	*Études Celtiques*
EchosCl	*Echos du Monde Classique. Classical Views*
EconHistRev	*The Economic History Review*
EpAnf	*Epigrafia Anfórica*
ESAR	*An Economic Survey of Ancient Rome*
EtCl	*Les Études Classiques*
EtPézenas	*Études sur Pézenas et l'Hérault*
Facta	*Facta. A Journal of Roman Material Culture Studies*
Hermes	*Hermes. Zeitschrift für Klassische Philologie*
Historia	*Historia. Zeitschrift für Alte Geschichte*
HistriaA	*Histria Archaeologica*
HistriaAnt	*Histria Antiqua*
IJFST	*International Journal of Food Science and Technology*
IEJ	*Israel Exploration Journal*
InstNautAA	*The Institute of Nautical Archaeology Annual*
InstNautAQ	*The Institute of Nautical Archaeology Quarterly*
IntJNautA	*International Journal of Nautical Archaeology*
JAA	*Journal of Anthropological Archaeology*
JASc	*Journal of Archaeological Science*
JFieldA	*Journal of Field Archaeology*
JRA	*Journal of Roman Archaeology*
JRadioNuclChem	*Journal of Radioanalytical and Nuclear Chemistry*
JRS	*The Journal of Roman Studies*
JWineRes	*Journal of Wine Research*
Klio	*Klio. Beiträge zur Alten Geschichte*
KTEMA	*Ktema. Civilisations de l'Orient, de la Grèce et de Rome antiques*
Latomus	*Latomus. Revue d'Études Latines*
L'Homme	*L'Homme. Cahiers d'Ethnologie*
MAAR	*Memoirs of the American Academy in Rome*
MdI	*Mitteilungen des Deutschen Archäologischen Instituts*
MEFRA	*Mélanges de l'École Française de Rome (Antiquité)*
MemMarchAnc	*Memorie dell'Accademia Marchigiana di Scienze, Lettere ed Arti di Ancona*
MemAmAc	*Memoirs of the American Academy in Rome*
MemTorClScMor	*Memorie della Accademia delle Scienze di Torino. Classe di Scienze Morali Storiche Filologiche*
NotAHisp	*Noticiario Arqueológico Hispánico. Arqueología*
NSc	*Notizie degli Scavi di Antichità*
Ocnus	*Ocnus. Quaderni della Scuola di Specializzazione in Beni Archeologici-Università di Bologna*
Opus	*Opus. Rivista Internazionale per la Storia Economica e Sociale dell'Antichità*
Ostraka	*Ostraka. Rivista di Antichità*
OxfJA	*Oxford Journal of Archaeology*
OXREP	*Oxford Roman Economy Project*
Padusa	*Padusa. Bollettino del Centro Polesano di Studi Storici, Archeologici ed Etnografici, Rovigo*

Phoenix	*Phoenix. The Journal of the Classical Association of Canada*
Picus	*Picus. Studi e ricerche sulle Marche nell'Antichità*
PP	*La Parola del Passato*
QuadAAbr	*Quaderni di Archeologia d'Abruzzo*
QuadAccFan	*Quaderni dell'Accademia Fanestre*
QuadAOst	*Quaderni del Gruppo Archeologico Ostigliese*
QuadMusAp	*Quaderni del Museo Provinciale di Apani*
QuadAEmil	*Quaderni di Archeologia dell'Emilia Romagna*
QuadAMant	*Quaderni di Archeologia del Mantovano*
QuadAPiem	*Quaderni della Soprintendenza Archeologica del Piemonte*
QuadAVen	*Quaderni di Archeologia del Veneto*
QuadFriulA	*Quaderni Friulani di Archeologia*
QuadScAnt	*Quaderni di Scienze Antropologiche*
QuadStorici	*Quaderni Storici*
RACFr	*Revue Archéologique du Centre de la France*
RAComo	*Rivista Archeologica dell'Antica Provincia e Diocesi di Como*
RANarb	*Revue Archéologique de Narbonnaise*
RdA	*Rivista di Archeologia*
RE	*Paulys Realencyclopädie der classischen Altertumswissenschaft*
ReiCretActa	*Rei Cretariae Romanae Fantorum Acta*
RendBologna	*Atti della Accademia delle Scienze dell'Istituto di Bologna. Rendiconti*
RendLinc	*Rendiconti dell'Accademia Nazionale dei Lincei*
Rimarcando	*Rimarcando. Bollettino della Direzione Regionale per I Beni Culturali e Paesaggistici delle Marche*
RivStLig	*Rivista di Studi Liguri*
RScPreist	*Rivista di Scienze Preistoriche*
RStMarch	*Rivista di Studi Marchigiani*
RStorAnt	*Rivista Storica dell'Antichità*
RTopAnt	*Rivista di Topografia Antica*
SFECAG	*Sociéte Française d'Étude de la Céramique Antique en Gaule*
SicA	*Sicilia Archeologica*
SpNov	*Specimina Nova*
StAnt	*Studi di Antichità. Università di Lecce*
StClOr	*Studi Classici e Orientali*
StMacer	*Studi Maceratesi*
StRomagn	*Studi Romagnoli*
StSalent	*Studi Salentini*
StudPic	*Studia Picena. Rivista di Storia e Cultura Marchigiana dall'Età Classica all'Età Contemporanea*
SupplIt	*Supplementa Italica*
TMA	*Tijdschrift voor Mediterrane Archeologie*
TransactAmPhilosSoc	*Transactions of the American Philosophical Society*
VHA	*Vegetation History and Archaeobotany*
VjesAMuzZagreb	*Vjesnik Arheloskog muzeja u Zagrebu*
VjesDal	*Vjesnik za arheologiju i historiju dalmatinsku. Bulletin d'archéologie et d'histoire dalmates*
Xenia	*Xenia. Semestrale di Antichità*

List of ancient written sources

Ant.	*De antidotis, Galen*
Anth. Pal.	*Anthologia Palatina*
Agr. Orig.	*De agricultura, Cato*
App. Verg.	*Appendix Vergiliana, Virgil*
Ath.	*Deipnosophistae, Athenaeus*
Balbo	*Pro Balbo, Cicero*
B Civ.	*Bella civilia, Appian*
Catull.	*Catullus*
Comp. Med. per Gen.	*De compositione medicamentorum per genera, Galen*
De arch.	*De architectura, Vitruvius*
De vir. ill.	*De viris illustribus, Aurelius Victor*
Dom.	*Domitianus, Suetonius*
Epigr.	*Epigrammata, Martial*
Ep.	*Epistulae, Seneca*
Epist.	*Epistulae, Ausonius*
Eutr.	*Breviarium ad urbe condita, Eutropius*
Flor.	*Epitome bellorum omnium annorum DCC, L. Annaeus Florus*
G.	*Georgics, Virgil*
Geogr.	*Geographica, Strabo*
Har. resp.	*De haruspicum response, Cicero*
Hist.	*Historia, Polybius; Historiae, Sallust; Histories, Herodotus*
HN	*Naturalis historia, Pliny*
Juv.	*Satires, Juvenal*
Lib. colon.	*Libri coloniarum*
Livy	*Ad urbe condita, Livy*
Mat. Med	*Materia Medica, Dioscorides*
Med.	*De re medica, Alexander of Tralles*
MM	*De methodo medendi, Galen*
MMG	*Ad Glauconem de medendi methodo, Galen*
Oros.	*Histories against the Pagans, Orosius*
Paus.	*Description of Greece, Pausanias*
Per.	*Periochae, Livy*
Pun.	*Punica, Silius Italicus*
Rab. perd.	*Pro Rabirio perduellionis reo, Cicero*
Rust.	*De re rustica, Columella; Varro; Palladius*
San. Tu.	*De sanitate tuenda, Galen*

Sat.	*Satirae, Horace*
Sen.	*Cato Maior de senectute, Cicero*
SMT	*De Simp. Medicament. Facultatibus, Galen*
Str.	*Strategemata, Frontinus*
Val. Max.	*Factorum ac dictorum memorabilium libri IX, Valerius Maximus*
Var.	*Variae, Cassiodorus*
Verr.	*In Verrem, Cicero*
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Prologue

> *"Italy experienced a notable increase in urbanisation from the first century BC; few of these towns could rely on imported grain, and their demands for other goods were also generally met locally. These demands will have affected patterns of land use in their territories in the same way, albeit on a much smaller scale, as those of the city of Rome."*
>
> *(Morley 1996, 71)*

The notion that in antiquity a significant portion of regionally produced foodstuffs was also consumed locally is not new. The idea goes back to the works of A.H.M. Jones and M. Finley and is therefore often referred to as the 'Finley/Jones model'.[1] While some of the more pessimistic aspects of this model – i.e. little or no significance of trade or industries and no economic growth whatsoever – have rightfully lost some of their interpretative powers over the years, the basic concept still holds largely true. This is first and foremost because in Roman Italy, just like in any other pre-industrial society, a very large number of people were active in the agricultural sector. Indeed, the majority of the Italian population – probably as much as 65 to 90% - were peasants whose main preoccupation was to foresee in their own subsistence needs.[2] This means that a large amount of food was never distributed, but consumed directly on the spot.[3] Second, a considerable amount of aliments did leave the premises, but was only transported over relatively short distances within a certain region. Some of this traffic undoubtedly consisted of the small surpluses that were used by peasant farmers as means to acquire additional products or services on local markets.[4] More substantial quantities, however, circulated within the context of provisioning local towns by more market-orientated farms. Indeed, in a

[1] Jones 1964; Finley 1973, especially p. 125-133; see also Greene 1990, 14-16.

[2] Hopkins 1978, 6-7, 15-16; Jongman 1988, 65-66.

[3] Garnsey 1999, 25-28.

[4] Garnsey 1999.

peasant-based economy such as the Roman Empire, satisfying local demand must always have remained one of the primary concerns.[5] Due to the relatively high transport costs and the logistic challenges of long-distance trade, most towns will have relied in the first place upon intra-regional resources for their daily provisioning, unless an area faced major shortages or had exceeded its carrying capacity, or if local climate and soil did not permit to cultivate certain crops.[6] As such, much food was bound to remain within regional or even local boundaries.

Such a premise logically holds that changes in the size of local population may have had considerable effects on agrarian possibilities and practices, as there are opportunities for surplus food or agricultural strategies influenced by land availability. Despite this notion, interpretative models of Italy's economy in the Roman period – and in particular those concerning the Italian wine and oil industry – have to a great extent stressed the importance of the volumes of food transported over longer distances; i.e on extra-regional or even extra-Italian levels. There is certainly some justification for this tendency, as archaeology has provided us with plentiful indications that Italian aliments like wine and olive oil circulated on quite an impressive scale in the Mediterranean in Roman times. Indeed, between ca. 200 BC and AD 200, an impressive number of Roman shipwrecks loaded with amphorae have been identified in what is the world's largest inland sea, while said clay containers have also been popping up in large amounts on an innumerable number of land sites across the Empire.[7]

Perhaps unsurprisingly, this conspicuousness has inspired more than one scholar to look for the driving forces behind Italian agro-economic changes in general – but in particular viticultural and oleocultural developments – in external stimuli and constraints. The focus has hereby been on the many extra-Italian trade and consumption markets spawned by Rome's progressive account of the Western and Eastern Mediterranean in the 250-year period following the First Punic War (264-241 BC); succeeded by the gradual loss of these provincial markets from the Augustan era onwards and throughout the first two centuries of the Empire because of import replacement and provincial competition. Accordingly, within this timeframe, the subsequent expansion and reduction of the Italian amphora trade was to be explained against the background

[5] Vera 1994, 244, note 23, who refers to Thorner 1964.

[6] Hopkins 1980, 101-102; Jongman 1988, 78-79; De Ligt 1990; Scheidel 1994; see also De Sena 2003, 22. Rome would be the obvious exception here, as there can be no doubt that – especially from the 1st century AD onwards – a substantial share of the city's food needed to be imported from areas outside Italy, such as grain from Sicily, Sardinia and North Africa (Rosenstein 2008).

[7] For graphs with dated shipwrecks, see Parker 1992, 549, fig. 3; and Morley 2007, 572-573; see also the Shipwrecks Database from the Oxford Roman Economy Project (http://oxrep.classics.ox.ac.uk/databases/shipwrecks_database/), in particular the timeline.

of these events.[8] This by now classic narrative has become particularly illustrative for the Tyrrhenian side of Italy, where a case has been made for the relation between the spread of villas equipped with wine presses in *Etruria*, *Latium* and *Campania*, the distribution of the Dressel 1 and Dressel 2-4 wine amphorae, and the economic benefits of the Gallic market; benefits that progressively disappeared from the mid-1st century BC onwards and allegedly made the Italian speculative production system collapse in the course of the Early/High Imperial period.[9] Recently, however, a similar story has been reconstructed for the central Adriatic side of Italy – which is the area discussed in this thesis – with regard to the events in the wider Adriatic and the Eastern Mediterranean and the circulation of the Lamboglia 2 and the Dressel 6A wine amphorae and the Ovoid Adriatic oil containers.[10]

As a result of this rather one-sided point of view, archaeological proxy indicators for the economic performance of the Italian wine and oil sector – in the first place amphorae and press installations – have been studied almost exclusively from said perspective. In contrast, there has been nearly no attention for how the developments in these two categories of archaeological evidence might relate to local events, such as population dynamics and their associated food resources. Be that as it may, with regard to the amphora evidence, a few scholars have rightfully stressed that the mere rise and abatement of Italian amphora exports cannot forthrightly mirror the beginning nor the end of Italian commercial wine and oil production. Rather, it would only reflect the expansion and reduction of a particular sector of the wine and oil trade that was always aimed more at the overseas market than the domestic one.[11] Indeed, the idea that the whole success or failure of Italian viticulture and oleoculture depended exclusively on the presence or absence of extra-Italian consumption markets is deeply flawed and overlooks the potential impact of Italy's towns and their territories on these businesses.[12]

Of course, saying that demography had a certain influence in the nature and evolution of agrarian practices in pre-industrial economies is stating the obvious, but studying said influence for the Roman era is all easier said than done. Something has to do with archaeological representativeness. Indeed, while amphorae can generally be considered good indicators for viticultural and oleocultural intensification and expansion, they are only so apparent in the archaeological record because of their durable nature. As these

[8] For a recent synthesis of the argument, see Panella 2010; for a more detailed overview, see Chapter 1 in this thesis, section 1.3.1 Wine, with references.

[9] Tchernia 1986.

[10] For the argument, see again Panella 2010, in particular p. 92; see also Tchernia 1986; for the details of this discussion, see once again Chapter 1 in this thesis, section 1.3.1 Wine; and section 1.3.2 Olive oil.

[11] For instance, see Purcell 1985; Tchernia 1986, 285-299; 2006; and Ikeguchi 2006.

[12] Morley 1996; Tchernia 2006, 363.

earthenware containers were rather designed for sea and river trade, their distribution was naturally focused on coastal areas, or inland areas that had navigable rivers.[13] On the other hand, their shape and frailty must have made them less suitable for transporting goods overland by cart or pack animal. In the latter case, perishable packaging materials such as wooden barrels, baskets and sacks would have been more adapted solutions.[14] Unfortunately, within the Mediterranean, such carriers are archaeologically not – or at least much less – traceable. As the supplying of the many Italian towns with locally produced wine and oil must have frequently involved such overland transport, it follows that much of this kind of intra-regional provisioning does not manifest itself clearly in the archaeological record.[15] Of course, in reality, this distinction between eyed consumption markets and types of containerization is bound to have been much less extreme, but it does not seem too far-fetched to assume that archaeology has somehow overexposed provincial surplus extraction and underexposed intra-regional consumption.

Wine and oil presses too have a relatively high degree of archaeological visibility, but while their presence on rural sites commonly suggests the production of a surplus for the market, it does not indicate which markets were actually involved.[16] Hence, it remains difficult to detect the level of local demand on the basis of this evidence alone, and thus to envision how – and to which extent – changes in this demand over time may have influenced viticultural and oleocultural practices in the towns' rural territories.

Furthermore, demography is a big headache in studies on the classical world. The main reason for this is, as might be expected, the lack of precise information on ancient demographic evolutions; i.e. in particular statistics that would allow us to follow in detail the changes in population over time. The pre-eminent illustration of this shortcoming is, of course, the conundrum surrounding the interpretation of two seminal pieces of numeral evidence found in the written sources; Polybius' manpower figures from 225 BC and the Augustan census figures from 28 BC; a seemingly interminable debate upon which I will not touch here.[17]

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[13] For the practice of shortsea shipping or cabotage along coastal routes in the Roman Mediterranean, see Horden and Purcell 2000, 118, 140, 365, 565; see also Erdkamp 2005, 177-181.

[14] Tchernia 1986, 285-292; Panella 1989, 162-163; Morley 1996, 10; De Sena 2005. Of course, it was entirely possible to use amphorae for land transport. They were probably just not the preferred type of container. Still, flat-bottomed or smaller and more solid types in particular must have been more deployable for this purpose (see Ghisleni/Vaccaro/Bowes 2011, 120). For a more thorough discussion, see Chapter 1, section 1.1 What amphorae can tell us.

[15] Morley 2007, 573. The issue is discussed in more detail at the end of Chapter 1, in section 1.3.1 on wine.

[16] For the argument, see Chapter 2 in this thesis, section 1.1 Pressing issues.

[17] For recent overviews, see Launaro 2011, 1-3; De Ligt 2012, 5-11; and Hin 2013, all with references.

Logically, this very unfavourable situation has repeatedly inspired scholars to look for different ways to explore the issue of demography in Roman times. One might think hereby at urban and rural survey data as a platform for deriving population figures, or at calculations regarding carrying capacity by means of caloric intake and agricultural productivity estimations.[18] These are also some of the paths that will be taken in the course of this thesis. There is no denying that these methods all have an intrinsic weakness; i.e. that at some point they all require the input of a large number of variable parameters and assumptions. It is also true – as has been stressed by scholars like Neville Morley and Luuk De Ligt – that because of this fundamental flaw, there is little use in trying to determine absolute population numbers, or exact food intakes and land outputs for that matter.[19] However, this does not mean that we should be completely discouraged to explore the potential role of demography in the ancient economy and shouldn't try at least to establish some useful orders of magnitude that allow us to debate the influence of lower and higher population figures – and thus of lower and higher local land needs – on the dialectics of the central Italian wine and oil sector over time.

Preliminary insights

In order to get a first apprehension of some of the ideas that lie behind this thesis, it might be useful to present some of the insights that have been acquired in recent years with regard to the importance of local food supply in the provisioning of Rome. It is a common assumption that between the end of the 2nd century BC and the time of Augustus the population of the city grew from ca. 500,000 to ca. 1 million inhabitants, and possibly continued to expand in the course of the 1st and 2nd centuries AD. Such a growth obviously generated a huge consumption market and must have made it profitable to raise production levels substantially in the surrounding countryside. In fact, the recent discovery of several Republican vineyards in Rome's immediate suburbium – in contrast with the general paucity of Republican amphorae in urban Roman contexts, especially in comparison with the Early/High Imperial period – seems to illustrate well the city's dominant reliance on local wine production from the 3rd century BC onwards.[20] This

[18] The array of possible research angles, however, is by now quite wide and diverse. An nice overview – and critique – is provided by De Ligt 2012, 10-39.

[19] Morley 2011; De Ligt 2012.

[20] Volpe 2009, in particular 378-381; and 2012, 66-67, who suggests that the wine originating from these nearby vineyards was transported to the city in skin containers or barrels.

situation seems to change from the Augustan era onwards, however, when the increasing presence of Italian and provincial amphorae in said contexts points towards a larger share of extra-regional and Mediterranean imports throughout the Early/High Imperial period; an evolution that has long been considered a sign of local and Italian agricultural crisis, especially in the wine sector.[21]

However, it has been argued that such an increase in provincial imports in Rome – and Ostia for that matter – should not be seen as a sign of viticultural or oleocultural crisis, but rather as an indication that agricultural production in the surrounding hinterland became increasingly unable to supply the Urbs with sufficient amounts of wine and oil in order to satisfy the huge demands of its bulging population. In fact, a recent study by Eric C. De Sena has estimated that in the Early Imperial period, Rome's hinterland could only provide ca. 32% of the city's wine needs and ca. 23% of its oil needs.[22] For his calculations, De Sena used a population figure of one million people and annual consumption figures of 167 million litres of wine and 20 million litres of olive oil.[23] The supposed immediate hinterland of Rome was put at 5,000 km².[24] On the production side, the author started from modern statistics, which show that Lazio nowadays produces some 340 million litres of wine from 45,000 hectares of land; and some 24 million litres of oil from 86,000 hectares. As the 5,000 km² large hinterland included some 65% of this land – i.e. about 29,000 hectares of vine land and 56,000 hectares of olive land – De Sena then applied Cato's yield figures of 33 hl/ha (wine) and 1.72 hl/ha (oil) for establishing total annual yields of ca. 96 million litres of wine and 9.7 million litres of olive oil.[25] Next, he detracted the amounts consumed by the producers themselves. For this calculation, De Sena roughly put the population living in Rome's hinterland at 250,000 people.[26] The results were consumption figures of 42 million litres of wine (ca. 43%) and 5 million litres of oil (ca. 51%), implying that local production was able to deliver some 54 million litres of wine and 4.7 million litres of oil to the urban plebs of Rome.

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[21] Panella 1981; for a more detailed discussion with other references, see Chapter 1, section 1.3.1 Wine, in particular note 198.

[22] De Sena 2005, in particular 9, Fig; 3.

[23] These numbers are based on a range of previous studies, as there are Garnsey 1983; Tchernia 1986; and Amouretti 1986; who all use ancient sources and/or modern dietary instructions in their estimations of ancient food requirements.

[24] A figure equally derived from preceding studies such as Morley 1996 and Peña 1999.

[25] For the details of these calculations, see De Sena 2005, 6-8. Used sources include the Istituto Nazionale di Statistica (www.istat.it), Carandini 1980; and Potter 1987 for the wine yields; and the International Olive Oil Council (http://www.internationaloliveoil.org/).

[26] The guidance for this figure can be found in Beloch 1886, 388-443; Brunt 1971, 124; Hopkins 1978, 68-69; Jongman 1988, 66-67; and Morley 1996, 33-39, 46-50, 182; studies that all involve the heavily contested manpower figures from Polybius and the Augustan census figures.

As might be expected, the specific value of De Sena's study does not lie in its presentation of calculated production or consumption figures, as the inclusion of a wide range of arbitrary variables holds that these should rather been seen as provisory estimates; an aspect also acknowledged by the author himself at the end of his paper.[27] The most interesting part of his analysis is that it provides us with a logical framework within which we can confront local production and consumption patterns with formations of amphora imports. Indeed, other scenarios could certainly be outlined by changing many of the values used by De Sena, but it is unlikely that any of those scenario's would allow for Rome's hinterland to completely cover the needs of it urban population. The chances become higher, however, when we perform the same calculations with the 500,000 population figure estimated for the Republican period; resulting in a share of local provisioning of 65 and 47% for wine and oil respectively. In other words, there is a higher degree of probability that in the Early/High Imperial period Rome's consumption needs in wine and oil required the contribution from other regions in Italy and the Mediterranean. Such a line of thought bodes well then – at least on the basis of the known ceramic evidence – with regions outside *Latium* and some of the provinces becoming important suppliers of foodstuffs to the capital in this period (*Figure* 1).[28]

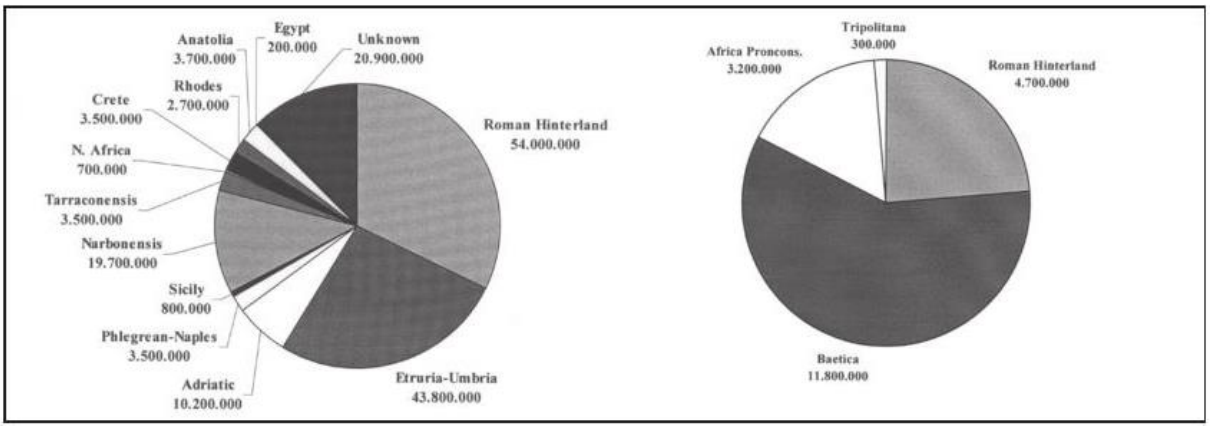


Figure 1 Proportions and origins of wine and oil supplies to the city of Rome in AD 100-150 (After De Sena 2005, Fig. 3-4).

Obviously, Rome was an unique case for pre-modern standards and there was no other town in Italy as populous and wealthy that it would have faced similar supply issues. Still, throughout the Late Republican and Early Imperial period – and especially from the 1st century BC onwards – Italy experienced a notable expansion of urban centres, with some 400 smaller and medium-sized towns expanding across the peninsula. A recent study on the physical size and demography of these centres by Luuk De Ligt has estimated that

[27] De Sena 2005, 9.

[28] For some thoughts on De Sena's model, see Marzano 2013a, 93-96.

their aggregate population in the first two centuries AD might have been around 900,000 people.[29] Again, we should not focus too much on the precise population figure, but the detailed nature of De Ligt's analysis suggests that his work provides us with a useful target figure for reflecting on the scale of urban consumption in this prologue. In fact, it suffices to compare the 100,000 hl figure estimated by André Tchernia on the basis of the available amphora evidence for annual wine consumption in Gaul – a huge market for Roman wine in the Late Republic – with the 1.5 million hl that would have been required in order to supply this whole urban population of Italy outside Rome and Ostia in the 1st century AD, when using De Sena's annual wine intake figures.[30] Add to this the probability that the inhabitants of these urban centres most likely relied in the first place upon intra-regional production for their provisioning, before turning towards extra-regional imports, and one can imagine them being a very respectable consumption group whose food requirements were able to give an impulse to local viticulture and oleoculture.[31] Still, urban consumption demand as a whole remains a marginally studied topic in Roman economic scholarship and the evolution if Italy's urban network and its influence on the surrounding territories has yet to be incorporated fully into models of Republican and Imperial viticultural and oleocultural developments.

Yet, in order to rightfully do so, it is important to view these towns as integrated with their territories. Indeed, in order to appraise the impact of such an urban demand for wine and olive oil, it is relevant to understand to which extent their territories were able to satisfy it; could they generate sufficient surpluses after subtracting the subsistence needs of the rural population. Ironically enough, in the case of wine and olive oil, much will have depended here on what was needed in terms of cereals. The Roman empire was a cereal-based peasant society and grain must always have remained the basic crop in Roman farming.[32] Moreover, cereals had a much lower production unit than vines and thus required a much larger amount of land. The issue is well-illustrated by a recent contribution by Wim Jongman, where the author compares the needs of an Italian urban population of 1.9 million for wine, olive oil and wheat with the amounts of land required for producing the necessary quantities. For his calculations, Jongman assumes a total cultivable area in Italy of 100,000 km². Annual per capita food needs are set at 100 litres of wine, 20 litres of oil and 200 kg of wheat; annual per hectare yields are 2,000 litres of wine, 440 litres of oil and 400 kg for wheat. Based on these parameters, Jongman calculates

[29] De Ligt 2012, 243-244.

[30] Tchernia 1983, 92. For a discussion on some archaeological and other evidence in favour of substantial wine consumption in Italian towns, especially in the Early Imperial period, see Unwin 1991, 124-128.

[31] Based on a per capita consumption figure of 20 litres, urban oil requirements would have been 18 million litres.

[32] A good illustration of this statement is Spurr 1986.

that wine and oil needs each required only about 1% of all agricultural land – 950 km² in the case of wine and 850 km² for olive oil – but cereal needs ca. 20% (19,000 km²).[33] Considering the high probability that most of these cereals were produced locally, it follows that the quantity of land that could be devoted to viticulture and oleoculture, and the way in which these lands were organised, may have been heavily determined by local cereal requirements.[34] In fact, comparative evidence from pre-industrial Europe indicates that local population dynamics and their associated cereal requirements may indeed play a decisive role in viticultural land use. For instance, during periods of population pressure, farmers tended to reserve the better soils for cereals and subsequently planted their vines on poorer soils.[35] No satisfying reconstruction then will ever emerge for Roman wine and oil by looking at viticulture and oleoculture alone.

The study area

With this thesis, I would like to explore these issues for the central Adriatic area of Italy in the Late Republic and the Early/High Empire (ca. 200 BC-AD 150). The phraseology 'central Adriatic' is here used to delineate an area of ca. 11,600 km² that comprises the Marche region and the northern part of Abruzzo (Abruzzo Teramano). It is situated between the Apennine hills and the central Adriatic coast and is characterised by a comb-shaped geomorphologic structure in the form of a series of parallel river valleys descending towards the sea. Prior to the Roman conquest in 286 BC, the section between the Esino and Vomano rivers was mainly home to the Picenian civilisation. The part of the Marche region lying to the north of the river Esino roughly coincided with the *Ager Gallicus*, a territory that was taken by Rome from the Celtic *Senones* at the beginning of the 3rd century BC. The region sided with Rome in the war against Hannibal during the Second Punic War (end 3rd century BC) and formed the stage for many conflicts related to the Social War (91-88 BC). During the Early Principate, emperor Augustus united the territories of the *Praetuttii* and the *Hadriani* – both located in the northern part of today's Abruzzo region – together with the territory of the *Picentes* into the fifth administrative district of his *Provincia Italia* (*Picenum*); the *Ager Gallicus* became part of the sixth *Regio* (*Umbria et Ager Gallicus*) (*Figure* 2).

[33] Jongman 2003, 113-114.

[34] For the argument of local cereal production, see Jongman 1988, 78; and Scheidel 1994, 159.

[35] Grigg 1980; Van Leeuwen/Seguin 2006.

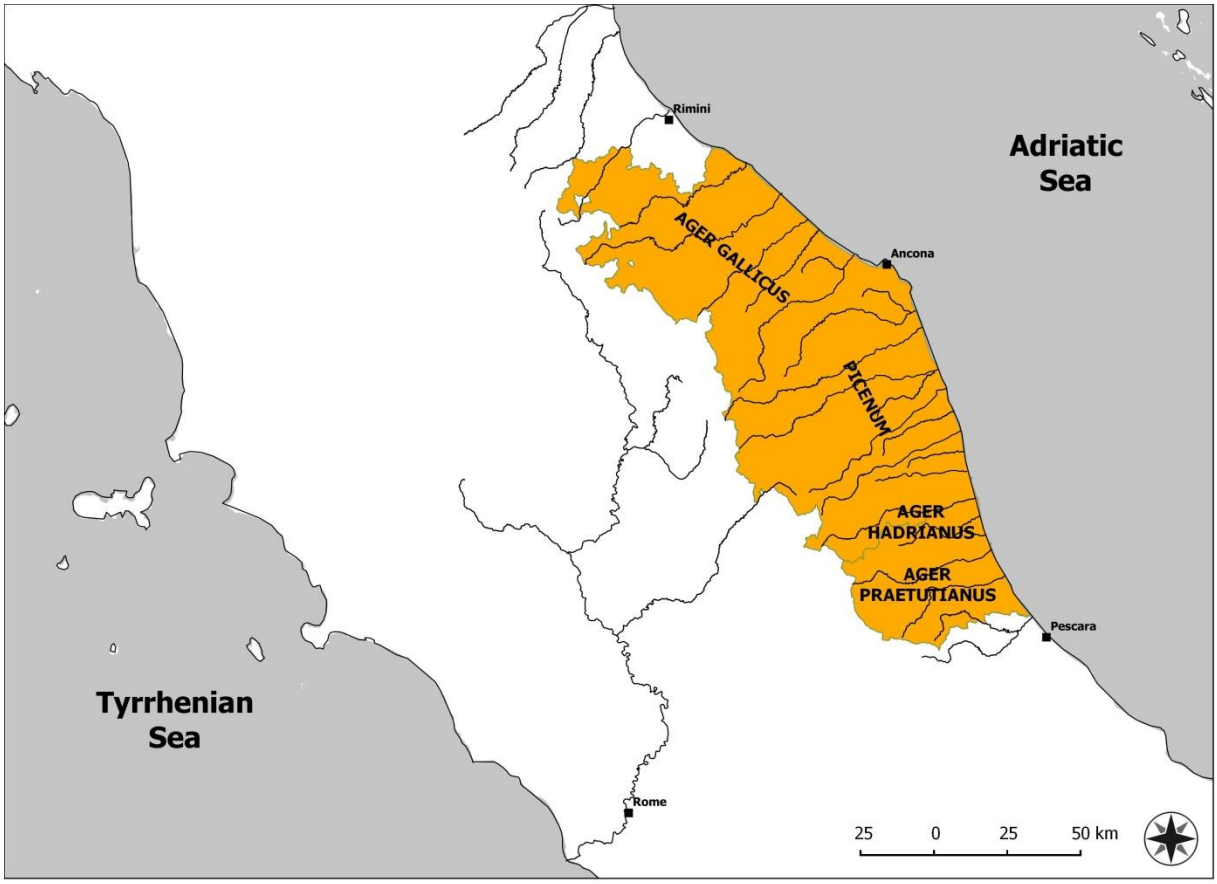


Figure 2 Situation of the central Adriatic study area within Italy (Map author).

This is a part of Italy that is dominantly hilly and mountainous, with about 2/3 of the area being classified as coastal or inland hills and the Apennine mountain chain covering more than 30% of the Marche region, and even some more in the Abruzzo Teramano section. The only real 'flat' sections in the area are located along the Adriatic coastal strip and in the valley bottoms of the numerous rivers (*Figure* 3). In general, the climate may be labelled as 'marine', but it is not uniform, with the coastal and lower valley hills displaying a mediterranean/mediterranean sub oceanic character, which evolves into sub-oceanic and mediterranean mountainous throughout the middle and upper valley sections up until the Apennine rocks. In terms of temperature and rainfall, this means that the coastal and lower valley sections experience slightly higher average annual temperatures (14-16°C) and lower annual precipitation levels (800-1,100 mm), while the middle/upper sections towards the Apennines have lower temperatures (13-12°C) and higher rainfall levels (1,250-1,400 mm). The summers can be hot and the winters can be harsh. The entire area, however, is influenced by cold and intense north-eastern winds that penetrate the region over the low hills and through the river valleys.[36]

[36] ISTAT; Rusco et al. 2009; Pollini et al. 2013, 472-477, 572-576.

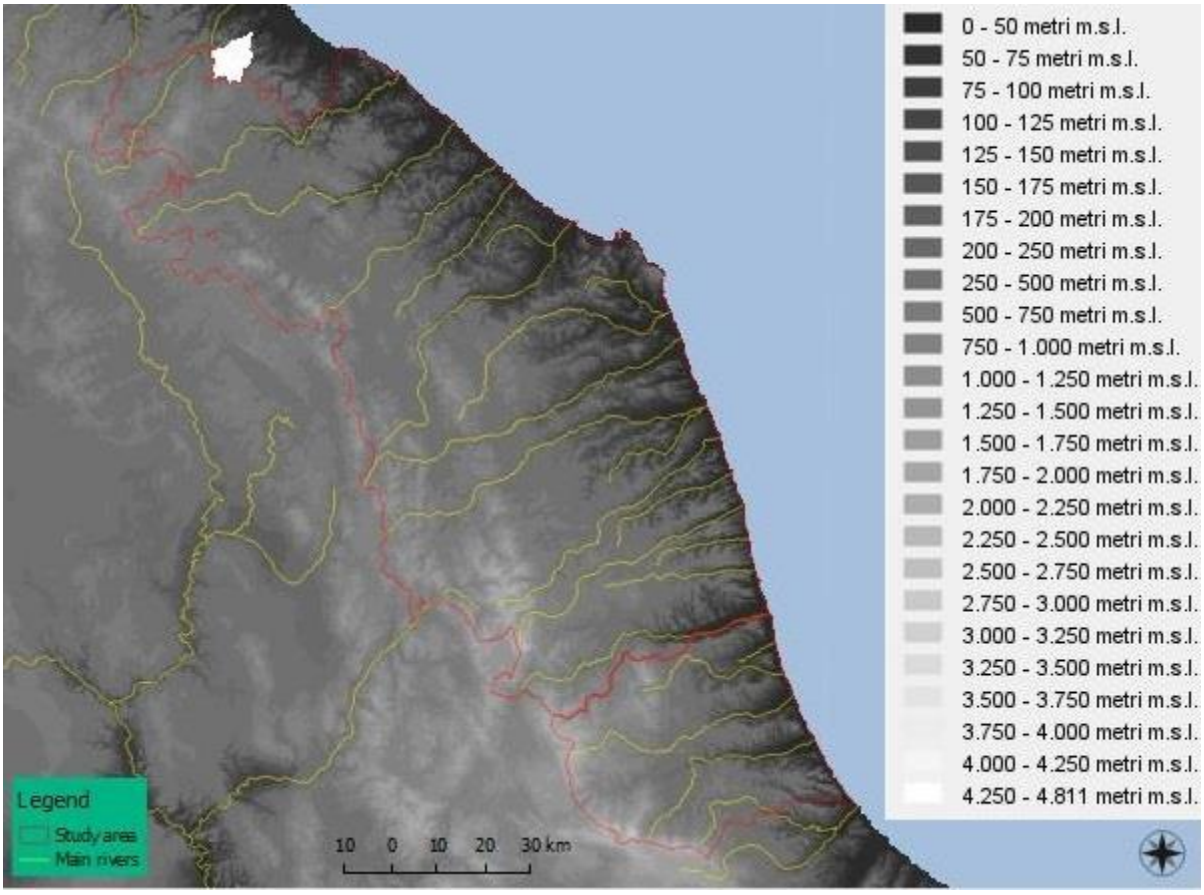


Figure 3 Digital elevation model of the study area (built in part with data from the Geoportale Nazionale (http://www.pcn.minambiente.it/GN/).

With regard to soils, the area is characterised by twelve major alluvial plains that are predominantly alternated by Pliocene/Pleistocene clayey deposits. In the upper valley sections, the presence of sandy stone materials becomes apparent, especially in the more southern part of the region. The upper mountainous zones mainly consist of limestone and marly limestone (*Figure* 4).[37]

Nowadays, the region is considered to be a 'significantly rural' area, with mostly small urban centres dispersed within large rural areas with relatively low population densities. Unsurprisingly then, almost 80% of the territory is classified as farmland, cultivated through an intense agricultural system centred on cereal farming and rotation crops in the lower and middle valleys, while pasture and forestry activities are mostly concentrated in the upper mountainous parts. Woody cultivations consist mainly of vines and olive orchards.[38]

[37] Centamore et al. 1991.

[38] Rusco et al. 2009, from data elaborated by ISTAT.

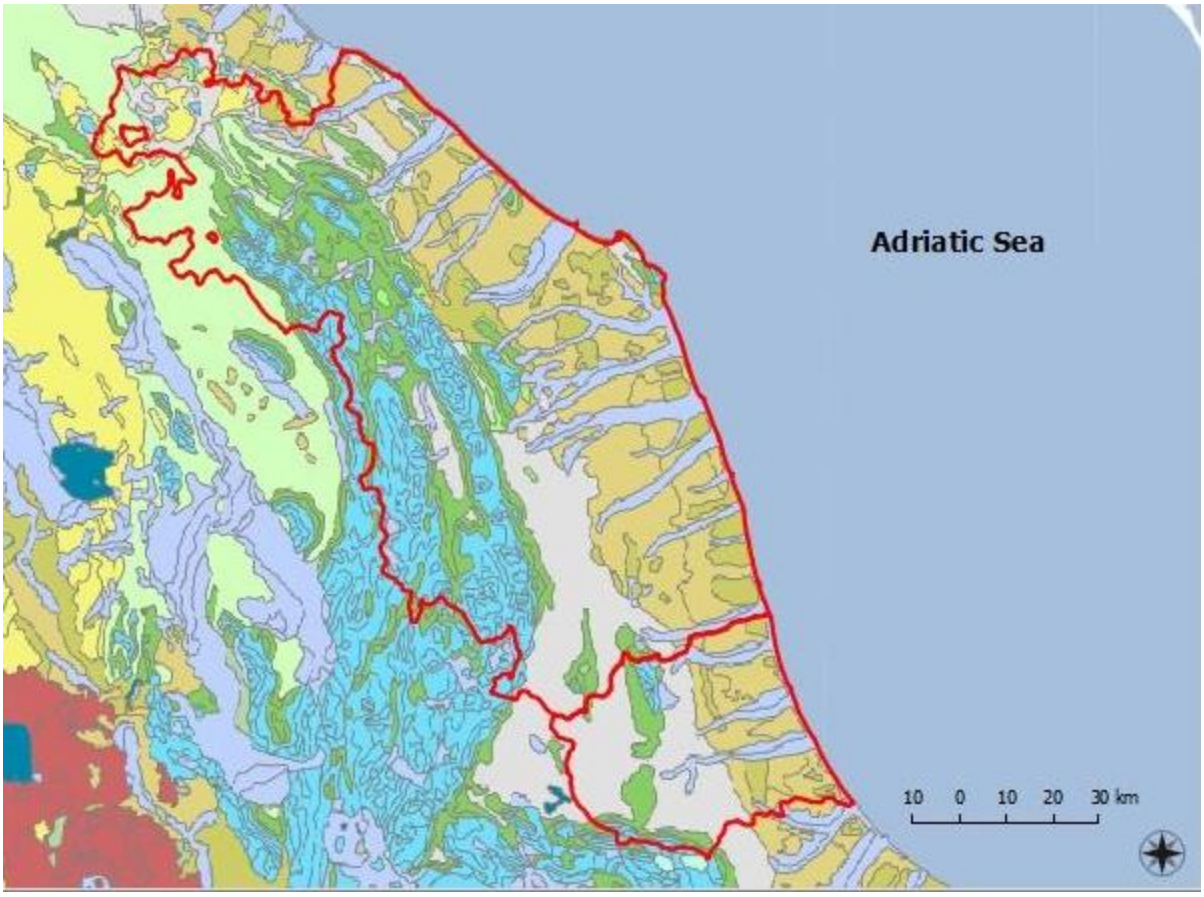


Figure 4 Soil map of the study area (indicated in red) (built in part with data from the Geoportale Nazionale): alluvial plains (light blue), Pliocene/Pleistocene clay (beige), sandstone (white-grey), limestone (cyan blue and green).

The reasons for choosing this particular area are threefold. First, with 20 of the 34 known Adriatic amphora kilns now located in these districts, the area seems to have been one of the most important regions producing these containers; and thus one of the most heavily involved in the Mediterranean wine and oil trade in Late Republican and Early Imperial times.[39] Second, with the presence of some 40 Roman towns in the High Imperial period, the region was also one of the more urbanised areas of Roman Italy – only surpassed by *Regio* I *Latium et Campania* along the central Tyrrhenian coast – and the most urbanised one *tout court* along the entire Adriatic coast.[40] Accordingly, the towns in this area had considerable smaller average territories at their disposal than their counterparts

[39] This argument is treated extensively in Chapter 1, section 1.2 Making central Adriatic amphorae speak, in particular illustrated by Figure 5.

[40] The total number of 40 towns here refers to the 23 towns in *Picenum* and the 17 towns that lie in the section of the Marche region that corresponds with a part of the sixth *Regio* (*Umbria et Ager Gallicus*).

in other regions (*Table* 1).[41] Third, on account of the many systematic interdisciplinary research projects active in the area during the last sesquidecade, the region has seen a considerable increase in exact archaeological and historical data. The situation has particularly much improved for the central and southern parts of the Marche, where field surveys and excavations have been carried out in the river valleys of the Potenza, the Esino and the Tenna (*Map* 1).[42] Among the many excellent results, these field surveys have indicated that the territories of these towns were among the most densely populated areas of the peninsula, especially in the Early Imperial period.[43] All this makes the region into quite an interesting candidate for exploring the possible role of intra-regional urban and rural consumption of locally produced foodstuffs – in particular cereals, wine and olive oil – in the nature and evolution of the viticultural and oleocultural landscape of central Adriatic Italy during the Late Republican and the Early/High Imperial period.

Table 1 Urban density and average territory size in High Imperial Italy (After Duncan-Jones 1982, 339, Table 9; and Jongman 1988, 70, table 1, both based on Nissen 1883; and Bekker-Nielsen 1989, 21-22).

	Regio	Area (km²)	Towns	Average area/ town (km²)	Towns/ 1000 km²
I	*Latium et Campania*	15,500	86	180	5.5
VI	*Umbria et Ager Gallicus*	10,000	49	204	4.9
V	*Picenum*	6,500	23	283	3.5
II	*Apulia et Calabria*	25,000	76	329	3
IV	*Samnium*	18,000	43	419	2.4
VII	*Etruria*	31,000	49	633	1.6
VIII	*Aemilia*	19,500	26	750	1.3
IX	*Liguria*	14,000	17	824	1.2
III	*Lucania et Bruttium*	27,500	24	1,146	0.9
X	*Venetia et Histria*	51,000	25	2,040	0.5
XI	*Gallia Transpadana*	32,000	12	2,667	0.4

[41] This statement is based on Wim Jongman's map of urban density in High Imperial Italy, built on previous work by R. Duncan-Jones and H. Nissen (Jongman 1988, 70).

[42] Field surveys have been carried out within the frameworks of the Potenza Valley Survey Project (Ghent University) (for references, see Vermeulen et al. 2009), the Upper Esino Valley Survey Project (UCL London) (Riva et al. 2005) and the Pisa South Picenum Survey Project (Pisa University) (Pasquinucci et al. 2005).

[43] De Graaf 2012; see also *infra*, Chapter 4 Modelling consumption patterns, section 1.5 Including the rural component.

Research plan and structure of the thesis

Investigating these research questions is by no means an easy task, but essentially starts from a careful reading of the relevant archaeological evidence – that is amphorae, presses and town remains – with fresh eyes. Therefore, in what follows, I would like to tackle this topic by first examining two of the main proxy indicators for commercial wine and oil production – amphorae and presses – in order to see which patterns emerge. Next, an attempt is made to reconstruct urban (and rural) demographic patterns through time on the basis of the available structural remains. With said population figures in mind, both a consumption and a land requirement model are then outlined through the use of ancient textual accounts and comparative evidence from pre-industrial central Adriatic Italy. Finally, these models are compared with the size of the study area in order to assess what portion of the local agricultural produce in cereals, wine and olive oil was consumed by the country- and urban dwellers in the region, and to which extent possible surpluses could be absorbed by consumption groups further afield over time.

Practically speaking, this thesis is split-up into three main parts. The first part evolves around production and is subdivided into two chapters. **Chapter 1** introduces the reader to the different amphora types attributable to the central Adriatic area of Italy between ca. 250 BC and AD 200. It is hereby not my intention to fully cover all aspects of this complex category of ceramic evidence. Instead, I will focus on those elements that I consider useful for providing answers to the main questions of this chapter. Those questions are essentially fivefold: to which extent was the region integrated into the wider Mediterranean trade network in Late Republican and Early/High Imperial times (1); how and when exactly did the extra-regional movement of wine and/or oil in amphorae from this area start (2); in which period did it reach its peak, when did it slow down and when precisely did it end (3); to which destinations were these foodstuffs transported and did their distribution networks change over time (4); and can we notice similar trends for wine and olive oil, or was their evolution somewhat different (5)? The elements that are systematically reviewed for each of them are content, origin, chronology and distribution. In the end, the main aim is to acquire a better apprehension of scale with respect to the time periods in which an enlargement, reduction or shift occurred in this particular sector of the wine and oil trade. As such, the chapter not only aims to reveal major phases of regional productive specialisation in wine and/or oil, but also to provide us with a first apperception of the possible impact of local conditions on export-oriented viticulture and oleoculture through time.

Chapter 2 discusses another good indicator of commercial wine and oil production: i.e. press installations. The aim of this chapter is to provide an elaborate overview of the available archaeological evidence for wine and oil production in the countryside of central Adriatic Italy. The question is hereby how press patterns may inform us about

local consumption, in addition to their logical role in the production for export. The core of the chapter is an inventory of all known rural contexts with the remains of pressing equipment and pressing establishments in the area. The data were collected by reviewing a large number of journals and book series, by consultation of the archives of the *Soprintendenza per I Beni Archaeologici* in Ancona, and by personal fieldwork on the site of Monte Torto di Osimo and in the valley of the river Potenza. The patterns that emerge from this inventory with regard to lay-out, spatial distribution and chronology are discussed in a second part. In addition, it is also tried to distinguish wine presses from oil presses by indicating the presence of specific production process related equipment. By doing so, the chief intention of this chapter is to provide tentative answers to two fundamental questions: for which periods is there evidence for commercial wine and/or oil production in the countryside (1); and how does this evidence relate to the amphora evidence discussed in the first chapter (2)?

With **Chapter 3**, we dive into the second part of the thesis, entitled 'population', where it is attempted to map the evolution in urban demography over time between ca. 300 BC and AD 200. The basis of this reconstruction is formed by a gazetteer of the 40 Roman towns in the area, wherein attention is drawn to the archaeological data for their physical extent and internal lay-out. For each of the towns, information is gathered in particular on four parameters: urban surface area (including possible suburban quarters), the nature and size of private space, the extension of public space, and the share of the street grid. These data are mainly collected from the available published evidence. Next, the patterns that may be observed throughout this gazetteer are discussed in a following section, as such forming the basis for the demographic reconstruction proposed in the final sections of the chapter. Admittedly, the reconstruction of demographic patterns from archaeological traces is always a tricky matter. Still, I am confident that the results of this gazetteer will allow at least for putting forward numerically justifiable estimates for the population densities of these towns during their heyday – i.e. roughly between the mid-1st century BC and the mid-2nd century AD – and to get some idea about their occupation in the Late Republican period. The end result may thus be described as nothing more – but certainly nothing less – than a well-founded hypothetical urban population model for the central Adriatic area.

The third and final part of the thesis centres on consumption (both food and land) and takes off with **Chapter 4**, where a food requirement model is outlined for the urban population over time. First, the chapter intertwines old and new pieces of textual and archaeological evidence on eating habits and dietary proportions. Next, the guidelines regarding human energy requirements as outlined by the FAO are used and acclimated for establishing a range of daily calorific intakes in antiquity. Following this, a third section sets-up an urban consumption model for both the Late Republican and the Early/High Imperial period. Finally, in order to complete the picture, a fourth section incorporates the subsistence needs of the rural population.

Chapter 5 forms the closure to the third part and concludes the thesis as a whole. It is devoted to an estimation of the amount of land that was needed in order to produce the necessary quantities of food. Once again, the focus is on cereals, vines and olives. The methodology followed is straightforward and involves the examination of yield data from ancient sources in combination with comparative evidence from the area in later historical periods. Based on these observations, the required amounts of land in both the Late Republican and the Early/High Imperial period are outlined for both monocultural and mixed regimes. These are then compared with the size of the studied territory in order to provide us with a preliminary impression of scale over time.

The concluding epilogue of this thesis reflects on how the models that were constructed throughout the different chapters can help us in understanding how local factors may have influenced the evolution of the viticultural and oleocultural sector in central Adriatic Italy over time. It must be stressed, however, that these models are not meant to provide us with full historical answers, or to present a 'true' version of the agro-economic past in this area of Roman Italy. Instead, they are merely constructed for shaping and testing a realistic hypothesis; a hypothesis that can be modified, adjusted or improved by future archaeological and historical research. The final result of this thesis can best be described then as a tentative scenario, a hypothesis for how local production and consumption and export of wine and olive oil could have related to each other in this part of Roman Italy in diachronic terms, and how this relationship may have influenced viticultural and oleocultural traditions over time.

I am fully aware that I will touch upon a wide array of topics – i.e. amphora studies, press remains, urban topography, demography, dietary habits, yield patterns, etc. – that would not only deserve a separate study on their own, but also have amassed copious amounts of scholarly work in the past, and continue to do so in the present. None of the chapters, therefore, claims completeness, nor do they aim at establishing some kind of authority on the various subjects. Superficially, however, they are not and I firmly believe that I have treated each argument with enough detail and acumen in order to rightfully engage them within the wider scope of this study; i.e. aiming at a better understanding of how intra-regional demographic developments in town and country might have influenced the developments in the wine and oil sector in this part of Roman Italy.

Practical notes

Before embarking on this endeavour, some practical notes may be useful. First, given the distinct nature of the different chapters, it was decided to organise the bibliography accordingly, meaning that the reader will find the majority of the references under the corresponding chapter heading. The works that are repeatedly cited throughout this thesis are assembled under a general section at the end of the bibliography. Second, as chapters 3 and 4 both required a large amount of cartographic and iconographic material, I opted for attaching the associated figures immediately behind each chapter, rather than assembling them all in an illustration section at the end of the thesis. In all other chapters, the figures are intermingled with the text. Third, the five appendices have been put together in a separate segment and can be found after the bibliography. The references with regard to the amphora findspots in Appendix I can also be found in the bibliographical section of Chapter 1. And finally, the consulted websites are fully referenced at in association with the relevant passages or figures in the text, but are not repeated in a separate list. This is not the case for the references to the ancient written sources, of which an overview is provided at the beginning of this work, after the list of abbreviations.

Part 1 Production

Chapter 1
Central Adriatic amphorae in the Mediterranean

"This is why I have chosen amphoras, as remarkable talkative tracers of economic history".
(Laubenheimer 2013, 99)

1.1 What amphorae can tell us

In the course of his pioneering typological work on amphorae from the Castra Praetoria and the 'Monte Testaccio' in Rome at the end of the 19th century, German archaeologist Heinrich Dressel immediately realised that these transport containers were capable of providing us with a considerable amount of information on Roman economic history. In particular, through his painstaking analysis of the epigraphic material that was present on these amphorae, he was able to formulate hypotheses about their content, date and possible regions of origin. As such, Dressel showed that amphorae were able to contribute significantly to the reconstruction of distribution networks of foodstuffs such as wine, olive oil and fish-sauces in Roman times.[1] Despite this awareness, the systematic study of these vessels did not start until after the Second World War, when the onset of underwater archaeology in the 1950's led to the discovery of many shipwrecks in the Mediterranean that were loaded with such pots. Indeed, the seminal work carried out by marine archaeologists such as Nino Lamboglia, Fernand Benoit and André Tchernia in the 1960's and 70's stimulated a renewed interest in amphora studies and allowed for the discipline to develop itself fully in the following decades.[2] The constant accumulation of

[1] Dressel 1899.

[2] See in particular Lamboglia 1950; and 1952; Benoit 1954; 1956; 1957; and 1961; and Tchernia 1968-70; and 1969. In 1965, an important catalogue of amphora stamps was published by Maurice Henry Callender, while Fausto

ceramic data in this period laid the basis for further refinements in typology and chronology, while a growing corpus of epigraphic data inspired the set-up of databases with painted or incised inscriptions and stamps.[3] In this process, the informative potential of amphorae came to full fruition, with several sub-aspects becoming the subject of proper research lines, like reliable quantification methods and focused prosopographic studies, or the examination of kiln remains and content analyses of full examples, or also fabric studies dealing with the mineralogical, petrographic and chemical composition of the clay with which these containers were made.[4]

As a result of this massive amount of new archaeological information, the value of amphorae in economic analysis now became appreciated in all respects. If nothing else, they were able to show us the relocation of goods such as wine and olive oil from their places of production to their places of consumption with relatively great precision. Furthermore, the creation of distribution maps through the assemblage of findspots allowed for establishing the geographic dispersion of certain amphora types, and thus for identifying the supply routes of these foodstuffs. Also, by counting the number of vessels on these sites, and by calculating the volume of their liquids, something could be said about the scale of these movements. Finally, thanks to the continuing improvement of typo-chronological seriations fed by the publication of new material, it became more and more possible to study the trends and patterns that emerged from these containers over time.[5] In this way, Roman amphorae grew from being a rather obscure category of material evidence into a major source of potential data for tackling broad agro-economic questions, in particular regarding the developments in the wine and oil business.

Zevi's reconsideration of Dressel's typology appeared in 1966. In the 1970's, two conferences in particular organised by the École française de Rome formed the backbone for further studies: '*Recherches sur les amphores romaines*' in 1971 (1972), and '*Méthodes classiques et méthodes formelles dans l'étude typologique des amphores*' in 1974 (1977).

[3] The most important one remains without doubt the '*Ceipac Corpus Database*' (http://ceipac.gh.ub.es/), but many other databases exist, like the '*Recueil de Timbres sur Amphores Romaines*' (RTAR) of the Centre Camille Jullian (http://publications.univ-provence.fr/rtar/), or the '*Corpus of matrices of stamps of Rhodian eponyms and producers*' by the Alexandre Centre for Amphora Studies (http://www.amphoralex.org/amphores/accueil/Amphores.php).

[4] Peacock/Williams 1986. For the pros and cons of several quantification procedures used in amphora studies, see the recent contribution by Mariana Egri in the '*Proceedings of the Sixteenth Annual Theoretical Roman Archaeology Conference*' (Egri 2007).

[5] It was precisely this potential relationship between amphorae and Roman economic history that formed the core of the third conference on amphora studies organised by the École française de Rome in 1986, '*Amphores romaines et histoire économique: dix ans de recherche*' (1989).

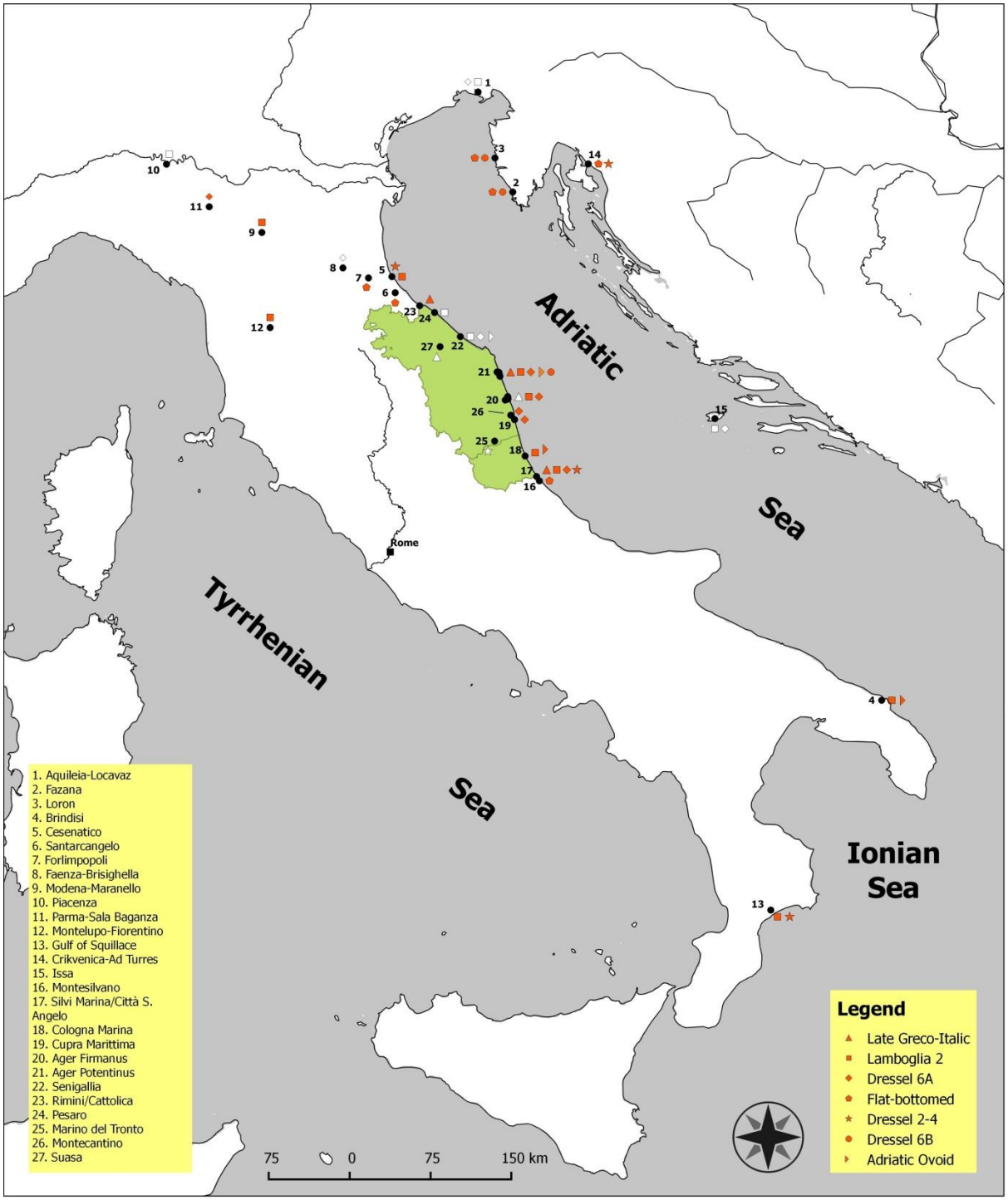


Figure 5 Production centres of central Adriatic amphora types (for the centres indicated in white, the production is only supposed) (Map author).

Still, in order to rightfully use these data for economic interpretation, it is important to understand what amphorae are and what exactly they represent. In other words, why did the Romans start to manufacture these containers in the 3rd century BC, and in which particular contexts were they employed? The idea of using amphorae – i.e. large ceramic jars provided with two opposite handles – for transporting liquid goods in antiquity was not a practice invented by the Romans, but one that originated some 1500 years earlier

with the Canaanites in the Bronze Age Near East.[6] From there, the tradition of amphora-making was first spread to the Egyptians, and later to the Phoenicians, the Greeks and eventually the Romans.[7] The reasons for their repeated 'invention' were purely utilitarian: the desire to transport bulk quantities of perishable commodities in a single turn, while creating a container that was still small enough to be managed by one or two persons, but at the same time was easy to manufacture in series and fairly cheap to produce in large numbers at once.[8] A baked clay carrier was hereby the obvious choice, as the wide natural availability of clay in the Mediterranean made it an easily obtainable raw material. Besides, while manufacturing these vessels was a relatively long process, it was also a fairly straightforward one.[9]

The particular shape of Roman amphorae was in part related to the nature of their content – the typical long neck, for instance, assured that the liquid could not be spilled over easily– but it was above all the result of the way in which they were to be moved. Indeed, the design of these containers betrays that they were meant in the first place to be used in water transport. With their often bag-, egg- or bullet-shaped bodies and spiked or dotted foots, they were well-adapted to be stacked in ship's holds, were they were commonly arranged into several superimposed levels of parallel rows, with the feet of the upper row inserted in the space between the handles of the lower row. On the other hand, their form and fragility undoubtedly proved to be less practical for carrying them overland by cart or pack animal. This is not to say that amphorae could not have been used in land transport – in fact, it has been argued that smaller versions and/or flat-

[6] The Latin word '*amphora*' is derived from the Greek word '*amphoreus*', which is an abbreviation of 'amphiphoreus', a term that literally refers to the typical handles on both sides (*amphi*) of the vessel (*phoreus*). Both words already occur on Mycenaean clay tablets and later also in Homer's Odyssey in order to denominate large two-handled wine vessels (Grace 1961; Laubenheimer 2013, 97).

[7] The Canaanites were a civilisation that populated the Syrian-Palestine coastal area between the 18th and the 8th centuries BC. They created the so-called 'Canaanite jar', a large two-handled carrier with a narrow base, broad shoulders and a small mouth. Somewhere in the 15th-14th century BC, the intense trade contacts with the Canaanites inspired the Egyptians to start manufacturing their own longer and slimmer version of the former's double-handed vessel. The classical biconical form of the Canaanite jar, however, did survive until the 8th-7th century BC, when it was adopted by the Phoenicians. It is likely that both the Phoenician and the Egyptian containers served as prototypes for the subsequent Greek amphora-shaped variants, which started to appear in the 7th century BC. Through the Greeks, the tradition of amphora making eventually reached Sicily and southern Italy, where so-called 'Greco-Italic' amphorae were manufactured in the 5th and 4th centuries BC. In the course of the 3rd century BC, these hybrid forms gradually gave birth to the first proper Roman amphorae (Peacock/Williams 1986, 20-30, with references).

[8] Lyding Will 1977; Peacock/Williams 1986, 21.

[9] In Roman times, they were probably built-up on the wheel in several stages out of separate coils of clay, alternated by drying phases required for obtaining the desired stability. On the whole, this operation generally lasted for about ten days. They were then fired in adapted kilns for ca. 24 days. It has been estimated that large kilns (ca.70 m^3) could fire 1,000 amphorae in a single time (Toniolo 2000, II-III).

bottomed types in particular would have been more adapted for this purpose – just that they were not the preferred type of container for moving foodstuffs overland.[10] In the latter case, less fragile, smaller and more flexible carriers – such as wooden barrels, cloths or skins – were likely considered to be more suitable solutions.[11] This is well reflected in the archaeological record, where the distribution of amphorae is mostly restricted to coastal areas, or inland areas that were served by large navigable rivers.[12]

One and two makes that amphorae were not the sole carriers used for transporting wine and oil in Roman times. Instead, they were only one possible type of bearer within a wider array of packaging material. The choice for one another depended primarily on three factors: the volume that was to be moved, the distance that it needed to be moved over, and the eyed transport route. In practice then, amphorae will have been the first choice for transferring large amounts of these liquids over longer distances via waterways. Casks or sacks, on the other hand, were rather used for carrying smaller amounts over shorter distances by road. It follows that the number of amphorae circulating in a certain period are not automatically representative for the total movement of wine and oil in that period, but just for the portion of it carried in amphorae. It also follows that our archaeological record is biased towards the movements of the first order, as baked clay is a durable material that survives well over time, as opposed to containers made out of more perishable materials that are archaeologically not – or much less – detectable. Indeed, archaeology is a very handy tool for mapping the circulation of earthenware containers, but one will have to look hard to find a distribution map of wooden barrels in the Mediterranean. Any study then that uses amphorae for telling something about the nature and the extent of the wine and oil trade in Roman Italy, will need to take into consideration that we only see a part of that trade. But which part?

To simply state that amphorae represent extra-regional trade and perishable containers intra-regional trade would be an oversimplification of a reality that is bound to have been much more complex and multi-layered. Indeed, archaeological evidence indicates that it will not have been uncommon for locally produced amphorae to circulate within sub- or intra-regional distribution networks.[13] Historical sources suggest that this could be done via small ships that operated along coastal routes through shortsea shipping or cabotage (tramping), or by vessels that could sail the navigable parts of inland

[10] Panella 1989, 160-161.

[11] Tchernia 1986, 285-292; Panella 1989, 162-163; Morley 1996, 10; De Sena 2005. For the use of wooden barrels in particular, see Marlière 2002; and 2004.

[12] The many distribution maps in the volume '*Amphores romaines et histoire économique: dix ans de recherche*' (1989) are exemplary.

[13] For an example of the use of local amphorae in inland regional trade in Roman times, see Ghisleni et al. 2011, 138-139. For the central Adriatic area in particular, see *infra* this chapter.

rivers.[14] Likewise, wooden barrels and skins were not only used to transfer locally produced agricultural commodities via roads to intra-regional extractors, but were also deployed for pouring over goods originally imported in amphorae; this in order to carry them to their final inland destinations.[15] Still, several decades of amphora studies have made it perfectly clear that most of the time these containers – especially the larger and more easily recognizable ones – are found in places located at considerable distances from their region(s) of origin. On the whole then, it is safe to assume that our ceramic evidence illuminates a sector of the wine and oil trade that was aimed in the first place at the overseas market, rather than the local market. As such, this makes amphorae the archaeological markers *par excellence* for tracing the developments in that particular sector over time, and thus for visualising changing consumption patterns in Roman provincial territories.

But does that mean that amphorae cannot tell us anything at all about the production and consumption patterns in their regions of origin? I believe that, indirectly, they can. Leaving aside the different mechanisms by which amphorae circulated within the Roman Empire – reciprocity and other exchange schemes, redistribution, or proper trade – their mere presence in a certain area suggests that there was an exportable surplus available in another area.[16] In order for that area to begin producing meaningful surpluses – i.e. surpluses that are large enough for noticeable quantities to be exported outside the region – three basic conditions needed to be fulfilled:

- A first and obvious condition was that the external demand for these food products was sufficiently large for internal production to scale up considerably. Evidently, there was no need for making substantial investments in land, people, equipment and infrastructure – and thus to take certain financial risks – in order to increase the yield of certain crops if the 'markets' for these crops were not big enough.
- A second prerequisite was that the local demographic situation had to allow for transferring a significant portion of locally produced foodstuffs towards consumption groups further afield. Indeed, in a peasant-based economy such as the Roman Empire, satisfying local demand was one of the primary concerns and the amount of food that could be exported reasonably depended on what was required in the first place to satisfy the needs of the domestic rural and urban population.[17]

[14] For a discussion and references, see Erdkamp 2005, 177-181; see also Horden/Purcell 2000.

[15] Tchernia 1997.

[16] For a good discussion on the different distribution mechanisms that existed in Roman times, see Peacock/Williams 1986, 54-66, with references.

[17] Vera 1994, 244, note 23, who refers to Thorner 1964.

- A final and perhaps most important *sine qua non* was that there needed to be a sufficient amount of suitable agricultural land available in the area for producing all this food.

With these three parameters in mind, it becomes clear that amphorae are not only direct tracers for following the evolution of an area's demand for food products from elsewhere; but can also be indirect proxy indicators for another territory's ability to produce the necessary surpluses over time. As this ability is closely connected with internal factors such as local demography and land availability, I believe that amphorae have the power to tell us something about consumption patterns and land use in their areas of provenance. It is hereby particularly important to look at the broader patterns of our amphora evidence, such as the appearance and disappearance of amphorae *tout court* from a certain area, or their increase and decrease in number in consumption areas, or the replacement of one amphora type by another over time, or also of a wine container by an oil container and vice versa. Such patterns are significant as they may inform us not only about the timeframe in which a territory was able to produce surpluses for external markets, but also about the periods in which this ability increased, peaked, or decreased, and about the moments in which the chief export commodity was wine, olive oil, or both.

In order to begin constructing such patterns for the central Adriatic area of Italy in Late Republican and Early/High Imperial times, we thus want to look not just at one particular amphora type from the region, but rather at the totality of types produced there throughout the entire time period. Once established, we would then like to identify the main commodity of each of the amphora types involved, i.e. whether it was wine or oil. Our next concern would be to determine the chronological extent of their respective life-cycles, trace the destinations to which they were sent, and evaluate the quantitative importance of their circulation. Finally, the ranking according to a typo-chronological structure of all the different amphora classes would allow for a concluding section to measure diachronically the export behaviour of wine and oil from the study area. Such an analysis would not only reveal major phases of regional productive specialisation in wine and/or oil, but may also provide us with a first apperception of the possible impact of local conditions on export-oriented viticulture and oleoculture through time. Performing such an analysis is then precisely the intent of this chapter.

1.2 Making central Adriatic amphorae speak

The role of the central Adriatic amphorae in the history of Italy's wine and oil industry between the end of the First Punic War (264-241 BC) and the High Imperial period (late 1st-2nd century AD) has long been underexposed in comparison with the better known Tyrrhenian and Ionian wine carriers – embodied mainly by the Greco-Italic, the Dressel 1 and the Dressel 2-4 – and the southern Adriatic oil containers, i.e. the so-called 'Brindisian ovoid' amphorae.[18] In recent years, however, our knowledge on these earthenware containers has much improved and it is now clear that they too form a very specific and important group of long-distance transport containers that reflect the existence of a major pre-industrial wine and oil business along the middle-northern eastern coast of the Italian peninsula.[19] The amphorae that have been brought into connection with the central Adriatic area of Italy over the years – be it through kiln remains, epigraphy, fabric analysis, ancient literary testimonies or climatic determinism – can be classified into nine main typology groups: the Adriatic version of the Late Greco-Italic (CAAT 1) (CAAT = Central Adriatic Amphora Type), the Lamboglia 2 (CAAT 2), the Dressel 6A (CAAT 3) and

[18] For a general introduction to the Greco-Italic and the Dressel 1 amphorae, see Tchernia 1986, 42-53; and Maza 1998; for their production sites, see Hesnard et al. 1989; for the Tyrrhenian Dressel 2-4, see Tchernia 1986, 127-128; for the production of ovoid amphorae in the kilns at Apani and Giancola in the territory of Brindisi, see in general Palazzo 2013 (Apani) and Manacorda/Pallecchi 2012 (Giancola), both with references to previous bibliography; for the excavation of the kiln at Apani, see Sciarra 1964; 1972; and 1973; for the numerous stamps found during these excavations, see Sciarra 1967; and 1970; for the classification of the different sub-types produced at Apani, see Palazzo 1988; and 1989; for a synthesis of the organisation of amphora production in the territory of Brindisi, see Manacorda 1994.

[19]. Since the seminal contribution by Maria Teresa Cipriano and Marie-Brigitte Carre '*Production et typologie des amphores sur la côte adriatique de l'Italie*' in the volume '*Amphores romaines et histoire économique*' in 1989, numerous specialised studies and articles have appeared on the subject. The full list can be found in the bibliographical section at the end of this work. The most important publications from the 1990's include Stefania Pesavento Mattioli's '*Anfore romane a Padova: ritrovamenti dalla città*' in 1992 and her '*Bonifiche e drenaggi con anfore in epoca romana: aspetti tecnici e topografici*' in 1998; and Brunella Bruno's '*Aspetti di storia economica della Cisalpina romana. Le anfore di tipo Lamboglia 2 rinvenute in Lombardia*' in 1995. More recent publications are the 2009 volume 'Olio e pesce in epoca romana nell'alto e medio Adriatico' by Maria Stella Busana, Chiara D'Inca and Silvia Forti; and the 2013 monograph '*Vicenza. Traffici commerciali in epoca romana: i dati delle anfore*' by Stefania Mazzocchin. Useful recent overviews and discussions are Marie-Brigitte Carre's and Stefanie Pesavento Mattioli's contribution '*Anfore e commerci nell'Adriatico*' in the volume '*L'archeologia dell'Adriatico dalla Preistoria al Medioevo*' and David Nonnis' chapter '*Appunti sulle anfore adriatiche d'età repubblicana: aree di produzione e commercializzazione*' in the volume '*Strutture portuali e rotte maritime nell'Adriatico di età romana*', both in 2001, Clementina Panella's important article '*Roma, il suburbio e l'Italia in età medio- e tardo-repubblicana: cultura materiale, territori, economie*' in the journal *Facta* in 2010; and the latest state of the art '*Transport amphorae Lamboglia 2 and Dressel 6A: Italy and/or Dalmatia? Some clarifications*', provided again by Marie-Brigitte Carre, Stefania Pesavento Mattioli and Patrick Monsieur in 2014 in the '*Journal of Roman Archaeology*'.

6B (CAAT 4), the Adriatic Dressel 2-4 (CAAT 5), the so-called 'Adriatic ovoid' (CAAT 6), 'flat-bottomed' (CAAT 7) and 'funnel-shaped' amphorae (CAAT 8), and the Schörgendorfer 558 (CAAT 9). Clear transitional types between the Greco-Italic and the Lamboglia 2 and between the latter and the Dressel 6A have also been discerned. An intermediate type between the ovoid amphora and the Dressel 6B has been labelled 'ante 6B'.[20] Amphora types CAAT 1-3, 5 and 7 were wine containers; CAAT 4, 6 and 8 were probably oil containers; CAAT 8 is considered to be an olive jar.

It is true that the manufacturing business of these amphorae was not confined to the central part of Italy's Adriatic coast. Instead, it must be seen as a much wider phenomenon that covered the entire middle-northern section of the Adriatic basin, the Po-plain in northern Italy, the Ionian coastal area in southern Italy, a part of Tuscany, and maybe even the Vesuvian area.[21] Indeed, amphora workshops have been identified from *Regio* X *Venetia et Histria* in the north (Aquileia-Locavaz; Fazana and Loron) down to *Regio* II *Apulia et Calabria* in the south (Brindisi-Apani/Giancola).[22] A series of coastal and more inland kilns is known to the south of the Po river (Cesenatico-Ca'Turci, Santarcangelo, Forlimpopoli, Faenza-Brisighella, Modena-Maranello, Piacenza, Parma-Sala Baganza), while a few isolated workshops producing 'Adriatic' types have also been attested further away, in Tuscany (Montelupo Fiorentino) and along the Ionian coast in Calabria (Gulf of Squillace).[23] One production centre is with certainty located outside Italy, at Crikvenica-Ad Turres in Croatia; while a second one is presumed further down along the Dalmatian coast on the island of Issa (*Figure* 5, n° 1-15).[24] That Lamboglia 2 were produced in diverse

[20] Cipriano 1991, 165; Carre/Pesavento Mattioli 2003, 460.

[21] For the attribution of some Lamboglia 2 to the Vesuvian area on the basis of fabric analyses, see Tchernia 1986, 54, note 40.

[22] For the Lamboglia 2 (and maybe also Dressel 6A) kiln in the territory of Aquileia (1) near the river Locavaz, see Maselli Scotti 1980, 385-386; and 1982, 82-84; see also Cipriano 1994, 207; and Buora et al. 2008. The workshops at Fazana (2) and Loron (3) in today's Croatia produced Dressel 6B and flat-bottomed amphorae (for Fazana, see Gnirs 1910a; and Bezeczky 1998a, 3-4; and Auriemma et al. 2012, 166, note 52; for Loron, see Tassaux et al. 2001; for the production of flat-bottomed amphorae in particular, see Maggi/Marion 2011). The amphora kilns at Apani and Giancola in the territory of Brindisi (4) produced early variants of the Lamboglia 2 type ('Apani I' and 'Giancola 2A' types). For the workshop at Apani, see Palazzo 2013; for Giancola, see now Manacorda/Pallecchi 2012, with previous bibliography.

[23] For Cesenatico (5) (Lamboglia 2; Dressel 2-4), see Mangani et al. 1981, 50-51; Cipriano/Carre 1989, 82; Farfaneti 2000, 130-135, n° 139-142; and Stoppioni 2009, 305, note 10. For Santarcangelo (6) (flat-bottomed amphorae), see Biordi 1983; and Stoppioni Piccoli 1983; for Forlimpopoli (7) (flat-bottomed), see Aldini 1978; and 1989. For Modena (9) (Lamboglia 2), see Giordani 1990; for Parma-Sala Baganza (11) (Dressel 6A), see Marini Calvini 1974; Carre 1985, 215. The presence of workshops at Piacenza (10) (Lamboglia 2; Bruno 1995, 87) and between Faenza and Brisighella (8) (Dressel 6A; Monti 1971; Righini 1971) is currently only supposed. For the kiln of Montelupo (12) (Lamboglia 2), see Bruno 1995, 90; for the Gulf of Squillace (13) (Lamboglia 2, Dressel 2-4), see Corrado 2009.

[24] The kiln recently found at Crikvenica (14) produced mainly flat-bottomed amphorae and maybe also some Dressel 2-4 (Lipovac Vrkljan 2009; 2011; and Radic Rossi 2011). For Issa-Stonca bay (15) (Lamboglia 2, Dressel 6A),

centres is also clear from the consumption sites of these amphorae, where they are frequently attested in different fabrics, attributable to both the southern, central and northern sections of the Adriatic basin.[25] Still, after more than three decades of study and research on these amphorae it is clear that the central Adriatic region of Italy was one of the most important zones producing these containers and I will focus my efforts on this area.

1.2.1 Wine amphorae

Adriatic late Greco-Italic (ca. 250/225 – 150/125 BC)

The manufacturing and distribution of the Adriatic version of the Late Greco-Italic amphora type is a complex and multifaceted issue that is still poorly understood and whose study is only at its beginning. A first issue lies within the terminology 'Greco-Italic' itself, which is being used nowadays for a range of largely similar containers that were produced in Italy between the end of the 4th century BC and the end of the-2nd century BC. A second problem is the long-time obscurity in Roman amphora studies of the actual existence of an Italian Adriatic production of Greco-Italics. Due to this vagueness, many published finds from the wider Adriatic and the Eastern Mediterranean coastal regions have been attributed either a Tyrrhenian-Italian or even local origin. Hence, the effective production and distribution scale of the Adriatic Greco-Italic is still unclear. In order to better understand these matters of contention, some clarification is required. Therefore, I will first briefly frame the history of Greco-Italic amphora studies before moving on to the evidence for its production along the central Adriatic coast of Italy. I will then review some of the potential evidence for its circulation in the Mediterranean.

see Cambi 1989, 321; Kirigin et al. 2006, 193-194, note 8; and Menchelli 2011. For the proposal of a massive production of these containers along the central Dalmatian coast, see Lindhagen 2009; reformulated in Lindhagen 2013, 231-232, with notes 4-6 in particular; for objections, however, see Panella 2010, 96-97 (*Addendum*); and Carre et al. 2014.

[25] For an overview of analyses carried out on Lamboglia 2 and their attribution to different geographic origins, see Bruno 1995, 83-91. The Lamboglia 2 found at Carthago Nova in Spain were subdivided into three different fabrics (Márquez Villora, Molina Vidal 2005, 115-116), with fabric type L2a probably originating from the central Adriatic area (Menchelli 2011); for Spain in general, see Pérez Ballester/Pascual Berlanga 2004, 34. For a discussion of Adriatic amphora fabrics in relation to the finds of these containers at the urban site of Suasa in the Marche region, see Gamberini 2011.

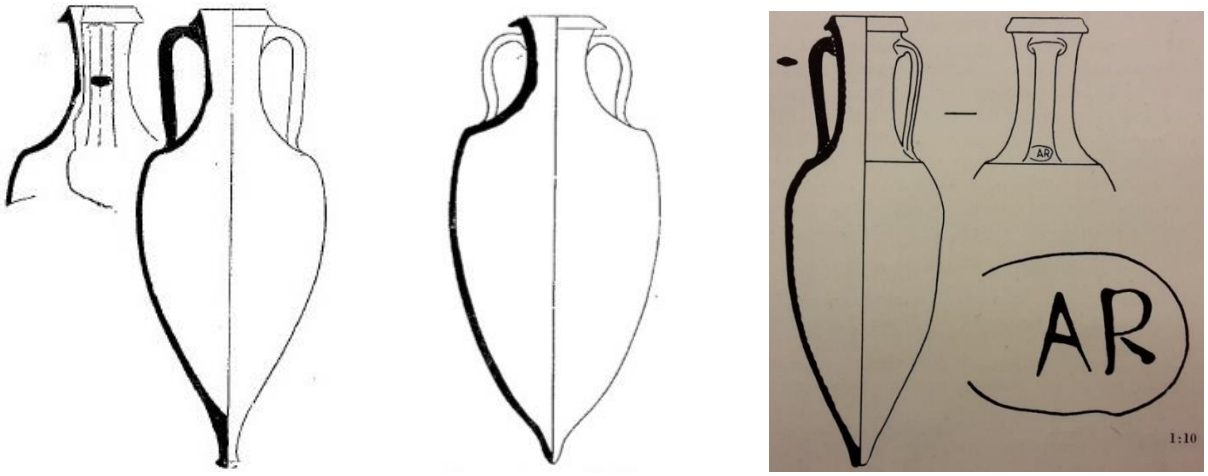


Figure 6 Greco-Italic from the Grand Congloué 1 shipwreck (After Lamboglia 1955, Fig. 21; original figure in scale 1:10).

Figure 7 Greco-Italic from Pech-Maho (After Lamboglia 1955, Fig. 20; original figure in scale 1:10).

Figure 8 Greco-Italic from the shipwreck of La Ciotat (After Benoît 1957, 255, Fig. 7; original figure in scale 1:10).

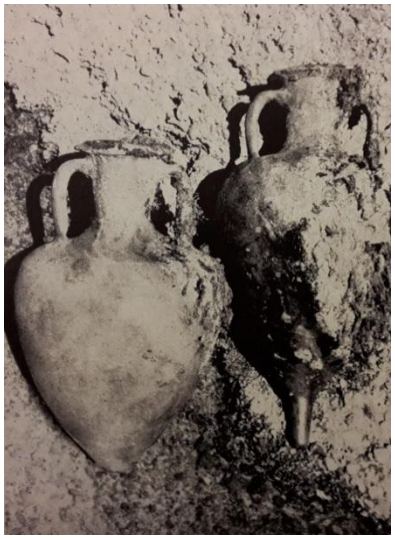
The term 'Greco-Italic' was used for the first time by Fernand Benoît in the 1950's in order to denominate a specific group of ca. 400 amphorae from Grand Congloué 1, a Roman ship sunk in the waters of Marseille near the end of the 3rd/beginning of the 2nd century BC. Said containers were characterised by a double truncated cone-shaped neck, an inclined rim with triangular profile, oval handles that started just under the rim, and a shoulder that was clearly separated from the belly by a rim (*Figure* 6). The denomination 'Greco-Italic' was appropriately used because these containers seemingly marked the transition from Greek amphorae with a curvilinear shoulder in the form of a spinning top to Roman amphorae with a shoulder marked by a ridge.[26] In 1955, Nino Lamboglia classified these amphorae as his 'Lamboglia 4-type', a name he equally assigned to a similar but somewhat earlier example from the oppidum of Pech-Maho close to Narbonne, dated to the 2nd or 3rd quarter of the 3rd century BC. While the Narbonne exemplar clearly approached the Grand Congloué types in overall shape, the former nevertheless differed from the latter by its shorter neck, flatter rim, slender handles, and higher placed shoulders (*Figure* 7).[27] In 1957 Fernand Benoît proposed to define these amphorae simply as '*Forme 1*' of his '*Série républicaine*', a denomination inspired by them being the first Roman amphorae anterior to the Imperial period.[28] While it was clear that these amphorae had been produced in a variety of places, their preponderance in places such as Taranto, Lecce, Paestum and Ischia – together with the presence of stamps

[26] Benoît 1954, 40-41; 1957, 251-256; 1961, 36-41.

[27] Lamboglia 1955, 264-265.

[28] Benoît 1957, 250-251.

mentioning Campanian families on examples from the shipwreck of La Ciotat (*Figure* 8) – favoured an origin in Magna Graecia.[29]



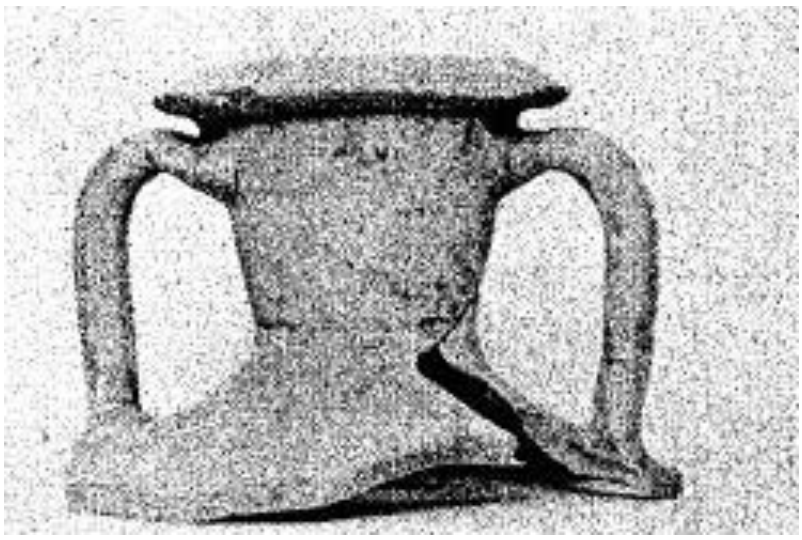


Figure 9 Greco-Italic from Reus (After Benoît 1957, 252, Fig. 2).
Figure 10 Greco-Italic from Koroni (After Vanderpool et al. 1962, Pl. 22).

Despite being much shorter and more heart-shaped than the examples from Grand Congloué 1 and Pech-Maho, Benoît had also included two amphorae from the Gulf of Reus (Spain) in the first category of his Republican Series (*Figure* 9). In 1962, Virginia Grace referred to these amphorae when she discussed a fragment of a comparable jar found on the Koroni peninsula (Greece) (*Figure* 10).[30] A Spanish/Western origin was supposed because of the appearance of Iberian letters on yet another exemplar of this type from the site of Ensérune in southern France, already mentioned by Benoît in 1957.[31] On the basis of her comparison with other examples from the town of Gela (Sicily) and the necropolis of Spina (northern Adriatic Italy), Grace dated the Koroni exemplar towards the end of the 4th century BC.[32] In 1979, the heart-shaped Greco-Italics from the necropolis of Spina were published more extensively by Serena De Luca De Marco (*Figure* 11). She noticed that most of these containers – which all dated around the end of the 4th/beginning of the 3rd century BC – had a pink/orange or yellowish-coloured fabric mixed with large chamotte particles, a combination characteristic for the so-called 'alto-

[29] Benoît 1954, 41; Lamboglia 1955, 264; Benoît 1957, 254-255.

[30] Grace 1963, 320, referring to Vanderpool et al. 1962, 38, n° 44, and Pl. 22.

[31] Grace 1963, following Vanderpool et al. 1962, 38; see also Benoît 1957, 254.

[32] On the basis of the destruction of the town somewhere between 285 and 282 BC, the Graeco-Italics from Gela are usually dated in the first quarter of the 3rd century BC (Orlandini/Adamesteanu 1956). For the two jars from the tomb in Spina – which have a somewhat shorter neck than the Gela ones and are dated to the end of the 4th century BC – see Aurigemma 1936, Pl. LXIV, lower right. The Koroni exemplar rather resembled the Spina jars than the Gela ones (Grace 1963).

adriatico' ceramic production. She also pointed out the similarities in both form and fabric between these containers – which she attributed to '*Classe IV*' of the Spina amphorae – and a part of the Greco-Italics from the necropolis of Adria (northern Adriatic), again dated towards the end of the 4th century BC. This made her consider the possibility of a local and thus Adriatic origin for at least some of the Spina and Adria containers.[33]

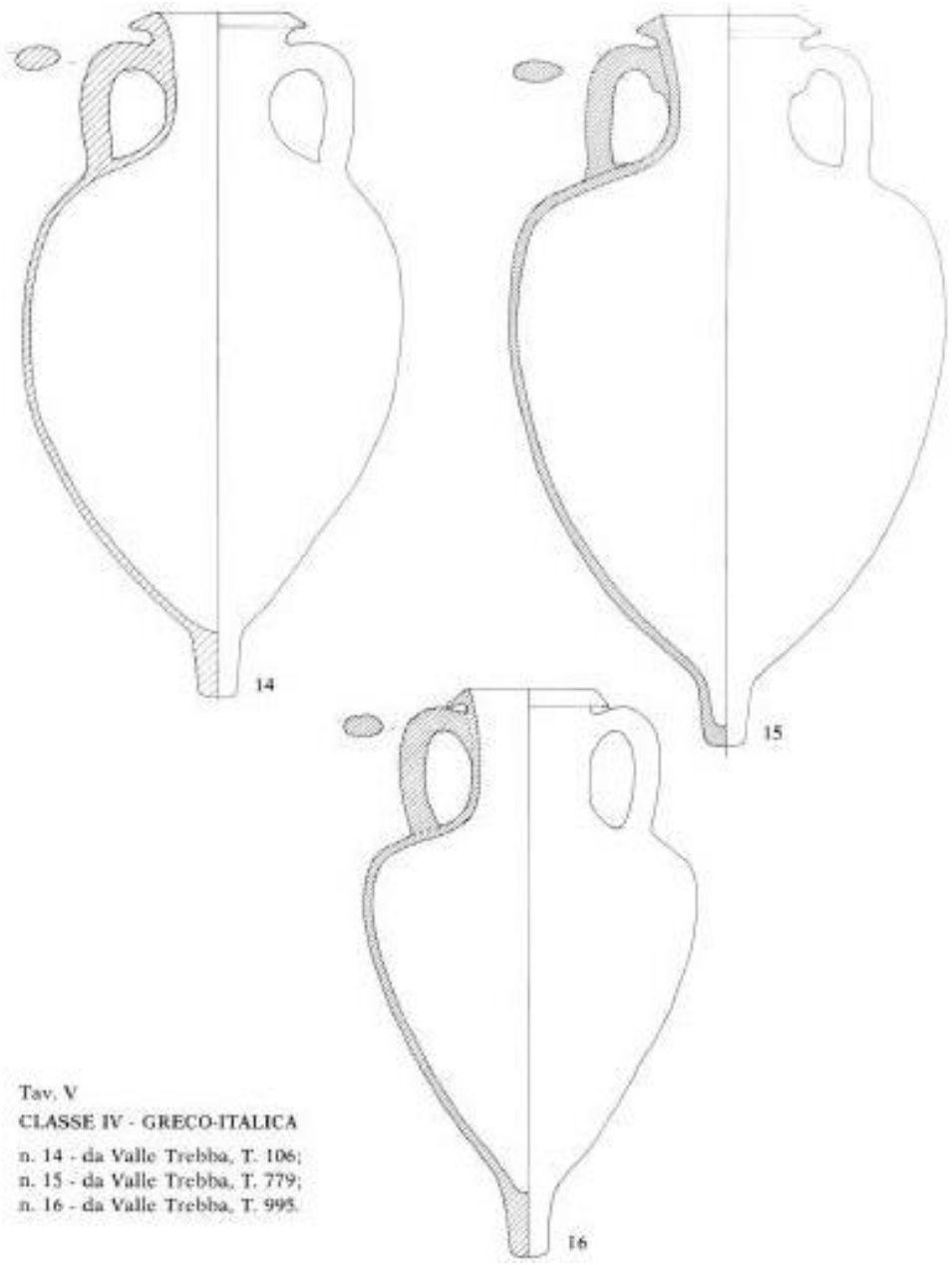


Figure 11 Greco-Italics from the necropolis of Spina (After De Luca De Marco 1979, 600, Tav. V; no scale provided with original figure).

[33] De Luca De Marco 1979, 577-578; 585-586.

However, with the accumulation of Greco-Italic finds in the Mediterranean over the years, the use of an identical terminology for jars so variable in shape and so distant in time had created a rather complex and confusing situation.[34] In an attempt to solve this problem, Elizabeth Lyding Will set-out a first proper classification of these containers in 1982. In what is now a seminal article in the history of the Greco-Italic studies, Lyding Will divided them into five subtypes, ranging from '*Form a*' to '*Form e*' and covering a time-period of ca. 200 years between the end of the 4th century BC and the end of the 2nd century BC. The first category – which was dated to the late 4th and the early 3rd century BC – was further subdivided into '*Form a1*' and '*Form a2*'. The former variant was also the shortest Greco-Italic type. This thin-walled jar was characterised by a flat rim, a short and narrow neck, handles with an oval section that started just below the rim, a broad and flat shoulder, a heart-shaped belly that had its widest diameter just below the shoulder, and a short cylindrical foot. The latter sub-form a2 was similar to Form a1, but its body was longer and the vessel had an overall narrower shape. To Form a1 – also called the "Spina-type" by Grace and Lyding Will – belonged the previously discussed jars of Reus, Adria, and Spina; to Form a2 the ones found in Gela. The frequent attestation of this form – especially the a2 variant – in and around Sicily, together with the frequent occurrence of Greek stamps, made Lyding Will propose a Sicilian origin for many of them, while an Aegean production was suggested for Form a1 on the basis of its somewhat different distribution (*Figure* 12).[35]

Lyding Will's '*Form b*' is represented by the previously mentioned jar from the *oppidum* of Pech-Maho (*Figure* 7), an exemplar she dated to the second half of the 3rd century BC on the basis of the destruction of the site at the end of the same century. Greco-Italics of *Form b* were taller and larger jars with thicker walls, a more pronounced ridge between the shoulder and the belly, but with a rather small and sturdy toe. An Italian origin was proposed because of the possible Latin stamp on the Pech-Maho jar.[36] An Italian production also seemed plausible for the Greco-Italics of '*Form c*', embodied by the jars from the Grand Congloué 1 shipwreck and dated around the turn of the 2nd century BC (*Figure* 12).[37] Vessels of '*Form d*' – called by Lyding Will the "standard" Greco-Italic – were again smaller than the *Form b* and *c*-types, but still larger than the *Form a*-ones. They maintained the longer and slender handles of the former, while re-introducing the solid toe of the latter, providing them with both an enlarged capacity and a balanced form. A Campanian-Pompeian origin was suggested for these containers, which probably

[34] Baldacci 1972a, 127-128.
[35] Lyding Will 1982, 341-344.
[36] Lyding Will 1982, 345-346.
[37] Lyding Will 1982, 346-348.

circulated between the first and last half of the 2nd century BC (*Figure* 13).[38] Finally, '*Form e*' was seen by Lyding Will as a Spanish variant of *Form d*, produced in the course of the 2nd century BC. Noticeable differences were the higher rim, the longer and narrower neck, long and S-shaped handles that re-joined said neck at its lowest section, and a more carrot-shaped belly. As such, this type clearly marked the formal transition between the Greco-Italic and its Tyrrhenian successor the Dressel 1 (*Figure* 13).[39]

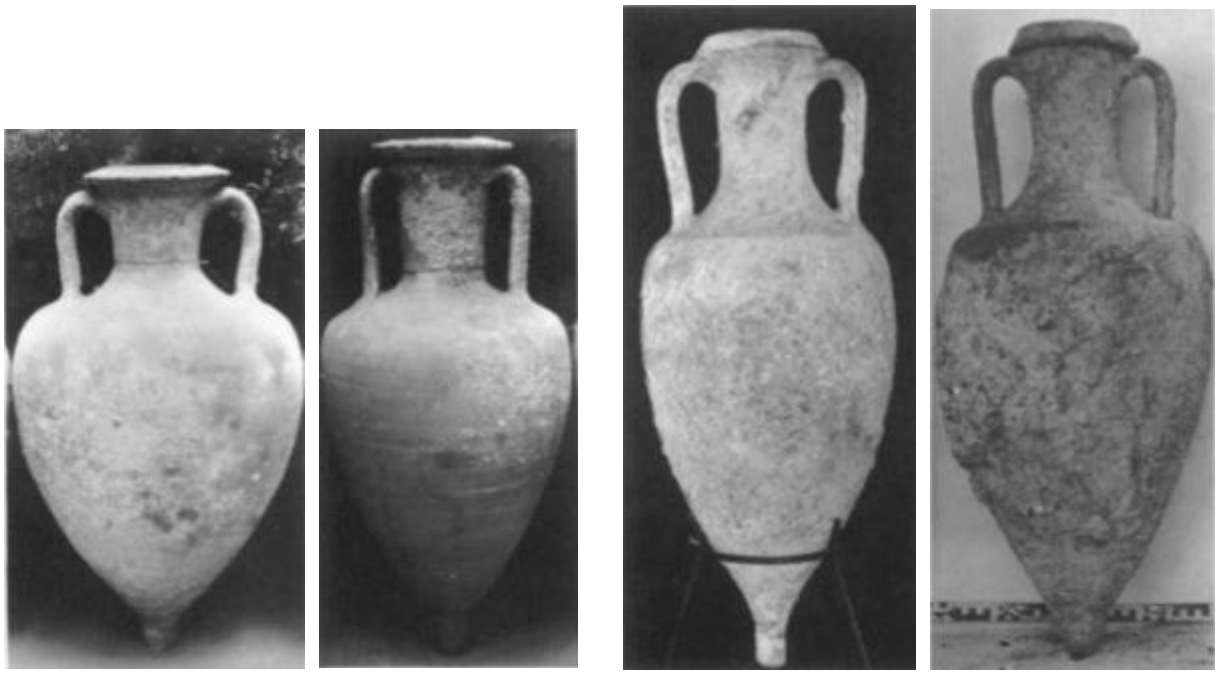


Figure 12 Lyding Will's classification of Greco-Italics (from left to right: **a1**, **a2**, and **c** (final two figures) (After Lyding Will 1982, Plate 85).

In 1986, Daniele Manacorda briefly addressed some of the inconsistencies associated with Lyding Will's classification. One aspect that was abundantly clear from her typology was the profound distance between her type A on the one hand and her types, C, D and E on the other hand.[40] This distance was expressed not only in chronological terms – the former type belonged to the second half of the 4th/beginning of the 3rd century BC, while the latter types only appeared about a century later – but also in epigraphic and historical terms. Indeed, type A jars had Greek stamps, were clearly inspired by Hellenistic Greek models and apparently halted their production in a period coinciding with the First Punic War (264-241 BC). Types C, D and E jars, on the other hand, mostly had Latin stamps, were much more standardized containers and seemingly started circulating in the wake of the

[38] Lyding Will 1982, 348-353.

[39] Lyding Will 1982, 353-355.

[40] Type B was not discussed by Manacorda because of the insufficient data regarding its formal reconstruction (Manacorda 1986, 581).

Second Punic War (218-201 BC). These diverse socio-economic contexts of their production – Greek or at least Hellenised/pre-Roman atmospheres for type A and Romanised milieus for types C, D, and E – made Manacorda introduce the preliminary terms '*greco-italica antica*' (type A) and '*greco-italiche tarde*' (types C, D, E). Still, he stressed the urgency of a more scientific categorisation of these vessels in the future, one that would better take into account their regional and chronological specificities.[41]



Figure 13 Lyding Will's classification of Greco-Italics (from left to right, types **d** and **e**) (After Lyding Will 1982, Plate 85).

In 1994, such an attempt was undertaken by Christian Vandermersch for the Greco-Italics of southern Italy, in particular with regard to Magna Graecia and Sicily as areas of origin.[42] In Vandermersch's proposed six-class typology – including the 5th-4th century forerunners of the ancient Greco-Italics, classified as types MGS I-III (Magno-Grecque-Siciliote) – Manacorda's ancient variants corresponded with his forms MGS IV and MGS V (Lyding Will's forms a2 and a1 respectively), while the late variants approached his type MGS VI (Lyding Will Form c).[43] The prototypes for the amphorae of type IV were the examples from the shipwreck of Filicudi F, dated to the early 3rd century BC.[44] Said containers were characterized by a body in the form of an arrowhead, a marked shoulder, long neck, and high handles with a flattish oval section; the rim had a profile in the form

[41] Manacorda 1986.

[42] Vandermersch 1994.

[43] These subclasses are practically identical to types RMR (Romaines-Medio-Repubblicaines) III, V and VI from Vandermersch's later re-classification (Vandermersch 2001).

[44] Albore Livadie 1985, 91. Vandermersch dates the shipwreck somewhat earlier, to the first years of the 3rd century BC or even to the late 4th century BC (Vandermersch 1994).

of either a triangle or the quarter of a circle (*Figure* 14). They occurred from the last decades of the 5th century BC until the first decades of the 3rd century BC, with the *terminus ante quem* being provided by the examples from Gela.[45] The following MGS V containers – represented in the first place by the exemplars from the early 3rd century shipwrecks of Secca di Capistello (Lipari) and Roghi (Panarea) – were shorter and more paunchy, and had a neck more in the shape of a sandglass (*Figures* 14 and 15). These containers – with the pots from Roghi in particular being close to the Spina jars in form – circulated contemporaneously with the MGS IV amphorae from the mid-4th century BC onwards, but continued somewhat longer, until the mid-3rd century BC. The most important formal innovation accompanying the appearance of its more elongated successor, the MGS VI Greco-Italic, was the introduction of the so-called 'mushroom-rim'. This type occupied the second half of the 3rd century BC and maybe also the first years of the 2nd century BC, with the Second Punic War (218-201 BC) probably being an important turning point (*Figure* 15).[46]

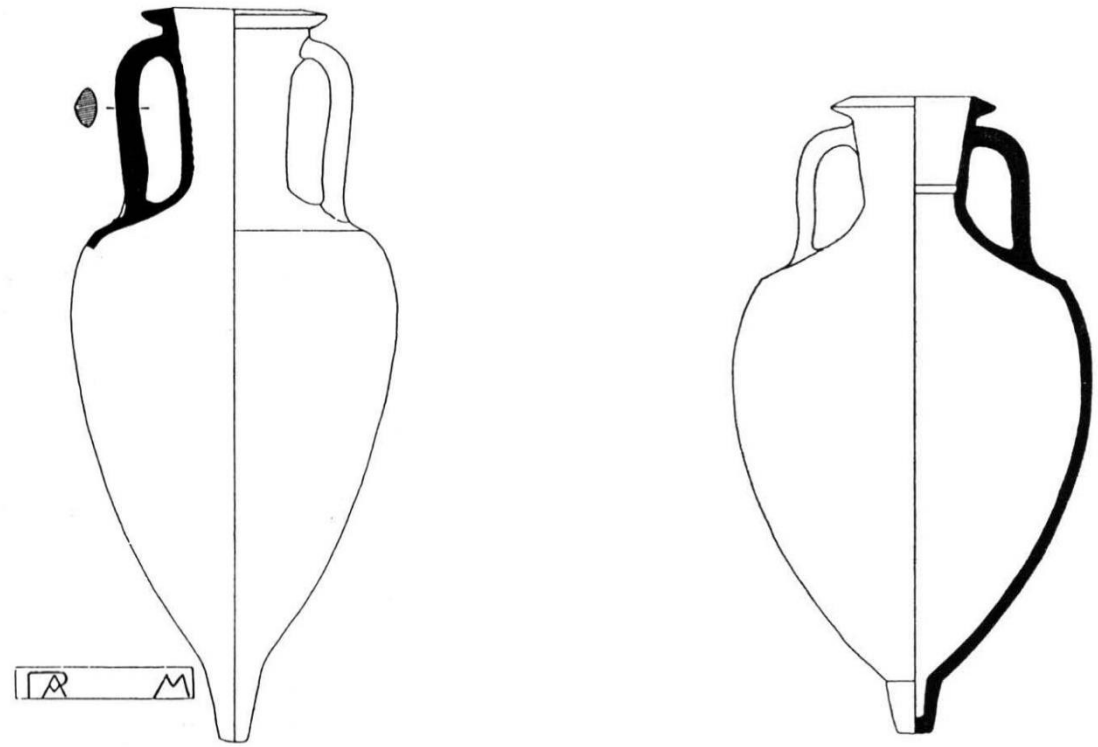


Figure 14 MGS IV from the shipwreck of Filicudi F (left) (After Albore Livadie 1985a, 91, Fig. 95) and MGS V amphora from the ship of Secca di Capistello (After Blanck 1978, 94, Fig. 3) (no scales provided with original figures in Vandermersch 1994).

[45] See *supra*, note 7.

[46] Vandermersch 1994.

The first thorough publication of an Adriatic context of Greco-Italics occurred in 2000 with Alessandro Toniolo's study of the amphorae from the necropolis of Adria. This is not the place to elaborate on Toniolo's lengthy and detailed discussion of these amphorae and their classification into 18 types. For the purpose of this chapter it suffices to say that his type 3 – dating to the beginning/mid-3rd century BC – corresponds best with Vandermersch's type MGS IV; his type 2 (end 4th – first half 3rd century BC) with MGS V; type 4 (first/second half of the 3rd century BC – first half 2nd century BC) can be linked to Lyding Will's form b; finally types 5-7 (second half 3rd century BC – first half 2nd century BC) can be compared with MGS Type VI. From type 3 onwards, the beige/yellowish fabric with clear pinky/orange-like tones – together with the inclusion of chamotte – made Toniolo think again of a local 'Adriatic' origin for these containers.[47] Unfortunately, until then, no Greco-Italic amphora kilns had been identified in the Adriatic.

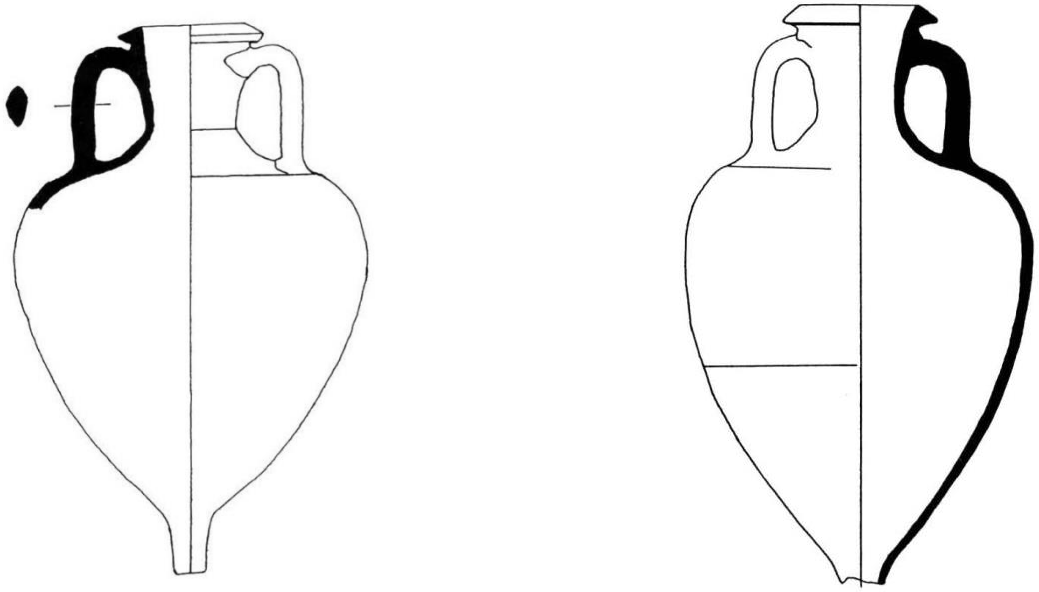


Figure 15 MGS V from the shipwreck of Roghi (left) (After Arch. Subacquea 2, 70, Fig. 57A) and MGS VI from Kamarina (right) (After Pelagatti 1984-1985, Fig. 4) (no scales provided with original figures from Vandermersch 1994).

For the central Adriatic area of Italy in particular, some significant progress was made in the following decade with the identification of amphora workshops in Cattolica (Rimini), Porto Recanati-Colle Burchio (Ancona), and Silvi Marina and Città S. Angelo in northern Abruzzo (Teramo) (*Figure* 5, n° 17, 21, 23). The earliest workshop currently known in the area is that of Cattolica in the surroundings of Rimini (*Ariminum*), which produced a type of Greco-Italic similar to Vandermersch's type MGS VI and Toniolo's

[47] Toniolo 2000, 38, and 46, fig. 87 for the 4a type in particular. See also *supra*, note 28 (also for Spina).

Adria 4(a) type, probably already from the mid-3rd century BC onwards (*Figure* 16, A-B).[48] More to the south, the workshop of Colle Burchio near Porto Recanati (*Potentia*) probably became active during the first quarter of the 2nd century BC with its production of 'late' Greco-Italic amphorae (*Figure* 16, C).[49] A similar or even somewhat earlier chronology may be proposed for the amphora kilns discovered at Silvi Marina and Città S. Angelo on the border between the provinces of Teramo and Pescara (*Age Hatrianus*), which equally produced these later Greco-Italic types.[50] The start date of these kilns has been situated around the mid-2nd century BC, but based on the findings of Cattolica and Colle Burchio an early 2nd or even a late 3rd century BC date may also be proposed.[51] On the basis of archaeometric analysis, the local production of late Greco-Italics is also supposed for the territory of Fermo (*Firmum Picenum*) in southern Marche, and for the Roman town of *Suasa* in northern Marche.[52] On the basis of these data then, the middle-northern Adriatic wine amphora production probably started somewhere around the mid-3rd century BC with the manufacturing of the Adriatic version of the late Greco-Italics.

As noted above, the current state of the art does not allow for the redaction of a proper distribution map of these vessels. This is in part due to a lack of published data, but also because of the difficulty of distinguishing the early Greco-Italics from the late Greco-Italics, and the late ones from the so-called 'transitional' Greco-Italics – i.e. a sturdier version of the earlier slender types with clear tendencies towards its follow-up the Lamboglia 2 – in underwater finds (*Figure* 16, left).[53] Indeed, many shipwrecks in the

[48] Stoppioni 2008; 2009.

[49] The proposed chronology is based on recent excavations by the PVS in the area of the western gate of *Potentia*, which led to the discovery of several Greco-Italic fragments in connection with the Republican city wall, whose construction is dated by Livy around 175/174 BC (XXXIX, 44, 10). After careful examination, most of these fragments turned out to be produced at the site of Colle Burchio (Vermeulen et al. 2011; Vermeulen/Monsieur 2012); for a preliminary discussion of the site, see Vermeulen et al. 2005, 58).

[50] Staffa 2003, 118-119, and 119-129; see also Panella 2010, 97.

[51] Panella 2010, 97.

[52] For Fermo, see Menchelli/Picchi 2014, 4; see also Pasquinucci/Menchelli 2002; for Suasa, see Esquillini 2011a. Archaeometric analyses on examples from Suasa, Rimini, Adria and Spina have ascertained that some circulation of local and regional production existed within the middle-northern Adriatic region (Esquillini 2011a; 2011b). For Adria, see also Toniolo 1998; and 2000; for Spina (mostly the older Greco-Italics), see De Luca De Marco 1979; and Bonomi et al. 2000. Fragments of late Greco-Italics are also known from the territory of Senigallia (Madonna del Piano di Corinaldo), but their origin has not been ascertained (Lepore et al. 2013). Another kiln that produced the late Greco-Italics – together with the later Lamboglia 2, Dressel 2-4 and flat-bottomed types between the mid-2nd century BC and the 1st century AD – has been attested at loc. Colle Castelluccio-Fornace in the province of Teramo (Staffa 2001a, 136, fig. 144; 2002, 58, note 208). This production site is not indicated on *Figure* 5 (see *supra*).

[53] The so-called "transitional" types are comparable with the Adria 16-18 types, originating from tombs dated to the 2nd century BC (Toniolo 2000, 137-171); and with the Will 3 type, dated between 166 and 146 BC based on the findings at Corinth and Carthage (Lyding Will 1989, 301-302).

Adriatic are known to have contained Greco-Italic and/or Greco-Italic-Lamboglia 2 containers as part of their cargo. They are especially numerous along the Istrian-Dalmatian coast (Croatia). Currently, the oldest known shipwreck in the northern Adriatic carrying Greco-Italics is the one discovered near Grado. It is dated to the mid-3rd century BC and contained Greco-Italics similar to Vandermersch's MGS VI or Toniolo's Adria 4 type.[54] Another ship is the one found near the island of Jelsa, but it is not clear whether the containers belong to the older or the later variant of the type.[55] Other examples are the shipwrecks found at Salvore, Pernat B, the island of Cres, and Punta Glavina on the island of Rab.[56] More towards central *Dalmatia*, ships have been located near the islands of Vis (A and C) and Hvar.[57] Examples from southern Dalmatia are the underwater sites of Lastovo B, E, and Korcula. More to the east, in Greece near Prevaza, another early 2nd century BC ship is known that contained exclusively late Greco-Italic containers.[58] Examples of shipwrecks with late Greco-Italics along the southern Italian coast of the Adriatic are Punta della Vapore near the Tremiti islands and Torre S. Sabina.[59] In the Ionian Sea there are two important shipwrecks in the province of Lecce, i.e. the shipwreck of S. Catherina di Nardo and that of T. Sinfono.[60] Along the Marchegian coast, two shipwrecks with late Greco-Italics (type Baldacci 2a) have been registered in the waters around Fano, dated to either the end of the 3rd or the beginning of the 2nd century BC.[61] Based on the unpublished doctoral dissertation by D. Vrsalovic, Branko Kirigin recently assembled 69 sites spread out along the western and eastern shores of the Adriatic were the Greco-Italic amphora-type had been registered. Most of these were underwater sites and are probably to be connected with shipwrecks. On the basis of these data, Kirigin established that 37 of these sites contained the earlier version of the container, while 22 had the later versions; some sites also had both types.[62] Concentrations of Greco-Italics – possibly of Adriatic origin – also occur in some of the

[54] Tortorici 2000.

[55] Gaffney et al. 1997.

[56] For Salvore, see Vrsalovic 1974, 21, 53, 238, 240; and Parker 1992, n. 1044; for Punta Glavina (Rab), see Parker 1992, n° 942.

[57] For a series of underwater finds on the south side of Hvar, see Petric 2002, 472, 476, 479; for Vis, see *Appendix* I.

[58] Parker 1992, n° 904.

[59] For Punta della Vapore, see De Juliis 1981, 19-20; and Ruegg 1971, n.3; for Torre S. Sabina, see Auriemma/Silvestrelli 2013, 445: some 12 shipwrecks and 50 isolated underwater finds are known from the Salento water area (Auriemma/Silvestrelli 2013, 440).

[60] For S. Catherina di Nardo, see Auriemma 2004, 2, 14-18; for T. Sinfono, see Auriemma/Silvestrelli 2013.

[61] Profumo 2003, 393.

[62] Kirigin 1994.

bigger centres of the East, such as Phoenike, Delos, Corinth, Athens, Carthage and Alexandria.[63]

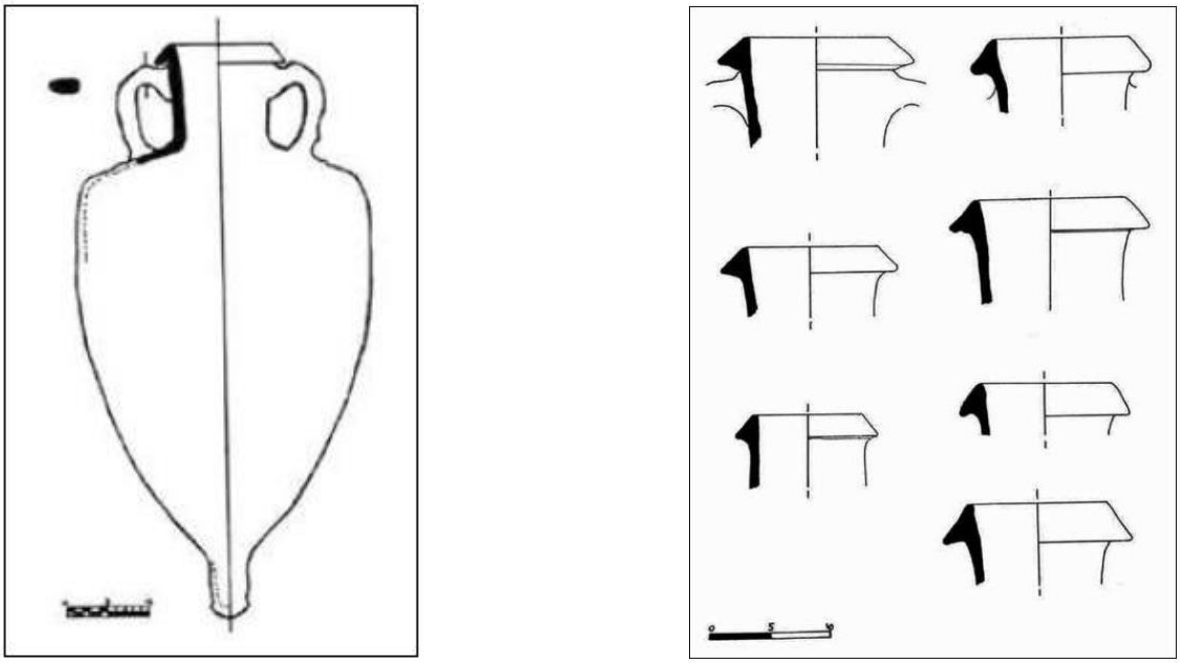


Figure 16 Greco-Italics from Cattolica (A-B) (After Stoppioni 2009, Fig. 1 and 2) and from Colle Burchio (C) (Vermeulen et al. 2005, 56, Fig. 39).

[63] For the East in general, see Lyding Will 1989, 302; and Senol 2007 for Alexandria in particular; for Phoenike, see Esquilini 2011b.

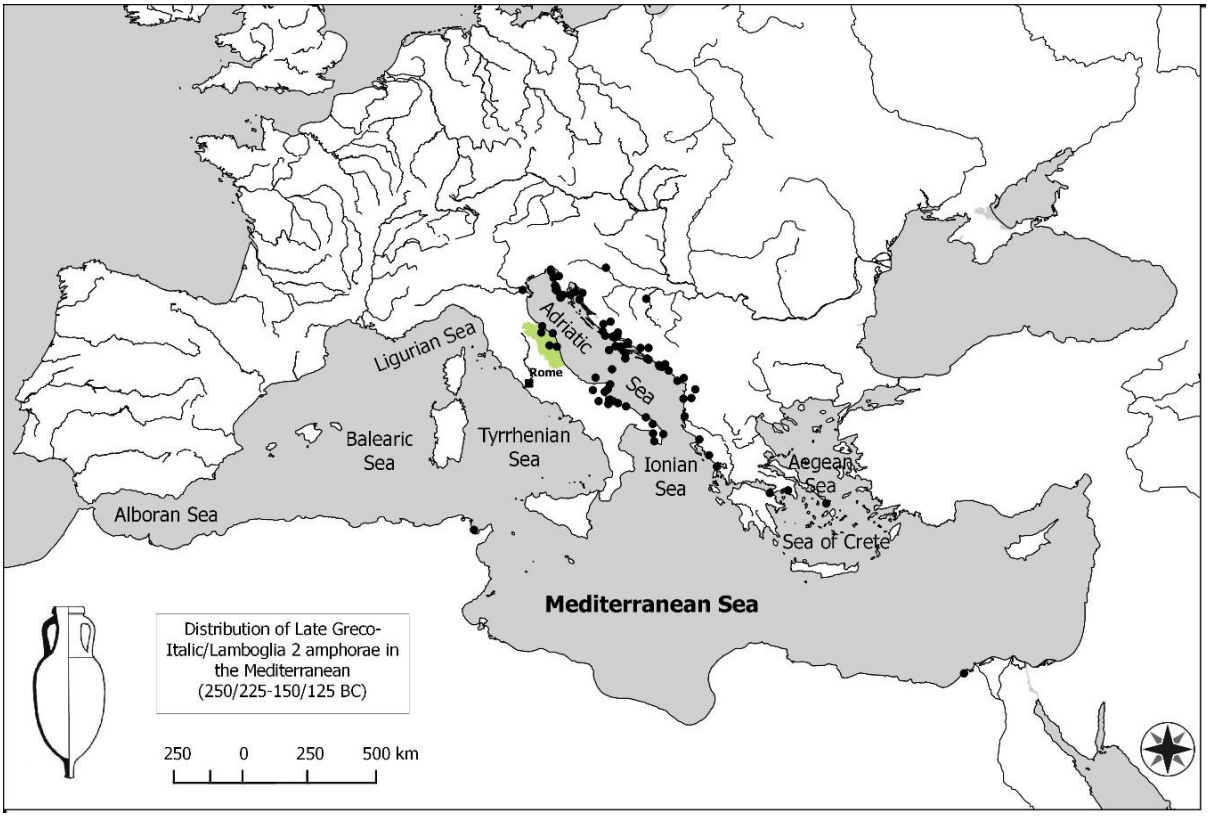


Figure 17 Findspots of (Adriatic) late Greco-Italic/Lamboglia 2 amphorae in the Mediterranean (Map author).

The cargo of the shipwreck of Torre Santa Sabina 4 mainly carried the transitional type towards the Lamboglia 2, similar to the Apani I type or the Giancola 2 type (see *supra*).[64] This transitional version is also known from the shipwrecks of Vela Svitnja (+ 600 ex.) and Cape Pernat near the island of Cres (several hundred ex.).[65] They also occur on the shipwreck of the island of Saplun near Lastovo.[66] Both the late Greco-Italics and the transitional forms have also been found on land sites, such as Aquileia, *Nesactium*, Pula and Sermin in the northern Adriatic, where they have been found in layers from the mid-2nd century BC, after the fall of *Nesactium* at the end of the Histrian Wars.[67] In the Marche, the transitional types are known from the territory of Fermo (*Figure* 17).[68] While we cannot be sure at the moment, it is possible – especially considering the recent discoveries of Greco-Italic kilns between Rimini and Pescara (see *supra*) – that at least a

[64] Auriemma/Silvestrelli 2013, 445.

[65] For Pernat, see Vrsalovic 1974, 134, 238; Cambi 1989, 318-320; and Parker 1992, n° 804; for Vela Svitnja, see also Parker 1992.

[66] In the past, their presence has been linked to local productions, but until now there is no proof of this (Cambi 1972; Vrsalovic 1979; Radic 1991).

[67] Vidrih Perko 2006, 211, note 28.

[68] Menchelli/Picchi 2014, 4, fig. 2.7.

part of the Greco-Italics and the transitional types encountered on sites in the Adriatic and the Eastern Mediterranean were coming from central Adriatic Italy from the mid-3rd century BC onwards.[69]

Lamboglia 2 (150/125 – 50/25 BC)

Somewhere between ca. 150 and 125 BC the Greco-Italic gradually merged into the proper Lamboglia 2. In their classic form, these thick-walled containers are characterised by a long cylindrical neck with two thick oval handles, a shoulder with a pronounced carination, a bag-shaped body that is either triangular or squarish in shape, and a base that consists of a pointed spike (*Figure* 18, centre). They are generally between 0.85 and 0.90 m high and their maximum diameter, which is reached towards the lower part of the belly, is ca. 0.35 m. They have a capacity between ca. 27 and 30 litres.[70] The oldest examples currently known of this type are the ones attested in the destruction layers of Athens from the last quarter of the 2nd century BC.[71] The end of the Lamboglia 2 production is generally situated in the last decades of the 1st century BC.[72]

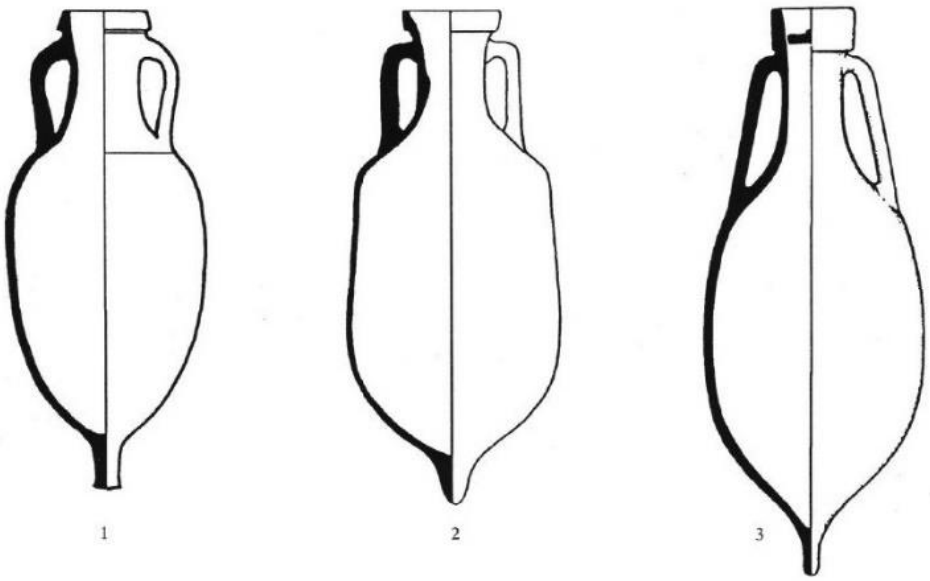


Figure 18 Greco-Italic/Lamboglia 2, Lamboglia 2 and Lamboglia 2/Dressel 6A variants (After Menchelli 2011; no scale provided with original image).

[69] The findspots of possible Adriatic Greco-Italics known from the literature have been assembled in *Appendix I*. Sites indicated with an * refer to shipwrecks or underwater finds. Because of the reasons cited in the text, neither the Appendix and the distribution map (*Figure* 17) may be considered complete.

[70] Charlin et al. 1978; Formenti et al. 1978.

[71] Davidson Weinberg et al. 1965.

[72] Bruno 1995, 29-30. Its circulation until the Augustan age is ascertained by findings in the military fortresses of Haltern and Oberaden (Lamboglia 1955, 262-263, especially notes 4 and 5).

While the Lamboglia 2 is now seen as one of the most representative middle-northern Adriatic wine carriers, it was long considered to be an oil container originating from Apulia. Indeed, when Nino Lamboglia encountered three examples of the former type on the shipwreck of Albenga in 1952, he erroneously identified them as oil amphorae because of their mere association with the Dressel 1 wine amphorae. Given the rather bulbous form of the former – which contrasted heavily with the slender and elongated Dressel 1, but somewhat resembled the Spanish Dressel 20 oil containers – this identification was considered acceptable.[73] As a consequence, Lamboglia 2 were believed to be oil amphorae until deep in the 1970's, when some examples were recovered from the shipwreck of La Cavalière that showed clear proof of pitching. As the ancient agronomists do not mention the pitching of oil containers, the presence of such a coating rather pointed into the direction of a wine, fish-sauce or olive content.[74] In 1978, the analysis of a full and equally pitched example from the shipwreck of Madrague de Giens finally confirmed that the main commodity of these amphorae had been in fact wine, and not oil.[75]

Be that as it may, because of their close resemblance with one of the amphora types likely produced in the kilns of Apani in Brindisi, Lamboglia 2 were still believed to be of sole Apulian origin.[76] It was only with the publication of some Lamboglia 2 workshops attested further to the north in the 1970's and 80's – such as in Abruzzo, Marche and the Veneto region – that scholars eventually began to consider the middle-northern Adriatic area as a possible place of origin of these containers.[77] More recent discoveries, in fact, have made if perfectly clear that the central Adriatic area of Italy was a major producer of these containers in Late Republican times.[78] Indeed, while the centre at Cattolica apparently halted its production activities after the Greco-Italic, a kiln located at Ca' Turci di Cesenatico just to the north of Rimini did deliver several fragments of Lamboglia 2.[79] Another production centre is supposed in the surroundings of Pesaro (Vallugola).[80] In the lower Potenza valley, just outside the city walls of *Potentia,* an artisanal complex was

[73] For the shipwreck of Albenga, see Lamboglia 1952, 165; and 1955, 262-263; for the shipwreck Chrétienne A, see Benoit 1956, 30; for Planier 3, see Tchernia 1969, 489.

[74] Charlin et al. 1978, 18-23, especially note 27 with cited bibliography. Because of the very thick coating present on some examples at Cartagena, Lamboglia 2 were at one point even considered to contain proper pitch (Mas 1972, 61-62).

[75] Formenti et al. 1978.

[76] Grace 1965, 11, who thought of Brindisi or Taranto as their place of origin; see also Tchernia 1969, 489; Baldacci 1972b, 8, note 2; and 25-27; Zevi 1967; Baldacci 1967-68; Desy 1983, 180; and again Tchernia 1986, 53-56, 68-74.

[77] Tchernia 1986, 54-55; Cipriano/Carre 1989, 80-82; Laubenheimer 1990.

[78] For the latest state of the art, see Carre et al. 2014 (see *infra*).

[79] Mangani et al. 1981, 50-51; Cipriano/Carre 1989, 82; Farfaneti 2000.

[80] In 1988, an almost intact Lamboglia 2 was found at Valllugola, showing signs of overfiring (Medas 1989).

excavated between 1967 and 1971.[81] It has been suggested by Andrea Tchernia that the use of numerous Lamboglia 2 necks for the construction of several walls there probably indicated the proximity of an amphora kiln.[82] This seems to be confirmed by the recent excavation of another Lamboglia 2 workshop in the territory of *Potentia*, at Acquabona – loc. Casa Valentini near the town of Potenza Picena, where similar amphora walls had been attested in 1969.[83] Lamboglia 2 were also manufactured in the *Ager Firmanus*, as attested most recently by the surveys of Pisa University, but already ascertained in 1969 through rescue excavations immediately to the south of Torre di Palme, where the remains of a kiln were uncovered in the vicinity of a row of 56 vertically placed Lamboglia 2 containers.[84] Further to the south, between Giulianova and Roseto degli Abruzzi, within the *Ager Hatrianus*, the kiln of Cologna Marina contained sherds of mainly Lamboglia 2 amphorae.[85] In the same area, the earlier kilns of Silvi and Città S. Angelo also continued their activity with the production of these containers, both in their classic form as in their advanced 'transitional' version towards the Dressel 6A (*Figure* 18, right) (*Figure* 5, n° 5, 17-21, 24).[86]

[81] Mercando 1979c.

[82] Tchernia 1986, 54-55. The same could be said of the structure made out of amphora necks (probably Dressel 6) found at Civitanova Marche, which has been interpreted as a drainage structure (Quiri 1985, 601, fig. 4).

[83] Monsieur 2009, cf. Mercando 1979d, 281-290. The site probably started production during the first quarter of the 1st century BC (Monsieur 2009; Van Limbergen et al. 2014).

[84] For the Pisa surveys, see Menchelli et al. 2008; Menchelli Ciuccarelli 2009; Menchelli 2012. For Torre di Palme, see Brecciaroli Taborelli 1984. L. Brecciaroli Taborelli interpreted the direction of this row of empty amphorae towards the nearby beach as an indication for these containers waiting to be loaded. The suggestion arose that they were sold on the spot and distributed to the nearby estates of landowners and wine producers through shortsea shipping along the Adriatic coast. They were then filled and redistributed (Brecciaroli Taborelli 1984, 64-66). While this theory provokes interesting questions about the complex relation between the manufacture, the filing and the distribution of amphorae, a somewhat similar situation at Giulianova suggests that we are dealing here with a practice of reuse of these containers. In fact, the presence at the latter site of a row of 23 almost intact Lamboglia 2 amphorae placed in vertical position – together with a very compact layer made out of amphora sherds, mixed with fragments of black gloss ware, mortar, red clay, coal and calcareous concretion – has been associated with structures used for the drainage of the area (Angeletti 2006, 176). Estuaries along the Adriatic coastline – like Giulianova along the Tordino river and Torre di Palme along the Fosso S. Biaggio – suffered frequently from periodic inundations and a high groundwater table in Roman times, requiring the intervention of systematic drainage related features. Such features are actually rather common for northern Adriatic Italy and the Po valley, where almost intact Lamboglia 2, Dressel 6A and Dressel 6B containers were systematically reused in structures dating between the mid-1st century BC and the early 2nd century AD (Pesavento Mattioli 1998b; see also Peña 2007, 182-183).

[85] Cipriano/Carre 1989, 81.

[86] Staffa 2003, 118-120; as is probably the case for the kiln attested at Colle Castelluccio-Fornace, where ill-baked Lamboglia 2 pieces formed by far the majority of the recovered amphora fragments (Staffa 2001a, 136, fig. 144; 2002, 58, note 208).

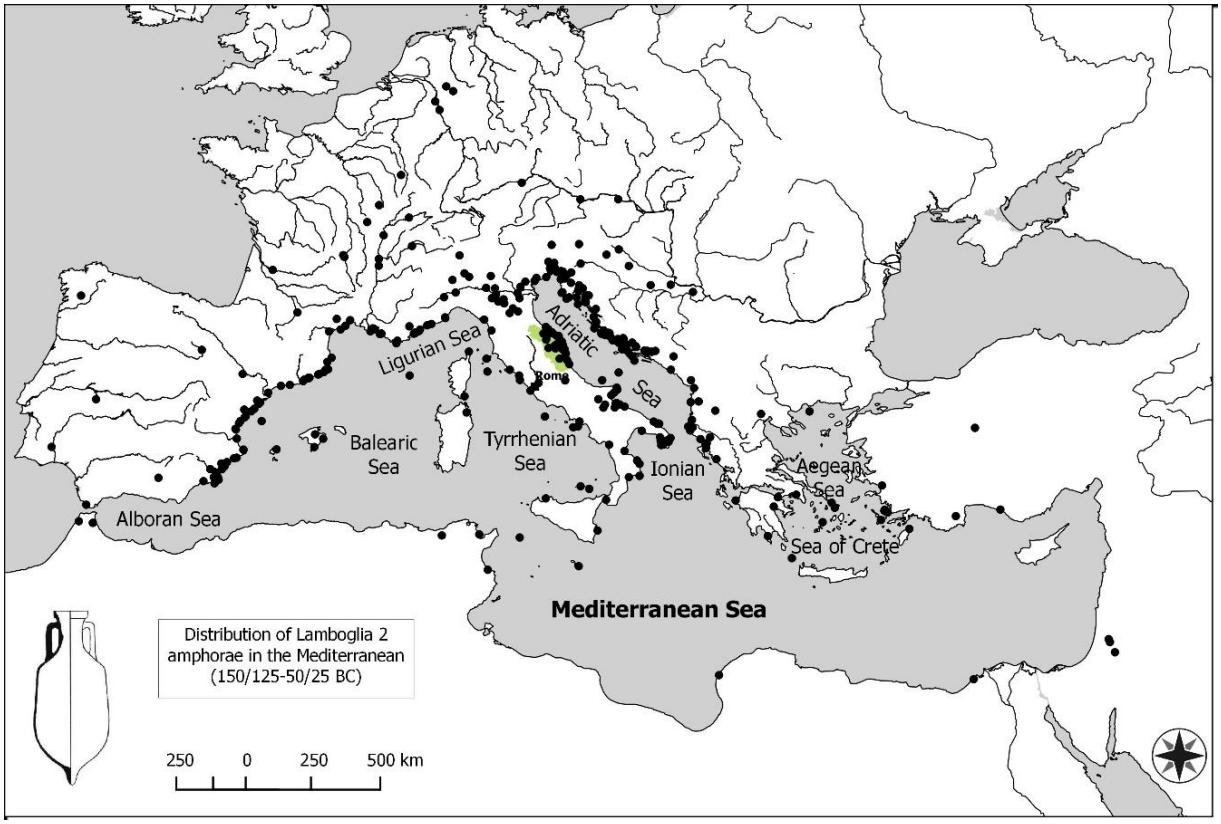


Figure 19 Findspots of Lamboglia 2 amphorae in the Mediterranean (Map author).

The diffusion pattern of these amphorae is very wide, but mainly concerns the northern and eastern sides of the Adriatic coast, the Eastern Mediterranean, and northern Africa (*Figure* 19).[87] Within Italy, an important concentration can be noticed in the north, especially in the wider Po plain; but the type occurs on many sites dispersed across the peninsula. Outside Italy, some examples are known from the Roman provinces of *Noricum* and *Pannonia* (Slovenia).[88] Its presence is particularly massive along the northern Dalmatian coast, where both underwater and on-land sites are numerous.[89] Important concentrations are known from the islands of Hvar, Korcula, Lastovo, Solta, Brac, Scedro, Palagruza and Ciovo.[90] On the whole, at least 64 shipwrecks are registered

[87] The findspots of Lamboglia 2 known from the literature have been assembled in *Appendix I*. Sites indicated with an * refer to shipwreck or underwater finds. Of course, both this appendix and the distribution map in the text (*Figure* 19) do not pretend completeness. In particular, it should be noted that the map for France is not complete; for a fuller version, see Loughton 2003, 199, fig. 15.

[88] The Roman province of *Pannonia* roughly corresponds with today's western Hungary, eastern Austria, northern Croatia, north-western Serbia, northern Slovenia, western Slovakia, and northern Bosnia and Herzegovina; the other parts of Austria and Slovenia belonged to *Noricum*.

[89] For a recent survey of finds in the Sibenik water area, see Koncani Uhac 2007, 364-365,with references; for the waters of Zadar, see Pesic 2013.

[90] Kirigin et al. 2006a, figs. 7-10. In particular, for the island of Hvar, see Gaffney et al. 1997; for the island of Brac, see Stancic et al. 1999; for the islands of Vis, Bisevo, Svetac, Palagruza and Solta, see Kirigin et al. 2006b.

that contain the amphora type, often in considerable quantities.[91] For instance, a shipwreck found at Vela Svitnja on the island of Vis contained a full cargo of ca. 800 Lamboglia 2, probably originating from different production centres in the Adriatic.[92] Ninety-six examples of this amphora type were counted on the shipwreck of Gospe od Prizidnice near the island of Covo; 59 of them were attested on the ship of Cape Cavlin near the island of Murter.[93] The shipwreck of Stari Stani near the island of Hvar contained another full cargo of ca. 100 Lamboglia 2.[94] Another shipwreck on Hvar, in the area of Stari Grad, carried almost 600-700 amphorae, while a shipwreck found near the locality of Hvar delivered some 250 vessels of this type[95] Further down to the south, two ships carrying again full cargoes of Lamboglia 2 were recently found along the coast of Montenegro and Albany, with several other findspots also known in the latter country.[96] In Greece, important numbers have been attested in particular in Athens and Delos, but they also occur on other islands such as Rhodes, Cos, Thasos, Antikythera, Siphnos, and even Malta. A shipwreck found near the island of Thasos contained more than 3,000 Lamboglia 2.[97] Further in the East they were shipped towards several localities along the coast of *Asia Minor* (Turkey), with the city of Ephesus being a particularly important destination. A shipwreck containing a full cargo of Lamboglia 2 is known at Yalikavak.[98] Outside Turkey, a few examples have been found in Israel (Jerusalem, Herodium and Masada). They are currently somewhat less represented in northern Africa, but the discovery of a large shipwreck with ca. 500 Lamboglia 2 for the coast of Alexandria (Egypt) deserves special attention.[99] Quantitatively speaking, its presence in the Western Mediterranean is less conspicuous – certainly in regard with the omnipresent central Tyrrhenian Dressel 1 amphora – but nevertheless the container has been attested on numerous sites in France and Spain. Only one site is known in Portugal. Some quantities also reached more northern European countries like Germany and Austria, with the sites of Magdalensberg, Haltern and Oberaden already becoming attraction poles towards the end of its circulation period (see *Appendix* I).

[91] Vrsalovic 1979; see also Cambi 1989, 320-321, note 37.

[92] Cambi 1989, 311-315.

[93] For the Gospe shipwreck, see Cambi 1989, 315; for Cape Cavlin, see Miholjek/Zmaic 2013.

[94] Parker 1992, 1114; and Jurisic 2006, 175-192.

[95] For Stari Grad, see Gaffney et al. 1997, 201; for Hvar, see *Idem*, 72.

[96] For the Boka Kotorska 2 shipwreck in Montenegro, see Royal 2008; 2009: for the recently attested shipwreck near the island of Sazan along the Albanian coast, see (http://www.archive.xray-mag.com/content/roman-shipwreck-full-wine-jars-found-adriatic).

[97] Tchernia 1986, 72.

[98] Sibella 2002, 9.

[99] Empereur 1998a, 614-615.

Dressel 6A (ca. 50/25 BC – AD 25/50)

The start date of the Dressel 6A production is still somewhat uncertain, but is generally situated in the 3rd or 4th quarter of the 1st century BC on the basis of its presence in the so-called 'amphora wall' at Carthage, whose construction is dated between 43 and 15 BC.[100] It is likely that this larger and more massive container gradually replaced the Lamboglia 2 somewhere between 50 and 25 BC, in the Augustan age or even somewhat earlier.[101] Dressel 6A are poorly represented in the Claudian layers at Ostia, and do no longer appear in the Flavian layers, suggesting that they probably ceased to be produced shortly after the mid-1st century AD.[102]Larger and more elongated than its predecessor, the Dressel 6A is a pear-shaped amphora with a long and slender cylindrical neck, provided with two round handles, and a long pointed base. They are generally between 0.95 m and 1.18 m high and their maximum diameter reaches 0.40 m. Smaller versions are ca. 0.70 m high and have a diameter of ca. 0.30 m (*Figure* 20).[103]

Like the Lamboglia 2, the Dressel 6A has long posed significant problems with regard to its content and region(s) of origin. Indeed, in a time in which no distinction was yet made between what are now called Dressel 6A and Dressel 6B, the production of the former was thought to be confined to *Venetia et Histria* in the northern corner of the Adriatic.[104] As *Istria* was a region famous for the quality of its olive oil in Roman times, the possibility of an oil or olive content was long considered valid.[105] That Dressel 6A containers were used on occasion for transporting fish-sauces was also clear from two examples – one found in Salzburg and another one in Verona – that contained actual fish remains.[106] Inscriptions mentioning different types of fish sauce also occur on other Dressel 6A examples, such as the ones found in Novara, or again in Verona.[107] Nevertheless, the presence of painted inscriptions mentioning words like "*mulsum*" (*CIL*

[100] Delattre 1894, 89; Carre 1985, 211, note 13.

[101] Lamboglia 1955, 262-263, fig. 18.

[102] Carre 1985, 213.

[103] Carre 1985.

[104] Tchernia 1986, 129. Dressel 6 were long thought to be originating from Istria and no distinction was made between the two occurring variations. The division in 6A and 6B was made by Buchi in 1972. The Dressel 6A is Baldacci's Forma II, while the Dressel 6B is his Forma III. The distinction into three types was accepted by Panella (Panella 1970, 117, 134-135; see further for the division Zerbinati 1970; Righini 1971; and Panciera 1972).

[105] Degrassi 1962, 967-970.

[106] For Salzburg, see Heger 1986, 133, fig. 1, 137, fig. 5, and Pl. 3; for Verona, see Cipolla 1891, 12. The Salzburg example in particular showed traces of a sauce on the basis of sardines (Lepiskaar 1986, 167); for a fish-sauce content, see also Frova 1952, 49-67; and Zevi 1966, 217-219.

[107] For Novara, see Scafile 1980; and Tchernia 1986, 132, note 23; for Verona, see Pesavento Mattioli 2000, 113, fig. 2). However, it is not yet clear if a certain variant of the Dressel 6A was effectively manufactured for the purpose of carrying such sauces, or if we are dealing here with individual cases of reuse (Carre et al. 2009, 218).

XV, 4582), "*vinum*" (*CIL* XV, 4653) or *VE/VET* – the latter probably referring to '*vetus*' and thus to a liquid subject to aging – together with the presence of a resinous coating on all examples from the depot of La Longarina, suggest that these containers were probably in the first place wine carriers.[108] Also, its production area proved to be much wider when kilns were attested further to the west and the south.[109]



Figure 20 "Picenian" Dressel 6A (left) (After Cipriano 1992, 94, Fig. 42) and smaller Dressel 6A from northern Italy (right) (After Cipriano/Ferrarini 2001, 113).

Workshops known for having produced this type in middle-northern Adriatic Italy are the previously mentioned sites of Acquabona, Torre di Palme and Città S. Angelo (*Figure* 5, n° 17, 18, 21). The same could be proposed for the seven sites registered by the University of Pisa in the territory of Fermo (*Figure* 5, n° 20). The production at the sites of Casa Alvata III and Cupra Marittima probably started (and ended) with this container (*Figure* 5, n° 21, 19).[110] Recently, another Dressel 6A workshop was identified in Contrada Montecantino near Massignano (*Figure* 5, n° 26).[111] With the appearance of this container in the Adriatic, it also becomes possible to tentatively link some of its more important producers with actual production centres in the area. Four Dressel 6A fragments found at the site of Torre di Palme contained the stamp of C(aius). IVL(ius) POLY(-), sometimes

[108] For wine, see Dressel, *CIL* XV, 2, 491, 4582; Zevi 1966, 216-219; Baldacci 1967-68, 10-11; Callender 1970, 14-16; and Tchernia 1986, 132.

[109] See again Carre et al. 2014 (see also *supra*).

[110] For Casa Alvata III, see Van Limbergen et al. 2014; For Cupra Marittima, see Fortini 1993.

[111] Virgili/Cacciamani 1994a, 16.

associated with BARBVL(a).[112] The distribution of these POLY-amphorae mainly concerns the Marche region, northern Italy and Rome, but one stamp is also known from Libya.[113] A series of Dressel 6A amphorae stamped with BAR or L. BAR – occasionally in association with L. LAET. ARG or SEX. IVL. ORP – and distributed throughout the Po plain and the Veneto region has been brought in relation with the POLY productions.[114]

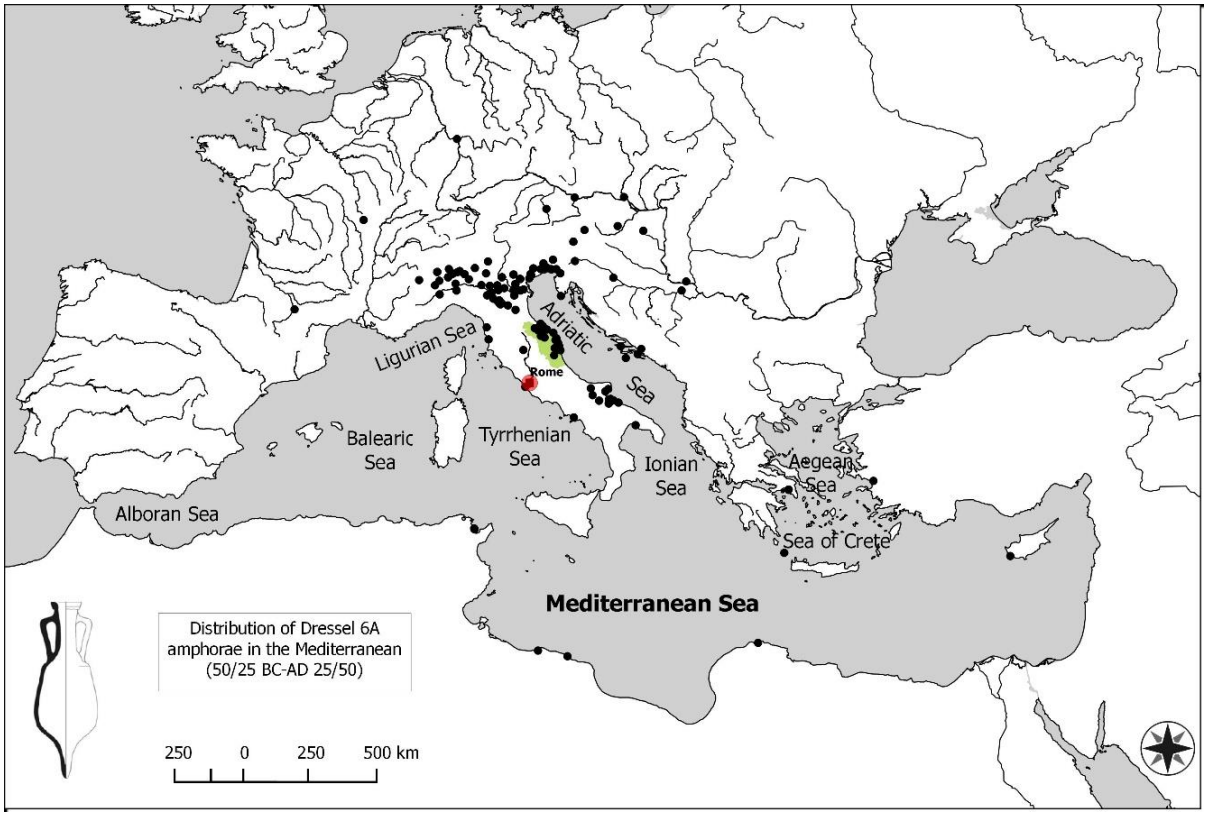


Figure 21 Findspots of Picenian Dressel 6A amphorae in the Mediterranean (Map author).

Numerous epigraphic testimonies hint at the presence of other still unidentified Dressel 6A production centres in the territories of *Picenum* and the *Ager Gallicus*. One name that has been brought in relation with the area is that of *T. Helvius Basila* – aedile, praetor, proconsul and legate of Tiberius, Claudius or Nero – whose name has been recognised in the stamp T.H.B., a formula omnipresent at Cupra Marittima in southern Marche.[115] The

[112] The first fragments from the site with said stamp were already discovered by A. Brandimarte at the beginning of the 19th century (*CIL* IX, 6080, 4-5); for the more recent findings at Torre di Palme-Fosse S. Biaggio, see Brecciaroli Taborelli 1984, 73-90.

[113] For the findspots of these amphorae, see Appendix I.

[114] Callender 1970, n° 180, Brecciaroli Taborelli 1984, 86-88. For an overview of their findspots, see Appendix I.

[115] The findings at Cupra Marittima are probably to be connected with the presence of a kiln (Fortini 1993, 91-92; see *supra*). D. Manacorda has contested the localisation of the origin of the T.H.B. amphorae in *Picenum* (Manacorda 2001, 397-399). Recently, however, a Dressel 6A kiln has been identified at Contrada Monte Cantino

stamp is mainly distributed within Italy – with a particular heavy presence in Rome, and to a lesser extent also in Padova and Altino – and occurs only occasionally outside the peninsula.[116] Amphora fragments stamped with L. TARI. R-V-FI, L TAR, L-T-A-R, and L.T.R. are probably to be connected with *L. Tarius Rufus*, one of the admirals of *Actium* and consul in 16 BC who – according to Pliny (*HN* 18.7.37) – wasted his fortune on estates in *Picenum*.[117] Dressel 6A amphorae stamped with his name again occur predominantly in Italy – especially the central and northern part of the peninsula – but they are poorly represented elsewhere.[118] A connection may be suggested with Dressel 6A stamps consisting of either BAR / BARB / BARBAR / and BARBARI, probably referring to *P. Rubrius Barbarus* – prefect of Egypt in 13/12 BC and the father-in-law of *L. Tarius Rufus* - whose gens *Rubria* has been hypothesised to be of central-southern Adriatic origin.[119] The recovery of Dressel 6A fragments with the name of L. SALVI at Capodarco di Fermo (FM) and Urbs Salvia (MC) and the presence of a member of the SALVIA family – *C. Salvius Liberalius Nonius Bassus* – at Urbs Salvia has suggested the possible involvement of this family in the production of Dressel 6A in *Picenum*.[120] Containers with this stamp have been mainly found in northern Italy, but examples are also known further to the south of the peninsula, along both the Adriatic and the Tyrrhenian coast. Their presence outside Italy is again weak and is restricted to a few examples in the Eastern Mediterranean, Croatia, *Noricum* and France.[121]

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di Massignano. A Dressel 6A fragment stamped with T.H.B. was found in the surroundings, at loc. Ara di Massignano (Virgili/Cacciamani 1994a, 16, n° 125 and 135; see also Cicala 2010, 113).

[116] For an overview of the findspots, see Appendix I. In Rome (*CIL* XV, 2905, 5), 19 examples are known from the *Castrum Praetorium* (*CIL* XV, 2905, 4-01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19), one from the baths of Diocletian (*CIL* XV, 2905, 3), 2 from the hortis Torlonia (*CIL* XV, 2905, 1-01, 1-02), and 2 from the Emporium (CIL XV, 2905, 2-01, 2-02). For Rome, see further *NSc* 1920, 281; *NSc* 1968, 11; Zevi 1966, 219 (Castrum Praetorium); Lissi 1968, figs. 4 and 6 (Via Casilina); Hesnard 1980, 144, 154, notes 42 and 43; Cafini/D'Alessandro 2010, 97; D'Alessandro 2011; and 2013. For Padova and Altino (both 7 ex.), see Appendix I. The stamp is also heavily represented at Novara (Scafile 1980, 220).

[117] Paterson 1982, 153-154; Zaccaria 1989, 475, 481, note 82 with references.

[118] For the known findspots, see Appendix I.

[119] For the connection with *L. Tarius Rufus*, see Zaccaria 1989, 475, note 36 with references; and Cipriano/Carre 1989, 86-87, and 99. For the gens *Rubria*, see Ricci 2006, 113-115.

[120] Branchesi 2007, 238-244. For the stamp of Fermo, see further Galiè 2005, 12-13, fig. 1, 19, fig. 2; and Menchelli/Ciuccarelli 2009, note 17); a stamp with SALV(I) without the *praenomen* has also been attested on Lamboglia 2 fragments at the production site of Cesano di Senigallia (Ancona) (Mercando 1979a, 121, figs. 29y, 31f; see also Van der Werff 1986, 132, n° 96; and Ciuccarelli 2014, 822). Lamboglia 2 stamped with SALVI are also known from Cremona (Bruno 1995, 146) and Padova (SAL) (Pesavento Mattioli 1992, 82-83, n. 38, tav. 4, 85, 38 a). The same family is also attested in other parts of *Picenum*, like *Asculum* and *Falerio*, but also in other regions of Italy, i.e. between *Apulia* and *Cisalpina*. Therefore, it is likely that these amphorae were not only produced in *Picenum*, but rather in several locations along the Adriatic coast (Menchelli/Ciuccarelli 2009).

[121] For the findspots, see Appendix I.

Another frequently attested stamp on Dressel 6A amphorae is that of M. HER. PICEN(T) – a name that either refers to the suffect consul *M. Herennius Picens* (AD 1), or to his father *M. Herennius*, who occupied the same position in 34 BC. As his cognomen probably refers to his region of origin, i.e. *Picenum*, these finds may hint at yet another production of these amphorae in the area.[122] Dressel 6A stamped by other members of the *Herennia* family – like *M. Herennius Phaedimus* (M. HER PHAE), *M. Herennius Priscus* (M. HER PRISC) and *M. Herennius Ren*(-) (M. HER REN) – have also been brought in relation with this line of production. For the moment, however, a Picenian origin for all of these amphorae cannot be attributed with certainty.[123] These amphorae are again mainly distributed in northern Italy, while an important destination outside the country seems to have been the site of Magdalensberg in Austria.[124] A shipwreck containing a full cargo of ca. 300 Dressel 6A is known from Gojca near the island of Hvar (Croatia). One of the amphorae bears the stamp HEREN. FLA.[125] Finally, a Picenian origin has also been proposed for the Dressel 6A amphorae signed by *Safinia Picens/Picentina*, known from the stamps SAFINIAEPICE and SAF. P(IC).[126] While the stamp is known from the Roman town of *Suasa* in the Marche region, the gens *Safinius* is currently not known from *Picenian* epigraphy.[127] The distribution of this stamp is similar to those of the *Herenni*, with only one example known outside Italy, at Carthage.[128] Another stamp, mentioning COPONI, has been found in Cremona and is also supposed to be of Picenian origin.[129]

The distribution pattern of all these stamped amphorae is similar to the diffusion of the Dressel 6A in general; i.e. a network that mainly served the Po plain and the middle northern Adriatic coast – it is the most attested wine amphora in *Venetia et Histria* in the 1st century AD – with only a small number of amphorae still reaching Greece, northern

[122] Carre 1985, 216-217. For a discussion of the stamps with M. HER PICEN, see Buora 1995.

[123] Because of the many findspots of *Herenni* amphorae in Emilia Romagna, it has long been assumed that these containers were manufactured in northern Italy (Gummerus 1916, 1471). On the possibility that the workshops of the *Herenni* were located in Istria, see Degrassi 1956, 105-106; followed by Zevi 1967, 28; and Deniaux 1979, 644-645; Andermahr considers both options (Andermahr 1998, 90, 292). Based on the discovery of a funerary monument belonging to a family of *Herenni* in the territory of Claterna, Susini considers the workshops to be located in Cispadana (Susini 1989, 141-143); an opinion shared by Buora, who situates them more precisely between Modena and Tortona (Buora 1995, 185); see also Cristofori 2004, 60-61, note 227.

[124] The findspots are arranged according to the different members of the family in Appendix I.

[125] Gaffney et al. 1997, 110, site number HV0515.00.

[126] Baldacci 1967-68, 27-28; Zaccaria 1989, 478-479, note 66, who links the name with the family of the *Herenni.*

[127] For Suasa, see Saracino/Vergari 1998, 159-160, n° 17 and 18; and Gamberini 2011; 2014; for the gens *Safinius*, see Mongardi 2014, 15-17, with references.

[128] The map shows the overall distribution of the Picenian Dressel 6A, including all name stamps; for the individual findspots per stamp, see *Appendix* I.

[129] Arcari 1996, 187, note 10.

Africa and the Western Mediterranean.[130] With the transition towards the Dressel 6A, middle-northern Adriatic wine begins to circulate within a geographically and quantitatively more confined pattern, that is now mainly aimed at the Po valley, *Gallia Cisalpina*, and the newly created provinces of *Noricum* and *Pannonia*. The trade with the eastern side of the Adriatic was clearly less significant, despite the shipwrecks found in Croatia near Gojca (Hvar), Kopiste (Lastovo) and Lirica (Peljesac peninsula), each containing full cargoes of more than 100 Dressel 6A (*Figure* 21).[131]

Dressel 2-4 (ca. 50/25 BC – AD 150/175)

The Dressel 2-4 wine amphora is mainly known as the Tyrrhenian – and later the Vesuvian (ca. 30 BC) – follow-up to the Late Republican Dressel 1 from 70-50 BC onwards.[132] However, these elongated almost missile-shaped and double-bar handled containers were also manufactured along the Adriatic coast between the mid-1st century BC and the mid-/second half of the 2nd century AD (*Figure* 22). The workshop at Silvi probably produced these containers, as is also the case for the kiln at Cesenatico and the recently attested workshop at Marino del Tronto near Ascoli; with the latter site being active between the end of the 1st century BC and the end of the 1st century AD (*Figure* 5, n° 5, 17, 25).[133] Recent surveys and excavations in and around the Roman towns of *Urvinum* (Urbino), *Suasa*, *Potentia* (Porto Recanati, Potenza Picena), *Ricina*, *Urbs Salvia* and *Firmum* (Fermo) in the Marche have all attested exemplars with an apparently Adriatic fabric, while Adriatic examples have also been identified on a few sites outside the Marche region, both in and outside Italy.[134] Still, because of the difficulties involving their identification it remains difficult to measure their real quantitative impact.[135] For instance, Dressel 2-4 amphorae

[130] For a list of findspots, see Appendix I.

[131] Jurisic 2000, 12.

[132] This is not the place to elaborate on its Tyrrhenian production and distribution, but good starting points are Hesnard 1977; Panella 1981; and 2001; and Tchernia 1986. For the end of the Dressel 2-4, see Woolf 1992, 286; and Peacock and Williams 1986, 106.

[133] For Silvi, see Staffa 2003, 118-119; for Cesenatico, see Stoppioni 2009, 305, note 10; for Marino del Tronto, see Antognozzi et al. 2014; the workshop at Colle Castelluccio-Fornace (Teramo) probably also produced Dressel 2-4 amphorae (Staffa 2001a, 136, fig. 144; 2002, 58, note 208).

[134] For *Potentia*, as well for other sites such as Cone di Arcevia and Tavernelle, see Mercando 1979c; and 1979d; the material from *Ricina* was collected within the framework of the PVS survey; for *Suasa*, see Mazzeo Saracino 1991, 79; and Gamberini 2014, 552-553; for Fermo, see Menchelli/Picchi 2014; for *Urbs Salvia*, see Giuliodori et al. 2007, 415; for Rome, see Cafini/D'Alessandro 2010; for Libya, see Cipriano/Carre 1989; for *Asia Minor* (Ephesus), see Bezeczky 2010; for Germany (Haltern), see Van Limbergen/Monsieur/Vermeulen 2015 (in press).

[135] Because of their fine fabric, they are often confused with the Greek originals from Kos, which they took as a model, or with North-Italian Dressel 2-4 imitations (personal communication P. Monsieur). For this reason, no attempt was made here to build a distribution map of supposed Adriatic Dressel 2-4 amphorae.

also circulated in the territories of *Noricum* and *Pannonia*, but it cannot be said to which extent these amphorae came from the Adriatic.[136]



Figure 22 Amphorae found in the waters near the harbour town of Fano (Roman *Fanum Fortunae*) (from left to right: Dressel 2-4 (first two images), Lamboglia 2/Dressel 6A, Dressel 6A) (After Dolci Santià 1983, 123-125).

Flat-bottomed amphorae (ca. AD 50/75 – 225/250)

Ever since the discovery of the production kilns at Forlimpopoli and Santarcangelo, the so-called flat-bottomed amphorae had emerged as the Adriatic wine successor to the Dressel 6A and the Dressel 2-4 (*Figure* 5, n° 6, 7). These smaller amphorae were produced from the last quarter of the 1st c century AD, throughout the entire 2nd century, and probably until the mid-/late 3rd century AD. In central Adriatic Italy their production has been attested at the kilns of Silvi Marina and Montesilvano, with the latter site being active between the 1st and the 2nd century AD (*Figure* 5, n° 16, 17).[137] It is likely that other small production centres existed along the central and southern Adriatic coast.[138] Their presence in *Picenum* at the cemeteries of *Potentia* and Urbino in particular has been linked to local productions, while a local provenance has also been proposed for the examples found near the town of Atri (*Hatria*).[139] The production of the *Ninnia* family, whose stamps

[136] For Magdalensberg, see Bezeczky 1998b; for Cibalae, see Ozanic 2005.

[137] Many of the amphorae found at Montesilvano (PE) were stamped by Gnaeus Herranius Geminus (Staffa et al. 1995, 296, site 2; see also Staffa 2003, 130-132); for Silvi Marina, see again Staffa 2003, 119; the kiln at Colle Castelluccio-Fornace (Teramo) also produced flat-bottomed amphorae (Staffa 2001a, 136, fig. 144; Staffa 2002, 58, note 208).

[138] For the argument, based on the findings around Fermo, see Menchelli/Picchi 2014.

[139] For *Potentia* (Porto Recanati), Urbino and San Severino Marche, see Mercando 1974; and 1982; for the hypothesis of local production in Urbino, see Panella 2001, 195-196, note 90; see also Cipriano/Carre 1989, 88-

have been attested in the form of *Q. Ninnius Secundus* on both Dressel 6A and flat-bottomed amphorae can probably be attributed to a border zone between *Picenum* and *Samnium*, in the *Ager Praetutianus*.[140] The main focus of production, however, seems to have been situated more to the north, towards Emilia Romagna and the lower Po valley; an area that had already began to establish its position on the wine market from the Augustan era onwards with its own variants of the Dressel 6A and the Dressel 2-4.[141] The Forlimpopoli variants in particular seem to have had much success and were widespread until the 3rd century AD, with Rome in particular still being a major attraction pole.[142] On the other hand, the production of the central Adriatic flat-bottomed amphorae seems to have been much more modest and it is not clear to which extent their circulation exceeded local boundaries.[143] Numerous examples of flat-bottomed amphorae with a local Adriatic fabric have been found at *Suasa* in northern Marche, indicating that the inland distribution of these containers was still noteworthy in the 2nd-3rd century AD (*Figure* 23).[144]

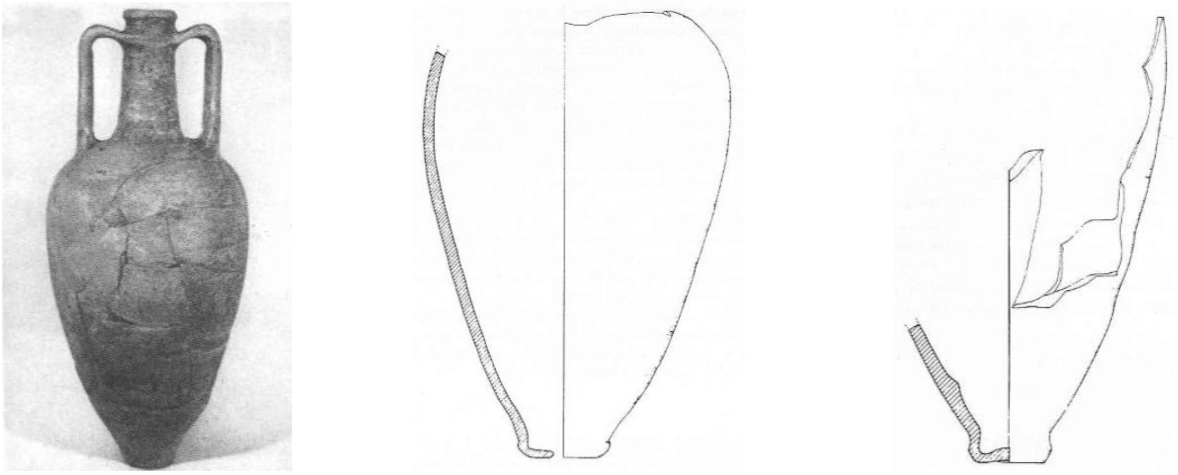


Figure 23 Forlimpopoli amphora Type D (from Cattolica) (After Aldini 1999, 27, Fig. 3) (left); Forlimpopoli amphora Type A1 (From Urbino) (After Aldini 1999, 32, Fig. 15) (original scale 1:4) (centre); Forlimpopoli amphora Type B (from Urbino) (After Aldini 1999, 33, Fig. 16) (original scale 1:4) (right).

90; for Atri, see Cipriano/Carre 1989, 89, note 86. The presence of forms not attributable to either the Forlimpopoli or Santarcangelo type, together with the attestation of visible defects on numerous examples, had already inspired Tobia Aldini to suppose some form of local production near Urbino (Aldini 1999, 32).

[140] Carre 1985, 235-241; Panella 2001, note 90; 2010, 97. These amphorae are also known outside *Picenum*, for instance in Venice (Canal 2013, fig. 165.3, Q.NINNI SECUND and Q.NSE).

[141] Zaccaria 1989, 477-478; Mazzocchin 2008; Mongardi 2014.

[142] Panella 1989; 2001, 195; Staffa 2003, 130-132. Examples of Forlimpopoli amphorae have also been found in Senigallia (La Fenice) (Salvini 2003, 18).

[143] For instance, flat-bottomed amphorae are present at Cremona in northern Italy, but it is not clear whether these are Tyrrhenian versions, or Adriatic imitations of Tyrrhenian containers (Arcari 1996, 187).

[144] Gamberini 2014, 553-558.

1.2.2 Olive oil amphorae

Adriatic ovoid amphorae (ca. 75/50 – 50/25 BC)

In Late Republican times, a series of ovoid olive oil containers was produced in a variety of places along the Adriatic coast.[145] For the middle Adriatic area, their manufacturing only started in the last fifty years of the Republic, with known workshops being Cologna Marina and Acquabona (*Figure*. 5, n° 18, 21) (*Figure* 25).[146] The type, especially the later version, is sometimes referred to as the 'Dressel ante 6B', a term proposed by Silvia Cipriano in order to situate the amphora chronologically in a phase somewhere before the proper Dressel 6B olive oil amphora (see *infra*). This identification was based on an example found at Padova (Via Gattamelata) that showed similarities with both the pure Brindisian ovoid container and the Dressel 6B, with the rim being typical for the former, but the neck being longer and more typical for the latter (*Figure* 24).[147] They are often found in association with Lamboglia 2 amphorae, as is the case for the production plant of Cesano di Senigallia in northern Marche.[148] A recent restudy of the amphora material from the latter site has pointed at the seemingly Adriatic fabric of these containers – at least from an empirical point of view – suggesting that they may be of regional or even local production.[149] Some of these ovoid amphorae bear Greek names, like ANTIOC, ATHENOD, MENOLA[150] and HERMA.[151] A shipwreck transporting these amphorae was discovered at Palombina, close to Ancona.[152] This oil container was probably produced from the mid-1st century BC, but seemingly had a rather limited circulation and quickly ceased production around 30-25 BC.[153]

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[145] For the production of ovoid amphorae in the kilns at Apani and Giancola in the territory of Brindisi, see *supra*, note 18. The type is similar to the Balducci Apula I type, that has been dated to the 2nd-1st century BC (Cipriano/Pesavento Mattioli 2003, 460).

[146] For Cologna Marina, see Cipriano/Carre 1989, 77-80; for Acquabona, see Monsieur 2009; and Van Limbergen et al. 2014.

[147] Cipriano 1991, 165-166.

[148] Mercando 1979a, pl. 30.1, pl. 35.i, pl. 36.1, pl. 38; see also *infra*, Chapter 2.

[149] Ciuccarelli 2014, 819.

[150] The MENOLA stamp also occurs on Lamboglia 2/Dressel 6A at Cesano di Senigallia (Ciuccarelli 2014, 821) and is known from several findspots in the lower Cesano river valley between the coast and the Roman town of *Suasa* (Carre 2002, 102); it also occurs on Lamboglia 2/Dressel 6A in Milan (Bruno 1995, 21), Rome, Ostia, Taranto, Faenza, Butrinto (Cipriano/Carre 1989, 77-78, note 47) and Padova (Pesavento Mattioli 1992, 127-128, n. 87, tav. 14); all found in contexts datable between 100/50 and 30 BC.

[151] The HERMA stamp also occurs on Lamboglia 2/Dressel 6A from Senigallia (*Sena Gallica*) (*CIL* XI, 6695, 50 a-b; Branchesi 2011, 83-83, n. 2.2), Nidastore di Arcevia (Callender 1970, 139, n. 698; *CIL* IX, 6695, 50 a-b), and Ozzano dell'Emilia (BO) (*Aemilia*) (Branchesi 2011, 84). A Lamboglia 2 with the stamp HER is known from the Lungomare Vanvitelli excavations at Ancona (Forti/Paci 2008, 321, n. 14).

[152] One of the amphorae at Palombina had the Greek name NICIA (Mercando 1975-1981).

[153] Outside Marche, examples of ovoid amphorae are known from Vercelli (Facchini 1996, 195).



Figure 24 Padova, Via Gattamelata, Adriatic ovoid (left) and transitional ovoid/Dressel 6B amphora (right) (After Cipriano 1991, 166, Fig. 6 and 7).

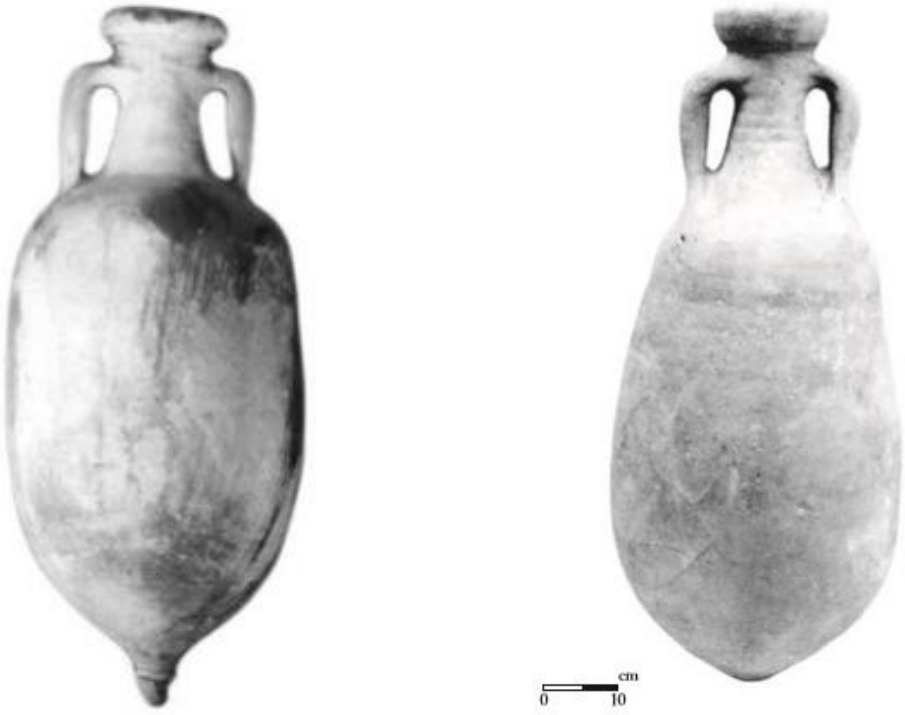


Figure 25 Middle Adriatic ovoid amphora (left) (After Pesavento Mattioli 1992, Fig. 3) and Dressel 6B first phase amphora (right) (After Cipriano 2009, 182, Fig. 8).

Dressel 6B (ca. 50/25 BC – AD 25/50)

The Dressel 6B olive oil amphorae were produced between the end of the Republic and the beginning of the 3rd century AD. Their production area was mainly confined to northern Italy and *Istria*, but the earliest variant of the type, the so-called 'Dressel 6B di

prima fase', was also produced in *Picenum* (*Figure* 25). Identified kiln sites include Acquabona and La Pineta in the lower Potenza valley (*Figure* 5, n° 21). Because of their close resemblance to the Istrian exemplars, the distribution of these containers is unclear, although probably not noteworthy. The practice of manufacturing Dressel 6B does not seem to have surpassed the mid-1st century AD in the central Adriatic area and its production probably halted around the same times as the Dressel 6A, i.e. between ca. AD 25 and 50.

Anfore con collo ad imbuto (ca. AD 25/50 – 200/225)

In recent years, however, another container has surfaced that may have filled the void left by the apparent disappearance of the Dressel 6B amphorae. Said container is known under the name 'Portorecanati' – after its very first place of attestation – or '*anfora con collo ad imbuto*'; the latter term being a direct reference to its typical long funnel-shaped mouth.[154] Two subtypes are generally discerned: a first type with an ovoid/ bag-shaped body, handles in the form of an ear or a semi-circle, and a neck that organically segues into the rim (*Figure* 27); and a second type with a more egg-shaped body, vertical handles, and a rim that is slightly separated from the neck by a fine line (*Figure* 28). They have in common the attachment of the handles halfway between rim and body, the absence of a marked shoulder between neck and body, and a tip in the form of a small, pointy button. These amphorae have a capacity of ca. 20 litres.[155] Both types began circulating at the beginning of the 1st century AD; the type 2-variants ceased towards the end of the same century; the type 1-forms continued until the end of the 2nd/beginning of the 3rd century AD.[156] While in the first half of the 1st century AD their presence on consumption sites is rather sporadic, their numbers begin to increase from the second half of that century onwards. These amphorae reached their maximum circulation between the last quarter of the 1st century and the first quarter of the 2nd century AD.[157]

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[154] Pesavento Mattioli et al. 1993; Mazzocchin 2009; Cipriano/Mazzocchin 2012. The first exemplars were discovered by Liliana Mercando in the 1970's in the vicinity of Porto Recanati, around the Roman town of *Potentia* (Mercando 1974).

[155] Pesavento Mattioli et al. 1993, 151.

[156] The 'highest' chronology currently attested for these containers is the Capitolium of Brescia, where they have been found in contexts dated between the end of the 2nd century and the first half of the 3rd century AD (Bruno 2002, 288-289; see also Mazzocchin 2009, 196, note 21).

[157] Cipriano 1992; Pesavento Mattioli et al. 1993, 155; Mazzocchin 2009, 198. They occur in Milan in drainage-related structures from the beginning of the 1st century AD, but their numbers increase between AD 85 and 120, while they also occur in later times, even until the 4th century AD (Bruno/Bocchio 1991, 269-271). In Oderzo, they are known from the first half of the 1st century AD (Cipriano/Ferrarini 2001, 29); at Magdalensberg they appear round the time of Tiberius (14-37 AD) (Maier Maidl 1990, 66; Schindler Kaudelka 2000, 396). These amphorae have been found in Claudian (AD 41-54) funerary contexts at Arsago Seprio and Nave (Jorio 1987, 185).

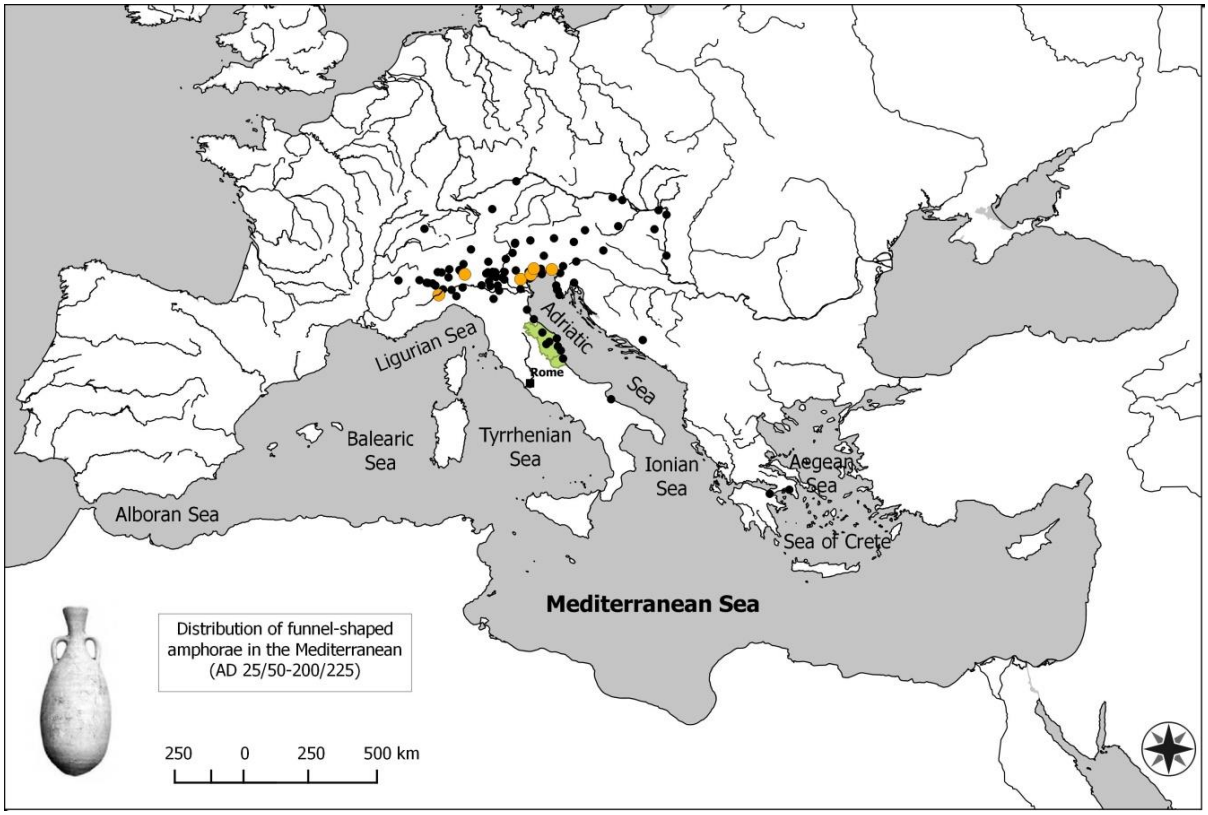


Figure 26 Findspots of funnel-shaped amphorae in the Mediterranean (the yellow spots indicate findspots of high concentrations) (Map Author).

As no kilns producing this type have until now been identified, we have to rely on circumstantial and archaeometric evidence for tracing their possible region(s) of origin. On the basis of their distribution pattern – which is similar to that of the Dressel 6A and Dressel 6B – Marie-Brigitte Carre proposed a local origin in 1985. Given their clear affinity with the Dressel 6B – in fact they were often confused with these amphorae in the past - likely candidates were Cisalpina or Istria.[158] The Istria-hypothesis has not found archaeological confirmation as the excavations at Loron and Fazana have not yielded fragments of the amphora type. Recent research has examined a number of samples. Four samples had characteristics compatible with the group of Dressel 6B amphorae produced

The finds from Salla (12 ex.) (Bezeczky 1982-83, 155, pl. 5, and 375, n° 18-28; 1987; 2005; Kelemen 1988) and Padova-Roncaglia (52 ex.) (Pesavento Mattioli et al. 1993) date to the end of the 1st century/first quarter of the 2nd century AD. In Porto Recanati (Mercando 1974; 1979), they occur in frequent association with flat-bottomed amphorae in a time period between Domitian and Antoninus Pius (ca. AD 80-150). The continuity of this form into the 2nd century is also confirmed by the finds from Asti (Zanda/Pejrani 1986, 104, n° 1; Zanda/Soma 1994, 177, n° 1, tav. XLIV, T. 13, n° 1, Hasta).

[158] For Cisalpina, see Carre 1985; and Bezeczky 1987, 26 ; for Istria, see Carre/Pesavento Mattioli 2003, 468-469. The appearance of a stamp HAD AVG on one exemplar had also lead to the hypothesis of their production in imperial *figlinae* in *Istria* in the 2nd century AD (Cipriano 1992, 47).

in Fazana and Loron. The theory has been put forward that they maybe were manufactured only once, or on a site in the vicinity of these two kilns.[159] The Gallia Cisalpina hypothesis was mainly put forward because of the large presence of the container on sites in the Po plain; i.e. besides the resemblance in both shape and fabric with the Dressel 6B, also produced in limited number in the Po plain.[160] But of the 38 samples recently analysed, only two seem to be slightly compatible with the fabric from Cisalpinian Dressel 6B containers (stamped with names from Padanian people), although they are more likely to refer to the middle Adriatic area.[161]



Figure 27 Anfore con collo ad imbuto, Type 1 (After Mazzocchin 2009, 194, Fig. 1).

Most of the archaeometric analyses, however, points towards a considerable production in the middle Adriatic area, and maybe in particular *Picenum*.[162] Indeed, these analyses have grouped 32 samples that have characteristics compatible with those of the clay along the central Adriatic coast.[163] There seems to be a particular resemblance with

[159] Mazzocchin 2009, 200.

[160] Carre 1985, 234.

[161] The examples originate from the site of Concordia (Belotti 2004); Carre/Pesavento Mattioli 2003, 468-469. If the content of these amphorae was indeed olive oil, then *Gallia Cisalpina* becomes an implausible area of production, as large-scale oil production was unlikely in that area because of climatic conditions; certainly a production large enough to support a second oil container after the few Dressel 6B that were already being produced in the Po plain.

[162] Mazzocchin 2009, 199.

[163] This clay composition has become known as the so-called 'Porto Recanati fabric, A hard fine-textured fabric that is reddish yellow to yellowish orange/bright or yellow hazelnut/pinkish or bright reddish brown/dark brown in colour. Inclusions are mainly white calcite/limestone and quartz (both small and medium inclusions);

the samples from Cesenatico (Rimini) and Cologna Marina (Pescara). These same analyses have also allowed for grouping more finely four samples from Roncaglia that show characteristics similar to the Dressel 6A containing Picenian stamps.[164]



Figure 28 Anfore con collo ad imbuto, Type 2 (After Mazzocchin 2009, 195, Fig. 3).

The diffusion pattern of these amphorae has been well studied by Stefania Mazzocchin. They circulated mainly in the northern Adriatic area – with a heavy presence in the Po plain and *Venetia et Histria* – and more to the north along the Danube river in *Noricum* and *Pannonia*. The highest numbers have been attested in some of the northern Italian towns, such as Padova (145 ex.), Altino (+ 100 ex), Oderzo (81 ex.), Alba Pompeia (73 ex.), Milan (67 ex.) and Aquileia. A number of sites in the Po area have yielded between 20+ and 50+ examples, like Brescia (30 ex.), Cividate Camuno (BS) (20 ex.), S. Lorenzo di Pegognaga (33 ex.), Clastidium (24 ex.), Concordia (31 ex.), Padova-Roman amphitheatre (47 ex.), Padova-via Beato Pellegrino (31 ex.), Padova-Roncaglia (52 ex.), Milano Metropolitana (49 ex.) and Cividate Camuno (20). All other Italian findspots have numbers below 15 exemplars.[165]

frequently mica is attested in very small dimensions; in some cases medium inclusions of chamotte are also present.

[164] Mazzocchin 2009.

[165] **One exemplar**: Aventicum, Chieri (TO), Ivrea, Asti, Alessandria-Hasta, Legnano (MI), S. Lorenzo di Parabiago (MI), Nave, Reggio Emilia, Peschiera (VR), Verona-Collezione del Museo Archeologico, S. Maria di Zevio (VR), Covolo di Camposilvano (VR), Trento-Palazzo Tabarelli, Padova-largo Europa, Adria, Torcello (VE)-canale Rigà, Castelraimondo (UD), Rovigno, Giulianova (TE); **two exemplars**: Mantova, Padova-Museo Civico, Classe, Porto Recanati (MC), Cupra Marittima (AP); **three exemplars**: Trento-Porta Veronensis, Rimini, Aquileia (UD): **four**

Their presence is decisively less conspicuous in the Danubian provinces, where sites generally contain only a few exemplars.[166] Noticeable exceptions are Salla (12), Vindobona (9) and Magdalensberg (7).[167] A shipwreck consisting almost entirely of these amphorae was found at Skoljic near Unije in Croatia, while excavations at a villa on the Brijuni island (Verige) delivered many fragments of this type (*Figure* 26).[168]

Olives for export? The Schörgendorfer 558 (ca. 25 BC – AD 150/175)

A last transport container that deserves our attention is the Schörgendorfer 558, a flat-bottomed amphora type that is also called '*anfora troncoconica*', a term derived from its characteristic truncated cone-shape. The vessel is known in two versions, with the second type (B) differing from the first type (A) only by its more elongated and somewhat slender shape (*Figure* 30). Based on their presence on Early/High Imperial consumption sites, jars of Type A apparently began circulating in the Augustan period and ended during the reign of the Flavians (AD 69-96); Type B jars appeared towards the end of the 1st century AD and lasted until the second half of the 2nd century AD.[169]

exemplars: Vercelli-Monastero della Visitazione, Como-Porta Pretoria, Cremona-Via Massarotti, Caorle (VE); **five exemplars**: Verona-Via Ponte Pietra, Padova-via Paoli; **six exemplars**: Milano-Università Cattolica (I livello), Trieste-piazza Barbacan; **seven exemplars**: Calvatone/Bedriacum, Brescia-via A. Mario, Padova città; **eight exemplars**: *Littamum* (S. Candido, BZ); **nine exemplars**: Margherita di Savoia (FG), Porto Recanati (MC); Altino; **ten exemplars**: Villadose (RO), Verona-via Campofiore; **12 exemplars**: Milano-Università Cattolica (II livello) ; **13 exemplars**: Brescia-Capitolium; **not determined**: Avigliana (TO), Rosta (TO), Torino, Ivrea-piazza Balla, Cerrione (BI)-loc. Cascina Vignazza, Alba (CN)-Palazzo Calissano, Alessandria-fraz. Villa del Foro, Ghemme-largo Gianoli (NO), Como-several excavations, Chiavenna (S0), Brescia-Liceo Arnaldo ex Chiesa S; Barnaba, Salò (BS), Laguna di Venezia, Portogruaro (VE), Aquileia (UD)-Canale Anfora, Loron.

[166] **One exemplar**: Oberstimm, St. Peter im Holz, Poetovio, Gorsium, Tokod; **two exemplars**: Emona, Narona; **three exemplars**: Libarna, Carnuntum; **four exemplars**: Savaria; **not determined**: Fluvio Frigido (Aidussina), Mursa, Aquincum, Corinth, Athens.

[167] The first distribution map appeared in Pesavento Mattioli et al. 1993, 154; the most recent one was presented by Stefania Mazzocchin in 2009 (Mazzocchin 2009, Tab. 1 – Le attestazioni delle anfore con collo ad imbuto, 204-206). To her list we can add some further attestations in Cervignano dei Friuli (6 ex.), dated between the last decades of the 1st c AD and the first years of the 2nd century AD (Tiussi 2010, 272-274), and the lagoon of Venice – i.e. at Canale S. Felice (Canal 2013, 263, fig. 113.19a; and 427, fig. 152a), Canale dei Bari – loc. Chiese Bruciate (Canal 2013, 442; fig. 165.3), and Canale Rigà (Canal 2013, 440, fig. 163.1c) – and in the Marche region in Treia (Vermeulen et al. 2001, 65, fig. 16, 22-23) and Fermo (7 ex.) (Menchelli 2012, 70; Menchelli/Picchi 2014, 11-12). An earlier findspot in the Marche region, at San Severino Marche, passed unnoticed (Mercando 1974). For a full list of findspots with references, see *Appendix* I.

[168] Jurisic 2000, 22.

[169] Pesavento Mattioli 2008; 2011.

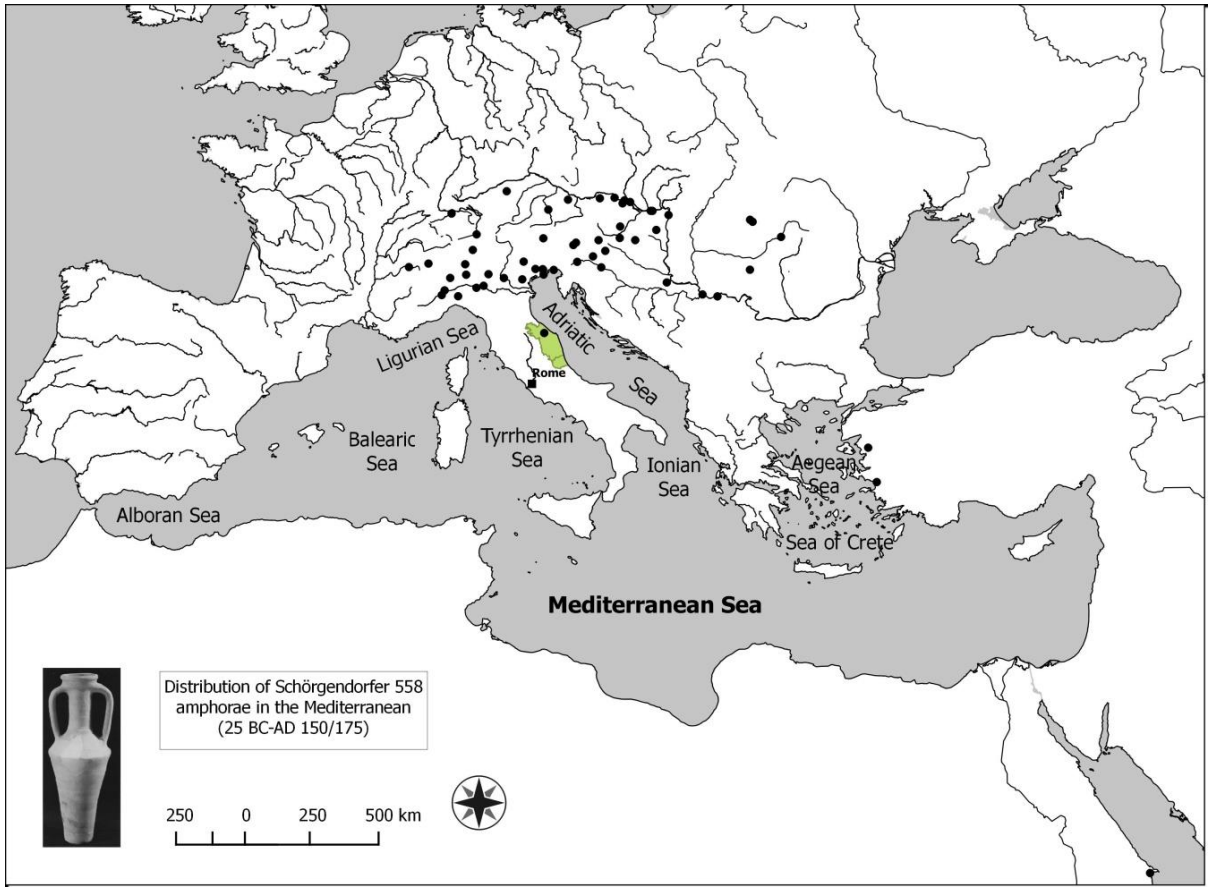


Figure 29 Findspots of Schörgendorfer 558 amphorae in the Mediterranean (Map Author).

Quantitatively speaking, the distribution of these containers is not that noteworthy, as only some 120 exemplars have been found. Within Italy, their diffusion is confined to the north, where numerous examples of mainly Type A vessels are known from *Gallia Cisalpina*. Outside Italy, they are found predominantly in the Danubian provinces. Except for one or two cases, these finds consist exclusively of the Type B variant.[170] In *Pannonia* and *Noricum*, some 24 sites are known to have yielded fragments of these containers, but their presence is most conspicuous in the Roman military camps of *Vindobona*, *Gorsium*, *Savaria* and *Carnuntum*.[171] More to the west, in the Roman province of *Raetia*, a few exemplars are known from *Augusta Vindelicorum* and Chur.[172] More recent research has also revealed a noticeable distribution of these vessels in the provinces of *Dacia*, *Moesia*

[170] Until now, Type A variants have been found only in Emona and Ribnica (Vidrih Perko 2006, 213).

[171] For an overview of findspots in *Pannonia*, see Bezeczky 2005, 54, fig. 10, with references.

[172] The Roman province of *Raetia* comprises eastern and central Switzerland, southern Bavaria and the Upper Swabia in Germany, the federal state of Voralberg in Austria, the major part of Tirol and a section of Lombardy in Italy.

and *Germania Superior*.[173] On the other hand, the Schörgendorfer 558 only occasionally reached the Eastern Mediterranean, where it has been attested in Turkey and Egypt (*Figure* 29).[174] As has already been uttered by Marie-Brigitte Carre in 1985, the rather small-scale distribution of this amphora type should probably be interpreted as the limited circulation of a somewhat luxurious food product.[175]

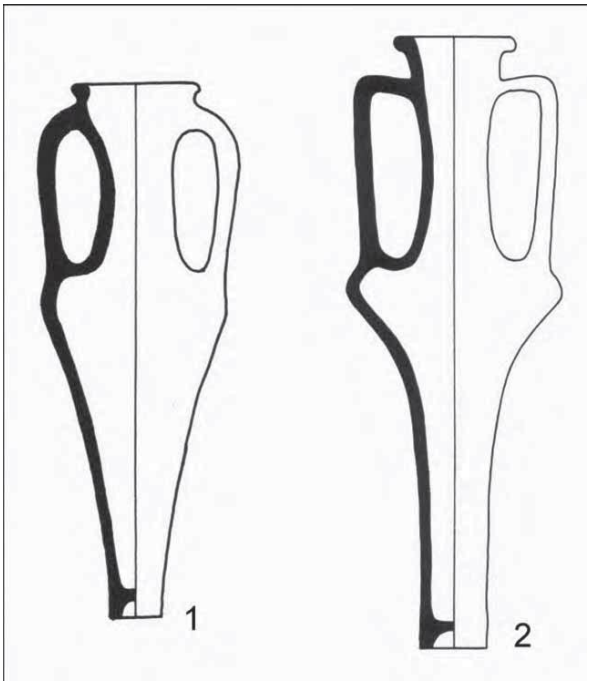


Figure 30 Schörgendorfer A (1) and B (2) (After Pesavento Mattioli 2008, 336, Fig. 1).

Fortunately, the red painted inscriptions found on some of these containers do not leave any doubt about their content. Indeed, some 40 *tituli picti* are known that mention either *OL(iva) NIG(ra)* or *OL(iva) ALB(a)* – i.e. mature or green olives – conserved either *EXD(VL)(ci)* or *EXMV(ria)* and considered *EXC(EL)(lens)* (excellent) in quality.[176] Both conservation methods are mentioned by Columella (*Rust.* 12.49-50) and these inscriptions

[173] *Dacia* is modern Romania; *Germania superior* is northern Switzerland; *Moesia* covers most of the territory of Serbia, the northern part of Macedonia, northern Bulgaria, and northern Dobruja.

[174] The first overviews of findspots of Schörgendorfer 558 were assembled by Paolo Baldacci in 1972 (Baldacci 1972, 27-28) and G. Muffatti Musselli in 1986 (Muffatti Musselli 1986, 189-194). Another survey has been presented by M.-B. Carre in 1985 (Carre 1985, 231-232). More recent published finds have been assembled by Stefania Pesavento Mattioli in 2011 and 2013. For the full list of findings with their respective references, see Appendix I.

[175] Carre 1985, 232.

[176] For an overview of these inscriptions, see Pesavento Mattioli 2008, 342-344, *Appendice*. Both conservation methods – *ex dulcis* and *ex muria* – are known from Columella (*Rust.* 12.49-50). For a discussion of these methods, see Pesavento Mattioli 2008, 338; and 2011, 166. The term *EXMV(rio)* is known from only one example in Vercelli; see Carre 1985, 232, who refers to *CIL* V, 8111, 3, where the inscription is read as *OL(iva) EX AM(aro)*.

make it perfectly clear that the Schörgendorfer 558 carried olives preserved either in a mixture of water and salt (*ex muria*) or in a substance on the basis of *defrutum* or *sapa*, sometimes mixed with honey (*ex dulcis*).

The precise origin of these amphorae is still a matter of debate. While their diffusion pattern – which is comparable to some extent with that of the Dressel 6A, the '*anfore con collo ad imbuto*' and the Dressel 6B – clearly hints at a provenience from somewhere in the Adriatic, no actual kilns are currently known and the *tituli picti* do not provide us with any valuable information regarding their source area. Considering the notoriety of Istrian olive oil in Roman times – a reputation celebrated by ancient writers such as Pliny (*HN* 15.3.8), Martial (*Epigr.* 12. 63. 1-2), Pausanias (*Paus.* 10, 32, 19), Galen (*MM* 11, 16; *Comp. Med. per Gen.* 6, 5; *SMT.* 6, 5) and later also Cassiodorus (*Var.* 12, 22-24) – A. Degrassi saw in them olive containers coming from *Istria*.[177] However, as Stefania Pesavento Mattioli has rightfully stressed, no fragments of these amphora types have been identified in the well-studied Dressel 6B kilns of Fazana and Loron.[178] Others have proposed a northern Italian origin, maybe around Padova, Milan or Lake Garda.[179] Again, this theory has been debunked by Pesavento Mattioli, who reminds us that the ancient sources mention neither the olives nor the oil from Cisalpina.[180] Ancient authors do mention the oil produced by Liburnian olive cultivators along the central eastern Adriatic coast, but it has been pointed out that the *tituli picti* rather point in the direction of a Latin-speaking production area; an element that would then better suit an origin somewhere along the middle-northern or southern Adriatic coast of the Italian peninsula.[181]

In fact, the best literary evidence for the production of high-quality olives on a considerable scale in the Adriatic comes from *Picenum*. In the 1st century AD, authors such as Silius Italicus (*Pun.* 6.648-650), Ausonius (*Epist.* 3.1) and especially Martial (*Epigr.* 1.43.7-8, 4.46.12-13, 4.88.7, 5.78.17-21, 7.53.4-5, 9.54.1, 11.52.11, 13.36.1-2) praise the region on numerous occasions for its excellent table olives, famous for their taste among the Roman elite and known to have been exported as far as north-eastern Gaul until at least the 3rd century AD.[182] Indeed, a recent discovery of a batch of storage jars in Bliesbruck (Moselle) – one of them containing a *titulus pictus*, written with a brush in black ink, mentioning '*oliva picena*' – shows that these table olives were still manufactured and widely

[177] Degrassi 1956, 108-109; an opinion shared by Carre 1985, 232.

[178] Pesavento Mattioli 2008, 340, especially note 26, where she refers to both earlier and recent work on these kilns.

[179] Bezeczky 2005, 57; in particular for Milan, see Ehmig 2000, 66.

[180] Pesavento Mattioli 2008, 340; 2011, 169. Nevertheless, a local but very limited production of Dressel 6B amphorae is supposed for the Po area; see Carre/Pesavento Mattioli 2003b; and Cipriano 2009.

[181] Pesavento Mattioli 2011, 169.

[182] A recent survey of this literary evidence can be found in Paci 2005.

appreciated in the 3rd century AD.[183] While it is possible that the inscription of Bliesbruck merely consists of a quality label or false mark, it nevertheless confirms the reputation of these olives outside Italy and provides an indication of economic contacts between central Adriatic Italy and north-eastern Gaul in the second half of the 3rd century AD.[184] In fact, the recent examination of three storage jars from the museum of Wiesbaden – located along the Rhine River somewhat to the north of Bliesbruck – delivered a second jar from the end of the 2nd century/beginning of the 3rd century AD with a similar incised *titulus pictus*. This discovery suggests that the example of Bliesbruck was not an isolated case.[185] Is it possible then – as has been argued Pesavento Mattioli – that the '*anfore troncoconiche*' carried the olives from *Picenum* in Early and High Imperial times?

With regard to fabric, the Schörgendorfer 558 suffers from the same defects as the other Adriatic containers, i.e. that the uniform sedimentary geology of the Adriatic basin makes it difficult to discern specific regions of provenance. The first archaeometric analyses carried out on some of the amphorae from *Pannonia* were able to distinguish two main sub-groups on the basis of the mineralogical composition of the fabrics: a first small group that was likely produced in Istria; and a second larger group that showed a higher rate of compatibility with a central Italian origin.[186] On the other hand, subsequent analyses of amphorae from these and other sites – such as Magdalensberg and Vindobona – did not yield conclusive results.[187] Likewise, the examination of an exemplar from Milan did not get beyond the assessment that the composition of the clay was typical for the alluvial coastal area of the Adriatic, while an Aegean origin could also not be dismissed.[188] Recently, somewhat more promising results were obtained at the University of Padova, where a Schörgendorfer 558 from Brescia was subjected to petrographic analysis within the framework of a larger geo-archaeological research project. This analysis established that the fabric showed a large resemblance to that of the so-called '*Picenian*' Dressel 6A containers (see *supra*).[189]

[183] Albrecht 1998, 321-328.

[184] Paci 2005.

[185] Paci 2009.

[186] Ivancsics in Bezeczky 1987, 125-127. An Istrian origin can be excluded for these examples, as they have been shown to contain volcanic inclusions in their fabric, an element absent in the Istrian Dressel 6B (Bezeczky 1987, 33; and 2005, 56-57).

[187] For Magdalensberg, see Bezeczky 1994, 116-117; for Vindobona, see Sauer 2005, 120-121.

[188] Bruno/Bocchio 1991, 271. Likewise, petrographic mineral analysis of a Schörgendorfer 558 example from the villa of Ercole at *Carnuntum* resulted in an identification compatible with both an Istrian or Aegean origin (Menchelli/Genovesi et al. 2008).

[189] Pesavento Mattioli 2011, 170.

1.3 Explaining the dialectics of amphora export

1.3.1 Wine

The widespread circulation of the aforementioned Adriatic containers – produced at least in part in southern Emilia, Marche and northern Abruzzo – indicates that in Late Republican and Early Imperial times a substantial portion of revenues from the cultivation of vines in the central Adriatic area was transported outside the region. The shipment of central Adriatic wine started somewhere in the second half of the 3rd century BC with the appearance of the late Greco-Italic amphora. One process that seems to be well-reflected is the link between the start of wine amphora production and urbanisation in the area and the first phase of Roman colonisation and urbanisation in the 3rd-2nd century BC. In archaeological terms, this link is most clear at *Ariminum* (Rimini) (286 BC) – a town that lies immediately outside the chosen study area, but whose territory in the 3rd century BC was part of the *Ager Gallicus* – where excavations have attested the gradual replacement of imported Greco-Italics from the Tyrrhenian (comparable in shape with the Will A type) with locally produced examples from the nearby workshop of Cattolica in the course of the 3rd century BC.[190] The relationship between the beginning of amphora fabrication and the foundation of maritime colonies in the area is also visible at *Potentia*, where the production of Greco-Italics again seemingly started shortly after the installation of the town in 184 BC.[191] A similar scenario could also be suggested for *Hatria*, where the probability of the production of older Greco-Italic types may be connected with the installation of the colony around 290-286 BC.[192]

These observations should not surprise us. The installations of these harbour towns along the central Adriatic coast offered a gateway for local farmers to the stable overseas markets that were opening up through Rome's expansion policy in the course of the 3rd-2nd century BC, as such motivating an increase in the production of wine in the neighbouring countryside. In fact, it would not be unthinkable if comparable connections showed up in the future for the other maritime foundations in the area, like *Castrum Novum* and *Sena Gallica* (289-283 BC), or *Firmum Picenum* with its port *Castellum Firmanorum* (264 BC) and Pisaurum (184 BC).

Whatever the case may be, the ca. 106 findspots assembled for the late Greco-Italic container show that in the course of the following 100-year period noticeable quantities of wine were being shipped from the central Italian coastal area towards markets on the

[190] Stoppioni 2011; 2013; see *supra*, Chapter 1.

[191] Vermeulen et al. 2011; Vermeulen/Monsieur 2012; Van Limbergen/Monsieur/Vermeulen 2014.

[192] Panella 2010, 19, note 2. For the discovery just outside the city of Atri of an amphora stopper – probably belonging to a Greco-Italic or Lamboglia 2 – mentioning *HATRIA*, see Tchernia 1986, 55-56.

opposite side of the Adriatic and the eastern shore of the Ionian Sea (*Chart* 1.1). The prominence of the transitional Greco-Italic/Lamboglia 2 type in particular among the many shipwreck finds indicates that these movements increased in both volume and intensity towards the mid-2nd century BC. This process continues with the introduction of the Lamboglia 2 around 150/125 BC. Indeed, between the end of the 2nd century BC and the mid-1st century BC, the quantitative importance of Lamboglia 2 amphorae in geographically widespread contexts in the Mediterranean marks a period of intense involvement of the area in extra-regional wine exports. This involvement is well-illustrated by the ca. 415 findspots assembled for this amphora type (*Chart* 1.1) and apparently reaches peak around 50/25 BC with the circulation of its transitional version Lamboglia 2/Dressel 6A. Starting with the circulation of its follow-ups from the Augustan period onwards – chiefly the Dressel 6A and to a lesser extent the Dressel 2-4 – a gradual but steady decrease of central Adriatic transmarine exports seemingly occurs; as apparent from the decisively lower number of findspots (ca. 125) assembled for the Dressel 6A (*Chart* 1.1). While these pear-shaped amphorae are still present in appreciable quantities on almost all northern Italian/Adriatic sites, they disappear almost completely from the rest of the Adriatic, the Ionian Sea and the Eastern Mediterranean (*Figure* 21).[193] It is also clear that in this period, or possibly somewhat earlier, Rome becomes quite an important market for middle-northern Adriatic wine.[194]This downward spiral continues in the course of the 1st and 2nd century AD with the flat-bottomed containers, which remain the only locally produced amphorae in the central Adriatic area from the mid-2nd century AD onwards.

Outlined as such, this curve shows many similarities with the one that scholars have reconstructed for the central Tyrrhenian coast of the Italian peninsula with regard to the evolution of the wine trade during the life-cycles of the Tyrrhenian Greco-Italic, Dressel 1, Dressel 2-4 and the flat-bottomed amphorae in Late Republican and Early/High Imperial times.[195] Traditionally, this curve has been interpreted as a boom-and-bust cycle that started through overseas export promotion and slowed down – and eventually ended

[193] For an overview of Dressel 6A distribution in general, see *Appendix* I. For *Venetia et Histria*, see Cipriano/Mazzocchin 2012, 241.

[194] 56% of all amphorae found during the recent excavations in the area of the Nuovo Mercato Testaccio in Rome belonged to the Dressel 6A type; 33% were defined as Lamboglia 2, but only because their identification as Dressel 6A was not certain, indicating that they probably belong to the late transitional type from the second half of the 1st century BC (Cafini/D'Alessandro 2010, 95).

[195] For the Tyrrhenian Greco-Italic and Dressel 1, see Tchernia 1986, 42-53; Hesnard et al. 1989; and Maza 1998; for the Dressel 2-4, see Tchernia 1986, 127-128; for the flat-bottomed amphorae of the 2nd century, see Panella 1989.

– because of provincial competition and import replacement in the provinces.[196] Indeed, in what is now a classic narrative, Rome's progressive conquest of the Mediterranean in the Late Republican period (200-30 BC) first lead to the creation of enormous melting pots consisting of military men, merchants, colonists and local elites that provided a strong and stable stimulant for the expansion and intensification of agricultural production in central Italy. Viticulture in particular was hereby a vastly remunerative activity that – through an intense exploitation of good agricultural land and by means of conspicuous investments – could generate substantial surpluses that could be shipped towards these external markets; a process amply evidenced by the widespread appearance of central Italian amphorae across the Empire.[197] When from the Augustan period onwards some of the provincial markets began to produce the wine they had previously imported, a gradual decrease of Italian transmarine exports occurred. Together with the attestation of an increasing importance of wine (and oil) imports from the provinces in the ceramic assemblages from Rome and Ostia, this lead some scholars to believe that provincial import replacement and competition had put in motion some sort of a crisis, touching in particular Italian speculative viticulture – but also the wider agricultural sector – in the course of the 1st and 2nd century AD.[198]

Likewise, much has been said about the importance of external stimuli as driving forces behind the developments in the Adriatic amphora evidence. Similar to the Tyrrhenian scenario, the wine boom was hereby provided by the many extra Italian trade and consumption markets spawned by Rome's progressive conquest of the wider Adriatic and the Eastern Mediterranean between ca. 200 BC and AD 30. Important catalysts were the victory of the Roman army at the battle of Pydna in 168 BC – which virtually ended the power of the Macedonian dynasty – and the inheritance of the Kingdom of Pergamum in 133 BC. Other crucial events were the installation of Delos as a free-trading centre in 167 BC and the destruction of Carthage and Corinth in 146 BC; all elements contributing

[196] In economic terms, a boom-and-bust cycle is typified by a period of considerable economic expansion (boom), followed by a (rapid) stagnation or decline (bust) (Bandeli/Sowers 2010). According to a recent dictionary of economics, 'export promotion' is an economic strategy typical for less developed countries that consists of relying on foreign markets for stimulating export-led growth; it is the opposite of 'import replacement' – or 'import substitution', whereby imports are replaced by domestically produced substitutes (Black/Hashimzade/Myles 2009). According to modern economic theory, such a process of 'entspezialisierung', in which a country begins to produce a product that it previously imported, would be a typical sign of crisis (Bang 2008, 73-76).

[197] Rosenstein 2008; Launaro 2011, 168-169.

[198] For the argument – which is heavily centred on the events in the Roman province of Gaul (*Gallia*) in that period – see Giardina/Schiavone 1981, especially Panella 1981. For overall syntheses, see Tchernia 1986; 2006; and Carandini 1988, 267-285. For central Tyrrhenian Italy in particular, see Carandini 1980; and 1989. The idea of a crisis, however, goes way back and originates from Rostovtzeff 1926.

to the large-scale circulation of Italian merchants in the Eastern Mediterranean, and hence to the marked increase in Italian imports between ca. 160 and 120 BC.[199] One of the principal markets of the Lamboglia 2 in the East was Delos; a prominence that has been explained by the presence of a large community of Italian residents that acted both as consumers and traders of Adriatic wine, interacting on their turn with traders from Laodicea, Berytos and Alexandria.[200] Considering the role of Delos as an important slave trading centre, one of the prime commodities that were exchanged for Adriatic wine were probably slaves.[201] A similar explanation has been proposed for the presence of Lamboglia 2 on the island of Thasos.[202] The swap-trading of wine for commodities such as slaves, cattle and skins probably also explains the massive presence of these central Italian containers both in the Northern Adriatic and along the Croatian coast.[203]

While the proverbial 'bust' of the central Adriatic wine trade during and after the reign of Augustus may not have been as drastic as the one occurring along the Tyrrhenian coast – our ignorance regarding the true extent of the Adriatic Dressel 2-4 distribution should caution us not to exaggerate the steep drop between the circulation of the Lamboglia 2 and the Dressel 6A – there is no denying that the Dressel 6A circulated in much smaller numbers and within a geographically more confined pattern than its predecessor. Once again, several external arguments have been brought forward in order to explain this descending evolution, like for instance the closure of the port of Delos in 69 BC, or the fact that some Italian traders on the Greek islands became wine growers themselves.[204] Accordingly, the only reason why the Adriatic wine trade did not collapse immediately was the creation of the Danubian provinces in the Augustan period, allowing for the Dressel 6A to still find a market in the legionary fortresses, *canabae* and some civilian settlements of *Noricum* and *Pannonia*.[205] Still, from the Augustan era onwards, the Lower Po valley began to establish itself on the wine market with its own variants of the Dressel 6A and the Dressel 2-4, probably somewhat at the expense of the central Adriatic area.[206]

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[199] Lund 2000, 87, fig. 10.

[200] For its role as a trading centre, see Hatzfeld 1912, in particular 143-144: for the consumption by Italians on the island, see Rostovtzeff 1941, 1254; see further Tchernia 1986, 72; and Lund 2000, 85-88. This exchange pattern likely explains the lesser importance of cities such as Alexandria and Ephesus as secondary attraction poles of Adriatic wine in the East (see *supra*).

[201] For the argument, see Rauh 2000.

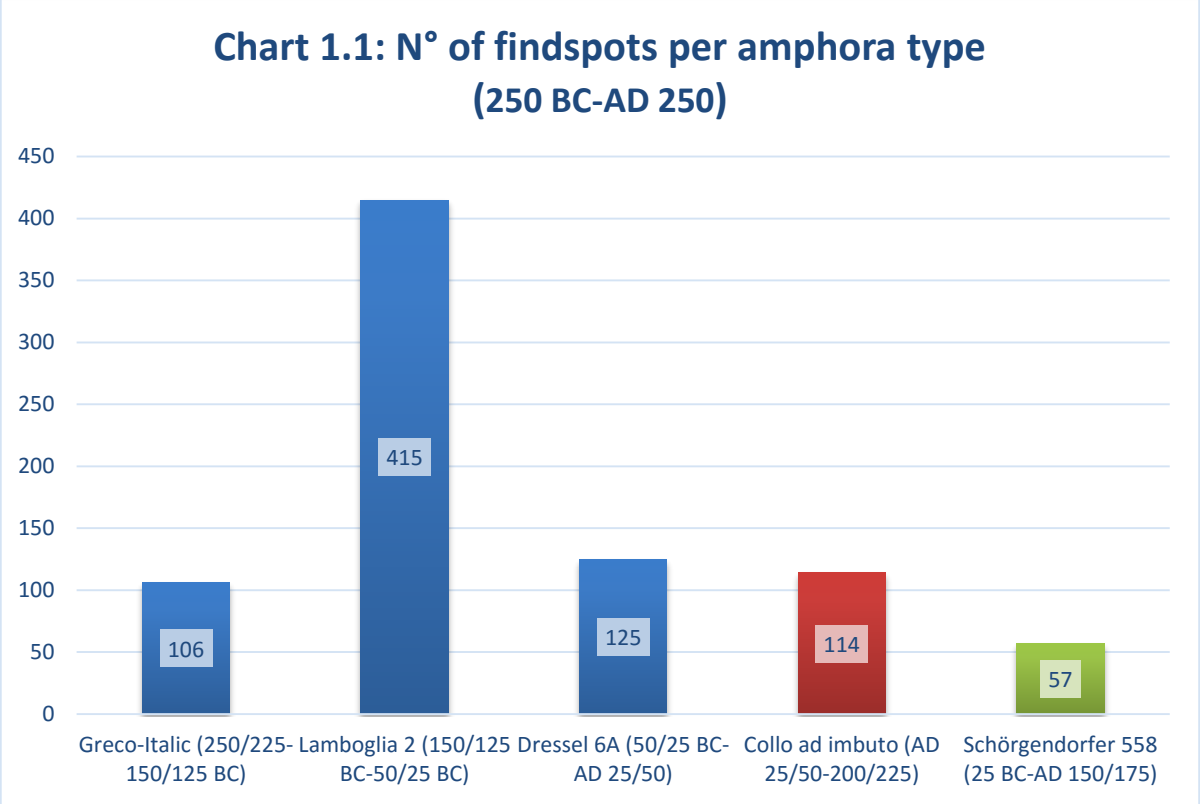
[202] Finley 1962, 51; and Tchernia 1986, 73.

[203] We know for instance from Strabo (*Geogr.* 5.1.8) that the Illyrians descended to Aquileia in order to purchase Roman wine (Tchernia 1986, 70).

[204] Tchernia 1986.

[205] See the findspots of Dressel 6A in *Appendix* I.

[206] Zaccaria 1989, 477-478; Mazzocchin 2008; Mongardi 2013.



After the mid-1st century AD, however, the downfall of the central Adriatic wine carriers became more explicit with the subsequent limited circulation of its flat-bottomed containers in the 2nd-3rd century AD, now pushed aside completely by the more successful northern Adriatic variants from Forlimpopoli and Santarcangelo.[207] Besides a decreasing distribution scale, another indicator for the declining importance of wine transported in amphorae in this period is the changing volume of these containers over time. Indeed, the introduction of flat-bottomed amphorae stood for the use of containers that were decisively less capacious than their predecessors. While pointy types like the Lamboglia 2, the Dressel 6A and the Dressel 2-4 all had capacities around 27-30 litres – and often more than 30 litres in the case of the Dressel 2-4 – flat-bottomed amphorae contained on average ca. 15-17 litres and only rarely more than 20 litres.[208] This development culminated in the 2nd-3rd century AD, when locally-made wine amphorae disappear completely in our archaeological contexts. Based on these observed changes in the

[207] Panella 1989; 2001, 195.

[208] For the Lamboglia 2 (27-30 l), see Charlin et al. 1978; and Formenti et al. 1978; for the Dressel 2-4 (28-30 l) and the flat-bottomed amphorae (15-20l), see Panella 1989, 144, 158-160. In fact, the reverse pattern can be noticed during the transition from the Early to the Late Greco-Italics in the 3rd-2nd century BC, with the former types often containing less than 10 litres, but the latter 20 litres or more (Sheperd/Lambrou 1989, 599, Tav. II; a late exemplar from Kamarina had a capacity of 25-26 litres (Vandermersch 1994).

Adriatic amphora record, Clementina Panella has recently argued for the occurrence of a viticultural crisis in central Adriatic Italy in the 1st-2nd century AD, similar to the Tyrrhenian one and caused by the loss of the provincial markets and by competition from within Italy.[209]

Leaving aside the questionable simplicity of such an unilateral 'prosperity-and-crisis' interpretation, the fact remains that the subsequent upwards and downwards trend of both the Tyrrhenian and Adriatic wine amphora evidence reflects considerable changes in the extent and the nature of the country's foreign wine trade over time. There can also be no doubt that these changes are to a certain degree related to external factors, like the gain and loss of Rome's economic monopoly in its provincial markets and thus the presence or otherwise of competition from within the wider Mediterranean. On the other hand, there has been less attention for how internal factors – i.e. regional or even local demography and land availability – might have influenced the developments in our amphora evidence. Indeed, following the behaviouristic model outlined at the beginning of this chapter, an increase or high level of amphora exports may also hint at a lower urban (and rural) demand for wine – and thus a higher land availability – allowing for a larger portion of the surpluses to find their way towards external markets. Then again, a decrease or disappearance of amphorae could also mean that internal demand became larger, up to a point that it affected the amounts of land and wine available for export. In this way, the rise and fall of Italian wine amphorae would not only reflect the enlargement and subsequent reduction of the overseas wine trade, but also fluctuations in the country's ability to export large amounts of wine over time.

For the central Adriatic area of Italy it follows that internal demand must have been relatively modest in the Middle and Late Republican period, allowing for the area to take full advantage of the opening-up of external markets in the course of the 2nd century BC. This process is well-reflected in the success of the Late Greco-Italic and the Lamboglia 2 between ca. 225/220 and 50/25 BC. With the circulation of the Dressel 6A within a geographically and quantitatively more confined pattern, however, this favourable situation must have changed considerably between the mid-1st century BC and the mid-1st century AD. Judging from the even lower distribution scale of the later flat-bottomed amphorae, the situation only worsened in the second half of the 1st century and the 2nd century AD. The gradual loss of the provincial markets is one explanation, but a rising impact of intra-regional consumption entities might certainly be another.

Still, it is difficult to straightforwardly establish equivalence between the progressive loss of amphora exports and a partial or complete compensation by a gradual rise in intra-regional consumption markets from 50/25 BC onwards. There are some developments in our amphora evidence, however, that may effectively point towards such a reorientation

[209] Panella 2010, 92.

of the local wine industry – i.e. from long-distance trade towards regional provisioning – in the course of the 1st and the 2nd century AD:

- First, it has been suggested that the relocation of amphora workshops from coastal areas towards more inland areas from the Augustan period onwards – as is the case with the flat-bottomed amphora kilns of Forlimpopoli and Santarcangelo, but also the Dressel 6A kilns of Faenza-Brisighella and Parma-Sala Baganza, or the Dressel 2-4 kiln of Marino del Tronto (*Figure* 5, n° 6-8, 11, 25) – reflects a partial shift in focus from exterior to inland markets.[210]
- Second, the evolution in itself from large amphorae ending with a tip (Greco-Italic, Lamboglia 2, Dressel 6A, Dressel 2-4) towards smaller flat-bottomed amphorae in the course of the 1st century AD has been argued to reflect the need for these containers to be carried over a combination of water and land-ways; an aspect that would have rendered them more suitable for supplying local towns, rather than distant centres.[211]
- Third, despite their demise in the wider Mediterranean, the inland distribution of locally produced amphorae apparently remained quite meaningful in some places in the 1st-3rd century AD. For instance, field surveys carried out by the University of Gent in the valley of the river Potenza in central Marche registered noticeable quantities of local Dressel 2-4 amphorae on several inland urban and rural sites, contrasting with the paucity of older types on these sites.[212] At the inland town of *Suasa* in the middle Cesano river in northern Marche, excavations by the University of Bologna recovered several hundreds of amphorae from the so-called "*Domus dei Coiedii*" between 1988 and 1998.[213] Among the 456 analysed rim fragments, six fragments belonged to the Late Greco-Italic type (1.31 %), 88 fragments belonged to the Lamboglia 2 (19.29 %), 23 fragments to the Dressel 6A (5.04 %), 25 fragments to the Dressel 2-4 (5.48 %) and 215 fragments to the flat-bottomed amphorae (47.12 %) (*Chart* 1.2, rim). The intensity of the wine movements during the life-cycles of the Greco-Italic, the

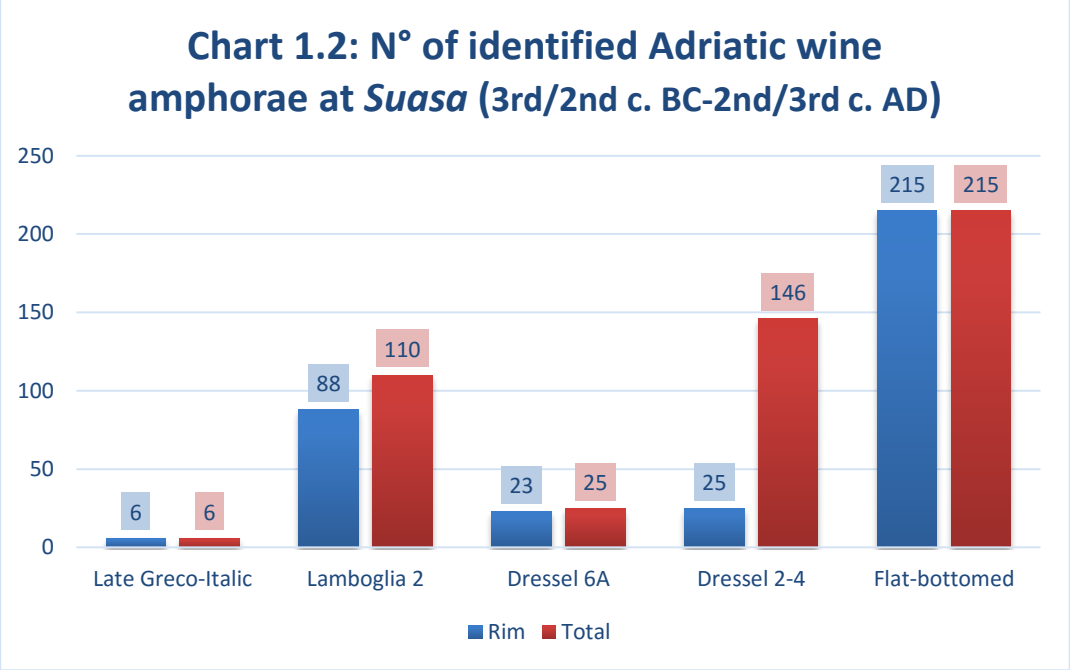
[210] For the flat-bottomed amphorae, see Panella 1989, 160-161. Although this process is not observed everywhere, as the Forlimpopoli- and Empoli-type amphorae (flat-bottomed) from the *Ager Volaterranus* were manufactured in the immediate hinterland of the harbour of *Vada Volaterrana* (personal communication with Simonetta Menchelli).

[211] Panella 1989, 156-160.

[212] Vermeulen et al. 2006. Although one should always be cautious and keep in mind that more recent occupation levels are easier to spot than older ones in survey contexts.

[213] Gamberini 2014.

Lamboglia 2 and the Dressel 6A coincides well with the curve outlined in chart 1.1 (see *supra*), even when we consider the totality of identified exemplars – i.e. including both rims, handles and feet (*Chart* 1.2, total).



The changes appear with the Dressel 2-4 and the flat-bottomed amphorae. At first sight – i..e based on the number of identified rim fragments – the Dressel 2-4 equals the Dressel 6A in quantitative importance. However, when we take into account the further 121 exemplars identified through the highly characteristic double-bar handle, these amphorae now outnumber the Dressel 6A by large.[214] Furthermore, all exemplars seem to have an Adriatic fabric, which hints at a local or regional production.[215] The same goes for the quantitatively even more dominant flat-bottomed amphorae (*Chart* 1.2, total).[216] These developments in the ceramic evidence suggest that the consumption of wine did not diminish at *Suasa* after the disappearance of the Dressel 6A, but on

[214] This numeral difference between Dressel 2-4 and the three previous amphora types might be an over-representation, as the double-bar handle makes the former much easier to identify (Gamberini 2014, 552, note 39).

[215] Gamberini 2014, 552-553, note 42; Esquilini 2014, 594, fig. 7.

[216] Gamberini 2014, 557; Esquilini 2014, 594, fig. 7, gruppo 2. Although this difference in number may be somewhat compensated by the smaller capacity of the flat-bottomed amphorae (ca. 15 l against 28-30 l for the Dressel 2-4) (Panella 1989, 144).

the contrary increased in the course of the 1st century AD and remained evident until the 2nd/3rd century AD with a dominant reliance on local sources.[217]

One of the more intriguing questions to this regard in recent scholarly literature is whether in the course of this timespan other perishable devices – especially wooden barrels – became more important for the transport of wine in the central Adriatic coastal regions. In fact, recent research into the use of wooden casks in the Roman West has made it perfectly clear that barrels were used simultaneously with amphorae in Gaul and Britain from at least the 1st century BC onwards.[218] The original popularity of these containers in these areas might well have had something to do with the beer-drinking tradition of the pre-Roman North, but with the advent of the Romans they also began to be used for the provisioning of wine, as illustrated by the many findings of barrels in Roman military camps.[219] The introduction of such wooden carriers in these afforested and navigable river-rich regions should not surprise us, given their suitability for river and land transport, but it is less clear how widespread their use was in Italy or other parts of the Empire. Some bias in preservation conditions is obviously involved here, but a coalescence of literary, iconographic and epigraphic evidence supports the co-existence of barrels and amphorae in Early/High Imperial Italy, in particular from the 2nd/3rd century AD onwards. Most of this evidence has been amply discussed by André Tchernia and Elise Marlière and there is no need to rehash their elaborations here, but it is worthwhile to dwell briefly on the evidence which concerns northern/central Adriatic Italy.[220]

One of the best-known pieces of information is the sarcophagus of a winemaker from Ancona, datable to the mid-3rd century AD.[221] The funerary relief depicts a scene of wine-selling with the liquid stored in a barrel in-between the trader and the buyer (*Figure* 31). To this we can add the High Imperial inscription belonging to the monument of a barrel maker at *Cupra Marittima* (*Figure* 32), as well as two urns from *Firmum Picenum*, one representing the pouring of wine from a goatskin into an amphora and the other showing the overland transport of wine in skins by means of a cart, with the latter datable to the mid-1st century AD.[222] More to the north, in the surroundings of Aquileia, we have the

[217] Once again, some caution is required and one should not forget that the *Domus dei Coiedii* represents an exceptionally large and rich domestic complex, whose consumption patterns may not necessarily reflect the overall trends of *Suasa* or other Roman towns in the area (see *infra*, Chapter 3 for a description of the *domus* and its evolution).

[218] Marlière 2001, 182, Fig. 101; and 2002, who lists the findspots of over 200 barrels in Roman Gaul and Britain between the 1st century BC and the 4th century AD.

[219] Tchernia 1997; Marlière 2013.

[220] Tchernia 1986, 285-292; Marlière 2002.

[221] Profumo 2005a.

[222] For the monument from Cupra Marittima, see Paci 2009; 2010; for the urns, see Marengo 2003.

testimony by Strabo, who describes the purchasing of Roman wine by the Illyrians in wooden barrels (*Geogr.* 5.1.8), and a passage from Herod, wherein the construction of a bridge made out of wine barrels by emperor's Maximinus' army in AD 238 is mentioned (VIII, 4, 4).





Figure 31 Sarcophagus of a winemaker from Ancona (After Regione Marche, www.beniculturali.marche.it).

Figure 32 Funerary monument of a barrel maker from Cupra Marittima (After Paci 2009, 291, Fig. 1).

While decisively meagre in quantity, the available evidence nevertheless prompts the question of why one would choose to use wooden barrels instead of amphorae in transport. For starters, there is no denying that the former have certain advantages when it comes to efficiently transporting larger quantities of liquid. Indeed, not only could single wooden casks be built to contain way more liquid than any amphora could hold, but it has also been calculated that the latter could only carry between one and four litres of cargo per kg of container, while the former had a much higher ratio of 4 to 9:1.[223] Furthermore, the stacking of cylindrical wooden containers with flat bottoms and covers in ships' holds certainly proved less space-consuming than the positioning of curve-shaped amphorae with pointy feet and necks. But there were also disadvantages to be reckoned with. Indeed, employing wooden barrels on a regular basis also meant repeated investments in their fabrication and maintenance. There was also the issue of raw material availability. As recalled earlier in this chapter, the widespread use of amphorae in the Mediterranean was in part promoted by the ubiquity of its basic medium – i.e. clay – in the area. This was not the case for wooden barrels, whose use was more economical in densely afforested areas such as the northern Mediterranean and northern Europe. Besides, wooden containers could be leaky – especially in the case of olive oil – or could absorb some of their liquid; both resulting in the partial loss of the cargo.[224]

[223] Peacock/Williams 1986, Table 1; Lane 1986, 234; and Marlière 2002, 12. Barrels could easily hold 600-800 litres and sometimes even more than 1300 litres (Baratta 1994, 238; Vera 2006, 312).

[224] Bevan 2014.

There was probably more than one factor involved when selecting barrels over amphorae or vice versa, but one medium for which the latter containers were certainly less-suited – given their high breakage risk – was hobbling land transport by cart or pack animal. A greater share of transport via that kind of routes might thus result in a higher employment of those barrels.[225] Indeed, we might easily imagine how the carriage of wine produced in the territories of the Adriatic towns and meant for local consumption frequently involved overland transport, meaning that much of this kind of intra-regional provisioning does not manifest itself clearly in the archaeological record (see *supra*).[226] What we could thus be witnessing in the container record is a shift in market focus – and this in transport modii – whereby the adoption of the barrel did not mean the end of overseas transport, but rather was an indication that local transport became the main preoccupation.[227] As such, the use of wooden casks would have allowed for easily provisioning local towns, while at the same time ensuring the availability of a cylindrical container that could also be stacked in ships.[228]

1.3.2 Olive oil

The chronology of the olive oil amphorae is radically different. The export of central Adriatic oil did not start before the 2nd quarter of the 1st century BC, when some – undoubtedly modest – amounts began to be exported outside the region in Adriatic ovoid amphorae and Dressel "ante 6B". As such, the region only jumped on the wagon that was pulled by the similarly shaped but much more successful Brindisian oil containers, produced at the kilns of Apani and Giancola in the southern Adriatic (see *supra*). The cessation of the Brindisian olive oil exports towards the end of the 1st century BC has been seen by André Tchernia as a consequence of the growing concurrence of other oil containers made in Istria (Dressel 6B) and Baetica (Dressel 20).[229] A similar explanation might be proposed for the brief life-period of the middle Adriatic ovoid/Dressel "ante 6B" containers (75/50-50/25 BC), as well as for the abeyance of the Dressel 6B production in the area after the mid-1st century AD (see *supra*). Contrary to what happened in the

[225] Many iconographic sources show the use of barrels on carts (Baratta 1994, 241, note 16).

[226] Morley 2007, 573.

[227] A similar evolution has been hinted at by the partial change from pointy towards flat-bottomed in amphorae in this period (see *supra* in this chapter).

[228] We know only of one shipwreck that contained wooden barrels – namely the 3rd century AD shipwreck of Guernesey (Marlière 2001, 192) – but the practice is amply documented in iconography (Baratta 1994, 241, note 17).

[229] Tchernia 2006. Daniele Manacorda, on the other hand, sees in these developments a deliberate choice by Apulian farmers to turn their attention more towards cereal growing and cattle raising (Manacorda 1995, 147; and 2001).

southern Adriatic, however, the export of central Adriatic olive oil might not have ended with the disappearance of these containers. Indeed, both archaeometric and circumstantial evidence hints that a more noteworthy export of olive oil started in the first half of the 1st century AD with the appearance of the funnel-shaped amphorae. These exports apparently reached a peak towards the end of the 1st century/beginning of the 2nd century AD. Still, with only 114 identified findspots, it is clear that central Adriatic olive oil never reached the high levels previously attained by the wine trade (*Chart* 1.1). Again, the gradual diminishment of their circulation from the mid-2nd century AD onwards might find its external explanation in the increasing competition from the Istrian Dressel 6B amphorae, which dominated the oil market until the 3rd century AD. A somewhat similar timespan and evolution may be proposed for the life-cycle of the Schörgendorfer 558; whose attestation at a mere 57 findspots points towards the limited export of olives with an exclusive character from the area (*Chart* 1.1). Eventually, both trades followed the same fate as wine and they simultaneously bled to death towards the end of the 2nd century AD, or certainly in the first half of the 3rd century AD.

Judging from the amphora record, it is clear that the region was never an important producer of olive oil for the overseas market. The saturation of the market might be one explanation – in the 2nd-3rd century AD the Baetican Dressel 20 oil amphora too circulated in the Adriatic[230] - but from an internal point of view, this might also be because of the inferior quality of the oil, or because suitable olive land was scarce in the area, or because local production was rather aimed at fulfilling local needs, rather than provisioning distant markets. A combination of all these explanations is also possible. Whatever the case, I will conclude this section with the observation that the central Adriatic area did not export its olive oil for most of the Late Republican period, but that it began to integrate itself into the northern Adriatic oil market from the Augustan age onwards, in a time in which a gradual abatement of middle Adriatic wine exports was ongoing. Internal factors might be the cause of these developments, but these are difficult to identify through the amphora evidence. Once again, if local consumption needs were the main incentive for this oil, much of it would have been circulating within the region in perishable skin containers, invisible to the archaeological eye.

[230] Auriemma et al. 2012, with references.

1.4 Conclusion

In this chapter, I have reviewed the wine and oil amphorae produced in the central Adriatic area of Italy in Late Republican and Early/High Imperial times. More than anything else, I have hereby tried to establish a framework for assessing the area's involvement in the overseas wine and oil trade over time. In doing so, the issue has been raised whether our amphora evidence forthrightly mirrors the evolution of commercial viticulture and oleoculture in the area, or whether these containers are also indirect proxy indicators for other, less visible transformations in the same sectors. For the purpose of this thesis, the quintessential questions are now whether or not the production of wine on a commercial scale continued during and after the demise of wine amphora exports in the 1st century AD, and if noteworthy oil production occurred in the area before the start of oil amphora exports around the mid-1st century BC. In order to provide some answers to these questions, the following chapter will analyse another good proxy indicator for commercial production, i.e. press installations.

Chapter 2
Wine and oil presses in central Adriatic Italy

> *"The very existence of presses is evidence of commercial-scale production, as subsistence production does not actually require grapes or olives to be pressed after crushing."*
>
> *(Lewit 2007, 124)*

2.1 Pressing issues

Next to amphorae, the remains of press installations for the production of wine and oil are one of our main sources for reimagining the ancient viticultural and oleocultural landscape. Just like amphorae, presses are a category of evidence with a relatively high level of archaeological visibility. This is because some of their component parts were made out of large stone blocks or brick structures that tend to survive well in the archaeological record. These durable elements include millstones, mortars, counterweights and base blocks, as well as paved processing floors and semi-subterranean features such as collecting/decantation tanks or semi-buried storage jars. Then again, the perishable wooden parts of these assemblages – like the press beam and its driving mechanisms (windlass or screw), as well as the lever for rotating the millstones – have left no traces in the archaeological record and their reconstruction remains in part hypothetical.

The durable elements that we recover are remnants of constructions that were expensive to construct and labour-intensive to operate. Suitable stone blocks for millstones, counterweights and base blocks needed to be traced down, acquired and often transported from their place of manufacturing to their place of use; wine and oil tanks needed to be built, *opus spicatum* press floors and press beds needed to be laid out; a

sufficient amount of pricey *dolia* were to be acquired for storing the produced liquids; etc. Especially stone olive crushing mills were an expensive piece of equipment and the millstones had to be made by specialised stone masons. Also the press with its lever and driving mechanisms required the use of suitable pieces of wood and its construction was necessarily a work of specialists. All this made the building of one or more presses – especially olive presses – quite a costly affair. Such an undertaking thus required a substantial financial input that was often out of reach for small peasants. Hence, our archaeological evidence highlights the portion of all past processing equipment that was owned by financially strong farmers that were able to make considerable investments in capital and labour.

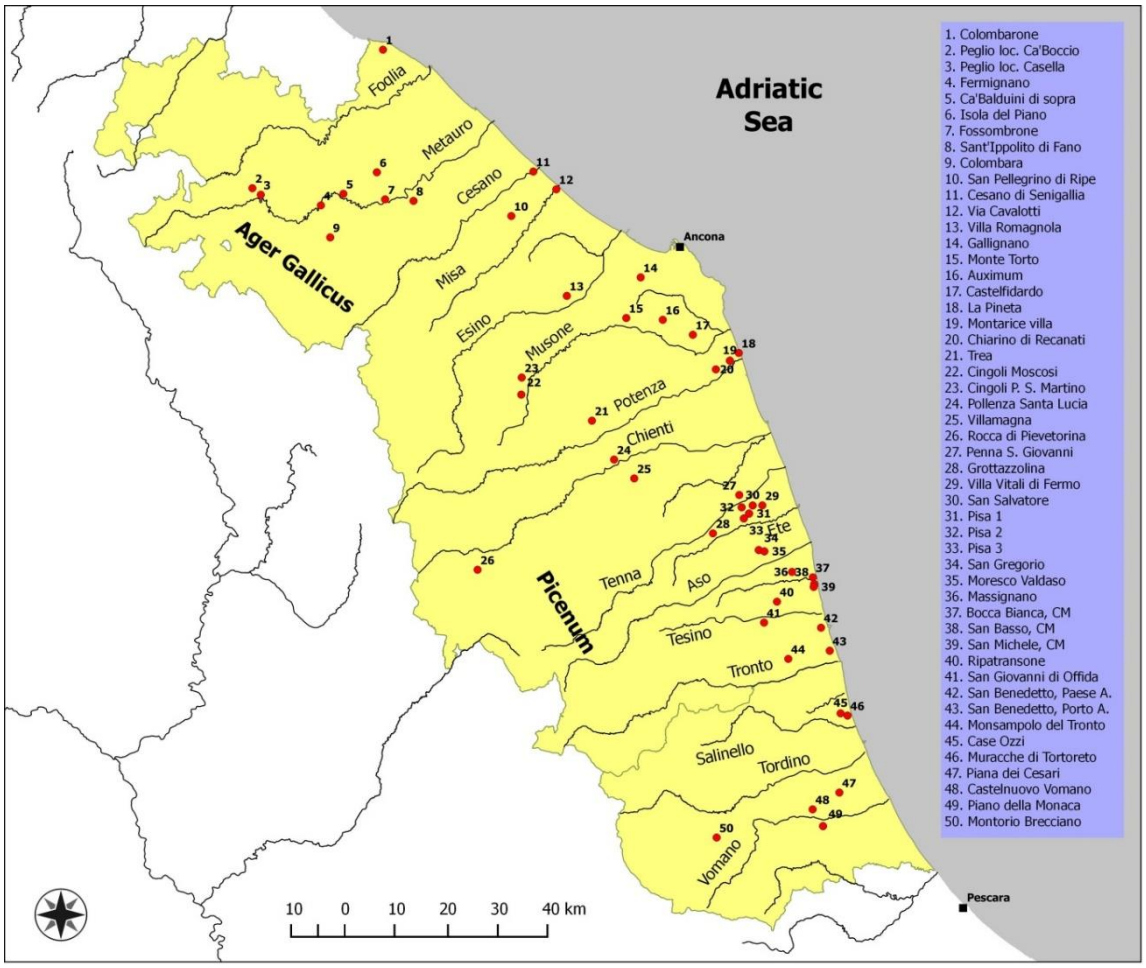


Figure 33 Sites with indications for grape and/or olive processing in central Adriatic Italy (Map author).

Hence, the use of such pricey and complex machinery only proved economical when wine and oil were produced on a substantial scale.[1] Indeed, the manufacturing of wine

[1] Mattingly 1988a, 157; Foxhall 2007, 178-179.

and olive oil on a more modest scale did not automatically require the intervention of fully equipped press installations. Often, cheaper and more primitive materials sufficed for the production of smallish amounts of these liquid on a domestic scale.[2] For instance, in small-scale wine production, grape crushing could easily be achieved by using mobile treading floors made out of wood or other perishable materials. Large-scale production, on the other hand, required the acquisition of a treading floor of a more permanent nature, often combined with a mechanical press. More pressure could thus be applied to the crushed grapes, increasing the output of the pressing.[3] Logically, this simpler equipment must have left only a few or no traces at all in the archaeological record and is therefore less identifiable or visible. However, the use of specialised, more permanent equipment – like stone olive crushers, treading floors for grapes and mechanical presses – was required for commercial agriculture on any substantial scale.[4] Although the priority of a large proportion of the rural population must have been domestic production, this category of farmers probably used cheaper technologies of a less permanent nature that have not survived the test of time.[5] The presence of one (or more) press(es) on a single rural site is thus a fairly reliable indicator for the production of wine and oil on a commercial scale on that particular site.

One and two makes that the number of attested presses in a certain area may reflect the regional economic performance of grape and olive cultivation, and thus the levels of commercial wine and oil production, attained in that particular area through time. The purpose of this chapter is then to evaluate the evidence for pressing equipment in central Adriatic Italy. The first section of this chapter systematically reviews all the archaeological remains that can be connected with grape and/or olive processing. For this, a total of ca. 1,000 (954) surveyed or excavated Roman rural sites in the Marche region and northern Abruzzo (Teramo) were checked for the possible presence of press installations. The data were collected from a variety of available sources. A regional synthesis concerning the rural occupation of the Marche in Roman times appeared in 1981, offering a complete overview of all published and non-published material from the archives of the Soprintendenza Archeologica delle Marche since the middle of the 19th century.[6] Rural site databases on a sub-regional level have also been assembled for central

[2] Amouretti 1986, 158-162; see also Brun 1986, 45; Foxhall 2007, 132, 178-181; and Rossiter 1981, 348.

[3] Curtis 2001, 227-233.

[4] Foxhall 2007, 176-177; see also Rossiter 1981, 348.

[5] Foxhall 2007, 251.

[6] Mercando et al. 1981.

and southern Marche, and for the valley of the river Metauro more to the north.[7] Recent field surveys in the area include the PVS (Potenza Valley Survey) in the valley of the river Potenza and the PSPS (Pisa South Picenum Survey) in the territory between the valleys of the rivers Tenna, Ete and Aso.[8] In addition, a number of journals and book series were reviewed: *Notizie degli Scavi*, *Picus – Studi e ricerche sulle Marche nell'antichità*, *Studi Maceratesi*, *Quaderni di Archeologia nelle Marche*, *Quaderni dell'Accademia Fanestre*, *Quaderni di Archeologia d'Abruzzo*, *Documenti dell'Abruzzo Teramano*, *Journal of Ancient Topography*, and *Papers in Italian Archaeology*. Other important publications are '*Monte Torto. L'impianto produttivo*', '*La Via Flaminia nell'Ager Gallicus*' and '*La Salaria in Età Antica*'.[9] Complementary research consisted of my consultation of the archives of the Soprintendenza Archeologica delle Marche in Ancona and personal fieldwork on the site of Monte Torto di Osimo (AN) during the spring of 2009, and on sites located in the central Marchegian valley of the river Potenza in the summers of 2012, 2013 and 2014. Following this overview, the second section then discusses some of the more important patterns that can be observed for this evidence, like the main lay-out of production plants, the respective share of wine and oil presses, their distribution in the landscape and their chronology. Finally, A concluding section reflects on how the press evidence relates to the amphora evidence discussed in the first chapter, and discusses the implications for our interpretations.

2.2 The archaeological evidence reviewed

2.2.1 Survey- and occasional surface finds

Obtaining conclusive press evidence without fully excavated contexts is difficult. This is because physical evidence for pressing equipment can be quite elusive in systematic survey contexts or occasional surface finds. For instance, over the years, rural field surveys in the area have frequently delivered the remains of opus spicatum floors and/or

[7] For central-southern Marche, see Pupilli 1994; for sites in relation to the Via Flaminia in het Metauro valley, see Ferretti 2002; for the territory of *Forum Sempronii* (Fossombrone) in the upper Metauro valley, see Monacchi 2010b.

[8] For the Potenza valley, see Percossi/Pignocchi/Vermeulen 2006; for the territory between the rivers Tenna, Ete and Aso, see Menchelli 2012.

[9] Pignocchi 2001; Luni 2002; and Catani/Paci 2000.

dolia fragments.[10] For instance, surveys by the University of Pisa in the territory of the Roman town of *Firmum* (Fermo) in southern Marche yielded a total of 80 *opus spicatum* tiles, with important concentrations on some 10 rural sites.[11] Also, these surveys recorded a total of 264 *dolia* fragments from 123 rural sites, with six of them displaying higher numbers of these storage containers.[12] Likewise, field research of the University of Macerata in the upper Metauro valley attested *opus spicatum* bricks on 14 rural sites in the territory of the Roman town of *Tifernum Mataurense* (Sant'Angelo in Vado); *dolia* fragments were found on 28 sites.[13] Bricks of the *spicatum*-type are also known from three rural sites registered during field surveys carried out by Ghent University in the Potenza river valley in central Marche. The same surveys further registered the presence of *dolia* on 30 sites.[14]

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[10] For a first, preliminary overview of Roman rural sites with *opus spicatum* tiles in the Marche region, see Mercando/Brecciaroli Taborelli/Paci 1981, 311-519, nrs. 43, 51, 71, 77, 84, 89, 99, 109, 116, 136, 160, 205, 214, 215, 223, 226, 228, 254, 265, 266, 280, 290, 371, 426, 434, 444, 453, 464, 490 (29 sites). For *opus spicatum* in the territory of the *Ager Gallicus* in particular, see Ferretti 2002, 213-261, nrs. 46, 54, 55, 65, 70, 73, 82, 85, 88, 96, 101, 107, 121, 131 (14 sites). For a few sites with these bricks in the territory of Serra de' Conti (AN); see Ceresani/Villani 2003, n. 1 (Ponte della Rota), 5 (San Martino), 7 (Molino), 10 (Cone), 12 (Granelli), 13 (Granelli 1), 14 (Farneto) (7 sites).

[11] Menchelli 2012, sites n°: 165/Psg4, 150/Fe 167; idigis 431/Fe43; id 232/Fe24; id 257/Fe69; id 552/Mr; id 663/Cl 3; id 622/MonLun64;); id 113/Svar1 (OS); id 596/Latro 1 (OS); and id 666/Sva12. For site n° id 552/Mr (Monte Rinaldo), see also Pupilli 1994, 82.

[12] Menchelli 2012, sites n°: 200/Fe 96 (7 examples); 165/Psg4 (several, number not specified); 150/Fe 167 (16 ex.); id 232/Fe24 (4 ex.); id 257/Fe69 (4+ ex.); and id 43/Ca6 (10 ex.).

[13] For the sites with *opus spicatum*, see Monacchi 2010b, 266-399, sites n°: 39 (Sant'Angelo in Vado loc. Crocifisso); 44 (Sant'Angelo in Vado loc. Bataina); 55 (Sant'Angelo in Vado loc. Volpella); 58 (Sant'Angelo in Vado loc. Palazzetto); 59 (Sant'Angelo in Vado loc. Spidaletto); 65 (Sant'Angelo in Vado loc. Fraternità alta); 87 (Sant'Angelo in Vado loc. Ombra); 95 (Sant'Angelo in Vado loc. Ca' Salvatore-Fosso di Gamberaie); 99 (Peglio loc. Ca' Gulino); 100 (Peglio loc. Casella); 105 (Peglio loc. Palazzuolo); 106 (Peglio loc. Ca' Bostringo); 108 (Peglio loc. Ca' Boccio); and 109 (Peglio loc. Calciuccio). For the sites with *dolia*, see again Monacchi 2010b, 266-399, sites n°: 3 ( ); 15 (Mercatello loc. Camasso); 16 (Mercatello loc. Ca' Bruciata); 39 (Sant'Angelo in Vado loc. Crocifisso); 40 (Sant'Angelo in Vado loc. Villaccia); 56 (Sant'Angelo in Vado loc. Ca' Mite); 61 (Sant'Angelo in Vado loc. Calcotto); 65 (Sant'Angelo in Vado loc. Fraternità alta); 66 (Sant'Angelo in Vado loc. Il Trebbio); 68 (Sant'Angelo in Vado loc. Ca' Scaviato); 72 (Sant'Angelo in Vado loc. Podere di Cesare); 75 (Sant'Angelo in Vado loc. Pian d'Achille); 76 (Sant'Angelo in Vado loc. Ca' Rinalduccio); 87 (Sant'Angelo in Vado loc. Ombra); 89 (Sant'Angelo in Vado loc. Ca' Martino); 90 (Sant'Angelo in Vado loc. Podretta – Ca' Martino); 95 (Sant'Angelo in Vado loc. Ca' Salvatore-Fosso di Gamberaie); 100 (Peglio loc. Casella); 101 (Peglio loc. Ca' Mercurio); 104 (Peglio loc. Villalta); 105 (Peglio loc. Palazzuolo); 106 (Peglio loc. Ca' Bostringo); 108 (Peglio loc. Ca' Boccio); 109 (Peglio loc. Calciuccio); 111 (Peglio, loc. Ca' S. Arcangelo); 114 (Urbania loc. Cantinaccia II-Ca' Rombaldone); 129 (Urbania loc. Case Nuove); and 132 (Urbania Via delle Querce n. 23).

[14] For *opus spicatum*, see Vermeulen et al. 2006, sites n.: 094 (Passo di Treia); 102 (Casa Piacampo); and 101 (Montarice villa). For Passo di Treia in particular, see also Vermeulen et al. 2002, 65, where the researchers from Ghent University propose in fact the identification of a press room on the site. For *dolia*, see again Percossi et al. 2006, sites n°: 035 (Mergnano S. Pietro); 038 (Le Casette); 045 (Casa Prato); 054 (Mecciano); 058 (Mergnano S. Pietro); 059 (Seppio); 062 (Casa Colle); 063 (Casa Prato); 065 (Casa Prato); 066 (Pianicella); 069 (Casa Matta); 074 (Castelleta); 075 (Casa Piccion); 077 (Monte Franco); 081 (Colle dei Carbonari); 082 (Le Moglie); 085 (Monte Franco); 099 (Villa Potenza-Cimarella); 100 (Campo di concentramento); 101 (Montarice villa); 104 (Casa

While these are both elements associable with press installations, they do no form conclusive evidence for their identification. Press rooms in Roman Italy do seem to have been paved consistently with *opus spicatum* floors – i.e. floorings made out of small rectangular bricks placed on their flat side and arranged according to a so-called 'herringbone' pattern (*Figure* 37; and 83) – but these pavements were probably one of the most widespread floor-types in Late Republican and Early Imperial times and they were commonly used for a wide range of utility spaces, like storage rooms, courtyards, terraces and other open areas.[15] *Dolium* potsherds can be indicative for the storage of on-site wine and/or oil production, but it is likely that almost every Roman farm or villa will have possessed at least one or two exemplars of these storage containers, whether or not its inhabitants were involved in the production of their content. Furthermore, *dolia* were not only used for preserving wine and oil, but they could also serve for the storage of other food products, such as cereals and fruits.[16] As such, the presence of these bricks and sherds in survey contexts may surely recall the utilitarian character of a site – or at least a part of it – but on their own they cannot provide firm proof for the existence of a press.

Still, in some cases the collected survey evidence amounts to a somewhat more coherent picture. For instance, the association of lumps of *opus spicatum* and cocciopesto floorings with many fragments of *dolia*, amphorae and millstone scraps on the sites of **Peglio loc. Casella** (n° 100) and **Peglio loc. Ca' Boccio** (n° 108) in the upper Metauro valley may effectively point towards the existence of pressing equipment on these sites.[17] Similarly, the finding of almost 80 *opus spicatum* tiles, a large amount of *dolia* and amphora fragments, and a small limestone basin in the same area on the site of **Montarice villa** in the lower Potenza valley has induced the researchers from Ghent University to interpret the zone as a productive space, maybe for the production of wine or oil.[18] A comparable suggestion has been made by Laura Pupilli for the site of **Passo di Colle di Grottazzolina** near Fermo on the basis of *dolia* sherds belonging to a minimum number of 12 exemplars

Lassandari); 108 (Casa Malati); 113 (Casa Senegagliese); 119 (Casa Cingolani); 120 (Casa Luzzi); 126 (Torre Nuova); 127 (Casa Torrigiani); 128 (Casa Mazieri); 130 (La Concia); and 131 (Potentia Sud).

[15] A recent example from the Marche region is the *opus spicatum* floor found within the urban area of *Potentia*, a Roman coastal town located near modern Porto Recanati in the lower Potenza valley. Based on the association of the brick floor with many fragments of animal bones showing clear traces of butchery, the area has been identified as a late antique meat processing plant (http://www.archeologia.beniculturali.it/index.php?it/142/scavi/scaviarcheologici_4e048966cfa3a/296).

[16] A *dolium* filled with carbonized cereals was discovered in the Roman town of Falerio (Bonvicini 1991, 144, n. 59, fig. LVI; Maraldi 2002).

[17] For Peglio loc. Casella, see Monacchi 2010b, 358-362; see also Spano 1998. For Peglio Loc. Ca' Boccio, see again Monacchi 2010b, 370-109.

[18] Vermeulen et al. 2013, 608.

and the recording of a large *opus spicatum* floor by local farmers.[19] Be that as it may, definite answers on the nature of these four sites are difficult to obtain without further excavations. For now, it is probably safer to catalogue them as sites with possible indications for oil and wine processing (*Figure* 33, n° 2, 3, 19, 28).

This is not to say that press installations can never be identified with certainty through surveys or other forms of field research. In fact, during surveys carried out by the University of Macerata in the upper Metauro valley, a part of a limestone base block belonging to a Roman press was found in the locality of **Ca' Balduini di sopra**, where surface finds point towards the presence of a large Roman villa occupied between the 3rd century BC and the 2nd century AD (*Figure* 33, n° 5; *Figure* 72).[20] Base blocks were stones meant to contain the *arbores* of the press, i.e. mostly wooden uprights that were used for the navigation of the horizontal wooden press beam (*prelum*).[21] These blocks generally have a rectangular form and on their flat surface they display an arrangement of two rectangular or square notches in which the wooden poles were inserted vertically. Over the years, similar *ex-situ* base blocks have been found at the sites of **San Gregorio di Monterubbiano**[22], **Moresco Valdaso**[23], **Massignano San Giuliana**[24], **Cupra Marittima San Michele**[25], **Ripatransone Castelluccio**[26], **San Benedetto Porto d'Ascoli**[27], **Case Ozzi di Tortoreto**[28], **Castelnuovo Vomano**[29], **Piano delle Monaca**, [30] and **Montorio Brecciano**[31] (*Figure* 33, n° 34, 35, 36, 39, 40, 43, 45, 48-50; *Figure* 54; 55; 56; 57; 58; 90). A number of stone blocks that could be interpreted as large base blocks were also attested by the Pisa surveys

[19] Pupilli 1994, 69-70; see also Busana et al. 2009; and Menchelli 2012.

[20] Agnati 1999a, 34; and Monacchi 2010a.

[21] While the use of stone piers is occasionally attested in Roman North Africa, only wood was used for the arbores in Late Republican and Early Imperial Italy and therefore their reconstructions remain largely hypothetical.

[22] Pupilli 1994, 77; see also Pasquinucci/Menchelli/Scotucci 2000, 362, n° 28.

[23] Pupilli 1994 (two base blocks); Busana et al. 2009; and Menchelli 2012.

[24] Ciarrocchi 1999.

[25] Three base blocks are known at Cupra Marittima San Michele, one measuring 1.77 x 1.04 m and another 1.75 x 1 m (Ciarrocchi 1999).

[26] Two base blocks are known at Ripatransone Castelluccio: a first complete exemplar measured 1.20x0.93 m, while a second exemplar was cut in half and only measured 0.77x0.95 m (Ciarrocchi 1999, 97-99).

[27] The rectangular base block (1.20x0.70x0.50 m) made out of travertine was found in the vicinity of the church of S. Giovanni, located on the left bank of the river Tronto near the coast (Conta 1982, 416, note 317; see also Pignocchi 1998, 210, note 18).

[28] In 1954, some Roman ceramic sculptures were found in the locality of Case Ozzi, located in the territory of the comune of Tortoreto. More recent fieldwork has also attested the presence of a square limestone base block in the same area (Lapenna 1996, 387).

[29] Staffa 1986b.

[30] The base block measured ca. 0.80x0.60 m (Staffa 1986a).

[31] In the church of Santa Maria a Brecciano (TE), a base block originating from a Roman rural settlement has been reused as a supporting block for a small pillar, situated next to the *ciborium* (Staffa 1991, 198-199).

on three sites around the modern town of **Fermo** (*Figure* 33, n° 31-33).[32] Finally, I was able to identify the presence of a fragmentary base block at **Osimo**, close to the town walls of the Roman settlement (*Auximum*) (*Figure* 33, n° 16; *Figure* 2.57).[33]

Only two complete examples of millstones are known *ex situ*, at the localities of **Penna San Giovanni** and **Villa Vitali** near Fermo (*Figure* 33, n° 27, 29; *Figure* 70; 71).[34] Based on the photographs published by Laura Pupilli, the two millstones appear to belong to the *mola-olearia* type rotary olive crushing mill. These cylindrical stones were turned with the aid of a horizontal wooden lever, inserted into the central hole of the millstones and supported by a vertical wooden shaft attached to the central olive mortar, i.e. a shallow circular stone construction with a flat bottom (*Figure* 97). When the olives were crushed in these mortars, pits and pulp were separated and a sour liquid, the *amurca*, was derived.[35] Fragments of olive millstones were also found at the surface site of Moresco Valdaso – in the neighbourhood of two *ex-situ* base blocks (see *supra*) – and at the excavated sites of Monte Torto di Osimo and Ripe San Pellegrino (see *infra*).[36] Pieces of Roman millstones have been recovered on several other surface sites, but these cannot be assigned with certainty to the milling of olives because of their highly fragmentary nature.[37] The general poor representation of olive millstones in the Italian archaeological record can largely be explained by the fact that they often proved to be useful stones that could be reworked and reused for other purposes after the abandonment of the production plant.[38] Likewise, the high number of dispersed base blocks in the countryside can be explained by their frequent removal from ancient sites in later times, due to their robustness and aptitude for construction purposes.[39]

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[32] The finding of *opus spicatum* bricks in the vicinity of these blocks on the sites of 'id 663/Cl 3' and 'id 622/MonLun64 seems to indicate the presence of press floors (Menchelli 2012).

[33] A photograph of another base block is known from the archives of the Soprintendenza, but the precise location is unclear (see *Table* 2, n° 51; *Figure* 62)

[34] Pupilli 1994, 27, 48; see also Menchelli 2012.

[35] Brun 2003, 182-183. This *amurca* could be used for a variety of purposes. The chemical composition and the anti-oxidizing character of this liquid ensured its use for insecticide purposes and it could therefore be used for the protection of grain silos and attics from parasites and insects by mixing the *amurca* with lime. It could also be used for the reinforcement of olive trees and to safeguard vines from caterpillars; the conservation of wine meant for overseas transport, the waterproof making of olive oil jars and for medicine preparations.

[36] For Moresco Valdaso, see Pupilli 1994, 78-79; for Monte Torto, see Pignocchi 2001; for Ripe San Pellegrino, see Andrenacci 2010. Based on its identification as an olive processing plant, the presence of an olive millstone can also be presumed for the site of Cesano di Senigallia (Mercando 1979a, 110-131) (see *infra*).

[37] For examples from the upper Metauro valley, see Monacchi 2010b, sites 16, 40, 72, 100, and 108.

[38] Mattingly 1993, 494; Foxhall 2007, 146, 172.

[39] Foxhall 2007, 146, 172-176. One of two base blocks at the site of Chiarino di Recanati was broken out of the floor of the press room (Percossi Serenelli 1999, 48-49) (see *infra*); one of two base blocks found at the site of Ripatransone Castelluccio was cut in half for purposes of reuse (Ciarrocchi 1999, 97-99) (see *supra*); for the example of Montorio Brecciano, see *supra*, note 30.

A surface find of particular interest is the quadrangular stone press bed that was recently found just outside the north-western corner of the city walls of the Roman town of *Trea* (loc. SS. Crocifisso di Treia) in the middle Potenza valley (*Figure* 33, n° 21).[40] The press bed consists of a circular surface cut into the underside of a reused limestone block, probably the base of a column belonging to a large Roman Imperial public building, such as a temple or a funerary monument (*Figure* 46). As a whole, the monolithic slab measures ca. 0.75 x 0.94 x 0.22 m. The press area is delineated by a circular channel with an internal diameter of ca. 0.62 m, and an external diameter of ca. 0.72 m (ca. Ø 0.7 m). The actual press platform is slightly convex and its most central part, measuring ca. 0.52 m in diameter, is somewhat more elevated than the rest of the platform (visible on the figures by its darker greyish colour) (*Figure* 47; and 48).

Due to the off-site character of the find, it is difficult to draw any firm conclusions about the precise functioning of the press bed. Indeed, the stone slab could have served as a pressing platform in any type of lever press, but in theory it could also have been used in a direct screw press, or even in a wedge press. Still, the latter type seems to have been used only for the production of perfumes from olive oil and this artisanal activity probably did not play a role in the Marche region in Roman times.[41] Be that as it may, there are indications that the press bed at Trea rather served as an oil press than as a wine press. First, the press area seems somewhat eroded and this could in part be the result of a repeated and frequent contact with the olives 'oily acid during processing.[42] Second, the inner diameter of the circular channel usually indicates the maximum size of the baskets that were used during pressing, i.e. ca. 0.60 m in the case of the press bed at *Trea*. Interestingly, traditional press baskets that were used in olive oil production in the Marche region in pre-industrial times are ca. 0.52 m in diameter (personal observation) (*Figure* 49). Moreover, with such dimensions, they are precisely the size of the darker area attested on the press platform found at *Trea*. Therefore, I would suggest that in this particular case the block formed part of an oil press.

The precise location of the press bed is also peculiar. In fact, its discovery close to the city walls – and thus in the vicinity of the monumental centre of the Roman town – marks only the fourth example in the region of a production installation placed within, or adjacent to, an urban context, next to the ones found at *Potentia* (Porto Recanati La

[40] The press bed was identified by the author during the summer campaign of the PVS in Trea in 2013; see Van Limbergen 2013; and 2014.

[41] Mattingly 1990.

[42] Brun 2004.

Pineta), *Forum Sempronii* (Fossombrone) and Senigallia (Via Cavallotti) (see *infra*).[43] Several examples are known from late antique urban contexts in the Mediterranean, where their presence has often been explained by a partial re-ruralisation of the town area in periods of urban decline and abandonment.[44] If a similar scenario should be assumed for *Trea*, this would put the dating of the press in the 3rd-4th c AD, or even later.[45] The same could be said for the quadrangular limestone block (0.70x0.70 m) found at the intersection of two paved streets during the excavations of the Roman town of *Forum Sempronii* (**Fossombrone**) (*Figure* 33, n° 7). A circular channel cut into the surface of the block indicates the latter's use as a press bed (*Figure* 53). In the vicinity of the block, somewhat more to the north, the remains of a kiln, a series of semi-buried *dolia* and at least two millstones made in volcanic rock were also registered. No precise chronological information is currently available, but the press is likely late antique.[46]

The counterweight block of a still non-localised press installation was recently identified in the late antique layers of the excavated Roman villa of **Colombarone di Pesaro** (*Figure* 33, n° 1).[47] Counterweights were large stones to which the vertical wooden screw-mechanism was anchored used for operating the horizontal wooden beam of the press. In this way, both leverage and pressure could be increased.[48] The counterweight of Colombarone consisted of a massive limestone block that had been recovered from an Early Imperial building, probably a funerary monument. Characteristic adjustments that ensure the identification of the block as a counterweight are the grooves cut-out at the short sides of the block and the central hole carved into its surface (*Figure* 44; 45). The recycling of large and robust building materials into monolithic press elements – such as is the case in Colombarone – especially formed a recurrent practice in late antiquity and numerous examples of reworked counterweights, base blocks and press stones are known from numerous sites across the Roman Mediterranean.[49] Based on the materials found during the excavation of the complex in the 1990's, the press can probably be situated somewhere between the mid-3rd century AD and the 6th century AD.[50]

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[43] For *Potentia*, see Mercando 1979c; for *Forum Sempronii*, see Luni 2007b; for Senigallia, see Lepore et al. 2012. The press bed found in the town centre of *Forum Sempronii* consists of a square limestone block measuring ca. 0.70 x 0.70 m (personal communication with Mario Luni (†), e-mail of 15/01/0214).

[44] Brun 2004.

[45] Vermeulen 2012a.

[46] Personal communication with Prof. Mario Luni(†), e-mail of 15/01/2014; see also Luni 2007b; and Luni/Mei 2012b.

[47] The counterweight block was identified by the author during his visit of the site of Colombarone in the summer of 2014.

[48] Mattingly/Hitchner 1993, 438-462.

[49] Brun 2004. For an example from Verona, see Liverani 1987, 16, fig. 4.

[50] Dall'Aglio 1996; 1997; and 2001.

2.2.2 Excavated sites

Occasional research activities and small-scale excavations in the 19th and 20th century resulted in the uncovering of several isolated 'on-site' press platforms (*arae*), base blocks and tanks, whether or not connected to parts of *opus spicatum* or hydraulic mortar (cocciopesto) floors. Examples include the partially excavated (wine) tank at **Fermignano San Giacomo** (*Figure* 69; 113)[51], datable between the 2nd century BC and the 1st century AD, the press beds in *opus spicatum* at **Gallignano di Ancona** (Ø 1.66 m) (*Figure* 52), **Porto Recanati La Pineta** (*Figure* 79) and **Cingoli Piano S. Martino** (Ø 1.25 m) (*Figure* 106), as well as the tanks at **Castelfidardo** (*Figure* 78), **Cingoli Moscosi**, **Cupra Marittima Bocca Bianca** and **Rocca di Pievetorina** (Figure 33, n° 4, 14, 18, 23, 17, 22, 37, 26).[52] A better preserved example is the villa of **Cupra Marittima San Basso**, where in the 4th century AD a pre-existing press room with base block, press floor and collecting tank was rearranged into the *caldarium* of a thermal complex (*Figure* 33, n° 38; *Figure* 50; 51; 114).[53]

At the end of the 19th century, the remains of press rooms were registered in **Contrada San Salvatore** – located at about one km from the modern town of Fermo (*Figure* 33, n° 30) – and in the locality of **Villa Romagnola** near the modern town of Jesi (*Aesis*) (*Figure* 33, n°13). At Contrada San Salvatore, the floor of the room was paved entirely with *opus spicatum* tiles placed on a layer of hydraulic mortar. The press room contained two circular press beds made out of *opus spicatum* bricks, with one of the platforms being connected to a collecting *dolium defossum* by means of a channel. The negatives of two other *dolia* hint at the presence of a storage space.[54] Chronological information is provided by the finding of numerous tiles stamped with the name of either TI PANSIANA or A FAESONIA. The first terminology refers to the northern Adriatic tile workshop *Pansiana* and its activity under the reign of Tiberius (AD 14 – 37); the second stamp is an abbreviation of *Auli Faesoni Africani*; a title that has been found on Roman bricks between the end of the 1st century AD and the 3rd century AD.[55] The *terminus ante quem* of the site is currently set by two coins from the 4th century AD.[56] At Villa Romagnola, only a part of a

[51] Ermeti/Monacchi 1993, 79-94; Monacchi 2010a.

[52] For Gallignano, see Mercando 1979a; for Porto Recanati (1st century – end 4th century AD), see Mercando 1979c; for Cingoli Piano S. Martino and Cingoli Moscosi (with *dolium*), see Percossi Serenelli 1998; for Castelfidardo (two tanks that are probably to be identified with a *structile gemellar* for decanting olive oil, see *infra*, Cesano di Senigallia), see Mercando 1979b; for Cupra Marittima Bocca Bianca (tank of 20 m³), see Ciarrocchi 1999; for Rocca di Pievetorina (tank paved in *opus spicatum*), see Mercando et al. 1981, 340, n° 361.

[53] Verdonck/Vermeulen 2004, 187.

[54] Rafaelli 1981.

[55] For the stamp of TI PANSIANA, see Matijasic 1983, 969-973; and Pellicioni 2012, 52; for A FAESONIA, see Ilakovac 2008, 153.

[56] Mercando et al. 1981, 343, no. 419.

circular press bed made in *opus spicatum* was still visible at the time. Based on the few recorded materials, the press was at least active from the end of the 1st century BC until the 1st century AD.[57]

In February 1879, Guglielmo Allevi – an inspector from the '*Scavi e Monumenti di Offida*' – recorded the remains of a Roman rural complex near the farmstead of Sig.ra Raffaella Desideri in Recchi, in the neighbourhood of **San Giovanni in Strada** (*Figure* 33, n°41). Based on the designs made by his companion Gabrielli, these remains included a floor paved in *opus spicatum*, a circular press bed (Ø 1.40 m) made out of the same material, and a rectangular base block in tuff stone (1.27x0.75 m) (*Figure* 123).[58] The exact location of the site is unknown, but it probably coincides with a terrain near S. Giovanni in Strada that is currently the property of Sergiacomi Vincenzo, an area where the Archeoclub di Offida recently collected various Roman materials. Important finds include a loom weight, some vernice nera and sigillata, a fragment of a thin-walled cup, a tubular rim in green glass, and a bronze fibula. All these materials can be dated between the Late Republican period and the beginning of the 2nd century AD.[59] In theory then, it is possible that the site was already active in the 2nd century BC, but the presence of only a single base block hints at a start of production around the mid-1st century BC (see *infra*).

A more extensively excavated site is the Roman villa at **Santa Lucia di Pollenza** (Figure 33, n° 24). This farmhouse in the middle Chienti valley was erected in the course of the 1st century BC. From the beginning of its existence, the complex was provided in its south-eastern corner with a press composed of a press floor in *opus spicatum* and a collecting tank consisting of a bowl in terracotta. Between the mid-1st century AD and the first decades of the 2nc century AD, a second press floor in *opus spicatum* with a connected collecting tank (2.1 m^3) was installed in the central/north-eastern section of the villa, replacing a former residential part of the villa. The presence of oil residues in the tank confirms the oil producing character of this second press. Somewhere after the 2nc century AD, the latter press was replaced by a newer version, indicated by an incised press floor (Ø 1.75 m) in an *opus signinum* floor. The whole complex was finally abandoned in the 4th century AD (*Figure* 73; 74).[60]

Lying on the north bank of the Cesano river, close to the shore, the rural complex of **Cesano di Senigallia** was unearthed in part through a rescue excavation on behalf of the Soprintendenza per i Beni Archeologici delle Marche in 1967 (*Figure* 33, n° 11). Said excavations revealed the presence of a press floor in *opus spicatum* (Ø 1.75 m) and a total

[57] Annibaldi 1895; Mercando et al. 1981.

[58] Vannicola 1996.

[59] Pignocchi 1998.

[60] Mercando 1980; Percossi 2005; and Frapiccini et al. 2006, 233-310.

of four tanks (*Figure* 59-64; 110).[61] The channel connecting the press floor to one of the tanks extends further in S-W direction and implies the presence of a second press floor, situated outside the excavated area (*Figure* 61). The identification of the site as an olive oil production plant has been assured by means of chemical residue analysis of the contents of tank B (*Figur*e 110).[62] Therefore, the two small interconnecting tanks B and C are probably to be identified with a system referred to by Columella when speaking of the *structile gemellar*, a sort of built-up collector with two divisions in it, used for the separation of the pressed liquid into olive oil and watery lees (*Rust.* 12.52.10). At Cesano di Senigallia, the separation probably worked on the principle of overflow decantation, with the oil floating on top of the heavier watery lees in the first tank and flowing into the second tank through the upper channel (*Figure* 62).[63] The interpretation of tank A (5.4 m^3), however, is subject to debate. The presence of three stairs in the north-eastern corner and a central depression in the floor are features generally attested in wine collecting reservoirs (*Figure* 63).[64] Our knowledge of the site is currently too fragmentary to draw definite conclusions, but tank A does not seem to be connected to a press floor or a *calcatorium*. The presence of a sandstone spout featuring an opening on the top, however, suggests the covering of the tank by a wooden lid and the pouring of liquid into the tank through the spout. The tank has been interpreted both as a collecting tank for the pressed oil or as a reservoir for recovering the last oil from the crushed and pressed olives.[65]

Due to the limited nature of the 1967 excavations, it long seemed that Cesano di Senigallia was a purely production orientated site, without any indications for nearby living quarters. However, between 2009 and 2010, a second rescue excavation by the

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[61] Mercando 1979a, 110-115; Dall'Aglio/Mazzoli 1991, 65-66.

[62] Mercando 1979a, 112, note 32. More recent excavations have also attested the carbonised remains of olive pits (Ciuccarelli 2014, 825, note 43).

[63] A similar system was used for the olive presses at the villa of Settefinestre in the *Ager Cosanus* (Carandini 1985) and the villa of Posta Crusta in Apulia (Brun 2004, 29). There are also numerous examples known of this type of olive oil press in the limestone hills of Late Roman Northern Syria. See for instance the sites of Sarfud, Kafr Nabo (Callot 1984, Pl. 120, 123), Déhès, El Bara (Tate 1992, fig. 81, 278), and Taqlé (Brun 2004, 120) to name only a few. Such an arrangement of two interconnecting tanks generally does not seem to occur for wine presses, but exceptions to the rule exist (Brun 1993, 526-532).

[64] For examples in central Adriatic Italy, see *infra*. Examples in Roman Gaul have been found at the vicus of Pignans (Brun 2005, 16-17), the villa of Mayran Saint-Victoir-La-Coste (Brun 2005, 33), the villa of Pardigon (Brun 2005, 39), the villa of Saint Martin Tardeau (Brun 2005, 42-45), and the villa of Belmont-Royan (Brun 2005, 111). For Roman Italy outside Marche the most useful comparison is the site of Pescarina di Spoltore in the province of Pescara (Staffa 2005, 70). Several large-scale wine presses at Lake Mareotis in Alexandria show a very similar lay-out (Empereur 1993, 39-47), and from Greece examples are known in Patras (Brun 2004b, 76).

[65] Mercando 1979a, 113; Brun 2004, 36. For the numerous amphora fragments discovered on the site – belonging to both oil (Adriatic ovoid) and wine containers (Lamboglia 2/Dressel 6A), see *supra*, Chapter 1.

Soprintendenza uncovered a series of rooms to the west of the previously unearthed structures (*Figure* 128). Despite the rudimentary nature of the walls – most of them were made out of pebbles, tiles and amphora sherds – the presence of mosaic fragments and painted stucco suggests that this section of the complex indeed belonged to the residential part of the settlement.[66] Thanks to these excavations, it was also possible to refine the chronology of the settlement, whose lifespan was long thought to be confined between 50-30 BC and the mid-1st century AD. However, the recent findings of vernice nera and other ceramic materials – together with a restudy of the older finds from 1967 – have allowed to push back the original construction of the site to the mid-3rd century BC. Still, because of the only superficial knowledge of the site, it is currently not clear whether the uncovered press room was only built around the mid-1st century BC, or represents a restructuration phase of an older production unit.[67]

The rural site of **San Pellegrino di Ripe** in the middle valley of the river Nevola was excavated in 1987 and 1989-1990 by the Soprintendenza Archeologica delle Marche, but only published in 2010 (*Figure* 33, n° 10). Despite the fact that only little stratigraphy was preserved because of modern levelling and agricultural operations, the excavations yielded the remains of an elongated complex consisting of a series of utility, working and storage spaces (*Figure* 104). In the northern corner of the building a heavily damaged press platform in *opus spicatum* (Ø 1.50 m) was found, together with a first small collecting tank connected with the platform through a covered channel (*Figure* 92). More in south-western direction, another room contained three badly preserved tanks with floors in *opus spicatum*. One of the tanks was provided with a staircase in its corner and had a circular cavity in the centre of the floor (*Figure* 91). A fourth large and more isolated tank (13 m³) had its walls covered with some kind of impermeable substance. Finally, a fragment of a millstone was recovered in the south-eastern corner of the building, while the negatives of several semi-buried storage *dolia* were attested in other adjacent rooms (*Figure* 121). The presence of the millstone, together with the identification of oil residues, indicate that the production unit was involved in the manufacturing of olive oil. Based on the materials found, the site was occupied at least from the beginning of the 1st century AD until the beginning of the 6th century AD. The production unit, however, was only active until the end of the 3rd/beginning of the 4th century AD, after which the zone was converted to a graveyard.[68]

The site of **Chiarino di Recanati** near the modern town of Recanati in the lower Potenza valley was identified by the Soprintendenza per i Beni Archeologici delle Marche in 1997 and subsequently briefly excavated, but it has not yet received full scientific publication

[66] As such, the complex may have covered ca. 2,800 m² (Ciuccarelli 2014, 817-819).

[67] Ciuccarelli 2014, 819; 824.

[68] Andrenacci 2010.

(*Figure* 33, n° 20). Based on current knowledge, however, it is clear that the rural complex was provided with a porticoed space, with a production unit situated to the north of it (*Figure* 105). The main room of the unit was paved in *opus spicatum* and had two hardly preserved press platforms made out of the same material. Each platform was connected to a large collecting tank by means of a channel. Next to one of the platforms, a base block was found still *in situ* (*Figures* 93 to 95).[69] The exact chronology of the site could not be determined, but is seems that the production plant was active for a long period of time, probably from the Late Republican period until Late Antiquity.[70] A useful *terminus post quem*, however, is the use of singular base blocks in the press room. As this feature indicates that the presses were drawn down by a screw, with or without counterweights - a type of lever press that became in use in Italy from the mid-1st century BC onwards and – its presence suggests that the presses were not built before ca. 50 BC.[71]

The Roman villa of **Colombara di Acqualagna** (+ 1000 m²) was excavated between 1995 and 1997 by the University of Urbino in collaboration with the Soprintendenza Archeologica per le Marche (*Figure* 33, n° 9; *Figure* 108; 116). The excavations delivered the structures of a rural building erected in the 2nd century BC and organised around a central courtyard (*peristylium*). The rooms to the east of the courtyard were storage and utility spaces, in which many agricultural tools, fragments of food containers and the carbonised remains of a wooden loom were found.[72] Towards the end of the Late Republican period, this rural complex was largely destroyed by a fire. At the beginning of the Imperial period, a new villa was built on top of the destroyed structures and a press room was installed in the north-western corner of the complex.[73] The actual pressing area consisted of a rectangular hydraulic mortar floor (cocciopesto) with heightened edges. A circular channel (Ø 1.75 m) cut into the same mortar floor and the presence of a base block (1.20x0.54 m) indicate that a mechanical press beam could be mounted over the floor. The result of the pressing process was collected into a lower rectangular tank (8 m³) provided with a staircase in one of its corners and a circular depression in the floor (*Figure* 67). Its layout shows undeniable resemblances to identified wine tanks in Italy, Roman Gaul, Greece and Egypt and its presence – together with the rectangular hydraulic mortar floor, which is probably to be identified with a grape treading floor or *calcatorium* – ensures the

[69] The missing of the second base block can probably be explained by its later removal for purposes of reuse.

[70] Percossi Serenelli 1999; see also Frapiccini et al. 2006.

[71] As may be derived from the testimonies of Pliny and Herod in the 1st century AD, who describe the mechanism as being a century old (White 1975, 229-232; Frankel 1999, 107); for a similar reasoning, see *supra*, San Giovanni in Strada.

[72] One of the rooms was paved with a cocciopesto floor, while another space served as a basement (Agnati 1999e, 497).

[73] Luni/Uttoveggio 2002, 21-67.

identification of the press room as a winery.[74] The insertion of a lead tube in one of the tank's walls presumes the presence of either a second tank, or a *dolium defossum* meant for capturing the liquid. The remains of a minimum number of two semi-buried *dolia* (*Figure* 68) in the south-western part of the villa point towards the presence of a storage room. The production unit was used for a long period of time – as attested by the fourfold recovering of the cocciopesto pavement in the press room – and continued to exist until the Late Imperial period.[75]

The site of **Sant'Ippolito di Fano** in the middle Metauro valley was excavated in 2001-2002 by the Soprintendenza Archeologica delle Marche (*Figure* 33, n° 8). The site was characterised by a very bad state of conservation and the walls of the complex were only preserved at foundation levels (*Figure* 75). As a consequence, the excavations yielded only little stratigraphic information. Still, the excavators were able to document the complete plan of a Late Republican/Early Imperial villa, consisting of a modest residential part, several porticoed spaces, and production and storage rooms (5,700 m²) (*Figure* 107). Of the production unit, two lower tanks and a storage space containing at least nine semi-buried *dolia* were documented (*Figure* 122). Both tanks were provided with a small staircase and one of them had a shallow circular depression in the floor. The first tank (14.7 m³) had its floor, walls, and stairs covered with a layer of hydraulic mortar (*opus signinum*) (*Figure* 76); the floor of the second tank (7 m³) was made in *opus reticulatum* (*Figure* 77).[76] They are probably to be identified as wine collecting tanks (see *supra*).

One of the best preserved and excavated sites in the area is the villa of **Muracche di Tortoreto** (3,710 m²) in the province of Teramo (*Figure* 33, n° 46). The villa was excavated between 1988 and 1989 by the Soprintendenza Archeologica dell'Abruzzo. Besides an important residential part, the excavations unearthed a large *pars rustica* consisting of a press room (6.90x6 m) provided with two presses (*Figure* 82; 84-86), and adjacent working space (4.90x2.90 m), and a lower collecting tank (2.9 m³) (*Figure* 87; 109, B1 and C1). In its first phase – which could date to the first half of the 2nd century BC – the press room was probably equipped with a simple lever press of the Catonian type.[77] Somewhere after the

[74] See *supra*, note 63.

[75] Agnati 1999e, 499.

[76] De Marinis 2003; 2006. I would like to express my gratitude to Dott. Gabriele Baldelli of the Soprintendenza Archeologica delle Marche for his friendly cooperation and professional openness regarding the archaeological site of Sant'Ippolito di Fano (Piandirose). I am grateful for the possibility to reproduce here some previously unpublished illustrations from the excavation report, that I was able to consult in Ancona. The site, excavated by Gabriele Baldelli in 2001, awaits full publication by the Soprintendenza and a material study is being prepared by the responsible archaeologists.

[77] This early date is suggested by the finding of an amphora dump that contained Dressel 1A amphora fragments and the stamped handle of a Rhodian amphora mentioning καλλωνος, a producer active between 220 and 180 BC (Lapenna 1996, 397, note 19, with reference to Bevilacqua/De Benedettis 1980, 35, n. 10).

mid-1st century BC – maybe in Augustan times – this press was replaced by two lever-and-screw presses of the type described by Pliny in the 1st century AD (Plin. *HN* 18.74.317). Of the latter production plant, only one circular press floor in *opus spicatum* (Ø 1.85 m) and one limestone base block (1.75x0.75 m) have been preserved (*Figure* 88; 109, A).[78] The owner's wealth is illustrated by the presence of a stone decorated spout in the form of a lion's head in the collecting tank, through which a pipe was originally inserted connecting the tank to the treading floor (*Figure* 83). Such decorated tanks are extremely rare in the archaeological record and only two other examples of stone spouts in the form of a lion's head in the Mediterranean come to mind.[79]

In a third phase – probably dating back to Julio-Claudian times – the northern wall of the working space was partially taken down and a second, larger working space (4.90x3.50 m) was added next to it (*Figure* 109, B2). A second, much larger (12.9 m³) collecting tank was also built next to the first tank, communicating with the latter through a wide opening in the dividing wall (*Figure* 109, C2). Both tanks were provided with a staircase and had a central cavity in the floor. Their interiors were covered entirely with cocciopesto. Again, the characteristics of the tanks suggest their use as wine collecting tanks, with the higher working spaces probably serving as grape treading floors (see *supra*). From a small semi-circular tank built into the corner of the larger collecting tank, a lead pipe connected the vat to another small rectangular tank built on top of a first semi-buried *dolium*. In the adjacent room, the negatives of several *dolia defossa* indicate the existence of a storage space (*Figure* 85; 109, F). The longevity of this production plant is attested by several alterations and repairs, like repeated coverings of the floors in the press room and the working spaces with *opus spicatum* and waterproof layers, renewals of the cocciopesto layers in the collecting tanks, and the reclosing at an undetermined moment of the communicating opening between the two collecting tanks.[80]

The production plant underwent a final resizing somewhere between the end of the 3rd century AD and the mid-5th century AD, when the press room became directly connected to a new small quadrangular tank, covered again with a layer of hydraulic mortar. In the same period, the storage space with the now collapsed *dolia defossa* was levelled and floored with a stone layer. Finally, a set of three small vats was constructed on top of the only remaining *dolium* (*Figure* 109, F)[81] The last phase of the site dates back

[78] The rectangular negative of a second base block was attested next to the first one (Lapenna 1996, 389).

[79] These concern the villa of Val Catena in Istria and the wine presses at Lake Mareotis in Alexandria (Brun 2004b, 53; see also Empereur 1993, 39-47.

[80] Lapenna 1996, 394.

[81] This phase is dated by a coin of emperor Aurelian (AD 270-275) and a fragment of an African oil lamp (ca. AD 425-450).

to the 5th-6th c AD and consists of a burial, implying the complete abandonment of the villa and the ceasing of production activities.[82]

Another well-known production plant is the oil/wine pressing unit of **Monte Torto di Osimo**, a farmhouse that occupies one of the hills lying on the left bank of the Musone river between S. Maria Nuova, Filottrano and Osimo (*Figure* 33, n° 15). The site has been subject to several excavation campaigns between 1982 and 1985 and was extensively published in 2001. Among the six identified phases of occupation between the Late Republic and the 6th c AD, the second phase (end 1st c BC – beginning 2nd c AD) delivered the remains of two separate press rooms, each of them provided with two presses (*Figure* 111). They were identified as being a wine press (P1) and an oil press (P2). However, both rooms require some further elaboration. The first press room (P1) houses two interconnecting press floors (Ø 1.75 m), which are connected to a system of two small rectangular tanks (ca. 0.6 m³) placed next to each (*Figure* 36). Both dimensions and lay-out of this tank system – the tanks were probably interconnected to a no longer existing overlying channel – are generally attributed in the Mediterranean to the decantation of olive oil.[83] Just as with Cesano di Senigallia, the separation of oil and watery lees will have worked on the principle of overflow decantation (see *supra*).

The situation in the second press room (P2) was more complex. First, the pressed liquid was collected in a system of three tanks (A, B, C). Second, two of those tanks (B and C) connected through a lead pipe at the bottom. Third, tank A and the two interconnecting tanks B and C were separately fed by a channel that split before arriving at the tanks (*Figure* 42; 111). The separate provision of those tanks was certainly production related and a similar system was found at the villa of Tor Bella Monaca outside Rome, where it was identified as a system to separate olive oil from the first and second pressing.[84] At Monte Torto di Osimo, tanks B and C processed the oil from a first pressing, while the larger tank A could receive the oil from a second or third pressing. The arrangement of tanks B and C served a similar purpose as the two tanks in the first press room (P1), but this time the separation of oil and watery lees was based on the principle of underflow decantation. The liquids were allowed to separate in tank B, with the interconnecting channel at the bottom being locked. Then, the blocking element was removed and the liquids were allowed to flow out in turn into tank C (*Figure* 111).[85]

On the basis of the above observations, both press rooms were used initially for the production of olive oil. But at a still undefined moment, somewhere between the middle of the 1st c AD and the beginning of the 2nd c AD, the original *opus spicatum* floor of the

[82] The burial is dated by the presence of a 5th-6th century AD African oil lamp (Lapenna 1996, 395).

[83] They do not seem to occur for wine presses, see *supra*, note 62.

[84] Smith/Widrig 1981, 99-114; see also Brun 2004, 10-11.

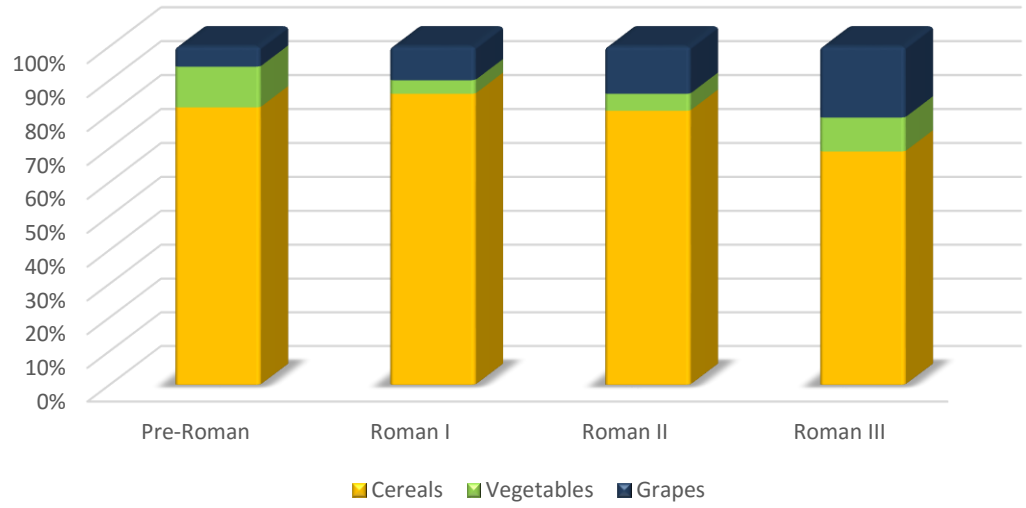
[85] This system was also used in Aegean pre-industrial installations (Forbes/Foxhall 1978, 39; see also Foxhall 2007, 138).

second press room was recovered by a layer of hydraulic mortar (*Figure* 112, phase 2). Until now, this has been interpreted as an attempt to repair the damage caused by ground fluctuations, which are typical for this part of the landscape. As can be seen on the site today, those fluctuations have indeed influenced the appearance of the site during the 2000 year period following the erection of the production unit. This however does not imply their predominance during the main occupation phase. For instance, the *opus spicatum* floor of the first press room was not touched during these alterations. At the same time of the recovering of the floor in the second press room, the original *opus spicatum* floor of tank A was also recovered with a thin layer of hydraulic mortar and both a circular central depression in the floor and two stairs in one of the corners of the tank were added. The roughness of both the mortar layer, the stairs and the circular depression suggests a rapid and originally unintended alteration. Tank A now featured characteristics similar to the tanks found at Tortoreto Muracche, Sant'Ippolito di Fano, and Colombara di Acqualagna (see *supra*). These alterations could therefore point in the direction of a partial re-orientation of the production plant towards wine production somewhere in the second half of the 1st c AD. The most suitable tanks was simply chosen to undergo the necessary changes.

Recently, an artisanal complex was excavated within the urban area of the Roman town of *Sena Gallica* (**Senigallia, Via Cavalotti**) by the University of Bologna. In one of the rooms of the complex (*Figure* 114, VANO A), a rather rudimental production plant was unearthed. The unit consisted of an area paved with recovered tile fragments placed on their flat side, which were kept together by some kind of impermeable substance (*Figure*. 80). The tiled platform (1.55x1.90 m) has been interpreted as a processing area, or as the basis of a press. The production plant was probably much larger, as a similar platform was also attested in another room of the complex. A rectangular hole in the pavement of another room has been interpreted as the negative of a base block broken out of the floor. In close connection with the platform, the negatives of several semi-buried storage *dolia* used for collecting the pressed liquid were found (*Figure* 81). A pit filed with amphora necks – almost all of the Lamboglia 2 type – was also attested in an adjacent room (*Figure* 115). Archaeobotanical analysis has registered the presence of a large number of grape pits; an element that suggests that the production plant was used in the first place for the processing of grapes (*Chart* 2.1). On the basis of the stratigraphy, the production unit belonged to the third phase of the complex, which is dated between the mid-2nd century BC and the beginning of the 1st century AD (*Chart* 2.1, Roman III).[86]

[86] Lepore et al. 2012, in particular p. 10, 12, notes .42, 43; and p. 15-16. In fact, the growing importance of grape seeds at the expense of cereals is very apparent in the graph, in particular between the second half of the 2nd century BC and the Augustan period (Roman III), when grape seeds represent more than 20% of all cultivated species (*Chart* 2.1). Incidentally, this is also the period roughly covering the life span of the Lamboglia 2 and marking the largest increase in the number of presses in the area (see *infra*, further in this Chapter).

Chart 2.1 Cultivated species at Senigallia, Via Cavalotti (After Lepore et al. 2012a, 15, Fig. 37).



In the summer of 2011, a small rural building was excavated by the Soprintendenza Archeologica delle Marche in **Contrada Fontanelle** in the territory of the comune of Monsampolo del Tronto (*Figure* 33, n° 44). The excavation unearthed a two-room complex of which the walls were only preserved at foundation levels (*Figure* 124). The fundaments of the building consisted of simple trenches filled with a mixture of small and medium-sized river pebbles, fragments of cocciopesto and brick, rock scalpings and some blocks of natural conglomerate, all put together without the use of a binding substance. One of the rooms (3.50x3.35 m) was paved in cocciopesto (*Figure* 125); in the other room (7.50x2.90 m) – adjacent to the first – a pit filled with tile fragments was found (*Figure* 126). This pit proved to be the negative of a removed *dolium defossum* (*Figure* 127). The paved cocciopesto room has been interpreted as the remainder of a collecting tank for wine or oil, while the semi-buried *dolium* may have belonged to a storage room.[87] The arrangement of a sloping cocciopesto floor connected to a *dolium defossum* – similar to the situation found at Senigallia Via Cavalotti – suggests in the first place a wine identification (see *supra*).

Some of the tiles from the pit were stamped with the letters Q POPPA^E, a terminology that could refer to the family of the *Poppaeii*. Two members of this *gens* – *Quintus* and *Gaius, Quinti filii* – are mentioned as "*patroni municipi et coloniai*" in two inscriptions from Teramo (*Interamnia Praetuttiorum*). On the basis of palaeographic and prosopographic arguments, these inscriptions can be dated to a time period between the awarding of colonial status

[87] Cicala/Speranza 2012, 146-147.

to the town of *Interamnia* during the Age of Sulla (ca. 100-80 BC) and 31 BC.[88] The characters mentioned on the inscriptions are either to be identified with the brothers *Gaius* and *Quintus Poppaeii*– consuls in AD 9 – or with their father and uncle.[89] These tiles then seem to indicate that the production plant ceased its production activities somewhere between the mid-1st century BC and the mid-1st century AD.

The site of **San Benedetto del Tronto–Paese Alto** has been excavated by the Soprintendenza per i Beni Archeologici delle Marche from 2010 to 2012 (*Figure* 33, n° 42). The excavations revealed both residential and utilitarian structures belonging to a building erected in the course of the 1st century BC. The artisanal section of the complex was characterized by floors in cocciopesto and *opus spicatum* –with various phases of repaving attesting their longevity – drainage structures made out of amphorae and a large tank provided with a cocciopesto coating (*Figures* 102 and 103). The apparently production-orientated character of the complex was maintained until the 4th century AD, after which the unit was abandoned and converted to a graveyard.[90]

The site of **Isola del Piano** was first identified in 2008 through fieldwalking and geophysical prospection and then excavated by the Soprintendenza per i Beni Archeologici delle Marche (*Figure* 33, n° 6). The excavations unearthed a rural complex consisting of ca. 10 rooms (*Figure* 118). In the northern/north-eastern part of the site, the remains of three tanks were uncovered. The first tank consisted of a set of two adjacent vats that were covered internally with a very compact layer made out of chalk and gravel (*Figure* 99). A second rectangular tank had its walls and floor covered with a layer of cocciopesto, was provided with a staircase and had a shallow circular depression in the form of a ceramic bowl placed in the floor (*Figure* 100; 101). The third tank was much larger, was ca. two meters deep and had a floor in cocciopesto (*Figure* 119). No stratigraphic information is available, but on the basis of the collected material, the site was at least active from the 3rd/4th century AD until the 6th century AD.[91]

Since the 1960's, occasional surface finds from an agricultural terrain in the territory of the town of Morro d'Oro hinted at the presence of an important Roman rural building in the locality of **S. Antonio-Piana dei Cesari** (*Figure* 33, n° 47). Recent research by the Soprintendenza Archeologica dell'Abruzzo has confirmed the predominantly production-orientated character of the site. In particular, several exploration ditches have registered the presence of two large circular working and/or storage spaces (Ø 11 m) bordered by walls in *opus caementicium*, a large rectangular tank with walls built in the same technique (20x4 m), two stockrooms with a minimum number of 33 semi-buried

[88] Andreau 1977, 157-209; Cancrini et al. 2001, 52.

[89] Gasperini/Paci 1982, 212; Cancrini et al. 2001, 51; and Wiseman 1971, 254, nos. 340-341.

[90] Lucentini et al. 2014.

[91] Bartolucci/Graziani 2014.

dolia, various sections of cocciopesto and *opus spicatum* pavements, and a large stone block (0.75x0.58 m) that probably belonged to a press installation. The materials found indicate that the site was occupied at least from the 2nd century BC until the 4th century AD (*Figure* 120).[92]

Finally, on-going excavations of the University of Macerata have uncovered the remains of a large Roman villa at the locality of **Villamagna** near Urbisaglia (*Urbs Salvia*) (*Figure* 33, n° 25). An extensive report has yet to appear, but the site apparently has yielded structures related to olive oil processing (*Figure* 96).[93]

Table 2 Sites with indications for grape and olive processing in central Adriatic Italy (A).

S	Press elements						N°	Chronology	W/O	Bibliography
										
1	\	1	\	\	\	\	**1**	mid-3rd c. – 6th c. AD	?	Personal observation
2	\	\	\	\	\	\	**1**	Roman	?	Monacchi 2010b, 370-379
3	\	\	\	\	\	\	**1**	Roman	?	Monacchi 2010b, 358-362; Spano 1998
4	\	\	\	\	1	\	**1**	2nd c. BC–1st c AD	W	Ermeti/Monacchi 1993; Monacchi 2010a
5	1	\	\	\	\	\	**1**	3rd c. BC – 2nd c. AD	?	Agnati 1999a, 34; Monacchi 2010a
6	\	\	\	\	3	\	**2**	3rd/4th c.–6th c. AD	W/O	Bartolucci/Graziani 2014
7	\	\	2	1	\	nd	**1**	Late antique	O	Luni 2007b; Luni/Mei 2012b
8	\	\	\	\	2	9+	**1**	Roman	W	De Marinis 2003; 2006; AS
9	1	\	\	1	1	2+	**1**	2nd c. BC-LI	W	Agnati 1999e; Luni/Uttoveggio 2002; AS,ZA/180/47
10	\	\	1	1	5	3+	**1**	1st c. AD–4th c. AD	O	Andrenacci 2010
11	\	\	\	2	4	\	**2**	Mid-3rd c. BC–mid 1st c. AD	O	Mercando 1979a; Dall'Aglio/Mazzoli 1991, 65-66; Brun 2004, 36; Ciuccarelli 2014; AS, ZA/45/15

[92] Formicone/Neroni 2010,

[93] Quiri 2002; 2005.

12	\	\	\	2	\	nd	**2**	Mid 2nd c. BC–Early 1st c. AD	W	Lepore et al. 2012
13	\	\	\	1	\	\	**1**	End 1st c. BC–1st c. AD	?	Annibaldi 1895; Mercando et al. 1981
14	\	\	\	1	\	\	**1**	Roman	?	Mercando 1979a; AS, ZA/02/28
15	4	\	1	4	6	20+	**4**	End 1st c. BC–Early 2nd c. AD	W/O	Hägglund 1995; Pignocchi 2001
16	1	\	\	\	\	\	**1**	Roman	?	Personal observation
17	\	\	\	\	3	\	**1**	Roman	O	Mercando 1979b
18	\	\	\	1	\	\	**1**	1st c.-end 4th c. AD	?	Mercando 1979c
19	\	\	\	\	\	\	**1**	180/125 BC-EI	?	Vermeulen et al. 2013, 608
20	1	\	\	2	\2	1	**2**	LR/LA	?	Percossi Serenelli 1999; Frapiccini et al. 2006
21	\	\	\	1	\	\	**1**	3rd-4th c. AD	O	Van Limbergen 2013; 2014
22	\	\	\	\	1	1+	**1**	Roman	?	Percossi Serenelli 1998
23	\	\	\	1	\	\	**1**	Roman	?	Percossi Serenelli 1998; AV,CASS 2/15
24	\	\	\	2	3	5+	**2**	1st c. BC–3rd/4th c. AD	O	Mercando 1980; Percossi 2005; Frapiccini et al. 2006
25	\	\	\	\	\	\	**1**	Roman	?	Quiri 2002; 2005
26	\	\	\	\	1	\	**1**	Roman	?	Mercando et al. 1981, 340, n° 361
27	\	\	1	\	\	\	**1**	Roman	O	Pupilli 1994, 27
28	\	\	\	\	\	12	**1**	Roman	?	Pupilli 1994, 69-70; Busana et al. 2009; Menchelli 2012
29	\	\	1	\	\	\	**1**	Roman	O	Pupilli 1994, 48
30	\	\	\	2	\	3+	**2**	1st c.–4th c. AD	?	Rafaelli 1891; Mercando et al. 1981; Pupilli 1994
31	3	\	\	\	\	\	**3**	Roman	?	Menchelli 2012
32	2	\	\	\	\	\	**2**	Roman	?	Menchelli 2012
33	1	\	\	\	\	\	**1**	Roman	?	Menchelli 2012
34	1	\	\	\	\	\	**1**	Roman	?	Pupilli 1994, 77; Pasquinucci et al. 2000, 362, n° 28

35	2	\	1	\	\	\	**2**	Roman	O	Pupilli 1994; Busana et al. 2009; Menchelli 2012
36	1	\	\	\	\	\	**1**	Roman	?	Ciarrocchi 1999
37	\	\	\	\	1	\	**1**	Roman	?	Ciarrocchi 1999
38	1	\	\	1	1	\	**1**	Mid-1st c. BC–4th c. AD	?	Percossi Serenelli 1993; Ciarrocchi 1999; Frapiccini 2000
39	3	\	\	\	\	\	**3**	Roman	?	Ciarrocchi 1999
40	2	\	\	\	\	\	**2**	Roman	?	Ciarrocchi 1999, 97-99
41	1	\	\	1	\	\	**1**	mid-1st c. BC–2nd c. AD	?	Vannicola 1996; Pignocchi 1998
42	\	\	\	\	1	\	**1**	1st c. BC-4th c. AD	?	Lucentini et al. 2014
43	1	\	\	\	\	\	**1**	Roman	?	Conta 1982, 416, note 317; Pignocchi 1998, 210, note 18
44	\	\	\	\	1	1+	**1**	ca. 50 BC–AD 50	W	Cicala/Speranza 2012
45	1	\	\	\	\	\	**1**	Roman	?	Lapenna 1996, 387
46	2	\	\	2	3	7+	**2**	2nd c. BC–5th/6th c. AD	W	Lapenna 1996
47	1	\	\	\	1	33+	**1**	2nd c. BC-4th c. AD	?	Formicone/Neroni 2010
48	1	\	\	\	\	\	**1**	Roman	?	Staffa 1986b
49	1	\	\	\	\	\	**1**	Roman	?	Staffa 1986a
50	1	\	\	\	\	\	**1**	Roman	?	Staffa 1991, 198-199
51	1	\	\	\	\	\	**1**	Roman	?	AS

2.3 In search for patterns

2.3.1 Main characteristics and general lay-out

Until recently, our knowledge of central Adriatic wine and oil presses in Marche and northern Abruzzo was of a very fragmented and unsystematic nature.[94] With this overview, however, some 51 rural sites – i.e. about 5.3 % of all sites examined – now prove

[94] An issue addressed in Cristofori 2004, note 118. Recently, this situation has somewhat improved thanks to synthetic overviews and discussions in Busana et al. 2009; and Van Limbergen 2010; 2011; 2013; and 2014.

to bear evidence that points towards the existence of one or several press installations in Roman times (*Figure* 33; *Table* 2). It goes without saying that this relatively low press density – ca. 0.005 presses per km² - only reflects the current state of research and cannot be considered exhaustive. Reasons include the inequality of archaeological investigations, the limitations of field surveys and surface finds, combined with a minority of excavated rural sites and their fragmentary conservation. It is therefore likely that much pressing equipment has not yet been observed or recorded and that similar facilities were present at other villas and farms in the area.[95] Also, due to the different circumstances in which the identified sites have been preserved, studied and/or published over several decades, our archaeological evidence is fragmentary in all senses. Often, little more is confirmed than the mere presence of a press in Roman times. Indeed, 52.9 % (27/51) of all sites examined offer no structural or chronological coherence whatsoever, resulting in 'off-site' surface remains of mostly base blocks and occasionally millstones, floor fragments, tanks, *dolia* and amphorae. Even sites that are somewhat better documented often cause interpretational difficulties because of their bad state of preservation. In many cases, tanks are the features most likely to have been preserved due to their subterranean character. Press floors, on the other hand, are frequently damaged by subsequent land usage in medieval and modern times. Furthermore, due to the use of less noble and more perishable building materials on these sites, upper structures are often largely destroyed or hardly preserved. Another obstacle is the often superficial level of archaeological registration, and therefore the impreciseness of many contexts. These biases in our archaeological evidence all contribute to considerable gaps in our knowledge; not only regarding the lay-out and functioning of these pressing facilities, but also in regard to their organisation within larger architectural units. For instance, at **Colombara di Acqualagna** (9), **Monte Torto di Osimo** (15), **Cesano di Senigallia** (11), and **Chiarino di Recanati** (20), the press room seems to have been organised around a courtyard. Nearby living quarters were discovered at the sites of **Sant'Ippolito di Fano** (8), **Colombara di Acqualagna** (9), **Cesano di Senigallia** (11), **Pollenza Santa Lucia** (24), **Cupra Marittima San Basso** (38) and **Muracche di Tortoreto** (46). However, no living quarters were apparently present at the sites of **San Pellegrino di Ripe** (11), **Monte Torto di Osimo** (15) and **Chiarino di Recanati** (20), where the poor execution of the walls hints

[95] Further consultation of the archives of the Soprintendenza per i Beni Archeologici delle Marche at Ancona could confirm the presence of pressing facilities at the sites of Pesaro Campanara, Monte Porzio, Corinaldo-San Benedetto, Castelleone di Suasa-Pian Volpello, Osimo-Roncisvalle and Pievefavera di Caldarola (not indicated on the map), see Van Limbergen 2011, Fig. 1, n° 36-40; 42).

at the purely production-orientated character of these sites.[96] One possibility is that these pressing facilities belonged to larger estates, with a farm building or residential villa further removed from the production plant. It is also possible that their presence may point towards the existence of press owners, unconnected to agricultural estates. Owners of olive groves or vineyards who lacked the facilities to produce their own oil and wine could let their liquids be pressed against payment or simply sell their fruits to these instances.[97] There is epigraphic evidence for the existence of professional oil makers (*collegia capulatorum*) in various towns of central and southern Italy and the press installations found within an urban contexts in the Marche may refer to the presence of such guilds in central Adriatic Italy.[98] The question of how the cultivators of vines and olive trees related to the producers of wine and oil – and how these relationships are reflected in the archaeological record – is obviously an interesting one, but it is not a question that this chapter aims to answer.

That being said, it seems that in the Marche and northern Abruzzo the general lay-out of the press rooms shows a certain degree of standardisation. The floors could be covered with either *opus spicatum* bricks, a layer of hydraulic mortar, or simply an arrangement of flat tiles. The first category is definitely the most common one, with the characteristic small bricks forming the pavement in some 15 production plants.[99] Within this category, single or double – sometimes interconnecting – press platforms (*arae*) were built entirely in *opus spicatum*. These press platforms were bordered by a concentric channel – made again out of *opus spicatum* tiles places on their flat side – leading to a subsidiary channel that connected them with singular or multiple tanks (*Figure* 36, 38-41, 50-52, 61, 74, 79, 86, 88, 92-95, 106, 123). The second category was only attested at three sites – **Colombara di Acqualagna** (9), **Pollenza Santa Lucia** (24) and **Fontanelle di Monsampolo del Tronto** (44) – and the third category is known from a single site (**Senigallia Via Cavalotti** (12)) (*Figure* 67, 73, 74, 80, 81). In the second category, the proper pressing area was indicated by a concentric channel cut directly into the hydraulic mortar floor at the sites of **Colombara di Acqualagna** and **Pollenza Santa Lucia**; at **Fontanelle** however, no specific area was indicated (*Figure* 125). Only in two cases – **Trea** (21) and **Forum Sempronii** (7) – did the press bed consist of a circular channel cut into a stone slab (*Figure* 46-49, 53). A diameter of 1.75 m is the most frequent dimension for these press platforms, but they can range

[96] Although in the case of Chiarino di Recanati, recent surveys by the PVS in the area have revealed the presence of many rich materials, pointing at the existence of a residential sector, maybe with thermal installation (Vermeulen et al. 2006, scheda 104).

[97] A similar explanation has been suggested to assess the complex social reality behind the production of Baetican olive oil (Rodriguez 1998, 188).

[98] Examples are the press beds found in the towns of ***Potentia*** (18), ***Trea*** (21) and ***Forum Sempronii*** (7); the press found at ***Senigallia*** (12) was probably a wine unit (see *supra*); for the epigraphic evidence, see Brun 2004, 8; and Marzano 2007, 103.

[99] These are sites n° 10, 11, 13, 14, 15, 18, 19, 20, 23, 24, 38, 41, 42, 46, and 47 (see *supra*).

between 0.60 and 1.85 m in size (*Table* 3). When in use, a stack of baskets filled with olive pulp or a wooden frame filled with grapes was placed on the press platform, a wooden lid was placed over it and the press beam was allowed to rest across the top.

Table 3 Dimensions of known press beds.

	7	9	10	11	14	15	21	23	24	41	46
Ø (M)	0.60	1.75	1.50	1.75	1.66	1.75 1.50	0.70	1.25	1.75	1.40	1.85

Table 4 Dimensions of known base blocks.

SITE			
4	1.29x0.54	\	\
13	1.10x0.65	0.58x0.35	0.30
	1.10x0.74	0.43x0.22	0.32
	1.10x0.82	0.43x0.22	0.33
32	1.77x1.04	0.54x.30	0.40
	1.75x1	0.60x0.30	0.57
34	1.20x0.93	0.44x0.29	0.33
	0.77x0.95	0.44x0.30	\
38	1.27x0.75	0.50x0.25	0.27
40	1.20x0.70x0.50	\	\
42	1.75x0.755	0.50x0.37	0.30
44	0.80x0.60	0.22x0.27	\
48	0.75x0.58	\	\

The presence of singular base blocks in these press rooms suggests that the press beam was drawn down by a screw, with or without a counterweights, a type of lever press that became widespread in Italy from the middle of the 1st century BC (Plin. *HN* 18.317). In the Marche and northern Abruzzo, their dimensions vary between 1.10 x 0.65 m (**Monte Torto di Osimo** (15)) and 1.77 x 1 m (**San Michele di Cupra Marittima** (39)). On their flat surface they always display an arrangement of two rectangular notches measuring 0.50 x 0.30 m on average (*foramina*). The distance between them ranges from 0.30 m to 0.57 m (*Figures* 54-58, 65, 66, and 89).[100] In general, base blocks meant for the insertion of a singular wooden upright are less common in Roman Italy and only six exemplars are known from

[100] With the inclusion of both surface and excavated sites, a total of 35 base blocks is known from the area; 29 of these belong to the type described here.

five sites in the area. Their dimensions are smaller (ca. 0.80 x 0.60 m) and on their flat surface they display only one slightly rectangular notch measuring ca. 0.22 x 0.27 m (*Figure* 72 and 90) (*Table* 4). Construction materials vary and both the use of limestone (**Monte Torto di Osimo**, **Tortoreto Muracche**), travertine (**San Benedetto del Tronto**), sandstone (**Moresco Valdaso**, **Monterubbiano San Gregorio**), tuff stone (**Offida San Giovanni**) and conglomerate (**Ripatransone**) are attested.[101]

Table 5 Dimensions of collecting and decantation tanks.

	SIZE (M)	CAPACITY (HL)	WINE/OIL
COLOMBARA DI ACQUALAGNA	1.75x1.50x1.90	50	Wine
SANT'IPPOLITO DI FANO	2.90x3.90x1.30 (A)	147	Wine
	2x2.50x1.40 (B)	70	
CESANO DI SENIGALLIA	0.90x1.02x1.08 (B)	10	Oil
	0.99x0.88x1.66x1.52x0.99 (C)	16	
	1.50x2.40x1.50 (A)	54	
	1.12x1.15x0.93 (D)	12	
SAN PELLEGRINO DI RIPE	2.27x1.40x0.75	24	Oil
	2.70x2.20x2.20	130	
MONTE TORTO DI OSIMO	1.47x2.50x1.36x2.50x0.85 (A)	29	Wine/Oil
	1.50x1.30x1.40x1.35x1.20 (B)	20	
	1.54x1.30x1.50x1.26x1.20 (C)	20	
	0.65x0.58x0.85x1.08 (D)	5.5	
	0.65x0.90x1.15 (E)	6	
	1.70x1.31x1.60x1.31x1.15 (F)	25	
POLLENZA SANTA LUCIA	1.60x1x1.30	21	Oil
CUPRA MAR. BOCCA BIANCA	4.80x2.40x1.80	200	?
MURACCHE DI TORTORETO	2.90x1x1 (C1)	29	Wine
	3.85x2.80x1.20 (C2)	129	

A subsidiary channel carried the pressed liquid from the press platforms towards the collecting and settling tanks. These tanks appear in different sizes and forms, but tend to be of modest dimensions. Out of 19 tanks for which information is available, 11 (58%) have a capacity between 5.5 hl and 30 hl; 4 (21%) have a capacity between 50 and 70 hl, and 4 (21%) exceed capacities of 100 hl (*Table* 5). The walls and floors of these tanks were mostly

[101] For Monte Torto di Osimo, see Pignocchi 2001; for Muracche di Tortoreto, see Lapenna 1996, 386-396; for San Benedetto del Tronto, see Conta 1982, 416, note 317; for Moresco Valdaso and Monterubbiano San Gregorio, see Pupilli 1994, 77-79; for Offida San Giovanni, see Pignocchi 1998, 207-218; for Cupra Marittima San Michele, see Ciarrocchi 1999.

covered with a layer of hydraulic mortar or *opus signinum* (**Tortoreto Muracche**, **Colombara di Acqualagna**, **Pollenza Santa Lucia**, **Fermignano San Giacomo**, **Monte Torto di Osimo**, **Sant'Ippolito di Fano**, **Isola del Piano**, **San Benedetto del Tronto**), but floors could occasionally be made out of *opus spicatum* (**San Pellegrino di Ripe**, **Cesano di Senigallia**, **Monte Torto di Osimo**), *opus reticulatum* (**Cesano di Senigallia**, **Sant'Ippolito di Fano**), or could simply be covered by a lead plate (**Monte Torto di Osimo**). Only in two cases, the pressed liquid was captured directly into a *dolium defossum* (**Senigallia Via Cavalotti**, **Monsampolo del Tronto**). Comparisons for this kind of production plant within Italy can be made with the press found at San Pietro di Casale (Bologna, Emilia Romagna) and to a lesser extent also San Giuliano di Puglia (Molise).[102]

After pressing, olive oil was stored in so-called *dolia olearia* (Cat. *Agr. Orig.* 10.4). Wine was decanted into *dolia defossa*, large semi-buried storage and/or fermentation containers.[103] Semi-buried *dolia* were recorded on ca. 23.4% of all sites (11/47), but the inequality of the available information does not allow for an accurate assessment of storage capacities. Still, important concentrations of at least seven, nine, twelve and twenty *dolia* were recorded at the sites of **Muracche di Tortoreto** (46), **Sant'Ippolito di Fano** (8), **Grottazzolina** (28) and **Monte Torto di Osimo** (15) respectively. Depending on the capacity of these vessels – 5 or 10 hl – the minimum storage volume on these sites ranged between 35-70 hl and 100-200 hl.[104] The Catonian farm model prescribed five press installations for an olive yard of 240 *iugera* (*Agr. Orig*. 10.1) and three presses for a vineyard of 100 *iugera* (*Agr. Orig* 11.1). Pliny recommended two presses for a vineyard of 100 *iugera* (*HN* 18.74.317). However, this literary ideality has often been proven substantially different from the archaeological reality. While it is certainly not rare to find villas equipped with double presses in Roman Italy, multi-press plants generally remain an exception.[105] This is not any different for the Marche and northern Abruzzo, where the majority of the production sites (38/51) seem to have contained only a single press; ten sites were equipped with double presses; two facilities had three presses; and only one production installation (**Monte Torto di Osimo**) consisted of four presses (*Table* 2; 3 and 4; *Chart* 2.1).

[102] For San Pietro di Casale, dated to the 1st century BC, see Ortalli 1991; and Brun 2004a, 49. For San Giuliano di Puglia, built at the end of the 2nd century or the beginning of the 1st century BC, see Brun 2004b, 184.

[103] Brun 2003, 65.

[104] Mattingly 1993, 494. According to J.P. Brun, the average capacity of a *dolium* in Roman Italy was 11 hl (Brun 2003, 65).

[105] Marzano 2007, 104-105, with examples.

2.3.2 Distribution in the landscape

Apart from four production facilities found within an urban context (see *supra*), all sites are located in the hinterlands of the Roman towns, spread out along the most important rivers in the region. With only ca. 25.5 % (13/51) of all sites examined lying in the northern part of the research area – i.e. the territory of the *Ager Gallicus* to the north of the Esino river– the remaining 74.5 % (38/51) are spread out over the territory of *Picenum*. Within *Picenum*, 25 of the 38 sites (ca. 49 % of all 51 sites) are located between the Tenna and Vomano rivers, occupying the more southern part of the region coinciding with the territories of the Roman towns of *Firmum Picenum* (*Ager Firmanus*), *Cupra Marittima* (*Ager Cuprensis*), *Interamnia* (*Ager Praetutianus*) and *Hatria* (*Ager Hatrianus*). In the northern part of *Picenum*, another important concentration of 13 sites (25.5 % of all 51 sites) can be noticed in the surroundings of Ancona, *Auximum* and *Potentia* (Figure 34; *Chart* 2.2). From east to west, we can notice that the majority of the sites (35/51 or ca. 68.6 %) is situated in the lower valley and coastal areas within a 20 km distance from the shore; 29.4 % of the sites (15/51) are located in the middle valley sections, while only one site (2 %) is situated further inland in the upper valley area (*Figure* 34; *Chart* 2.3).

On the one hand, this archaeological situation may reflect the differing importance of viticulture and oleoculture in the region, with both cultures being most dominant in the lower coastal areas and then gradually diminishing towards the inland areas and the Apennines, where altitude was a limiting factor and the morphological characteristics of the terrain were probably more adapted for pasture. On the other hand, there is an apparent relationship between the geographic dispersion of the known pressing establishments – and the amphora workshops for that matter – and the literary evidence for wine production in the area.[106] Indeed, between the end of the 3rd century BC and the 3rd century AD, several Greek and Latin authors allude to the potential for viticulture in both the southern, central and northern coastal parts of the region.[107] The earliest literary attestation is provided by the Greek historian Polybius (ca. 200-117 BC), who mentions the region in relation to the passing of Hannibal through the territories of the *Praetutia* and *Hadriana* in the south of *Picenum* for its abundance of *"old wine"* (τοις παλαιοις οινοις) (*Hist.* 3.88). Referring to roughly the same period as Polybius, the Roman poet Silius

[106] While the Vomano river has been chosen as the most southern limit of the research area, remains of presses do occur further to the south along the Adriatic coast, situated in the province of Pescara: Loreto Aprutino-Fidrano Basso (Pellegrini 2003, 326); Loreto Aprutino-Colle Fiorano (Pellegrini 2003, 326); Nocciano loc. Casali-Follonica (Staffa 2003, 140); Pianella loc. Conoscopane-Piano Leone (Staffa 2003, 136); Elice loc. S. Agnello (Staffa 2005, 69-70); Spoltore loc. Pescarina (Staffa 2005, 70-71); Penne loc. S. Angelo-Case Almonti (Staffa 2005, 84).

[107] Useful overviews of the literary evidence on wine production in the area include Tchernia 1986, 131, 167-168, 259-260, 338, 348-349; Cristofori 2004, 40-47; and Cercone 2008, 14-22.

Italicus (ca. 25-100 AD) again cites the land of the *Praetutia* in his account of the Second Punic War and describes its surrounding landscape as *"fields planted full with vines"* (*vitiferos agros*) (*Pun.* 15.568). Still for the 3rd-2nd century BC, but this time for the northern part of the area, the occurrence of record harvests of 10 and 15 *cullei* per *iugerum* – that is ca. 205-310 hl/ha – in the *Ager Gallicus* and *Gallia Cisalpina* is mentioned in Cato's *Origines*, a work that is later cited by Varro (*Rust.* 1.2.7-8). These yields are later quoted again by Pliny (*HN* 14.5.52) and Columella (*Rust.* 3.3.7).[108]

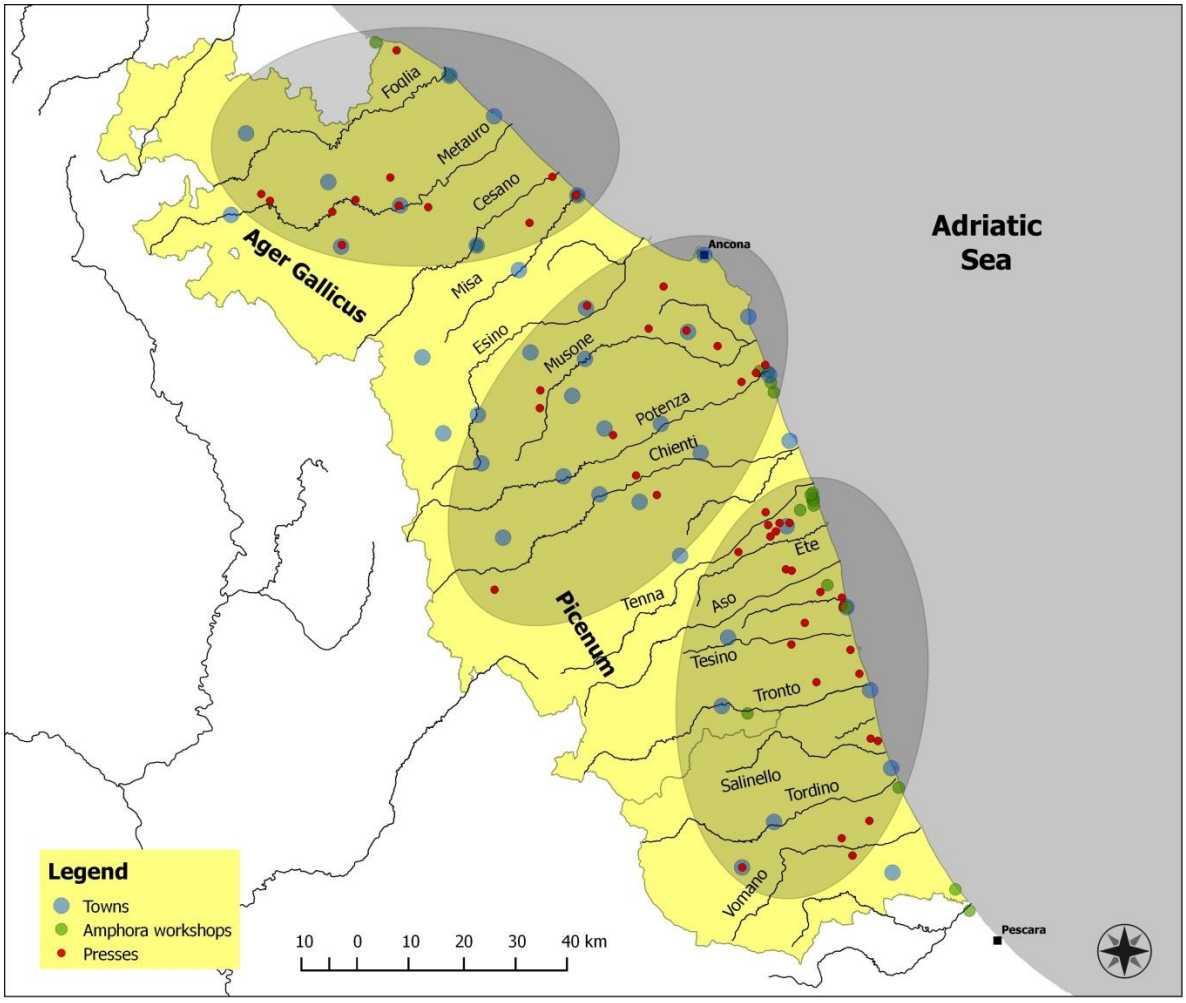


Figure 34 Distribution of presses and amphora workshops in central Adriatic Italy (Map author).

Some two centuries later, at the beginning of the 1st century AD, the Greek historian Strabo brings up the region around Ancona in northern *Picenum* for *"its abundance of wine and wheat"* (εὔοινός ἐστι καὶ πυροφόρος) (*Geogr.* 5.4.2). The same region is named again by Pliny (*HN* 14.8.67), and by Athenaeus at the end of the 2nd/beginning of the 3rd century AD, who cites Galen and classifies the wine from the area as *"good and rich"* (*Ath.* I, 26f). Around

[108] For a more detailed discussion of these and other yield figures, see *infra.*

the time of Augustus, a specific wine from *Picenum* – Ἁδριανόν νέκταρ or the *Hadrianum* – is praised in two epigrams of the Greek anthology by Antiphilos of Byzantium and Antipater of Thessaloniki (*Anth. Pal.* 6.257, 9.232). The same wine is cited by Dioscorides in the mid-1st c AD as a neighbouring wine of the Πραιτυτιανός or the *Praetutianum* (*Mat. Med.* 5.6.8); a wine with which Pliny (*HN* 14.8.60, 67; 9.75-76) and Silius Italicus (*Pun.* 15.568) were also familiar. The various interpretations of these passages – which hint at a favourable appreciation of these wines by the Greek elite – and the erroneous identification by Pliny (*HN* 14.8.67) of the *Hadrianum* as a northern Adriatic wine from the Veneto region have been amply discussed and do not require further elaboration.[109] It suffices to say that the origins of both the *Praetutianum* and the *Hadrianum* can now firmly be placed in the southern part of *Picenum*; i.e. in the territories of the towns of *Interamnia Praetuttiorum* (*Ager Praetutianus*) and *Hatria* (*Ager Hatrianus*) (*Figure* 34). According to Pliny, the *Praetutian* wine was very suitable for making *mulsum*, a sweet mixture of wine and honey (*HN* 14.9.75). The therapeutic qualities of the *Hadrian* wine, on the other hand, can be derived from numerous citations in the works of Galen (2nd-3rd c AD) and Alexander of Tralles (6th-7th c AD).[110]

Another important wine from *Picenum*, the *Palmensia* – probably produced in the coastal territory of *Firmum Picenum* – was also highly praised by Pliny (*HN* 14.8.67) (*Figure* 34). Wine from *Picenum* in general is mentioned for the last time in Diocletian's Edict on Maximum Prices in 301, while the *Hadrianum* in particular occurs on three Egyptian papyri in the 3rd century AD.[111] Around the same time, Athenaeus defines the *Hadrianum* as a wine with a *"pleasant odour, easily assimilated, and altogether innocuous"* that *"should be made rather early in the season and set aside in an open space so that the richness peculiar to their nature may evaporate"* (*Ath.* I, 33a). As such, the location of both presses and amphora workshops seemingly confirms the literary tradition.

2.3.3 Chronology

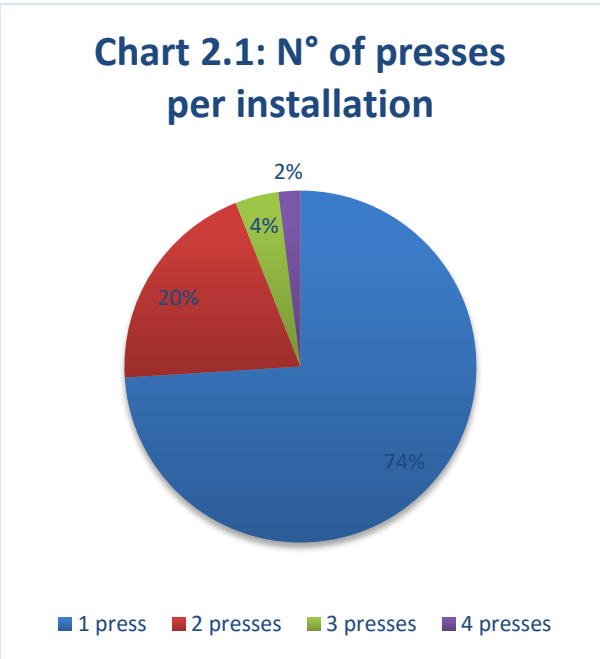
For many sites, the full chronology is unclear. Their chronological evolution is limited to the assumption of an active phase somewhere in the Roman period. This is especially so for the sites that have been identified through survey, or through loose surface finds of stone press elements, but also for some of the excavated sites that have only been

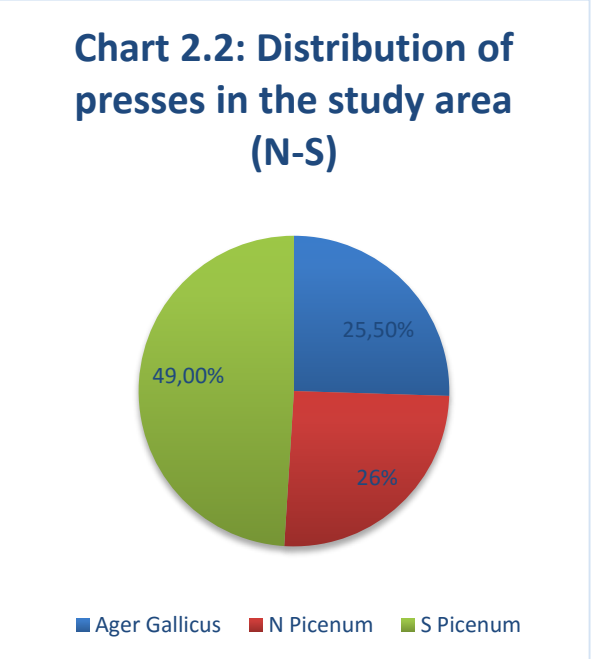
[109] Tchernia 1986, 348-349.

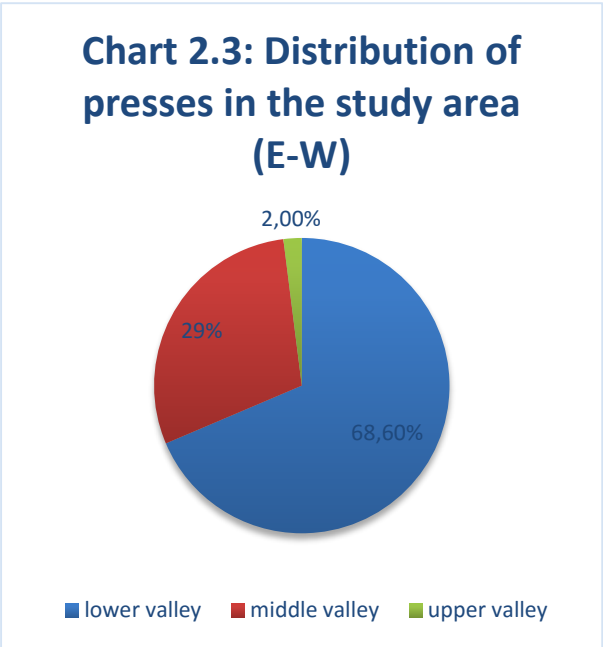
[110] Galen, *San. Tu.* VI, p. 275, I. 16; p. 334, I. 14; p. 335, I. 4: *MM* X, p. 485, I. 2; p. 501, I. 12; p. 833, I. 9; *MMG* XI, p. 87, I. 7; *Ant.* XIV, p. 167, I. 10 (from the editions by C.G. Kühn, *Claudii Galeni opera omnia*, Lipsiae 1821-1833). Alex. Trall. *Med.* II, 217, 269, from the edition by Puschmann.

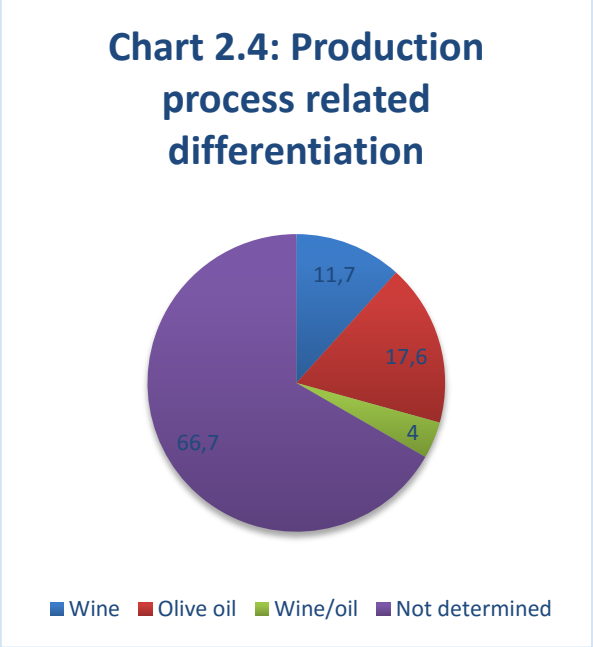
[111] Although this denomination may refer more to wine from the Adriatic area in general, rather than to wine from the territory of *Hatria* in particular (Rathbone 1983b, 90-94).

uncovered superficially (site n° 2, 3, 8, 14, 16, 17, 22, 23, 25-29, 31-37, 39, 40, 43, 45, 48-51). This means that for 28/51 sites (ca. 55 %), the information is too limited for deriving any useful chronological patterns. Based on their finding circumstances, the press elements of **Colombarone di Pesaro**, **Fossombrone-Forum Sempronii** and **Trea** are likely to be dated to the Late Antique period; i.e. probably not before the mid-3rd century AD and not later than the 6th century AD. The period between the 3rd century AD and the 5th/6th century AD is also the time in which we know for sure that wine and/or oil were produced at the site of **Isola del Piano**, but it is possible that the structures date back to earlier times. The press units of **Cesano di Senigallia** and **Ca 'Balduini di sopra** are the only two sites whose production activities may date back to the 3rd/mid-3rd century BC. They are joined by the sites of **Muracche di Tortoreto**, **Senigallia Via Cavalotti**, **San Giacomo di Fermignano**, **Montarice villa** and **Piana dei Cesari di Morro d'oro** in the 2nd/mid-2nd century BC. In the course of the 1st century BC – most likely around the 50's BC – production plants become active at the sites of **Colombara di Acqualagna**, **Villa Romagnola di Jesi**, **Monte Torto di Osimo**, **Chiarino di Recanati**, **Pollenza Santa Lucia**, **Cupra Marittima San Basso**, **San Giovanni di Offida**, **San Benedetto Paese Alto** and **Fontanelle di Monsampolo del Tronto**. Most of these sites remain active until the end of the 1st century AD, with the exception of **Senigallia Via Cavalotti**, **Cesano di Senigallia, Montarice** and **Fontanelle**, which all end their production activities in the first decades of that century or towards the 50's AD. Around the same time, however, new press rooms are installed at **San Pellegrino di Ripe**, **Porto Recanati la Pineta** and **San Salvatore di Fermo**. After the 1st century AD, some other sites cease their production (**San Giacomo di Fermignano**, **Villa Romagnola di Jesi**, **Fontanelle**), but most of them continue into the 2nd, 3rd and even 4th centuries AD. The units of **Muracche di Tortoreto** and **Piana dei Cesari** are the only early sites that remain active until the 5th/6th century AD (*Chart* 2.5).



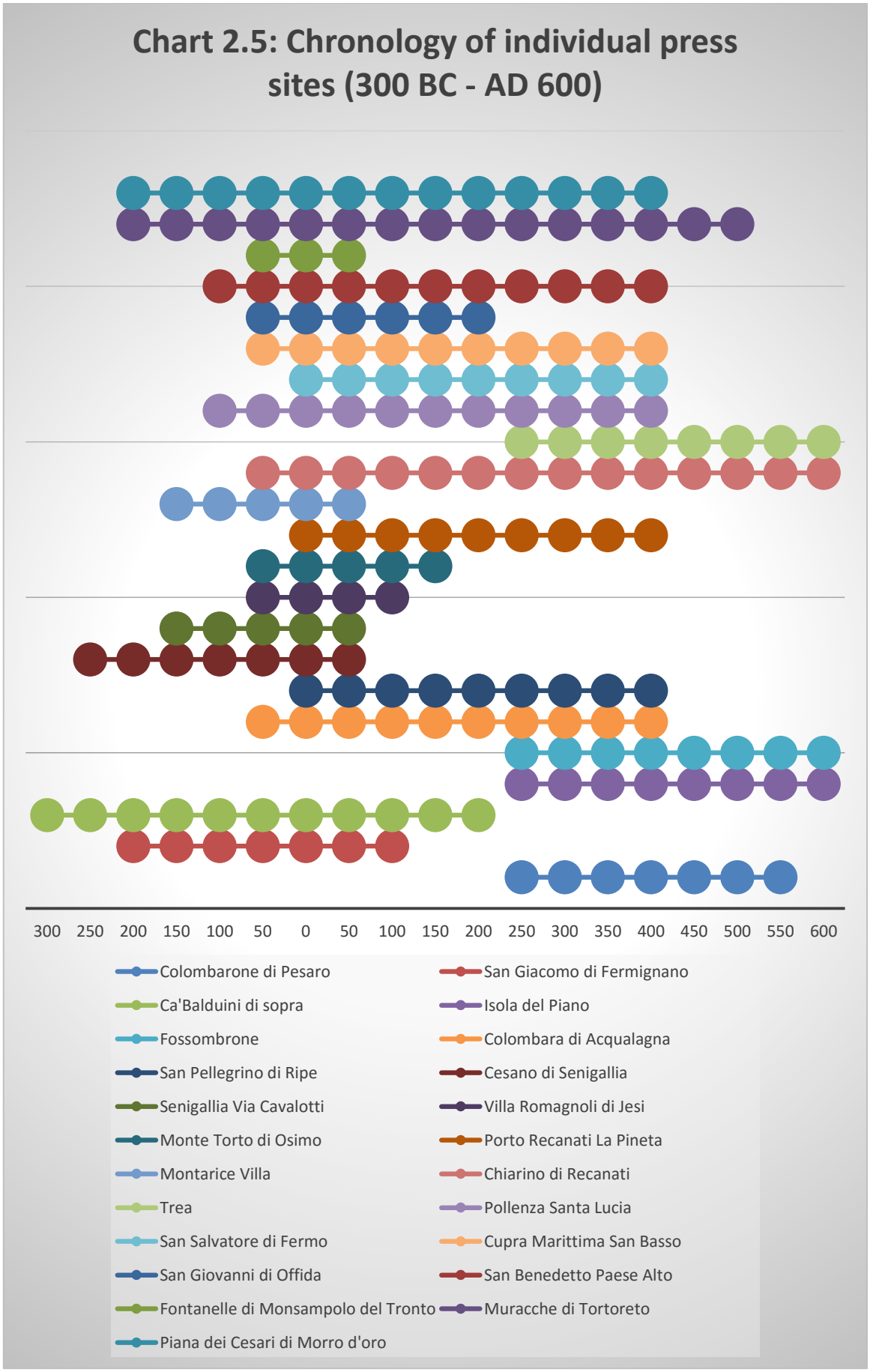




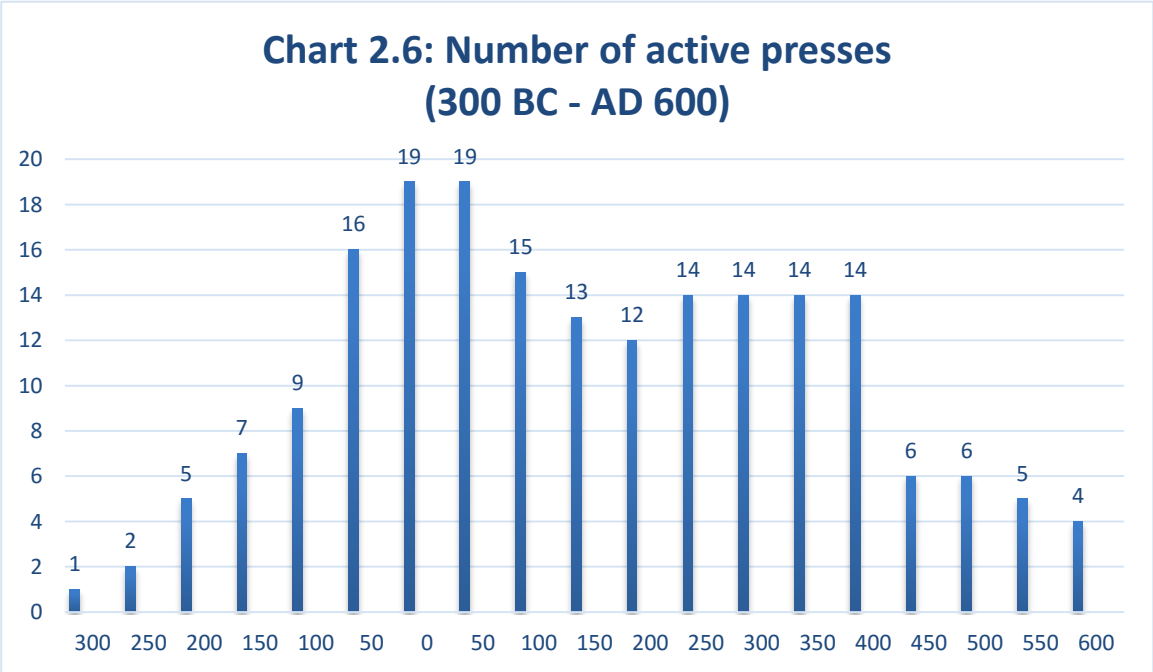


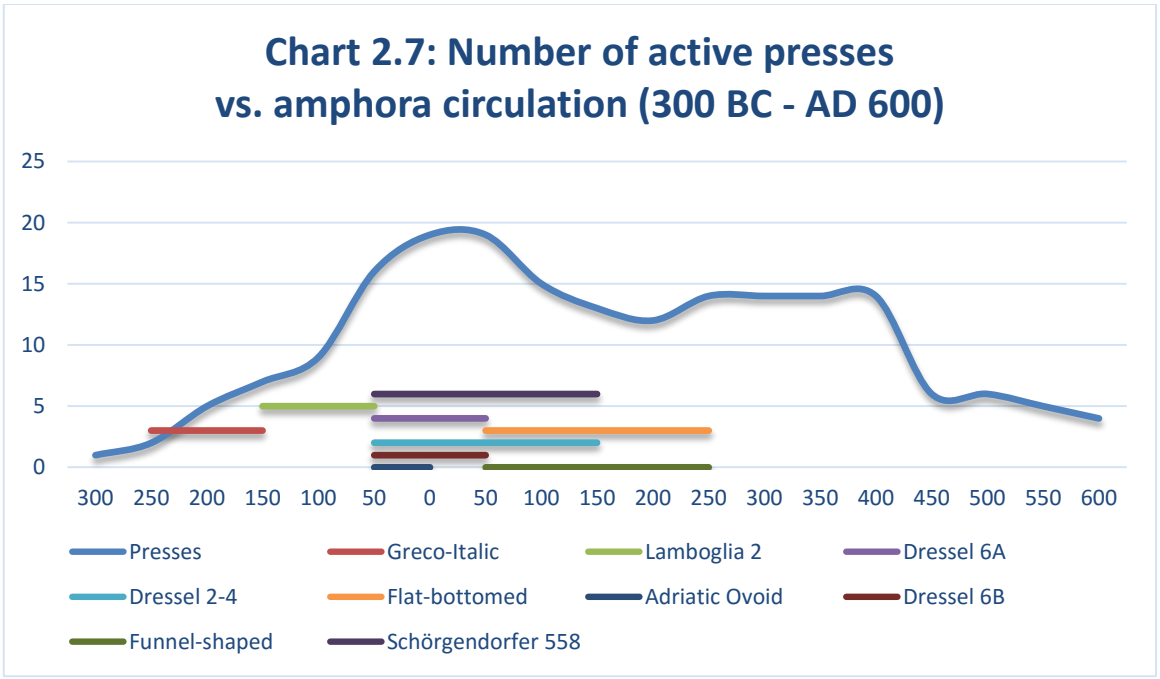
A noteworthy pattern is the apparent longevity of some production plants. The best example is undoubtedly the villa of **Muracche di Tortoreto**, which was active for more than six centuries from at least the mid-2nd century BC until the 4th/5th century AD. Another illustration of this phenomenon is the rural building of **Piana dei Cesari di Morro d'oro**, active for almost six centuries from the 2nd century BC until the 4th century AD. The villa of **Pollenza Santa Lucia** was equipped with pressing facilities for ca. five centuries, i.e. from the 1st century BC until the 4th century AD. The same goes for the villa of **Colombara di Acqualagna**, in which a press room was installed at the end of the 1st century BC that remained in use until the 4th century AD. The mid-1st century BC pressing platform of the farm building at **San Basso di Cupra Marittima** was replaced by a small thermal complex only in the 4th century AD. A similar timespan may be proposed for the site of **San Benedetto del Tronto Paese Alto**. The oil plant of **San Pellegrino di Ripe** was erected in the 1st century AD and only closed down some four centuries later, at the end of the 4th century AD.[112] This was probably also the case for the sites of **Porto Recanati La Pineta** and **San Salvatore di Fermo**. The precise chronology of the site of **Chiarino di Recanati** is less clear, but the site was at least active from the mid-1st century BC until late antique times (*Chart* 2.5).

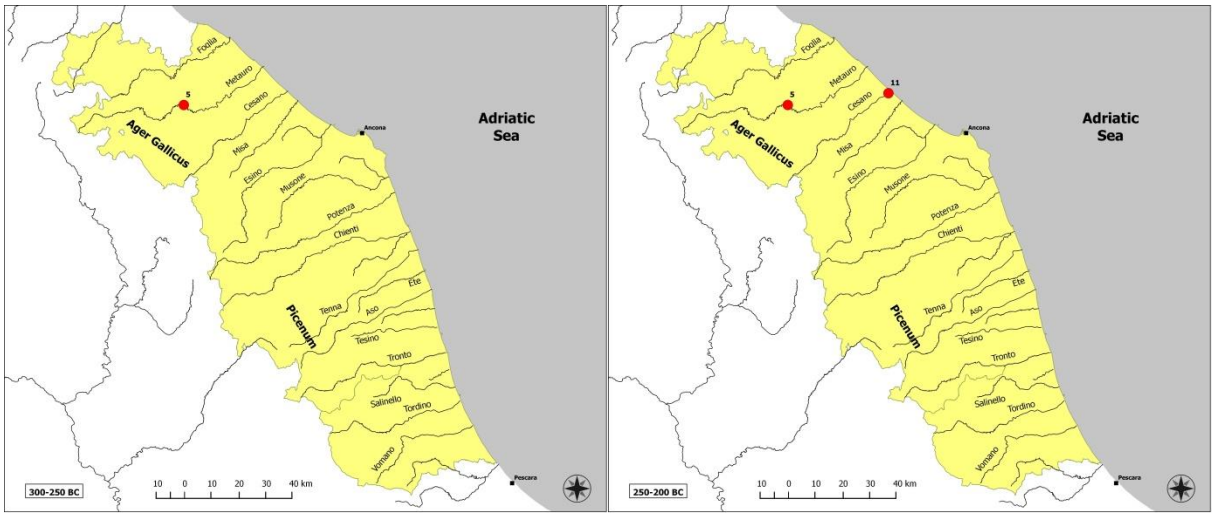
[112] The site of Ripe San Pellegrino probably became active somewhere between Augustus and Nero (Andrenacci 2010, 78).


Chart 2.5: Chronology of individual press sites (300 BC - AD 600)
300 250 200 150 100 50 0 50 100 150 200 250 300 350 400 450 500 550 600
Colombarone di Pesaro
San Giacomo di Fermignano
Ca'Balduini di sopra
Isola del Piano
Fossombrone
Colombara di Acqualagna
San Pellegrino di Ripe
Cesano di Senigallia
Senigallia Via Cavalotti
Villa Romagnoli di Jesi
Monte Torto di Osimo
Porto Recanati La Pineta
Montarice Villa
Chiarino di Recanati
Trea
Pollenza Santa Lucia
San Salvatore di Fermo
Cupra Marittima San Basso
San Giovanni di Offida
San Benedetto Paese Alto
Fontanelle di Monsampolo del Tronto
Muracche di Tortoreto
Piana dei Cesari di Morro d'oro

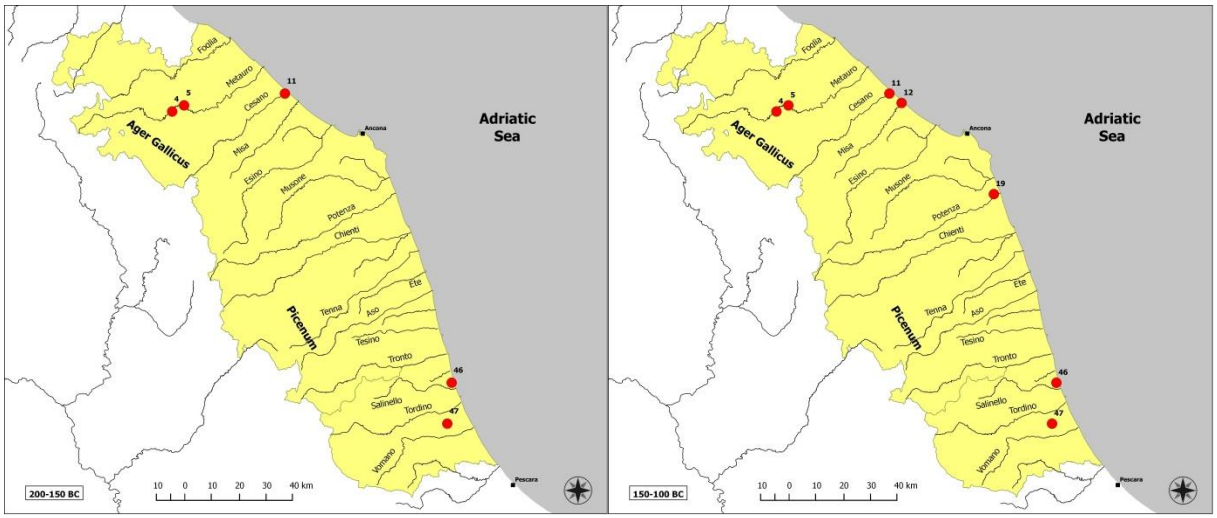
When we take into consideration the overall chronology of production plants in the Marche and northern Abruzzo, some further interesting patterns become clear. For instance, one may notice the apparently small number of active presses before the end of the 3rd century BC. This number slowly begins to rise from the beginning of the 2nd century BC onwards, but only increases exponentially in the course of the 1st century BC. Between the mid-1st century BC and the mid-1st century AD a peak is reached, after which a small decline is noticeable in the second half of the 1st century AD. However, a considerable number of presses remains active throughout the 2nd ,3rd and even 4th century AD. The real decline only starts from the beginning of the 5th century AD onwards, when a rather steep drop in press numbers can be noticed (*Chart* 2.6). As mentioned before, some of these presses tend to remain over longer periods of time, but a quick looks at Figure 35 suffices to show that others disappear or shift to a different place in the landscape over time (*Figure* 35: A-L). Also, when we compare this pattern with the one constructed for the amphora evidence in the previous chapter, it becomes clear that their respective evolutions are somewhat different. Indeed, while amphora exports start somewhere in the second half of the 3rd century BC, peak in the first half of the 1st century BC and gradually decrease from the mid-1st century BC onwards – and in particular from the mid-1st century AD onwards – most of the presses do not date before the second half of the 2nd century BC; only to rise substantially in the course of the 1st century BC and to peak in the 1st century AD. Besides, after the end of the latter century, the number of presses does not decrease as dramatically as the amphora evidence would suggest (*Chart* 2.7). As such, these two proxy indicators for commercial wine and/or oil production do not seem to have completely concurrent evolutionary patterns. In short, the heavy decline in amphora evidence does not seem to be reflected in the press evidence, suggesting that the conditions for their respective existence were not always identical.



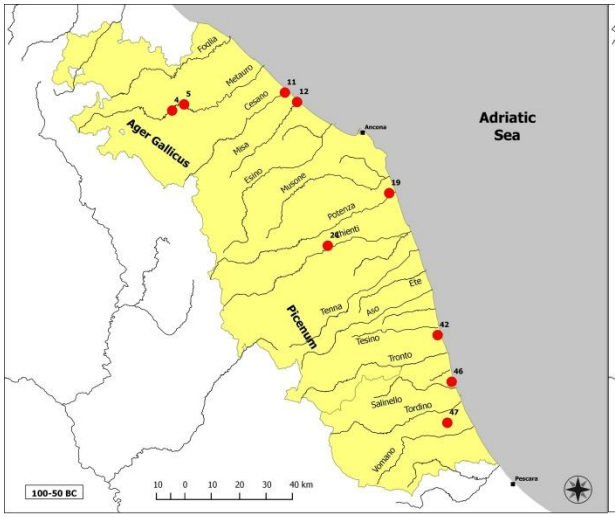

Chart 2.7: Number of active presses
vs. amphora circulation (300 BC - AD 600)
25
20
15
10
5
0
300 250 200 150 100 50 0 50 100 150 200 250 300 350 400 450 500 550 600
Presses
Greco-Italic
Lamboglia 2
Dressel 6A
Dressel 2-4
Flat-bottomed
Adriatic Ovoid
Dressel 6B
Funnel-shaped
Schörgendorfer 558


Adriatic Sea
Ager Gallicus
Picenum
300-250 BC
250-200 BC

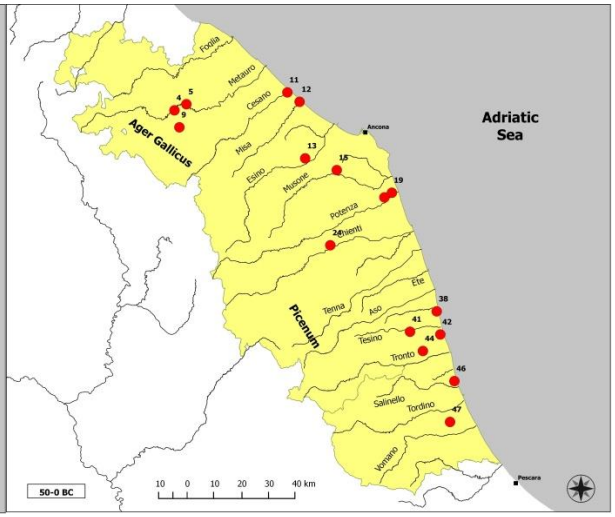
A B


Adriatic Sea
Ager Gallicus
Picenum
200-150 BC
150-100 BC

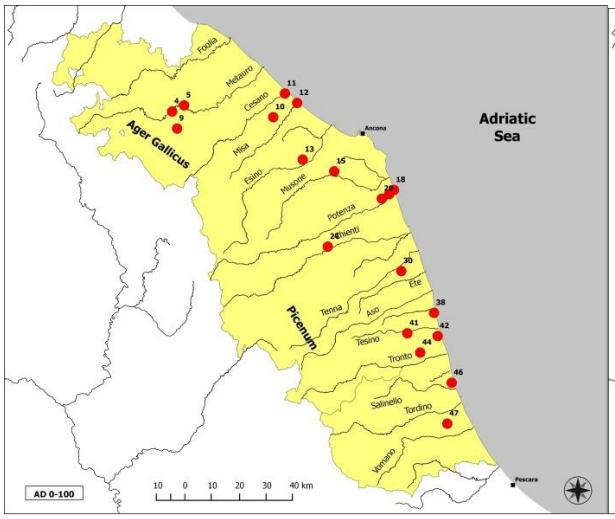
C D


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
Ete
Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
100-50 BC
10 0 10 20 30 40 km

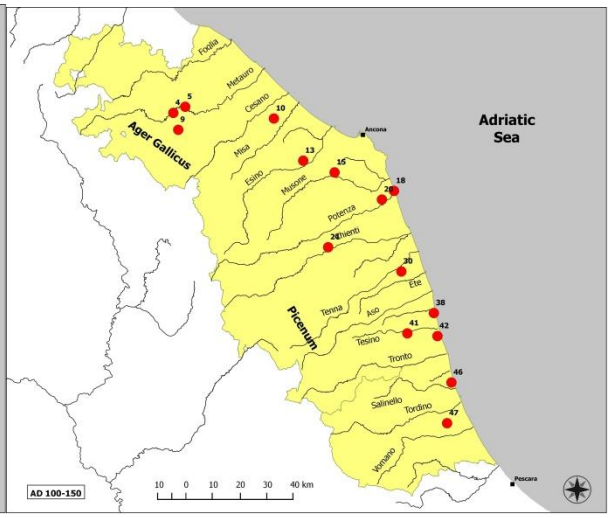
E


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
Ete
Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
50-0 BC
10 0 10 20 30 40 km

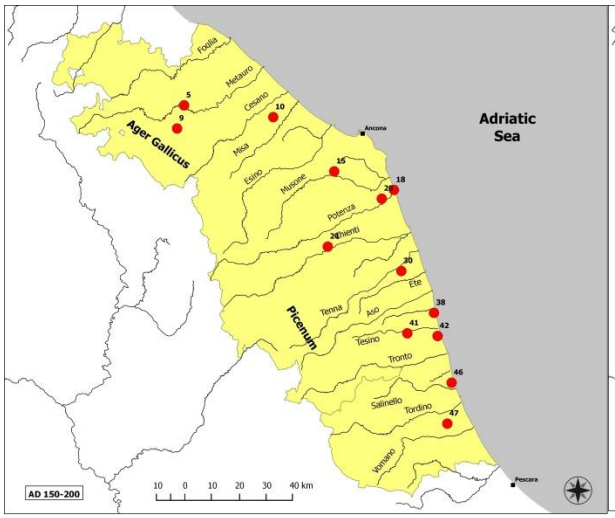
F


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
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Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
AD 0-100
10 0 10 20 30 40 km

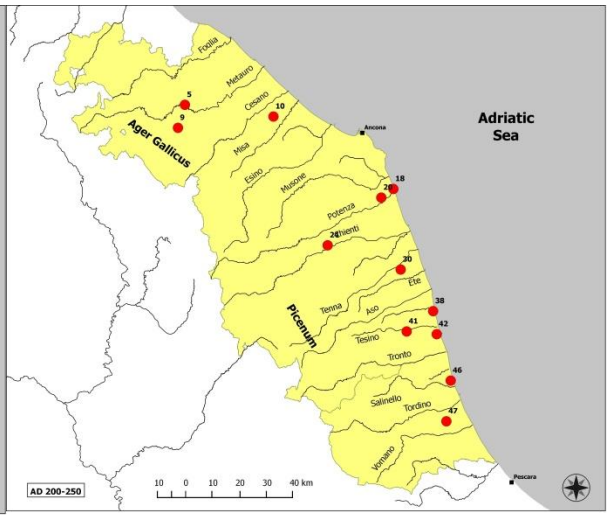
G


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
Ete
Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
AD 100-150
10 0 10 20 30 40 km

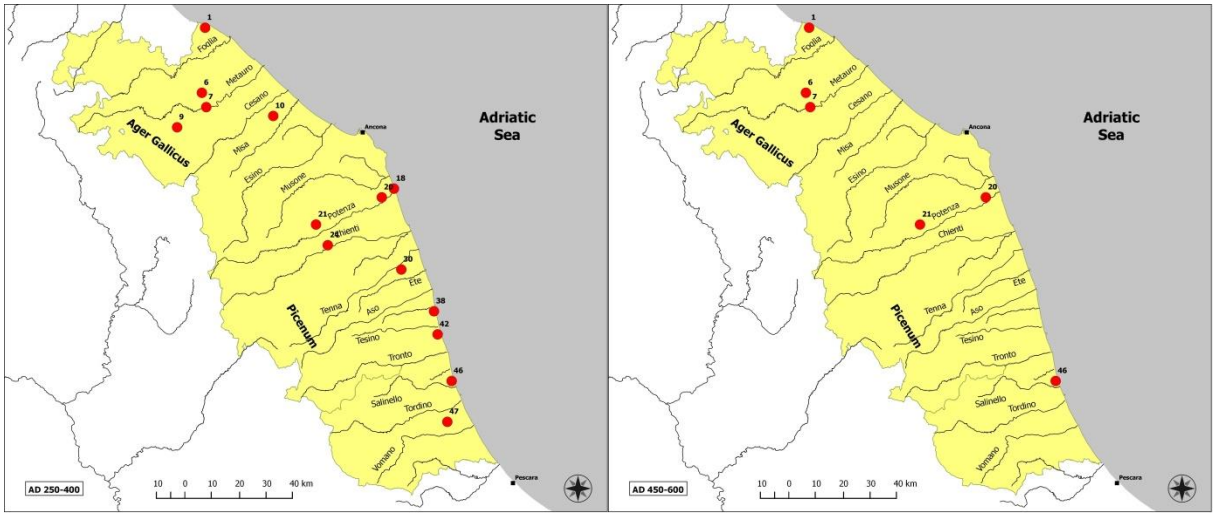
H


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
Ete
Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
AD 150-200
10 0 10 20 30 40 km

I


Adriatic Sea
Ancona
Pescara
Ager Gallicus
Picenum
Foglia
Metauro
Cesano
Misa
Esino
Musone
Potenza
Chienti
Ete
Tenna
Aso
Tesino
Tronto
Salinello
Tordino
Vomano
AD 200-250
10 0 10 20 30 40 km

J



K L

Figure 35 Number of active presses over time (A-L, 300 BC – AD 600) (Maps author).

2.3.4 Wine or oil?

This brings us to a last important issue for the purpose of this chapter, that is production process related differentiation or the act of distinguishing grape and olive processing facilities.[113] The possibility to determine the nature of the processed agricultural product mainly depends on the presence of what one may call 'production process determinable elements' in agricultural installations; that are features that may help to differentiate a wine press from an oil press. Still – as must be clear from the previous section – recognizing such apparatuses in the archaeological record of central Adriatic Italy is not straightforward. An obvious handicap is the progressive attrition of press features since the Roman era (see *supra*). In fact, the information offered by ten sites is too fragmentary in order to say anything about the functioning of the pressing equipment, let alone determining whether the uncovered features were related to the production of wine or olive oil (sites n° 2, 3, 19, 22, 25, 26, 28, 37, 42, 47) (10/51 sites). Another hurdle is the difficulty with which absolute indicators for on-site olive or grape processing may be established. Indeed, in order for a press feature to be an effective element of distinction, an undeniable link should be displayed between the latter and a particular stage in a particular manufacturing process sequence. This would be easy if oil and wine were produced in very different ways, but alas both liquids were obtained through a largely

[113] While J.J. Rossiter was the first to confront literary and archaeological evidence within the context of this question (Rossiter 1981), the best point of entry to the subject is probably the discussion lead by Jean-Pierre Brun *"La discrimination entre les installations oléicoles et vinicoles"* during the colloquium *"La production du vin et de l'huile en Méditerranée"* (Brun 1993). For a review of this discussion, see Rossiter 1998, 598-599. More recent contributions to the topic consists of Curtis 2001, 372-373, and Curtis 2008, 379-384, and again Brun 2004.

similar procedure in antiquity, meaning that their production infrastructures were mostly alike. As such, press installations often tend to pose significant interpretative problems.

For instance, as both fruits could be squeezed using the same type of press, the applied pressing technology is not a feature suited for this purpose. Cato already described presses for oil and wine in the same way (*Agr. Orig.* 18-19) and both lever and screw presses were used in wine and oil production throughout the Roman Mediterranean. This makes it virtually impossible to say something about the nature of the processed agricultural product for sites that have been identified via base blocks or press counterweights (site n° 1, 5, 16, 31-34, 36, 39, 40, 43, 45, 48-51) (16/51 sites). The same goes for a circular press platform (*ara*), whose absence may rather indicate grape than olive processing, but whose presence alone is not enough to exclude the former. Indeed, despite the fact that grape juice is a much less sluggish liquid than olive oil – meaning that it does not require explicitly to be drained from the pressing area towards the collecting area by means of channels, contrary to olive oil ,which is a very heavy and thus slow-moving liquid that is much more dependent on a channelling system – circular press areas occur on both identified wine and oil production sites in Roman Italy and can therefore not be considered typical for either one of them.[114] This means that sites with only said feature – or with a combination of a base block with a press bed – as a starting point do not offer conclusive evidence for distinguishing a wine press form an oil press (site n° 13, 14, 18, 20, 23, 30, 38, 41) (8/51 sites). For reasons that are explained in the previous section, one exception may be the stone press bed from the town of **Trea** (see *supra*).

In order to determine more securely whether a press installation was specifically used for the production of wine or olive oil, attention should be paid to the preparatory treatments of grapes and olives; i.e. treading and crushing respectively. Prior to pressing, grapes were crushed in the form of underfoot treading, a simple procedure that remained the most dominant and effective way to collect juice from grapes throughout Antiquity. Actually, it was during this process – and not during pressing – that the largest amount of grape juice was released. Afterwards, extra pressure could be applied to the trodden grapes with the aid of a mechanical press, but this only served the maximum extraction of the remaining juice and was not an essential stage in winemaking in ancient times. Unfortunately, recognising archaeological evidence for grape treading is difficult.[115] Still, the heightened edges of a hydraulic mortar floor at the site of **Colombara di Acqualagna** probably formed a basin in which grapes could be trodden before they were put under the press (see *supra*). The same goes for the rectangular cocciopesto floor connected to a semi-buried *dolium* at the site of **Fontanelle di Monsampolo del Tronto**. Likewise, the

[114] Brun 1993; Carrington Smith 1994, 374; see also Curtis 2001, 97.

[115] Curtis 2008.

paved working space connected to a collecting tank at the site of **Muracche di Tortoreto** is probably to be identified as a grape treading floor or *calcatorium* (see *supra*).

Olive crushing was a process meant to destroy the integrity of the fruit, and thus to separate the flesh from the nut, which was essential in order to enable the subsequent efficient extraction of olive juice from the olives.[116] Only a small amount of liquid was retrieved during this initial stage – the *amurca* (see *supra*, note 35); the largest portion was extracted during the pressing of the crushed pulp, soaked in hot water and piled in baskets under the press beam. A widely recognised type of olive crusher throughout Mediterranean history – and thus an ideal production process determinable element – is the rotary mill. These mills could take various forms, but were all related to, or derived from, a wide range of occurring rotary mills, of which Cato's *trapetum* (*RR* 20.2) (*Figure* 98) and Columella's *mola olearia* (*Rust.* 12.52.6-7) (*Figure* 97) were the two predominant types.[117] As mentioned above, the complete millstones found at the sites of **Penna San Giovanni** and **Villa Vitali** were both of the *mola-olearia* type (see *supra*) (*Figure* 70; 71). No *trapeta* stones have been identified, but the poet Martial refers to the *"trapeta"* of *Picenum* in his mentioning of the region's table olives.[118] The smaller millstone fragments found at the sites of **Moresco Valdaso**, **Monte Torto di Osimo**, **Ripe San Pellegrino** *and* ***Forum Sempronii*** (**Fossombrone**) probably all belonged to equipment used for the crushing of olives, but these could not be assigned to one of the aforementioned types (see *supra*).

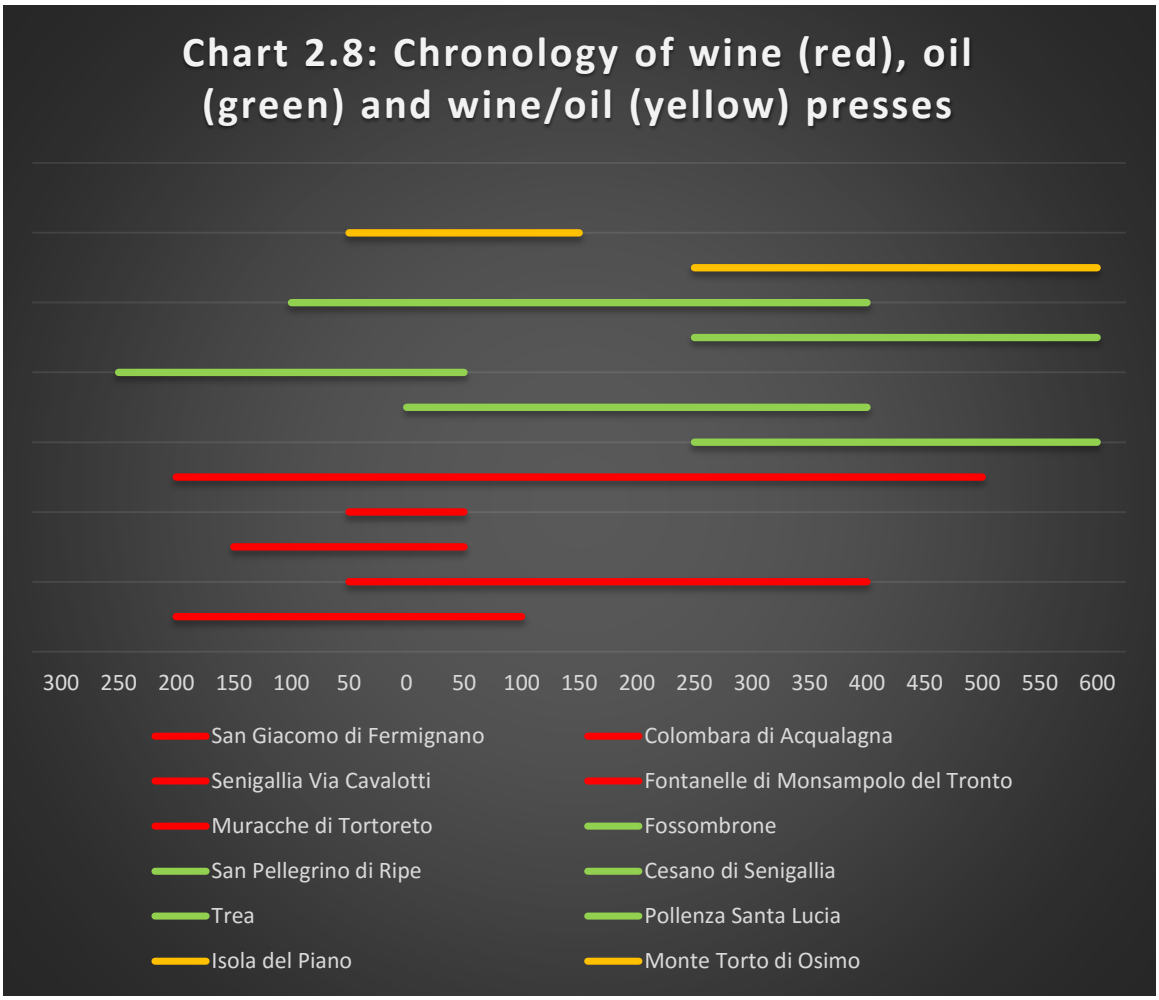
In order to achieve a consumable end product, both grape and olive juice underwent finishing treatments in their collecting tanks: oil needed to be separated from its watery lees and residues through decantation; the must needed to be clarified by removing the grape skins and pits with the aid of filters and settling cavities. The construction of two or three interconnecting tanks in a press room is usually interpreted as a structure for the former procedure. The presence of such tanks at the sites of **Monte Torto di Osimo**, **Cesano di Senigallia**, **San Pellegrino di Ripe**, **Castelfidardo** and **Isola del Piano** suggests that on these sites the press installations featured equipment related to the production of olive oil. For the sites of **Cesano** and **Ripe** – as well as for the site of **Pollenza Santa Lucia** - a similar conclusion was reached on the basis of chemical residue analysis (see *supra*). On the other hand, the presence of stairs and a central cavity in the floor in tanks found at the sites of **Colombara di Acqualagna**, **Fermignano San Giacomo**, **Sant'Ippolito di Fano**, and **Muracche di Tortoreto** suggests that wine production was the primary activity of said

[116] Avitsur 1994, 97.

[117] Drachmann 1932, 7-49; White 1975, 227-229.

[118] For these and other references in Martial, see *supra*, Chapter 1, section 'Olives for export?'; for a description of the functioning of a *mola olearia*, see *supra* in this chapter, section 'Survey- and occasional surface finds', sites **Penna San Giovanni** and **Villa Vitali**; the crushing operation in the *trapetum* was essentially the same as in the *mola olearia*, except for both the mortar and the millstones being hemispherical in the former.

sites. While the stairs enabled the producers to clean out the tanks after processing, the cavity in the floor was probably meant for the settling of the impurities in the must.[119] As such tanks were also present at **Monte Torto di Osimo** and **Isola del Piano**, it is possible that the production of both liquids was combined on these sites. Grape production is also considered to have been the primary activity of the site of **Senigallia Via Cavalotti** because of the presence of a considerable number of grape pits (see *supra*).



While it is theoretically possible that the same pressing facility was used for the production of wine and oil,[120] it seems that for ca. 11.7 % (6/51) of all sites examined, wine production probably was the primary economic activity; ca. 17.6 % (9/51) were used in the first place for the production of olive oil; ca. 4 % may have had a double function; for ca. 66.7 % (34/51) of all sites the processed product could not be determined (*Chart* 2.4). Within the identified press units, ca. 35.3 % (6/17) were used in the first place for wine, ca. 53 % for oil (9/17) and ca. 11.7 % for both products. With regard to chronology, both

[119] Rossiter 1981, 351-352; Brun 2003, 63.

[120] The harvest times for grapes and olives do not coincide (Marzano 2007, 106).

wine and oil presses are present in all considered time periods, but the former are concentrated more in the period between ca. 200 BC and AD 50/100, while the latter are rather comprised between 100/50 BC and AD 400. An emphasis more on olive oil rather than on wine from the mid-1st century AD onwards – an evolution which seems to be equally visible in the amphora evidence (see *supra*) – might be seen reflected in this pattern, but the small sample size (12/51 sites) on which this pattern is based should always be kept in mind (*Chart* 2.8).

2.4 Conclusion

The archaeological evidence discussed in this chapter undoubtedly points into the direction of a considerable wine and oil production along the shores of the central Adriatic coast of Italy during the Late Republican and Early/High Imperial period. The nature of this evidence – i.e. press rooms equipped with expensive mechanical presses and professional olive crushing tools and grape treading spaces, as well as the presence of respectable *celle vinarie* or *olearie* – indicates that we are dealing here with a category of farmers who were involved in production activities transcending purely subsistence levels and carried out with sale in mind. Being a proxy indicator for commercial production as such, it is worthwhile to stress that the press evidence seems to tell a somewhat different story than the amphora evidence discussed in the first chapter:

- First, in the case of olive oil, it hints at the existence of a production whose role could only be guessed at from literary and amphora sources alone, especially concerning the Early/High Imperial period.
- Second, its numeral peak in the course of the 1st century AD contrasts with the contemporaneous decline of wine amphora exports.
- Third, even if the number of presses somewhat decreases from the end of the 1st century/beginning of the 2nd century AD onwards, it always remains at a respectable level in the following centuries, in a period in which the role of amphorae is flat out minimal in comparison to earlier times.

Whatever the reasons for these differences might be, they show incontrovertibly that a decline in amphora distribution should not necessarily imply a decline in overall production. Again, this raises the question if the output of these presses was increasingly being directed towards the local markets from the Early Imperial period onwards – rather than towards the evolving provincial markets – in containers not necessarily visible in

the archaeological record. One way to explore the question of whether the gradual loss of these provinces from 50/25 BC onwards was indeed in some way compensated by a rise of intra-regional consumption markets – read middle Adriatic urban populations – is to look at the towns themselves. This is what I will do in the following chapter.



Figure 36 Monte Torto di Osimo (Photo author).



Figure 37 Monte Torto di Osimo, dolia (Photo author).



Figure 38 Monte Torto di Osimo, base block (Photo author).



Figure 39 Monte Torto di Osimo, base block 2 (Photo author).



Figure 40 Monte Torto di Osimo, base block 3 (Photo author).



Figure 41 Monte Torto di Osimo, press bed (Photo author).



Figure 42 Monte Torto di Osimo, collecting tanks (Photo author).



Figure 43 Monte Torto di Osimo, collecting tank (Photo author).



Figure 44 Colombarone, counterweight block (Photo author).



Figure 45 Colombarone, counterweight block (Photo author).



Figure 46 SS Crocifisso di Treia, press bed (Photo author).



Figure 47 SS Crocifisso di Treia, press bed (Photo author).



Figure 48 SS Crocifisso di Treia, press bed (Photo author).



Figure 49 Traditional olive press bed, Treia (Photo author).



Figure 50 Cupra Marittima San Basso, press floor (http://www.naturamediterraneo.com/forum/topic.asp?TOPIC_ID=5807).



Figure 51 Cupra Marittima San Basso, press bed (http://www.maredelpiceno.it/accoglienza/larea-archeologica-di-cupra-marittima.html).



Figure 52 Gallignano di Ancona, press bed (AS, Class. ZA 02/28).



Figure 53 Fossombrone/Forum Sempronii, press bed (Photo Devi Taelman).

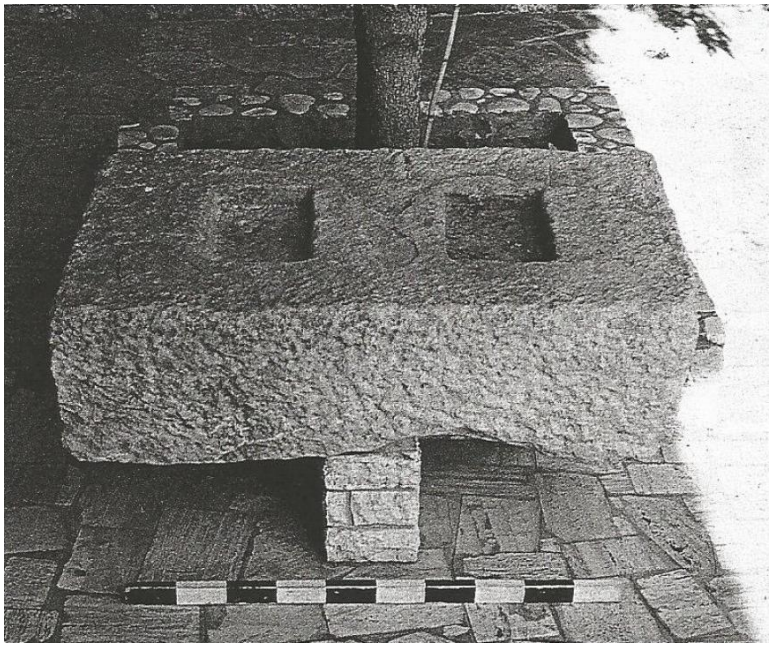


Figure 54 Castelnuovo Vomano, press block (After Staffa 1986, 249, Fig. 150).



Figure 55 Cupra Marittima San Michele, base block (After Ciarrocchi 1999, 62).

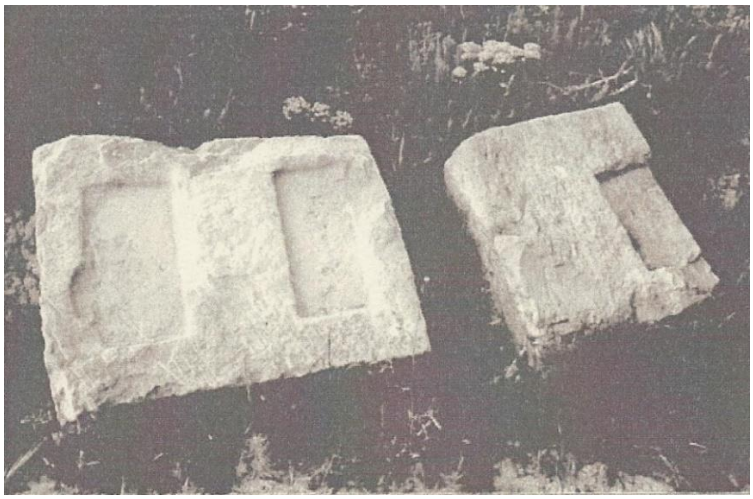


Figure 56 Cupra Marittima Ripatransone, base block (After Ciarrocchi 1999, 99).

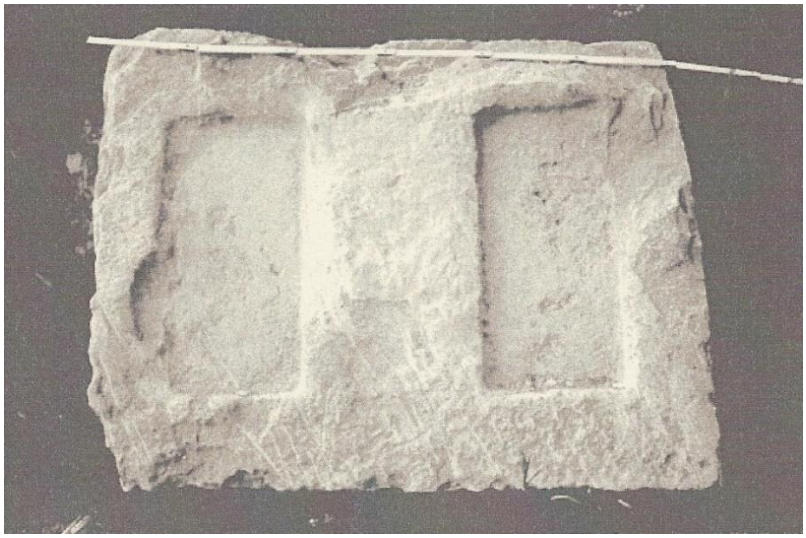


Figure 57 Cupra Marittima Ripatransone, press block (After Ciarrocchi 1999, 99).



Figure 58 Cupra Marittima Massignano, base block (After Ciarrocchi 1999, 75).



Figure 59 Cesano di Senigallia, press complex (After AS, ZA/45/15).

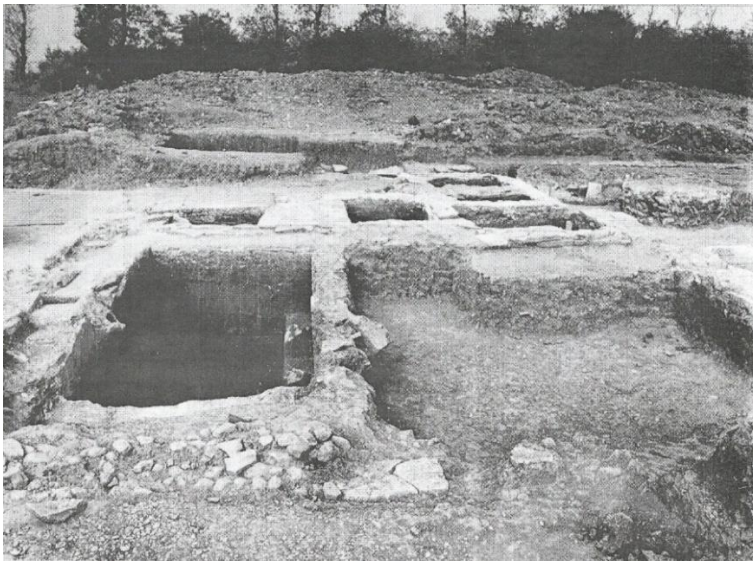


Figure 60 Cesano di Senigallia, press complex (After AS, ZA/45/15).

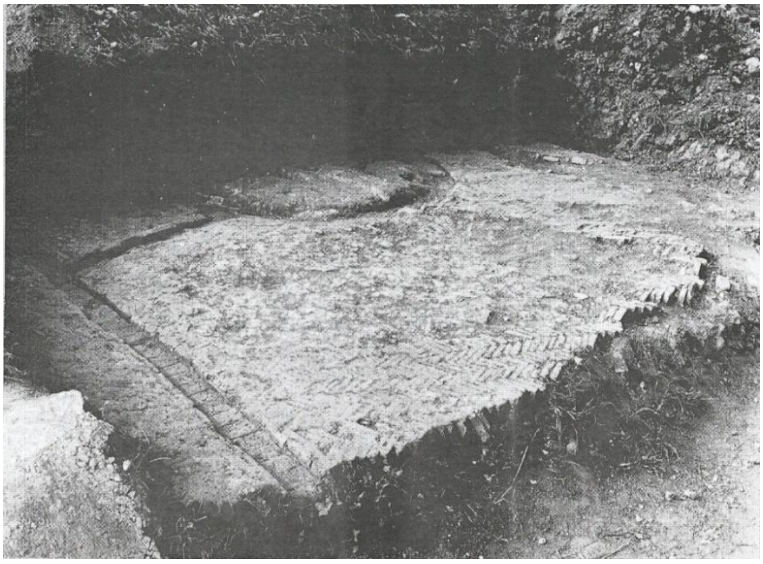


Figure 61 Cesano di Senigallia, press floor (After AS, ZA/45/15).



Figure 62 Cesano di Senigallia, decantation tanks (After AS, ZA/45/15).

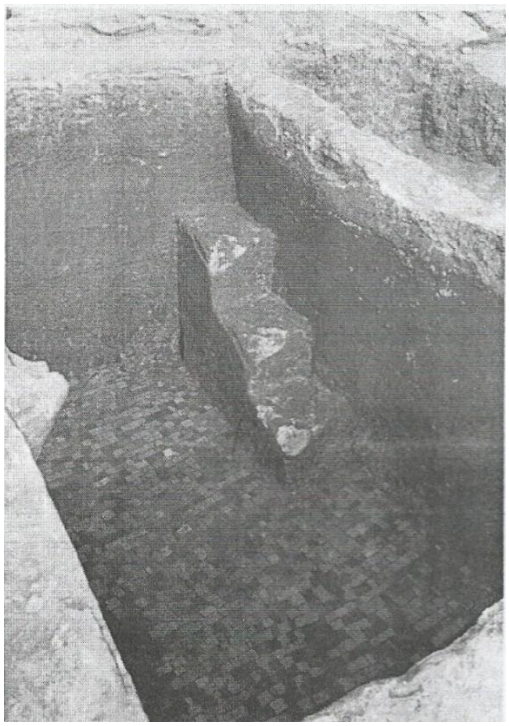


Figure 63 Cesano di Senigallia, collecting tank (After AS, ZA/45/15).

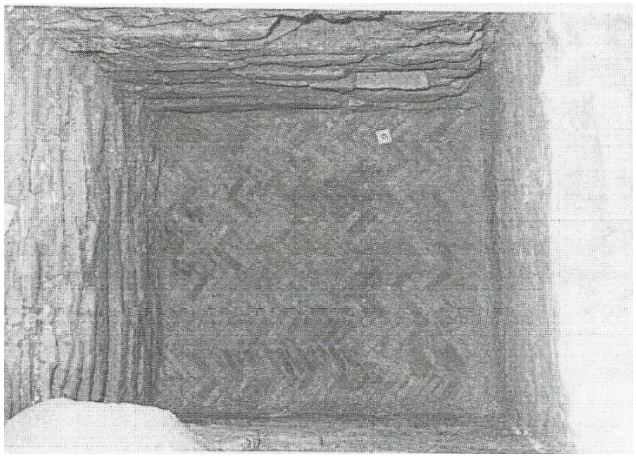


Figure 64 Cesano di Senigallia, decantation tank (After AS, ZA/45/15).

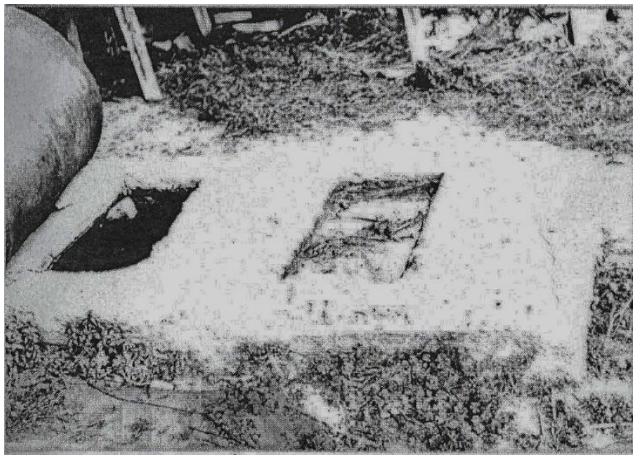


Figure 65 Location not known, base block (After AS).

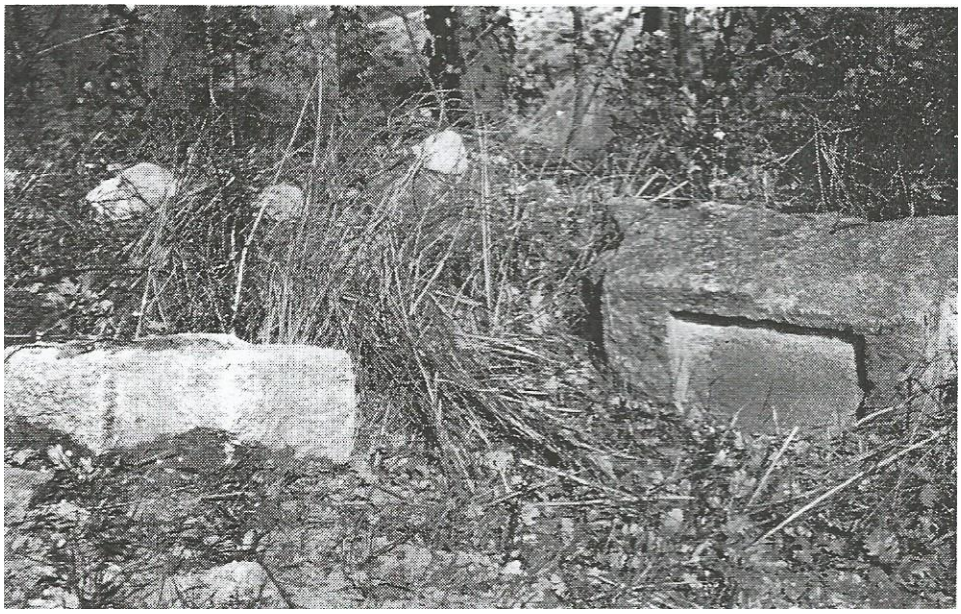


Figure 66 Moresco Valdaso, base block (After Pupilli 1994, 72, Fig. 98).

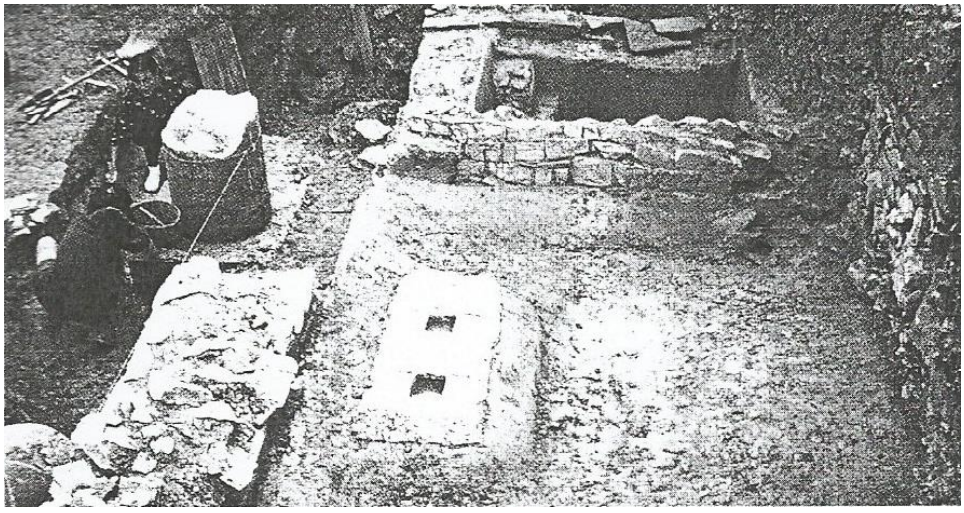


Figure 67 Colombara di Acqualagna, press room (After Luni 2002, 41, Fig. 13).

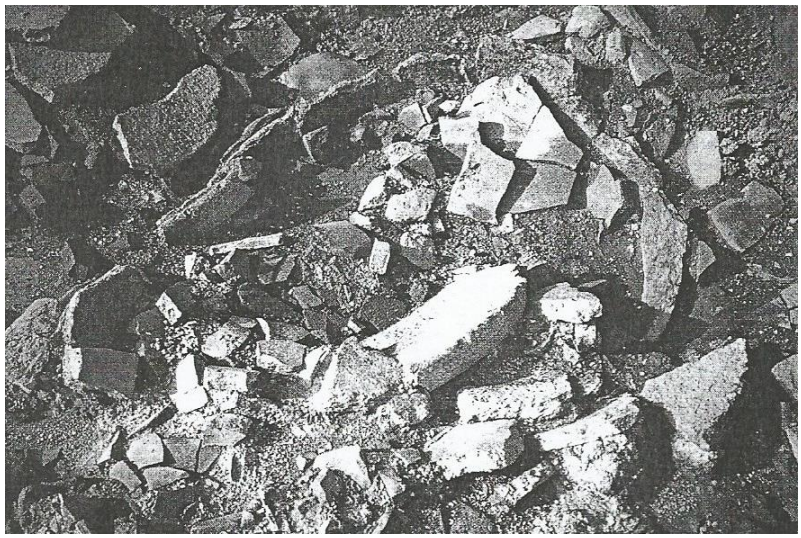


Figure 68 Colombara di Acqualagna, dolium (After Luni 2002, 36, Fig. 8).

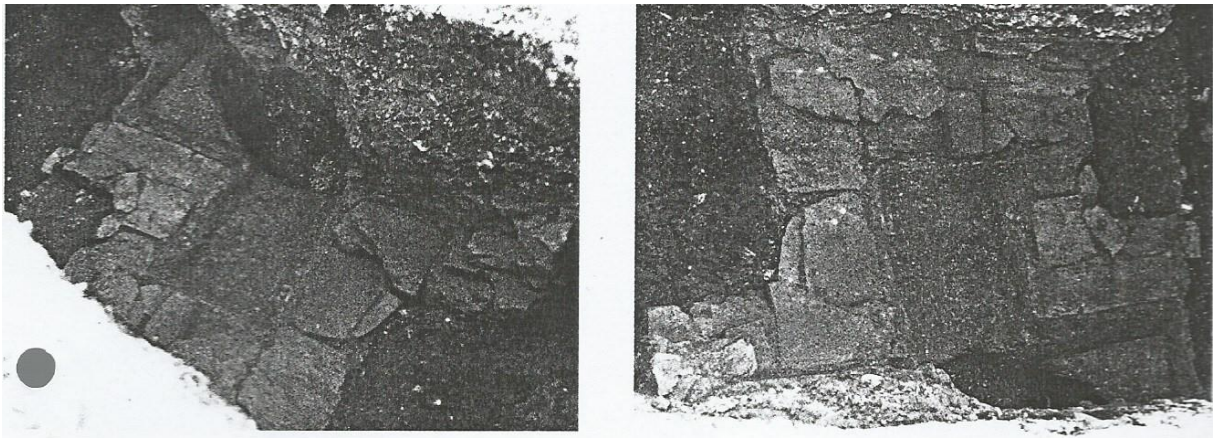


Figure 69 Fermignano S. Giacomo, press (After Ermetti/Monacchi 1993, 82, Fig. 4).

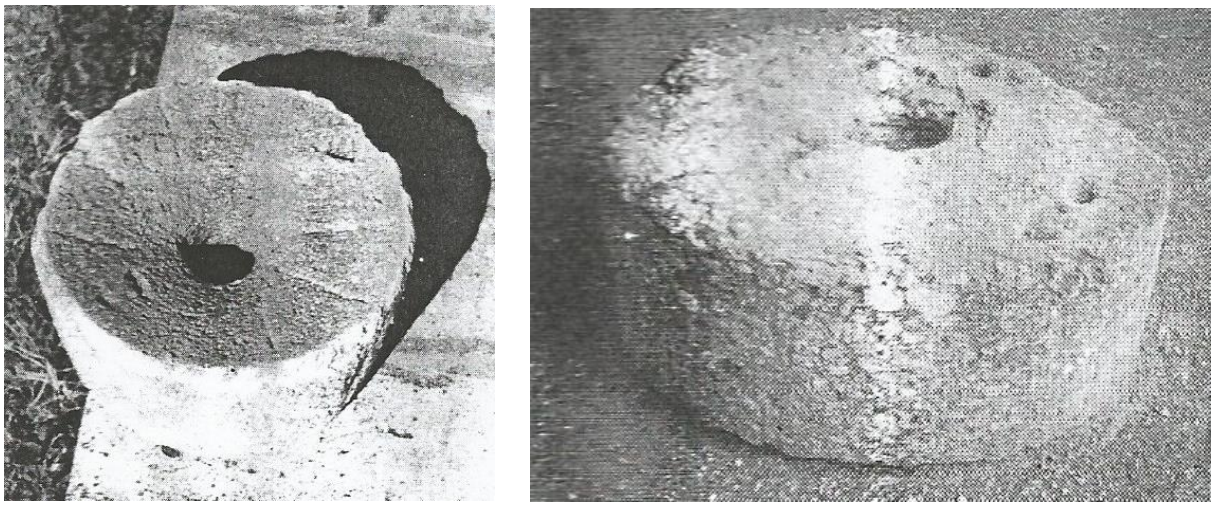


Figure 70 Penna S. Giovanni, millstone (After Pupilli 1994, 48, Fig. 78).
Figure 71 Villa Vitali di Fermo, millstone (After Pupilli 1994, 27, Fig. 20).



Figure 72 Ca' Balduini di sopra, base block (After Monacchi 2010, 187, Fig. 47).

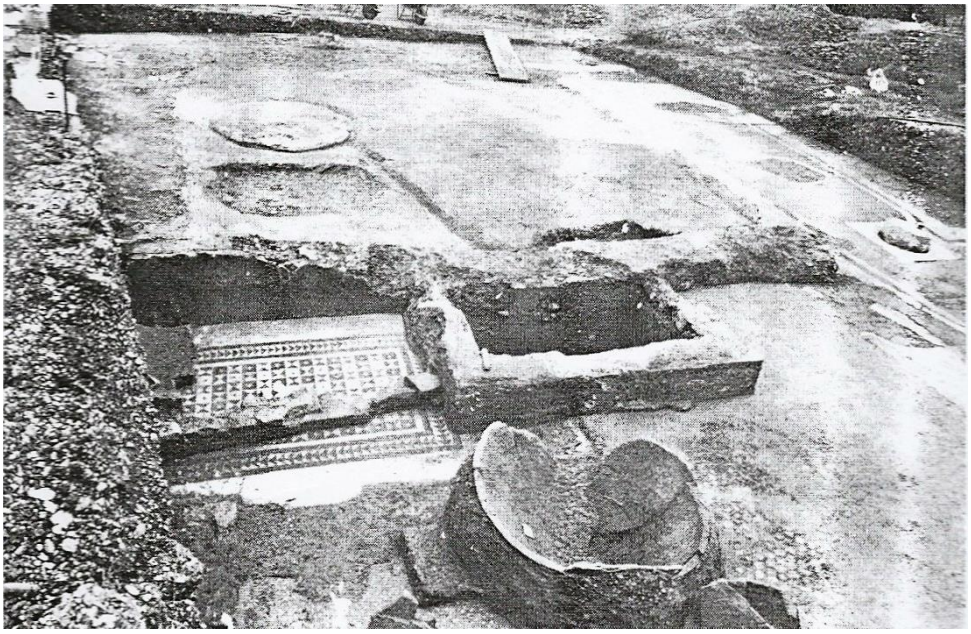


Figure 73 Pollenza Santa Lucia, press room (After Mercando 1980, tav. 9).

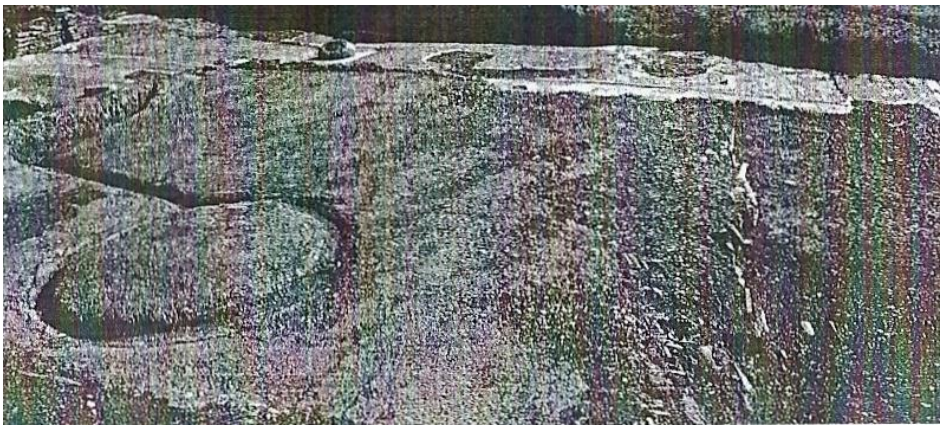


Figure 74 Pollenza Santa Lucia, press bed (After Frapiccini et al. 2006, 309, Fig. 4).

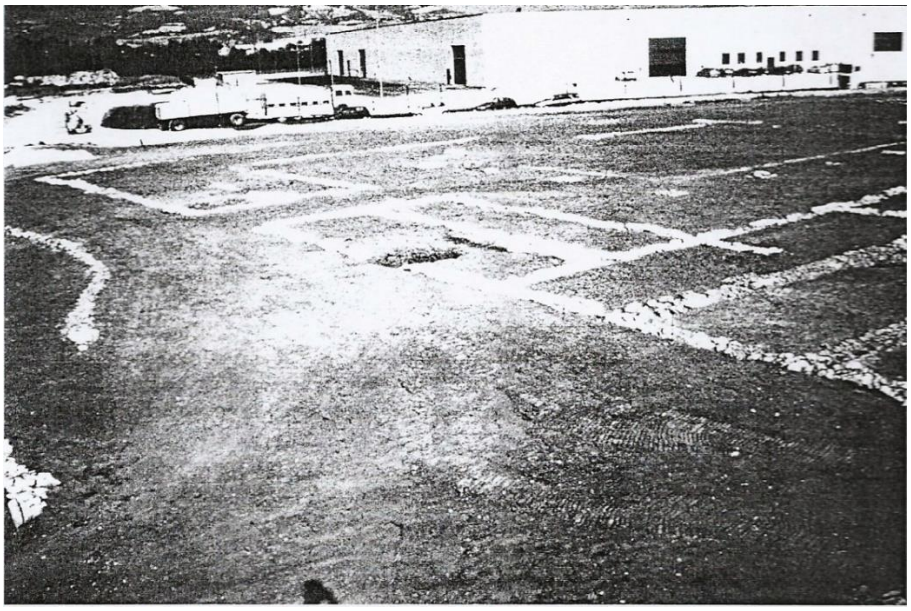


Figure 75 Sant'Ippolito di Fano, rural complex (After De Marinis 2003, 81, Fig. 3).



Figure 76 Sant'Ippolito di Fano, Tank A (AS).

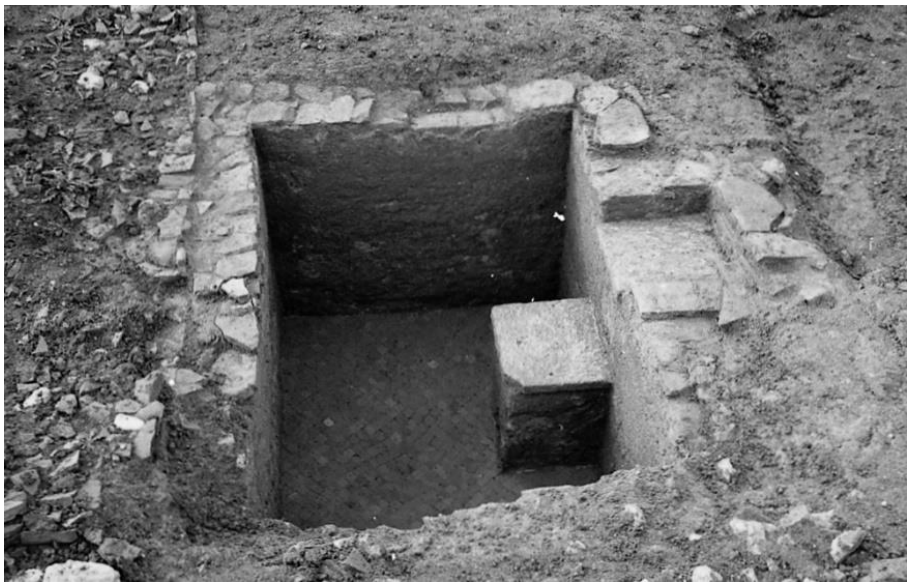


Figure 77 Sant'Ippolito di Fano, Tank B (AS).

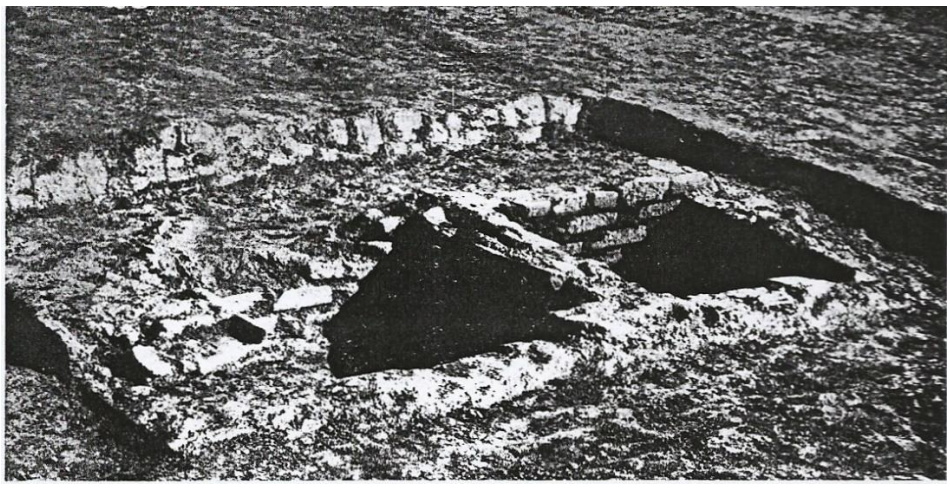


Figure 78 Castelfidardo, tanks (After Mercando 1979b, 136, 48).

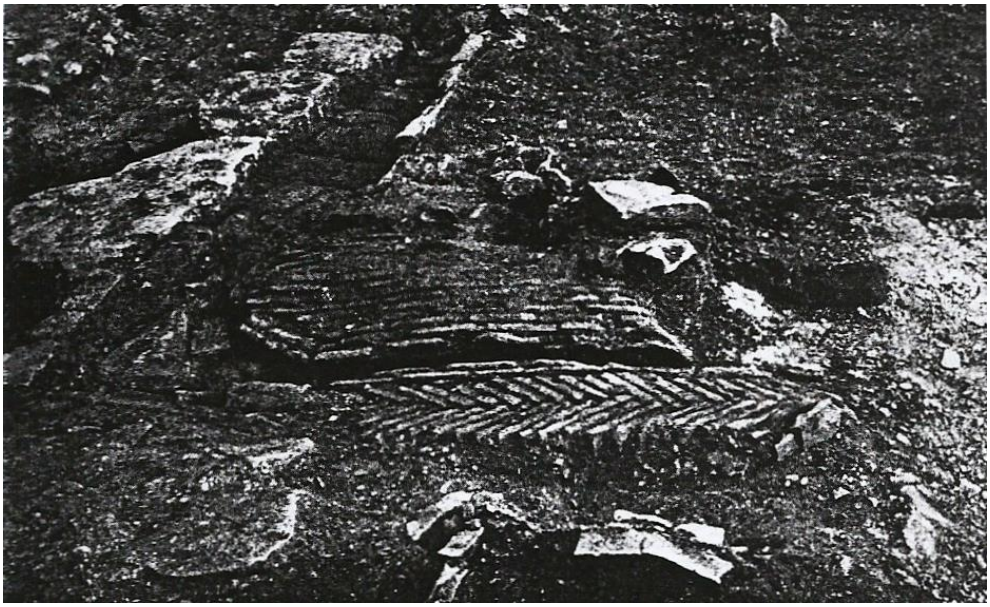


Figure 79 Porto Recanati, press bed (After Mercando 1979c, 189, Fig. 107).





Figure 80 Senigallia, Via Cavalotti, press floor (After Lepore et al. 2012, Fig. 32).
Figure 81 Senigallia, Via Cavalotti, dolium tank (After Lepore et al. 2012, Fig. 26).



Figure 82 Muracche di Tortoreto, rural complex (http://gamadriatico.blogspot.it/p/muracche.html).



Figure 83 Muracche di Tortoreto, lion's head (http://gamadriatico.blogspot.it/p/muracche.html).



Figure 84 Muracche di Tortoreto, rural complex (http://www.studiodercole.com/ restauro-architettonicoprogetto-per-la-valorizzazione-del-parco-archeologico-domus-delle-muracche-tortoreto/#!).



Figure 85 Muracche di Tortoreto, dolium (http://www.studiodercole.com/restauro-architettonicoprogetto-per-la-valorizzazione-del-parco-archeologico-domus-delle-muracche-tortoreto/#!).



Figure 86 Muracche di Tortoreto, opus spicatum detail (http://www.studiodercole.com/restauro-architettonicoprogetto-per-la-valorizzazione-del-parco-archeologico-domus-delle-muracche-tortoreto/#!).

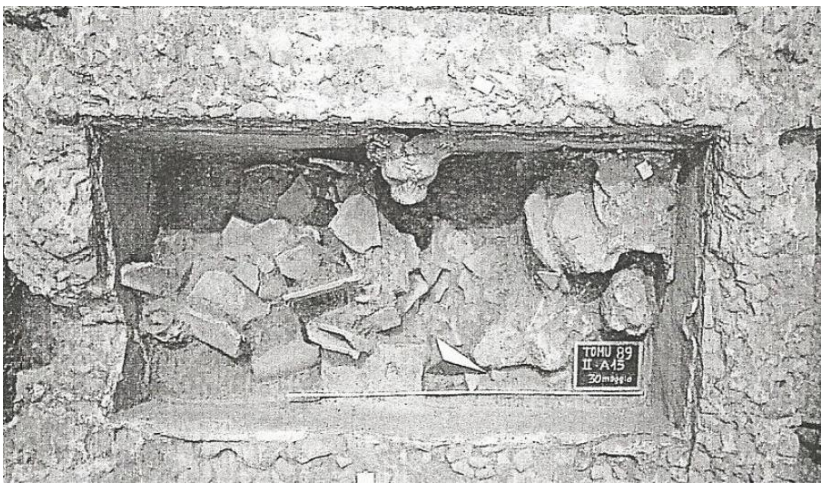
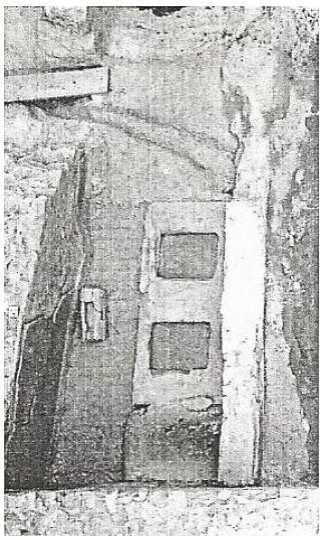


Figure 87 Muracche di Tortoreto, collecting tank (After Lapenna 1996, 390, Fig. 342).



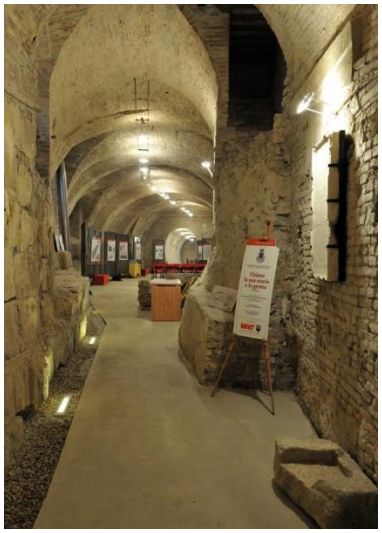


Figure 88 Muracche di Tortoreto, base block (After Lapenna 1996, 390, Fig. 341).
Figure 89 Osimo/Auximum, base block (right lower corner). (Photo Servizio Turismo).



Figure 90 Case Ozzi di Tortoreto, base block (After Lapenna 1996, 387, Fig. 337).

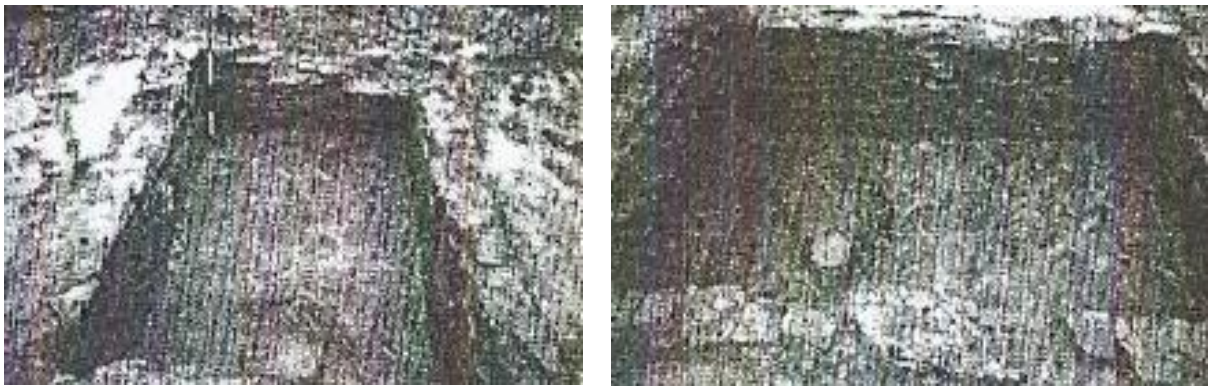


Figure 91 Ripe San Pellegrino, tanks (After Andrenacci 2010, 77, Fig. 5).



Figure 92 Ripe San Pellegrino, press bed (After Andrenacci 2010, 77, Fig. 4).



Figure 93 Chiarino di Recanati, base block (After Percossi 1999, 48).

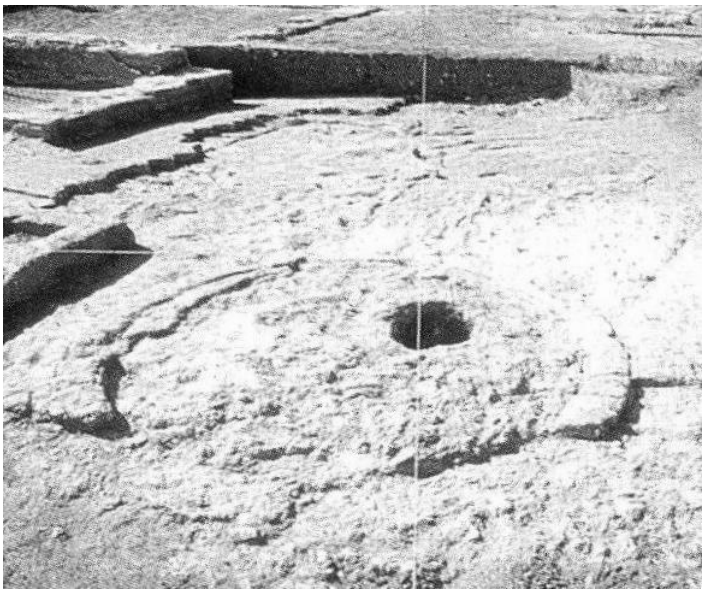


Figure 94 Chiarino di Recanati, press bed (After Percossi 1999, 48).

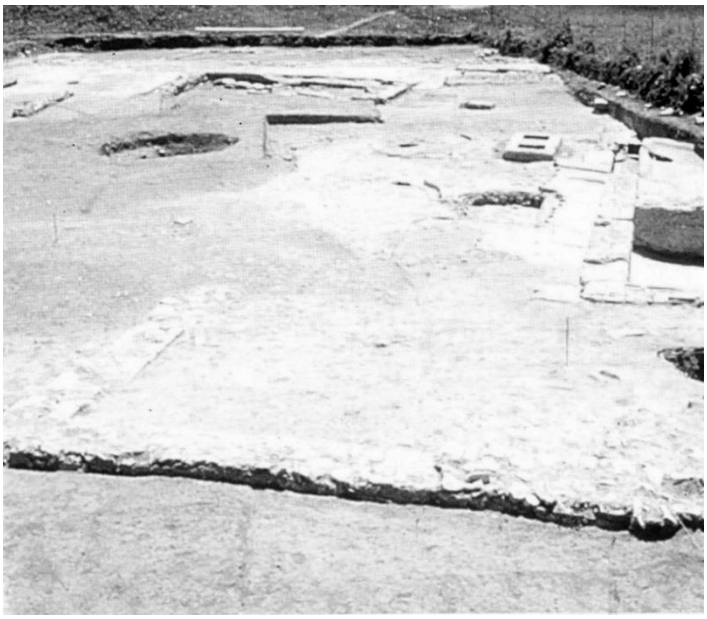
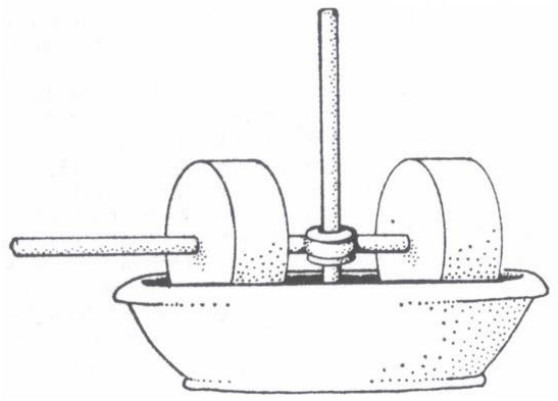


Figure 95 Chiarino di Recanati, press room (After Percossi 1999, 49).



Figure 96 Villa Magna di Urbisaglia, cellar (http://larucola.org/2012/07/13/ larcheologia-e-da-valorizzare/).



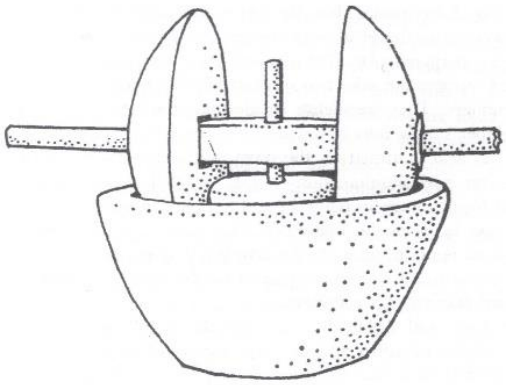


Figure 97 Mola olearia (After White 1975, Fig. 58).
Figure 98 Trapetum (After White 1975, Fig. 56).



Figure 99 Isola del Piano, the foundations of two tanks (After Bartolucci/Graziani2014, Fig. 5).



Figure 100 Isola del Piano, third tank (After Bartolucci/Graziani 2014, Fig. 6).



Figure 101 Isola del Piano, detail of the third tank (After Batolucci/Graziani 2014, Fig. 7).



Figure 102 San Benedetto del Tronto (After Lucentini et al. 2014).



Figure 103 San Benedetto del Tronto, tank A (After Lucentini et al. 2014).

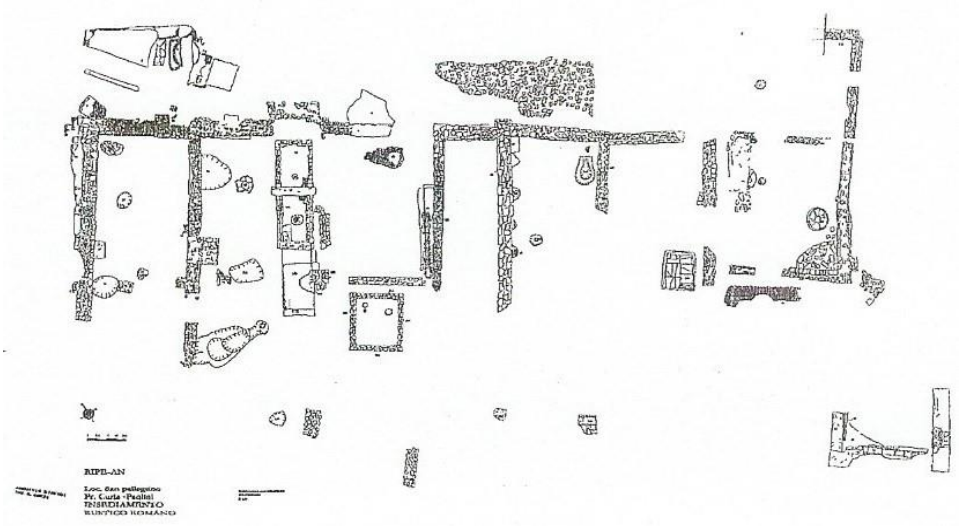


Figure 104 San Pellegrino di Ripe (After Andrenacci 2010, 75, Fig. 3).

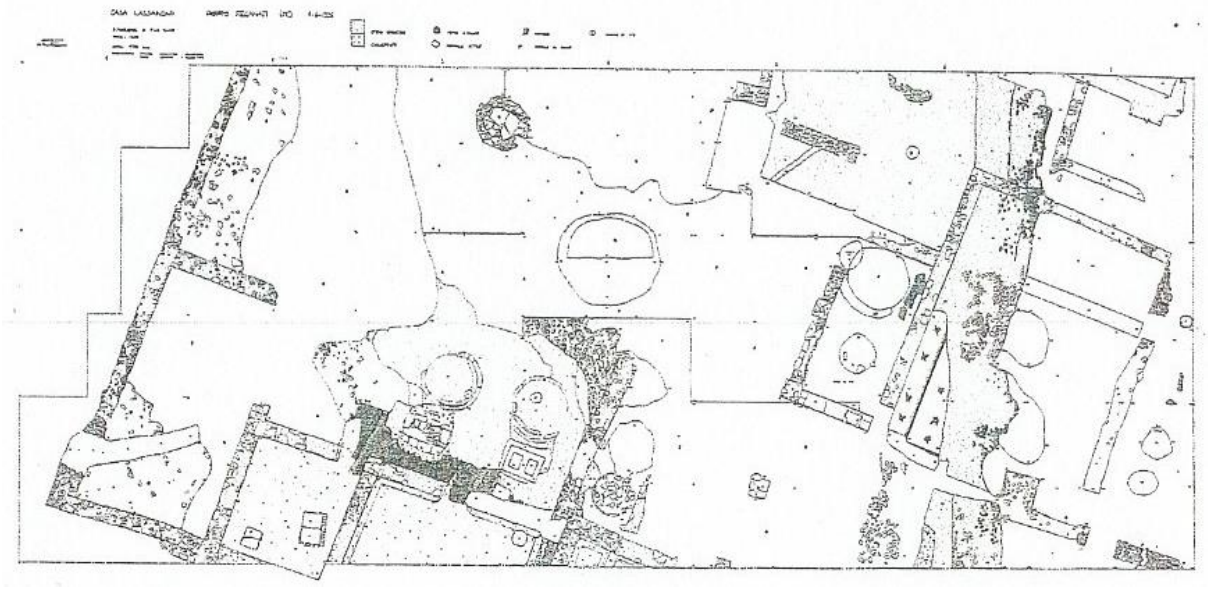


Figure 105 Chiarino di Recanati (After Frapiccini et al. 2006, Fig. 7).

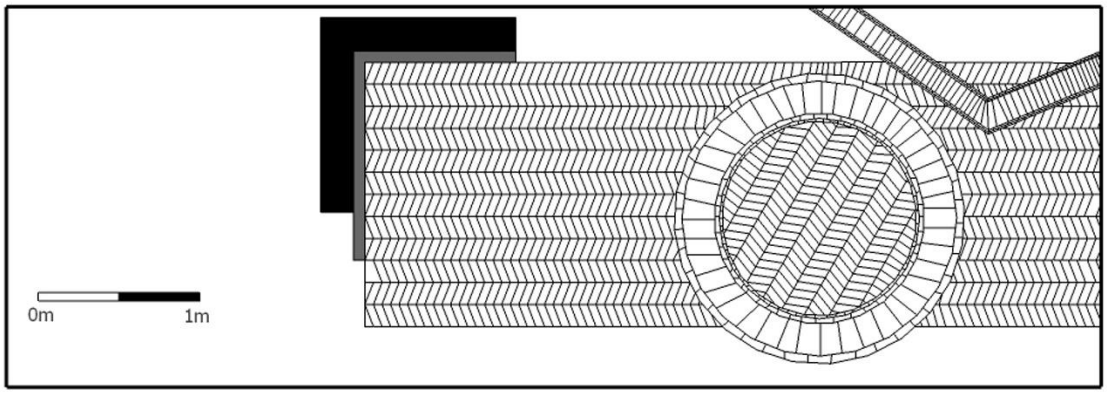


Figure 106 Cingoli Piano San Martino (After AV, Cass 2/15).

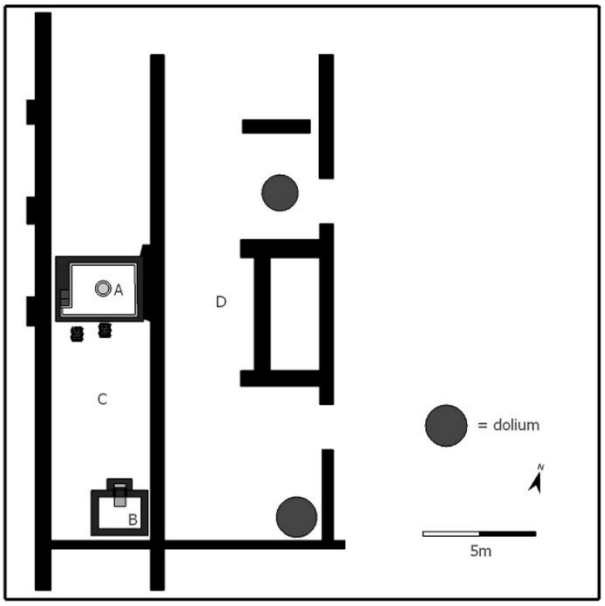


Figure 107 Sant'Ippolito di Fano (After AS).

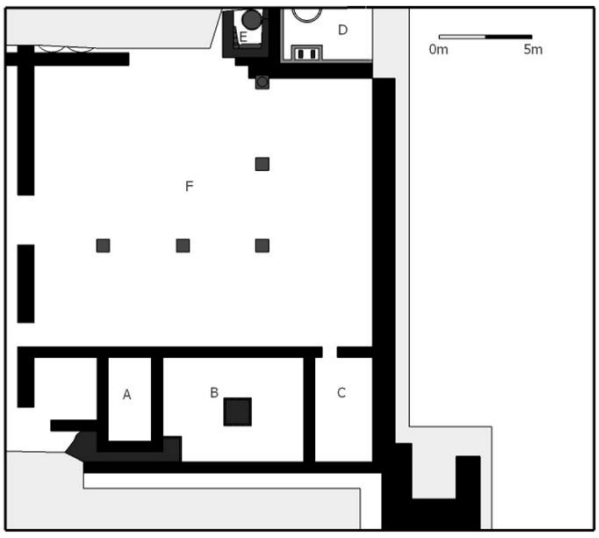


Figure 108 Colombara di Acqualagna (After Luni 2002, 34, Fig. 6).

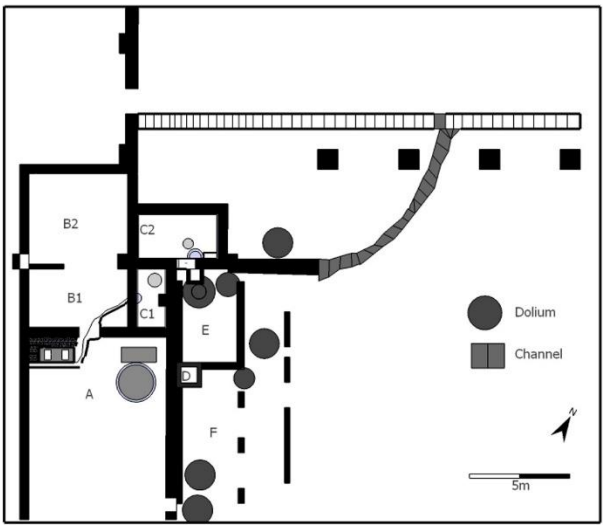


Figure 109 Muracche di Tortoreto (After Lapenna 1996, 391, Fig. 343).

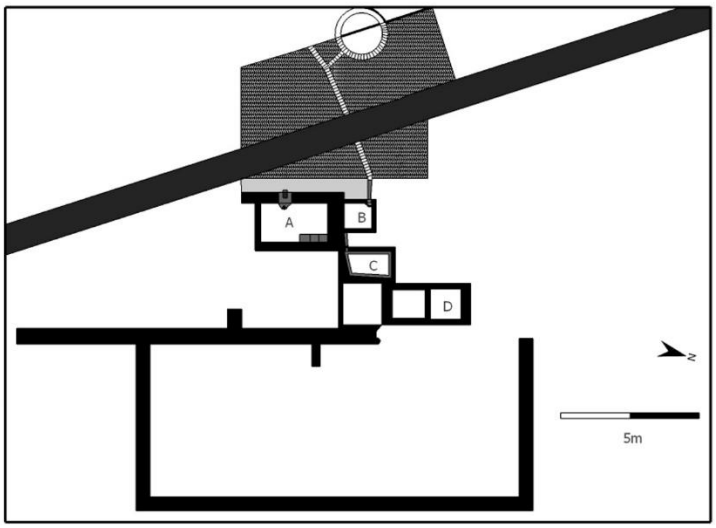


Figure 110 Cesano di Senigallia (After Mercando 1979, 112, Fig. 22).

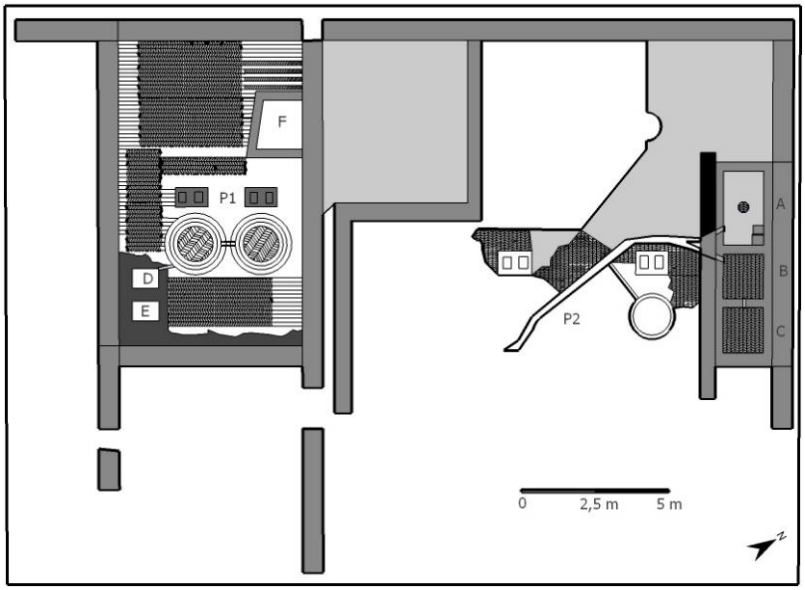


Figure 111 Monte Torto di Osimo (After Pignocchi 2001, 49, Fig. 42).

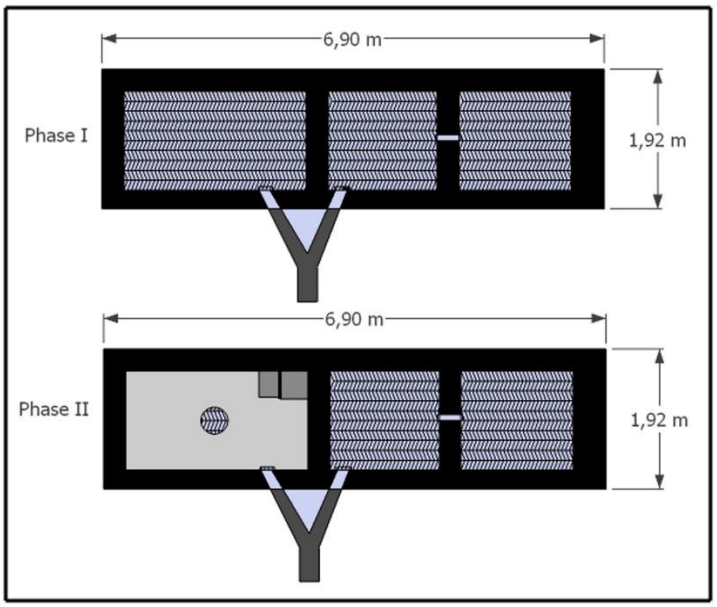


Figure 112 Monte Torto di Osimo, tank system (Figure author).

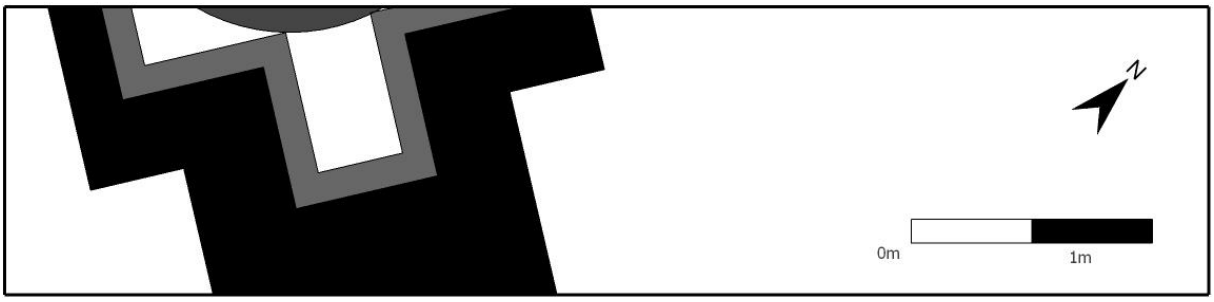


Figure 113 Fermignano San Giacomo (After Ermetti/Monacchi 1993).

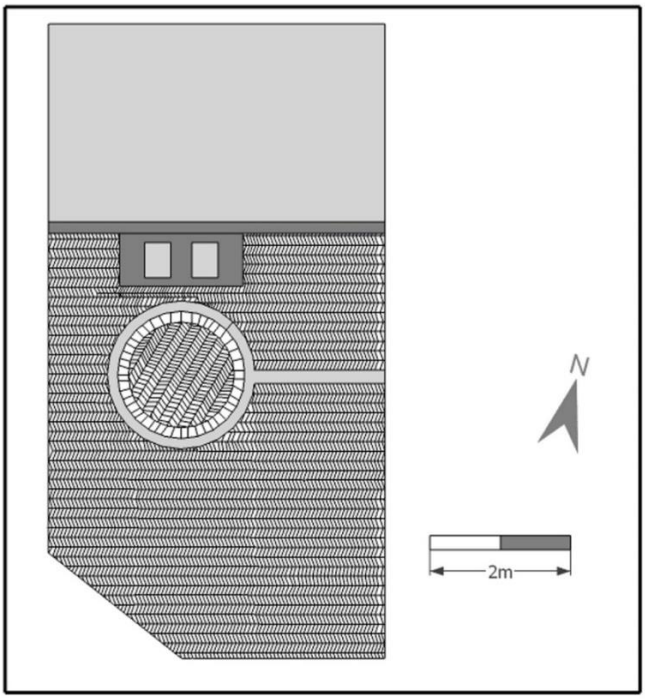


Figure 114 Cupra Marittima San Basso (After Ciarrocchi 1999, 49).



Figure 115 Senigallia Via Cavalotti (After Lepore et al. 2012, 11, Fig. 28).

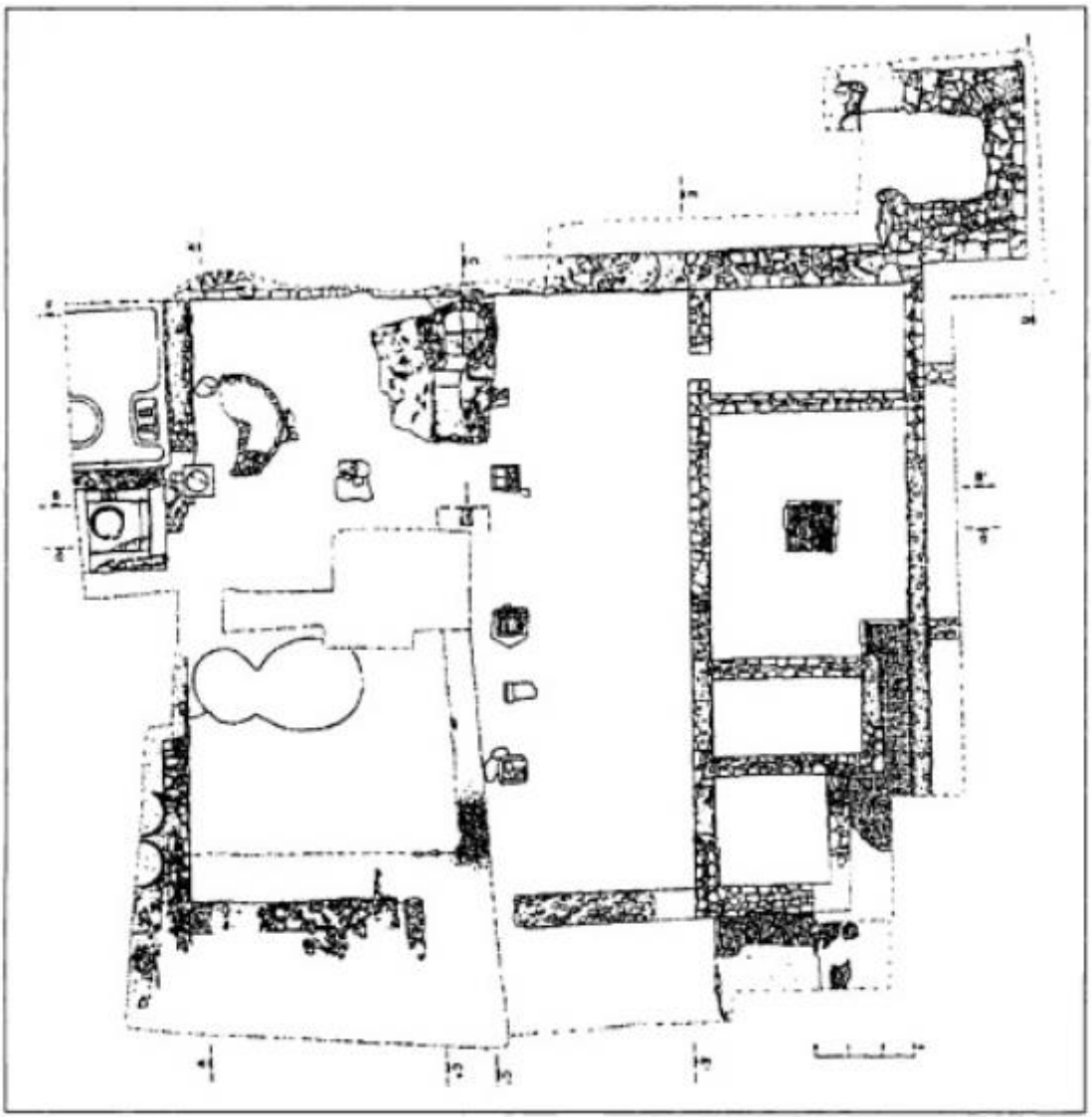


Figure 116 Colombara di Acqualagna (After Agnati 1999, Tav. V, 8).

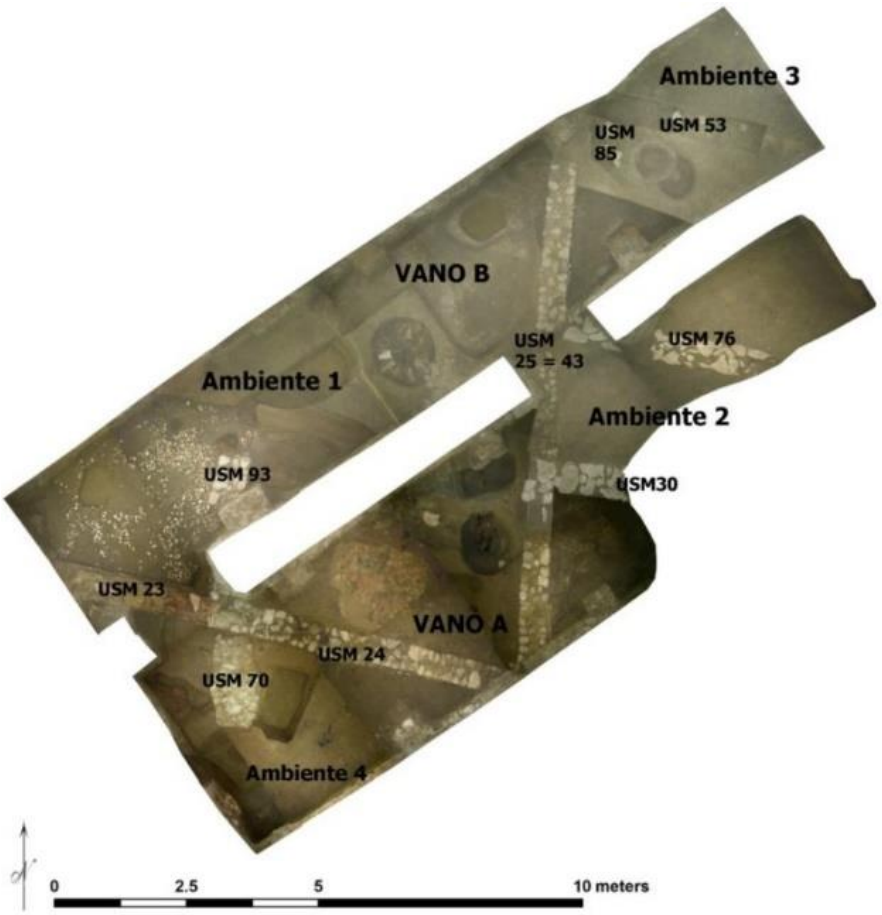


Figure 117 Senigallia Via Cavalotti (After Lepore et al. 2012, Fig. 1).

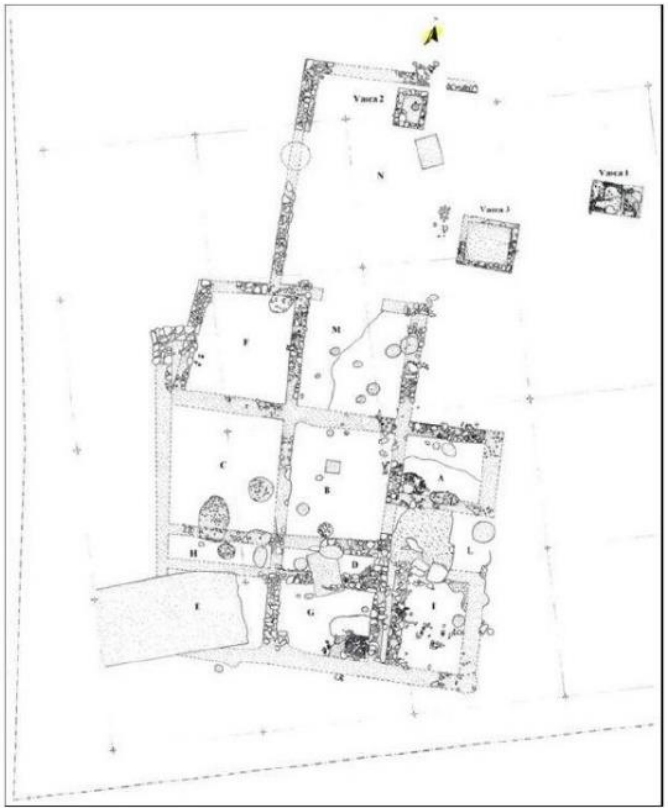


Figure 118 Isola del Piano (After Bartolucci/Graziani 2014, Fig. 1).



Figure 119 Isola del Piano, tank 3 (After Bartolucci/Graziani 2014, Fig. 8).

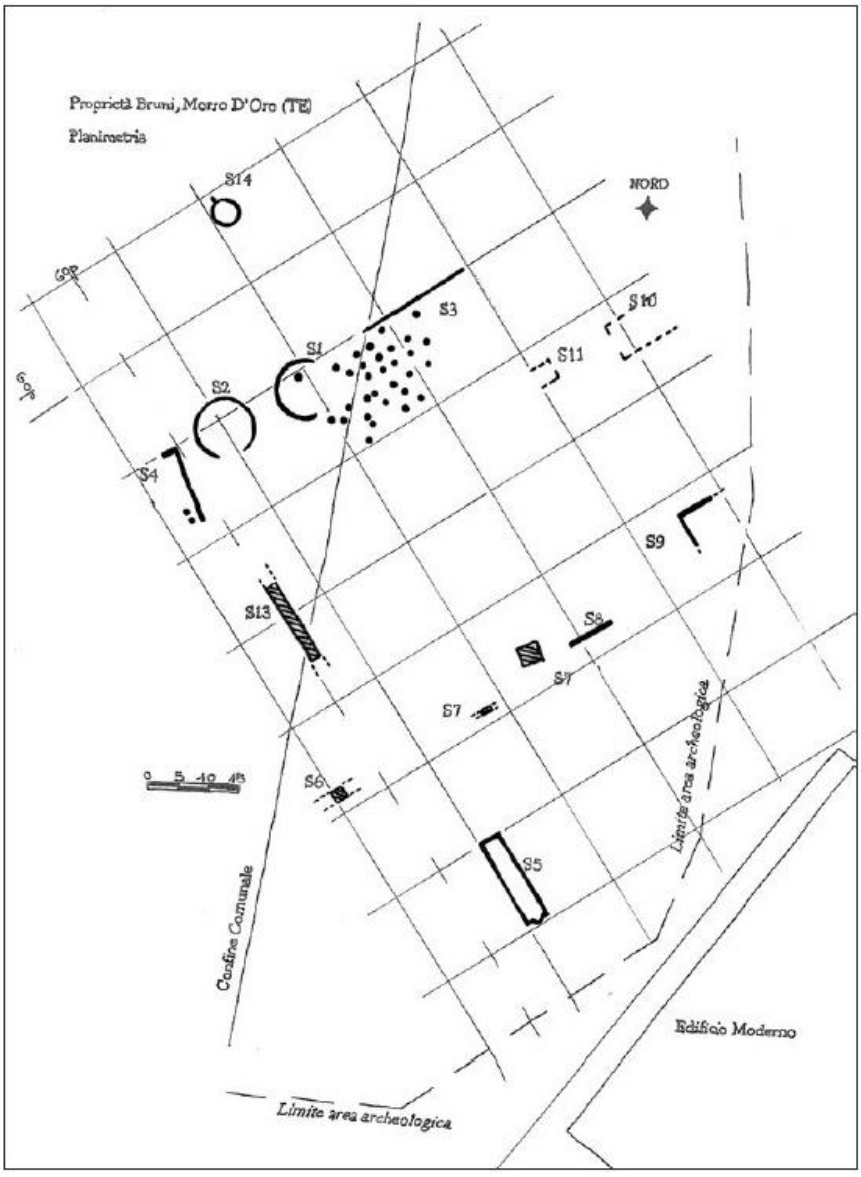


Figure 120 Piana dei Cesari (After Formicone/Neroni 2010, 577, Fig. 2).



Figure 121 Ripe San Pellegrino, dolium defossum (After Andrenacci 2010, 100, Fig. 20).

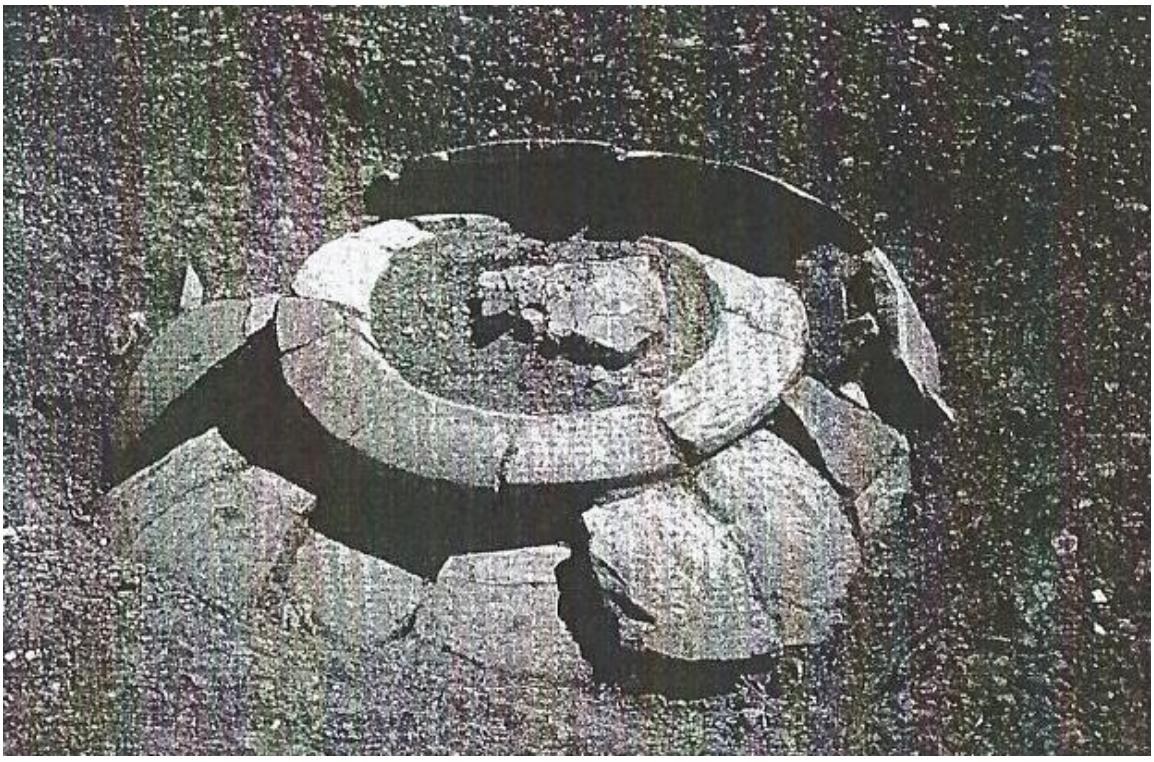


Figure 122 Sant'Ippolito di Fano, dolium defossum (After De Marinis 2006, 125, Fig. 10).

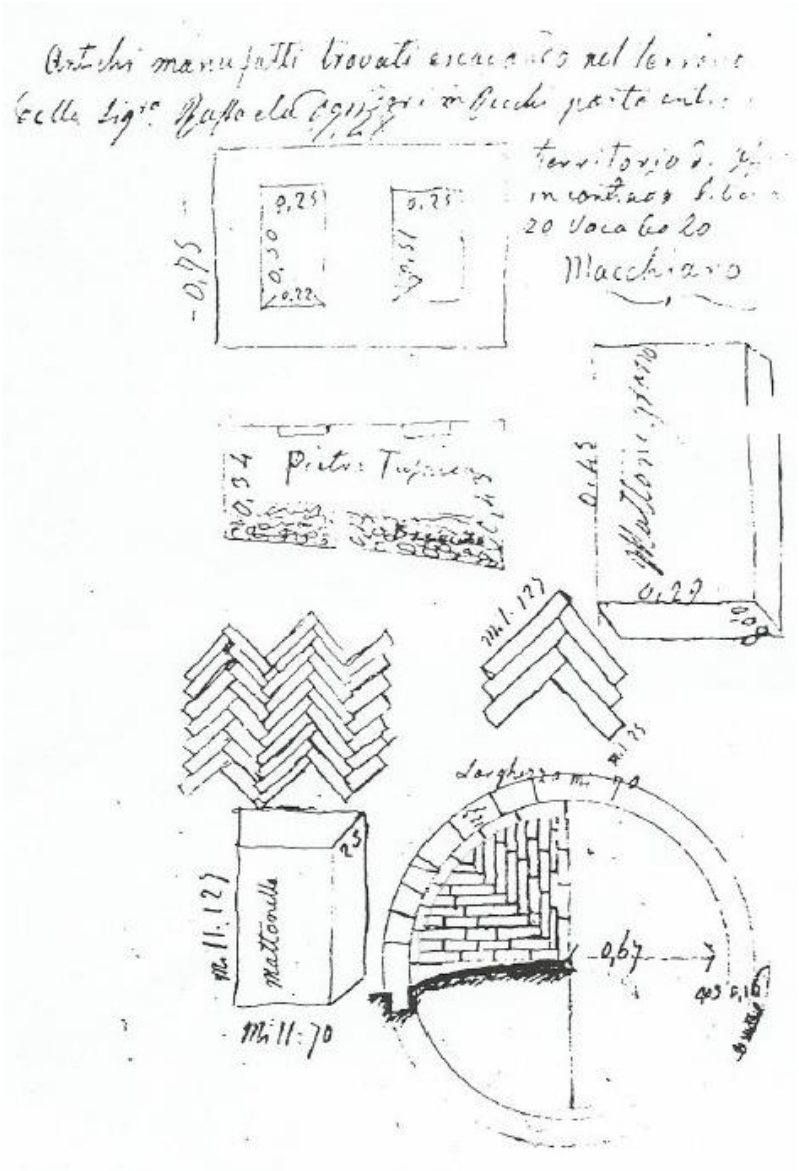


Figure 123 San Giovanni di Offida (After Vannicola 1996).

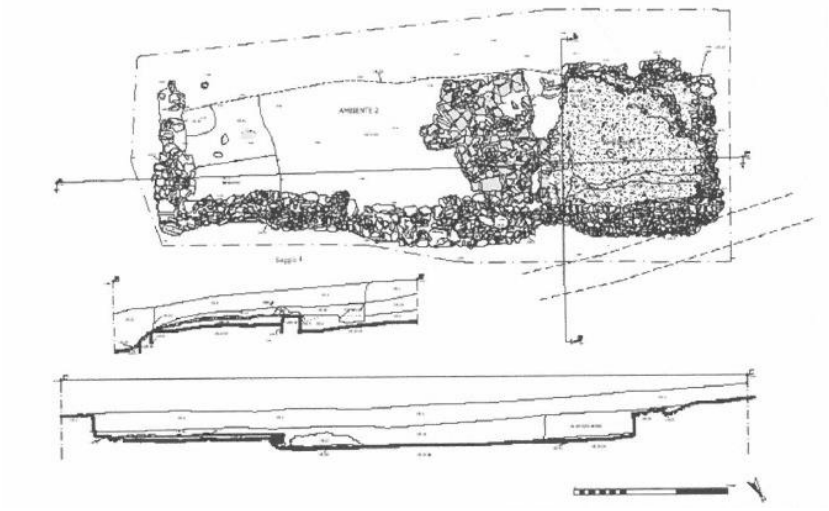


Figure 124 Fontanelle di Monsampolo del Tronto (After Cicala/Speranza 2012, 143, Fig. 2).



Figure 125 Fontanelle di Monsampolo del T. (After Cicala/Speranza 2012, 145, Fig. 3).



Figure 126 Fontanelle di Monsampolo del T. (After Cicala/Speranza 2012, 147, Fig. 4).



Figure 127 Fontanelle di Monsampolo del T. (After Cicala/Speranza 2012, 148, Fig. 5).

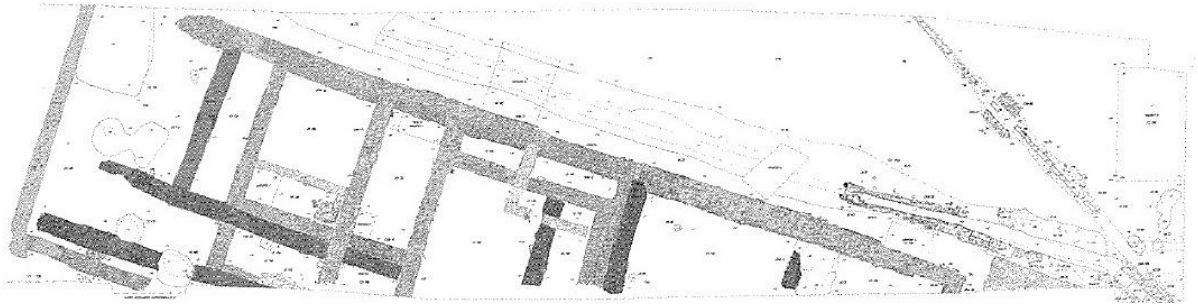


Figure 128 The residential section of the rural complex at Cesano di Senigallia (After Ciuccarelli 2014, 818, Fig. 4).

Part 2 Population

Chapter 3
The urban population

> *"The most obvious difficulty is off course the limited and problematic evidence for the sizes of urban populations, whether these are calculated on the basis of inscriptions recording civic benefactions, the length of the city walls, or the size of the built-up area."*
>
> *(Morley 2011, 145)*

3.1 A very short history of urbanisation in central Adriatic Italy

The appearance of an urban civilisation in the central Adriatic regions of Italy in the course of the Late Republican period was a direct result of Rome's intense military involvement in the area between the end of the 4th century BC and the mid-3rd century BC. Initially, these contacts were established in the form of treaties, first with the native centre of *Camerinum* in 310 BC (*Livy* IX.36) and later with the Picenian population as a whole in 299 BC (*Livy* X.10.12; XI.7.8). In particular the latter partnership – which probably applied to the territory between the rivers Esino and Salinello (*Figure* 129) – was inspired by Rome's desire to find allies in their response to the hostile attitude expressed by the *Praetutti* and the Samnites in the south, and the Celtic people in the north.[1] The fruits of these alliances were harvested in 295 BC, when the Roman army decided the outcome of the Third Samnite War by defeating a coalition of Samnites, Etruscans, Umbrians and their Celtic allies at *Sentinum* (*Figure* 129, n° 12). Another concrete result was the conquest

[1] Laffi 1975; Raggi 2014.

of the territory of the *Praetutti* – i.e. the *Ager Praetutianus* – in 290 BC by Manius Curius Dentatus (*Figure* 129). About a decade later, in 283 BC, these events led to the incorporation of the *Ager Gallicus* – i.e. a territory lying to the north of the river Esino that Rome took from the Celtic *Senones* – into the Roman *ager publicus* (*Figure* 129).[2] Rome's increasing presence in the Adriatic, however, did not bode well with the Picenian people, who ultimately ended their collaboration with an armed rebellion in 269/268 BC; a conflict that was eventually ended in their disadvantage and which resulted in a partial deportation of the Picene population and the full annexation of the *Ager Picenus* into the Roman state.[3] Those who remained were organised into settlements that first had the status of *civitas sine suffragio* (partial Roman citizenship), and later on *civitas pleno iure* (full citizenship).[4] The notable exceptions were the indigenous Italic settlements of *Asculum* and *Ancona*, which acquired the status of *civitas foederata* or federate town (*Figure* 129, n° 13, 33).[5]

In the midst of these tumultuous events, a series of Latin and Roman colonies were founded by the Romans along the central Adriatic coast: *Hatria* (L) and *Sena Gallica* (R) between 290/289 and 285/283 BC (*Figure* 129, n° 37, 9); *Ariminum* (L) more to the north (268 BC); *Castrum Novum* (R) and *Firmum Picenum* (L) around 264 BC (*Figure* 129, n° 35, 30); and finally *Aesis* (R) in 247 BC (*Figure* 129, n° 11).[6] Right from the beginning, this first colonisation wave was accompanied by the distribution of viritane allotments on the confiscated lands; a process that reached a more systematic character around 232 BC with the appliance of the *Lex Flaminia de agro Gallico et Piceno viritim dividendo*.[7] Together with the development of the *Via Flaminia* and its side roads between 223 and 220 BC, these initiatives – named after the tribune Gaius Flaminius – led to a significant reorganisation of the central Adriatic territory. One important consequence was hereby the gradual establishment of a series of *praefecturae* or road stations – often sprouted from pre-existing indigenous settlements, but not necessarily with an urban character – along

[2] Harris 1971; Sisani 2007.

[3] Literary sources that refer to these events are Livy (*Per.* XV); Eutropius (*Eutr.* II, 9); Florus (*Flor.* I, 14); Orosius (*Oros.* IV.4.5-7; and Frontinus (*Str.* I.12. 3); see also Delplace 1993, 4, note 24; regarding the partial deportation of the *Picentes* to the region of Salerno, see Strabo (*Geogr.* 5.4.13); and Pliny (*HN* 3.5.70).

[4] The full citizenship was probably awarded as quickly as 241 BC (Bandelli 2002; Paci 2008c, 423; 2010b, 15-18; and Antolini/Marengo 2010, 209-215).

[5] For discussions, see Laffi 1975; Bandelli 2002; and Giorgi 2005.

[6] For a discussion on the exact foundation dates of these colonies, see Delplace 1993, 11-13; the foundation of *Sena Gallica* is mentioned by Polybius, (*Hist.* II.19.12), who dates the colony to 285/284 BC (Delplace 1993, 4, note 22); the foundation of *Firmum* is recalled in the work of *Velleius Paterculus* (*Vell. Pat.* I.14.8); the foundation of a colony at *Aesis* (modern Jesi) is debated (Mommsen 1860, 332, note 113; Salmon 1955, 66; Hübner 1866; and Bandelli 2002, 35-37).

[7] Moscatelli 1985; Sisani 2007.

these routes, such as *Forum Sempronii*, *Suasa*, *Ostra*, *Sentinum*, *Cingulum*, *Ricina*, *Trea*, *Septempeda*, *Tolentinum*, *Falerio* and *Cupra Montana* (*Figure* 129, n° 6, 8, 10, 12, 15, 20-22, 28, 31, 38) (see *infra*). The Second Punic War (218-201 BC) temporarily halted this process of colonial expansion and territorial development, but after 190 BC three new Roman colonies were founded at *Pisaurum* and *Potentia* (184 BC), and at *Auximum* (174-157/156 BC) (*Figure* 129, n° 1, 19, 14).[8] In the final decades of the 2nd century BC, the territories of *Ancona* and *Auximum* were touched by the Gracchian land reforms (133-123 BC); i.e. a profound reorganisation of the *ager publicus* that is also thought to have led to the foundation of the Roman colony of *Pollentia* (later *Urbs Salvia*) (*Figure* 129, n° 27).[9]

In the wake of the Social War (91-88 BC) – yet another fruitless attempt of the Italian allies to separate themselves from the Roman State – the gradual process of transforming the *praefecturae* into *municipia* – i.e. autonomous administrative towns – was set in motion. The settlements that received the status in the first half of the 1st century BC were governed by a college of four magistrates (*quattorviri*); those that acquired it after the mid-1st century BC had a college of two magistrates (*duoviri*).[10] Based on this distinction, it seems that the towns of *Pitinum Pisaurense*, *Urvinum Mataurense*, *Fanum Fortunae*, *Tuficum*, *Attidium*, and *Camerinum* belong to the first category (*Figure* 129, n° 2, 3, 5, 17, 24, 29); the towns of *Forum Sempronii*, *Suasa*, *Ostra*, *Cupra Montana*, *Planina*, *Cingulum*, *Ricina*, *Trea*, *Matilica*, *Septempeda* and *Cupra Marittima* would belong to the second category (*Figure* 129, n° 6, 8, 10, 38, 16, 15, 20-23, 32). The attribution of municipal status to the towns of *Tifernum Mataurense*, *Sentinum*, *Ancona*, *Asculum* and *Hatria* in the years surrounding the Social War is based on historical grounds (*Figure* 129, n° 4, 12, 13, 33, 37). It is currently not clear when precisely the towns of *Cluana* and *Tolentinum* acquired the status (*Figure* 129, n° 25, 28) (see *infra*).

Of equal importance for the urban development of the central Adriatic area was the fact that from the 1st century BC onwards this process was accompanied by a vast program of veteran resettlement and land distributions. Indeed, the *Liber Coloniarum* informs us about the assignment of veteran allotments in the territories of several *municipia* and older colonies in the area between the second Triumvirate (43-33/32 BC) and the reign of Augustus (27 BC-AD 14): *Sena Gallica*, *Ostra*, *Sentinum*, *Auximum*, *Cingulum*, *Tuficum*, *Potentia*, *Ricina*, *Trea*, *Septempeda*, *Matilica*, *Attidium*, *Pausulae*, *Urbs Salvia*, *Tolentinum*, *Camerinum*, *Cupra Marittima* and *Castrum Truentinum* (*Figure* 129, n° 9, 10, 12, 14, 15, 17, 19-24, 26-29, 32,

[8] For *Potentia* and *Pisaurum*, see Livy XXXIX.44.10; and *Vell. Pat.* I.15.2; for *Auximum*, see again *Vell. Pat.* I.15.3.

[9] For the veteran allotments under the reign of the Gracchi at *Ancona* and *Auximum*, see the *Liber Coloniarum* (*Lib. Colon.* I and II, 227.1-3; 253.1-4); see also Delplace 1993, 162-163. For the possible foundation of the colony of *Pollentia* near the end of the 2nd century BC, see Fabrini 2013b, 198-201.

[10] Moscatelli 1985; Paci 1998a; Sisani 2007; Marengo 2012.

34).[11] In some localities, these operations took on the form of proper colonial (re-)foundations, such as in Ancona, where the placement of veterans from the battle of Filippi was accompanied by the rewarding of colonial status in 42/41 BC. The same goes for the ancient Roman colony of *Pisaurum*, which was now re-founded.[12] The ancient Latin colony of *Firmum* – which in the meantime had become a *municipium* after the Social War – also saw its receiving of veterans from the troops of Anthony reinforced with a colonial deduction in the same period.[13] After 31 BC – or even after 27 BC – colonial deductions probably also occurred at *Fanum Fortunae*, *Falerio* and *Asculum* (*Figure* 129, n° 13, 1, 30, 5, 31, 33).[14]

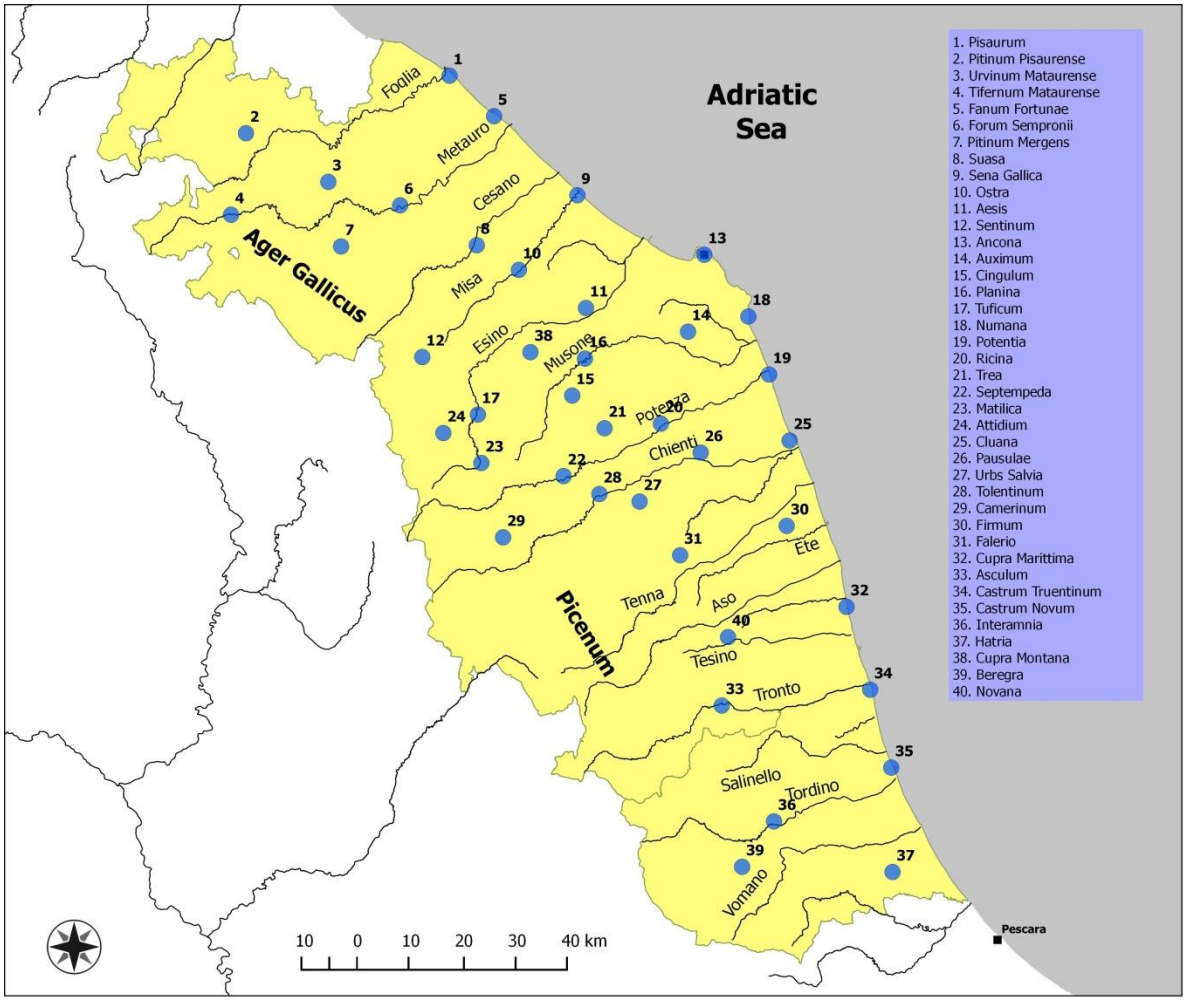


Figure 129 Roman towns in central Adriatic Italy (Map author).

[11] Delplace 1993, 161-167, with references to the *Liber Coloniarum*; see also Paci 1998d.

[12] Gabba 1953; 1973, 459-471; Keppie 1983, 58; Paci 1998d.

[13] For the epigraphic testimony of this colonial foundation, see *CIL* IX, p. 508; see also Polverini 1987, 38.

[14] Paci 1998d, 211, note 7, with references; see also Branchesi 2007. As such, the towns that do not seem to have been involved in this process are: *Cluana, Numana*, *Cupra Montana*, *Novana*, *Planina*, *Forum Sempronii*, *Pitinum Mergens*, *Pitinum Pisaurense*, *Urvinum Mataurense* and *Pitinum Pisaurense*.

To summarise, the urbanisation history of the area may be subdivided into two main phases: a first one from the beginning of the 3rd century until the end of the 2nd century BC; and a second one from the beginning of the 1st century BC until the Age of Augustus. With only five colonies erected in the course of the 3rd century BC and 3-4 colonies in the 2nd century BC, the urban presence in the region was limited and largely confined to the coastal area until the beginning of the 1st century BC, with inland areas remaining almost untouched by the process. Large parts of the territory were only urbanised in the course of the 1st century BC – and in particular from the 40's BC onwards – when all settlements were elevated to municipal status and many of them were the object of veteran allotments. Consequently, with 40 towns in *Picenum* and the *Ager Gallicus*, the central Adriatic region became one of the more urbanised areas of Italy in the Early/High Imperial period.[15]

While the broad lines of this urbanisation process are thus reasonably clear, the question is now how these settlements developed over time in demographic terms. Unfortunately, textual accounts do not provide us with much useful information to this regard. No source, for instance, mentions the actual number of settlers that were sent to the colonies in the area. We know from other foundations in Italy that in the 3rd century BC Latin colonies were generally much larger than Roman colonies – i.e. between 2,500 and 6,000 families for the former against only 300 families for the latter – because of the different reasoning behind their installation.[16] After the Second Punic War, the contrast became less pronounced, with Latin colonies receiving on average 3,000-4,000 settlers and Roman colonies about 2,000.[17] Still, without specific references to the colonies in the central Adriatic region, these general figures do not offer a firm basis for setting-up reliable demographic reconstructions. Neither do the references to the military forces provided by Rome's allies in the area, like *Camerinum*, which was able to furnish a cohort of 600 men during the Second Punic War (*Livy* XXVIII.45) and two cohorts (ca. 1,000-2,000 men) for the battle of Vercellae (101 BC) (Cic. *Balbo* XX.46). While the ability of the allied centre to furnish that many troops may certainly point towards the presence of a noteworthy population – in particular towards the end of the 2nd century BC – it is impossible to know to which extent these people came from the settlement itself, or from the surrounding countryside. Likewise for *Sena Gallica*, whose inability to deliver troops for Rome's second conflict with Carthage in 209 BC (*Livy* XXVII.38.3-7) may certainly hint at a low population level, but not much more.

In his study on the economy of the Roman Empire, Richard Duncan-Jones has tried to estimate the population of some Italian towns by using epigraphic evidence for large-

[15] 3.5 towns per 1000 sq. Km in *Picenum* and 4.9 towns per 1000 sq. Km in the *Ager Gallicus* (Jongman 1988, 70, Table 1, after Duncan-Jones 1982, 337 ff.).

[16] Salmon 1969, 70-72; Delplace 1993, 13; Rosenstein 2012.

[17] Pelgrom 2013, 73-84, notes 11 to 14, with references to the examples mentioned by Livy.

scale gifts or distributions. Two of his case studies concerned the towns of *Pisaurum* and *Sentinum*. This is not the place to discuss the details of Duncan-Jones' calculated population figures. It suffices to say that on the basis of the available evidence he estimated a free population of 9,800-18,550 people – or a total population of 12,600-23,800 people – for *Pisaurum* in AD 120/180; for *Sentinum* his calculations resulted in a free population of 2,725-5,550 people, or a total population of 3,500-7,200 people, in AD 88/96. For both towns, Duncan-Jones used the lower figure for the actual urban centre, while the higher figures were considered referring to the population as a whole; that is with the inclusion of the surrounding territory.[18] Again, such calculations may offer valuable order of magnitudes in the specific cases of *Pisaurum* and *Sentinum*, but offer little ground for calculating overall urban population figures in Late Republican and Early/High Imperial times.

Therefore, I will focus my efforts here on the archaeological data regarding the physical extent and the internal plan of the towns in the area. This is by no means a flawless category of evidence to rely on, but in my opinion it nevertheless offers the best structure for establishing a workable urban demographic model for the central Adriatic region. First, I will discuss the main factors that influence the population density of a Roman town and touch upon some issues that tend to complicate our calculations. Next, all 40 Roman towns that lie within the study area are systematically reviewed in the form of a gazetteer. For each town, information is assembled on the extent of the urban surface, the share of public and commercial space, the size and nature of private architecture, and the dimensions of the *insulae* and the street grid. Where available, evidence is gathered for the potential existence of suburban quarters. Any possible data on the evolution of each of these elements through time is also recorded. When useful, the archaeological evidence is complemented with literary and epigraphic sources. For each town, the most important quantitative data on town area, suburbs, public and private architecture are collected within a summarising chart. The public elements that are to be included in this chart are mostly voluminous constructions, like the circuit wall (), the *forum* square ( ), the theatre (), the amphitheatre (), the public bath complex (), the temples ( ), the basilica ( ), the *macellum* (), and the cisterns (). Buildings with a likely public nature, but whose function could not be determined, are indicated by **UI** (unidentified). Regarding private housing (DA = domestic architecture), a distinction will be made between ***domus*** complexes and multi-storey buildings (**MS**). Where possible, the nature and size of extramural buildings (**EA** = extramural architecture) are also mentioned. The presence or absence of each of these features within the urban area is indicated with a simple **y/n** (yes/no); all measurements are expressed in square meters.

[18] Duncan-Jones 1982, 268-269, 273, Table 7.

Finally, each town is provided with a short bibliographical section, mentioning the most important titles.

The patterns that emerge from this gazetteer are discussed in a following section. This is first done for the public space, and then for the private space. Based on these analyses, the urban demographic model is set-up in a final section. A concluding section will summarize the main results of this chapter and discuss these findings in relation to the amphora- and press patterns constructed in the first two chapters of this thesis.

3.2 Calculating the population of a Roman town

Putting an approximate figure on the population of a town at any moment in its occupation history on the basis of the available archaeological evidence – let alone sketching its demographic evolution over time – is a highly problematic issue. A first and often encountered problem is assessing the precise extent of a particular town area. The best way to approximate the urban surface from the archaeological evidence is to calculate the area delimited by the town walls. However, not every town was necessarily provided with such a circuit wall, as sometimes the natural barriers of a site were considered sufficient for defending the settlement. It goes without saying that in the latter case such natural limits may offer some guidance, but these cannot be considered absolute limits. Furthermore, the walled area did not necessarily have to coincide with the actual inhabited area, as it was possible that the enclosed zone was not completely built-up, or that suburbs gradually developed because of a lack of space within the original enclosure. In addition, the amount of archaeological evidence available to use is often insufficient for accurately tracing the entire course of the circuit wall, or for establishing the extension of the built-up area. The location of extramural cemeteries and suburban rural villas may provide some indication, but generally only allow for estimating the limits of a town with a large margin of error. Be that as it may, the first step in any urban demographic reconstruction is always to acquire as much archaeological data as possible on the physical extent of the Roman towns you are targeting.

Next, in order to calculate the number of residents that occupied the deduced urban area in Roman times, the town area needs to be multiplied with an average number of people per urban hectare. Needless to say, however, there is no such thing as a standard population density – or a fixed growth/decrease rate for that matter – for Roman towns in Italy. This is mainly because a number of variables influence the amount of people that could be fitted within a certain urban area. First and foremost, the number of persons per urban hectare could vary considerably because of differences in the private architectural

make-up of the town, like variations in the type of housing and the use or otherwise of one or multiple upper storeys. For instance, the notable differences between the population densities proposed for towns like *Cosa* (105-125/ha) and *Pompeii* (106-303) and cities such as *Ostia* (290-840) and *Rome* (580-730) can mainly be explained by the dominance of *domus*-type buildings – with either only a ground floor (*Cosa*) or sometimes also an upper floor (*Pompeii*) – in the former towns and the frequent use of multi-storey *insulae* in the latter. Indeed, a total of 24 larger (ca. 660 m²) and 224 smaller houses – which were approximately half the size of the larger ones – were documented for *Cosa* in the Late Republican period. Assuming a family unit of 10-12 persons for the former houses and a unit of 5-6 persons for the latter, the population of the ca. 13 ha large town has proposed to have been in the range of 1,360-1,632 people; i.e. ca. 105-125 persons per ha.[19] Over the years, many scholars have also made estimates for the population of *Pompeii* in the 1st century AD by extrapolating the number of excavated rooms/houses to the total town area (ca. 66 ha). The most famous of these reconstructions is the one carried out by Wallace-Hadrill, who estimated a population of ca. 10,000 people (151 p/ha) for the Campanian town.[20] Other estimates range from 12,000 (181 p/ha) to 20,000 (303 p/ha).[21] It is clear that the main factor influencing the lower and the higher estimates is the inclusion or otherwise of upper storeys in the houses.[22] On the other hand, common population estimates for *Ostia* – with a walled area of ca. 69 ha, i.e. about the same size as *Pompeii* – range from 20,000 to 58,000 people.[23] The considerable higher derived population densities for the Roman harbour town – i.e. between 290 and 840 p/ha – find their explanation in the fact that the people of *Ostia* were mainly housed in residential buildings that had an average height between 2.5 and 4 storeys.[24] The same goes for Rome itself, whose population in Imperial times has been estimated as high as 800,000 or 1 million inhabitants.[25] With an urban area of ca. 1,386 ha enclosed by the Aurelian walls,

[19] Fentress et al. 2003, 25; see also De Ligt 2008: 2012; and De Graaf 2012.

[20] Wallace-Hadrill 1991, 109-203; 1994.

[21] For the lowest estimate, see Fiorelli 1873; for slightly higher estimates ranging from 15,000 to 18,000 persons (227-272 p/ha), see Beloch 1898, 273-274; estimates between 18,000 and 20,000 (272-303 p/ha) are given by Nissen 1877. A figure between 10,000 and 12,000 is now thought to be the most accurate (Storey 1997).

[22] Wallace-Hadrill 1994, 96; Lazer 2009, 74.

[23] The lowest figure is provided by Nibby 1829, 61 (20,000 inhabitants or 290 p/ha); substantially higher figures are offered in Calza 1926, 16 (36,000 people or 521 p/ha) and in Meiggs 1960; 1973, 532-534, 597-598 (a maximum of 58,000 inhabitants or 840 p/ha). Based on the analysis of the different residential units, Packer 1971 estimates the population at a maximum of 27,000 inhabitants (391 p/ha) (Storey 1997).

[24] Duncan-Jones 1982, 276-277; De Ligt 2008, 149; 2012, 219.

[25] These are the figures we can find for the population of the town in Brunt 1971, 376-388; Hopkins 1978, 96-98; Stambaugh 1988, 90; Bairoch 1989, 259; Robinson 1992; and Lo Cascio 1999, 165. A considerably lower estimate of less than 500,000 people has been offered by J. Carcopino (Carcopino 1940); a figure that also seems to be suggested in Storey 1997.

such a population would have implied densities between 570 and 720 p/ha.[26] Again, these proportionally high densities can be connected with the presence of multi-storey buildings in the city from Republican times onwards.[27] As such, it is important to understand whether the central Adriatic towns rather resembled towns as *Cosa* and *Pompeii* in their private architectural lay-out, instead of cities such as *Ostia* and Rome. In other words, we need to assemble as much information as possible on the nature of the residential units in these towns.

A second parameter that influenced the overall population density of a Roman town was the effective amount of space that was available for private housing. Indeed, the size of the residential area was affected by the extent of the areas reserved for other constructions, such as public, administrative, religious and commercial buildings.[28] It is unlikely that Roman towns knew a strict zoning system – i.e. a system in which buildings with similar functions are deliberately grouped together in certain urban districts – and most sectors will have commonly accommodated a mixture of living quarters, shops, taverns, workshops and leisure facilities.[29] Still, the main area for public architecture was certainly the central *forum* and its immediate surroundings, occupied by large buildings such as porticoed *tabernae*, temples, the basilica and the *macellum*. The public bath complex too was usually situated not far from the central square. Other voluminous constructions were the theatre and the amphitheatre. The position of these spectacle buildings within the urban area could vary according to the morphology of the terrain and the availability of ample space. This is why it was not uncommon for the latter building to be situated outside the town walls, but when possible it could also be inserted within the main urban zone.

While none of these structures will have had standardised dimensions – and thus the proportional share of public buildings will have differed slightly from one town to the other – a recent study by Marta Conventi on the organisation of urban space in some 40 Roman towns in Italy has yielded some interesting results regarding the percentage of space that each of these structures could take up within the town. The *forum* square, for instance, could take up a minimum of 0.8 % and a maximum of 5.84 %, while it occupied on average 2.47 % of the total urban area. Moreover, most of the smaller towns – i.e. the ones below 40 hectares – seemed to have had a proportionally large *forum*, covering

[26] Or between 440 and 560 p/ha if the suburbs outside the Aurelian walls are included, according to De Ligt 2008, 149.

[27] The presence of such buildings can also be assumed from some of our literary sources (Yavetz 1958; 506-507, referring to Livy XXI.62.3, Strabo 5.3.7, and Suet. Aug. 89). For the archaeological evidence, see Wallace-Hadrill 2000, 204-208; see also De Ligt 2012, 219.

[28] Wilson 2011, 171; De Ligt 2012, 213.

[29] Paoli 1963, 5-35; Laurence 1995; Storey 1997.

usually about 2 % of the urban space, but occasionally also 4% or higher.[30] Based on the same study, it seems that the basilica on average occupied about 0.53%, while it never took up less than 0.18% or more than 0.93%. The theatre and the amphitheatre could take up between 0.14% and 1.95%, and between 1.18% and 2.57% respectively. On average, the former occupied about 0.74%, while the medium figure for the latter was 1.85%.[31] This means that, on the whole, these structures combined could take up as less as 2.3 % and as much as 11.29 % of the total town area, with an average overall occupation ratio of 5.59 %. Regarding their variable impact on the overall population density figure of a town, the cases of *Cosa* in Italy and *Sabratha* in *Tripolitania* may be considered exemplary. Indeed, in the case of *Cosa*, the aforementioned density of 105-125 persons per ha referred to the entire urban area – i.e. including the areas reserved for public and commercial activities – while the adjusted figure for the available private space only would be rather 130-155 p/ha, i.e. approximately 25% higher. Then again, for *Sabratha*, Andrew Wilson calculated the density of the residential part of the town – which had a total town size of ca. 34.6 ha and a total estimated population of 5,730-14,326 people – between 182 and 457 persons per ha. By extracting the space taken up by the public architecture of the town – i.e. approximately 3.26 ha or 9.4 % of the urban area – a slightly lower overall density figure between 165 and 415 p/ha (ca. 9 % lower) was obtained.[32] These examples illustrate well that it is equally important to assess as precise as possible the portion of the town area occupied by non-residential buildings.

Two final variables that impacted the amount of buildings that could be fitted within a certain town area *tout court* were the proportion of the street grid, and the extent of the space left open for the insertion of minor squares or gardens.[33] For instance, a lower estimate of ca. 8,000 people (121 p/ha) proposed by H. Eschebach for the population of *Pompeii* was inspired by the excavations of W.F. Jashemski within the town, which had indicated the notable presence of intramural areas under cultivation.[34] With regard to the former variable, the possible impact of the street grid was determined by both the individual width of the streets as the total number of streets within the urban area. Indeed, it stands to reason that wider roads took up more space of the urban surface than narrower roads.[35] We may also assume that towns organised according to a subdivision in

[30] Conventi 2004, 159-165.

[31] Conventi 2004, 172-191.

[32] For *Cosa*, see De Ligt 2008, 149; 2012; for Sabratha, see Wilson 2011, 172-174.

[33] Chevalier 1983, 103; Conventi 2004, 166.

[34] Eschebach 1970, 60; see also Wallace-Hadrill 1994, 96. A similarly low figure of 7,000-7,500 people (106-113 p/ha) was also proposed by J.C. Russell (Russell 1977).

[35] Again, the varying dimensions of these streets may be illustrated by the aforementioned study by Marta Conventi, who registered road widths between 3.1 m and 12 m for the *decumanus maximus*, and between 3.5 m and 10 m for the *cardo maximus*. Secondary streets, on the other hand, had smaller widths between 2.4 m and 6.5 m. The respective average widths were 6.37 m, 7.31 m and 4.44 m (Conventi 2004, 237).

larger *insulae* had a lower number of streets than towns subdivided into smaller *insulae*. Even if in most cases it is unlikely that we will acquire detailed and complete information on these two parameters through archaeology, any available data might still be worthwhile in order to rightly inform our demographic reconstructions.

We must also take into consideration that all of these factors could change over time, influencing as such the existing population density of a town. For instance, in the case of walled towns, it is unlikely that the town area was completely built-up from the beginning. More likely, they became crowded more gradually; in which case suburbs began to develop only after the space between the walls was completely built-up. Such a scenario may imply lower densities in the initial years of the town's existence and higher densities in later years.[36] Population densities could also change because new and mostly smaller houses were gradually fitted in between older and larger ones, or because older and smaller houses were incorporated into new and larger ones. Another possible evolution was that it became more common to build houses with one or more storeys, instead of houses only provided with a ground floor. The number of people that could live in a certain town area could also be affected by proportional changes in the organisation of the urban space through time. Indeed, residential areas could be turned into administrative, religious or commercial areas – or vice versa – while processes of monumentalisation and/or restructuration could increase or decrease the amount of space used for public architecture within a town over time. The same goes for the lay-out of the *insulae* and the streets, which may be adapted according to the newly created circumstances. This means that we need to gather as much data as possible on these processes in order to inform our urban demographic reconstructions over time.

Finally, the extent to which information can be collected on these determinant factors depends primarily on how these towns have survived in the archaeological record, together with the amount of attention that they have received over the years. Towns like *Rome*, *Cosa*, *Pompeii* and *Ostia* have all been studied intensively over a long period of time and especially in the case of the latter two towns archaeological research has been able to detect their vestiges rather well thanks to an exceptional state of preservation. The situation for the study area, however, is radically different and poses some significant problems. Occasionally, so little has remained of these towns – or has been recorded over the years – that we cannot say much more than their possible location in the landscape. This is currently the case for the towns of *Beregra* (39) and *Novana* (40), whose exact locations still have to be identified. Hence, the topography of these towns is virtually unknown to us. In other cases, when we do know the locations of the ancient towns, the sites have only been touched marginally by modern archaeological research and almost nothing can be said about their extent, internal lay-out or even their wider structuring.

[36] De Ligt 2008, 147; De Ligt 2012.

This is the situation we encounter in particular for the towns of *Pitinum Mergens* (7), *Planina* (16), *Tuficum* (17), *Numana* (18), *Attidium* (24), *Cluana* (25), *Pausulae* (26), *Castrum Novum* (35) and *Cupra Montana* (38). Even when we have somewhat more information – which is the case for towns like *Pitinum Pisaurense* (2), *Cupra Maritima* (32) and *Castrum Truentinum* (34) – our knowledge of the sites is fragmentary at best.

Furthermore, most of the Roman towns in the Marche and northern Abruzzo developed on hilltops or other strategic points along the coast and rivers that continued to be occupied in post-antique times. As such, these towns now lay completely – or at least in part – under their medieval and modern counterparts. Examples include the towns of *Pisaurum*-Pesaro (1), *Urvinum Mataurense*-Urbino (3), *Fanum Fortunae*-Fano (5), *Sena Gallica*-Senigallia (9), *Aesis*-Jesi (11), *Ancona* (13), *Auximum*-Osimo (14), *Cingulum*-Cingoli (15), *Matilica*-Matelica (23), *Tolentinum*-Tolentino (28), *Camerinum*-Camerino (29), *Firmum Picenum*-Fermo (30), *Falerio*-Piano di Falerone (31), *Asculum*-Ascoli Piceno (33), *Interamnia Praetuttiorum*-Teramo (36), and *Hatria*-Atri (37). It goes without saying that also here the reconstruction of their original town plans remains problematic in many ways. Most of the time, the lay-out of the Roman town can only be reconstructed in part by searching for analogies in the medieval and modern town plan. The information on public and private architecture is also mostly fragmentary, with the position of the different public and residential spaces often being unclear, or structural remains being limited to partial plans consisting of wall transects and floor pavements.

Our best evidence undoubtedly needs to come from the town areas that were gradually abandoned in post-Roman times and subsequently remained free – either in their totality or at least in part – from more recent constructions. The towns that fall under this category are *Tifernum Mataurense* (4), *Forum Sempronii* (6), *Suasa* (8), *Ostra* (10), *Sentinum* (12), *Potentia* (19), *Ricina* (20), *Trea* (21), *Septempeda* (22), and *Pollentia-Urbs Salvia* (27). While not all of these towns have been studied with the same intensity – or show their traces with the same clarity – most of them offer enough archaeological information and have received sufficient scientific attention in the last two decades in order to serve as the backbone for our demographic reconstructions. The town areas in particular of *Suasa*, *Sentinum*, *Potentia*, *Trea* and *Ostra* will be helpful for this purpose, as these have been the subject of intensive geo-archaeological research by teams from the Universities of Bologna, Ghent, Urbino and Genova.

3.3 Gazetteer of towns

3.3.1 *Pisaurum* (Pesaro)

The Roman colony of *Pisaurum* was founded together with the more southern colony of *Potentia* in 184 BC (see *infra*). Contrary to the latter town, the former remained occupied in later times and is now completely covered by the modern town of Pesaro (*Figure* 129, n° 1). Logically, this situation hinders our understanding of the ancient urban topography and its evolution over time. Fortunately, thanks to numerous excavations in the historical town centre, Pesaro still offers some useful information. The findings of rudimentary structures and impasto ware, for instance, in the Via Galligarie have made it clear that the site was occupied in pre-Roman times.[37] With the arrival of the Romans in 184 BC, a fortified settlement was created with a circuit wall in *opus quadratum* that enclosed an area of ca. 18.9 hectare *intra-muros*.[38] On top of the *opus quadratum* wall, the remains of a more recent circuit wall in *opus latericium* have been attested in several locations. The dating of the latter wall is not certain, but could either go back to the reigns of the Triumvirate and Augustus – a period in which *Pisaurum* underwent two colonial re-foundations – or to the 3rd century AD, when the town needed to defend itself against the first barbarian invasions.[39] Leaving aside the dating of the second town wall, a rough reconstruction of the town plan is possible on the basis of the excavation results. It seems that *Pisaurum* was regularly subdivided into a series of 35 *insulae*. Eighteen out of these 35 *insulae* measured ca. 2x2 *actus* (ca. 70x70 m) and formed the central portion of the town. The southern part was organised into six *insulae* of ca. 2.x2.5 *actus* (ca. 70x88m) and one *insula* of ca. 1x2.5 *actus* (ca. 35x88 m), while the northern part contained a series of seven irregularly shaped *insulae*. Finally, the eastern section of the town was filled-up by three *insulae* of ca.2x1 *actus* (70x35 m) (*Figure* 130).[40] On the whole, these *insulae* took up an area of ca. 170,800 m² or 17.1 hectare; i.e. 90.3 % of the town area. The *insulae* were separated by each other by a series of four *decumani* and seven *cardines*. Each *decumanus* was about 496 m long and between three and four meters wide, taking-up some 7,936 m² of space.[41]

[37] Di Cocco 2004b, 89.

[38] A size of 193,000 m² is mentioned in Moscatelli 1988, 23. Walls made in *opus quadratum* are a feature typical for the oldest circuit walls of Roman towns in the area, such as is the case for *Potentia*, *Asculum*, *Septempeda*, *Ancona*, *Auximum*, *Firmum Picenum*, *Urvinum Mataurense*, *Hatria*, and possibly also *Sentinum* and *Aesis* (see *infra*).

[39] For the first hypothesis, see Annibaldi 1965, 52; for the second one, see Luni 1984, 122.

[40] A previous – less detailed – reconstruction of the town plan supposed an internal division according to 2x3 *actus* (Agnati 199b, 118).

[41] The width of the *decumani* has been attested archaeologically (Di Cocco 2004a, 47-49).

The length of the *cardines* varied between ca. 355 and 387 m and together they took up another 10,364 m² of space.[42] As such, the street grid occupied an area of ca. 18,300 m² (1.8 ha); i.e. 9.7 % of the total urban area.

Unfortunately, establishing the position and the share of the public buildings within the town is highly problematic. The *forum* has not been ascertained archaeologically, but it almost certainly coincides with the current Piazza del Popolo, an area measuring ca. 75x50 m (ca. 3,750 m²) (*Figure* 130, n° 30, 31).[43] It is obvious that there must have been several temples in the town, but not much can be said about their position or size. According to a famous passage by Livy (XLI. 27), the town must have been provided with a temple dedicated to the god Jupiter from the beginning of its foundation. Other cult places – like for instance an *Augusteum* – are attested epigraphically, but have not yet been identified archaeologically. [44]Also, both a theatre and an amphitheatre were probably erected in the Augustan period or in the 1st century AD, but their locations remain hypothetical.[45] The same goes for the thermal complexes of the town, whose existence in both the Late Republican and the Early/High Imperial (1st century BC – 1st/2nd century AD) period can only be derived from literary and epigraphic sources.[46]

There is more information for the nature and the evolution of private urban architecture. One of the best documented examples is the *domus* found in Piazza Matteotti between 1999 and 2000 (*Figure* 130, n° 56). Here, excavations revealed the partial plan of a large and richly decorated *domus* with at least 19 rooms organised around a central courtyard.[47] The building measured ca. 25x25 m (ca. 625 m²), but the complex extended almost certainly over a somewhat larger area.[48] It is interesting to note that the house seems to have been constructed *ex-novo* at the beginning of the 1st century AD in a previously unoccupied area close to the south-eastern corner of the circuit wall. Further alterations and extensions were realised in the course of the same century. In the late antique period, the large house was again subdivided into smaller units.[49] The excavations also yielded the remains of a second *domus*, but both its extension and organisation are unclear for the moment. It is clear, however, that the area was used as a cemetery in the

[42] The excavations have not been able to determine the exact width of the *cardines*, but I have taken here the 4m figure of the *decumani* (Di Cocco 2004a, 49-52).

[43] Ciampichetti/Trebbi 1984, 290-301; Di Cocco 2004a, 54-55.

[44] Di Cocco 2004a, 55-56.

[45] Gladiator games are recorded epigraphically (*CIL* XI, 6377; 6357) (Di Cocco 2004a, 56-58).

[46] Di Cocco 2004a, 58-60.

[47] Destro/Fiori/Giorgi 2004, 141-146.

[48] Remains pertaining to an Imperial *domus* complex were also uncovered nearby, in the Via Don Minzoni (*Figure* 130, n° 57) (Di Cocco 2004c, 146).

[49] Di Cocco 2004b, 108; Destro/Fiori/Giorgi 2004, 144-145.

late antique period.[50] Another *domus* that was also only erected in the Early/High Imperial period (1st-2nd century AD) has been identified under the Palazzo della Provincia, once again in a more peripheral *insula* of the Roman town; close to the southern section of the circuit wall (*Figure* 130, n° 49). Two adjacent rooms with frescoed walls and floors paved with mosaics were found over an area of ca. 24 m², but occasional structural finds in the immediate vicinity hint at the existence of a much larger complex.[51] A third excavation in the southern town area, in the current Via Diaz, uncovered some rooms and part of a courtyard that belonged to a probable *domus* dating again to the 1st-2nd century AD (*Figure* 130, n° 48). The explored area measured ca. 6x9 m (54 m²), but the precise extension of the building is unclear.[52]

A small excavation in the fall of 2000 in the Via Mazzolari (Palazzo Leonardi) – this time in the northern border area of the Roman town – unearthed a part (ca. 110 m²) of another rich *domus* complex (*Figure* 130, n° 15). Its extension could not be determined, but further excavations between 1999 and 2001 under the nearby Palazzo Toschi (again in Via Mazzolari) uncovered wall sections and pavements that may belong to the same residential unit. This would imply the presence of a *domus* measuring possibly 40x25 m (1,000 m²). The original nucleus of the building dates back to the Late Republican period, but significant restructuration works and enlargements occurred around the mid-1st century AD. Further internal modifications were applied between the 2nd and the 3rd century AD.[53] Finally, the remains of a large residential/artisanal complex were excavated between 1999 and 2005 in the Via dell'Abbondanza, located in the north-eastern corner of the Roman town (*Figure* 130, n° 16). On the whole, the complex measured at least ca. 35x25 m (875 m²). The first phase of the building consisted of a series of rooms organised around a central courtyard and goes back to the Late Republican period or the end of the 1st century BC. In the High Imperial period – probably from the mid-1st century BC onwards – further internal subdivisions were applied. The complex was gradually abandoned from the 3rd century AD onwards and was finally replaced by a cemetery in the 5th century AD.[54]

The cases of the *domus* complexes of Piazza Matteotti, Palazzo della Provincia and Via Diaz are particularly interesting, as they suggest that the southern sections of the town only became fully inhabited at the beginning of the Early Imperial period. Indeed, if we

[50] Destro/Fiori/Giorgi 2004, 145. A 26 m long section of a paved street with a total width of 4.16 m was also found next to the *domus* (Baldelli et al. 2005, 164).

[51] Baldelli/Lani/Valli 2004, 137-141; Baldelli et al. 2005, 169-172. The presence of a residential complex in this area was known since the 1930's (Di Cocco 2004b, 105).

[52] Di Cocco 2004d, 135-137.

[53] Baldelli/Lani/Tassinari 2004, 119-122; Baldelli et al. 2005, 172-175.

[54] Baldelli/Tassinari 2004; Di Cocco 2004b, 105.

take into consideration all archaeological finds in the town area, an almost total lack of Republican finds may be noticed in the entire southern block of *Pisaurum*; a phenomenon that contrasts with the central section of the settlement (*Figure* 131). This difference might imply that the original inhabited area of the Republican town was somewhat smaller – perhaps ca. 15.5 hectare – and that a significant part of the urban area was still unoccupied at the time. If true, the phenomenon if filling-up this area in the Early Imperial period can almost certainly be brought in relation with the placement of numerous veterans during the last decades of the 1st century BC, when *Pisaurum* – just like *Asculum* and *Sena Gallica* (see *infra*) – underwent two colonial deductions.[55] Furthermore, the findings of mosaic floors and structures outside the walled urban area – between the northern circuit wall and the Roman harbour – point towards a noteworthy extramural expansion of the inhabited area in northern direction in this period, or even somewhat earlier at the end of the Late Republican period.[56] Other finds of mosaic floors dated to the High Imperial period (first and second half of the 2nd century AD) hint at the further development of this suburban quarter between the 1st and 3rd century AD.[57] Four epigraphic documents from the 2nd century AD mention the presence of a *vicus* outside *Pisaurum*, but it is not certain whether or not these refer to the attested suburban remains.[58] Anyway, the changed river course of the Foglia – especially in the Imperial period – must certainly have left the area open for considerable extra-urban expansion.[59]

N° 1	Public architecture							DA	EA
Type								Domus	
y/n	x	x	x	\	\	x	\	x	x
m²	189,000	3,750	\	\	\	\	\	625; 875; 1,000	\

Bibliography: Annibaldi 1965; Luni 1984; Sommella 1988; Agnati 1999; Destro/Fiori/Giorgi 2004; Di Cocco 2004a; 2004b; 2004c; 2004d; Baldelli/Lani/Tassinari 2004; Baldelli/Lani/Valli 2004; Baldelli/Tassinari 2004; Baldelli/Dall'Aglio et al. 2005; Baldelli/Lani et al. 2005; Campagnoli et al. 2005

[55] Paci 2008c, 390.

[56] Di Cocco 2004a, 61-62; Campagnoli et al. 2005, 72.

[57] Luni 1984, 131.

[58] Campagnoli 1999, 51-53.

[59] Campagnoli et al. 2005, 74-75.

3.3.2 *Pitinum Pisaurense* (Pieve di San Cassiano in Pitino)

The Roman town of *Pitinum Pisaurense* has been located in the area around the Pieve di San Cassiano in Pitino (Macerata Feltria), where it occupied a large terrace of ca. five hectares at the joining of the Apsa stream and the Fosso di Cacciarvello (*Figure* 129, n° 2).[60] Various vernice nera fragments attest the occupation of the site in the 3rd-2nd century BC. The settlement received municipal status in 90 BC through the *lex Iulia de civitate*.[61] Our knowledge of the site is fragmentary in all senses. The only notable archaeological remains of the Roman town consist of a section of a paved Roman road – probably to be identified with the *decumanus maximus* – a thermal complex with building phases between the Late Republican and High Imperial period, and the remains of an unidentified public building under the floor pavement of the Pieve (*Figure* 132).[62] The existence of numerous public features – like a temple for the god Saturn and a statue for the goddess Fortuna – is attested through epigraphy.[63] The traces of a probable *domus* have been registered by means of aerial photography in 2004.[64] The Roman cemetery has been identified at the opposite side of the Apsa stream.[65]

N° 2	Public architecture							DA	EA
Type								Domus	Tombs
y/n	\	\	\	\	x	x	\	x	x
m²	50,000	\	\	\	\	\	\	\	\

Bibliography: Virzì 1991b; Agnati 1999g; Monacchi 1999; 2009; Dall'Aglio/Campagnoli 2002

[60] Agnati 1999g, 594.

[61] The status of *municipium* is attested by the presence of *quattorviri* (Monacchi 2009, 223).

[62] The road section had a width of ca. 4 m and was flanked by a wall section in opus vittatum, probably dating to the mid—Imperial period (Agnati 1999g, 598). The first phase of the thermal building dates back to the 2nd-1st century BC. This is probably the complex mentioned in *CIL* XI, 6040, attesting the restauration and the embellishment of the building in the Imperial period (Agnati 1999g, 594-595; Monacchi 1999; 2009, 223; Dall'Aglio/Campagnoli 2002, 60-64). The building under the Pieve with walls in *opus vittatum mixtum* may be identified as a temple (Agnati 1999g, 597-598; Monacchi 2009).

[63] For the temple dedicated to Saturn, see *CIL* XI, 6027 and 6047 (Agnati 1999g, 597; Monacchi 2009, 223).

[64] Monacchi 2009, 224-226, figs. 3 -7.

[65] Monacchi 2009, 221.

3.3.3 *Urvinum Mataurense* (Urbino)

The Roman town of *Urvinum Mataurense* was built on the 'Poggio', a hilly terrace situated on the eastern flank of the Apennines between the rivers Metauro and Foglia (*Figure* 129, n° 3). Precisely because of its strong strategic and defensive qualities, the site was frequented from prehistoric times onwards.[66] Indeed, the existence of a respectable pre-Roman settlement is attested through the remains of a protohistoric hut in the vicinity of one of the town gates of Urbino (loc. Casa Volponi) and the finding of numerous ceramic fragments datable to the Middle and Late Iron Age (6th-4th century BC) in various locations across the hilltop.[67] However, it seems that the site only acquired a more permanent and proper urban character with the installation of a fortified *oppidum* by the Romans in the 3rd-2nd century BC. The most conspicuous testimony of this phase of the settlement is the *opus quadratum* circuit wall erected in the second half of the 3rd century BC. Due to the use of different building techniques in various sections of the wall, their precise development is not clear, but it is possible that the Poggio was not completely enwalled from the beginning, or that a first circuit wall was succeeded by a second, wider enclosure in the course of the Late Republican period or in Augustan times.[68] Anyway, these walls enclosed an area of ca. eight to nine hectares that was quickly built-up in the following two centuries. Indeed, between the beginning of the 2nd century BC and the age of Augustus, the town area became completely occupied with public and private buildings, as attested by the remains of wall structures and mosaic and/or cocciopesto pavements belonging to *domus* complexes, baths, a cistern and a theatre. The construction of the theatre dates back to the first half of the 1st century AD – perhaps to the Augustan period – and occupied a space of ca. 75x50 m (3,750 m²) within the walled area (*Figure* 134, A).[69] A cistern was built in the Early Imperial period on the highest point of the Poggio and covered an area of ca. 29.7x26.7 m (ca. 800 m²) (*Figure* 135, B). Its floors were paved in *opus spicatum*, while the walls were made out of *opus caementicium*, covered with a layer of cocciopesto; the internal columns of the complex were made in *opus latericium*. The cistern could contain some 3,000 cubic meters of water.[70] The *forum* has not yet been identified, but it has been hypothesised under the actual Piazza Duca Federico, where according to the presumed town plan the *decumanus maximus* (Torricini – Via

[66] Agnati 1999a, 20.

[67] Said ceramic fragments consist mainly of impasto and campana ware (Luni 1993, 34, note 3 with references; Agnati 1999a, 23).

[68] Agnati 1999a, 26-29.

[69] Luni 1977; Agnati 1999a, 29-30.

[70] Luni 1993, 38-44; Agnati 1999a, 30.

Veterani) and the *cardo maximus* (Via Saffi-Puccinotti-Veneto) crossed (*Figure* 134 and 135).[71]

Recent archaeological finds have made it clear that already in Late Republican times the town seems to have expanded its habitation outside the original walled area. Indeed, from the second half of the 1st century BC onwards – probably coinciding with the receiving of municipal status – a new quarter developed to the north of the town on a plateau named 'Pian del Mercato' in medieval times (*Figure* 134; and 135).[72] In order to provide these new suburban quarters with water, a new cistern was built in the outside the walled area measuring ca. 36x21 m (ca. 750 m²), now located under the church of S. Giorgio (*Figure* 134, G; and 135, G).[73] The birth and the further development of these suburban quarters – which may have housed a new public area – in the course of the Early and High Imperial period have been brought in connection with the monumentalisation of the town centre from Augustan times onwards; an evolution best illustrated by the construction of the theatre and the monumental cistern within the walled nucleus on the Poggio (see *supra*).[74] Numerous inscriptions further attest the vitality of the town in the 1st-2nd century AD.[75]

N° 3	Public architecture								DA	EA
Type									Domus	Cistern
y/n	x	x	x	\	x	\	\	x	x	x
m²	80,000	\	3,750	\	\	\	\	800	\	750

Bibliography: Luni 1977; 1982; 1985; 1993; Agnati 1999a; Perna 2013a

3.3.4 *Tifernum Mataurense* (Sant'Angelo in Vado)

The Roman *municipium* of *Tifernum Mataurense* has been identified on the site of the modern centre of Sant'Angelo in Vado, a little town positioned on a large fluvial terrace in the upper Metauro valley (*Figure* 129, n° 4). The area was occupied by a small

[71] The finding of some honorary inscriptions in the area seems to confirm this hypothesis (Luni 1993, 35, note 7).

[72] The status of *municipium* is confirmed by the mentioning of the *quattorvir quinquennalis* Gaius Vesidienus Bassus (*CIL* XI, 6068) and the two *quattorviri* Gemnius and Veiacus (*CIL* XI 6072; NSA 1878, 362-364).

[73] Luni 1993, 44-45; Agnati 1999a, 30-31.

[74] Agnati 1999a, 28-29.

[75] Luni 1993, 43.

protohistoric settlement in the 8th-7th century BC.[76] The first traces of a Roman presence on the site date back to the 3rd-2nd century BC and consist mainly of vernice nera fragments.[77] While the settlement must probably be considered an *oppidum* allied with Rome in this period, it is not clear up to which extent it was characterised by permanent architecture. Still, the presence of walls made out of river pebbles under the Casa Lani in Via Ghibelline (*Figure* 136, n° 10) and the reuse of large sandstone blocks for the construction of walls under the Casa Boccioni in the Via Madonna (*Figure* 136, n° 1) may refer to a first 'urban' phase in the Republican period.[78] Almost all known structures of *Tifernum Mataurense*, however, refer to a period following the attribution of the status of *municipium* in the years immediately after the Social War (91-88 BC).[79]

Despite its only partially covering by the later urban centre, very little is known about the topography and the extension of the Roman town. This lack of knowledge is expressed in particular with regard to the public architecture of the settlement. The attestation of large pavement slabs – apparently belonging to a large, heavily frequented open space – under the courtyard of the monastery of S. Caterina have led to the hypothesis that the *forum* may be situated in this area (*Figure* 136, A).[80] A Late Imperial (3rd century AD) honorary inscription found in the neighbourhood attests the existence of a Late Republican/Early Imperial temple dedicated to the god Silvanus (*Figure* 136, B). A public thermal complex positioned next to one of the streets of the town has been discovered during excavations carried out by the Soprintendenza Archeologica delle Marche between 1957 and 1959. Since 2003, further excavations were carried out by the University of Macerata. The complex occupied at least some 512 m² (ca. 32x16 m), but may have extended over an entire *insula* (*Figure* 136, C). The oldest phase of the building dates back to the 1st century AD; while modifications were applied in both the mid-Imperial period (end 1st/beginning 2nd century AD) and Late Antiquity.[81]

On the positive side, *Tifernum Mataurense* does offer some very useful evidence for private urban architecture in the area. This is mainly because of an aerial photography flight in the summer of 1992, which revealed a substantial portion of the south-eastern quarter of the Roman town, located in the area of the current Campo della Pieve. Said photographs were checked in the field by a series of excavations on behalf of the Soprintendenza Archeologica delle Marche between 1999 and 2004 and confirmed the

[76] Catani 2004, 100.

[77] Agnati 1999f, 542.

[78] Catani 2004, 104, note 26.

[79] Monacchi 1997; Luni 1991.

[80] This hypothesis has been reinforced by the findings of various marble and bronze statues, column bases, numerous coins and an Imperial honorary inscription in the immediate vicinity of the monastery (*CIL* XI, 5991) (Catani 2004, 101-102, notes 14-18, with references).

[81] Catani 2004, 103-104; Stortoni 2010; 2013; 2014.

presence of several residential buildings positioned at the intersection of a *cardo* and a *decumanus* (*Figure* 137). The first of these buildings – located to the south of the *decumanus* and to the west of the *cardo* – consisted of a *domus* measuring ca. 950 m². Excavations in 1999 uncovered a 400 m² section of the building. Said excavations established that the house had been constructed in the second half of the 1st century AD (Flavian Age) (*Figure* 136, E). While the foundation levels of the house were not reached, two exploration trenches attested the presence of ceramic fragments datable to the first half of the 1st century BC. The *domus* was also preceded by a more rudimentary residential building – roughly datable to the second half of the 1st century BC or the Augustan period – that consisted of walls made in pebbles linked with clay. The 1st century AD *domus* underwent some modifications in the course of the 2nd century AD and was seemingly destroyed by a fire towards the end of the that century, or in the first decades of the 3rd century AD. In the 4th century AD, the building was restored and remained occupied until its abandonment in the 5th-6th century AD.[82]

In 2003, new excavations in the southern part of the field uncovered the complete plan of another richly decorated *domus* of ca. 925 m², subdivided into 23 rooms organised around a courtyard (*Figure* 136, n° 9; *Figure* 137, b). Once again erected in the 1st century AD on the location of a pre-existing Late Republican building (1st century BC), the *domus* apparently underwent some modifications in the Flavian Age (AD 69-96). The house was continuously occupied between the 1st and the 3rd century AD, but was abandoned in the course of the latter century. It was reused as a residential/production building in the 4th-5th century AD, before being abandoned in the 5th-6th century AD (*Figure* 133).[83] On the aerial photographs, the ground plan of five other *domus* complexes could also be discerned; a first one of ca. 560 m² located to the east of the *cardo* and to the south of the *decumanus* (B); a second one of ca. 480 m² immediately to the south of the former (C), a third one of ca. 390 m² (D), a fourth of ca. 360 m² (E), and a fifth of ca. 470 m² (F) (*Figure* 136 and 137).

The internal division of the town is not completely clear, but the urban area may have been organised into *insulae* of 1x2 *actus* (ca. 35x70 m). Of the street grid, only three *cardines* and one *decumanus* are archeologically known. The former streets had a width between 4.70 and 6.20 m; the latter one measured 6.40 m (*Figure* 136). Until now, no traces of a town wall have been identified and it has been suggested that that the settlement was only

[82] One part of the building seems to have been reserved for artisanal/production activities (Catani 2004, 104-105; Palermo 2006).

[83] The existence of an older building on the site was attested through the findings of wall structures in association with vernice nera (Tornatore 2006, 23). For the excavations, see Luigi Palermo in Tornatore 2006, 23-30; De Marinis/Quiri in Tornatore 2006, 31-64; and Tornatore 2006b, 65-77.

delimited by natural barriers, occupying a maximum area of 12 hectare.[84] Two cemeteries are known in the immediate vicinity of the ancient town, a first smaller one to the south – active between the 1st century BC and the mid-Imperial period – and a second larger one to the west dated between the mid- and the late Imperial period.[85]

N° 4	Public architecture							DA	EA
Type								Domus	\
y/n	\	x	\	\	x	x	\	x	\
m²	120,000	\	\	\	512	\	\	955; 923; 559; 820	\

Bibliography: Luni 1991; Monacchi 1997; 2010a; Agnati 1999f; Catani 2002; 2004; 2010; Catani/Monacchi 2004; Tornatore 2006; 2006b; Palermo 2006; De Marinis/Quiri 2006; Stortoni 2004; 2010; 2013; 2014; Catani/Stortoni 2009

3.3.5 *Fanum Fortunae* (Fano)

The Roman colony of *Fanum* is situated in its entirety under the modern town of Fano (*Figure* 129, n° 5). The settlement originated as a pre-Roman sacral area centred on the temple for the goddess *Fortuna*, active at least from the end of the 3rd century BC.[86] While the settlement probably obtained the status of *conciliabulum civium Romanorum* shortly after that date, it is still unclear how the coastal town developed in the course of the two centuries preceding the foundation of the Augustan colony. In 1976, Nereo Alfieri imagined the town in the time of Caesar merely as *"un aggregato con caratteri di urbanistica spontanea di modeste dimensioni ed importanza"*.[87] While it is true that, in general, the republican period of the settlement is scarcely documented, there are indications to suggest that in Late Republican times – at least for the period between 90 and 49 BC when *Fanum* most likely received its status of *municipium* – the site already knew some kind of urban character.[88] The most obvious expression of this evolution are the two wall sections made out of sandstone blocks arranged in *opus* (*quasi*) *reticulatum*, which hint at the

[84] Catani 2004, 101, 106-108.

[85] Catani 2004, 105-106.

[86] Luni 2000, 63.

[87] Alfieri 1976-77.

[88] Although this fragmentary character is in part due to a lack of excavations in the town centre. The presence of Republican oil lamps ensures the Roman occupation of the site from the mid-2nd century BC onwards (Mercando 1984); the status of *municipium* is attested epigraphically by the presence of '*quattorviri nude dicti*' (Paci 2004d).

existence of a walled settlement before the Augustan period.[89] Further finds under the church of S. Agostino include a mosaic in *opus signinum* that likely dates to the last decades of the 1st century BC, some Late Republican architectural fragments and an honorary inscription for one of the *quattorviri*, named P. Publius Scantius (*Figure* 139, n° 1).[90] It has been proposed that this original nucleus of the town – rather spontaneously developed around the existing sanctuary – consisted of 12 *insulae* of 2.5x2.5 *actus* (88x88 m), occupying an area of ca. 9.3 hectare.

The foundation of the colony of *Iulia Fanum Fortunae* – or *Iulia Fanestris* – is generally dated in a period between the battle of *Actium* (31 BC) and the awarding of the title of *Augustus* to Octavian (27 BC).[91] The Augustan walls were built in *opus vittatum* and followed the natural limits of the terrace on which the town was constructed (*Figure* 138 and 139).[92] *Opus vittatum* was widely used in the Augustan period for the erection or the renewal of circuit walls and in central Italy the building technique has not been attested before the mid-1st century BC. An inscription on the main gate of *Fanum* mentions the completion of the construction works around AD 9-10, indicating that the building program covered a period of ca. 40 years.[93] It was long thought that the walls of *Fanum* enclosed an area of only 18 hectare, but recent recalculations have shown that the town covered an in part irregularly shaped area closer to 25 hectare.[94] Indeed, in addition to the 12 existing *insulae* of Late Republican *Fanum* – covering an area of approximately 9.3 hectare (see *supra*) – 14 *insulae* of 2.5x1.25 *actus* and 22 irregularly shaped *insulae* – covering ca. 15.7 hectare – were now added (*Figure* 138).

Excavations within the town area have shown that in the Early Imperial period the town was enriched with several public complexes. Over the years, one of the most

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[89] For the walls, see Luni 2000a, 50-63. Generally, these two building techniques are discussed in relation to defensive structures built in the aftermath of the Social War (Luni 1992, 130). The *opus quasi reticulatum* technique is also known from wall phases in *Trea* and *Asculum* (Moscatelli 1985, 80; 1988, 49-50); the *opus reticulatum* is known from *Asculum*, *Numana*, and *Ariminum* (see *infra*). Roberto Perna thinks at a construction date in the time of Caesar (Perna 2012, 386); given that the *opus quasi reticulatum* technique does not seem to have been introduced in *Picenum* before the mid-1st century BC, Luciano De Sanctis discards the hypothesis of a first anterior circuit wall and dates the wall sections to the Augustan period (De Sanctis 2004b, 45).

[90] Luni 1992, 134; Polidori 2002, 327.

[91] The term 'Iulia' could also refer to a foundation under the reign of the *Triumviri*, but in general *Fanum* is considered to be part of the 28 colonies allegedly founded by Augustus under his own authority. For the argument, see Alfieri 1992, 77, 86, notes 5 and 6;

[92] Much has been written on the Augustan town walls of *Fanum* and its gates and towers, but this is not the place to enter into the details of these discussions; See e.s. Luni 1992; Purcaro 1992; 2009; Luni 2000a; 74-123; De Sanctis 2009, 22-66; and Taus 2009.

[93] Luni 1992, 125-127, with references.

[94] For the former figure, see Luni 1992, 107; Luni 2000a, 74; and De Sanctis 2004a, 56; for the latter, see De Sanctis 2004b, 42. A size of 245,000 m² is mentioned by Moscatelli 1988, 23.

discussed finds has been the monumental structure found under the monastery of S. Agostino (*Figure* 139, n° 1). Long identified with the basilica known to have been constructed at *Fanum* by the architect Vitruvius (*De arch.* 5.1.6), the complex is now thought to rather have been a sacral area, maybe to be identified with the Imperial temple for the goddess Fortuna.[95] In the area now occupied in part by the Piazza Amiani and the Scuola L. Rossi, the remains of large porticoed building (ca. 25.5x22 m) (ca. 561 m²) and an adjacent thermal building (*natatio*) (ca.18x12 m) (216 m²) were unearthed around the turn of the 19th century (*Figure* 139, n° 2). Together with these structures, fragments of several marble statues were found, amongst which a figure with the portrait of Emperor Claudius (AD 41-54).[96] Initially thought to have belonged to the *forum* of the town, the structures are now believed to have been part of a *palaestra*.[97] Another excavation carried out at the beginning of the 19th century in the Piazza Andrea Costa delivered the remains of several structures in association with a sculptured portrait datable to the Flavian age (*Figure* 139, n° 3).[98] In 2001, an excavation by the Soprintendenza Archeologica delle Marche in the area of the Via De Amicis confirmed the presence of a theatre, measuring at least 35x65 m (ca. 2,275 m²) and probably occupying almost half an *insula* (*Figure* 140, T).[99] While the precise position of the *forum* square is currently unknown, the presence of all these buildings and statues in a central area of the Roman town has inspired Paulo Taus to locate the *forum* complex with its surrounding buildings and theatre in this zone, occupying as much as four *insulae* (ca. 30,976 m²) or ca. 12.4% of the total urban area.[100] Finally, the amphitheatre was recently discovered in the western sector of the town, next to the theatre and close to the walls, and measured ca. 110x85 m (ca. 9,350 m²), occupying another 3.74 % of the walled area (*Figure* 140, A).[101] Together, the public architecture thus occupied at least 40,326 m², or ca. 16.1 % of the total urban area.

The residential architecture of the town is poorly known. The best known example of an Imperial house is the so-called "Domus dei pesci", named after a mosaic floor in *opus sectile* and *opus tessellatum*, dated to end of the 2nd/beginning of the 3rd century AD.[102]

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[95] Sensi 1992a; Luni 2000a, 133-139; De Sanctis 2004a, 121-133.

[96] Sensi 1992b. Two other marble portraits of an older and a younger man may be attributed to the emperors Vespasian and Domitian respectively (De Sanctis 2004a, 137).

[97] De Sanctis 2004a, 134-138.

[98] Sensi 1992c. Luciano De Sanctis confuses this portrait with another white marble portrait from the Museo Civico di Fano – believed to depict Octavia, the sister of the emperor Octavian Augustus (end 1st century BC) – of which the provenance is unknown (De Sanctis 2004a, 139-140; for the description of the portrait of Octavia, see Sensi 1992d, 323-324; for the proposition of its provenance from the excavations under the Scuola L. Rossi, see Baldelli 2009).

[99] Baldelli 2002.

[100] Taus 2009.

[101] Baldelli 2002; Purcaro 2003.

[102] Luni 2003a, 270-276.

N° 5	Public architecture								DA	EA
Type								UI	Domus	
y/n	x	\	x	x	x	x	x	x	x	x
m²	250,000	\	2,275	9,350	216	\	\	561	\	

Bibliography: Alfieri 1992; Ermeti 1992; Luni 1992; 2000a; 2003a; Mercando 1984; Sensi 1992a; 1992b; 1992c; 1992d; Purcaro 1992; 2003; 2009; Agnati 1999; Taus 2000; 2009; Baldelli 2002; 2009; Polidori 2002; De Sanctis 2004a; 2004b; 2005; 2006; 2009; Paci 2004a; Magnini 2008

3.3.6 *Forum Sempronii* (San Martino del Piano)

The Roman town of *Forum Sempronii* is situated somewhat to the east of the modern centre of Fossombrone (*Figure* 129, no. 6). Being bordered on three sites by natural limits, the site possessed clear strategic and defensive qualities that made it an interesting attraction pole from pre-Roman times onwards. Indeed, ceramic fragments found within the area of the later Roman town indicate that the site knew some form of occupation from the Iron Age onwards.[103] The first Roman presence almost certainly goes back to the end of the 3rd century BC, in relation with the *Via Flaminia* that constituted the main axis of the town (*Figure* 141).[104] The first datable layers of the Roman settlement refer to the second half of the 2nd century BC, when the *forum* square was installed in the time of Gaius Sempronius Gracchus. With the acquisition of municipal status after 49 BC, the town entered a phase of major flourishing, characterised by the erection of many prestige buildings in the course of the 1st and the 2nd century AD.[105] This is attested in the first place by several inscriptions mentioning the existence of temples/altars for Apollo, Fortuna, Silvanus, Bacchus and Plotina. Other indications include the widespread use of marble in that period, and the findings of sculptured portraits picturing the emperors Caligula (AD 37-41) and Hadrian (AD 117-138), a statue belonging to either Trajan (AD 98-117) or Hadrian, as well as a marble head of emperor Marc Anthony (43-33 BC).[106] The gradual decay and partial abandonment of the town probably started from the 4th/5th century AD onwards,

[103] Luni/Mei 2012b, 59-68.

[104] In this period, it is possible that the settlement had the status of *praefectura* (Montanari 2007, 41).

[105] The *municipium* was governed by a college of *duumviri* (*CIL* XI 6117, 6123; see also Montanari 2007, 43, note 36).

[106] A marble statue of the god Silvanus is known from the museum of Fossombrone. The names of the emperors Claudius, Hadrian, Antoninus Pius (AD 138-150) and Diadumenianus are also recorded epigraphically (Montanari 2007; Luni 2007, 28-29; Luni/Mei 2012b, 27).

as attested by the presence of tombs datable between the 4th and the 7th century AD in the central area of the settlement (*Figure* 141, n° 18).[107]

From 1974 onwards, fieldwork by the University of Urbino – including excavations and aerial photography – has significantly enhanced our knowledge of the Roman town. It is now clear that the circuit wall – provided with towers and closely following the natural topography of the site – enclosed an area of ca. 25 hectare. The town area was organised at least into 12 *insulae* of ca. 2x3 *actus* (ca. 70x105 m) and 18 irregularly shaped *insulae* that filled-up the areas close to the city wall. The *forum* complex occupied two full *insulae*, measuring on the whole ca. 70x210 m (ca. 14,700 m²). This surface, however, includes the buildings that flanked the public square, such as the probable *Augusteum* (ca. 12x18 m) (ca. 216 m²), the two main temples and a *macellum* (*Figure* 141, *forum*, n° 6, 8, 23).[108] It is likely that the two *insulae* immediately to the south-east of the *forum* were also largely occupied by public buildings, such as a temple, a *palaestra* and a second thermal complex (*Figure* 141, n° 3, 18).[109] In this way, another 14,700 m² of the town area may have been reserved for public space. In 1974, a large thermal building was excavated near the southern wall of the town over an area of ca. 43.3x27.9 m (ca. 1,208 m²) (*Figure* 141, n° 1). On the basis of the building techniques and the recovered materials, the complex was in use from the beginning of the 1st century AD until the 4th century AD and abandoned in the course of the 5th century AD.[110] An excavation report from the 19th century mentions the existence of a theatre and an amphitheatre within the enclosed area. While the former has yet to be located, the latter was recently identified in the south-eastern corner of the town through aerial photography.[111] The building probably occupied a full *insula* and measured ca. 83x67 m (ca. 5,560 m²) (*Figure* 141, n° 20).

Since the 19th century, small-scale excavations have attested the presence of several richly decorated *domus* complexes inside the town area, represented by mosaic and brick floor pavements datable to a period between the 1st and the 3rd century AD.[112] The most conspicuous example is the so-called 'Domus di Europa', a large residential complex (ca. 30x40 m) (ca. 1,200 m²) built around the mid-2nd century AD and named after its most famous mosaic floor representing the abduction of Europa (*Figure* 141, n° 4).[113] Another

[107] Luni/Mei 2012b, 31; Mei/Gobbi 2014.

[108] The now almost surely identified *Augusteum* was previously thought to be the basilica of the town because of the presence of an apse in its central room (Luni/Mei 2012b, 43; Luni/Gori 2014).

[109]Luni/Mei 2012b, 47.

[110] Gori/Luni 1982; Luni 2003, 252-253; 2007b, 30; Luni/Mei 2012b, 46.

[111] Luni 2007, 30; Luni/Mei 2012b, 52, fig. 25.

[112] Some of the terracotta pavements could go back to the 2nd-1st century BC (Mercando 1983, 89, 92-93, 102; Venturini 2007).

[113] The complex was probably realised by uniting two previously independent residential buildings (Venturini 2007, 62-86).

private structure is the 'Domus degli animali esotici', probably built in the 1st century AD and named after the 2nd century AD wall painting found in one of the rooms (*Figure* 141, n° 19).[114] From the 3rd century onwards, said *domus* underwent a major restructuration and acquired a more productive character, as attested by the introduction of cocciopesto pavements, the installation of a furnace, and the presence of grain millstones made in volcanic rock.[115]

The information on extra-mural occupation is scarce, but the remains of monumental tombs and other structures outside the town gates point towards the existence of cemeteries and residential/artisanal quarters to the east and the west of the town (*Figure* 141, n° 10, 12, 14, 15).

N° 6	Public architecture							DA	EA
Type								Domus	Tombs Villa
y/n	x	x	x	x	x	x	x	x	x
m²	250,000	14,700	\	5,560	1,208	\	\	1,378	\

Bibliography: Gori/Luni 1982; Mercando 1983; Agnati 1999c; Gori 2004; Luni 2003; 2007a; 2007b; Montanari 2007; Cardinali 2007; Venturini 2007; Luni/Mei 2012a; 2012b; Luni/Gori 2014; Mei/Gobbi 2014

3.3.7 *Pitinum Mergens* (Pole di Pian di Valeria)

The exact position of the *municipium* of *Pitinum Mergens* has long been the subject of debate, but it is now believed to have been situated in the locality of Pole near Pian di Valeria (*Figure* 129, n° 7).[116] Unfortunately, almost nothing is known of the Roman settlement, whose remains are limited to a few excavated wall structures now reburied. Still, the registration of two wall sections – one in *opus quadratum* and another in *opus vittatum* – attests that the town was provided with a circuit wall, erected in two distinct phases.[117] The remains of a theatre – with a maximum diameter of 70 m –have also been noted in the past.[118] An estimated size of nine hectares has been attributed by Agnati.[119]

[114] Cardinali 2007.

[115] Luni/Mei 2012b, 49.

[116] The status of *municipium* – probably acquired around 90 BC – is attested epigraphically (*CIL* XI 5954a; 5959).

[117] Luni 1996b, 384-385.

[118] Agnati 1999e; Dall'Aglio/Campagnoli 2002, 57-59.

[119] Agnati 1999e.

N° 7	Public architecture							DA	EA
Type								Domus	\
y/n	\	\	x	\	\	\	\	x	\
m²	90,000	\	\	\	\	\	\	\	\

Bibliography: Agnati 1999e; Luni 1996b; Dall'Aglio/Campagnoli 2002

3.3.8 *Suasa* (Pian Volpello di Suasa)

The Roman town of *Suasa* is situated in the modern locality of Pian Volpello di Suasa in the middle Cesano valley (*Figure* 129, n° 8). The administrative stages of the town are more or less clear, with the settlement probably operating as *conciliabulum civicum Romanorum* in the first half of the 3rd century BC, before acquiring the status of *praefectura* in the second half of that century. Somewhere in the second half of the 1st century BC, *Suasa* became a *municipium*.

More than twenty-five years of research by the University of Bologna has delivered much information on the topography and the lay-out of the town. Recent excavations have made it clear that *Suasa* already had some kind of regular structure with permanent dwellings and artisanal quarters from the first half of the 3rd century BC onwards. Indeed, under the pavements of the so-called "Casa del primo stile" - i.e. an elongated *domus* with *atrium* dated to the second half of the 2nd century BC (see *infra*) – wall foundations made out of loose pebbles and brick were found that could be dated to the first half of the 3rd century BC (*Figure* 143, 144).[120] Also, under the Imperial "Edificio di Oceano" - a small thermal complex of which the first phase goes back to the 1st century BC (see *infra*) – a cocciopesto floor was registered in association with ceramic material datable to the mid-3rd century BC (*Figure* 143).[121] Similar 3rd century BC ceramic fragments were retrieved from an excavation trench in the north-western sector of the *forum*.[122] Finally, structures datable to the 3rd century BC were also found under the large 'garden' of the Imperial "Domus dei Coiedii", a massive residential complex of which the main structures date to the 2nd century AD (*Figure* 143) (see *infra*).[123]

In the course of the Late Republican period – and in particular in the 2nd and 1st century BC – the settlement seem to have developed according to a more organised town plan with both residential and public structures. For instance, a sacral complex consisting at

[120] Mazzeo Saracino 2004; 2007; Destro/Giorgi 2008, 92-94; 2012; Zaccaria 2010; Giorgi 2012, 347.

[121] Destro/Giorgi 2009, 213; Di Lorenzo/Giorgi 2010, 371-378.

[122] Podini 2010, 239-240.

[123] Giorgi 2012, 347-348.

least of a *monopteros* (Ø 5 m) and a second rectangular temple (ca. 10x7 m) (ca. 70 m²) was found under the later *forum* square and dated to the end of the 2nd/beginning of the 1st century BC (*Figure* 144, Area sacra) [124] Under the aforementioned "Domus dei Coiedii" wall structures were found that revealed the pre-existence of an original smaller nucleus structured around an *atrium* and measuring ca. 40x12 m (ca. 480 m²), dated to a period between the 2nd century BC and the mid-1st century BC (*Figure* 144, Casa ad atrio).[125] Another *domus* building that may be dated to the 2nd century BC is the "Casa del primo stile" (*Figure* 144, Casa del primo stile). The excavated area covers a surface of. ca. 7x65 m (ca. 455 m²), but the complex almost certainly continued in eastern direction.[126] The first and oldest part of the narrow building consisted of a small but richly decorated *domus* with *atrium*, measuring ca. 7x27 m (ca. 189 m²) (*Figure* 145, n° 5, 6, 7, 7a, 10, and Atrio, Edificio 3). Between the beginning of the 1st century BC and the beginning of the 1st century AD, a second part (ca. 266 m²) was built immediately to the east of the *domus*. This section of the complex was organised in a different way and may have had a mixed residential/artisanal function (*Figure* 145, n° 1, 2, 3, 9, 11, AX, AY, and AW). Between the mid-1st century AD and the end of that century, the complex seems to have been temporarily abandoned, at least until its subsequent inclusion into the "Domus dei Coiedii at the beginning of the 2nd century AD (see *infra*).[127]

It is clear, however, that the Imperial period marks the era in which the most significant building activities took place at *Suasa*, involving among other things the construction of the theatre, the amphitheatre, the monumental version of the *forum* and some very large *domus* complexes in the 1st-2nd century AD. The *forum* was probably laid out in the first half of the 1st century AD – either under the reign of Augustus (27 BC – AD 14) or Tiberius (AD 14-37) – and consisted of a rectangular square (ca. 70x50 m) (ca. 3,500 m²) surrounded by a porticoed building on four sides (*Figure* 142; 143).[128] Earlier reconstructions only considered the presence of porticoed structures along three sides of the square, in this way assuming an overall size of ca. 100x60 m (ca. 6,000 m²) for the whole complex.[129] As such – considering the apparent lack of large administrative and religious buildings around the *forum* – the complex was interpreted as a commercial space with the rooms of the porticoed structure functioning as workshops and *tabernae*. In turn,

[124] For the *domus*, see Zaccaria 2010; for the temple complex, see Destro/Giorgi 2008, 84-87; and Giorgi 2012, 347; and Destro/Giorgi 2012, 131-132.

[125] De Maria 1991, 25, fig. 7; Campagnoli 2010, 322-324; Giorgi 2012, 346.

[126] Zaccaria 2010, 163-164; De Maria mentions dimensions of 6x50 m (300 m²) (De Maria 2009, 173).

[127] De Maria 2009, 172-188; Zaccaria 2010, 163-173.

[128] The porticoed building consisted of a series of *tabernae* (workshops), each measuring 7x5 m, with the exception of the ones in the corners, that measured 7x7 m. (De Maria 2009, 155).

[129] De Maria 2009, 154.

this interpretation led to the presumption of the existence of a second still unidentified *forum* with civil and sacral functions.[130] However, more recent excavations in the area of the *forum* have revealed the existence of a porticoed building also on the western side of the square, on the opposite side of the road (Via del Foro) that crossed the *forum*, in this way including the street into the monumental complex. Three larger buildings behind this portico have now been interpreted as places with sacral and/or administrative functions (*Figure* 146, n° 3-6, and S). On the whole, the complex measured ca. 100x75 m (ca. 7,500 m²).[131]

Another conspicuous public building was the amphitheatre (ca. 98x77 m) (ca. 7,550 m²), built at the end of the 1st century BC or the beginning of the 1st century AD (*Figure* 142; 143, Anfiteatro).[132] A construction date in the 1st century AD has also been proposed for the theatre of *Suasa*. The building occupied a sector of ca. 50x30 m (ca. 1,500 m²) of the town area and its continuing use in the 2nd-3rd century AD is attested both archaeologically and epigraphically (*Figure* 142, A; 143, Teatro).[133] The 2nd century is also the period in which the "Edificio di Oceano" – a bath complex that probably belonged to a residential building – underwent significant modifications and received the mosaic floors to which it has been named (*Figure* 142, R; 143, Edificio di Oceano). Further alterations were applied to the thermal building in the 3rd century AD.[134]

By far the most interesting Imperial building of Suasa, however, is the famous *Domus dei Coiedii*, a residential complex located immediately to the west of the *forum*, on the opposite side of the Via del Foro (*Figure* 143, Domus dei Coiedii). Developing from a Late Republican nucleus and probably incorporating some earlier smaller houses (2nd-1st century BC) (see *supra*), the *Domus dei Coiedii* underwent a series of transformations and enlargements in the course of the 1st century AD. With the inclusion of the earlier "Domus del primo stile" (see *supra*), the complex reached its most monumental and extensive phase in the first decades of the 2nd century AD. In this period the house covered an area of ca. 3,000 m², subdivided into living quarters (ca. 1,500 m²), a large garden (ca. 1,080 m²), baths (ca. 225 m²) and an auditorium (ca. 150 m²) (*Figure* 147).[135] The progressive decay of the town seems to have started in the 4th century AD, when both the *Domus dei Coiedii* and the *forum* show signs of poor restoration interventions and partial abandonment. This

[130] Destro/Giorgi 2008, 84-91; 2012, 133.

[131] De Maria/Giorgi 2013, 94-113.

[132] Quiri 2010.

[133] Boschi 2010, 152; Giorgi 2010a; and 2012, 34; Destro/Giorgi 2008, 84-85; and 2012, 134.

[134] The small bath complex was excavated over an area of ca. 11x7.2 m (ca. 79.2 m²) (Di Lorenzo/Giorgi 2010; Destro/Giorgi 2012, 134; Giorgi 2012, 348).

[135] De Maria 2009, 151; Bogdani/Giorgi 2010; Destro/Giorgi 2012, 134; Giorgi 2012; 347-348; De Maria/Giorgi 2013, 108-109. The vicinity of such a massive *domus* to the *forum* of the town has been linked to a (partial) public function of the complex (Sisani 2013).

process continued in the 5th century AD, when a part of the *Domus* was converted to a graveyard.[136] Finally, the town area seems to have been completely abandoned in the 6th/7th century AD.

In recent years, interesting topographic results have also been obtained through geophysical survey within the town area. In particular, said surveys have revealed the existence of several public and private structures to the west, the north and the south of the *forum* complex (*Figure* 142, M, N, O, P, and Q). Other noteworthy features include the traces of four streets: a first one visible over a distance of ca. 640 m to the west of the *forum* with a SW-NE orientation (Figure 142, G), and three other streets with a SE-NW orientation, approximately four meters wide and visible for over 450 m (D, E) and 220 m (F).[137] As no remains of a town wall have been detected, it remains difficult to estimate the size of the urban area. Some indication for the southern limit is provided by the presence of a cemetery – active in the 1st-3rd century AD – and a late antique suburban villa (ca. 50x25 m) (ca. 1,250 m²) (*Figure* 142, 'Necropoli meridionale' and 'villa tarda').[138] Based on the aforementioned information from geophysical surveys, it is possible that the urban area covered a surface of ca. 42 ha at the moment of its maximum expansion.[139]

N° 8	Public Architecture							DA	EA
Type								Domus	Villa Tombs
y/n	\	x	x	x	x	x	\	x	x
m²	420,000	7,500	1,500	7,550	79	70	\	189; 455; 480; 3,000	1,250

Bibliography: Dall'Aglio/De Maria 1988; 1997; Dall'Aglio/Giorgi et al. 2012; De Maria 1991; 2009; 2010; Mazzeo Saracino 2004; 2007; Destro/Giorgi 2008; 2009; 2012; Bogdani/Giorgi 2010; Boschi 2010; Campagnoli 2010; Giannotti 2010; Giorgi 2010; 2010b; Podini 2010; Quiri 2010; Zaccaria 2010; Di Lorenzo/Giorgi 2010; Giorgi 2012; Giorgi et al. 2012; De Maria/Giorgi 2013; Sisani 2013

[136] Destro/Giorgi 2012, 135.

[137] Boschi 2010; Giorgi et al. 2012.

[138] For the cemetery, see in particular Giorgi 2010b; and Giannotti 2010; for the villa, see Dall'Aglio et al. 2012; Destro/Giorgi 2012, 135; and De Maria/Giorgi 2013, 87, note 20. Field surveys on the site of the villa delivered only late antique material, but it cannot be excluded that the building dates back to earlier times.

[139] A size of less than 20 ha has been proposed by Enrico Giorgi, but considering the extension of the *forum* square and the clear presence of a street grid to the north of the *forum*, such dimensions do not seem likely (Giorgi 2012, 346).

3.3.9 *Sena Gallica* (Senigallia)

The Roman colony of *Sena Gallica* was founded at the beginning of the 3rd century BC on a natural fluvial terrace delimited by the Misa river and the Adriatic coastline (*Figure* 148). As the colony is completely covered by the modern town of Senigallia, very little was known until recently about the lay-out of the settlement. The oldest literary information was a passage in Livy, who mentioned the refusal by the town of delivering military troops for Rome's second conflict with Carthage in 209 BC (*Livy* XXVII.38.3-7).[140] The most important archaeological finds within the urban area consisted of ceramic fragments datable to the 3rd-2nd century BC and some undated mosaics spread-out throughout the town area.[141] The *Liber Coloniarum* informs us that *Sena Gallica* was the object of a veteran settlement in the Age of the Triumviri, but none of the public buildings that would have accompanied such an event are currently known from the archaeological record.[142] They are also not recorded in epigraphic sources.[143] In recent years, however, excavations by the Soprintendenza Archeologica delle Marche and an ambitious research program by the University of Bologna have resulted in new insights into the origin, organisation and development of the Roman town.

One of the more interesting bits of information has been provided by the excavation of a part of the south-western section of the Roman town between 1990 and 2002 in the area of the 'Teatro Fenice' (*Figure* 149). Said excavations unearthed the remains of two streets, a paved square, a public fountain and in particular three *domus* buildings, of which only one was uncovered in its entirety (*Figure* 150; 151; *domus* 1, 2, 3).[144] The presence of three further houses is supposed, but not confirmed at the moment (*Figure* 151, *domus* 4, 5, 6).[145] As the two other *insulae* bordering the crossroad did not reveal any structures, it is possible that this area always remained open (*Figure* 151, isolato nord-ovest, isolato nord-est). Being situated in a more peripheral area of the town, the ca. 3.3 m wide streets may be identified as secondary axes of the street grid. The first phase of the residential area goes back to the end of the 3rd/beginning of the 2nd century BC. Said phase is

[140] This refusal has been interpreted as a confirmation of the town's scarce population in that time (Sisani 2007, 89).

[141] Ortolani/Alfieri 1978; Stefanini 1994-1995.

[142] *Lib. Colon.*I.226.9-12; II.258.10-12 (from the edition by Blume et al. 1848).

[143] Paci 1982.

[144] The excavators originally identified only one *domus* building and considered the other structures to pertain to *tabernae* (Salvini 2003). Recent research by the University of Bologna, however, has confirmed the presence of at least three *domus* buildings (Lepore et al. 2014).

[145] A thick separation wall to the south of *domus* 1 hints at the presence of a fourth residential building in the *insula*, a hypothesis that seemingly finds its confirmation in the presence of floor levels (*Figure* 151, *domus* 4); as this wall also *limits* domus 2 and 3 to the south, there may be two further houses in the other *insula* too (*Figure* 151, *domus* 5, 6).

represented by floor levels characterised by stamped sandstone pieces, discovered under the later floors of all three *domus* buildings. As such, they hint at the existence of a residential quarter consisting of paved streets and houses with a regular plan organised around an *atrium* already at the end of the 3rd century BC, some fifty years after the foundation of the colony. The second phase may be situated between the end of the 2n century BC and the beginning of the 1st century BC and is characterised by drainage works and public interventions on and around the streets, together with the heightening of the floor levels inside all three *domus* buildings. In this phase, the complete *domus* (*domus* 2) measured ca. 17x27 m (459 m²) (*Figure* 152). The third phase dates between the Age of Augustus and the late antique period and is limited to some structural changes and repaving operations in the individual houses. It seems that the quarter maintained its residential function until the 6th century AD, after which the introduction of tombs attest the conversion of the area into a Christian graveyard.[146]

Another recent excavation is the one carried out in Via Cavalotti (*Figure* 149). These excavations unearthed structural remains with occupation phases from the 5th century BC until the Augustan period. The first phase – datable around the 5th/4th century BC – refers to the pre-Roman period and consists of habitation structures made out of perishable building materials, connected to an open space paved with pebbles and shells.[147] Somewhere between the end of the 4th century BC and the beginning of the 3rd century BC, these structures were destroyed be a fire, after which the area was subsequently drained and levelled in the course of the 3rd/2nd century BC for the construction of an artisanal/residential building with rooms delimited by walls made in pebbles linked by clay. During a third phase – dated between the mid-2nd century BC and the Augustan period – the rooms of this complex underwent some modifications and a wine production plant was installed in one of the spaces. Around the beginning of the 1st century AD, the area was abandoned.[148] Interesting was also the stratigraphy of the excavations in Via Gherardi, where a *domus* was erected in the 2nd-1st century BC, on the place of a previous structure that, on his turn, had been erected in an area frequented around the end of the 4th/beginning of the 3rd century BC (*Figure* 149, "Scavo Via Gherardi"), attested by the presence of vernice nera, tiles and floor fragments.[149] Tile structures similar to the ones found under the *domus* of La Fenice and again datable to the

[146] Salvini 2003, 17-19; Lepore et al. 2014.

[147] Dating elements include skyphoi (second half 4th century BC), numerous fragments of red band ceramics (5th/4th century BC) and various impasto ware fragments (5th/4th century BC) (Lepore et al. 2012).

[148] Lepore et al. 2012a.

[149] Lepore et al. 2012b

end of the 4th/beginning of the 3rd century BC were also found in the Via Armellini.[150] Finally, findings of vernice nera, amphorae and mosaics in the area now occupied by the Episcopio building point towards the occupation of the zone from the 3rd century BC until the 1st century AD.[151]

In 2010, excavations in Via Baroccio uncovered the remains of a Roman sanctuary, whose first phase dates to the end of the 4th/beginning of the 3rd century BC (*Figure* 149, "Scavo Via Baroccio").[152] With the proper installation of the colony around 284/283 BC, the area near Via Baroccio seems to have been restructured in connection with the erection of the circuit wall. Indeed, the excavations also delivered the negative trench of the town wall, which was built in yellowish quadrangular sandstone blocks.[153] A section of said town wall in yellow sandstone blocks had been noted before in the vicinity of Piazza G. Simoncelli in 1954 (*Figure* 149 "Piazza Simoncelli").[154] It is possible that the circuit wall of *Sena Gallica* was built in two phases; an evolution suggested by the finding of a curvilinear tower from the 1st century BC near the Stabilimento Pio XII (*Figure* 153).[155] Another section of quadrangular sandstone blocks in *opus quadratum* is known from under the Rocca malatestiano-roveresca (Piazza del Duca) – together with the remains of a quadrangular tower built in large limestone blocks – but these remains are now thought to belong to the defensive structures of the medieval town, rather than to the previously supposed Late Republican period.[156] Still, excavations under the tower have attested the Roman presence in this zone from the 2nd century BC until the 1st century AD through vernice nera and other materials.[157] While it is difficult to determine the limits of the urban area, some indication is provided by the presence of tombs dated to the Late Republican period, located near the Viale IV Novembre (*Figure* 149).[158] Based on the natural borders of the site, a minimum size of ca. 18 hectare is now attributed to the settlement (*Figure* 148).[159] With regard to the internal organisation of the settlement, a division of 1x2 *actus* has been reconstructed on the basis of the excavations in Via Baroccio and the Fenice area (*Figure* 152). A different reconstruction with *insulae* of 1x1.5

[150] A Rhodian amphora datable to the second half of the 3rd century BC is known from this context (Salvini 2003, 50).

[151] The finding of unguentaria also hints at the vicinity of a 2nd century BC cemetery (Salvini 2003, 56).

[152] For the excavations in Via Baroccio, see Lepore 2012, and Lepore et al. 2012b

[153] Perna 2013a, 74-75; Lepore 2013, 306.

[154] Ortolani/Alfieri 1953, 168-169, n° 2.

[155] Perna 2013a, 75.

[156] For the Roman hypothesis, see Ortolani/Alfieri 1978); for the medieval identification, see Salvini 2003, 57.

[157] Salvini 2003, 57-59.

[158] Salvini 2003, 55.

[159] Lepore 2013, 312-313; a much smaller size of 85,000 m² (8.5 ha) is mentioned in Moscatelli 1988, 23.

actus has been proposed by Robert Perna (*Figure* 153). He also hypothesis a smaller nucleus of ca. 379x127 m (48,133 m²) for the original colonial settlement.[160]

N° 9	Public architecture							DA	EA
Type								Domus	
y/n	\	\	\	\	\	x	\	x	x
m²	180,000	\	\	\	\	77	\	459	\

Bibliography: Ortolani/Alfieri 1953; 1978; Paci 1982; Dall'Aglio et al. 1991; Stefanini 1991; 1994-1995; Salvini 2003; Sisani 2007; Lepore 2012; 2013; Lepore et al. 2012a; 2012b; 2013; 2014; Perna 2012: 2013a

3.3.10 *Ostra* (Ostra Vetere – Le Muracce)

The Roman town of *Ostra* has since long been identified in the locality of Muracce in the Misa River valley (*Figure* 129, n° 10). The settlement probably emerged in the wake of Rome's conquest of the *Ager Gallicus* in the 3rd century BC as a *conciliabulum civicum Romanorum*. Following the appliance of the *Lex Flaminia de agro Gallico et Piceno viritim dividendo* in 232 BC, it likely received the status of *praefectura*. At the beginning of the 1st century BC (91-88 BC) – or perhaps rather in Augustan times – O*stra* became a *municipium* governed by *duumviri* (*CIL* XI, 5750). Not much is known about the earliest phases of occupation, but fragments of vernice nera and coarse ware, together with traces of structures made out of wood and clay, hint at the existence of a settlement with a rather rudimentary character in the 3rd-2nd century BC.[161] The first steps towards a more pronounced urban character were taken towards the mid-2nd/beginning of the 1st century BC with the installation of a large gravelled central square on the place of the later *forum*.[162] The real monumental development of the town, however, only took place in the Early/High Imperial period. Indeed, between the Augustan period and the 1st/2nd century AD an intense building program lead to the appearance of a permanent *forum* square paved with marble and limestone slabs, surrounded by several public buildings, such as *tabernae*, temples, a *sacellum*, a theatre, and a thermal complex. Thanks to non-systematic

[160] Perna 2012, 377.

[161] Dall'Aglio et al. 2012, 16; Boschi/Silani 2012, 72. A *dolium* fragment of local origin with an Etruscan inscription has been dated to the 3rd-2nd century BC on the basis of its execution in the square capital alphabet (Colonna 1984). The presence of Etruscan speaking people in this part of Italy has been interpreted as a sign of mass population movements in the wake of the colonial work under Flaminius (Colonna 1984; Sisani 2007, 190).

[162] Dall'Aglio et al. 2012.

excavations at the beginning of the 20th century by Cavalier Giuseppe Baldoni di Montalto and recent research by the University of Bologna, the development and the dimensions of the monumental centre of the town are now fairly well-known. In the Augustan period, a small *sacellum* was erected in the form of a building measuring 2.85x3.85 m (ca. 11 m²), accompanied by a circular structure with an eternal diameter of 11.20 m, recalling as such the form of a tholos (*Figure* 154, STR 18-19).[163] Towards the end of the Augustan period – or already in the Giulio-Claudian period – two buildings with a sacral function (temples?) were built along the western side of the *forum*, occupying sections of ca. 300 and 200 m² respectively (*Figure* 154, Tempio and STR 4).[164] At the end of the 1st/beginning of the 2nd century AD, the *forum* was permanently paved (75x65 m) (ca. 4,875 m²) (*Figure* 154, hatched space) and a large porticoed sacral structure was constructed along the north-eastern side of the square, measuring on the whole 20.8x26.3 m (ca. 550 m) (*Figure* 154, STR 8). The theatre took up a zone of ca. 50x35 m (ca. 1,750 m²) (*Figure* 154, Teatro), while the baths stretched out over an area of ca. 65x80 m (ca. 5,200 m²) (*Figure* 154, Terme). In the second half of the 2nd century AD, an unidentified rectangular building (12x18 m) (216 m²) was added to the west of the porticoed temple complex (*Figure* 154, STR 20).[165] Together with the presence of large open space of ca. 3,200 m² immediately to the north-west of the *forum* (*Figure* 155, A) (see *infra*), it seems that the public space occupied an area of at least 15,000 m².

Further excavations, aerial photography and geophysical prospection on the town area by the University of Bologna have also revealed some interesting information on the extension and organisation of the domestic space. First, the finding of *opus signinum* and black and white mosaic floors under the pavements of the Imperial thermal complex – built at the end of the 1st/beginning of the 2nd century AD – revealed the pre-existence of a Late Republican/Augustan residential quarter in the area of the later baths (*Figure* 154, Terme).[166] Second, traces of two *domus* buildings flanked by *tabernae* – each measuring ca. 30x50 m (ca. 1,500 m²) – and a large open space of ca. 40x80 m (ca. 3,200 m²) (A) were identified along one of the principal roads of the town (*Figure* 155, B).[167] Finally, traces of a large complex – covering at least an area of ca. 160x40 m (ca. 6,400 m²) – were attested to the north-east of the *forum* (C), together with another construction more to the south (D). The complex has been interpreted as a large suburban villa, but its perfect alignment with traces referring to the street grid of the town might also imply an intra-urban

[163] Dall'Aglio et al. 2014, 837.

[164] The exact dimensions of the largest temple are given in Dall'Aglio et al. 2014, 837: 12.20x24 m (ca. 293 m²) for the podium, and 12.20x16.90 m (ca. 206 m²) for the actual temple.

[165] Dall'Aglio 2012; Boschi/Silani 2012; Dall'Aglio et al. 2014, 836-838.

[166] Dall'Aglio et al. 2012, 14.

[167] Boschi/Silani 2012.

position (*Figure* 155).[168] No traces of a town wall have been discovered, but taking into account the results of the aerial and geophysical prospections – together with the size of the *forum* square and the position of the Misa river – the total urban area may have covered some 39 hectares at the moment of its maximum expansion (ca. 500x780 m) (*Figure* 155).[169] In the course of the 3rd century AD, the town seems to have maintained most of its vitality, but the transformation of the main temple into a church and the insertion of tombs in the *forum* area in the 4th-5th century AD point towards significant changes in the urban space.[170]

N°10	Public architecture								DA	EA
Type								UI	Domus	Villa
y/n	\	x	x	\	x	xx	\	x	x	x
m²	390,000	4,875 m²	1,750	\	5,200	300; 200; 550	\	216	1,500	6,400

Bibliography: Colonna 1984; Ortolani/Alfieri 1953; Virzì 1991a; Landolfi 2006; Sisani 2007; Silani/Tassinari 2009; Boschi/Silani 2012; Dall'Aglio et al. 2012; 2013; 2014; Perna 2013a

3.3.11 *Aesis* (Jesi)

The Roman colony of *Aesis* was founded in the course of the 3rd century BC on a low hill situated to the left of the Esino River, in an area inhabited since the Bronze Age (*Figure* 129, n° 11).[171] Unfortunately, as the Roman settlement lies completely under the modern town of Jesi, not much is known of its lay-out or urban evolution. The attestation of various sections of *opus quadratum* and *opus testaceaum* walls in the medieval circuit wall of Jesi point respectively towards the pre-existence of both a Late Republican (3rd-2nd century BC) and an Augustan town wall in Roman times.[172] Furthermore, the uncovering of wall structures in combination with mosaic, brick and/or cocciopesto floors on several occasions in the historical centre of the modern town indicate that the Roman settlement was characterised by the presence of *domus* complexes from the end of the 2nd century BC

[168] Traces that may refer to ancient streets are D and E. A section of street E has been excavated behind the temple and had a width of ca. 3.50 m; a street width between 5 and 7m has been noted around the *forum* (Boschi/Silani 2012, 78).

[169] A size of 32 hectares – *suburbium* included – has been proposed in Boschi/Silani 2012, 78.

[170] Dall'Aglio et al. 2014, 838.

[171] For the pre-Roman phases of *Aesis*, see Brecciaroli Taborelli 1996-1997; Landolfi 2006b; and Pignocchi/Landolfi 2012.

[172] Luni 2003, 210-217, figs. 25-26.

onwards, in particular with a concentration in the Augustan period and the 1st-2nd century AD.[173] The *forum* has not yet been identified, but is supposed to be situated under the current Piazza Federico II (*Figure* 156).[174] The theatre (ca. 56.5x42 m) (ca. 2,373 m²) has been identified under multiple modern houses located between the Via Francesco di Giorgio Martini, the Via Roccabella and the Costa Lombarda (*Figure* 156). In most cases only the *opus caementicium* nucleus of the walls has been preserved, but the few remains of its outer covering in *opus latericium* allow for a broad dating in the Early Imperial period.[175] Under the Palazzo Mestica a Roman cistern has been found in association with a group of sculptures dating to the Julio-Claudian period (27 BC – AD 68).[176] The limits of the Roman urban area are not clear, but on the basis of the zone covered by the medieval town wall *Aesis* could have occupied an area of at least ten hectares (*Figure* 156).

N° 11	Public architecture							DA	EA
Type								Domus	
y/n	x	\	x	\	x	\	\	x	\
m²	100,000	\	2,373	\	\	\	\	\	\

Bibliography: Annibaldi 1941; Megna 1986; 1990; Brecciaroli Taborelli 1996-1997; Luni 2003; Landolfi 2006a; 2006b; Pignocchi/Landolfi 2012

3.3.12 *Sentinum* (Sassoferrato)

The Roman town of *Sentinum* developed on a rather flat fluvial terrace positioned between the river Sentino – a left affluent of the Esino River – and the Marena stream (*Figure* 129, n° 12). The settlement seems to have been founded *ex-novo* in the course of the 3rd-2nd century BC, perhaps as a *praefectura* in the wake of the *Lex Flaminia de agro Gallico et Piceno viritim dividendo* in 232 BC. The settlement's elevation to municipal status must have occurred just before or after the Social War.

The town was enclosed by a circuit wall provided with towers following the natural borders of the fluvial terrace, in this way enclosing an irregularly-shaped area of some 15 hectares (*Figure* 158).[177] The attestation of various building techniques points towards the succession of at least three circuit walls over time. Already at the end of the 19th century

[173] Landolfi 2006b, 427-429.

[174] Megna 1990; Landolfi 2006b, 426.

[175] Megna 1986, 177.

[176] Pignocchi/Landolfi 2012, 153, note 3.

[177] A size of 160,000 m² is mentioned in Moscatelli 1988, 23.

G. Mengarelli discovered a section of a massive wall in *opus quadratum* – i.e. a building technique typical for the oldest phase of the town walls in the region and generally dated to the 3rd-2nd century BC (see *infra*) – some 27 m to the south from the town's northern limit (*Figure* 158, Cinta in blocchi?). As such, it seems that the oldest Republican nucleus of *Sentinum* was somewhat smaller that its successors, maybe in the range of 5 ha (ca. 225x225 m).[178] Another part in the north-western section of the circuit wall – this time bordering the plateau – was made out of an *opus caementicium* nucleus with a façade in square blocks. This wall has been brought into relation with the settlement's elevation to the status of *municipium* and has been dated to the end of the 2nd/beginning of the 1st century BC.[179] The final sections of the wall – now provided with round towers - have been dated in a period between the Age of Augustus and the beginning of the 1st century AD.[180]

For a long time, *Sentinum* was one of the poorest known Roman urban centres in the Marche region.[181] In recent years, however, our knowledge of the internal organisation of *Sentinum* has much improved thanks to intensive geophysical surveys and new excavations by the Universities of Urbino and Genova, in collaboration with the Soprintendenza Archeologica delle Marche. In fact, in the central section of the town, geomagnetic prospections have registered an area free of structures measuring ca. 30x60 m (ca. 1,800 m²). Considering its position at the crossing of the *decumanus maximus* and the *cardo maximus*, this area is probably to be identified as the *forum* square (*Figure* 159, Foro).[182] Given the relatively small size of this *forum* – with a surface of 1,800 m² it only occupied 1.2 % of the walled area – it is possible that said surveys have only registered the last phase of the square, reduced in size somewhere after the mid-1st century BC.[183] To the eastern side of the square, the surveys also registered a series of walls that are likely to be interpreted as a series of workshops (ca. 1,150 m²) flanking the *forum* (*Figure* 159). The structures immediately to the south and the east of the *forum* could not be identified, but are considered to be part of the wider *forum* complex with its adjacent buildings (*Figure* 159).[184] In its totality, this complex may have occupied the full two large central *insulae* of

[178] Mengarelli 1892, 9; Medri 2008a. This technique was also used for the oldest town walls of *Asculum* (Pasquinucci 1975, 24-26; Paci/Perna 2001, 9-11; Perna 2013, 78).

[179] Medri 2008b, 309. The only testimony of a gate is the one excavated by Mengarelli in the southern part of the town (Mengarelli 1892, 6-7; Fabbrini 1961, 316-319). Based on the ceramic material present, the wall most probably dates to the second half of the 2nd c BC (Brecciaroli Taborelli 2008). In fact, the presence of Republican material in the town area datable to the second half of the 2nd c BC has been noted before (see Brecciaroli Taborelli 1978). Similar data have emerged from recent excavations (Medri 2007).

[180] Medri 2008a, 204.

[181] Conventi 2008, 378.

[182] Hay/Bottacchi 2008, 63; Medri 2008a, 209.

[183] This is a phenomenon that has been noted in other Roman towns in Italy (Conventi 2004, 160; 2008, 381).

[184] Hay/Bottacchi 2008, 63-64.

the town, occupying as such an area of ca. 14,303 m² (ca. 76.81x186.22 m). By detracting the space taken up by the streets surrounding the complex, the area covers a surface of ca. 2x5 *actus* (71x177.6m) (ca. 12,610 m²) (*Figure* 160).[185] Excavations in the *insulae* immediately to the west and the south of the *forum* – at the crossing of the *decumanus* and the *cardo* – have confirmed the chiefly sacral/commercial nature of the surroundings of the main square (*Figure* 161, Area 1 and 2).[186] Further to the north, still along the *insulae* holding the *forum*, structures have been observed by G. Mengarelli at the end of the 19th century that may belong to the theatre of the town (*Figure* 157, Teatro?).[187] Finally, in the *insula* immediately to the north-east of the *forum*, a public thermal complex was almost completely excavated in the course of the previous century, occupying a surface of ca. 3,800 m² (*Figure* 161, Terme Urbane).[188] As such, considering the totality of our archaeological evidence, it seems not unlikely that a central area of ca. 28,506 m² was reserved for public space only (*Figure* 160).

The geomagnetic prospections have equally indicated the primarily residential function of the town's western section and the remaining eastern parts. Detailed floor plans of these buildings, however, are absent and there is little information on the size of these houses (*Figure* 159; 160).[189] Structural remains of *domus* buildings are limited to a few traces of house floors and walls, excavated in the previous century in the so-called "Insula del Pozzo", situated to the north-east of the *forum* (*Figure* 161, Insula del Pozzo). Some of these floors consisted of richly decorated mosaics (both single- and multi-coloured) or luxurious white marble plates. Others seem to have been more rudimentary and functional, like *opus spicatum* floors or floors made out of other types of small bricks.[190] One development that has been hinted at by the geophysical survey evidence is the further subdivision of many of the original *insulae* over time, suggesting that new buildings were fitted in, presumably because of significant population pressure (*Figure* 160; 162).[191]

Finally, it seems that in the 2nd century AD the town developed a noteworthy suburban quarter to the south-east of the original urban centre. This evolution is indicated by some occasional finds and by the presence of a very large thermal complex

[185] Conventi 2008, 380.

[186] Said excavations unearthed the remains of monumental fountain, a probable *macellum*, a *compitum* and a porticoed temple (Medri 2008b; 2008a, 211-212).

[187] Medri 2008a, 216. There are currently no traces for an amphitheatre.

[188] Fabbrini 1961. The complex has been dated between Republican times and the mid-1st century AD (Brecciaroli Taborelli 1976); see also Cavallo 2008.

[189] Hay/ Bottacchi 2008; Conventi 2008, 381.

[190] Pagnani 1965, 70. The most famous mosaic is the so-called Mosaic of Aion, found in 1806 in one of the urban *domus* buildings (see Catani 2008 for a discussion and references).

[191] Medri 2007, 302-303; Medri 2008b, 312-313.

just outside the southern entrance gate (*Figure* 161). The baths extended over a surface of ca. 7,000 m², of which 3,000 m² was reserved for the actual thermal sector. It has been suggested that – just like the aforementioned subdivision of the *insulae* – the construction of these baths in the first decades of the 2nd century AD in particular, and the development of a suburban quarter in general, are to be brought into relationship with the phenomenon of population growth in town and country, in this way creating a shortage of living space in the town and requiring the construction of a larger thermal complex.[192] Outside the town area, two cemeteries have also been located, with tombs dating either to the end of the Republican period/beginning of the Imperial period, or to the end 1st/beginning 2nd c AD.[193]

N°12	Public architecture							DA	EA
Type								Domus	Baths Tombs
y/n	x	x	\	\	x	x	\	x	x
m²	150,000	1,800	\	\	3,800	\	\²	\	7,000

Bibliography: Mengarelli 1892; Fabbrini 1961; Pagnani 1965; Brecciaroli Taborelli 1976; 1978; Medri 2007; 2008a; 2008b; 2014; Catani 2008; Cavallo 2008; Conventi 2008; Hay/Bottacchi 2008

3.3.13 *Ancona* (Ancona)

Following a long tradition of research on the history of Ancona, scholars have repeatedly stressed the Greek origin of the coastal town, allegedly born as a Syracusan colony at the beginning of the 4th century BC (*Figure* 129, n° 13).[194] However, the attestation of tombs and small habitation nuclei scattered across the more favourable locations of the site have indicated that the area was inhabited from the Bronze Age onwards.[195] Therefore, more recent scholarship has rather stressed the indigenous character of the original settlement, influenced profoundly by the processes of Hellenism and Romanisation from the 4th century BC onwards.[196] Considering the historical events of the 3rd century BC, the Italic settlement of Ancona probably received the status of *civitas foederata* in the course of that century. According to a passage by Livy (XLI.1.2-3) the harbour of Ancona became

[192] Brecciaroli Taborelli 1978, 27-28; Medri 2014.

[193] Medri 2008b, 315.

[194] Alfieri 1938; Sebastiani 1996. This reconstruction is mostly based on a passage by Strabo, who wrote that the city had been founded by said colonists (*Geogr.* 5.4.2).

[195] Lollini 1956; 1975; 1976b; Baldelli 1983, 464-465; see also Sebastiani 1996, 17-18.

[196] Colivicchi 2002; 2008.

the operating base of the Roman fleet within the context of the Istrian and the Illyrian Wars in the first half of the 2nd century BC (178-163 BC). At the end of that century, the town received veteran allotments under the Gracchi brothers, indicating that the *Ager Anconitanus* was now considered *ager publicus*.[197] In the wake of the Social War, Ancona likely became a *municipium* during the first half of the 1st century BC, before being elevated to the status of colony under Augustus. During the reign of the Triumviri, the territory of Ancona once again received veteran allotments; this time in the form of two Caesarean legions involved in the battle of Filippi.[198] Pliny's explicit mentioning of the town as an Augustan colony suggests that a third and final colonial foundation also occurred under his reign.[199] At the beginning of the 2nd century AD, the harbour of Ancona again became a logistical base for emperor Trajan in his war against the Dacians.[200] The further flourishing of the town in the 2nd and 3rd century AD is also attested epigraphically.[201]

While the main historical phases of the Roman town are thus reasonably clear, the reconstruction of its topography and urban evolution over time is still highly problematic. A first issue is the extension of the walled area in both Republican and Imperial times. Over the years, the remains of a massive sandstone wall in *opus quadratum* have been attested in several locations across the modern town. A first reconstruction was offered in 1938 by Nereo Alfieri, who considered the wall sections found in the area of the monastery of S. Bartolomeo (*Figure* 216, n° 7-8) and the section in the Via della Cisterna (*Figure* 216, n° 20) as belonging to the fortified acropolis of the 4th century BC Greek settlement, extending as such until the actual Largo Dante Alighieri (*Figure* 217). The section under the Chiesa di S. Maria della Piazza, on the other hand, testified an extension of the walled area under Roman occupation in the 3rd century BC (*Figure* 216, n° 32).[202] In 1965, a more plausible reconstruction was offered by G. Annibaldi, who attributed all the *opus quadratum* walls to the Republican fortification of the Roman settlement. According to Annibaldi, two sections in particular – one along the Lungomare Vanvitelli and another under the church of S. Maria delle Piazza (Figure 216; 217, n° 14 and 32) – clearly showed the functioning of these walls not merely as defensive structures, but also as terrace walls meant for organising the hilltop settlement in Roman times. Also, the occasional superimposition of *opus quadratum* and posterior *opus latericium* sections

[197] As can be deduced from the *Liber Coloniarum* (Pais 1885, 44).

[198] As mentioned by Appian (*B Civ.* 4.11; 5.90).

[199] Ancona is mentioned as a Roman colony in the time of Pliny (*HN* 3.13.111); see also Paci 2008b, 537-540.

[200] As attested by the erection of the monumental arch in the harbour in AD 115 (*CIL* IX, 5894; see also Sebastiani 1996, 33-36).

[201] Sebastiani 1996, 27, notes 36-42.

[202] Alfieri 1938, 18; see also Moretti 1945, 41-44; for the section under the church of Santa Maria della Piazza, see also Petrelli 2014, 151-153.

indicated either restorations or modifications of these structures in High Imperial times (2nd century AD) (*Figure* 216; 217, n° 14, 32).[203]

Considering the now erroneous presumption of a Greek colonial foundation in the 4th century BC – together with the attestation of similar *opus quadratum* circuit walls dating back to the 3rd/2nd century BC in many other Roman towns in the region (see *infra*) – it seems indeed likely that the walls of Ancona are to be connected with the first phase of the Roman settlement, rather than with the supposed Greek town. In fact, recent excavations along the Lungomare Vanvitelli – in an area located immediately to the north of the previously attested wall section (*Figure* 217, no. 14) – have ascertained that the Republican circuit wall continued until the harbour area.[204] An exact date of construction cannot be proposed, but it seems plausible that the walls were erected in the time of Ancona's elevation to a military operating base between 178 and 163 BC (see *supra*).

Be that as it may, any attempt to reconstruct the enclosed urban area on the basis of these few structures remains a difficult exercise. However, by taking into consideration the totality of our archaeological evidence, some useful indications may still be offered. First, the aforementioned excavations in Lungomare Vanvitelli seem to suggest that the western limit of the walled area followed a course largely similar to the current Via Vanvitelli (*Figure* 217, n° 12, 13, 74-76). Second, similar portions of *opus quadratum* walls – either belonging to the urban enclosure or to other likely Republican structures – are known within the historical town centre of Ancona. For instance, sandstone walls in *opus quadratum* under the Cathedral of San Ciriaco on the Colle Guasco have been interpreted as the remains of a podium (ca. 32.10x19.10 m) (ca. 613 m²) for a Republican temple complex dedicated to the goddess Venus (*Figure* 216, n° 1).[205] The remains of an arched structure in *opus quadratum* have been found inserted within the later amphitheatre, located between the Colle Guasco and the Colle dei Cappuccini (*Figure* 216, n° 5).[206] Furthermore, in an area immediately to the west of the amphitheatre, excavations in 1978 unearthed yet another section of *opus quadratum* sandstone walls in connection with a paved street dated to the 2nd century BC.[207] Sandstone walls in *opus quadratum* have also been attested under a Late Republican thermal complex, situated in the zone of the

[203] Annibaldi 1965, 52-53; Sebastiani 1996, 82. Some of these sections, however, belong to private or public buildings (Sebastiani 1996,46-47, 53-54, 62, 64, 79)

[204] Salvini 2001, 16-17.

[205] Annibaldi 1961; Bacchielli 1985, 106-137; Sebastiani 1996, 29-33. On the basis of the aforementioned 'Greek' hypothesis, the temple was first dated to the 4th century BC (Bacchielli 1985), but is now considered to be of a younger date, possibly the 3rd or even the 2nd century BC (Annibaldi 1965, 62; Luni 2003b; Colivicchi 2008). The cult of Venus is attested at Ancona through literary sources (*Catull.* XXXVI.11-16).

[206] Sebastiani 1996, 42.

[207] Pignocchi/Hägglund 1998.

current Palazzo Fazioli (*Figure* 216, n° 19).[208] Other sections include the wall found in Via Boncompagno (*Figure* 2.16, n° 40), and another wall between the Via Gallo and the Corso Mazzini (n° 43).[209] Third, the location of Late Republican tombs in a corner area between the Via Nicola Matas and the Via Germabei (*Figure* 218, n° 5 (black square), second half 3rd-2nd century BC), and close to the amphitheatre (*Figure* 216, n° 5, 2nd-1st century BC) – in zones surely outside the walled area – may provide some indication for the position of the eastern town wall.[210] As such, an area may have been walled in the 2nd century BC approximating the reconstruction proposed by Innocenzo Dall'Osso in 1975 (ca. 6.6 ha) – for the exception of a reduction in space within his '*ampliamento romano*' (- ca. 0.8 ha), and an addition to both the southern limit of said feature (+ ca. 0.9 ha) and the so-called '*città greca*' (+ ca. 0.1 ha) – resulting in an enclosed area of ca. 6.8 ha (*Figure* 219).

It seems that already from the end of the 2nd century/beginning of the 1st century BC onwards, the walled area was gradually built-up and the small town began to expand in both southern and eastern direction. Testimonies of these filling-up and expansion processes – which may be brought in connection with the land distributions under the Gracchi and the later elevation to municipal status – are the earliest phases of the *domus* complexes under the Palazzo Panzini Bevilacqua and the church of S. Francesco, both situated in a zone between the Vicolo Orsini and the Via Matas and dated to the first half of the 1st century BC (*Figure* 216, n° 28, 30).[211] Also, more to the south-east, an artisanal complex was active in Late Republican times (n° 54).[212] Many of the known domestic complexes, however, seem to have their first phase of occupation under the reign of Augustus and in the course of the 1st century AD, in a period following the town's acquisition of colonial status. Examples include the richly decorated building complex between the Via Fanti and the Vicolo Orsini (n° 31) and several mosaic pavements scattered to the south/south-east of the Late Republican wall (n° 35, 37, 45-48, 50-53).[213] Also, the occupation of the *domus* near the church of S Francesco continued in this period

[208] Sebastiani 1996, 50-51.

[209] Sebastiani 1996, 66-67.

[210] Pellegrini 1910, 342-356; Alfieri 1938, 56-57; Sebastiani 1996, 89; for the tombs to the north-west of the amphitheatre in particular, see Baldoni/Mazzacuva 1978-79, 1-29. The presence of Roman cemeteries is attested from the 3rd century BC onwards (NSA 1910, 334-335; Alfieri 1938, 56-57). In Via Goito, for instance, tombs have been attested that can be dated to the first half of the 2nd century BC on the basis of the presence of stamped Rhodian amphorae (Alfieri 1938, 21-24; Mercando 1976, figs. 16-18). For the Late Republican tombs in Via Matteotti, see NSA 1902, 445-463; and Sebastiani 1996, 89-92; for the mosaic floors, see Sebastiani 1996, 68-72.

[211] Sebastiani 1996, 54-59.

[212] The structures belonging to the Late Republican phase of the complex were all of a very rudimentary character, characterised by low foundations made out of amphora sherds (Quiri 1985, 602-606; Sebastiani 1996, 72). The area was previously occupied by tombs dated to the 2nd/1st century BC (Baldoni/Mazzacuva 1978-79, 1-129).

[213] Sebastiani 1996, 59-62, 64-65, 67-72.

(n° 30), while the aforementioned Late Republican artisanal complex was seemingly converted into a porticoed residential area (n° 54-59).

In this period, the town was also enriched with several public buildings, like an amphitheatre (ca. 93x74 m) (ca. 6,882 m²) (*Figure* 216, n° 5), a thermal complex (n° 19), a likely temple (n° 65), and a large sport complex (ca. 200x100 m) (ca. 20,000 m²) (n° 61-64).[214] Once again, the position of the *forum* is unclear. Recent scholarship has located the square in the area occupied by the current Piazza del Senato (*Figure* 217). Arguments that would be in favour for such an hypothesis are the vicinity of several public buildings – such as the amphitheatre, the large thermal complex and a storage building (*Figure* 217, n° 5, 19, 14) – and the attestation of column bases belonging to monumental structures (n° 15, 16); i.e. elements that would indicate the presence of a large area reserved for public architecture.[215] Also, to the south of the piazza, in the zone of the Palazzo Fatati, the remains were uncovered of a monumental cryptoporticus with walls in *opus latericium*, *opus reticulatum* and *opus caementicium*, dated to the 1st century AD (n°. 21). Such a construction may have served as a supporting structure for the terrace on which the *forum* was laid out.[216] Anyway, it seems clear that the monumentalisation of the town's centre in the Early Imperial period was accompanied by an extension of the urban area with at least ca. 4.8 hectare in south/south-eastern direction, enlarging the occupied area up to ca. 11.6 hectare.[217]

A last intense building phase within the town can be situated at the beginning of the 2nd century AD, when the harbour zone was completely restructured (*Figure* 216, n° 2, 12-14, 23, 24, 27) and both the amphitheatre and the ancient circuit wall underwent restorations under the reign of Trajan (AD 98-117).[218] Finally, the remains of some structures in *opus latericium* in the Via Podesti and the Via Barilari may refer to a further extension of the inhabited area in southern direction (*Figure* 216, n° 66, 67).

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[214] Sebastiani 1996, 40-44, 48-21, 76-79. Previously, Nereo Alfieri has estimated the overall size of the amphitheatre at ca. 111x97 m (ca. 10,767 m²), able to house ca. 20,000 people (Alfieri 1938, 47). Stefania Sebastiani estimates the number of spectators rather between 7,000-8,000 people (Sebastiani 1996, 41). The dating of the amphitheatre, the baths and the temple in a period between the second half of the 1st century BC and the end of the 1st century AD is mainly based on the use of *opus reticulatum* for the construction of their walls.

[215] Sebastiani 1996, 40-44, 46-51, 84.

[216] Sebastiani 1996, 51-52. However, like in *Firmum Picenum* and *Atri*, the chronology of this structure would again pose the problem of the location of the Republican *forum* (see *infra*).

[217] The presence of Imperial tombs along the course of the Via Giacomo Matteotti/Corso Giovanni Amendola and in the area of the Piazza Cavour likely indicates the exclusion of these sections from the urban zone. Still, a size of more than 300,000 m² is proposed by Moscatelli 1988, 23.

[218] This urban building phase may be identified through the use of *opus latericium*. For the harbour area, see Sebastiani 1996, 46-47, 53-54, and Salvini 2001; for the amphitheatre, see Sebastiani 1996, 44; for the circuit wall, see *supra*. Two cisterns in *opus caementicium* also likely date to this period (Sebastiani 1996, 36-39).

N° 13	Public architecture							DA	EA
Type								Domus	Tombs
y/n	x	\	\	x	x	x	x	x	x
m²	116,000	\	\	6,882	\	613	20,000	\	\

Bibliography: Pellegrini 1910; Alfieri 1938; Moretti 1927; 1945; Lollini 1956; 1975; 1976b; Annibaldi 1961; 1965; Dall'Osso 1975; Mercando 1976; Baldoni/Mazzacuva 1978-79; Polichetti 1981; 2003; Baldelli 1983; Sebastiani 1983; 1996; 2014; Bacchielli 1985 Quiri 1985; Pignocchi/Hägglund 1998; Salvini 2001; Colivicchi 2002; 2008; Luni 2003b; Petrelli 2014

3.3.14 *Auximum* (Osimo)

The remains of the Roman *municipium* of *Auximum* lie under the modern town of Osimo, located on a sandstone hill in the middle Musone valley (*Figure* 129, n° 14). The area was occupied from protohistoric times onwards (ca. 9th – 3rd century BC), but nothing is known about the character of these early settlements.[219] After the Roman conquest, the settlement became first a *municipium sine suffragio*, then a *colonia optimo iure*, all somewhere between 174 and 157/156 BC.[220] The most visible part of the ancient town are still the Roman towns walls – built in tuff stone blocks arranged according to an *opus quadratum* technique –which run over a length of ca. 1,700-2,000 m and enclose an area of ca. 15-16 hectare.[221] We know from Livy that these walls were erected in 174 BC by the decision of the *censor* Q. Fulvius Flaccus (*Livy* XLI.27). There is little information on the internal organisation of the town area. Based on the few known archaeological remains, a reconstruction of the town scheme has recently been proposed, with the central part of the town possibly being divided into 18 *insulae* of ca. 1x1 *actus* (35.6x35.6 m), the eastern part into 20 *insulae* of 1x1.5 *actus* (35.6x53 m), and the western section into 3 *insulae* of 2x2 *actus* (ca. 71x71 m). The remaining space between these *insulae* – which cover a total area of ca. 85,753.48 m² (ca. 8.6 ha) excluding the street grid – and the town walls would have further been subdivided into a series of ca. 20 irregularly spaced *insulae* covering another 6.4 to 7.4 hectare (*Figure* 163).[222] Ancient authors mention the existence of a *forum* with *tabernae* and a wooden podium at *Auximum* from the beginning of the 2nd century BC

[219] Gentili 1955.

[220] Destro 1997, 106, note 5; Branchesi 2006, 154, note 2, with ample references.

[221] Gentili 1955, 57; Baldoni 2000, 32; Moscatelli suggests a size of more than 125,000 m² (Moscatelli 1988, 23).

[222] Five irregular *insulae* in the central section, nine in the eastern section and four in the western section (Destro 1997, 108-110).

onwards, but the position of the square is not entirely clear.[223] In the assumption that the *decumanus maximus* would coincide with the current Corso Mazzini, and the *cardo maximus* with the Via del Sacramento, the *forum* may have been located in the area covered by the Piazza del Comune and the Piazza Boccolino, covering multiple *insulae* at the western foot of the hill (*Figure* 163; *forum*).[224] Numerous inscriptions refer to the monumentalisation of the *forum* by prominent citizens in the course of the 2nd century AD, but almost nothing is known archaeologically of the buildings that surrounded the square in Roman times.[225] Inscriptions dated to the 1st century AD mention training camps for and spectacles with gladiators, but there are currently no archaeological traces for an amphitheatre, or a theatre.[226] The information on the domestic architecture of the town is limited to the remains of two *domus* buildings, one of which is dated to the second half of the 1st century AD.[227] In the zones to the east and the north-west of the hill, - an area where in medieval times the villages of Cavaticcio and S. Giacomo were located – some Roman remains have been noted that could be considered part of the suburban quarters of *Auximum*.[228]

N° 14	Public architecture							DA	EA
Type								Domus	
y/n	x	\	\	\	\	\	\	x	x
m²	160,000	\	\	\	\	\	\	\	\

Bibliography: Gentili 1955; Sommella 1988; Luni 1994; Destro 1997; Baldoni 2000; Branchesi 2006; Landolfi 2006a

3.3.15 *Cingulum* (Cingoli)

An inscription found in the immediate vicinity of today's Cingoli point towards the existence of a nucleated Roman settlement from the 3rd century BC onwards on the hill on which the modern centre of Cingoli is situated(*CIL* IX, 5679) (*Figure* 129, n° 15). Based on the known literary sources, it is likely that a centre with the status of *praefectura* developed here in the wake of Rome's conquest of *Picenum* (Cic. *Rab. Perd.* VIII.22). Several

[223] *Livy* XLI.27.10; Plutarch, *Vit. Pomp.*VI.3; see also Branchesi 2006, 156, note 9.

[224] Destro 1997, 111-112; Branchesi 2006, 156, note 10.

[225] Branchesi 2006, 162. It is possible that the *forum* was built on a terraced surface (Sommella 1988, 82), while the remains of a probable thermal complex (Destro 1997, 112, note 35) and some other public buildings have also been noted in the vicinity of the square (Gentili 1955, 97-98, 107).

[226] Destro 1997, 113, note 41.

[227] Gentili 1955, 76.

[228] Some ruins have also been noted to the south-east of the hill, in Contrada Roncisvalle (Gentili 1955, 76).

epigraphic sources hint at the flourishing of *Cingulum* between the 1st century BC and the mid-4th century AD, but unfortunately almost nothing is known of actual the topography of the town.[229] Two sections of a wall made out of a core in *opus caementicium* with a façade in *opus vittatum* – found at the foot of the hill, in Borgo San Lorenzo – confirm the construction of a town wall either in the second half of the 1st century BC, probably on the occasion of the settlement's elevation to municipal status, or in the Age of Augustus (*Figure* 165).[230] The location of the *forum* has been hypothesized on the basis of the position of the town gates and the course of the *decumanus* and the *cardo*. Another indication may be the discovery of the remains of a Roman temple in the nearby church of Borgo San Lorenzo. The exact size of the square is not known, but has been estimated at 70x35 m (2x1 *actus*) (ca. 2,450 m²) by P.L. Dall'Aglio (*Figure* 165).[231] Based the findings of some structures referable to *domus* buildings, it seems that the settlement was built in at least three terraces on the eastern slope of the hill.[232] It is currently not clear whether the urban area was confined to the actual zone of Borgo San Lorenzo, or continued under today's Cingoli (*Figure* 220, A). As such, it remains difficult to estimate the overall extent of the town area, which could have occupied an area of either six or 15 hectares (*Figure* 220, B).

N° 15	Public architecture							DA	EA
Type								Domus	
y/n	\	x	\	\	\	x	\	x	\
m²	60,000; 150,000	2,450	\	\	\	\	\		\

Bibliography: Dall'Aglio 1983; Paci 1986; 1998a; 2004b; Percossi 1998; Frapiccini et al. 1998, 319-322

3.3.16 *Planina* (S. Vittore di Cingoli)

The existence of a *municipium* at S. Vittore di Cingoli has recently been confirmed by the attribution to the site of an inscription – dated to either the Age of Caesar or the Triumvirate – mentioning restructuration works in an existing basilica by a college of *duumviri* (*CIL* IX, 5688).[233] It has been suggested that the *municipium* is to be identified with

[229] Frapiccini et al. 1998, 319.
[230] Dall'Aglio 1983, 57; Percossi Serenelli 1998, 63-64; Paci 2004b, 148.
[231] Dall'Aglio 1983, 60-63, 66, note 28; Percossi Serenelli 1998, 64.
[232] Dall'Aglio 1983; Percossi 1998, 65.
[233] Paci 1988; 1991, 74-75; 2004c, 156-157.

the Roman town of *Planina* (*Figure* 129, n° 16).[234] Not much remains of the sanctuary that preceded the Roman settlement in the mid-Republican period, other than some vernice nera fragments, a few clay and stone architectural pieces, and a bronze votive object.[235] The Roman town is also scarcely documented. In the second half of the 19th century, a series of rooms with floors paved with mosaics or bricks, in association with tanks in *opus signinum* that were interconnected by a series of channels – probably belonging to a thermal complex – were excavated.[236] Later excavations unearthed the structural remains of two rooms paved with mosaics that were likely part of a 2nd century AD *domus* (*Figure* 166)[237] A series of six Early Imperial cremation tombs (1st century AD) is known from excavations carried out along the "Strada Provinciale di Val Musone".[238] The vitality of the centre in the 1st-2nd century AD is attested by numerous ceramic finds, such as terra sigillata italica, glass, thin-walled fragments, and oil lamps.[239] The existence of a porticoed building is attested by an inscription dated to the 1st century AD.[240]

Bibliography: Servanzi Collio 1863; Annibaldi 1966; Mercando 1974; 1980; Delplace 1987; Paci 1988; 1991; 2004c; Landolfi/Bandelli 1997; Percossi 1998; Frapiccini et al. 1998; Marchegiani 2004

3.3.17 *Tuficum* (Borgo Tufico)

The small town of Borgo Tufico covers the remains of the Roman *municipium* of *Tuficum* (*Figure* 129, n° 17; and 168). Occasional excavations have attested the occupation of the site in pre-Roman times.[241] Besides the presence of some vernice nera fragments, the Late Republican phase of the site is poorly attested, with the settlement apparently acquiring a more organised nature only after its rise to *municipium* in the course of the 1st century BC.[242] From the Early Imperial period onwards in particular, several inscriptions attest the erection of public buildings in the town centre, such as an aqueduct under the reign of Nero (AD 54-68) and numerous buildings in the time of Caesius Silvester (first half 2nd century BC), like a temple for the goddess Venus (*CIL* XI 5687) and one for Augustus (*CIL*

[234] Delplace 1987, 8; Paci 2004c, 154-155.
[235] Landolfi/Baldelli 1997; Frapiccini et al. 1998, 323.
[236] Servanzi Collio 1863; Frapiccini et al. 1998, 322-323.
[237] Annibaldi 1966; Mercando 1980.
[238] Mercando 1974.
[239] Percossi 1998.
[240] Paci 1991, 78-79, n° 2.
[241] Venanzioni 2005, 48, note 65 and 51, hereby referring to Moscatelli 1985, 81-97.
[242] Venanzioni 2005, 50. The transition to a *municipium* governed by *quattorviri* somewhere after the Social War is attested epigraphically (*CIL* XI, 5686-5733; see also Paci 1998c).

XI, 5689), another unidentified temple (*CIL* XI 5700), and a *ponderarium* (*CIL* XI 5695).[243] These and other inscriptions attest well the overall vitality of the town between the 1st and the 2nd-3rd century AD.[244]

Excavations, however, have yielded little information on the lay-out of the settlement and both its internal architectural plan and urban borders are virtually unknown to us. Based on the findings of several large pavement slabs, huge travertine blocks and the remains of an important porticoed building in the locality 'La Ripe-Stazione di Albacina' in the second half of the 19th century AD, Ilaria Venanzioni has localised the *forum* in said zone of Borgo Tufico (*Figure* 167, 7a).[245] Giulia Baratta, on the other hand, considers the major concentration of the aforementioned honorary inscriptions in the localities of Case Lunghe, Bisci, Moregine and Moresine as indications for locating the *forum* near the church of San Lazzaro, on the right river bank of the Esino (*Figure* 167; 168).[246] The presence of an amphitheatre is supposed on the basis of an inscription found in 1572, but now lost (*CIL* XI, 5716).[247] Based on the presence of several (extra-urban) cemeteries – probably dating to the 2nd century AD (*Figure* 167, 'necropoli', 7f, 7h) – and a probable suburban villa located to the north of Borgo Tufico (*Figure* 167, 7c), a possible town area of ca. 40 hectares has recently been proposed.[248] However, as this area most likely includes both suburban and rural settlement, a more modest size of 15-20 hectares may be more realistic.[249]

N° 17	Public architecture							DA	EA
Type								Domus	
y/n	\	x	\	x	\	x	\	\	x
m²	200,000	\	\	\	\	\	\	\	\

Bibliography: Ambrosini 1848; Gamurrini 1893; Moscatelli 1985; Pignocchi/Sabbatini 2001; Venanzioni 2004; 2005; Pearce et al. 2009; Frasson 2013; Petraccia 2013; Baratta 2013; Perna 2013c

[243] Ambrosini 1848, 15; Pignocchi/Sabbatini 2001, 233; Venanzioni 2005, 51.

[244] One honorary inscription mentions emperor Caracalla (AD 188-217) (*CIL* XI, 8050).

[245] Venanzioni 2004; 2005, 40-42; 2013, 53.

[246] Frasson 2013, 71-73; Baratta 2013, 43. There seems to be some confusion, however, on the precise location of the findings reported by F. Gamurrini at the end of the 19th century (see *supra*).

[247] Baratta 2013, 54, note 59.

[248] The remains of a porticoed building, mosaics and domestic structures have been recorded to the north of Borgo Tufico (Pignocchi/Sabbatini 2001, 234-235; Venanzioni 2005, 42, 51).

[249] As has been suggested by Pearce et al. 2009, 92.

3.3.18 *Numana* (Numana)

The Roman town of *Numana* is situated in the area occupied by the modern town of Numana, located at the southern foot of the Monte Conero (*Figure* 129, n° 18). Excavations carried out in 1960 and 1974-75 have made it clear that the Roman centre replaced a previous Picenian settlement.[250] The status of *municipium* is attested epigraphically.[251] Another honorary inscription attests the Imperial interest in the town in the 2nd century AD.[252] In archaeological terms, the site remains one of the least known Roman settlements in the region and only a few remains are still visible among the buildings of the modern centre: some wall nuclei in *opus caementicium* (*Figure* 169, n° 1, 2, 4); and several walls in *opus reticulatum* (*Figure* 169, n° 3).[253] Some of the former remains may belong to a temple dedicated to the goddess Venus, apparently attested by L. Spada at the end of the 19th century (*Figure* 169, n° 4).[254] The same L. Spada also noted an amphitheatre to the west of the Via Roma, but no remains of such a construction are visible today (*Figure* 169, Via Roma).[255] Given the lack of archaeological documentation, it is currently not possible to reconstruct either the internal organisation or the extension of the urban area. On the basis of the natural limits of the terrain, a size of ca. 16 hectares (800x200 m) has been proposed by Manlio Lilli (*Figure* 170).[256]

N° 18	Public architecture							DA	EA
Type								Domus	
y/n	\	\	\	x	\	x	\		\
m²	160,000	\	\	\	\	\	\		\

Bibliography: Spada 1877; Lollini 1975; 1976a; Gasperini 1981; Baldelli 1991; Lilli 2002

3.3.19 *Potentia* (Porto Recanati)

One of the best documented towns in the area is *Potentia* (*Figure* 129, n° 19), a Roman town that lies in the surroundings of today's Porto Recanati in the lower Potenza valley. Ten

[250] Lollini 1975; 1976a; Baldelli 1991, 98, 108.
[251] *CIL* IX, 5831, 5832.
[252] Gasperini 1981, 44-45.
[253] Lilli 2002, 470-475.
[254] Spada 1877, 23.
[255] Spada 1877; Lilli 2002, 488-489.
[256] Lilli 2002, 486-487.

years of intensive aerial photography analysis, large-scale geophysical survey and systematic fieldwalking by the PVS – together with excavations in the area of the western town gate – have resulted in significant advancements in our understanding of the topography and evolution of this urban settlement.[257] In fact, three main phases have been identified in the town's occupation history. The first phase probably relates to the early years of the colony between 184 and 174 BC and represents the initial organisation of the town after the arrival of the colonists. In that period, the town area – most likely enclosed by an earthen bank (*agger*) with palisade and a ditch – covered ca. 525 x 300 m (15.7 ha).[258] According to a passage in Livy (XXXIX.44.10), the colony was provided with a three-gated circuit wall in 174 BC. This wall has been detected both in aerial imagery as through geophysical prospection and enclosed a town area of some 16 hectare, regularly subdivided into 48 *insulae*. Of the three existing town gates only the western gate was excavated by Ghent University, together with a section of the wall itself. The latter was built according to the *opus quadratum* technique with rectangular sandstone blocks of different sizes put together with the use of clay.[259] The same Titus Livy also informs us about the installation in the same period of an aqueduct, a temple dedicated to Jupiter and the first phase of the *forum*.[260] A third phase – probably after the mid-1st century BC – likely concerned an enlargement of the walled space with some 50 m to the east. As such, the town was enlarged with 12 *insulae* and now measured 525x350 m or ca. 18.4 hectare *intra muros* (*Figure* 171). The reasons for this reorganisation of the town area are not entirely clear, but possibly there is a relationship with the necessity to partially rebuild the town in the aftermath of a major earthquake that occurred in the region around the mid-1st century BC (Cic. *Har. resp.* 28.62).[261]

Based on the available epigraphic evidence the town clearly flourished during the Augustan era and the High Imperial period (later 1st-2nd century AD).[262] This evolution has found support in the survey results of the PVS within the town area, which suggest that the intensity of intra-mural habitation increased significantly between the Late Republican period and the 1st/2nd century AD (*Figures* 172 and 173). It is possible that in the course of the 1st century AD residential quarters gradually developed in the immediate

[257] For summaries and overviews of some of the results, see Vermeulen 2009; 2011; Vermeulen/Boullart 2001; Vermeulen/Verhoeven 2004; 2006; and Vermeulen et al. 2002; 2006; 2009.

[258] Vermeulen et al. 2011, 192-193; Vermeulen/Monsieur 2012, 168, 172.

[259] Vermeulen et al. 2011, 176.

[260] Percossi Serenelli 2001; Percossi 2012; Vermeulen/Monsieur 2012, 169.

[261] Vermeulen/Carboni 2011; Vermeulen et al. 2011; Vermeulen 2012. Excavations in the area of the temple have indeed identified an important destruction layer, possibly dated to the mid-1st century BC (Paci/Percossi Serenelli 2005, 200); traces of an important reconstruction under Augustus have also been attested during the excavations of the western town gate (Vermeulen/Monsieur 2012, 170).

[262] Paci 1995.

suburbium of *Potentia*, but archaeological evidence for extra-mural buildings is currently thin. Still, concentrations of Early Imperial domestic pottery and brick building materials just outside the western and southern town gates suggest that some form of extra-urban residential occupation existed in the first two centuries of the Empire.[263] The absence of such materials in later Roman times also suggests that from the 3rd century AD onwards the habitation definitely contracted again within the walled urban area. The same surveys have also attested an apparent contraction of the habitation within *Potentia* from the mid-5th century AD onwards, when mainly the *forum* area and the northern section of the town remained in use, while the entire eastern section seems to have been abandoned (*Figure* 174).[264] In fact, these surveys back-up some of the most significant excavation results that have been obtained over the years, such as the demolishing of the temple next to the *forum* at the end of the 4th century AD, and the insertion of 5th-6th century tombs in the north-eastern corner of the town, in an area previously occupied up until the early 5th century AD.[265]

The three main exit roads of the town were all bordered by cemeteries (*Figure* 171, A, B, C). With over 400 tombs excavated in the 1960's by the Soprintendenza Archeologica delle Marche, the northern one is the largest and best known cemetery and seems to have been in use from the 2nd century BC until the 4th century AD.[266] The western cemetery was touched upon during the excavations of the western town gate by the PVS team and can broadly be situated in the 1st-2nd century AD.[267] The presence of the southern necropolis has been attested through geomagnetic surveys.[268] Finally, a large artisanal-industrial zone dating to the Augustan period occupied the southern part of the northern cemetery and a section of the intra-mural area of the town.[269] The attestation of a press floor in association with a kiln producing Dressel 6A wine amphorae and Dressel 6B oil amphorae point towards an important production-related function of the area between the mid-1st century BC and the mid-1st century AD.[270]

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[263] Vermeulen 2012b, 84. Recent geomagnetic surveys in the area immediately to the western town gate of *Potentia* have revealed the traces of a building that may be identified as a suburban villa (Vermeulen et al. 2012, 41, fig. 7).

[264],Vermeulen 2008; 2012b, 84.

[265] Mercando 1979c; Percossi Serenelli 2001; Vermeulen 2012b, 86. Recent geomagnetic surveys confirmed the presence of several funerary monuments further along the western exit road of the town (Vermeulen et al. 2012, 41, fig. 7).

[266] Mercando et al. 1974; Percossi Serenelli 2001, 44; Monsieur 2007; Percossi 2007; see also Vermeulen 2012b, 86.

[267] Vermeulen et al. 2011, 195.

[268] Vermeulen et al. 2012, 38-39.

[269] Mercando 1979c.

[270] Vermeulen/Monsieur 2012, 170-171.

The internal organisation of the individual *insulae* is difficult to reconstruct from the geophysical and aerial survey imagery, but some broad elements of the town's organisation are sufficiently clear. In its most expansive form, the town was subdivided into 60 *insulae*. Of these, some 24 *insulae* measured 1x2 *actus* (35x70 m), one row of 12 *insulae* measured 1x2.5 *actus* (35x87.5 m), another row of 12 measured 1x1.5 *actus* (35x52.5 m), and a final row of 12 measured 1x1 *actus* (35x35 m). On the whole, these *insulae* took up ca. 132,300 m² (13.2 ha or 71.9 %) of the total urban area (18.4 ha), leaving about 5.2 ha of space for the actual street grid (28 %). Within the town area, the *forum* square itself measured ca. 120x30 m (ca. 3,600 m²). On both its long sides it was bordered by a series of porticoed shops, measuring ca. 1,920 m² (16x120 m) along the western side and ca. 2,880 m² (24x120 m) along the eastern side (4,800 m²). Large publics buildings occupied the northern (ca. 1x1 *actus* or 35x35 m) (ca. 1,225 m²) and the southern side (ca. 15x30 m) (ca. 450 m²) of the complex.[271] Immediately to the east of the *forum* an area of ca. 135x65m (ca. 8,775 m²) also housed a Late Republican/Augustan temple – measuring ca. 192 m² (24x8 m) and positioned inside a porticoed enclosure of ca. 1,152 m² (24x48 m) – and a small *macellum* (16x32 m) (ca. 512 m²).[272] Another temple (ca. 384 m²) (16x24 m) was also identified immediately to the south of the Augustan temple.[273] In the eastern part of the town, a semi-circular public building, probably an odeon or a small theatre, occupied ca. 1x1.5 *actus* or 35x52.5 m of space (ca. 1,838 m²) (*Figure* 171). A thermal complex was also identified in the southern part of the town, but its extensions are unknown.[274] On the whole then, the public architecture took up a space of at least ca. 19,200 m² (1.9 ha), i.e. ca. 10.5% of the whole town area. That leaves about 11.3 ha (61.4%) for residential space. While the survey results do not allow for assessing the size and number of houses that occupied a single *insula*, excavations in the central part of the town have indicated that the private architecture was of the *domus*-type, with rooms centred around a courtyard.[275]

N° 19	Public architecture							DA	EA
Type								Domus	
y/n	x	x	x	\	x	x	x	x	x
m²	184,000	4,950	1,838	\	\	192	450 1,225	\	\

Bibliography: Mercando et al. 1974; Mercando 1979c; Percossi Serenelli 1990; 1995; 2001; Paci 1995; Paci/Percossi Serenelli 2005; Percossi 2007; 2012; Monsieur 2007; Vermeulen 2008; 2009;

[271] The northern public building could be the temple dedicated to the god Jupiter

[272] Percossi Serenelli 1995; 2001; see also Vermeulen/Monsieur 2012, 165.

[273] Vermeulen/Verhoeven 2006, 11-12.

[274] Vermeulen/Carboni 2011.

[275] Percossi Serenelli 1995; 2001.

2011; 2012a; 2012b; Vermeulen/Boullart 2001; Vermeulen/Verhoeven 2004; 2006; Vermeulen/Carboni 2011; Vermeulen et al. 2002; 2006; 2009; 2011; 2012; Vermeulen/Monsieur 2012

3.3.20 *Ricina* (Villa Potenza)

The remains of the Roman town of *Ricina* are spread out between the buildings of the modern road settlement of Villa Potenza, located in the middle Potenza valley some 15 km from the coast (*Figure* 129, n° 20). The site probably developed in the wake of Rome's conquest of *Picenum* in the 3rd century BC as a *praefectura* with *civitas sine suffragio* – or originated as a settlement for viritane colonists after the *Lex Flaminia de agro Gallico et Piceno viritim dividendo* in 232 BC – before receiving the status of *municipium* in the course of the 1st century BC. Small-scale excavations on various locations within the Roman town area have confirmed the consistent occupation of the site at least from the late 2nd century BC onwards, when the settlement was apparently provided with a few facilities, like a street lined with shops.[276] It is from the Augustan period onwards, however, that the town seems to have experienced its heyday. This is attested by the functioning of a monumental cemetery located south-west of the town between the reigns of Augustus and Tiberius (27 BC – AD 37) and at least the 3rd century AD.[277] The theatre – made in *opus caementicium* with coverings in *opus latericium* and measuring ca. 72x50 m (ca. 3,600 m²) – was probably also built in the first half of the 1st century AD.[278] Epigraphical sources point towards the undertaking of a large building program in the 2nd century AD, such as the restoration of the thermal complex next to the theatre in the time of Trajan (AD 98-117) (*CIL* IX, 5746), and repair works to the streets and squares.[279] Another major restructuration program seems to have been planned in the time of Septimius Severus (AD 193-211) – in connection with the promotion to the status of *Colonia Helvia Ricina* – but unfinished decoration works at the theatre suggest that these plans were never fully realised.[280] Still, the existence of houses with mosaic pavements has been attested archaeologically for both the 2nd and the 4th century AD. Then again, the registration of two late antique tombs on top of the structures of the street with shops point towards the contraction of the habitation area after the 4th century AD.[281]

[276] Mercando 1970c; Moscatelli 1985, 85; Percossi Serenelli 1989, 65-117.
[277] Mercando/Bachielli/Paci 1984; Percossi Serenelli 1989, 85-86; Capodaglio/Cipolletta 1996, 26-32.
[278] Percossi Serenelli 1989.
[279] Mercando 1980; Capodaglio/Cipolletta 1996, 9.
[280] Capodaglio/Cipolletta 1996, 11.
[281] Mercando 1970c; 1970d; 1980; Percossi Serenelli 1989.

Until recently, not much was known of the actual topography or extension of the town. In recent years, however, fieldwork carried out by the PVS team of Ghent University has significantly increased our knowledge on several aspects of the urban settlement. Crop marks registered during various aerial photography campaigns have confirmed the presence of a circuit wall that likely enclosed an area of ca. 25 hectare (*Figure* 164 and 175).[282] Following some surviving structures on the terrain – i.e. remains consisting mainly of walls made out of nuclei in *opus caementicium* covered with *opus latericium* – aerial photography imagery has also made it clear that the town possessed a large public space consisting of a temple (ca. 33x18 m) (594 m²) placed within a wide enclosure of at least 90x50 m (ca. 4,500 m²) (*Figure* 164), and possibly even 170x50 m (ca. 8,500 m²) (*Figure* 175, n° 1).[283] The identification of the deity is not clear, but the existence of temples dedicated to Augustus, Jupiter and Mercury in the town is known epigraphically.[284] Recently, it has been proposed to recognise in this complex the central *forum* area with the *Capitolium* of the town.[285] Another major discovery has been the previously unknown amphitheatre, located to the north-east of the theatre and measuring ca. 80x70 m (ca. 5,600 m²) (*Figure* 164; 175 n° 3).[286] Immediately to the north-east of the temple, the plan of a large Imperial *domus* (1st-2nd century AD) centred around an *atrium* and a *peristylium* has been registered (*Figure* 164; 175). The complete plan or extension of the complex is not clear, but the traces cover an area of at least 40x40 m (ca. 1,600 m²). Other crop marks have been observed in the town area that could also be interpreted as parts of domus complexes dating mainly to a period between the 1st century BC and the 1st century AD. However, material from the 4th-5th century AD is also present.[287] To the south-west of the temple, the remains of a cistern (ca. 12x5.35 m) (ca. 64.2 m²) are still visible (*Figure* 164; 175, n° 2). Crop marks in the surrounding field hint at the existence of other walls, maybe belonging to a thermal complex or another public building. Based on the recovered ceramic evidence, the occupation of this central part of the town seems to have peaked during the Principate, but both Late Republican and Late Imperial material has been attested.[288] Finally, a series of parallel linear traces near the south-western corner of the town in combination with the retrieving of many *dolium* and amphora fragments hint at the existence of tabernae or *horrea* (*Figure* 164; 175).[289] Important information was also

[282] Vermeulen et al. 2005, 41; Carboni/Vermeulen 2014, 930.

[283] Vermeulen et al. 2005, 41-42; Vermeulen 2012a, 335.

[284] Cecchi 1968.

[285] Carboni/Vermeulen 2014, 930.

[286] Vermeulen 2011; 2012a.

[287] Vermeulen et al. 2005, 41-43; Vermeulen 2012a.

[288] Vermeulen et al. 2005, 42; Vermeulen 2012a; Carboni/Vermeulen 2014.

[289] Vermeulen et al. 2005, 43; Vermeulen 2012a.

acquired concerning the immediate *suburbium* of *Ricina*. Indeed, crop marks in the zones of both the SW and the NE town gate may indicate the development of extramural residential quarters (*Figure* 164; 175); while a small rural Early Imperial temple (ca. 18x9 m) (ca. 162 m²) was also identified to the north-west of the town.[290]

N° 20	Public architecture							DA	EA
Type								Domus	Tombs Temple
y/n	\	\	x	x	x	x	x	x	x
m²	250,000	\	3,600	5,600	\	4,050	64.2	1,600	162

Bibliography: Cecchi 1968; Mercando 1970c; 1970d; 1980; Mercando/Bachielli/Paci 1984; Moscatelli 1985; Percossi Serenelli 1989; Capodaglio/Cipolletta 1996; Percossi/Frapiccini 2008; Vermeulen 2011; 2012a; Vermeulen et al. 2005; 2009; Carboni/Vermeulen 2014

3.3.21 *Trea* (Passo di Treia)

The remains of the Roman *municipium* of *Trea* have been located on an elevated plateau nearby the modern day town of Treia in the middle Potenza valley (*Figure* 129, n° 21). The precise origins of the settlement are not clear, but recent surveys in and around the urban site have revealed the presence of Picenian material, suggesting that the Roman town was at least partially built on a pre-existing protohistoric centre.[291] As the *itinerarium Antonini* identifies *Trea* as a town lying on the *Via Flaminia per Picenum Anconam* – i.e. a *diverticulum* of the main *Via Flaminia* that lead to *Ariminum* (Rimini) – the settlement probably possessed the status of *Praefectura* in the 3rd-2nd century BC. The *Liber Coloniarum* mentions land allotments in the territory of *Trea* under the second triumvirate.[292] Almost nothing is visible of the site today, besides two sections of the circuit wall in *quasi reticulatum* technique; a wall that was probably erected in the wake of the settlement's acquisition of municipal status around 49 BC.[293] Excavations in the late 18th century by Fortunato Benigni uncovered similar wall sections, the remains of a basilica and a sanctuary under

[290] Vermeulen et al. 2005, 43-44; Vermeulen 2012a.

[291] Vermeulen et al. 2012, 278. Such an origin had already been suggested given the vicinity of the Monte Pitino – an important Picenian centre in pre-Roman times – and the site's obvious strategic position (Lollini 1976b; Boullart 2005; and Vermeulen et al. 2002; 2009).

[292] Moscatelli 1985.

[293] Paci 1999; Vermeulen et al. 2012, 264. Based on the building technique, the construction of the town wall is usually situated either in the first half (Moscatelli 1985, 82-87) or the second half of the 1st century BC (Percossi Serenelli 2000, 75).

today's monastery of SS. Crocifisso.[294] Later research activities include the surveys carried out by Umberto Moscatelli on and near the town site in the 1970's, and the excavations by Fabrini under the aforementioned monastery of SS. Crocifisso between 1985 and 1988.[295] On the basis of this knowledge, the total town area of *Trea* was estimated at ca. 13 ha (*Figure* 176).[296]

Since 2003, fieldwork by the PVS using a combination of aerial photography, geophysical prospection and artefact survey has notably increased our knowledge of the topography and evolution of this Roman settlement. One important contribution of these research activities is the attestation of a smaller intramural area than previously thought: 11 ha, which makes *Trea* the smallest of the four towns in the Potenza valley. It is also clear that these walls were provided with several rectangular towers, while a town gate was attested along the southern course of the circuit wall (*Figure* 177). More importantly, however, thanks to this work some 70% of the town's infrastructure is known today. The central section of the settlement was occupied by the rectangular *forum* square (ca. 100x35 m) (ca. 3,500 m²) – including a small temple of ca. 20x10 m (ca. 200 m²), probably to be identified as the *Capitolium* of the town – and its adjacent buildings, i.e. a basilica to the west (ca. 35x20 m) (ca. 700 m²), flanked by possible temples to the north (ca. 530 m²) and to the south (ca. 710 m²), and a series of *tabernae* to the south and the north of the square occupying a combined area of ca. 4,500 m², together with a probable *macellum* in the south-east corner measuring at least 30x30 m (ca. 900 m²). To the north-east of the *forum*, a large unidentified porticoed building occupied an additional space of ca. 25x25 m (625 m²) (*Figure* 177). In total, it is likely that the area reserved for public space took up some 12,000 m² or 1.2 ha (ca. 80x150 m); i.e. ca. 12% of the total urban surface. House plans are not precise, but the registered traces and artefacts point towards the presence of large and richly decorated buildings of the *domus* type from the 1st century BC onwards (*Figure* 177).[297]

With regard to the internal organisation of the town, there seems to be at least eight *insulae* of 3x1 *actus*, bordered by streets that have an average width of 4m (*Figure* 177).[298] An interesting feature is the existence of two orientations in the street grid. Indeed, the western part of the town has a SW-NE orientation and occupies the higher point of the plateau; the eastern part lies on the lower section and has a NW-SE orientation. One of the most visible elements of this grid is the 6m wide *decumanus maximus*, which enters the settlement through the western gate and crosses the entire western section of the site,

[294] Percossi Serenelli 2000; Vermeulen et al. 2012.

[295] For the surveys, see Moscatelli 1985; 1988; for the excavations, see Fabrini 1990.

[296] Moscatelli 1988.

[297] Vermeulen et al. 2012, 273, 275-277.

[298] Vermeulen 2009; 630; Vermeulen et al. 2012.

but is abruptly halted by the monumental *forum* complex that occupies most of the eastern side (*Figure* 177). Remote sensing activities by the PVS have clearly attested that this road originally continued its course towards a gate in the northern circuit wall, but was later obliterated by the insertion of the *forum* and its adjacent buildings, after which the road was derived towards a yet to be identified gate in the north-east (*Figure* 177).[299] These observations clearly suggest a re-organisation of the urban area in the Early Imperial period as a direct result of the monumentalisation of the town centre, most likely including an enlargement of the original Late Republican nucleus.[300]

It is clear that Trea experienced its heyday in the course of the 1st and 2nd centuries AD, but it is not clear if it ever developed suburban quarters.[301] Still, considering the relatively small space for housing inside the town walls, it certainly is possible that in the course of the 1st century AD some kind of extra-mural quarters developed, in particular to the east and the west of the town where the topography of the location the most allowed for it. In fact, some surface scatters on the southern slope of the settlement could be considered to belong to extra-mural buildings (*Figure* 178).[302]

N° 21	Public architecture									DA	EA
Type									UI	Domus	
y/n	y	y	n	n	y	y (4)	y	y	y	y	x
m²	110,000	3,500	\	\	\	200 530 710	700	900	625	\	\

Bibliography: Lollini 1976b; Moscatelli 1985; 1988; Fabrini 1990; 2003b; Marengo 2000; Percossi Serenelli 2000; Fabrini 2003b; Boullart 2005; Vermeulen 2009; 2012a; Vermeulen et al. 2002; 2005; 2009; 2012

3.3.22 *Septempeda* (San Severino Marche)

Just like *Trea*, the origins of the Roman town of *Septempeda* probably lie in its role as a road settlement along the *Via Flaminia per Picenum Anconam*, installed in the course of the 3rd-

[299] Vermeulen et al. 2012, 273.

[300] Most of the Republican material collected during the surveys by the PVS was found in the higher western part of the town (Vermeulen et al. 2012, 274).

[301] The site shows traces of occupation between the 2nd century BC and the early 6th century AD (Vermeulen 2009, 630).

[302] Vermeulen et al. 2012.

2nd century BC on the place of a previous Picenian settlement.[303] The urban area is situated on a river terrace along the Potenza River, located immediately to the north of the current main valley road some 40 km inland from the coast (*Figure* 129, n° 22). Archaeological research in the 20th century has revealed several wall sections in *opus quadratum* and two gates provided with towers belonging to the town's enclosure, which encompassed both the lower and the higher area to the north of the valley road (*Figure* 221, n° 1 and 2).[304] Recent aerial photography by the PVS has confirmed the somewhat irregular course of this circuit wall, which encompassed a roughly pentagonal area of ca. 15 ha. Close to the south-western town gate, excavations have uncovered a cemetery that was in use between the 3rd and the 2nd century BC. As the town walls were built on the place of this cemetery, their construction is probable to be situated somewhere after the end of the 2nd century BC, and most likely in the first half of the 1st century BC.[305] Other discoveries include the presence of two Early Imperial *domus* buildings (end 1st century BC/2nd century AD) along the *decumanus maximus* (*Figure* 221, n° 4), and a thermal complex measuring ca. 30x30 m (900 m²), with the latter building replacing a Late Republican artisanal unit that produced vernice nera (3rd-1st century BC) (*Figure* 221, n° 3). The reuse of architectonical decoration fragments in the bath complex also points towards the pre-existence of a Late Republican sacral building nearby, maybe to be identified with the temple for the goddess Feronia.[306] Outside the town walls, the remains are known of a cemetery dating to the 1st-2nd century AD (figure 221, n° 6) and an artisanal complex meant for the production of ceramics that was in use between the 1st and the 4th century AD (n° 5).[307] More recent aerial photography work by the PVS further identified sections of the urban street network, an Early Imperial *domus* with *atrium* and *peristylium* and a major extra-mural sacral complex just outside the eastern town gate, measuring ca. 55x70 m (3,850 m²) (*Figure* 224).[308] Said research also established the position of the *forum* (*Figure* 224). The only public building attested epigraphically is the basilica (*CIL* IX, 5576).

[303] The area shows traces of a Picenian presence in pre-Roman times, and of a Roman occupation from the 3rd/2nd century BC onwards (Landolfi 1987; 1990; 1991; 2003; Marengo 1998).

[304] Landolfi 2003.

[305] Landolfi 1987, 405-407; Landolfi/Perna 2004, 89-91; see also Sisani 2006, 328; for a dating in the first half of the 1st century BC, see Moscatelli 1985, 76-82; a chronology that is also assumed by Roberto Perna on the basis of the *opus quadratum* building technique – rather than the *opus vittatum* so typical for the 'municipal' walls of the second half of the 1st century BC (Perna 2013a, 80-84).

[306] Landolfi 2003; Sisani 2006, 329; see *CIL* 5711 for the inscription mentioning the deity.

[307] Landolfi 1987; 1990; 1991; 2003.

[308] For the *domus*, see Vermeulen et al. 2006, 216-218; Vermeulen 2009, 632; for the sacral building, see Vermeulen et al. 2009, 105; and Vermeulen 2011, 264.

N° 22	Public architecture							DA	EA
Type								Domus	
y/n	\	\	\	\	x	x	\	x	x
m²	150,000	\	\	\	900	\	\		3,850

Bibliography: Landolfi 1987; 1990; 1991; 2003; 2006a; Landolfi/Perna 2004; Moscatelli 1985; Marengo 1998; Sisani 2006; Vermeulen 2009; 2011; Vermeulen et al. 2006; 2009; Perna 2013a

3.3.23 *Matilica* (Matelica)

The Roman *municipium* of *Matilica* is covered by the modern town of Matelica in the upper Esino valley (*Figure* 129, no. 23). The occupation of the site probably goes back to the Iron Age (ca. 7th century BC), but pole holes found under the Palazzo Chierichetti indicate that a more structured settlement only developed from the 5th/4th century BC onwards. Still, the settlement does not seem to have possessed a real urban character for much of the Late Republican period. The findings of vernice nera and several votive objects suggests a possible sacral function in the 3rd-2nd century BC.[309] Excavations along the Corso Vittorio Emanuele have attested that a somewhat more regular form of habitation – consisting of private buildings with decent pavements in *opus signinum* and black and white mosaics – only developed from the mid-1st century BC onwards; i.e. in a period probably coinciding with the acquisition of municipal status.[310] The real development of the town, however, seems to occur in the course of the 1st and especially the 2nd century AD. Indeed, this was a period of intense building activity for *Matilica*, as attested by the many finds of wall structures in *opus latericium*, *opus caementicium* and *opus mixtum*, fragments of both monochrome and polychrome mosaics, cocciopesto floors and wall paintings.[311] These finds suggest that in the High Imperial period – certainly until the 2nd half of the 2nd century AD and the beginning of the 3rd century AD – ample space was used for the building of large and luxurious *domus* complexes. In most cases, the extension of these buildings is unknown, but some observations can still be made. For instance, the *domus* complex under the Palazzo Chierichetti was excavated for an area of ca. 600 m², but may have taken up a larger area. (*Figure* 179, n° 32).[312] The wall structures and floors found under the Palazzo Ottoni may have belonged to a *domus* measuring at least ca. 1,200 m²

[309] Biocco 2000, 59, 65.

[310] De Marinis et al. 2007, 179.

[311] Mercando 1980; Biocco 1999; 2000; De Marinis et al. 2007, 181-183.

[312] One hypothesis has made the *domus* taking-up an entire *insula* of 2x2 *actus* – i.e. ca. 4,900 m² - but this seems unlikely (Biocco 2000, 51-57; De Marinis et al. 2007, 184).

(*Figure* 179, n° 9-13).[313] A few rooms (ca. 125 m²) belonging to another *domus* were also found under the Palazzo del Governo and the Piazza Leopardi (*Figure* 179, n° 4-8).[314] The decay of the town seems to have set in the course of the 3rd-4th century AD, when many domestic spaces were badly repaired, reduced in size or reformed to more functional/artisanal areas.[315]

The knowledge on the public architecture of the town is equally scarce. Only one public building is currently known, i.e. an Imperial thermal complex excavated over an area of ca. 480 m² (*Figure* 179, n° 22).[316] The *forum* is believed to be situated under the current Piazza Mattei, but this hypothesis has not yet been confirmed archaeologically. Based on the dimensions of the Piazza, the *forum* could have measured ca. 70x53 m (ca. 3,710 m²), which corresponds roughly to 2x1.5 *actus* (*Figure* 179, Foro).[317] Finally, two sections of the street grid were found, a first one (*cardo*) with a width of ca. 3 m and another one (*decumanus*) measuring ca. 1.80 m (*Figure* 179, n° 2 and 17).[318] On the basis of these finds, an internal division into insulae of 2x2 actus (70x70 m) has been proposed.[319] Concerning the further spatial organisation of the settlement, it is interesting to note that height analyses carried out on the structural remains have made it clear that the Roman town was organised into different levels according to the morphology of the location.

There are currently no traces of a potential town wall, but it seems logical that the extension of the urban area was determined by the natural morphology of the site. Indeed, Matelica is situated on top of a natural alluvial terrace that is delimited on three sides by the river Esino and the Rio Imbrigno current. An elongated form of the town measuring ca. 600x200 m (ca. 12 ha) would correspond will with these natural circumstances.[320] There is no information on extramural private buildings, but three funerary zones were identified outside the town: a first one to the north; a second one to the south-east with tombs dated to the 2nd century AD (loc. Fontincelle); and a third one to the south-west that was already in use in the Iron Age (loc. Crocifisso).[321]

[313] Biocco 2000, 36-38.

[314] Biocco 2000, 30-35.

[315] Biocco 2000, 66.

[316] Biocco 2000, 45-47.

[317] It has been suggested that the *forum* covered an entire *insula* of ca. 2x2 *actus*, or ca. 4,900 m² (Biocco 2000, 60-61; 2012, 119, note 24).

[318] Biocco 2000, 30, 40.

[319] Biocco 2000, 61.

[320] Biocco 2000, 59-60; 64-65.

[321] For the cemetery at loc. Fontincelle, see Biocco/Gobbi 1999, 61; for the one at loc. Crocifisso, see Baldelli et al. 1999.

N° 23	Public architecture							DA	EA
Type								Domus	Tombs
y/n	\	x	\	\	x	\	\	x	x
m²	120,000	3,710	\	\	480	\	\	600; 1,200	\

Bibliography: Mercando 1980; Baldelli et al. 1999; Biocco 1999; 2000; 2012; Biocco/Gobbi 1999; De Marinis et al. 2007

3.3.24 *Attidium* (Attiggio)

The Roman town of *Attidium* is located on the site of modern Attiggio, a community distant some 5 km from the centre of Fabriano (*Figure* 129, n° 24). Not much is known of the settlement before its elevation to the status of *municipium* shortly after the Social War (91-88 BC).[322] Before the installation of a Picenian settlement at the end of the 6th/beginning of the 5th century BC, the site has been occupied since the end of the Neolithic.[323] In the 3rd and 2nd centuries BC – a period in which it may have been ranked as *civitas foederata* – the site probably knew some kind of extensive habitation.[324] The proper 'urban' phase of *Attidium*, however, seems to have started only from the Augustan era onwards, when its territory was the object of land distributions to the veterans of the emperor.[325] This flourishing period is mainly reflected in the survived epigraphy, but also in a few excavated structures from the town.[326] Almost nothing is known of the internal organisation of the urban area and our knowledge is mostly limited to the remains of a quadrangular public building (ca. 13.2x12.3 m) (ca. 162 m²) – possibly a temple dating back to ca. AD 117/138 (*Figure* 180, n° 1) – a small thermal complex from the 2nd century AD (*Figure* 180, n° 10), and some transects of paved street levels (*Figure* 180, n° 2).[327] Considering the relatively small size of both the thermal complex as a whole and its

[322] The dating for the receiving of *municipal* status after 90 BC has been proposed by G. Paci and is based on the presence of *quattorviri* in *CIL* XI, 5676 (1st century AD) (Paci 1998c; see also Petraccia 2009, 134, n° 9). Pliny ranks *Attidium* among the urban centres of *Regio* VI *Umbria et Ager Gallicus* (*HN* 3.14.113). An honorary inscription from the 2nd-3rd century AD mentions Lucius Musetius Sabinus as a *patronus* of the *municipia* of *Attidium*, *Tuficum* and *Cupra Montana* (*CIL* XI, 5718).

[323] The Picene phase is documented by black-figured attic ceramics (Luni 2003, 179; Petraccia 2009, 14).

[324] For the archaeological evidence relating to the pre- and early-Roman phases of *Attidium*, see Marengo 1993, 13-14; Pignocchi/Sabbatini 2001, 227; Pandolfi 2007, 42; and 2009, 39-42. The possibility of a *civitas foederata* has been proposed by Pignocchi/Sabbatini 2001.

[325] As mentioned in the *Liber Coloniarum* (*Lib. colon.* I, 240, 10; II, 252, 8; see also Petraccia 2009, 13, notes 11-12).

[326] Marengo 1994; Pignocchi/Sabbatini 2001, 230; Pandolfi 2007, 51.

[327] In the vicinity of the public building a block was found with a dedication to emperor Hadrian (AD 117-138) (Marengo 1987, 321-326; see also Pignocchi Sabbatini 2001, 230; and Pandolfi 2007, 40; and 2009, 43-45).

individual rooms – six rooms were excavated over a surface of 175 m² - the facility probably belonged to a private residential building.[328] The position and size of the *forum* are currently not clear. Based on current knowledge, the limits of the inhabited area are almost impossible to define, but following the morphology of the site and the presence of a probably extra-urban cemetery dating to the 2nd-4th century AD (*Figure* 180, n° 8, 14), an extension of ca. 10 ha has been proposed by Cristiana Pandolfi.[329] A smaller size of ca. 4-5 hectares has been proposed by John Pearce, Maria Pretzler and Corinna Riva.[330]

N° 24	Public architecture							DA	EA
Type								Domus	Tombs
y/n	\	\	\	\	x	x	\	\	x
m²	100,000	\	\	\	175	162	\	\	\

Bibliography: Marengo 1987; 1993; 1994; Paci 1998c; Virzì 1991b; Pignocchi/Sabbatini 2001; Riva et al. 2005; Cardinali/Luni 2006; Pandolfi 2007; 2009; Petraccia 2009; Pearce et al. 2009

3.3.25 *Cluana* (Civitanova Marche)

The Roman town of Cluana has been situated by Nereo Alfieri in the area of San Marone di Porto Civitanova Marche (*Figure* 129, n° 25). We know from an inscription that the town was provided with a *compitum* – i.e. a sacral altar – near the end of the 2nd/beginning of the 1st century BC and that the settlement was awarded municipal status in the course of the latter century.[331] Most epigraphic testimonies date to the 1st-2nd century AD, one of which attests the existence of an Augustan cult.[332]. A recent examination by Maria Cecilia Profumo of a series of unpublished excavation reports by the Soprintendenza Archeologica delle Marche has allowed her to define approximately the main functional areas of the town, but the exact configuration and the extension of the settlement remain unclear (*Figure* 198).[333]

Bibliography: Alfieri 1993; Giagni 1998; Cardinali 2003; Profumo 2014

[328] The black and white mosaics of the baths are dated to the 2nd century AD (Pignocchi/Sabbatini 2001, 231-232; Pandolfi 2007, 44, 51); for the excavation of the building, see Virzì 1991b; the walls are all made out of a nucleus in *opus caementicium*, with either an *opus testaceaum* or *opus vittatum* covering (Pandolfi 2009, 47). The remains of an aqueduct have also been noted (Pandolfi 2007, 42).

[329] Pandolfi 2007, 52; 2009, 53-54.

[330] Riva et. Al 2005; Pearce et al. 2009, 91.

[331] Branchesi 2009.

[332] Giagni 1998, 331-332.

[333] Profumo 2014.

3.3.26 *Pausulae* (San Claudio al Chienti)

The Roman town of *Pausulae* has been identified in the surroundings of the modern centre of Corridonia, in an area next to the monastery of San Claudio al Chienti (*Figure* 129, n° 26). Literary testimonies on *Pausulae* are limited to Pliny's mentioning of the settlement as one of the *municipia* of *Picenum* (*HN* 3.13.111), and its inclusion in the *Liber Coloniarum*, indicating the distribution of veterans in the *Ager Pausulanus* under the Triumvirate (*Lib. colon.* I, 226; II, 257). Unfortunately, only a few elements of the urban topography are currently known to us. Between 1980 and 1982, a ca. 680 m² large section of the town area was excavated by the Soprintendenza Archeologica delle Marche to the south-east of the monastery. These operations uncovered a series of rooms that were part of an artisanal building that was positioned along one of the paved streets of the town between the last decades of the 1st century BC and the 2nd century AD.[334] These excavations also yielded a few clay architectural elements that point to the existence of a Republican temple, probably between the mid-2nd century BC and the mid-1st century BC.[335] The vitality of the centre in the Imperial period – especially in the 1st century AD – is indicated by a series of funerary and honorary inscriptions.[336] Not much is known about the extension of the urban area, but a combination of field survey and aerial photography has pinpointed a concentration of ceramic and building material extending over an area of ca. 20 hectares, delimited by what seems to be a circuit wall (*Figure* 222).[337]

N° 26	Public architecture								DA	EA
Type								UI	Domus	\
y/n	\	\	\	\	\	x	\	x	\	\
m²	200,000	\	\	\	\	\	\	680	\	\

Bibliography: Moscatelli 1981; Percossi Serenelli 1982; Percossi Serenelli/Frapiccini 1999; Antolini et al. 2006; Paci 2008a; Branchesi 2009

[334] Percossi Serenelli 1982; Percossi Serenelli/Frapiccini 1999, 375.

[335] Percossi Serenelli 1982; Percossi Serenelli/Frapiccini 1999, 376; Branchesi 2009, 55.

[336] Percossi Serenelli/Frapiccini 1999, 375; Antolini et al. 2006; Branchesi 2009, 61. One of the more important epigraphic documents consists of a honorary inscription to emperor Commodus (AD 177-178) (Branchesi 2009, 72-73, n° 3).

[337] Moscatelli 1981. A size of 135,000 m² is estimated in Moscatelli 1988, 23.

3.3.27 *Pollentia-Urbs Salvia* (Urbisaglia)

The remains of the Roman colony of *Urbs Salvia* are located in the immediate vicinity of the medieval centre of Urbisaglia (*Figure* 129, n° 27). At the moment, there are no indications to suggest that the Roman town was preceded by an earlier Picenian settlement. For a long time, the only evidence for the Roman occupation of the site in the 2nd century BC consisted of loose ceramic fragments, seemingly unconnected to structures. However, since 1995, excavations by the University of Macerata within the urban area of *Urbs Salvia* have contributed significantly to our understanding of the town's lay-out and extension over time. One of the more interesting results of these excavations in recent years has been the clear attestation of an elaborate Late Republican urban phase from at least the end of the 2nd century BC onwards. For instance, excavations in the area occupied by the Imperial *forum* complex have revealed the remains of a pre-existing public or sacral building, datable to the end of the 2nd century BC or the beginning of the 1st century BC (*Figure* 183, n° 1).[338] Another indication is provided by the finding of large reused sandstone blocks – probably originating from a Late Republican public structure datable again to the end of the 2nd century BC – under the so-called 'Tempietto del foro'; i.e. a temple erected in the Age of Tiberius (AD 14-37) (*Figure* 184, n°9).[339] Again, in front of the temple of *Salus Augusta*, floor pavements have been found that may belong to a residential unit dated towards the first half of the 1st century BC (*Figure* 183, n° 6, 8).[340] In fact, further registrations of Late Republican walls and floors in different sectors of the later temple complex seem to confirm the zone's functioning as a mainly residential area between the end of the 2nd century BC and the mid-1st century BC (*Figure* 185, n° 1-5; 3.54, n° 10).[341] Structures made out of pebbles – datable again to the end of the 2nd/beginning of the 1st century BC and maybe referring to an artisanal quarter – have also been found

[338] This building replaced a former artisanal complex with a ceramic kiln, datable to the 2nd century BC. The partial plan of the new building consisted of two rooms, the first measuring ca. 6x2.80 m and the second one ca. 4.10x8.15 m (dimensions of 3.7x6.3 m are given by Perna 2007, 351), and a preceding courtyard (ca; 7.99x4.90 m); both obliterated by later structures linked to the reorganisation of the *forum* complex in the second half of the 1st century BC (Fabrini 2003a, 132-135; 2005b, 249; 2009, 196-198; 2012, 283-284; 2013a, 67-68; 2013b, 215-217; see also Perna 2006, 71-74).

[339] Fabrini 2003a, 128-131; 2005a 106-114; 2005b, 249; 2009, 198-202. The most recent synthesis is Fabrini 2013b.

[340] Fabrini 2000, 121-126; 2003a, 116-121; 2009, 202-204. Based on the available evidence, one of the *domus* buildings has been reconstructed measuring ca. 28x14 m (ca. 392 m²); for the description of this *domus*, located under the western wing of the later temple; see Montali 2013, 121-136.

[341] Fabrini 2003a, 121-127; 2013b, 219-227. Immediately to the south of the temple complex, under the so-called 'Edificio delle acque', simple structure made out of pebbles and black clayish dirt have been found that may date again to the end of the 2nd century BC (*Figure* 184, n° 6) (Fabrini 2005a, 79; Perna 2007, 353).

more to the north of the temple complex, located immediately inside the Augustan town wall (*Figure* 181).[342]

It seems likely that all these structures are to be identified with the remains of the Late Republican colony of *Pollentia*, founded near the end of the 2nd century BC on the site of the later Augustan colony of *Urbs Salvia*. Given the complete absence of indications for the existence of a town wall in this period, it is difficult to estimate the size of this first town. On the basis of the aforementioned structures and the confirmed *ex-novo* construction of the posterior Augustan town wall, Roberto Perna has proposed a smaller extension for the Late Republican town, covering some 14.8 hectares and essentially confined to the plain (*Figure* 181).

The settling of veterans under the reign of the Triumviri (43-41BC) – and the associated foundation of the colony of *Urbs Salvia* – initiated a vast building program in the Augustan period and in particular under the reign of Tiberius (AD 14-37) that lasted until the reign of the Flavian dynasty (AD 69-96).[343] This program completely altered the lay-out of the town and enriched the settlement with several monumental public buildings. In the time of Augustus, the town was provided with a circuit wall in *opus testaceaum* – furnished with several towers and gates – that now enclosed an area of ca. 42 hectares (*Figure* 182).[344] The water provisioning of the town in the Early Imperial period was assured by the construction of an aqueduct and a large cistern, measuring approximately 50.5x7.25 m internally (ca. 366 m²).[345] Two other public buildings that may be dated to the Augustan period are the so-called "Edificio delle Acque" (ca. 20x15 m)–(ca. 300 m²) to the east of the *Salaria Gallica* – and the *porticus duplex* immediately to the north of the *forum* (*Figure* 184, n° 6, 2).[346]

In the Age of Tiberius, a large temple surrounded by a porticoed building dedicated to the *Salus Augusta* was constructed to the east of the *Salaria* (*Figure* 184, n° 8). The complex itself covered an approximate surface of 2,142 m² (ca. 51x42 m), but together with its adjacent structures occupied a zone of some 4,000 m² (ca. 80x50 m).[347] Subsequently, the complex underwent a series of restorations and modifications between the end of the 2nd

[342] Perna 2006, 53-56; 2007, 353.

[343] *Liber Coloniarum* (*Lib. colon.* I, 226, 6-7); see also Delplace 1995, 38; and Paci 1998d, 209-244.

[344] For a detailed description and discussion of the circuit wall, see Perna 2006, 12-45. A size of more than 40 hectares is also mentioned in Moscatelli 1988, 23.

[345] Delplace 1993, 292-295; Perna 2006, 99; Fabrini 2007a, 318-319. The existence of a public bath building near the *forum* is attested epigraphically (Fabrini 2007a, 320). Recent excavations in the northern sector of the *forum* area have unearthed a structure with apse, flanked by two rectangular vats, which may refer to said thermal complex (Fabrini 2007b).

[346] For an analysis of the *porticus duplex*, see Fabrini 2005a, 71-78; see also Fabrini 2007a, 321-323; for the "Edificio delle Acque", see again Fabrini 2005a, 78-105; and Fabrini 2007a, 323-327.

[347] For a description of the complex, see Perna 2006, 58-64.

century AD and the Severan Age (AD 193-235), but seems to have been gradually decayed from the mid-3rd century AD onwards.[348] Immediately to the south of the main temple, another minor temple – the so-called "Tempietto del Foro" – occupied a further space of ca. 15.15x9.55 m (ca. 145 m²).[349] The construction of the theatre – measuring 102.45x64.9 m (ca. 6,650 m²) – and the so-called "Edificio a nicchioni" and the "criptoportico superiore" may also be dated to the Augustan-Tiberian period (*Figure* 182, n° 41, 32-38). The latter constructions seem to have delimited a terraced public square of ca. 5,670 m² (135x42 m).[350] The same goes for the *forum* square (ca. 2,213 m²), which received its final lay-out around the mid-1st century AD, in relation with an entire restructuring of the central monumental area of the town, well attested by the construction of the aforementioned temple with porticoed building (*Figure* 182). Further minor squares of unknown dimensions have been hypothesised by Roberto Perna to the south of the main temple complex – in an area where the remains of another probable temple have been attested (*Figure* 182, n° 25) – and to the north of the *porticus dupl*ex (*Figure* 182, n° 31).[351] Finally, the construction of the amphitheatre (ca. 7,135 m²) (ca. 97.14x73.45 m) in the immediate *suburbium* of *Urbs Salvia* is generally also dated to this period (*Figure* 182).[352] Taking into account all the known public structures, the space reserved for public architecture within the walled area took up at least some 18,980 m² in the course of the 1st-2nd century AD. It does not seem unreasonable to assume, however, that the total space taken up by public architecture may have been ca. 30,625 m² (ca. 175x175 m or 5x5 *actus*); i.e. ca. 7.3 % of all urban space.

N°27	Public architecture								DA	EA
Type								C	Domus	
y/n	\	x	x	x	x	x	\	x	x	x
m²	400,000	2,213	6,650	7,135	\	145; 300; 2,142	\	366	392	\

Bibliography: Delplace 1993; 1995; Paci 1998a; Perna 2006; 2007; 2013a; 2013b; Fabrini 2000; 2001; 2003a; 2005a; 2005b; 2007a; 2007b; 2009; 2012; 2013a; 2013b; Montali 2013; Paci 2013b

[348] Fabrini 2007a, 233-248.

[349] For a description, see Perna 2006, 64-66.

[350] For a description of the theatre, see Perna 2006, 85-94; for the complex delimited by the "Edificio a nicchioni" and the "criptoportico superiore" see also Perna 2006, 77-83; and Perna 2007, 363. The retrieval of sculptures pertaining to the theatre attests the undertaking of embellishment works around the beginning of the 2nd century AD (Perna 2006, 91, note 332).

[351] Perna 2007, 365-366.

[352] For a description, see Perna 2006, 45-51.

3.3.28 *Tolentinum* (Tolentino)

Almost nothing is known of the urban lay-out of the Roman *municipium* of *Tolentinum* that preceded the modern town of Tolentino (*Figure* 129, n° 28). Its municipal rank is attested through epigraphy (*CIL* XI, 5570), but it is unclear when this status was awarded to the settlement.[353] The only excavations were carried out under the Palazzo Bezzi at the end of the 19th century and revealed the partial plan of a public building with an apsidal room, together with an inscription mentioning emperor Vespasianus (AD 69-79) (*CIL* IX, 6371) (ca. 160 m²) (*Figure* 188).[354] Another inscription dedicated to emperor Gallienus (AD 253-260) is known from the church of S. Catervo.[355] The precise location of the *forum* is unknown, but it is supposed under the current Piazza S. Nicola.[356] The existence of a temple dedicated to the goddess Juno in the 1st century AD is known from an inscription.[357]

Bibliography: Scarin 1972; Moscatelli 1985; Massi Secondari 1988; Paci 1993

3.3.29 *Camerinum* (Camerino)

The Roman town of *Camerinum* lies in part under modern Camerino and occupies an elongated hill that looks out over the valleys of the rivers Chienti and Potenza (*Figure* 129, n° 29). The retrieval of ceramic fragments datable to the Bronze Age and the Iron Age from various excavations in the modern town centre of Camerino indicates that the site was inhabited at least from the 5th century BC onwards.[358] Structures that date to this period are scarce, but recent excavations in Piazza Umberto I have unearthed rudimentary wall sections datable between the late 5th century BC and the mid-4th century BC (*Figure* 189, n° 2).[359] Regarding the Late Republican period, literary testimonies confirm the existence of a noteworthy native centre loyal to Rome, able to furnish a cohort of 600 men during the Second Punic War (*Liv.* XXVIII, 45) and two cohorts (ca. 1,000-1,200 men) for the battle at *Vercellae* (101 BC) (Cic., *pro Balbo*, XX, 46). The settlement probably

[353] One inscription from the first half of the 2nd century AD literally mentions the term '*municipium*' (Paci 1993, 71-72, n° 5).

[354] Massi Secondari 1988. Another inscription, thought to be mentioning emperor Valerianus (AD 253-260) (*CIL* IX, 6370), has recently been restudied by Gianfranco Paci, who has expressed his doubts on its identification (Paci 1993, 73-74, n° 7).

[355] Paci 1993, 69, n° 3.

[356] Paci 1993, 64.

[357] Massi Secondari 1988; Paci 1993, 68-69, n° 1.

[358] Lilli 2001, 122-125; Silvestrini et al. 2012; Silvestrini/Antongirolami/D'Ulizia 2014.

[359] Silvestrini/Antongirolami/D'Ulizia 2014, 661.

acquired municipal status shortly after 90 BC, as attested by the presence of *quattorviri* (*CIL* XI 5633 – 5635). Unfortunately, almost nothing is known of the settlement in the Late Republican period. Excavations in 2007 and 2010 in Piazza Mazzini have uncovered the remains of a large sacral building flanked by a porticoed construction, positioned along one of the *cardines* of the town and erected somewhere between the end of the 4th century BC and the 2nd century BC (*Figure* 189, n° 7). Remains of *opus sectile*, painted stucco and monochrome white mosaics indicate the public function of the building until the end of the 2nd century/beginning of the 3rd century AD, after which the area was gradually abandoned.[360]

Likewise, the few small-scale excavations that have been carried out in the centre of Camerino over the years offer little information for the reconstruction of the Roman town in the Imperial period. In 1867-1868, excavations in the vicinity of the Porta dell'Annunziata are reported to have unearthed the remains of a circus or amphitheatre (*Figure* 190: 191, n° 10).[361] According to local testimonies from the 19th century, remains of the temple for Bellona and Jupiter were found under the church of S. Maria in Via S. Agata, and under the cathedral of Camerino.[362] In 1985, wall structures and a part of a colonnade were found under the Teatro Marchetti along the Corso Vittorio Emanuele that may have belonged to a public building of the Augustan period, possibly the *forum* (*Figure* 190; 191 n° 1).[363] The existence of other public buildings may be derived from several inscriptions dated between the 2nd and the 3rd century AD, but none of them are identified archaeologically.[364] Remains of private architecture are mostly limited to fragmented sections of wall structures and pavements (*Figure* 190; 191, n° 6). One mosaic floor that was probably part of a multi-phase *domus* has been dated between the end of the 1st century BC and the beginning of the 2nd century AD (*Figure* 190; 191, n° 7).[365] An excavation in the Via dell'Archetto revealed the remains of another domus, dated between the end of the 1st century BC and the beginning of the 2nd century AD (*Figure* 190: 191, n° 9).[366] The wall remains in *opus vittatum* found under Piazza Umberto I likely refer to a residential structure from the Augustan/Roman period (*Figure* 189, n° 2).[367] Because of this lack of archaeological data, the urban lay-out is almost impossible to reconstruct. Remains of thick walls made in large sandstone blocks found in Via Ugo Betti and in Piazza Umberto

[360] Silvestrini/Antongirolami/D'Ulizia 2014, 664-665.
[361] Conti 1872; Lilli 2001, 133.
[362] Lilli 2001, 133, note 63.
[363] Lilli 2001, 118-119, 30.
[364] Lilli 2001, 144.
[365] Mercando 1980, 49-51; Lilli 2001, 130-133.
[366] Lilli 2001, 132.
[367] Silvestrini/Antongirolami/D'Ulizia 2014, 661.

I may refer to either defensive or terraced structures, but their identification is not certain (*Figure* 189, n° 2 and 9).[368] It is possible that the town did not have a circuit wall, but was only bordered by natural limits. Based on the morphology of the terrain, an elongated town plan with a single axis measuring ca. 1,000x200 m (ca. 20 ha) may be supposed.[369]

It seems, however, that at least in the Imperial period *Caminerum* had a substantial suburban quarter. Elements that point towards the existence of a such a quarter are the remains of a statue dedicated to Marcus Aurelius (AD 161-180) and some inscriptions found in the locality of Borgo S. Giorgio, located immediately to the south-east of the town (*Figure* 192, A).[370] In 1966, the remains of a thermal complex were identified through excavations in an area immediately to the south of Borgo S. Giorgi, in loc. Vallicelle (*Figure* 192, B). Based on the excavation diary, a chronology between the reigns of Hadrian (AD 117-138) and the Severan dynasty (AD 193-235) has been proposed.[371] Other excavations in the same area unearthed the remains of a monumental building with walls made out of large sandstone blocks (*Figure* 192, C).[372] It is possible that the rise of this suburban quarter can be linked to the reorganisations carried out in the territory of *Camerinum* under Augustus, as attested by the mentioning of subdivisions in *centurie* in the *Liber Coloniarium*.

N°29	Public architecture							DA	EA
Type								Domus	Baths Statue
y/n	\	\	\	x	\	x	\	x	x
m²	200,000	\	\	\	\	\	\	\	\

Bibliography: Conti 1872; Mercando 1980; Lilli 2001; Silvestrini 2010; Silvestrini et al. 2012; Silvestrini/Antongirolami/D'Ulizia 2014

3.3.30 *Firmum Picenum* (Fermo)

The Roman town of *Firmum Picenum* is situated on the Colle del Girofalco, a hill located between the valleys of the rivers Tenna and Ete on which the medieval town of Fermo later developed (*Figure* 129, n° 30). Because of this complicated topographical situation,

[368] Silvestrini/Antongirolami/D'Ulizia 2014, 666.

[369] Lilli 2001, 128.

[370] In the past, these remains have been considered testimonies for the location of the *forum*, while a more recent interpretation locates the *Campus Martius* in this area (Lilli 2001, 135, note 67).

[371] Lilli 2001, 135.

[372] Lilli 2001, 136.

our knowledge of the Roman settlement is fragmentary. The Latin colony was founded in 264 BC and subsequently provided with a first circuit wall made out of quadrangular sandstone blocks arranged according to the *opus quadratum* technique. This initial town wall enclosed an area of ca. 12 hectare (*Figure* 193, full black line). A second town wall – made out of large quadrangular limestone blocks – enclosed a larger area of ca. 18.6 hectare (*Figure* 193, dotted black line). The latter wall can probably be dated to the period between the Triumvirate and the Age of Augustus, when an extension and a reorganisation of the town area occurred in the aftermath of the veteran settlements from the battle of Filippi.[373] Based on the building technique – *opus caementicium* walls covered with *opus latericium* – the construction of the theatre (ca. 75x20 m) (ca. 1,500 m²) is usually situated in the 1st century of the Empire (*Figure* 193, n° 6). The building underwent several restorations in the course of the High Imperial period, in particular under Antoninus Pius (AD 138-150) and Marcus Aurelius (AD 161-180), and in the first half of the 3rd century AD.[374] On the eastern side of the hill, a very large cistern – measuring ca. 66.5x30.5 m (ca. 2,028 m²) and built in walls of *opus caementicium* nuclei with *opus latericium* bricks, covered internally with a layer of *opus signinum* – may also have been constructed under the reign of Augustus (*Figure* 193, n° 2).[375] Its contemporaneity with another cistern – built according to the same construction techniques on the southern side of the hill and measuring ca. 29.5x14 m (ca. 413 m²) – and with a monumental supporting wall makes it clear that the cistern was in fact part of a radical building program (*Figure* 193, n° 3).[376] Indeed, its clear potential as a supporting structure has nourished the hypothesis that the cistern served at least in part as a plateau for the construction of the *forum* square. If this was indeed the case, the *forum* and its adjacent buildings would have been inserted on top of a terraced structure measuring ca. 75x150 m (ca. 11,250 m²) (*Figure* 193, n° 1)[377] Another important public area of the town must have been the acropolis on top of the hill, a large plateau of ca. 2,400 m² where the main temple of the town (*Capitolium*) was probably located.[378]Until now, neither the main thermal

[373] Pasquinucci 1987, 155; Baldelli et al. 2003, 351-352; Luni 2003, 143-144. A size of more than 200,000 m² is suggested by Moscatelli 1988, 23.

[374] Pasquinucci 1987, 259-295, 328-329; Luni 1996a; Baldelli et al. 2003, 353.

[375] Pasquinucci 1987, 207-243.

[376] Pasquinucci 1987, 193-206 ; Luni 1996; Baldelli et al. 2003, 352-353.

[377] Nothing is known of the buildings that must have flanked the *forum*, but the existence of an *Augusteum* is attested epigraphically. However, just as we will see in the case of *Hatria* (Atri), such a reconstruction would render the location of the Republican *forum* problematic (see *infra*). Another possible candidate for the *forum* is the current Piazza del Popolo (Pasquinucci 1987, 239, 320-321).

[378] Excavations in the area yielded the remains of monumental structures and a statue of Jupiter (Pasquinucci 1987, 157-160; Catani 2000; Baldelli et al. 2003, 352)

complex nor the likely amphitheatre has been located.[379] The only remains referring to the private architecture of the town are the two rooms found under the tower of the church of the Madonna del Pianto, which may be connected to a Late Republican/Early Imperial *domus* complex .[380] Concerning the immediate *suburbium* of the town, the existence of a cemetery with funerary monuments is known in the zone of Campolegio, situated immediately to the west of the walled area.[381]

N° 30	Public architecture							DA	EA
Type								Domus	Tombs
y/n	x	x	x	\	\	x	x	x	x
m²	120,000 186,000	11,250	1,500	\	\	\	413 2,028	\	\

Bibliography: Pasquinucci 1987; Luni 1996a; Catani 2000; Baldelli et al. 2003; Luni 2003

3.3.31 *Falerio* (Piano di Falerone)

The site on which the later Roman town of *Falerio* was built was certainly occupied from the 6th/5th century BC onwards (*Figure* 129, n° 31). The Late Republican phase of the town – in which the site may have had a sacral function – is only represented by a few vernice nera fragments, votive objects and some funerary epigraphy.[382] Only from the Augustan period onwards, the archaeological remains point towards the existence of a proper planned urban settlement. One of the most visible remains of the growing monumentality of *Falerio* in this period is the theatre (ca. 49x37 m) (ca. 1,810 m²), whose reconstruction can probably be linked to an important building program in either the Augustan (27 BC – AD 14) or the Julio-Claudian period (27 BC – AD 68) (*Figure* 194, n° 13).[383] Another important building was the amphitheatre (ca. 88.80x80 m) (ca. 7,100 m²), erected most likely somewhat after the construction of the theatre; i.e. in the second half of the 1st century

[379] Pasquinucci 1987, 328-329.

[380] The first room was paved with mosaics, the other with *opus spicatum* bricks (Pasquinucci 1987, 296, 329-330).

[381] Pasquinucci 1987, 335.

[382] Maraldi 2002, 103-104.

[383] Maraldi 2002, 34-5, 39-41. The use of various building techniques, such as *opus caementicium*, *opus latericium*, *opus vittatum* and *opus reticulatum* indicate that the theatre was built and repaired in various phases. Based on an honorary inscription to Gaius Caesar (*CIL* IX, 5425) – a nephew of emperor Augustus – the first phase of the theatre is commonly dated in the first decades of the 1st century AD (Delplace 1996, 120). The honorary inscription to emperor Claudius in AD 43 (*CIL* IX, 5426) can probably be linked to a second phase (Maraldi 2002, 40).

AD (*Figure* 194, n° 34).[384] A first big public cistern (ca. 32.4x8 m) (ca. 260 m²) with walls in *opus vittatum mixtum*, located in the Via del Pozzo, is dated to the age of Augustus or Tiberius (end of the 1st century BC/beginning of the 1st century AD); a second one (10.5x17.1 m) (ca. 180 m²) built in *opus latericium* in the Via dell'Anfiteatro can only be linked to the Imperial period in general (*Figure* 194, n° 1, 7).[385] The settlement seems to have flourished in particular in the 2nd century AD, when the town was enriched by public baths (ca. 400 m²) and luxurious *domus* buildings, and when epigraphic testimonies mention the town's colonial status and allude to the repaving of several streets and the renewal of the decorative statues of the theatre.[386] The archaeological structures that relate to the existence of various residential quarters made-up of *domus* complexes in the 2nd century AD are all very fragmentary and not much can be said about their dimensions or chronology.[387] The remains of a large podium in *opus caementicium* (ca. 18.40x12 m) (ca. 220 m²) in the Via del Tempio have been interpreted as the foundations of an Imperial temple.[388] Various small-scale excavations across the modern centre of Piano di Falerone have unearthed sections of paved streets pertaining to the Roman town plan. Based on these findings, the width of the streets could range from 2.90 to 4.20 m (*Figure* 195).[389] No traces of the ancient *forum* exist –nor of its adjacent monuments and public buildings – but on the basis of the archaeological finds in the town area a size of either ca. 70x70 m (2x2 *actus*) or 53x53 m (1.5x1.5 *actus*) has been proposed.[390]

Because of the absence of a proper town wall, it is difficult to determine the limits of the urban habitation. Still, some topographic indications exist for at least estimating its approximate size. Structures that can almost certainly be situated in the immediate *suburbium* of the town are the previously mentioned amphitheatre and the two cisterns

[384] The walls of the amphitheatre are made in *opus latericium*, a building technique also used for the walls of the amphitheatre of *Urbs Salvia*, built under the reign of the Flavians (AD 69-96) (Maraldi 2002, 51-54) (see *supra*).

[385] For the first cistern, see Maraldi 2002, 25-28; for the second cistern, see again Maraldi 2002, 31-33.

[386] The area of the public baths has been explored archaeologically for an area of only 20x20 m (400 m²), but they were probably much larger. The presence of black and white mosaics allows for the complex to be dated in the second half of the 2nd century AD (Maraldi 2002, 41-42, 48-49, fig. 40). Another Imperial thermal complex (ca. 80 m²) was partially excavated in the immediate vicinity of the theatre (Maraldi 2002, 41-42). The repairs of the theatre took place around the mid-2nd century AD (Delplace 1996, 123).

[387] The mosaics of a large *domus* in the Via del Pozzo, provided with a small thermal complex date to the 2nd century AD. A second *domus* was located thanks to the identification of the *peristylium*, while of a third *domus* only the *atrium* was unearthed. All these domus buildings show signs of reshaping in the course of the 2nd century AD; changes that can probably be linked to an extensive building program (Maraldi 2002, 58-60, 63-64, 98).

[388] Maraldi 2002, 62. The existence of other temples within the urban area is attested epigraphically (*CIL* IX, 5422, 5438).

[389] Dimensions of 2.90, 3.60, 3.90 and 4.20 m respectively were attested (Maraldi 2002, 85-93).

[390] Maraldi 2002, 95-96.

(*Figure* 194, n° 34, 1; 7), and the suburban villa (ca. 15x28 m) (420 m²) identified to the north of the town (*Figure* 194, n° 4).[391] Furthermore, the presence of numerous Roman tombs – spread out around the town centre and most likely located *extra-muros* – provide good indications for the limits of the proper urban area (*Figure* 196). Some of these tombs were found somewhat to the south of the suburban villa and dated to the end of the Republican period and the beginning of the Early Imperial period.[392] Others were located to the south of the modern town and are dated to the second half of the 2nd century AD (*Figure* 196).[393] As such, the town could have measured ca. 280-300x300 m (ca. 9 hectare).[394] Finally, the presence of tombs from the 3rd century AD onwards within the urban area may indicate a contraction of the habitation in that period.[395]

N° 31	Public architecture							DA	EA
Type								Domus	Villa
y/n	x	x	x	x	x	x	cistern	x	x
m²	90,000	2,809 4,900	1,810	7,100	400 80	220	260 180	\	420

Bibliography: Bonvicini 1954; Moscatelli 1985; 1988; Delplace 1996; Landolfi/Paci 2002; Maraldi 2002; Landolfi 2006a

3.3.32 *Cupra Maritima* (Cupra Marittima)

The Roman town of *Cupra Maritima* roughly coincides with the current town of Cupra Marittima (*Figure* 129, n° 32). A reference by Strabo indicates the existence of a pre-Roman sanctuary dedicated to the goddess Cupra (*Geogr.* 5, 4, 2). The Late Republican occupation of the site is further attested by the findings of vernice nera fragments.[396] The site is mentioned as a town for the first time in an inscription dated to 47 BC, mentioning the status of *municipium* ruled by *duumviri* (*CIL* IX, 5305).The few structures that remain of the settlement are to be connected with the urban building operations carried out in the time of Augustus. The *forum* can be recognised in the vast rectangular open space (ca. 60x90

[391] Maraldi 2002, 28, 85, 100-101.

[392] Maraldi 2002, 30-31.

[393] Maraldi 2002, 85, 100-101.

[394] Maraldi 2002, 104. Based on the old map published by Bonvicini, Moscatelli puts a 16 hectare figure on the town (Moscatelli 1988, 23).

[395] Maraldi 2002, 106.

[396] Luni/Uttoveggio 2001, 250.

m) (ca. 5,400 m²) in loc. La Civita (*Figure* 197, Foro). On its western side, the square was bordered by a large porticoed building (ca. 48.52x28.91 m) (ca. 1,403 m²) that has been interpreted as the basilica of the town.[397] The eastern side of the square was occupied by a temple (ca. 25.40x16 m) (ca. 406 m²) – most likely the *Capitolium* for the goddess Cupra, or a temple for the goddess Venus – probably built in the second half of the 1st century BC (*Figure* 197, Tempio).[398] Two arches in *opus latericium* placed next to the temple are to be dated somewhat later, towards the end of the 1st century AD, or the first decades of the 2nd century AD.[399] The acropolis of the town has been situated on the hills of the "Colle Morganti", extending over a hypothesized area of ca. 3.5 ha (*Figure* 197, acropoli).[400] In the presumed harbour area of the town, a large building called "Mura Mignini" (ca. 17.8x19.3 m) (ca. 344 m²) has been interpreted as being the main maritime storage complex (*Figure* 197, "mura Mignini").[401] Various sections of a presumably Augustan town wall in *opus vittatum* have also been preserved.[402] Said walls indicate the approximate limits of the enclosed urban area to the south and to the east (*Figure* 197). On the basis of these remains, Giovanni Ciarrocchi has estimated the size of the settlement at ca. 10 hectares. Perna estimates a somewhat larger size of 16.7 ha (16,720 m²).[403]

N° 32	Public architecture								DA	EA
Type								UI	Domus	Tombs Villa
y/n	\	\	\	\	\	x	x	X	x	x
m²	167,000	5,400	\	\	\	406	1,403	344	\	\

Bibliography: Fortini 1981; Bacchielli 1993; Ciarrocchi 1993; 1999; Percossi/Frapiccini 2000; Luni/Uttoveggio 2001; Percossi 2003; Perna 2012

[397] Based on current knowledge, the building cannot be dated precisely, but it was probably erected in the course of the 1st century AD (Bacchielli 1993; Catani 1993; Percossi Serenelli 1999).

[398] The walls of the temple's podium were made out of a core in *opus caementicium* and a covering in *opus* (*quasi*) *reticulatum* (Bacchielli 1993, 37).

[399] If the building is indeed to be identified with the temple for the goddess Cupra, the two arches could refer to interventions carried out under the reign of Hadrian in AD 127 (*CIL* IX, 5294) (Bacchielli 1993, 39-40).

[400] Ciarrocchi 1993, 283-285.

[401] Ciarrocchi 1993, 288-292.

[402] Luni/Uttoveggio 2001, 252.

[403] Perna 2012, 382.

3.3.33 *Asculum* (Ascoli Piceno)

The Roman colony of *Asculum* was built on a fluvial terrace, delimited on its northern side by the river Tronto and on its southern and eastern side by the Castellano stream (*Figure* 129, n° 33). The archaeological remains pertaining to the Picenian settlement of Ascoli Piceno – a rather noteworthy centre if we have to believe some of the literary sources – are limited to a few tombs and some ceramic fragments.[404] With the conclusion of the Roman conquest of *Picenum* in 268 BC, this Picenian settlement acquired the status of *civitas foederata*. The only remains that may date to this period are the wall sections made out of large sandstone blocks in *opus quadratum* that seem to have been part of the first proper circuit wall of the settlement.[405] Despite the probability that the Roman settlement must have developed some kind of urban character in the course of its Republican existence, almost nothing is known archaeologically of the period preceding the town's acquisition of municipal status after 89 BC.[406] Indeed, it is probably to the first half of the 1st century BC that we can date the second town wall of Ascoli, made out of nuclei in *opus caementicium* and covered with fronts in *opus quasi reticulatum*.[407] Residential structures that go back to this period include the rooms paved with cocciopesto floors under the ex-Standa in Via Panichi (*Figure* 199, n° 7), and the earliest phases of the *domus* complexes under the famous Caffè Meletti and the Palazzo dei Capitani (*Figure* 199, n° 6 and 5).[408] The erection of a few public buildings may also date to this period, like the Roman bridges of Cecco and of Solestà – which seem to have been built on previously existing structures (*Figure* 199) – and maybe also the Corinthian temple under the church of S. Gregorio Magno (see *infra*), as well as another unidentified porticoed space under the Palazzo dell'Arengo (ca. 50x35 m) (ca. 1,750 m²) (*Figure* 199, n° 8) (see *infra*).[409] A similar dating – i.e. roughly between the times of Sulla and Caesar – may be proposed for the construction works on the *acropolis* of the town, now under the plateau of the Annunziata (ca. 120x70 m) (ca. 8,400 m²), made in *opus caementicium* nuclei with *opus vittatum* coverings (*Figure*

[404] Picenian tombs datable to the 6th century BC have been found in the historical town centre, under the church of S. Francesco and along the corso Mazzini; ceramic fragments have been found in the fillings of the Roman bridge of Solestà; outside the centre the remains of a Picenian cemetery have been located in the area of Campo Parignano, i.e. the same area as the Roman cemetery (Pasquinucci 1975, 124; Giorgi 2005, 207-208).

[405] For a discussion on the dating of these walls, see Giorgi 2005, 212-213, with references. Recent excavations under one of the Roman town gates, the so-called Porta Gemina, have uncovered remains of this town wall in *opus quadratum*, dated to the 4th-3rd century BC on the basis of the stratigraphy (Profumo 2009, 494).

[406] Laffi 1975, 19.

[407] Campagnoli/Giorgi 2003; Giorgi 2005, 214.

[408] Quiri 1985; Profumo 1985; Lucentini 2002, 87-90.

[409] Pasquinucci 1975, 5-19; Giorgi 2005, 215; Profumo 2006; 2009.

199); the same goes for some of the tombs in the Roman cemetery outside the Porta Romana (*Porta Gemina*) (*Figure* 199).[410]

In the second half of the 1st century BC, the Roman colony of *Asculum* was deducted. This was the start for a monumental building program that lead to the construction of the so-called Porta Gemina, the theatre, the amphitheatre, several temples, and probably also the *forum*.[411] The position of the *forum* within the urban lay-out of *Asculum* is still uncertain. Traditionally, the *forum* occupied one of the *insulae* at the intersection of the *cardo maximus* and the *decumanus maximus*. While the latter can almost certainly be identified with the current Corso Mazzini, the location of the former is less clear. As such, five possible scenarios have been proposed over the years. A first scenario has located the *forum* in the vicinity of the current Piazza del Popolo, i.e. under the Palazzo dei Capitani (*Figure* 199, C).[412] Excavations under said palazzo have indeed found a large open space floored in *opus spicatum* bordered on one side by a paved street.[413] However, as this courtyard proved to be bordered on the other three sides by several rooms, a more recent interpretation has proposed to identify the structure rather as the *macellum* of the town.[414] A second scenario has pinpointed the *forum* in the area occupied today by the Convento di San Francesco (*Figure* 199, D). Elements in favour for such an hypothesis are the finding of an ancient pavement made out of large travertine slabs (each ca. 3 m long) along the current Via del Trivio – stones that may have belonged to the pavement of a public building or the *forum* square itself – and the probability that the medieval monastery of San Francesco was built in an area that was still largely unoccupied; i.e. a space perhaps left open by the presence of the ancient *forum*.[415] More recent excavations, however, have unearthed mosaic and cocciopesto floors clearly belonging to residential buildings in the same area.[416] Based on alternate positions of the *cardo*, other hypotheses have included the Piazza Arringo, the Piazza Bonfine and the Piazza Sant'Agostino (*Figure* 199, E, B, A); none of them however with satisfying or conclusive arguments.[417]

We do now that the Roman colony was enriched by several temples. The medieval church of San Venanzo, for instance, was built on the remains of an Ionian temple (ca. 14.22x8.22 m) (ca. 117 m^2), consisting of a building in *opus quadratum* positioned on a

[410] Torelli 1977, 441; Giorgi 2005, 215-216.

[411] The construction of the aqueduct and the requalification of the Roman bridges also date to this period (Giorgi 2005, 218).

[412] Profumo 2005; 2009.

[413] Quiri 1985; Profumo 1985; Giorgi 2005, 221.

[414] Profumo 2009, 493-494, referring to an interpretation of Giovanna Cicala of Pisa University.

[415] Torelli 1977, 441; but especially Giorgi 2005, 222.

[416] Profumo 2009, 514; Lucentini et al. 2014, 420, note 27.

[417] Pasquinucci 1975, 132-133; Giorgi 2005, 221; for the recent findings in Piazza Arringo in favour of a public function, see *infra*.

podium with a nucleus in *opus caementicium* (*Figure* 199, n° 2). On the basis of the decorative elements, the complex has been dated to the 2nd or the 3rd quarter of the 1st century BC.[418] The same goes for the medieval church of San Gregorio Magno – incorporating the structures of a Corinthian temple of which the walls of the *cella* were made in *opus reticulatum* (ca. 22,.12x11.14 m) (ca. 246 m²) (*Figure* 199, n° 1) (see *supra*) – and the Ionian temple under the church of S. Agostino (Figure 199, n° 3).[419] The remains of a possible fourth temple with a podium – apparently surrounded by a porticoed building that enclosed an estimated area of ca. 1,090 m² (42x26 m) – were recently unearthed under the Palazzo dell'Arengo.[420] The Early Imperial theatre was built against a natural slope of the Annunziata and covered an area of ca. 3,770 m² (*Figure* 199). The amphitheatre most likely dates to the same period and covered a very large area within the urban area of ca. 148x125 m (ca. 18,500 m²).[421]

Less is known of the residential architecture of the town. The remains of two or three *domus* complexes have been uncovered in the area of the Palazzo di Giustizia and the Via Galilei, all datable between the end of the 1st century BC and the 2nd century AD (*Figure* 200, *domus*).[422] On the basis of all the available information, a reconstruction of the first *domus* has estimated the size of the residential building around 2,310 m² (ca. 77x30 m)(*Figure* 201).[423] Outside the town walls, no traces of buildings have been detected, but the cemetery outside the Porta Gemina became fully occupied and monumentalised from Augustan times onwards.[424]

Thanks to the good survival of the Roman town plan in the medieval and modern town plan of Ascoli, a reconstruction of the organisation scheme of *Asculum* may be proposed. Believing as the current Corso Mazzini coincides with the *decumanus maximus* – and the Via del Trivio with the *cardo maximus* – eight (4x2) other *decumani* have been reconstructed to the north and the south of the former, while the existence of 16 (8x2) other *cardines* has been supposed to the east and the west of the latter (*Figure* 199).[425] The division into *insulae* seems to have been based on a 2x2 *actus* scheme (ca. 70.90x70.90 m),

[418] Pasquinucci 1975, 30-42; Visani 2007; Altini 2007. Conventi mentions dimensions of 14.20x11.55 (ca. 164 m²) for the Ionian temple (Conventi 2004, 137); Profumo indicates dimensions of 14.20x6.35 m (ca. 90 m²) (Profumo 2009, 496).

[419] Luni 2000b; Lucentini 2002; Giorgi 2005, 221.

[420] Profumo 2009, 509, 513.

[421] The walls of the amphitheatre are covered with *opus quasi reticulatum*. The supposed dimension of the minor axis, however, seems exaggerated (Conventi 2004, 137, Profumo 2009, 498, 517). For the theatre of *Asculum*, see also Masturzo/Landolfi 2011.

[422] Pasquinucci 1994.

[423] Profumo 2009, 518-519.

[424] Stortoni 2000; Giorgi 2005, 218.

[425] Pasquinucci 1975, 128-130.

while the average street width was ca. 5.40 m.[426] The result would have been a town scheme consisting of ca. 75 *insulae* measuring each ca. 76.30x76.30 m (2x2 *actus*); i.e. a surface of 5,821.69 m², or 5,026.81 m² excluding the streets. As such, the street grid would have taken up a total surface of 59,616 m² (ca. 13.7%) within an organised urban area of 436,626.75 m² (ca. 43.7 ha).[427] With the public space taking-up at least 29,409.81 m² (ca. 6.7 %) – considering the high probability that the *forum* took up an entire *insula* – some 347,600.94 m² (ca. 79.6 %) was thus theoretically available for residential architecture.

N° 33	Public architecture							DA	EA
Type								Domus	Tombs
y/n	x	\	x	x	\	4	x	x	x
m²	437,000	\	3,770	18,500	\	117; 246; 1,090	1,750	2,310	\

Bibliography: Pasquinucci 1975; 1994; Laffi 1975; Torelli 1977; Gaggiotti et al. 1980; Quiri 1985; Profumo 1985; 2005b; 2006; 2009; Luni 2000b; Stortoni 2000; Lucentini 2002; Campagnoli/Giorgi 2003; Conventi 2004; Giorgi 2004; 2005; Landolfi 2006a; Visani 2007; Altini 2007; Masturzo/Landolfi 2011; Lucentini et al. 2014

3.3.34 *Castrum Truentinum* (Case Feriozzi di Martinsicuro)

The remains of the Roman town of *Castrum Truentinum* – or *Truentum* – have recently been identified in loc. Case Feriozzi di Martinsicuro (Teramo) (*Figure* 129, n° 34).[428] The occupation of the area in pre-Roman times is attested by the findings of structures and materials datable to the Late Bronze Age and the Iron Age.[429] The Roman settlement probably originated as a fortified nucleus – as its name seems to attest – and was elevated to the status of *municipium* in the course of the 1st century BC.[430] The topographical information on the Roman town – which formed the crossing point of the Via Salaria and the coastal road – is very scarce. Along the coast, structures consisting of walls in *opus*

[426] Excavations in the Corso Mazzini revealed a section of the paved street, measuring ca. 5.40 m (Profumo 2009, 503); the paved street excavated in the Via del Trivio measured only 2.61 m (Giorgi 2005, 219, note 19; Profumo 2006), a section of a *decumanus* with a width of 3.90 m was uncovered in Piazza Arringo (Profumo 2009, 505). Conventi attributes a width of 5.90 m to the *cardo maximus*, and a width of 4.40 m to the smaller streets of the town (Conventi 2004, 136).

[427] Conventi reconstructs *insulae* of 75.225x75.225 m, covering each ca. 5,658 m² with the street gird included (Conventi 2004, 136). A size of over 500,000 m² for the urban area is estimated in Moscatelli 1988, 23.

[428] Staffa 1995.

[429] Staffa 1995, 113-114; 1998, 33, note 148.

[430] Cancrini 1995, 150.

incertum and floors simply paved with gravel – clearly organised according to a regular street plan – most likely refer to storage or living spaces in connection with a Late Republican commercial/residential quarter, dated between the second half of the 2nd century BC and the first half of 1st century BC (*Figure* 202, n° 2-7, 15, 17).[431] The remains of a monumental structure in *opus quadratum* in relation with the base of a column hint at the existence of an important Late Republican public building (*Figure* 202, n° 8). Other remains along the streets of the town probably refer to porticoed buildings and tabernae (*Figure* 202, n° 11-14).[432] More in north-western direction, excavations have uncovered a large public building consisting of a series of spaces organised around a courtyard with a fountain (ca. 56x48 m) (ca. 2,688 m²) (*Figure* 202, n° 19). The first phase of the building – which is probably to be identified with the *macellum* of the town – was made in *opus incertum* and dates back to the 2nd-1st century BC. The restoration phase of the building in the first half of the 2nd century AD is represented by *opus latericium* walls.[433] The position of the *forum* is unknown, but given the presence of a *macellum*, it is likely that the public square was situated in the same zone. The occurrence of major restructuration works in several sectors of the town in the 4th-5th century AD indicates that the coastal settlement still flourished in that period.[434]

Given that no traces of a circuit wall were detected, it is difficult to estimate the size of the urban area. Some information, however, is provided by the ancient course of the river Tronto, which was situated approximately 50 meters to the south of the actual course. As we know from written sources that *Castrum Truentinum* was located immediately next to the river, the latter can probably be considered the northern limit of the town (*Figure* 203, Tronto).[435] Also, the presence of tombs to the west of the identified urban structures, in connection with the *Via Salaria*, provides some indication for the western limit of the town (*Figure* 203, n° 2-6).[436] Therefore, an area of ca. 25 ha (ca. 500x500 m) may be considered the absolute limit at the moment of the town's maximum expansion.

N° 34	Public architecture								DA	EA
Type								M	Domus	
y/n	\	\	\	\	\	\	\	x	x	x
m²	250,000	\	\	\	\	\	\	2,688	\	\

[431] The earlier occupation of the zone is attested by several ceramic fragments datable between the 5th and the 2nd century BC and wall structures made out of pebbles and perishable materials (Staffa 1995, 119-120; 1998, 34-35).

[432] Staffa 1998, 35-36.

[433] Staffa 1998, 36.

[434] Staffa 1995, 124-132; 1998, 38.

[435] Strabo (*Geogr.* 5.4.241); Pliny (*HN* 3.13.18); see also Staffa 1995, 115-119.

[436] Staffa 1998, 34.

Bibliography: Cancrini 1995; Staffa 1995; 1998

3.3.35 *Castrum Novum* (Giulianova)

The Roman colony of *Castrum Novum* is situated in the zone of modern Giulianova (*Figure* 129, n° 35). As the expansion of the modern town has almost completely obliterated the traces of the Roman settlement, not much can be said about the latter's lay-out. The few excavations that have been carried out in the zone have delivered rudimentary structures consisting out of walls made in pebbles that may date back to the first phase of the Roman colony in the 3rd century BC.[437] With regard to the Late Republican and the Early/High Imperial period, the remains of a richly decorated *domus* complex have been found in the Via Bellocchio, attesting its apparent construction over several levels – i.e. organised in terraces – and its various changes in the course of its long lifetime (*Figure* 204; 205, n° 10).[438] Walls and floors belonging to other residential structures have also been attested in various parts of the area (*Figure* 204, n° 7, 8, 11-13).[439] Recently, an artisanal/production complex has been attested in the Via Turati, situated in what must have been a peripheral area of the town (*Figure* 204; 205). The complex was active between the end of the 3rd/beginning of the 2nd century BC and the end of the 1st BC. Subsequently, the area was converted into a cemetery that remained in use until the 4th-5th century AD; an evolution that attests its position outside the proper urban area in the Early/High Imperial period.[440]

There are currently no traces for a town wall, but it seems likely that the Roman town occupied the coastal plain. The remains of Roman bridge, used for entering the town, may confirm this hypothesis (*Figure* 205, n°2). According to a description of the still visible remains of the Roman town in the 19th century, the walled settlement may have had a quadrangular form measuring ca. 450x450 m (ca. 20 ha).[441] Based on the current reconstruction, the walled area covered ca. 13.4 hectares (ca. 640x210 m) (*Figure* 204; 205).

[437] These structures have been dated primarily by the presence of vernice nera (Angeletti 2006).

[438] Angeletti 2006, 179. Based on the findings of paved street sections along the Via Brecciola, the latter road probably corresponds with one of the streets of the Roman town (Cerulli 1967, 19; Staffa 2002, 31).

[439] Staffa 2002, 32.

[440] Of this cemetery, some 20 tombs have been excavated in the Via Turati that date from the 1st/2nd century AD until late antiquity (Angeletti 2006, 175-178).

[441] Staffa 2002, 29-31 notes, 64-65.

N° 35	Public architecture							DA	EA
Type								Domus	Tombs
y/n	\	\	\	\	\	\	\	x	X
m²	134,000	\	\	\	\	\	\	\	\

Bibliography: Cerulli 1967; Migliorati 1994; 2006; Staffa 2002; Angeletti 2006

3.3.36 *Interamnia Praetuttiorum* (Teramo)

The remains of the Roman town of *Interamnia Praetuttiorum* are covered completely by the modern town of Teramo (*Figure* 129, n° 36). Several excavations within the town area between 1988 and 1991 have delivered fragments of impasto ware in association with the remains of huts, indicating the permanent occupation of the site between the 7th and the 5th century AD.[442] These remains can probably be brought in connection with the pre-Roman settlement that preceded the installation of the Roman *conciliabulum* in the 4th-3rd century BC.[443] The restriction of these finds to the eastern section of the town suggests that this *Praetutian* settlement was of a more modest nature than its Roman successor. Remains of walls made out of pebbles in association with cocciopesto floors and vernice nera fragments in the same sector of the town may be attributed to the first phase of the latter site, roughly occupying the same area as the protohistoric nucleus (*Figure* 206, "abitato protostorico e pretuzio").[444]

The Roman settlement quickly developed in the course of the 2nd century BC and apparently reached a certain level of urbanisation towards the end of that century and the beginning of the 1st century BC. Indeed, several *domus* buildings have been attested with phases that go back to the 2nd-1st century BC. These finds mostly consist of *opus signinum* and mosaic floors, cocciopesto pavements with insertion of decorative motifs, or occasional wall sections.[445] Examples are the floors found in the "vico Corto" (*Figure* 207, n° 41) and in the "vico dell'Ariete" (n° 44), in the "Via del Baluardo" (n° 40, 58), and in the "Vico dei Tribunali" (n° 9), or the ones unearthed in "Largo Madonna delle Grazie" (n° 30) and in "Corso de' Michetti" (n° 11), with the latter's oldest levels dating back well to the 2nd century BC.[446] Another *opus signinum* floor of a 3rd-2nd century BC *domus* was

[442] Staffa 1998, 8-11.

[443] Staffa 1998, 11, referring to Sommella 1985, 390; see also Angeletti 1994.

[444] Staffa 1998, 12-13.

[445] Staffa 1990; Guidobaldi 1995, 231-236.

[446] This chronology is mainly based on the presence of vernice nera that can be dated to 190-130 BC (Mazzitti 1983; Staffa 1998, 13-15, with references in notes 9-13).

found at the intersection between the "corso de' Michetti" and the "largo Melatini" (n° 53).[447] Parts of other Republican pavements have also been registered in the "via Argentina" (n° 8), and at the crossing of the "via S. Antonio" and the "via Savini" (n° 6), while another Republican *domus* (2nd century BC) was again excavated in the "corso de' Michetti" (n° 50).[448] As such, the archaeological evidence points towards the existence of a planned residential quarter that may date back in part to a period preceding the Social War. Based on the location of these remains, this first urban nucleus may have covered some 6.3 hectares (ca. 250x250 m) (*Figure* 206; 207).[449]

After the elevation to municipal status, the tendency to build rich *domus* complexes seems to have continued in the course of the 1st century BC and into the Early Imperial period; a time in which the town also began to expand gradually into western direction.[450] The best known example is the so-called "*Domus* del Leone", a large and richly decorated Late Republican house built in the first half of the 1st c BC (*Figure* 207, n° 4).[451]. Under the reign of Augustus – when *Interamnia* had received the status of *colonia* – the public architecture was enriched with the addition of a theatre, occupying a space of ca. 74x54 m (ca. 4,050 m²) in the western part of the town (*Figure* 207, n° 2).[452] Under the current Piazza Verdi, a monumental terraced structure in *opus caementicium* may also have been realised in this period, maybe serving as a supporting platform for the *forum* of the town (*Figure* 207, n° 22).[453]

In the course of the High Imperial period (1st-2nd century AD), the private architecture of the town continued to be characterised by a vast array of richly decorated *domus* complexes.[454]. Examples of this trend are the *domus* in the "Vico delle Ninfe" and the one in "Via Porta Carrese". Many of these residential buildings already underwent some form of reorganisation in the first half of the 1st century AD.[455] Somewhere between the second half of the 1st century AD and the beginning of the 2nd century AD, the town seemingly underwent a radical reorganisation. This process may be linked to the construction of some important public buildings, like a large thermal complex (ca. 50x40 m) (ca. 2,000 m²)

[447] Staffa 1998, 14.

[448] For the first two *domus*, see Mazzitti 1983, 99-101, 109-110; for the latter, see Staffa 1998, 14-15, note 23; for the dating of the latter, see also *supra*, note 337.

[449] For considerations on the town plan in this period, see Migliorati 1976; and Staffa 1998, 15-17.

[450] The status of *municipium* in this period is ascertained by an inscription mentioning *duumviri* (*CIL* I, 1905).

[451] For the Domus del Leone in particular, furnished with mosaics datable to the Age of Sulla (100-80 BC), see Mazzitti 1975; for further examples of *domus* buildings with phases dated to this period, see Mazzitti 1975, 22-27; 1983, 119-123; Guidobaldi 1995, 231-232; and Staffa 1998, 17-18.

[452] Mazzitti 1983; Staffa 1998, 17. The colonial status is mentioned in *CIL* IX, 5067.

[453] Staffa 1998, 18.

[454] Staffa 1998, 19.

[455] Staffa 1998, 19.

immediately to the north of the *forum* (*Figure* 207, n° 17) and a smaller bath building (ca. 20x15 m) (ca. 300 m²) in the eastern sector of the town (n° 54, 55), both replacing former residential quarters.[456] Based on the use of *opus latericium*, the construction of the amphitheatre in the western corner of the town (ca. 74x56 m) (ca. 4,144 m²) may also be dated to this period (*Figure* 207, n° 1).

The extension of the urban area is not clear, but may have covered some 26 ha at the moment of its maximum expansion (*Figure* 206; 207). From the 3rd century AD onwards, the impoverishments of both public and private buildings, their partial conversion into artisanal quarters, and the abandonment of some sectors of the town indicate the gradual decay of the settlement.[457]

N° 36	Public architecture							DA	EA
Type								Domus	
y/n	\	\	x	x	x	\	\	x	\
m²	260,000	\	4,050	4,144	2,000; 300	\	\	\	\

Bibliography: Migliorati 1976; Mazzitti 1975; 1983; Sommella 1985; 1988; Angeletti 1994; Guidobaldi 1995; Staffa 1990; 1998

3.3.37 *Hatria* (Atri)

The Roman town of *Hatria* lies under the modern town of Atri, on a hilltop between the currents Piomba and Calvano, some 10 km from the coast (*Figure* 129, n° 37). The finding of cemeteries dated between the mid-6th century BC and the beginning of the 5th century BC shows that the area was occupied in pre-Roman times.[458] The foundation of the Latin colony of *Hatria* occurred somewhere in the first decades of the 3rd century BC, in the wake of the conquest of the territory of the *Praetutti* by Manius Curius Dentatus.[459] *Hatria* probably became a *municipium* in the aftermath of the Social War, but regained its status as a colony with the second colonisation under Augustus.[460]

[456] Sommella 1988, 127; Staffa 1990, 26-27; 1998, 19.

[457] Staffa 1998, 21-23.

[458] Coarelli/La Regina 1984, 46. Some archaic ceramic fragments have also been found during excavations under the Cathedral of Atri (Azzena 1987, 6-9); see also Guidobaldi 1995, 37-45.

[459] Several ancient authors mention the distribution of viritane allotments of either seven *iugera* – Valerius Maximus (*Val. Max.* IV.3-5); Pliny (*HN* 18.3-4, 18); Columella (*Rust.*, 1.praefatio.14) – and 14 *iugera* (Aurelius Victor, *De vir. ill.* 33.5).

[460] Guidobaldi 1995, 194. In fact, Pliny mentions the town as a colony (*HN* 3.13.110).

Unfortunately – just as is the case with many of the Roman hilltop towns in this region that were overbuilt in later times – it is difficult to have a clear notion of the topography and the extension of the Roman settlement. Furthermore, the scarcity of excavations in the historical town centre makes the reconstruction and the evolution of its internal plan a highly problematic issue. Unsurprisingly then, a constant point of discussion has been the precise extent of the walled area in Roman times. For a long time, the only remains of the Late Republican circuit wall that must have surrounded the colony from the 3rd-2nd century BC onwards were the two wall structures in *opus quadratum* found along the northern section of the Via della Circonvallazione (*Figure* 208, n° 31 and 40).[461] While fragmentary, these two finds made it clear that the town wall most likely followed an irregular course that was adapted to the natural limits of the hill.[462] This hypothesis was recently confirmed by the registration of two other sections of this wall along the south-western course of the same Via della Circonvallazione, in connection with the later medieval wall (*Figure* 212, n° 58).[463] These finds also confirmed the largely overlapping of the Roman and medieval town walls along the northern, western and southern borders of the hill. A more ambiguous element of debate has been the eastern limit of the Roman town. A first hypothesis by Luigi Sorricchio in 1911 included the three branches that formed the eastern limit of the plateau – i.e. the Colle Maralto to the NE, the Colle Muralto to the SE and the Colle di Mezzo in the centre (*Figure* 210) – and attributed an extension of ca. 70 hectare to the settlement.[464] In 1987 – taking into consideration the apparent absence of archaeological traces on both the Colle Maralto and the Colle Muralto – Giovanni Azzena proposed a much more modest size of ca. 21 hectare for the Roman site, mostly coinciding with the medieval centre of Atri.[465] In 1995, Maria Paolo Guidobaldi objected to the latter hypothesis by pointing out the likely finding of a Roman temple on the Colle Maralto by E. Brizio already in 1901, and the presence of an extensive system of underground channels on the Colle Muralto.[466] A recent combined study by Azzena of a 16th century map of Atri – showing the remains of ancient circuit walls on all three eastern branches of the hill – and an aerial photograph of the town from 1954 has now confirmed that the Roman habitation indeed continued onto the Colle Maralto, the Colle di Mezzo

[461] A first section was found near the monastery of S. Lucia (no. 31), while a second one has been signalled more in north-eastern direction (Azzena 1987, 48-49, 66-67).

[462] A good example of this strategy in the region is the Roman *municipium* of *Trea* (see *supra*).

[463] Azzena 2006, 28.

[464] Sorricchio 1911.

[465] A possible exception was made for the Collo di Mezzo, where the attestation of street pavements to the east of the Cathedral suggested that the area was indeed part of the planned Roman town (Azzena 1987, 65-67).

[466] Guidobaldi 1995, 198-199. For the temple, see Brizio 1901; for the tunnels, see Azzena 1987, 72.

and the Colle Muralto, in this way ensuring that *Hatria* was in fact the largest Roman town in the central Adriatic region.[467]

Concerning the spatial organisation of the settlement, it is interesting to note that height analyses carried out by Giovanni Azzena on the excavated remains of both public and private structures have shown that the Roman town must have been organised into different terraces that followed the natural curves of the hill (*Figure* 210).[468] On the basis of the known archaeological structures, a basic subdivision into *insulae* of 2x3 *actus* (ca. 70x105 m) has been proposed by Azzena (*Figure* 211). Another peculiarity is the existence of two different orientations in the town plan: a first SW-NE orientation occupying the central and eastern section of the main plateau, and a second SE-NW orientation in the western corner of the hill (*Figure* 212). It has been suggested that this difference in orientation may be linked to a major reorganisation of the town in Imperial times, this in order to take full advantage of the topography of the hill.[469] A connection may be proposed with the second colonial deduction at *Hatria*, known to have been executed somewhere between the Triumvirate and the Augustan Age.[470] Some strength for this hypothesis may come from the theatre – occupying a vast surface of ca. 70x35 m (ca. 2,275 m²) in the north-eastern part of the Roman town, between the actual street levels of the Via dell'Orfanotrofio and the Via della Circonvallazione (*Figure* 208, n° 34) – whose construction is generally situated in a period between the reign of Augustus and the end of the 1st century AD.[471] The construction of an amphitheatre in this period may also be supposed on the basis of an inscription mentioning a *curator muneris* (*CIL* IX, 5016). In fact, the recent examination by Giovanni Azzena of an old aerial photograph (see *supra*) seems to hint at the existence of such a building (ca.60x70 m) (ca. 4,200 m²) on the Colle Maralto.[472] Another possibility for the reorganisation of the town plan is the period between the end of the 1st century AD and the beginning of the 2nd century AD, during which many building interventions occurred in the town, maybe to be connected with the euergetism on the part of emperor Hadrian (AD 117-138).[473]

The position of the *forum*, the main public area of the town, is still uncertain. The traditional hypothesis of its location under the Piazza della Cattedrale has been debunked

[467] Azzena 2006.

[468] Azzena 1987, 69-72.

[469] Azzena 1987, 68-72.

[470] Guidobaldi 1995, 194-195.

[471] Azzena 1987, 53-57, 77-78.

[472] Azzena 2006, 34, fig. 10.

[473] These restructuration works are mainly visible in the eastern part of the town, in the area occupied by the current Piazza della Cattedrale, where a large *domus* replaced several pre-existing smaller houses (*Figure* 208, n° 6), and a Republican residential quarter was first replaced by a small thermal complex, and afterwards by an artisanal complex in the 3rd century AD (*Figure* 208, n° 35) (Azzena 1987, 24-25, 57-60, 82).

by the recent findings of habitation and artisanal structures in front of the Cathedral (*Figure* 208, n°4-6, 35). Another hypothesis locates the *forum* in the zone of the current Piazza del Comune, where a large Imperial cistern under the Palazzo Comunale – containing at least nine rooms and measuring ca. 58.21x17.10 m (ca. 995.4 m²) – may have served as a supporting structure for a large open space (*Figure* 208, n° 16).[474] However, as this reconstruction poses the problem of the location of the Republican *forum* and its apparent relocation in Imperial times, such a hypothesis is again unlikely.[475] Recently, a more plausible proposition by Azzena has situated the *forum* square in a more central area of the town, immediately to the north of the Corso Adriano – believed to coincide with the *decumanus maximus* of the Roman town – and close to a zone where the remains of a monumental quadrangular structure in *opus quadratum* walls (ca. 70x50 m) (ca. 3,500 m²) may refer to the podium of a large Republican temple (*Figure* 208, n° 15, 36; *Figure* 213, n° 59).[476] Finally, more to the south, under the Cathedral of the town, a large cistern – built in *opus quadratum* walls covered with cocciopesto and measuring ca. 25x28 m (ca. 700 m²) – may have been part of a Late Republican thermal complex close to the *forum* (*Figure* 208, n° 28).[477]

The information on the private architecture of the town is equally scarce. In various parts of the town, the remains of wall structures, mosaic and cocciopesto floors indicate the existence of *domus* complexes in both Late Republican and Early/High Imperial times. The best documented example of a Republican building is the *domus* found in the garden of the Curia Vescovile, constructed already in the 3rd century BC and restructured in the course of the 2nd century BC.[478] On the basis of current knowledge, the decay of the town seems to have started in the 3rd-4th century AD.

N° 37	Public architecture							DA	EA
Type								Domus	
y/n	x	x	x	x	x	x	\	x	\
m²	700,000	\	2,450	4,200	\	3,500	995.4 700	\	\

[474] The dating of the cistern to the Imperial period, however, poses problems for the location of the Republican *forum* in this zone (Azzena 1987, 73-75). For the description of the cistern, see Azzena 1987, 29-34. Analogies for such artificial *forum* constructions supported by cisterns in the area are the cases of *Firmum*, *Auximum* and *Ancona* (see *infra*). Marcello Gaggiotti debunks the Piazza Comunale-hypothesis, but does not offer a valuable alternative (Gaggiotti 1991).

[475] Gaggiotti 1991.

[476] Azzena 2006, 36-37, referring in part to Azzena 1987, 29.

[477] The cistern was later transformed into the crypt of the Cathedral (Azzena 1987, 45-46, 75-77)

[478] Azzena 1987, 50-53.

Bibliography: Brizio 1901; Sorricchio 1911; Coarelli/La Regina 1984; Azzena 1987; 2006; Gaggiotti 1991; Guidobaldi 1995; Staffa 2001b

3.3.38 *Cupra Montana* (Cupra Montana)

The Roman town of *Cupra Montana* lies immediately to the north-east of the medieval hilltop town with the same name (*Figure* 129, n° 38). The settlement was erected on the site of a pre-Roman centre – probably a *pagus* – in the 3rd century BC. In the course of that century it probably became a *praefectura* and it likely received the status of *municipium* somewhere after 49 BC.[479] All the known structures date to the second half of the 1st century BC/beginning of the 1st century AD. The cistern (ca. 19x10.4 m) (ca. 200 m²) and the baths in particular – with the walls being primarily built in *opus caementicium* or *opus latericium*, and some sections also in *opus reticulatum* – may be connected with the rise of the settlement to municipal status at the beginning of the Early Imperial period (*Figure*. 214; 215, n° 15).[480] Based on the location of the archaeological remains and the natural topographic situation, the size of the town has been estimated between 15 and 22-23 hectare.[481] The existence of a cemetery to the south of the modern centre – datable to the 2nd-4th century AD on the basis of coin finds mentioning the emperors Commodus (AD 180-192), Alexander Severus (AD 222-235), Constantine the Great (AD 306-337) and Julian (AD 361-363) – is known from 19th century literature (*Figure* 214; 215, n° 3).[482]

N° 38	Public architecture									DA	EA
Type								C	UI	Domus	Tombs
y/n	\	\	\	x	x	\	\	x		x	x
m²	230,000	\	\	\	\	\	\	200	323	\	\

Bibliography: Lilli 2000; Polidori 2000.

[479] One inscription attests the existence of a *pagus* (*CIL* IX, 5699); another inscription Lucius Musetius Sabinus as a *patronus* of the *municipium* (*CIL* XI, 5718) (Lilli 2000, 189, notes 3-4, and 208).

[480] Another unidentified structure measured at least 16.80x19.20 m (ca. 323 m²) (Lilli 2000, 201-208). It is possible that the town also possessed an amphitheatre (Lilli 2000, 218-221).

[481] It seems unlikely that the town measured as much as 37.8 hectare (Lilli 2000, 213).

[482] Polidori 2000, 379.

3.3.39 Beregra and Novana

The Roman town of *Beregra* has previously been brought in connection with several localities in the Marche region – such as near Montefano in the surroundings of Osimo or Santa Maria Nuova near Jesi– but it is now thought to have been located in northern Abruzzo, near Montorio al Vomano (*Figure* 129, n° 39).[483] The precise location of the town of *Novana* is still unclear, but several possible locations have been suggested: loc. Montedinove, or loc. S. Maria di Comunanza, both situated in the valley of the river Aso; and loc. Zoccolanti di Amandola along the river Tenna (*Figure* 129, n° 40).[484] At the moment, nothing can be said about the configuration of both towns.

Bibliography: Alfieri 1982; Delplace 1993; Guidobaldi 1995 (*Beregra*); Paci 1993-1994; Cardinali/Luni 2003; Bernetti 2009 (*Novana*)

3.4 Patterns of urban space

In order to start building our urban demographic model for the towns of central Adriatic Italy, we must start with the analysis of their best documented phase; i.e. the Early/High Imperial period. Indeed, as the gazetteer has repeatedly shown, we have the most reliable information concerning the overall size of urban space, the extension of the public area, the dimensions of the street grid and the nature of private space for the period between ca. the mid-1st century BC and the 2nd century AD. The most logical way to proceed then is to apply a top-down structure, with the analysis of the Imperial phase forming the basis for saying something about the nature of these towns in the Late Republican period. I will first discuss the patterns of public space, and then those of private space. Concerning the former category, the main purpose of this section is to arrive at realistic figures for the total space taken up by public architecture in the towns of central Adriatic Italy; in this way establishing the potential areas that were available for private architecture. With regard to the latter category, my efforts will concentrate on how to best fill-in these residential areas with houses and number of inhabitants.

[483] For Osimo, see Alfieri 1982, 206-207; for northern Abruzzo, see Delplace 1993, 89-91; and Guidobaldi 1995, 27-29.

[484] For Montedinove, see Cardinali/Luni 2003, 20; for S. Maria di Comunanza and Zoccolanti di Amandola, see Bernetti 2009, 117; see also Paci 1993-1994, 4-6.

3.4.1 Public architecture

Urban area

For 15 out of the 40 towns in the region, it was possible to deduce the approximate urban surface from the area delimited by the town walls. Together these towns cover an area of ca. 369.6 hectares.[485] For 20 out of 40 towns, it was only possible to estimate the urban area from circumstantial evidence, such as natural barriers or indirect spatial indications, like the position of extramural cemeteries and suburban villas, or later medieval town areas. On the whole, these towns cover an additional estimated area of ca. 354.7 hectares.[486] To the five towns for which it was not possible to determine the physical size from the archaeological evidence, the average size of 21 ha obtained from the sum of the other town surfaces was assigned. As such, another area of ca. 105 hectares was obtained.[487].The total urban surface area for the Early/High Imperial period is then ca. 829.7 hectares (*Table* 6; *Appendix* II, *Table* 78).

Table 6 Sizes of urban space in central Adriatic Italy (the areas deduced from the walled area are indicated in red, the areas derived from the sum of the known town surfaces are indicated in green; for the more elaborate version of this table, see Appendix II, Table 77; and 78).

N°	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ha	18.9	5	8	12	25	25	9	42	18	39	10	15	11.6	16	15
N°	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
ha	21	20	16	18.4	25	11	15	12	10	21	20	42	21	20	18.6
N°	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**			**Total**		
Ha	9	16.7	43.7	25	13.8	26	70	23	21	21			**829.7**		

Street grid

It was only possible to calculate the approximate space taken up by the street grid in four towns: *Pisaurum* (9.7%), *Sena Gallica* (17.2%), *Potentia* (28.1%), and *Asculum* (9.6%) (*Table* 7). An interesting pattern is that – despite being approximately of the same size – there seems to be quite a difference between the area reserved for the street grid at *Pisaurum* (1.8 ha), *Sena Gallica* (3.1 ha) and *Potentia* (5.2 ha). It is obvious that these differences are mostly linked to the size of the internal *insulae* – and thus to the number of streets – and the average width of the streets. For instance, at *Pisaurum*, streets were roughly between

[485] These are towns n° 1, 3, 5, 6, 9, 12, 14, 19-22, 27, 30, 33, 37 in the gazetteer. They are indicated in red in *Appendix* II.

[486] Gazetteer, n° 2, 4, 7, 8, 10, 11, 13, 15, 17, 18, 23, 24, 26, 29, 31, 34-36, 38.

[487] Gazetteer, n°

three and four meters wide, while the town area itself was subdivided into a series of 35 fairly large *insulae*; with most of them measuring 2x2 *actus* (18), but other divisions of 2x2.5 *actus* (6), 2.5x1 *actus* (1) and 2x1 *actus* (3) also being present. At *Potentia*, on the other hand, streets were on average between five and six meters wide, while the internal division consisted of a series of 60 mostly smaller *insulae*, with dimensions being 1x2 (24), 1x2.5 (12), 1x1.5 (12), and 1x1 *actus* (12). As such, this seems to explain why the street grid took up only ca. 10% at *Pisaurum*, but almost 30% at *Potentia*. This patterns is further confirmed by the case of *Sena Gallica*, where the known street width is 3.30 m, while a subdivision in a series of 21 regular *insulae* of 1x2 *actus* – together with 21 irregularly shaped *insulae* – has recently been reconstructed. As such, the streets were about as wide as at *Pisaurum*, but there were more of them because of an internal subdivision in smaller parcels, in this way explaining the larger 17.2% share of the street grid. Another good test case is *Asculum*, where a width of 2.61 m has been recorded for the *cardines*, and a width of 3.90 m for the *decumani*, with the exception of the *decumanus maximus* (5.40 m). Based on the reconstructed town plan with 75 *insulae* of 2x2 *actus* – comparable in both division and street width with *Pisaurum* – the proportion of the street grid at *Asculum* would have been ca. 4.2 ha, or 9.6% of the total town area; i.e. comparable with the 9.7% calculated for *Pisaurum* (*Table* 7).

This – admittedly small - sample size may be used as a framework for estimating the share of the street grid for a few towns for which we have less information. At *Tifernum Mataurense*, for instance, the recorded street widths are 4.70 and 6.20 m for the *cardines*, and 6.40 m for the *decumani*; an internal organisation according to *insulae* of 1x2 *actus* has been proposed. With both the street widths and the *insulae* circling the dimensions of the streets at *Potentia*, one might thus argue that the share of the street grid was closer to 30% (*Potentia*) than to 15 (*Sena Gallica*) or 10 % (*Pisaurum*, *Asculum*). The same goes for *Auximum*, for which no street widths are currently known, but where both the dimensions and the number of *insulae* resemble the situation at *Potentia* (30%). At *Fanum Fortunae* the street widths were again in the range of the *Potentia* figures (5/86 m), but the *insulae* were much larger – i.e. 2.5x2.5 and 2.5x1.25 *actus* – implying a somewhat smaller share of the grid, perhaps 20%. At *Sentinum*, on the other hand, the situation seems to rather approach the *Sena Gallica* numbers, making a share of ca. 15% a likely option for this town. A similar figure may be argued for *Forum Sempronii*, where streets are generally wider, but *insulae* are also larger. Based on the same reasoning, smaller shares may be proposed for the street grids at *Trea*, *Matilica*, *Falerio*, and *Hatria* (10%) (*Table* 7).

For the remaining 26 towns it was not possible to estimate the size of the street grid on the basis of the available information. To these towns, I assigned an intermediate figure of 15% (*Appendix* II, *Table* 77). This figure was chosen on the basis of the analysed examples for central Adriatic Italy – which suggest proportions ranging between 10 and 30 % - and on the results from Marta Conventi's study on the organisation of urban space

in Italy, which indicate proportions between ca. 10 and 50 % for the street grid on the whole, but between ca. 12 and 30 % for towns of 20 ha and less (*Table* 8).

Table 7 Calculated percentages of the street grid (red = known; * = estimated); for the full list of derived and estimated proportions for street grids and insulae, see Appendix II, Table 77.

N°	Town	Insulae		Street width (m)	Street grid (%)	Insulae (%)
		N°	actus			
1	*Pisaurum*	35	2x2; 2x2.5; 2.5x1; 2x1	3-4	9.7	90.3
4	*Tifernum Mataurense*	\	1x2	4.70 (*cardo*) 6.20 (*cardo*) 6.40 (*decumanus*)	30*	70*
5	*Fanum Fortunae*	48	2.5x2.5; 2.5x1.25	5.86	20*	90*
6	*Forum Sempronii*	30	2x3	4.50 (*cardo*) 4.70 (*cardo*)	15*	85*
9	*Sena Gallica*	42	1x2	3.30	17.2	82.8
12	*Sentinum*	30	1x2.5	5.81 (*decumanus*) 3.61 (*cardo*) 3.60 (average)	15*	85*
14	*Auximum*	61	1x1; 1x1.5; 2x2	\	30*	70*
19	*Potentia*	60	1x2; 1x2.5; 1x1.5; 1x1	5-6	28.1	71.9
20	*Trea*	8	3x1	6 (*dec. max.*) 4	10*	90*
23	*Matilica*	\	2x2	3 (*cardo*) 1.80 (*decumanus*)	10*	90*
31	*Falerio*	\	1.5x2; 2x3	2.90; 3.60; 3.90; 4.20	10*	90*
33	*Asculum*	75	2x2	5.40 (dec. max.); 3.90; 2.61	9.6	90.4
37	*Hatria*	\	2x3	4,20	10*	90*

Forum

For the majority of the towns, the position or the size of the *forum* is completely unclear.[488] In four cases – i.e. *Pisaurum*, *Cingulum*, *Matilica* and *Falerio* – the dimensions of the square

[488] These are *Pitinum Pisaurense*, *Urvinum Mataurense*, *Tifernum Mataurense*, *Fanum Fortunae*, *Forum Sempronii*, *Pitinum Mergens*, *Sena Gallica*, *Aesis*, *Ancona*, *Auximum*, *Planina*, *Tuficum*, *Numana*, *Ricina*, *Septempeda*, *Attidium*, *Cluana*, *Pausulae*, *Tolentinum*, *Camerinum*, *Firmum*, *Asculum*, *Castrum Truentinum*, *Castrum Novum*, *Interamnia*

have been hypothesised either on the basis of its supposed coinciding with the current main square of the town, or because of its theoretical location inside the reconstructed street grid. These dimensions range from 2,450 m² (*Cingulum*) to 4,900 m² (*Matilica*, *Falerio*), but their hypothetical nature makes them unreliable for further analysis. [489] Precise data on the dimensions of the *forum* were only collected from seven out of 40 towns.[490] The square covered a minimum surface of 1,800 m² (*Sentinum*) and a maximum surface of 5,400 m² (*Cupra Marittima*). In most cases, however, the surface area ranged between 3,200 and 3,600 m². On average, the square measured approximately 3323 m². For the towns for which the exact dimensions of the walled area were known – i.e. *Sentinum*, *Potentia*, *Trea* and *Urbs Salvia* – the *forum* took up a minimum portion of 0.5 % (*Urbs Salvia*, 42 ha) and a maximum portion of 3.2 % (*Trea*, 11 ha). The average portion was 1.7 %. The proportional difference in surface occupation seems to be linked mainly to the size of the settlement; i.e. the square taking-up a higher percentage in smaller towns and a lower one in larger towns.[491] Therefore, rather than opting for a fixed percentage, I choose to use the average figure of 3,323 m² for the towns for which the size of the *forum* was unknown. With the exception of *Pitinum Pisaurense* (6.6 %), *Urvinum Mataurense* (4.2 %), *Pitinum Mergens* (3.7 %), *Falerio* (3.7 %) and *Cupra Marittima* (5.4 %) – not incidentally all smaller settlements with an estimated surface area below or equal to 10 hectares – this resulted in the *forum* taking up a portion between 0.5 and 3.3 % of the town. The derived average proportion was 2.7%. As such, the obtained size was considered acceptable for further analysis (*Appendix* II, *Table* 76).

Theatre

The presence of a theatre was ascertained archaeologically in 16 towns, but its dimensions could only be determined for 13 of them.[492] The minimum space occupied by the spectacle building was 1,500 m² (*Suasa*, *Firmum Picenum*); the maximum space was 6,650 m² (*Pollentia-Urbs Salvia*). The average space was ca. 2,870 m². The portion taken up by the theatre of the entire urban area could be determined for eight out of the 16 towns.

Praetuttiorum, *Hatria*, *Cupra Montana*, *Beregra* and *Novana* (gazetteer n° 2-7, 9, 11, 13, 14, 16-18, 20, 22, 24-26, 28-30, 33-40).

[489] For *Pisaurum*, a surface of ca. 3,750 m² has been proposed; for *Matilica* and *Falerio* alternatives have also been suggested of 3,710 m² and 2,809 m² respectively (gazetteer n° 1, 15, 23, 31).

[490] These are the towns of *Suasa*, *Ostra*, *Sentinum*, *Potentia*, *Trea*, *Urbs Salvia* and *Cupra Maritima* (gazetteer n° 8, 10, 12, 19, 21, 27, 32).

[491] At *Potentia*, the square took up ca. 2% (3,600 m²) of the 18 ha large town area; at *Sentinum* (15 ha), the *forum* occupied ca. 1.2 % (1,800 m²).

[492] Theatres are currently known at *Urvinum Mataurense*, *Fanum Fortunae*, *Suasa*, *Ostra*, *Aesis*, *Potentia*, *Ricina*, *Urbs Salvia*, *Firmum Picenum*, *Falerio*, *Asculum*, *Interamnia Praetuttiorum* and *Hatria* (gazetteer n° 3, 5, 8, 10, 11, 19, 20, 27, 30, 31, 33, 36, 37). At *Forum Sempronii*, *Pitinum Mergens* and *Sentinum*, they have been noted in the past, but their position is not known at the moment (gazetteer n° 6, 7, 12).

In these cases, the minimum proportion was 0.4 % (*Hatria*), while the maximum proportion was 4.7 % (*Urvinum Mataurense*). For the other six towns, the proportions all ranged between 0.8 and 1.6 %. As such, the derived average percentage was 1.5 %. The average surface area of 2,870 m² was used for the other towns. This resulted in the theatre taking-up between 0.4 % (*Suasa*, *Ostra*) and 5.7 % (*Pitinum Pisaurense*) of urban space. However, in almost all cases – with the exception of the aforementioned towns, together with *Pitinum Mergens* (3.2 %) – the percentage ranged between an acceptable 1.1 and 2.9 % (*Appendix* II, *Table* 76).

Table 8 Calculated proportions of the *insulae* and the street grid in 11 Roman towns in Italy (After Conventi 2004, 170).

Town	Urban area (m²)	Insulae		Street grid	
		m²	%	m²	%
Tridentum	130,000	113,750	87.5	16,250	12.5
Telesia	179,664	138,776	77.4		22.6
Florentia	201,600	144,000	71.6		28.4
Libarna	230,000	150,930	65.8		34.2
Venafrum	274,890	252,000	91.7		8.3
Falerii Novi	306,000	194,326	63.5		36.5
Alba Pompeia	386,750	262,132	67.6		32.4
Aquileia	409,670	310,500	75.9		24.1
Aug. Praet.	417,600	275,968	65.9		34.1
Bononia	500,000	231,150	46.2		53.8
Aug. Taur.	510,000	460,800	90		10

Amphitheatre

The presence of an amphitheatre was ascertained archaeologically in ten towns.[493] The existence of such a spectacle building at *Pisaurum*, *Auximum* and *Tuficum* is supposed on the basis of epigraphic sources.[494] Testimonies from the 19th century mention the remains of amphitheatres at *Numana* and *Camerinum*, but their exact positions are currently unknown.[495] An amphitheatre may also have existed at *Cupra Montana*.[496] With the exception of *Urbs Salvia*, where the building was erected immediately outside the town

[493] Amphitheatres are currently known at *Fanum Fortunae*, *Forum Sempronii*, *Suasa*, *Ancona*, *Ricina*, *Urbs Salvia*, *Falerio*, *Asculum*, *Interamnia Praetuttiorum* and *Hatria* (gazetteer n° 5, 6, 8, 13, 22, 27, 31, 33, 36, 37).

[494] Gazetteer n° 1, 14, and 17.

[495] Gazetteer n° 18 and 29.

[496] Gazetteer, n° 38.

walls, the amphitheatre was always inserted into the main urban area. Based on the available information, the minimum area occupied by the building was 4,144 m² (*Interamnia Praetuttiorum*) and the maximum area was 9,350 m² (*Fanum Fortunae*).[497] The average area was 6,390 m². Percentage wise, the proportions ranged between 0.6 % (*Hatria*) and 5.9 % (*Ancona*); on average it took up 2.8 %. By applying again the average surface area of 6,390 m² to the other towns in the area, the amphitheatre occupied a proportion between as little as 1.6 % (*Ostra*, *Interamnia Praetuttiorum*) and as much as 12.8 % (*Pitinum Pisaurense*). In most cases however, it occupied no more than 5.3 % (*Appendix* II).

Other public buildings

There is decisively less information on the dimensions of the other public buildings in the town, such as the main temples, the *tabernae*, the basilica, the *macellum*, the cisterns and the public baths.[498] With regard to the latter category, for instance, only a few bath houses have been excavated in their entirety.[499] A recurrent scheme, however, seems to be the presence of a large bath complex close to the *forum* of the town – with noted dimensions between 2,000 and 5,200 m², or an average surface of 3,666 m² - and the location of a second smaller thermal building in another zone of the settlement. The dimensions of the latter building varied between 300 and 1,208 m², resulting in an average surface of 633 m² (*Appendix* II, *Table* 76). For the basilica, dimensions of 700 m² (*Trea*) and 1,403 m² (*Cupra Maritima*) have been noted respectively; resulting in an average figure of 1,050 m².[500] For the *macellum*, dimensions are currently known of 400 m² (*Forum Sempronii*), 512 m² (*Potentia*), 600 m² (*Castrum Truentinum*), and 900 m² (*Trea*); resulting in an average figure of 603 m² (*Appendix* II, *Table* 76).[501] Based on the published plans, it has been possible to measure the dimensions of the *tabernae* in their entirety only for the towns of *Suasa* (4,000 m²), *Trea* (4,500 m²) and *Potentia* (4,800 m²), resulting in an average of ca. 4,433 m² (Appendix *II*, Table 76, where the figure is added to the area taken up by the *forum*, as indicated by the symbol '+').[502] A town typically housed a number of temples. The city of

[497] The 18,500 m² size supposed for the amphitheatre of *Asculum* is here not taken into consideration because of the unreliability of this figure (gazetteer n° 33).

[498] The surfaces occupied by the cisterns have not been included in my calculations, as they often occupied higher areas of the town, either immediately inside or outside the town walls, or served as platforms for the construction of other buildings and squares, such as the *forum*.

[499] These include the complexes unearthed at *Tifernum Mataurense*, *Forum Sempronii*, *Ostra*, *Sentinum*, *Septempeda*, *Matilica*, *Falerio*, and *Interamnia Praetuttiorum* (gazetteer, n° 4, 6, 10, 12, 22, 23, 31, 36).

[500] Gazetteer n° 21, 32.

[501] Gazetteer n° 19, 21, 34.

[502] At *Sentinum*, only a part of the *tabernae* – measuring ca. 1,150 m² - are visible on the geophysical imagery; see gazetteer n° 8, 12, 19, 21.

Pompeii, for instance, had nine temples spread out over its 66 ha large urban area. Based on the combination of archaeological and epigraphic sources, it seems that the towns of central Adriatic Italy typically housed one larger main temple and between two and five smaller temples within their urban area.[503] The larger temples varied in size between 384 and 613 m² - with an average size of ca. 540 m² - and the smaller temples mostly ranged from 117 to 300 m² (ca. 202 m² on average), with only two temples falling under the 100 m² level (74 m² on average) (*Appendix* II, *Table* 76). In order to acknowledge the presence of temples within the urban area of all towns, I decided to assign one temple of each category to the towns for which we have no information; i.e. one temple of 540 m², another of 202 m² and a third of 74 m² (*Appendix* II, *Table* 76).

The overall size of public space and the implications for the size of private space

There are only a handful of towns for which we have an approximate idea of the total space taken up by public architecture. One of the best documented sites to this regard is *Trea*, where the identified public buildings grouped together in the central section of the town occupied a complementary area of ca. 11,665 m² (ca. 1.2 ha), or 10.6 % of the total urban area. Based on the published town plan, it is easily acceptable that the total central area reserved for public space was in the range of 23,150 m² (2.3 ha); i.e. ca. 21 % of the town (*Figure* 177). This space may have included the temples for Minerva and Vittoria, whose existence is attested epigraphically.[504] Earlier excavations in the 18th century attested the presence of at least one other temple – a *Serapeum* for the goddess Isis – and a thermal building in the southern part of the town.[505] By incorporating the derived average figures for public space regarding thermal buildings and a small temple – but excluding the averages for a theatre and an amphitheatre, which have not been attested despite intense geophysical and aerial photography research – the total area occupied by public space may have amounted to 27,523 m² (2.8 ha), or ca. 25% of the town (*Appendix* II, *Table* 77).

Another fairly well-documented example is *Potentia*. There, the registered public architecture occupies a complementary space of ca. 12,123 m² (1.2 ha); i.e. ca. 6.6 % of the walled urban area. Again based on the published plan, it is not unreasonable to assume a total central area devoted to public architecture of ca. 19,200 m² (1.9 ha) (120x160 m),

[503] Temples are known at *Pisaurum* (2), *Pitinum Pisaurense* (2), *Tifernum Mataurense* (1), *Fanum Fortunae* (1), *Forum Sempronii* (6, of which 3 attested archaeologically), *Suasa* (1), *Ostra* (2), *Ancona* (2), *Tuficum* (3, only attested epigraphically), *Numana* (1), *Potentia* (1), *Ricina* (1), *Trea* (4), *Attidium* (1), *Pausulae* (1), *Urbs Salvia* (3), *Tolentinum* (1), *Camerinum* (1), *Firmum Picenum* (1), *Falerio* (3), *Cupra Maritima* (1), *Asculum* (4), and *Interamnia* (2) (gazetteer, n° 1, 2, 4,-6, 8, 10, 13, 17,-21, 24, 26-33, 36).

[504] Marengo 2000.

[505] For the temple, see Fabrini 1990; and Capriotti Vittozi 1999; for the associated baths, see Percossi Serenelli 2000.

maybe occupied by a further basilica, a main thermal complex and some temples. Spread-out further over the town, the presence of a thermal building and an apparent small theatre (1,838 m²) has also been attested archaeologically (*Figure* 171). It is very unlikely that an amphitheatre was positioned inside the walls. As such, with the addition of the average figure for a hypothetical second small thermal building, the public space may have covered a complementary area of ca. 21,671 m² (2.2 ha), or 11.8 % (*Appendix* II, *Table* 77). The same line of reasoning may be applied for *Sentinum*, where the registered public buildings surrounding the *forum* in the central sector of the town cover a complementary area of ca. 5,399 m² (0.5 ha), or 3.6 % of the walled area. However, based on the organisation of the town plan and the published map – which indicate further public buildings to the west and to the south of the *forum* complex – it seems likely that a large central area of ca. 24,894 m² (2.5 ha) was completely reserved for public space; i.e. 16.6 % of the town (*Figure* 160). With the addition of the public thermal complex (3,800 m²) to the east of the *forum*, the public space may have covered ca. 28,694 m² (2.9 ha), or 19.1 % of the town (*Appendix* II, *Table* 77).

Another good example is *Ostra*. The known public buildings and squares cover a zone of ca. 14,800 m² (1.5 ha); i.e. a surface area that may coincide with ca. 3.8 % of the whole estimated urban area. With the addition of the average figures for the probable public buildings – which may include the *tabernae* surrounding the *forum* complex, a basilica, a *macellum*, two further temples and a second smaller bath building, all easily hypothesised in the zones surrounding the *forum* – the public surface may have occupied a zone of ca. 22,131 m² (2.2 ha), or 5.7 % of the town (*Appendix* II, *Table* 77). Finally, useful evidence also comes from *Suasa* and *Forum Sempronii*. At *Suasa* the known public constructions amount to a total surface of ca. 16,550 m² (1.7 ha), representing roughly 3.9 % of the total urban area. By adding again the averages for the unknown buildings – i.e. the basilica, the *macellum*, the main bath complexes and the temples - the public space may have covered a zone of ca. 25,215 m² (2.5 ha), or some 6 % of the town (*Appendix* II, *Table* 77). At *Forum Sempronii*, the principal public area including the *forum*, the *Augusteum* and the other temples, the *macellum*, and the main thermal complex covered a likely area of ca. 29, 400 m² (2.9 ha), or 11.8 % of the walled town. With the addition of another thermal complex (1,208 m²), the amphitheatre (5,560) and the supposed theatre, the total public space may have covered an area of ca. 39,038 m² (3.9 ha); i.e. 15.6 % of the town (*Appendix* II, *Table* 77).

For the other towns, the total estimated public space was estimated by combining the measurements of the known public buildings with the average derived figures for the other buildings, with the exception of the amphitheatre, which was only added when known through epigraphy or by previous research. As such, the minimum portion of the urban area taken up by public space was 3.1-5.7 %; the maximum proportions ranged between 23.7 and 30.5 %. Unsurprisingly, the lower figures were obtained for the larger towns (*Suasa*, *Ostra*, *Urbs Salvia*, *Castrum Truentinum*, *Hatria*), while the higher figures refer

to the smaller towns in the area (*Pitinum Pisaurense*, *Urvinum Mataurense*, *Trea*, *Falerio*). For 21 out of 40 towns, the proportions ranged between 10.1 and 21.6 %, coinciding as such with settlements that covered an area between ca. 10 and 25 ha. Finally, a series of ten towns had their public spaces occupying between 7.8 and 9.3 % of the total urban area (*Appendix* II, *Table* 77). With regard to the availability of residential space, these calculations result in a minimum proportion of 54.5% (*Pitinum Pisaurense*) and a maximum proportion of 86.9 % (*Hatria*), again not incidentally coinciding with the smallest and the largest urban centre in the area. For most towns, a proportion in the 60-70 % range was obtained (*Table* 9; *Appendix* II, *Table* 77). The next question is then how we should fill-in these residential areas.

Table 9 Derived and estimated proportions for the public and private space in the central Adriatic towns; for an extended version, see Appendix II, Table 77).

N°	Town	Street grid		Public space		Private space	
		ha	%	ha	%	ha	%
1	*Pisaurum*	1.8	9.7	2.4	13	**14.6**	**77.4**
2	*Pitinum P.*	0.8	15	1.5	30.5	**2.7**	**54.5**
3	*Urvinum*	1.2	15	1.9	23.7	**4.9**	**61.3**
4	*Tifernum*	3.6	30	1.8	15	**6.6**	**55**
5	*Fanum*	5	20	4.3	16.9	**15.8**	**63.1**
6	*Forum*	3.8	15	3.9	15.6	**17.3**	**69.4**
7	*Pitinum M.*	1.4	15	1.8	20.1	**5.8**	**64.9**
8	*Suasa*	6.3	15	2.4	5.7	**33.3**	**79.3**
9	*Sena*	3.1	17.2	1.8	10.1	**13.1**	**72.7**
10	*Ostra*	5.9	15	2.2	5.7	**31**	**79.3**
11	*Aesis*	1.5	15	1.8	17.6	**6.7**	**67.4**
12	*Sentinum*	2.3	15	2.9	19.1	**9.9**	**65.9**
13	*Ancona*	1.7	15	2.5	21.6	**7.4**	**63.4**
14	*Auximum*	4.8	30	2.4	15.3	**8.8**	**54.7**
15	*Cingulum*	2.3	15	1.8	12	**10.9**	**73**
16	*Planina*	3.2	15	1.8	8.6	**16**	**76.4**
17	*Tuficum*	3	15	2.4	12.2	**14.6**	**72.8**
18	*Numana*	2.4	15	2.4	15.3	**11.2**	**69.7**
19	*Potentia*	5.2	28.1	2.2	11.8	**11.1**	**60.1**
20	*Ricina*	3.8	15	2.8	11.2	**18.5**	**73.8**
21	*Trea*	1.1	10	2.8	25	**7.1**	**65**
22	*Septempeda*	2.3	15	1.8	12.2	**11**	**72.8**
23	*Matilica*	1.2	10	1.8	15	**9**	**75**
24	*Attidium*	1.5	15	1.8	17.6	**6.7**	**67.4**

25	*Cluana*	3.2	15	1.8	8.6	**16**	**76.4**
26	*Pausulae*	3	15	1.8	9	**15.2**	**76**
27	*Urbs Salvia*	6.3	15	3	7.2	**32.7**	**77.8**
28	*Tolentinum*	3.2	15	1.8	8.6	**16**	**76.4**
29	*Camerinum*	3	15	2.4	12.2	**14.6**	**72.8**
30	*Firmum*	2.8	15	1.7	9	**14.1**	**76**
31	*Falerio*	0.9	10	2.4	26.6	**5.7**	**63.4**
32	*Cupra Mar.*	2.5	15	2	12	**12.2**	**73**
33	*Asculum*	4.2	9.6	3.8	8.7	**35.7**	**81.7**
34	*Castrum T.*	3.8	15	1.8	7.2	**19.4**	**77.8**
35	*Castrum N.*	2.1	15	1.8	13.1	**9.9**	**71.9**
36	*Interamnia*	3.9	15	2.1	8.2	**20**	**76.8**
37	*Hatria*	7	10	2.2	3.1	**60.8**	**86.9**
38	*Cupra Mon.*	3.5	15	1.8	7.8	**17.7**	**77.1**
39	*Beregra*	3.2	15	1.8	8.6	**16**	**76.4**
40	*Novana*	3.2	15	1.8	8.6	**16**	**76.4**

3.4.2 Private architecture

General patterns

One pattern that has emerged very clearly from the gazetteer is the general paucity of data regarding the private architecture of the central Adriatic towns. Indeed, for the majority of the towns in the area we only dispose of isolated wall sections and/or various types of floor pavement segments, associable at most with rooms or partial house plans.[506] This may either be because archaeological research in these towns has focused more on monumental structures of the settlement, rather than on the residential ones, or because more recent occupation levels hinder our understanding of older housing units. Obviously, it is not possible to deduce either the full plan or the dimensions of these residential units from such fragmentary finds. What is sufficiently clear, however, is that these structures all refer to houses that were of the *domus*-type, organised around an *atrium* and/or a *peristylium*. Another characteristic noticed in the case of towns developed

[506] This is true for practically all urban sites in the area: *Pitinum Pisaurense*, *Urvinum Mataurense*, *Fanum Fortunae*, *Pitinum Mergens*, *Aesis*, *Auximum*, *Cingulum*, *Planina*, *Tuficum*, *Numana*, *Septempeda*, *Attidium*, *Cluana*, *Pausulae*, *Tolentinum*, *Camerinum*, *Firmum Picenum*, *Falerio*, *Cupra Maritima*, *Castrum Truentinum*, *Castrum Novum*, *Hatria*, *Cupra Montana*, *Beregra* and *Novana* (see *supra*, gazetteer n° 2, 3, 5, 7, 11, 14-18, 22, 24-26, 28-32, 34, 35, 37-40), but the cases of *Ancona* and *Interamnia Praetuttiorum* in particular may be considered emblematic (see *supra*, gazetteer n° 13 and 36).

on hilltops is the frequent organisation of these *domus* complexes over different terraces in coherence with the morphology of the hillslopes.[507] Thanks to numerous archaeological interventions, we are somewhat better informed on the nature of private space in the towns of *Pisaurum* and *Sena Gallica*. Even in the cases of the better 'researchable' abandoned Roman towns, house structures have not always proven to be visible in detail through geophysical or aerial photographic imagery; either due to bad preservation conditions or to soil visibility issues.[508]

Based on the often limited chronological information offered by these remains, the presence of such *domus* complexes in these towns is attested for both the Late Republican and Early/High Imperial period. For some of the oldest colonies in the area – i.e. the ones founded in the course of the 3rd century BC, like *Sena Gallica*, *Aesis*, *Interamnia* and *Hatria* – they seem to have appeared already from the 3rd-2nd century BC onwards.[509] In most cases, however, the residential architecture of this period seems to have consisted mainly of simple structures with walls made out of pebbles linked by clay, and rudimentary floors.[510] It is only between the second half of the 2nd century BC and the mid-1st century BC that *domus* buildings began characterising the urban lay-out of most settlements, often still in co-existence with simpler housing units. The towns of *Suasa* and *Pollentia-Urbs Salvia* in particular illustrate this evolution well, but other examples may be cited.[511]

From the Augustan period onwards, their presence became especially noticeable and both the number and richness of these houses peaked in the course of the 1st and the 2nd century AD. Prime examples of this increasing residential building activity in the Early Imperial period are the towns of *Pisaurum* and *Interamnia Praetuttiorum*; good illustrations of their maintaining prosperity in the High Imperial period are *Tifernum Mataurense*, *Forum Sempronii*, *Suasa*, and to a lesser extent *Ricina* and *Matilica*. Both processes, however,

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[507] Again, this is likely true for all urban sites that developed on hilltops, but one of the best known examples of this arrangement according to terraces is the so-called "Domus con pavimento a torri", a 3rd-2nd century BC house excavated in part under the garden of the 'Curia Vescovile' of Atri (*Hatria*) (see *supra*, gazetteer n° 37). The method of organising houses and other structures according to terraces has also been attested in particular at *Ancona*, *Cingulum*, *Matilica* and *Castrum Novum* (see *supra*, gazetteer n° 13, 15, 23, 35).

[508] Three fine examples of the latter category are the towns of *Sentinum*, *Potentia* and *Trea* (see *supra*, gazetteer n° 12, 19, 21). The complete plan of a *domus* was registered by means of aerial photography at the site of *Pitinum Pisaurense*, but no plan of the building has been published (see *supra*, gazetteer, n° 2).

[509] The case of *Sena Gallica* – i.e. three domus buildings dating back to the 3rd-2nd century BC – is especially revealing (see *supra*, gazetteer n° 9); for the early *domus* buildings of *Aesis* (2nd century BC), *Interamnia* (3rd-2nd century BC) and *Hatria* (3rd century BC, but restructured in the 2nd century BC), see *supra*, gazetteer n° 11, 36, 37.

[510] For examples, see *Tifernum Mataurense*, *Suasa*, *Sena Gallica*, *Castrum Novum* and *Interamnia Praetuttiorum* (see *supra*, gazetteer n° 4, 8, 9, 35, 36).

[511] For these two towns, see *supra*, gazetteer n° 8, 23 and 27; other examples include *Pisaurum*, *Tifernum Mataurense* and *Matilica* (see *supra*, gazetteer n° 1, 4, 23).

have been documented in many of the central Adriatic towns.[512] One prominent aspect of many of these houses is their apparent longevity over several centuries. Said longevity is well attested by a number of interventions in the 1st-2nd century AD that refer to either restorations or transformations, enlargements or reductions, or rather an overall reorganisation of the existing spaces.[513] Another noteworthy evolution in the course of the 1st-2nd century AD is the tendency to construct very large *domus* complexes that both enlarge and incorporate pre-existing smaller houses. The best illustrations of this process are the well-studied 1st century AD "Domus dei Coiedii" at *Suasa* and the mid-2nd century AD "Domus di Europa" at *Forum Sempronii*, but the trend has also been noticed in the Imperial *domus* of the Piazza della Cattedrale at *Hatria*, and in the mid-1st century AD *domus* of the Via Mazzolari at *Pisaurum*.[514] While at the beginning of the 3rd century AD most of these houses seem to have maintained their grandeur and vitality, signs of decay and abandonment usually began kicking in from the 3rd/4th century AD onwards.[515] Towards the 5th-6th century AD all houses seem to have been either completely abandoned, or converted in part into graveyards.[516]

House size and number of inhabitants

The residential lay-out of a Roman town typically consisted of a mixture of houses with various sizes. The well-known and thoroughly studied towns of *Pompeii* and *Herculaneum* are good illustrations of this practice. Obviously, we cannot hope to have such detailed information on the houses occupying the towns of central Adriatic Italy. Here we need to build our picture from the information provided by geophysical and aerial prospections, together with the few houses that have been excavated in their entirety over the years. One of the best documented cases to this regard is the habitation quarter recently registered by means of aerial photography at *Tifernum Mataurense*. Said fieldwork revealed

[512] For the sites of *Pisaurum* and *Interamnia Praetuttiorum*, see *supra*, gazetteer n° 1 and 36; for the sites of *Tifernum Mataurense*, *Forum Sempronii*, *Suasa*, *Ricina* and *Matilica*, see *supra*, gazetteer n° 4, 6, 8, 20, 23); for further illustrations of the general pattern described here, see the cases of *Aesis*, *Ancona*, *Auximum*, *Planina*, *Septempeda*, *Camerinum*, *Firmum Picenum*, *Falerio*, *Asculum*, and *Castrum Novum* (see *supra*, gazetteer n° 11, 13, 14, 16, 22, 29-31, 33, 35).

[513] These processes can be noted in many of the *domus* buildings at *Pisaurum*, *Tifernum Mataurense*, *Suasa*, *Sena Gallica*, *Falerio* and *Interamnia Praetuttiorum* (gazetteer n° 1, 4, 8, 9, 31, 36).

[514] For *Suasa*, see gazetteer n° 8; for *Forum Sempronii*, see n° 6; for *Hatria*, see n° 37; for *Pisaurum*, see n° 1.

[515] See, for instance, *Tifernum Mataurense*, *Fanum Fortunae*, *Forum Sempronii*, *Suasa* and *Matilica* (gazetteer n° 4, 5, 6, 8, 23).

[516] The latter process has been registered at *Pisaurum*, *Forum Sempronii*, *Suasa*, *Potentia*, *Ricina*, *Falerio* and *Castrum Novum* (gazetteer n° 1, 6, 8, 19, 20, 31, 35). One notable exception is *Sena Gallica*, where the houses of 'La Fenice' seem to have maintained their residential character until the 6th century AD, before being converted into a graveyard as well (gazetteer n° 9).

the traces of nine probable houses positioned around the crossing of two paved streets. Two large houses occupied a surface between 800 and 1,000 m² – i.e. house A (ca. 950 m²) and house G (ca. 925 m²) – but the other houses were smaller in size, covering surfaces between either 400 and 600 m² (560 m² for house B, 480 m² for house C, and 470 m² for house F) or even below 400 m² (390 m² for house D and 360 m² for house E) (*Figure* 152).[517] The same mixture is visible on the geophysical imagery from *Sentinum*, where we can clearly see a mashing together of houses with differing sizes and shapes in the south-western sector of the town. Admittedly, individual house plans are difficult to discern on the published plan, but in one case the registered traces do allow for indicating the presence of a *domus* measuring ca. 460 m², positioned next to a smaller house of ca. 300 m² (Figure 186, A).

Further information on house sizes comes from the town of *Trea*, where aerial photography has revealed a large portion of the urban area. Again, detailed internal house plans cannot be retrieved from the current map, but in the western part of the town the traces clearly attest the lining-up of several very large *domus* buildings along one of the main street of the town, measuring between 1,300 and 1,600 m² (*Figure* 133, A-D). Another bit of information comes from *Ostra*, where a portion of a residential quarter has been registered by means of aerial photography. Said quarter – positioned along one of the main streets of the town – consisted of what seems to be four houses flanked by a series of *tabernae*. While the published plan only allows for roughly estimating the size of these houses – one house may have measured ca. 540 m², two others ca. 400 m² and the fourth ca. 800 m² - the general lay-out of the quarter seemingly confirms both the spatial pattern and the size-range individuated for the private architecture of the other towns. Finally, some useful indications for house size may also be collected from a few partially excavated houses in the towns of *Pisaurum*, *Forum Sempronii*, and *Matilica*: two Early Imperial houses were uncovered almost in their entirety at *Pisaurum*, a first one of ca. 625 m² with at least 19 rooms distributed around a courtyard, and a second one of ca. 875 m²; the very large 'Domus di Europa' at *Forum Sempronii* extended over an area of approximately 1,200 m²; and the two *domus* complexes uncovered at *Matilica* measured at least 600 m² and 1,200 m² .

Table 10 Estimated residential occupation densities based on a ratio of 34-39 m²/person.

Size (m²)	Ratio space/person (34-39 m²)	Density (p)
300	/	7-8
360		9-10

[517] Gazetteer n° 4.

390	10-11
400	10-11
460	11-13
470	12-13
480	12-14
540	13-15
560	14-16
600	15-17
625	16-18
800	20-23
875	22-25
925	23-27
950	24-27
1,200	30-35
1,300	33-38
1,600	41-47

As no detailed internal plans can be retrieved from these traces – and thus no information on the precise number of rooms in these houses is available – we can merely estimate the number of persons that lived in them. As we have seen – taking as a starting point the estimated population of 10,000 people for the city of *Pompeii* – Wallace-Hadrill calculated an average occupation of 7-8 persons per average-sized house of 271 m². This left him with a theoretical occupation ratio of 34-39 m² per person.[518] If we apply these figures to the aforementioned houses, this would imply the following occupation densities: 7-11 persons for the houses below 400 m²; 10-18 persons for the houses between 400 and 600 m²; 20-27 persons for the houses between 800 and 1,000 m²; and 30-47 persons for the houses larger than 1,000 m² (*Table* 10).

Thanks to a few better excavated and published houses, we are able to further refine our figures for both the sizes of the individual houses and the number of people that lived in them. A first example is the Late Republican *domus* recently unearthed at *Sena Gallica*. This typical *atrium*-house measured 17x27 m (459 m²) and was subdivided into a total of 14 spaces: an entrance room (*vestibulum*), two rooms with a commercial or storage function (*tabernae*), five bedrooms (*cubiculum*) distributed around a central courtyard (*atrium*), two adjacent wing rooms (*alae*), a *tablinum* and two dining rooms (*triclinium*) (*Figure* 150). The open *atrium* occupied a space of ca. 120 m² (13.5x9 m), in this way leaving the actual roofed area at 339 m². If we again apply Wallace-Hadrill's ratio of 34-39 m²/p, the number of inhabitants would fall in the range of 11-13 persons. Alternatively,

[518] Wallace-Hadrill 1994, 99.

however, we might apply Wallace-Hadrill's other methodology in this case – i.e. assuming an average occupation of one person per ground-floor room, excluding the spaces not used for living, such as entrances and passageways, or commercial and/or storage rooms – and consider the number of living rooms to equal the number of inhabitants.[519] This would result in a slightly lower occupation of 10 persons for the *domus*. As such, an average occupation density of 10-11 persons might not be unreasonable.

The same line of reasoning can be applied to the Late Republican house discovered under the Imperial temple at *Urbs Salvia*. Measuring ca. 392 m² (14x28 m) - of which 288 m² roofed space - and organised into a *vestibulum* flanked by two *tabernae*, an *atrium* with four adjacent *cubicula* and two *alae*, and a *tablinum* flanked by two *triclinia*, the *domus* could either have housed 10-11 persons (Wallace-Hadrill's first method) or 7 persons (Wallace-Hadrill's second method). Again, an average population between 7 and 10 persons may be realistically assumed (*Figure* 185; 186). Another Late Republican house of similar size is the so-called 'Casa ad atrio' found under the Imperial 'Domus dei Coiedii' at *Suasa*. Said *domus* measured ca. 480 m² (40x12 m) and consisted of an entrance (*vestibulum*) flanked by a *taberna* and a bedroom, an *atrium* with three adjacent bedrooms (*cubiculum*), a *tablinum* and a *triclinium*, a garden (*hortus*) and a backroom (*Figure* 144; 147, a). If we distract all the spaces of the house not used for living, the number of rooms in the house adds up to seven. The actual roofed space of the house – i.e. without the areas occupied by the *atrium* (78 m²) and the *hortus* (125 m²) – covered 277 m². Depending on which calculation method we apply, the *domus* may thus have housed either seven persons, or between 12 and 14 persons.

Another well-known Late Republican house is the smaller 'Casa del primo stile', located somewhat to the south of the 'Casa ad atrio'. The first phase of the building consisted of a *domus* measuring only 189 m² (27x7 m) and organised into an entrance, an *atrium*, a *tablinum*, two bedrooms, a corridor and a likely wide utility space at the back (*Figure* 144; 145). The roofed space was about 169 m². With only three real living rooms, the number of inhabitants must have been relatively low, maybe ranging between 4-5 persons, or even only 3. An argument in favour of the higher range of numbers may be the supposed presence of a second floor, or at least an upper flat.[520] In a second phase, some 266 m² of space was added to the *domus*, in this way enlarging the house up to 455 m². Theoretically, the building may now have housed between 11 and 13 persons, but a large part of the newly constructed sector seems to have had an artisanal/utility function, suggesting that the number of inhabitants did not rise that dramatically. Taking into consideration the four smaller rooms of the new sector, an estimated figure of seven or nine persons may be a more realistic occupation density (*Figure* 145, AX, 11, 12, 2).

[519] Wallace-Hadrill 1994, 101.

[520] De Maria 2010, 22-23.

Recently, one of the *domus* buildings discovered at *Tifernum Mataurense* – i.e. house G (*Figure* 136, n° 9) – was completely excavated. The Early Imperial house consisted of a total of 23 rooms, occupying a surface of ca. 925 m². The house included a *vestibulum* flanked by two *tabernae* and another utility space, a *tablinum* flanked by three other rooms, an *atrium*/*peristylium* surrounded by six (bed)rooms to the north and the south, and a *triclinium* flanked by two rooms in the back. The five rooms in the north-eastern corner of the house were occupied by a small thermal installation and a likely second entrance (*Figure* 133). The number of rooms used for living was probably no more than 12. This means that the house may have been inhabited by about a dozen persons or at the highest by 23 to 27 persons.

A last but very well-documented Imperial house is the huge *Domus dei Coiedii* at *Suasa*, a *domus* that extended over approximately 3,300 m² at the moment of its maximum expansion in the 2nd century AD (*Figure* 147). Approximately 55% of the complex was taken up by a large porticoed garden/*peristylium* of ca. 1,800 m² (BT, AD, AE, BA, BB, BC, BD, BE, BQ, BR, BG), in which a private thermal installation of ca. 225 m² was inserted towards the end of the 2nd century AD (BL, BI, BP, BM, BS, BN). This left about 1,500 m² for the actual residential/representation quarters of the house, subdivided into a total of 40 rooms organised around an *atrium* (A). Not all of these rooms, however, were used for living purposes: one room contained another thermal installation (AS); another large room of 120 m² was an audience room (S); four rooms formed a probable *hospitium* or lodging space (AF, AK, AN, AQ); and a further 13 rooms were most likely *tabernae* (AB, AC, AL, AH, AO) and service or storage spaces (AG, AP, AR, AT, AU, AV, A, AZ). With the further exception of the entrance of the house (K) and the numerous passageways and corridors (T, D, F, N, AI), this leaves some 15 rooms available for living (AA, U, V, R, Q, P, O, C, E, G, H, I, L, M1, M2) (*Figure* 223). Based on an average space of 34-39 m² per person, the house would have been inhabited by 38-44 persons. If we apply the ratio of one person per room, however, there may only have resided some 15 people in the *domus*.

The comparison between the two calculation methods neatly highlights how houses of similar size may have had slightly different occupation densities due to a differing number of individual living rooms. The same is true in the opposite side, as smaller houses may have had occupation densities equalling those of larger houses because of a similar number of (smaller) rooms. The 'Domus dei Coiedii' in particular is a fine example of how a much bigger house does not necessarily need to imply a proportionally bigger household, but may rather be linked to a family disposing of more wealth and space. From the available evidence, it is also clear that the occupation density of a house was not fixed over time. While we cannot hope to express these diachronic alterations in exact numbers, the process is well-attested by the various adaptions of space in a *domus* through time. Perhaps, a first useful order of magnitude may be acquired by setting the absolute minimum occupation at the derived room-figures, while the higher figures derived from the surface area calculations may be considered the absolute maximum occupation. Still,

in some cases this leaves us with quite large variations in household size, such as 7-14 persons for a 480 m² large house, or 12-27 persons for a 925 m² house, or especially 15-44 persons for a 3,300 m² house (*Table* 11, Derived density 1). Another option might be to use the lower figures from the surface area calculations as maximum occupation densities. Obviously, this gives us overall lower density ranges, but at least the pattern becomes more balanced across the different house sizes (*Table* 11 Derived Density 2).

Table 11 Estimated residential occupation densities of the excavated houses.

Size (m²)	N° of rooms	Density 1 (34-39 m²/p)	Density 2 (1 room/p)	Derived density 1	Derived density 2
189	3	4-5	3	3-5	3-4
392	7	10-11	7	7-11	7-10
455	7	11-13	7	7-13	7-11
459	10	11-13	10	10-13	10-11
480	7	12-14	7	7-14	7-12
925	12	23-27	12	12-27	12-23
3,300	15	38-44	15	15-44	15-38

Table 12 House sizes grouped according to 200 m² bands between 0 and 1,000 m².

0-200	200-400	400-600	600-800	800-1,000	1,000-2,000	>2,000
189	300	400 (x2)	600	800	1,200 (x2)	3,300
	360	455	625	875	1,300	
	390	459		925	1,600 (x2)	
	392	460		955		
		470				
		480 (x2)				
		540				
		560				
1	**4**	**10**	**2**	**4**	**5**	**1**

In order to construct possible urban population densities from these houses, two methods may be considered. A first method uses the average surface area derived from the currently known house sizes – i.e. ca. 690 m² based on a total of 26 houses, excluding as such the exceptionally large 'Domus dei Coiedii' – and applies the density figure obtained from the surface area method; which in this case would result in an occupation of 17-20 persons. Next, the number of houses that may fit in the urban area reserved for private space is then calculated and multiplied with the occupation density figure. For instance, at *Potentia*, this would result in a total of 160 houses, or an estimated population between 2,720 and 3,200 persons. The population density for the inhabited area only

would be 245-288 p/ha, while the overall population density of the town would be 148-174 p/ha. However, several objections may be raised against the representative value of these figures. First, the use of an overall average surface figure does not allow for incorporating the occupation densities based on room numbers. As these densities have consistently hinted at lower occupation numbers, we might thus be overestimating the number of people that lived in the town. Second, this methodology does not take into account the diversity in house sizes that we know to have characterised the private lay-out of a Roman town. As such, I decided not to use this calculation method.

Table 13 House sizes grouped according to four 200 m² bands.

300-500	500-700	800-1,000	1,000-2,000
300	540	800	1,200 (x2)
360	560	875	1,300
390	600	925	1,500
392	625	955	1,600 (x2)
400 (x2)			
455			
459			
460			
470			
480 (x2)			
12	**4**	**4**	**6**
420	**580**	**890**	**1,400**

Alternatively, I first ranked the houses according to surface bands of 200 m² from 0 to 1,000 m². The larger houses were grouped together in bands of 1,000-2,000 m² and > 2,000 m² respectively. As such, the majority of the houses could be situated in the 400-600 m² range (10); five houses ranged between 1,000 and 2,000 m²; four houses fell in the 200-400 m² and 800-1,000 m² bands respectively; and two houses occupied surfaces between 600 and 800 m²; the < 200 m² and > 2,000 m² bands each contained only one house (*Table* 12). However, as this classification did not seem to reflect well the original distribution of house sizes – no house was smaller than 300 m² in the 200-400 m² band, only two houses were larger than 500 m² in the 400-600 m² band, and no house was larger than 700 m² in the 600-800 m² group – I decided to regroup them according to more adapted categories. First, I rearranged categories 2 to 4 into two bands of 200 m² each, i.e. 300-500 and 500-700. I then excluded the 189 m² house from the calculations, as it had been quickly transformed into a 455 m² house, already classified under the 300-500 m² band. Next, as the > 2,000 m² band only consisted of the exceptionally large 'Domus dei Coiedii', I omitted this category as well and instead added its 1,500 m² living space to the 1,000-2,000 m²

band. The 800-1,000 m² group was kept the same. This resulted in a total of 12 houses in the first band (300-500), four houses in the second band, 3 houses in the third, and six houses in the fourth (*Table* 13).

The use of this classification as the basis for our demographic calculations has several advantages. First, it enables us to propose a model in which the lay-out of the residential area would be made-up of houses with differing sizes. For instance, ranked according to this classification, it follows that for each very large house of > 1,000 m², there would be two houses of 300-500 m² and approximately 0.7 house of 500-700 m² and 800-1,000 m² each. While admittedly based on a small amount of evidence and largely theoretical, it would at least provide us with a reconstruction akin to the situation encountered in other Roman towns. Second, it also allows us for deriving an average figure for each of the subgroups, rather than one overall average figure for all house sizes combined. In this case, the average figures would be 420 m², 580 m², 890 m² and 1,400 m² (*Table* 13). Third, said ranking also makes it possible to employ the combined occupation figures derived from both room numbers and surface area. For instance, we might set the minimum occupation of a 420 m² house at seven persons, while a number of 12 might be a reasonable maximum occupation. Likewise, the minimum figure for a 580 m² might be ten, while the maximum figure might be 15. The situation becomes somewhat more complicated for the two upper categories, as we have seen that substantially larger houses do not always imply substantially larger households. The derived densities of 12-23 persons for a 890 m² house – and of 15-38 persons for a 1,400 m² house – represent too wide ranges for useful calculations, but densities of 12-17 and 15-20 respectively might be considered reasonable alternatives. As such, this methodology was kept in order to calculate the number of inhabitants for the 40 Roman towns in the Early/High Imperial period.

3.5 Setting-up an urban demographic model

In order to illustrate the methodology, we might look at one of the better studied towns in the area, i.e. *Potentia*: the application of this calculation method would result in a mixture of approximately 68 houses of the first category (420 m²), 24 houses of both the second (500-700 m²) and the third (800-1,000 m²) category, and 34 houses of the upper category (1,400 m²), fitted-in over a residential area of ca. 11.1 ha. In demographic terms, such a reconstruction would point towards an estimated population between 1,514 and 2,264 persons; i.e. a density of 137-204 persons/ha for the residential area only, or 82-123 persons/ha for the total town area (18.4 ha) when we include the street grid and the public space (*Table* 14; *Appendix* II, Table 78). It might be useful here to draw attention to

a recent study by Peter De Graaf, who – on the basis of the work of the PVS – has stressed the resemblance of *Potentia's* lay-out with the architectural make-up of towns such as *Cosa* and *Pompeii*, in this way suggesting population densities ranging between 93-112 and 113-136 persons/ha; or a total population of ca; 1,674-2,016 or 2,034-2,448 persons (see *supra*).[521] As the two figures are comparable, the same methodology was subsequently used for estimating the Imperial populations of the 39 other towns in the study area. This resulted in a total estimated urban population between 82,725 and 123,800 people for the region in the first 250-year period of the Empire. The results are summarised in the table below (*Table* 14), but a more elaborate version of the calculations may be found in Appendix II, Table 78.

Table 14 Estimated town populations in the Early/High Imperial period; for a more elaborate version, see *Appendix* II, *Table* 78.

N°	Town	Population	Density (p/ha)	
			Residential	Total
1	*Pisaurum*	2,009-3,004	138-206	106-159
2	*Pitinum P.*	364-544	135-201-	73-109
3	*Urvinum*	677-1,012	138-207	85-127
4	*Tifernum*	888-1,328	135-201	74-111
5	*Fanum*	2,140-3,200	135-203	86-128
6	*Forum*	2,351-3516	136-203	94-141
7	*Pitinum M.*	808-1,208	139-208	90-134
8	*Suasa*	4,491-6,716	135-202	107-160
9	*Sena*	1,776-2,656	136-203	99-148
10	*Ostra*	3,758-5,688	121-183	96-146
11	*Aesis*	888-1,328	133-198	89-133
12	*Sentinum*	1,332-2,002	135-202	89-133
13	*Ancona*	968-1,448	131-196	83-125
14	*Auximum*	1,201-1,796	137-204	75-112
15	*Cingulum*	1,463-2,188	134-201	98-146
16	*Planina*	2,169-3,244	136-203	103-154
17	*Tuficum*	1,958-2,928	134-201	98-146
18	*Numana*	1,558-2,328	139-208	97-146

[521] De Graaf 2012, 42-44. De Graaf suggests a total number of either 1,920-2,304 or 2,332-2,799 people for *Potentia*, but these figures are based on a presumed walled area of ca. 20.6 ha, while the *intra muros* area was probably rather 18 ha (Vermeulen/Mlekuz 2012, 216, Table 20.2; see *supra*). In his calculations for the overall urban population of the Potenza valley, De Graaf applies a constant average density of 124 persons/ha for the four towns; i.e. a population of ca. 2,230 people for *Potentia*; 2,728 for *Ricina* (based on a size of 22 ha; but the settlement was probably rather 25 ha large; see *supra*), 1,364 for *Trea* (11 ha), and 1,860 for *Septempeda* (15 ha) (De Graaf 2012, 49).

19	*Potentia*	1,514-2,264	137-204	82-123
20	*Ricina*	2,482-3,712	134-201	99-148
21	*Trea*	968-1,448	136-204	88-132
22	*Septempeda*	1,463-2,188	133-199	98-146
23	*Matilica*	1,201-1,796	133-200	100-150
24	*Attidium*	888-1,328	133-198	89-133
25	*Cluana*	2,169-3,244	136-203	103-154
26	*Pausulae*	2,038-3,048	134-201	102-152
27	*Urbs Salvia*	4,389-6,564	134-201	105-156
28	*Tolentinum*	2,169-3,244	136-203	103-154
29	*Camerinum*	1,958-2,928	134-201	98-146
30	*Firmum*	1,907-2,852	135-202	103-153
31	*Falerio*	757-1,132	133-199	84-126
32	*Cupra Mar.*	1,645-2,460	135-202	99-147
33	*Asculum*	4,804-7,184	135-201	110-164
34	*Castrum T.*	2,613-3,908	135-201	105-156
35	*Castrum N.*	1,332-2,002	135-202	97-145
36	*Interamnia*	2,664-3,984	133-199	102-153
37	*Hatria*	8,225-12,300	135-202	118-176
38	*Cupra Mon.*	2,402-3,592	136-203	104-156
39	*Beregra*	2,169-3,244	136-203	103-154
40	*Novana*	2,169-3,244	136-203	103-154
Total		**82,725-123,800**	**134-201**	**100-149**

It is more difficult to gauge the size and lay-out of these civic centres in the Late Republican period, as our knowledge prior to their Early Imperial monumentalisation and development is fragmentary. Nevertheless, a careful reading of the archaeological evidence presented in the gazetteer might point us into the right direction (see the gazetteer for details and references):

- First, there are indications that many of the towns occupied an overall smaller surface area in the two centuries preceding the Augustan era. This evolution is most obvious in towns were a more restricted circuit wall preceded the Early Imperial one: *Sentinum*, *Ancona*, *Potentia* and *Firmum Picenum*. In other cases, the totality of the archaeological evidence suggests that a significant part of the urban area was unoccupied in Late Republican times (*Pisaurum*, *Fanum Fortunae*, *Sena Gallica*, *Urbs Salvia*, *Interamnia*). Indications for the border zones of these towns only becoming fully occupied in the Early Imperial period especially comes from *Pisaurum*, where the 1st century AD *domus* buildings in the southern sections of the settlement were often erected in previously unoccupied areas. The same goes for *Ancona*, where many houses in the south-eastern section were only erected in the Augustan period or later, in one case at the expense of

an earlier Late Republican artisanal quarter. Another development which suggests that large portions of the marginal zones within the walled urban area remained free from constructions prior to the Augustan period is the frequent insertion of a massive spectacle building like the amphitheatre in said areas. Assessing the exact size of their inhabited areas in the Late Republican period will always remain a bit of guesswork, but the available evidence suggests that these settlements were generally between 63 (*Fanum Fortunae*) and 75 % (*Interamnia*) smaller, or between 35 (*Firmum*) and 41% (*Ancona*). While the evidence for *Potentia* hints at a reduction of only 13% on the basis of the circuit wall, the surveys and excavations by the PVS strongly suggest that most of the colony's intramural sectors were only extensively occupied in the 2nd century BC and were intensely built-up in the course of the 1st century AD.[522]

- Second – simultaneously with the expansion of the inhabited area towards the more marginal zones of these settlements – a reduction of residential space and the expansion of public space may be noted in the central sectors of the towns. Indeed, it is clear that the monumentalisation of the central Adriatic towns from the Augustan period onwards goes hand in hand with a complete reorganisation of their urban lay-out. In four cases, we know that these developments led to the reconversion of centrally placed residential areas into public areas. For instance, at both *Ostra* and *Hatria*, the Imperial baths close to the *forum* complex were preceded by Late Republican/Augustan residential quarters. At *Urbs Salvia*, the Imperial temple near the *forum* was built in a previously residential zone, as attested by the remains of Late Republican houses under the sacral complex. Again, in a border zone of the amphitheatre at *Ancona*, remains of Late Republican houses were found in an area that subsequently became part of the central *forum* complex and its adjacent public buildings. A similar scenario may be proposed for *Trea*, where the installation of the monumental *forum* complex in the Imperial period completely altered the lay-out of the central section of the town. Finally, at *Septempeda*, the Early Imperial thermal building near the *forum* replaced a Late Republican artisanal unit. These developments suggest not only that the area occupied by public space in these towns was smaller in the Late Republican period, but also that a larger part of their central zones was used for private and artisanal purposes.
- Third, many towns show traces for the development of suburban quarters from the Augustan period onwards, often with signs of intensification in the course of the 1st century AD. The evidence is most conspicuous at *Pisaurum*, but

[522] *Pisaurum* (18%), *Fanum Fortunae* (63%), *Sena Gallica* (73%), *Sentinum* (67%), *Ancona* (41%), *Potentia* (13%), *Urbs Salvia* (65%), *Firmum Picenum* (35%), *Interamnia* (75%); see *Appendix* II, *Table* 77.

extramural expansions have also been noted at *Urvinum Mataurense*, *Sentinum*, *Auximum* and *Camerinum*. Based on the work of the PVS, it is likely that some form of extra-urban residential occupation also existed at *Potentia*, *Ricina* and *Trea* in the first two centuries of the Empire. Such developments are usually a sign for a lack of space within the original enclosed area, which would imply that they only began to develop after the space between the walls had been completely built-up, in this way creating a shortage of living space. Therefore, it seems unlikely that the whole walled area of these towns was densely built-up in the Late Republican period, or had already reached its maximum occupation.

Table 15 Estimated sizes of residential space in the 40 towns of central Adriatic Italy in the Late Republican period; for a more elaborate version, see *Appendix* II, *Table* 79) (*for *Senigallia*, I used the 40% reduction instead of the 73% calculated in the text because of the uncertainty of the latter number; the same was done for *Potentia* and *Pisaurum* because of their low calculated figures of 13 and 18% respectively).

N°	**1***	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9***	**10**	**11**	**12**	**13**	**14**	**15**
ha	9.4	1.8	3.3	4.3	6.7	12	3.8	2.1	8.2	19.1	4.3	4	6	5.9	6.9
N°	**16**	**17**	**18**	**19***	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
ha	10	9.4	7.4	7.5	12	5.1	6.9	5.7	4.3	10	9.4	11.9	10	9.4	9.4
N°	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**			**Total**		
Ha	4.1	7.7	23	12	6.3	4.6	37	11	10	10			**351.9**		

To summarise, the evidence seems to suggest that most towns were smaller in the Late Republican period – or at least had a more restricted occupation inside the walled area – and that the overall space reserved for public architecture was of a more limited nature. It is impossible to know precisely how much smaller these settlements originally were, but a reduction of 30-40 % or even 60-70 % with respect to their Imperial phases might not have been unusual. Therefore, for the towns for which no information was available, I used a guestimated 40% reduction figure in order to put forward a number for their size in the Late Republican period (*Appendix* II, *Table* 79). Estimating the exact size of public space in these early phases is equally problematic. We know that the early foundations of the 3rd and the 2nd century – like *Potentia*, *Pisaurum* and *Auximum* – were provided with public areas from the start, mostly restricted to a circuit wall and a central *forum* square with temple (see *supra*, gazetteer). Public structures were also present at the federate town of *Ancona* in the 3rd-2nd century BC and at the colony of *Pollentia-Urbs Salvia* from the end of the 2nd century BC onwards. It is also clear that many *praefecturae* or road stations did not wait for their municipalisation in order to develop certain public structures, as is illustrated well by the cases of *Suasa*, *Ostra*, *Sentinum* and *Septempeda*. Putting an exact figure on the amount of space that was occupied by public architecture in these towns is

off course impossible, but a good starting point might be the average area occupied by a central square with its temple and porticoed shops. For the few towns for which we know the size of this complex in the Imperial period, the occupied area was about 7,500-8,400 m². The derived average calculated earlier was ca. 7,750 m² (*Appendix* II, *Table* 77). Therefore, for the former cases I used their respective dimensions as the size for the public area; for the latter I used an informed estimated figure of 7,800 m² (*Appendix* II, *Table* 79). The proportions of the street grid were kept the same. The derived estimated areas available for private space in the Late Republican period are summarised in the table above (*Table* 15), but a more elaborate version may be found in Appendix II, Table 79.

It is also more difficult to reconstruct the residential make-up of these towns for the Late Republican period. While some of the oldest colonies must have been provided with *domus*-like buildings from the 3rd-2nd century BC onwards – a phenomenon well attested at *Sena Gallica* – they were probably not a part of most settlement's residential areas before the mid-2nd century BC. Be that as it may, no information is available on the size and nature of said housing structures, leaving us with only *domus* buildings to provide useful information for filling-up the Late Republican residential areas of the central Adriatic towns. The question is then whether the mixture of houses reconstructed for the Early/High Imperial period also applies to the Late Republican period. To this regard, some useful observations may be made. As we have seen earlier in this chapter, houses sizes in the area could be grouped into four bands of 200 m²: 300-500, 500-700, 800-1,000, and 1,000-2,000 (see *supra*). The larger houses of the 800-1,000 and the 1,000-2,000 groups, however, all seem to date to the Imperial period, or at least do not appear before the mid-1st century BC. Indeed, there is currently no indication for the existence of such large houses in the Republican period, with the latter only appearing from the Augustan period onwards, often enlarging or incorporating pre-existing smaller houses. This evolution implies that mostly smaller houses characterised the lay-out of the residential areas in Late Republican times.

We can then reconstruct the mixture of houses for this period in two ways: a first method would only take into account the 300-500 and 500-700 categories, as such arriving at a ratio of 1:3, i.e. for every 3 houses of 420 m² there would have been one house of 580 m²; a second method would incorporate the 189 m² Republican house noted at *Suasa* (see *supra*), meaning that there would have been 11 houses of 420 m² and 4 houses of 580 m² for each house of 190 m² (3-5 people). In the aforementioned case of *Potentia* – which had an estimated residential republican area of 74,850 m² (7.5 ha) – this would have resulted in a mixture of either 41 houses of 580 m² and 123 houses of 420 m² - equalling a population between 1,271 and 2,091 people- or 10 houses of 190 m², 40 houses of 580 m² and 110 houses of 420 m², resulting in a population of 1,200-1,970 people. With respect to the total urban area of *Potentia* in the Early/High Imperial period (18.4 ha), these figures would translate into densities of 69-113 or 65-105 p/ha. The same methodology was

subsequently used for estimating the Late Republican populations of the 39 other towns in the study area. This resulted in a total estimated urban population between 61,117-61,710 and 101,302-102,357 people. The results are summarised in the table below (*Table* 16), but a more elaborate version of the calculations may be found in Appendix II, Table 79.

Table 16 Estimated urban population sizes for the Late Republican period; for a more elaborate version, see *Appendix* II, *Table* 79. The densities per hectare refer to the total urban area as calculated for the Early/High Imperial period; when taking into account only the estimated Late Republican areas, these densities would of course be higher.

N°	Town	Population 1	Population 2	Density (p/ha)	
				1	2
1	*Pisaurum*	1,581-2,601	1,560-2,561	**84-138**	**83-136**
2	*Pitinum P.*	310-510	240-394	**62-102**	**48-79**
3	*Urvinum*	558-918	600-985	**70-115**	**75-123**
4	*Tifernum*	713-1,173	720-1,182	**59-98**	**60-99**
5	*Fanum*	1,116-1,836	1,080-1,773	**45-74**	**43-71**
6	*Forum*	2,015-3,315	2,040-3,349	**81-132**	**82-134**
7	*Pitinum M.*	651-1,071	600-985	**72-119**	**67-109**
8	*Suasa*	3,472-5,712	3,480-5,713	**83-136**	**83-136**
9	*Sena*	1,364-2,244	1,320-2,167	**76-125**	**73-120**
10	*Ostra*	3,224-5,304	3,240-5,319	**83-136**	**83-136**
11	*Aesis*	713-1,173	720-1,182	**71-117**	**72-118**
12	*Sentinum*	651-1,071	600-985	**43-71**	**40-66**
13	*Ancona*	992-1,632	960-1,576	**86-141**	**83-136**
14	*Auximum*	992-1,632	960-1,576	**62-102**	**60-99**
15	*Cingulum*	1,147-1,887	1,200-1,970	**76-126**	**80-131**
16	*Planina*	1,674-2,754	1,638-2,688	**80-131**	**78-128**
17	*Tuficum*	1,581-2,601	1,560-2,561	**79-130**	**78-128**
18	*Numana*	1,240-2,040	1,200-1,970	**77-128**	**75-123**
19	*Potentia*	1,271-2,091	1,200-1,970	**69-113**	**65-107**
20	*Ricina*	2,015-3,315	2,040-3,349	**81-133**	**82-134**
21	*Trea*	868-1,428	840-1,379	**79-130**	**76-125**
22	*Septempeda*	1,147-1,887	1,200-1,970	**76-126**	**80-131**
23	*Matilica*	961-1,581	960-1,576	**80-132**	**80-131**
24	*Attidium*	713-1,173	720-1,182	**71-117**	**72-118**
25	*Cluana*	1,674-2,754	1,638-2,688	**80-131**	**78-128**
26	*Pausulae*	1,581-2,601	1,560-2,561	**79-130**	**78-128**
27	*Urbs Salvia*	2,015-3,315	2,040-3,349	**48-79**	**49-80**
28	*Tolentinum*	1,674-2,754	1,638-2,688	**80-131**	**78-128**
29	*Camerinum*	1,581-2,601	1,560-2,561	**79-130**	**78-128**

30	*Firmum*	1,581-2,601	1,560-2,561	**85-139**	**84-138**
31	*Falerio*	682-1,122	720-1,182	**76-125**	**80-131**
32	*Cupra Mar.*	1,302-2,142	1,320-2,167	**78-128**	**79-130**
33	*Asculum*	3,875-6,375	3,840-6,304	**89-146**	**88-144**
34	*Castrum T.*	2,015-3,315	2,040-3,349	**81-132**	**82-134**
35	*Castrum N.*	1,054-1,734	1,080-1,773	**76-126**	**78-128**
36	*Interamnia*	775-1,275	720-1,182	**30-49**	**28-45**
37	*Hatria*	6,231-10,251	6,240-10,244	**89-146**	**89-146**
38	*Cupra Mon.*	1,860-3,060	1,800-2,955	**81-133**	**78-128**
39	*Beregra*	1,674-2,754	1,638-2,688	**80-131**	**78-128**
40	*Novana*	1,674-2,754	1,638-2,688	**80-131**	**78-128**
Total		**61,117-102,357**	**61,710-101,302**	**74-123**	**74-122**

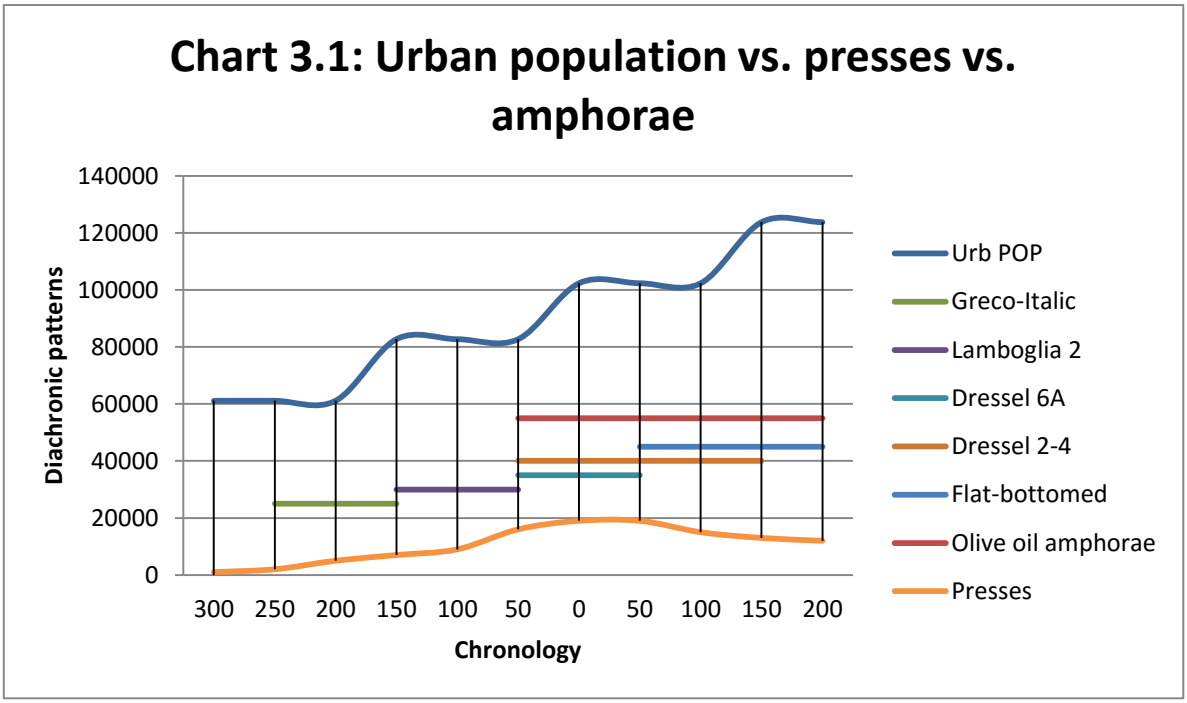
Table 17 Comparison between Late Republican and Early/High Imperial population levels.

Period	Urban area (ha)	Urban population	Density (p/ha)
Late Republican	469.1	61,117-102,357	74-123
Early/High Imperial	829.7	82,725-123,800	100-149

As Table 17 illustrates well, a comparison between the two population models suggests that for a large part of the Late Republican period the urban population was considerably lower than in the Early/High Imperial period (*Table* 17). The fact that these figures partially overlap is the result of the methodology applied – i.e. working with a range of household sizes – and of the assumption that the residential areas of the Late Republican period were characterised by smaller houses than those of the Early/High Imperial period, implying that the former were somewhat more densely occupied than the latter. Still, considering the totality of the evidence discussed in this chapter, I do believe that these estimates can offer a good starting point for exploring the implications of both lower and higher urban population levels in the central Adriatic area.

For all the reasons cited above, we might hereby assume that the lower estimates – i.e. populations of 61,117-82,725 – are more indicative for the Late Republican period, while the higher estimates (102,357-123,800) could be more indicative for the Early/High Imperial period. This is also how the evolution of the urban population is visualised in the chart below (*Chart* 3.1). This evolution is all the more interesting when compared to the patterns constructed for the amphora- and press evidence in the previous two chapters. With the number of presses steadily increasing alongside the number of urban residents, there seems to be a clear link between a rise in commercial production facilities and a rise in local urban demand. Even if some presses disappear after the mid-1st century AD, they remain quantitatively important enough for suggesting a continuous link with the presence of a prosperous urban population until the end of the 2nd century AD. The same level of concurrency, however, is not apparent from the comparison with the amphora

curve. Indeed, the lower population values coincide with the period of maximum wine exports in Greco-Italics and Lamboglia 2; the higher population values appear when these exports began to decrease (Dressel 6A), or were reoriented towards more inland local markets (Dressel 2-4, flat-bottomed amphorae). Incidentally, these higher values also coincide with a period of notable olive oil production and export (*Chart* 3.1).



3.6 Conclusion

In this chapter, I have reviewed all the available archaeological evidence with regard to the extent and the lay-out of the 40 Roman towns in the study area. The main purpose was hereby to construct a reliable framework that could serve as a basis for setting-up an urban demographic model for the central Adriatic area of Italy in Late Republican and Early/High Imperial times. The model derived as such has yielded four main results:

- First, most of the 40 located Roman towns should be counted as small- (7-11 ha) and medium-sized (15-30 ha); only a few centres are larger (40-45), with one centre (*Hatria*) possibly being much larger (70 ha).
- Second, there is a good case for arguing that the urban population of central Adriatic Italy was considerably lower in the Late Republican period than in the Early/High Imperial period. Given the nature of the archaeological record, I hereby believe that figures of ca. 60,000-80,000 (74-100 persons/ha) and

100,000-120,000 (123-149 persons/ha) are good working ranges for the former and latter period respectively.

- Third, I note that the period coinciding with the highest population figures is also the period with the lowest amphora circulation. It is also the period with the only olive oil circulation in amphorae. This contrasting pattern between people and clay containers suggests once again that there might be a relationship between changes in the wine and oil sector and local demographic developments.
- And fourth, the transition from the lower population figures to the higher figures between ca. 300 BC and AD 200 goes hand in hand with a gradual rise in wine and oil presses.

In order to further investigate these issues, I will now look at consumption patterns and land requirements in the following chapters.

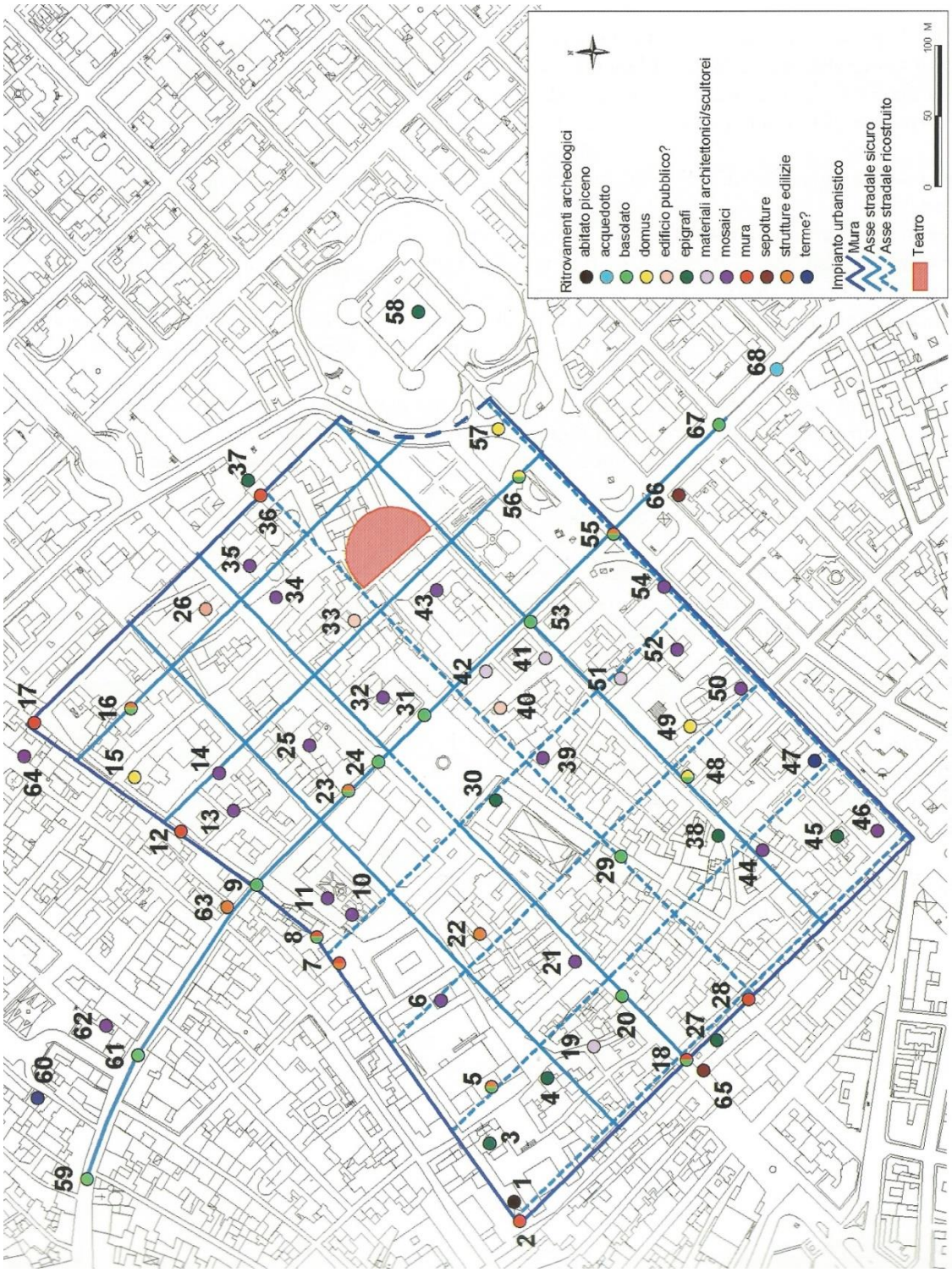


Figure 130 Map of Roman *Pisaurum* with indication of the archaeological findspots. House structures are indicated in yellow; paved street sections in green, public buildings in pink, mosaic finds in purple, wall sections belonging to the circuit wall in red, burials in brown, unidentified building structures in dark yellow, and a possible thermal building in dark blue. The most important numbers mentioned in the text are the domus complexes of Piazza Matteotti (56), Palazzo della Provincia (49), Via Diaz (48), Via Mazzolari (15), and Via dell'Abbondanza (16); the forum area is situated near n° 30 and 31; the hypothetical theatre is indicated in red (After Dall'Aglio/Di Cocco 2004, 173, Tavola I).

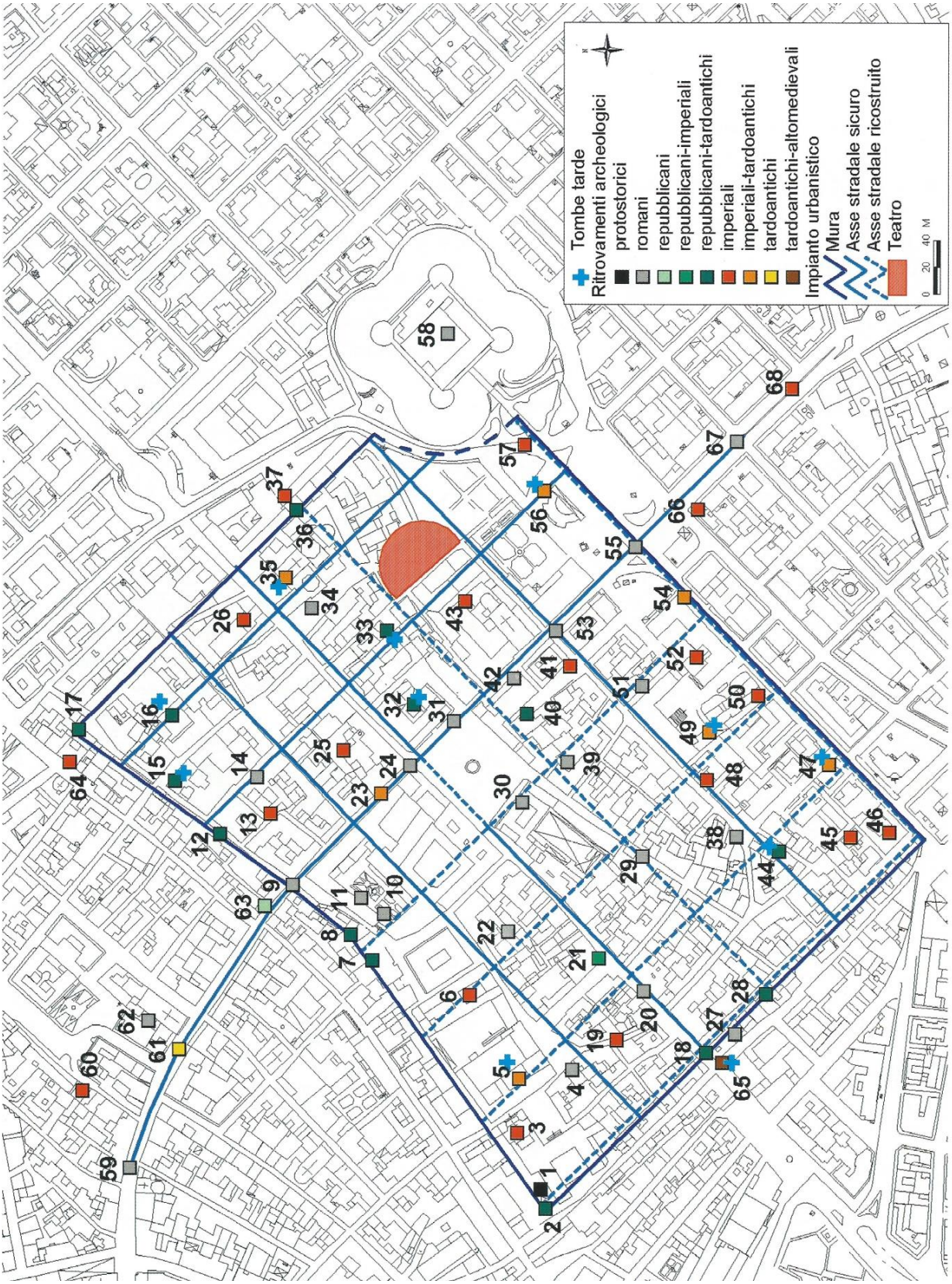


Figure 131 Map of Roman *Pisaurum* with indication of the archaeological findspots per time period: Roman (grey), republican (light green), republican/imperial (green), republican/late antique (dark green), imperial (red), imperial/late antique (dark yellow), late antique (yellow) and late antique/medieval (brown); the hypothetical theatre is indicated in red (After Dall'Aglio/Di Cocco 2004, 174, Tavola II).

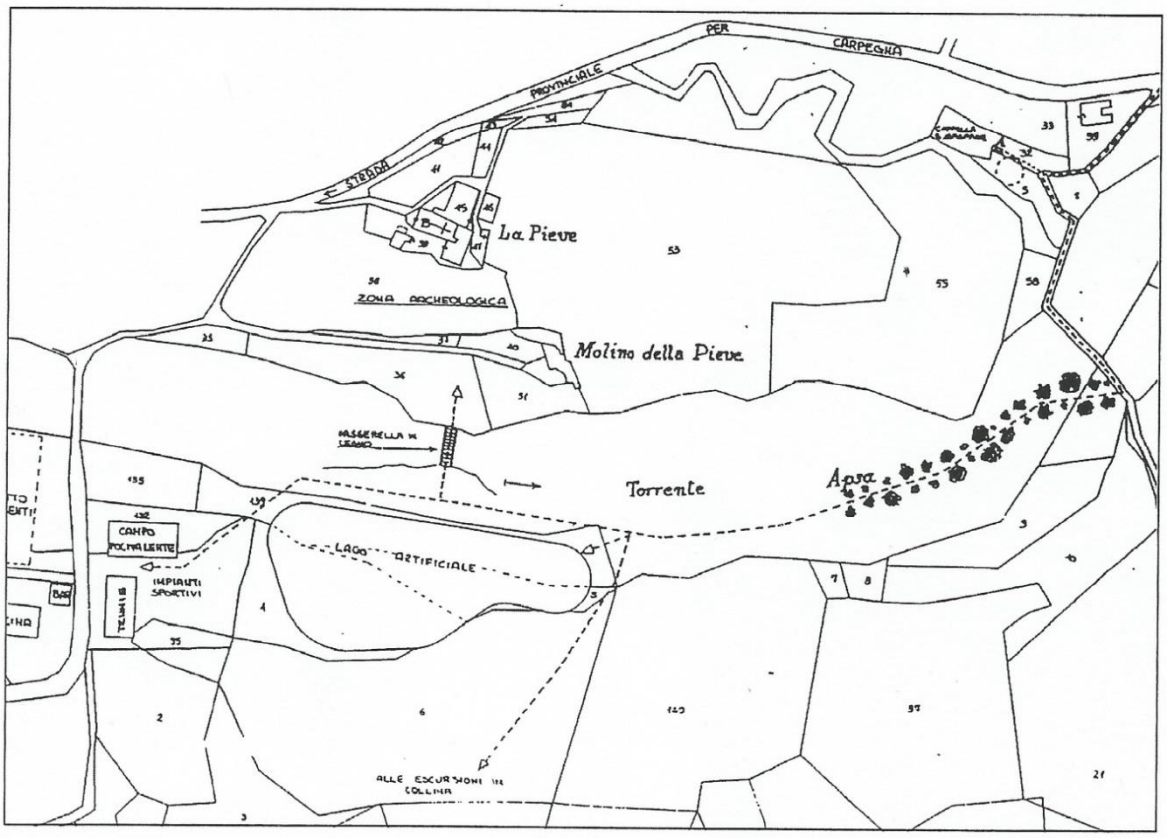


Figure 132 Archaeological area near the Pieve di San Cassiano (Pitinum Pisaurense (After Monacchi 1999, 87, Fig. 6).

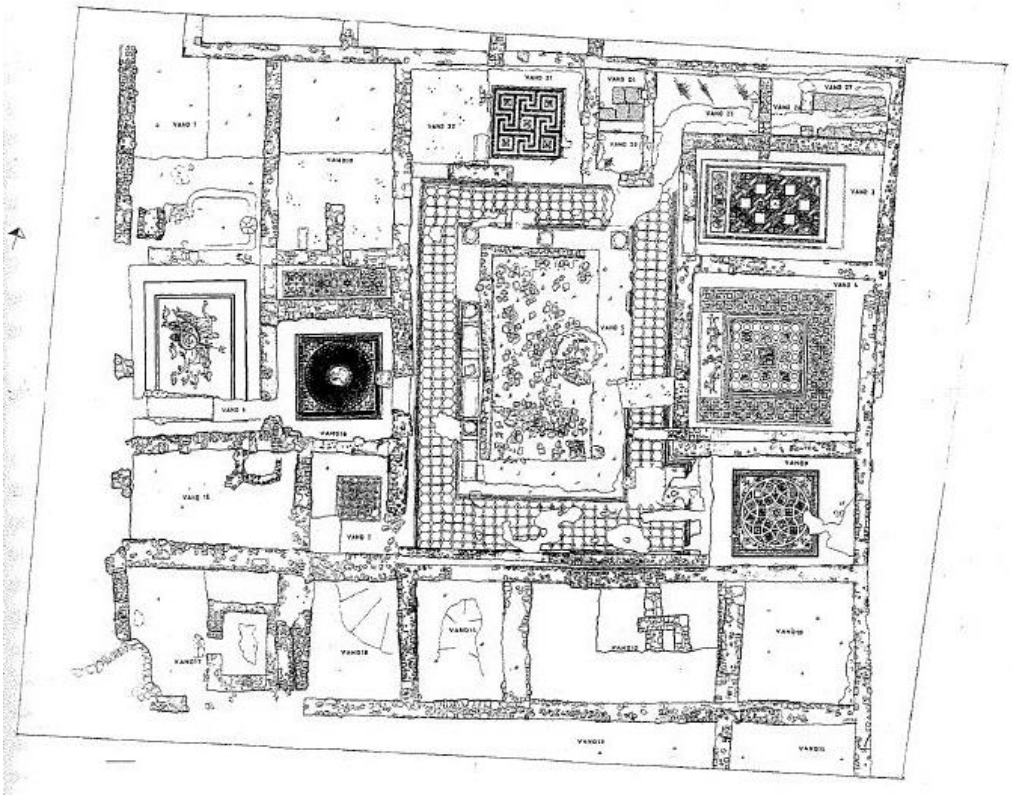


Figure 133 Plan of the Imperial domus at Tifernum Mataurense (After Tornatore 2014, 883, Fig. 2).

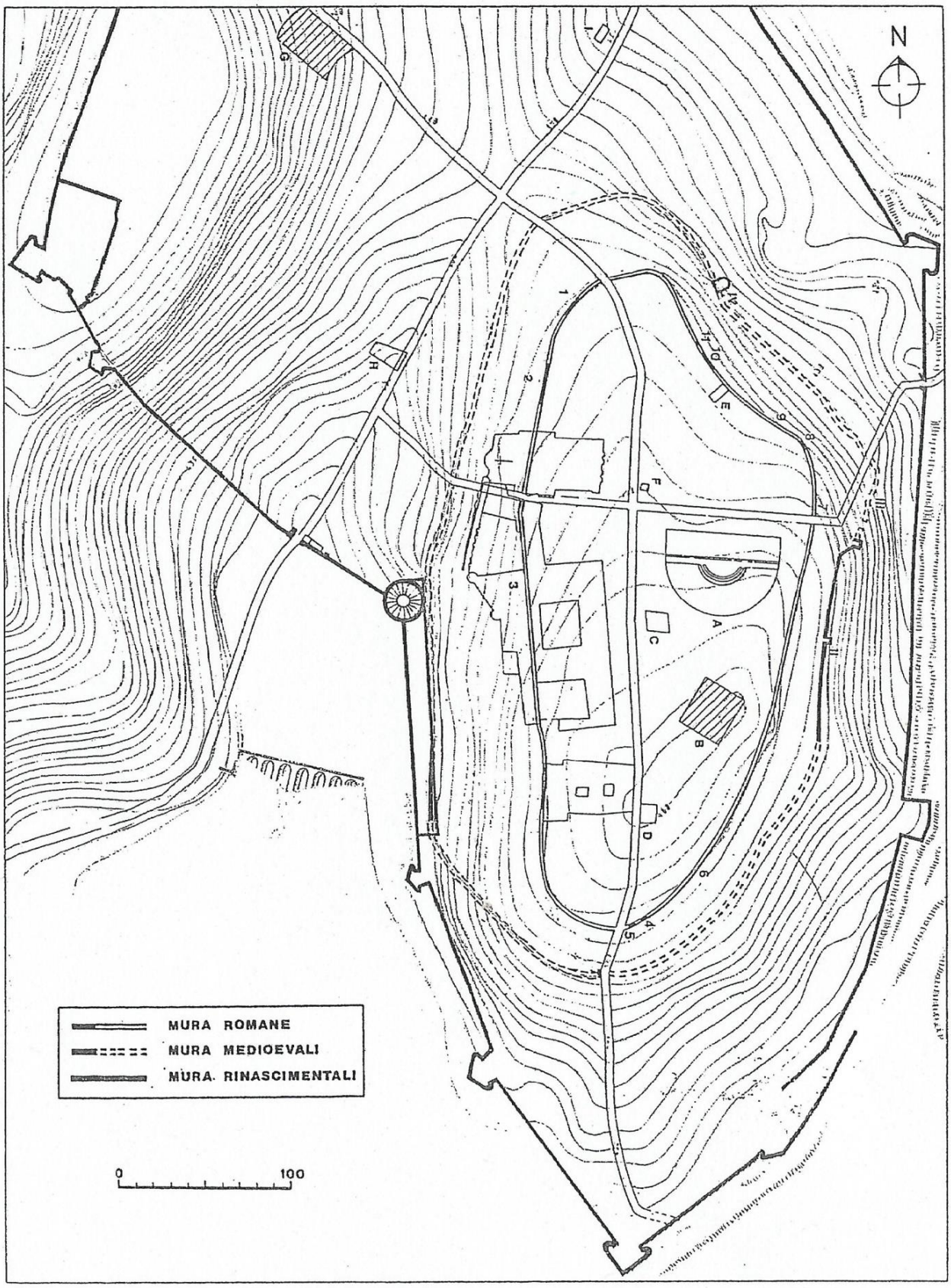


Figure 134 Map of Urvinum Mataurense with indication of the Republican town wall, the theatre (A), the two cisterns (B and G), the public baths (C), the remains of buildings with mosaic pavements (D, F, H) and a likely nymphaeum (I) (After Luni 1993, 49, Fig. 2).

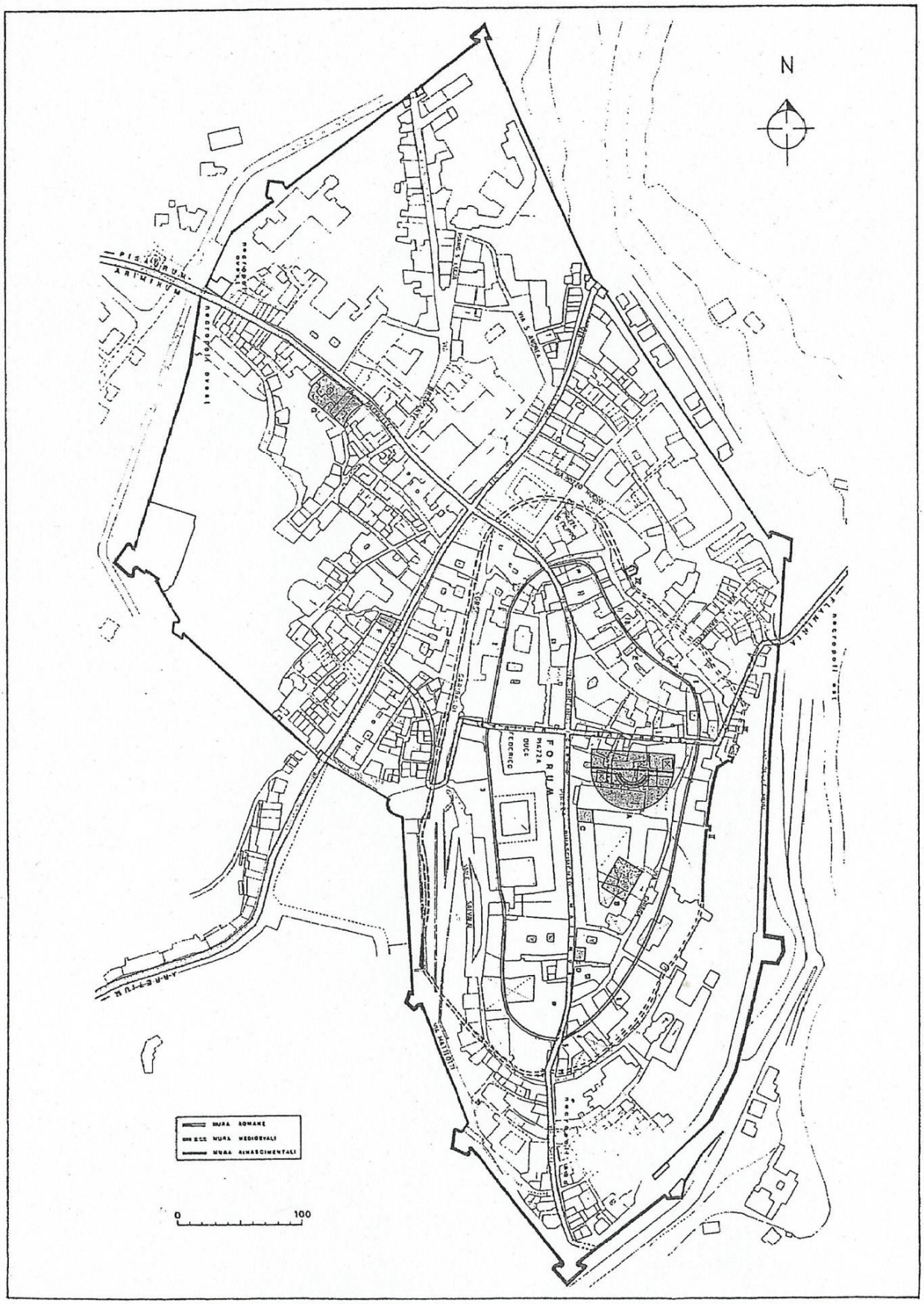


Figure 135 Map of *Urvinum Mataurense* with the indication of the expansion of the town area in northern direction (After Luni 1993, 51, fig. 4).

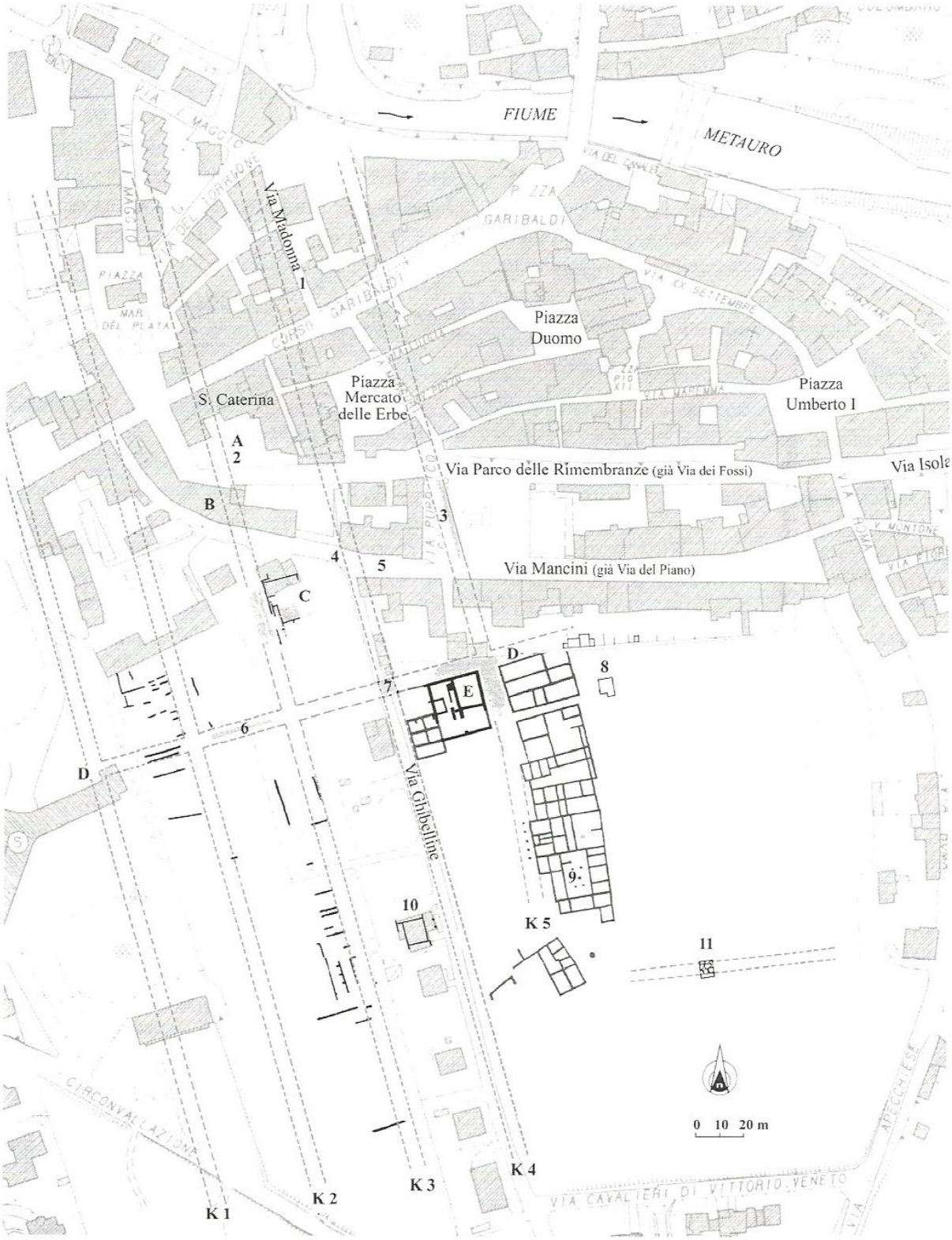


Figure 136 Map of *Tifernum Mataurense* with indication of the features visible through either aerial photography or excavation: the *forum* (A), the temple of Silvanus (B), the baths (C), the *decumanus* (D), the excavations by the Soprintendenza Archeologica delle Marche in 1999 (E), the *domus* excavated by said Soprintendenza in 2000 (9), and the structures under Casa Lani in the Via Ghibelline in 1961 (10) (After Catani 2004, 98, fig. 1).

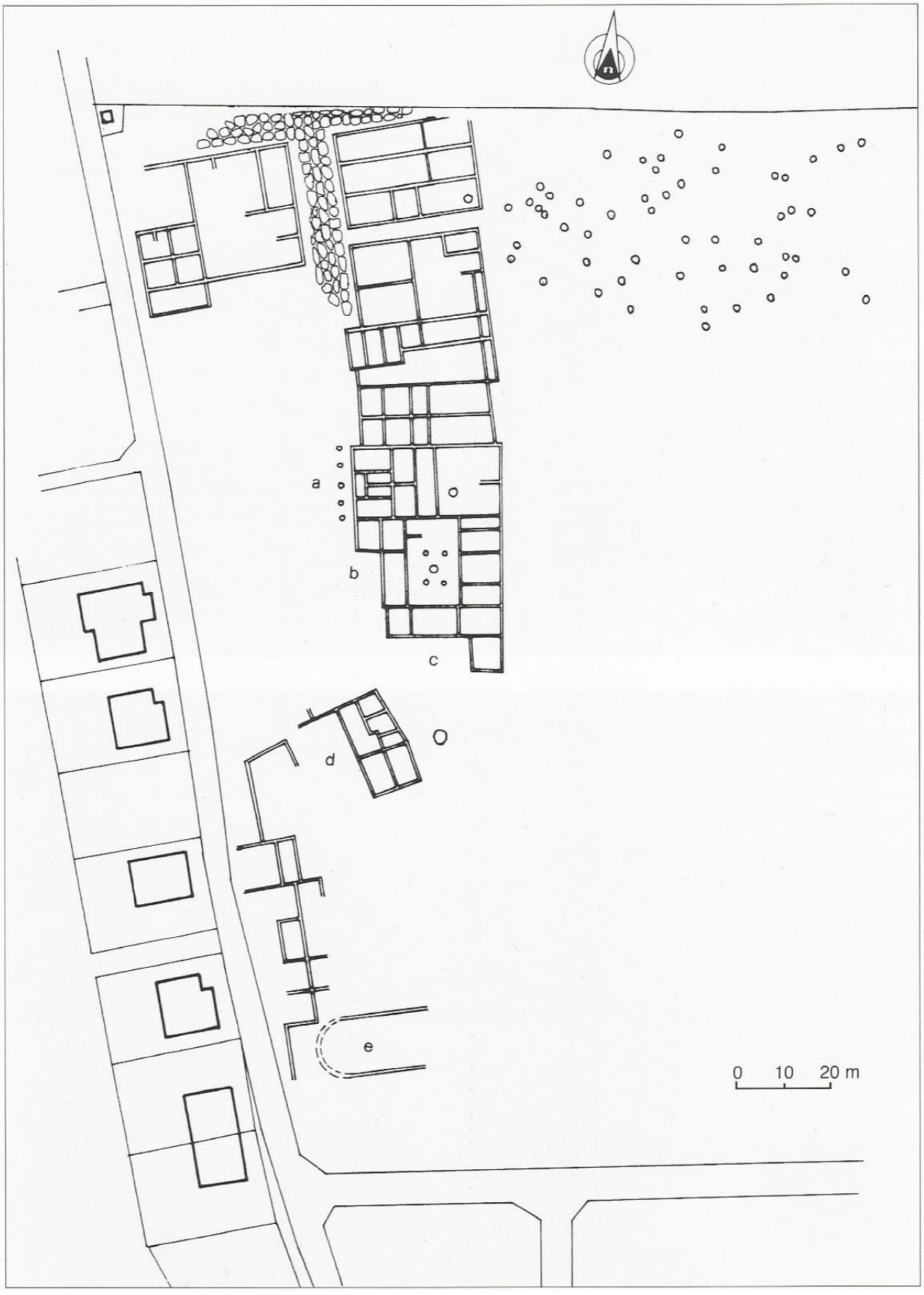


Figure 137 Reconstruction of the eastern quarter of *Tifernum Mataurense*, with indication of the large domus excavated since 2003 (a, b, c) (After Monacchi 2010c, 245, fig. 63).

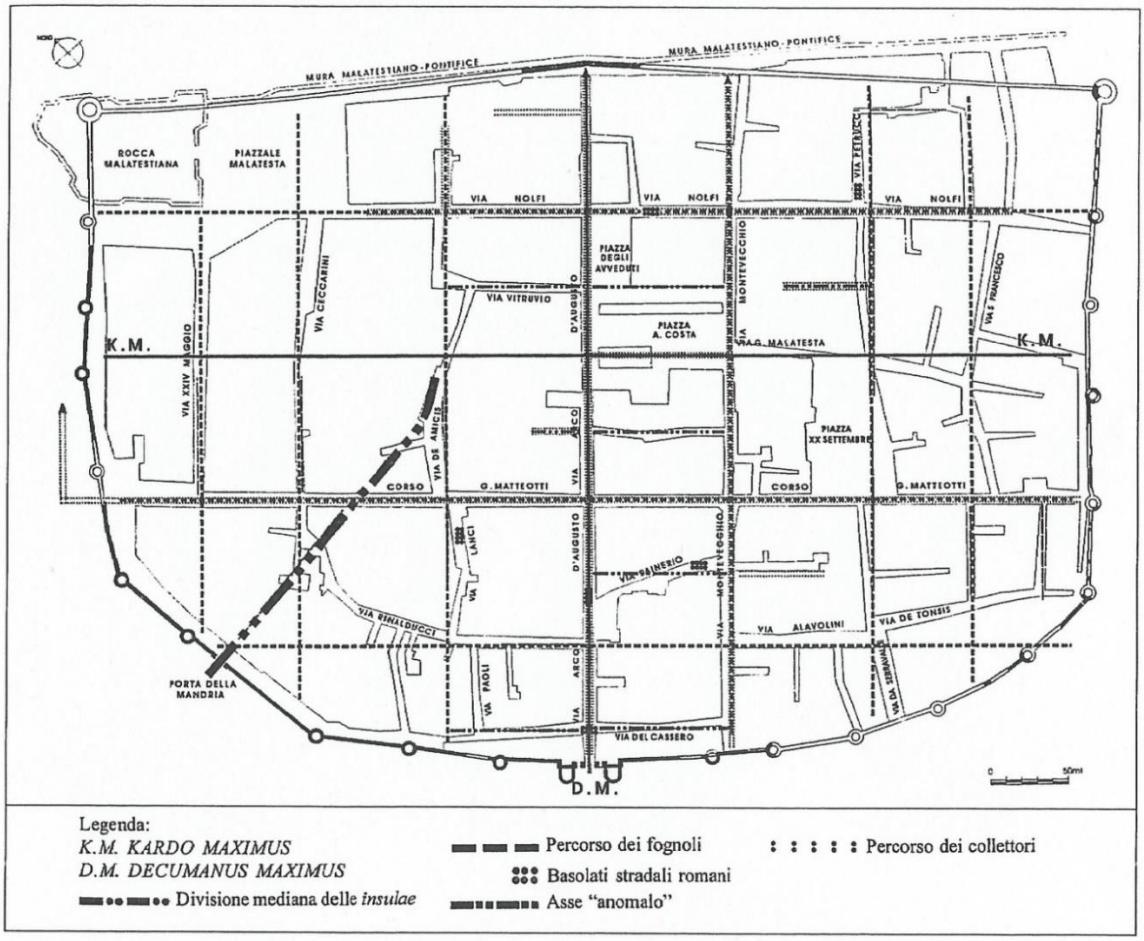


Figure 138 Map of *Fanum Fortunae* (After Magnini 2008, 71, fig. 2).

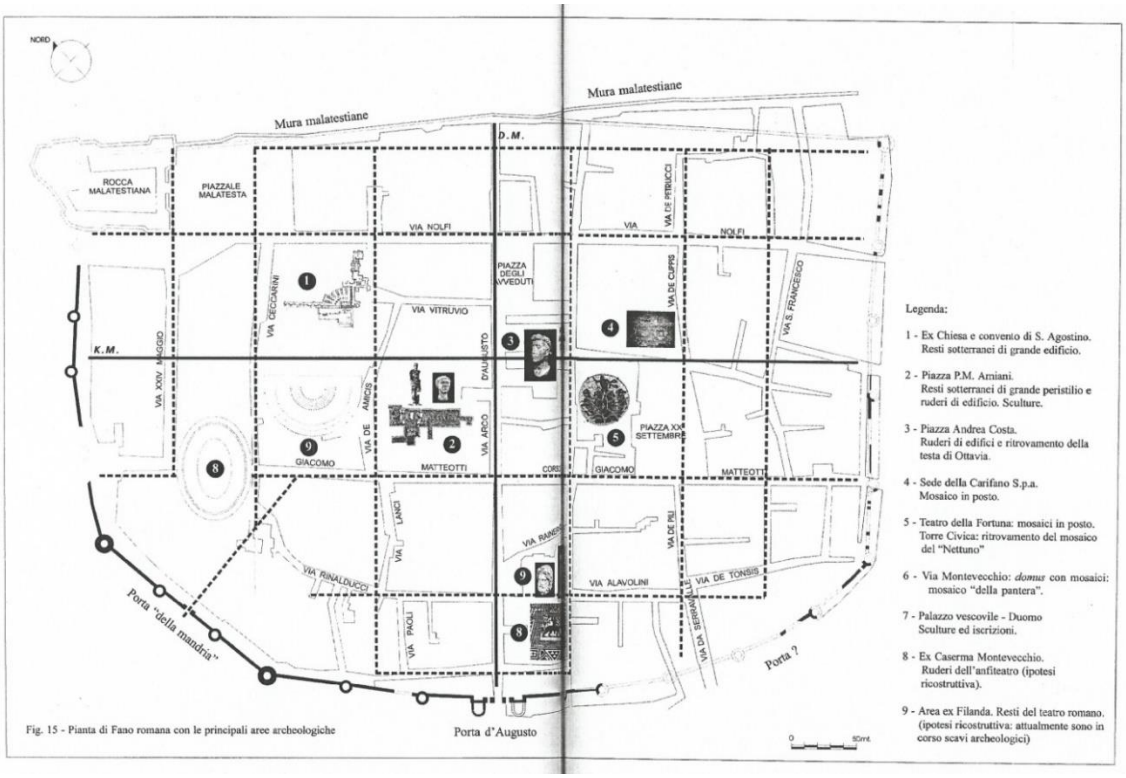


Fig. 15 - Pianta di Fano romana con le principali aree archeologiche

Figure 139 Plan of *Fanum Fortunae* (After De Sanctis 2004b, 40-41, fig. 15).



Figure 140 Partial plan of *Fanum Fortunae* (After Purcaro 2003, 41, fig. 2).

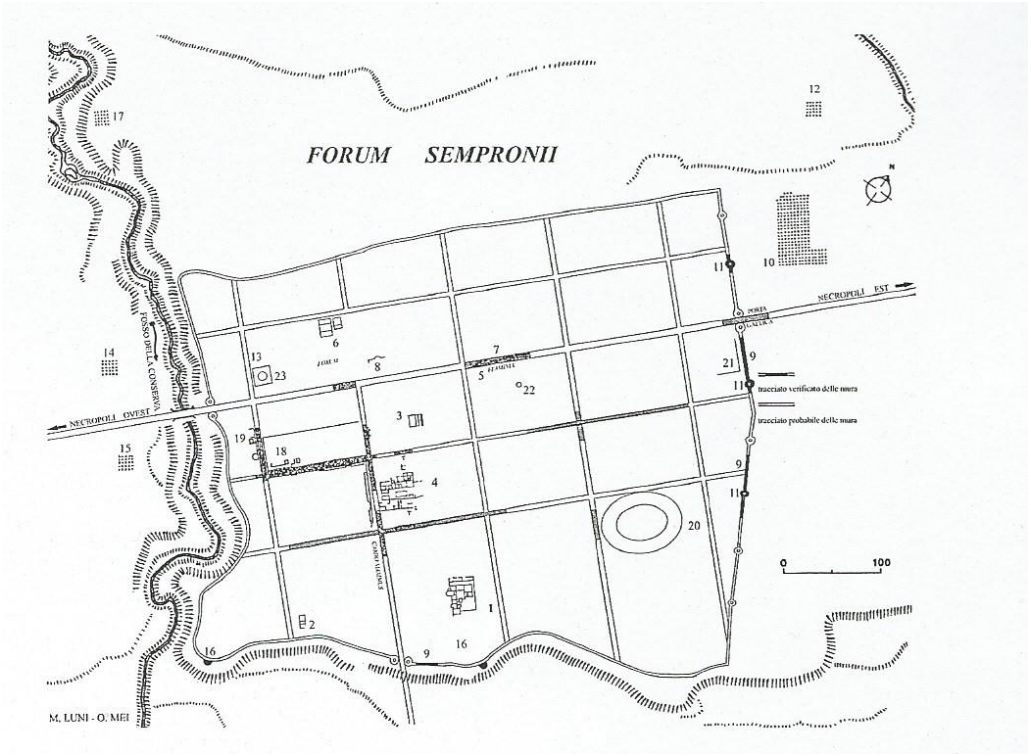


Figure 141 Map of *Forum Sempronii* with indication of the baths (1), the Domus di Europa (4), the temples that flanked the *forum* (6), the *Augusteum* (9), extra-mural cemeteries (10), a suburban villa (12), extra-mural buildings (14-15), the Domus degli animali esotici (19), the amphitheatre (20), and the probable *macellum* (23) (After Luni 2012b, 43, fig. 16).

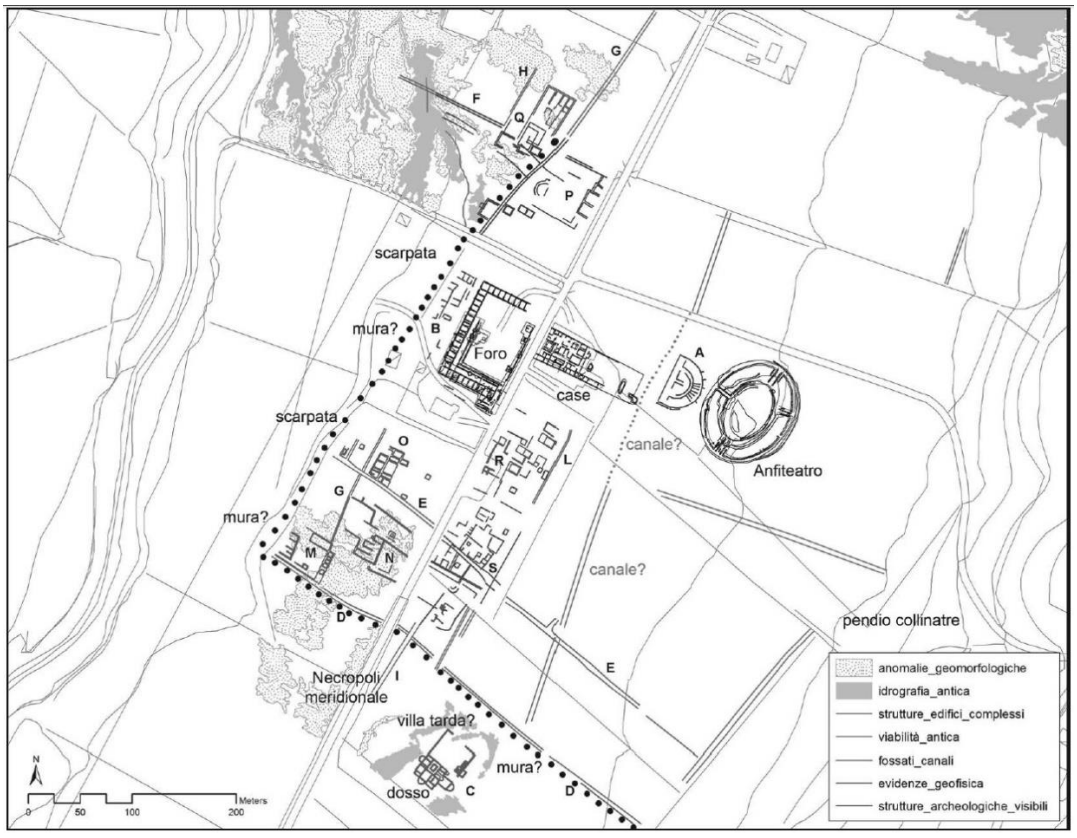


Figure 142 Overall town map of *Suasa* (After Giorgi 2012, 356, fig. 10).

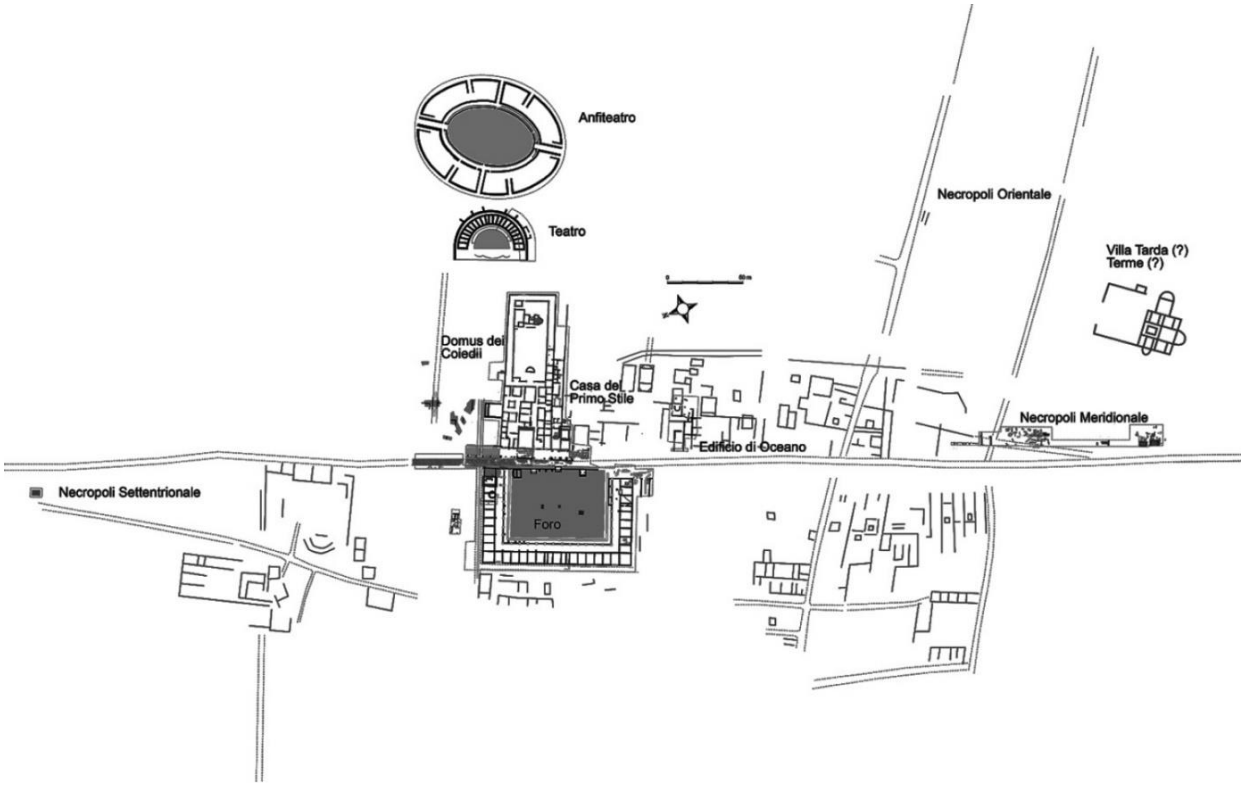


Figure 143 Town map of *Suasa* (After De Maria/Giorgi 2013, 80, fig. 1).

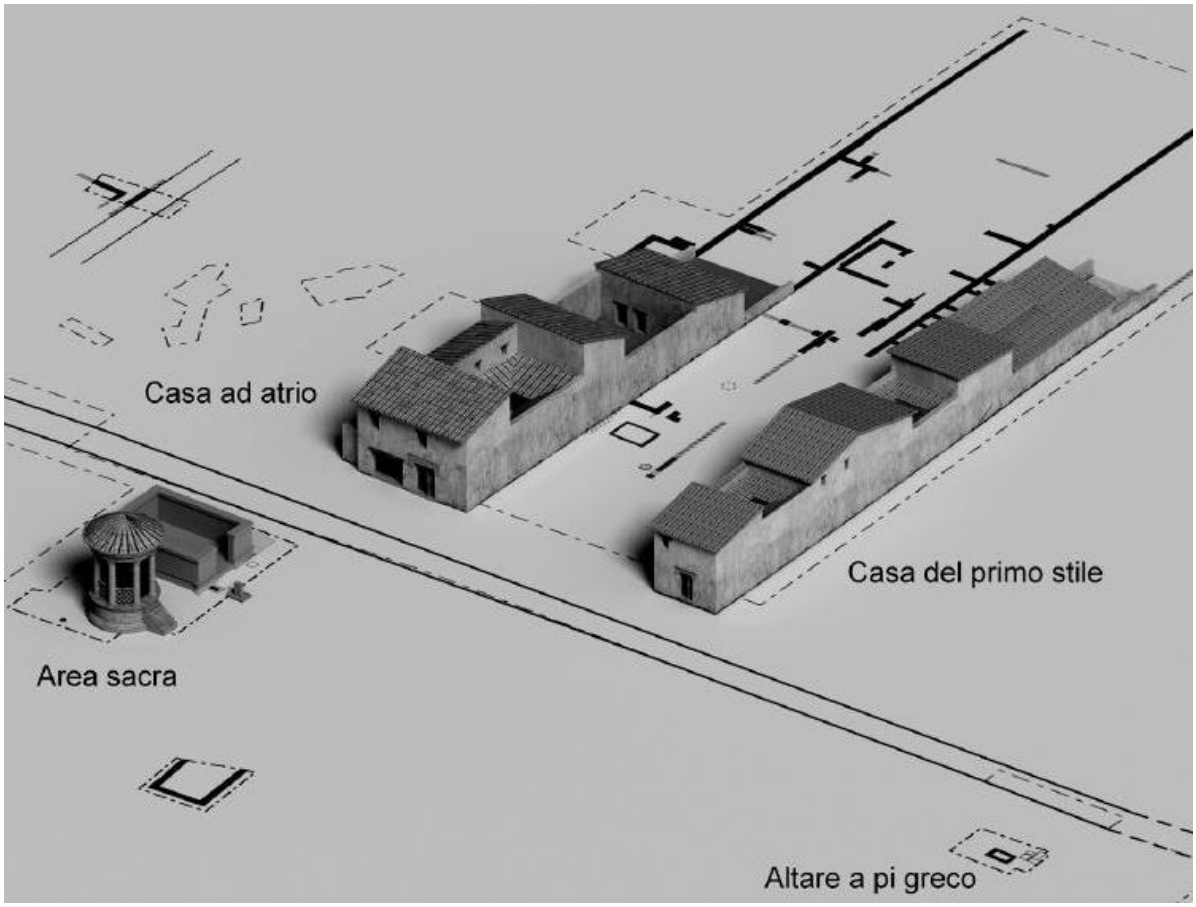


Figure 144 Partial reconstruction of Late Republican *Suasa* (After De Maria/Giorgi 2013, 82, fig. 3.15).

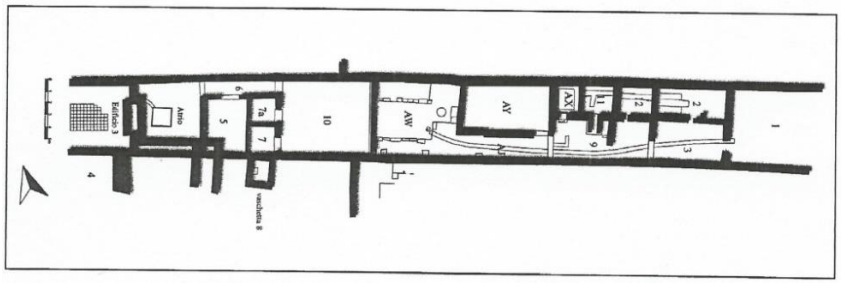


Figure 145 Plan of the Domus del Primo Stile at Suasa (After De Maria 2009, 174, fig. 12).

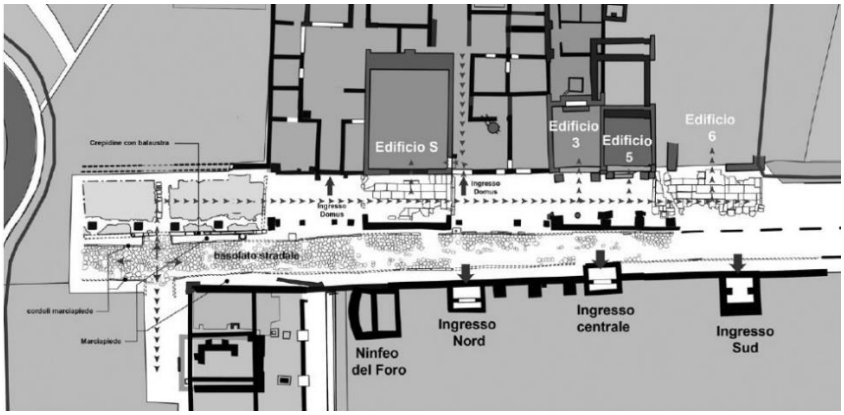


Figure 146 Map of the area to the south of the *forum*, occupied by the Via del Foro and adjacent buildings (After De Maria/Giorgi 2013, 99, fig. 12).

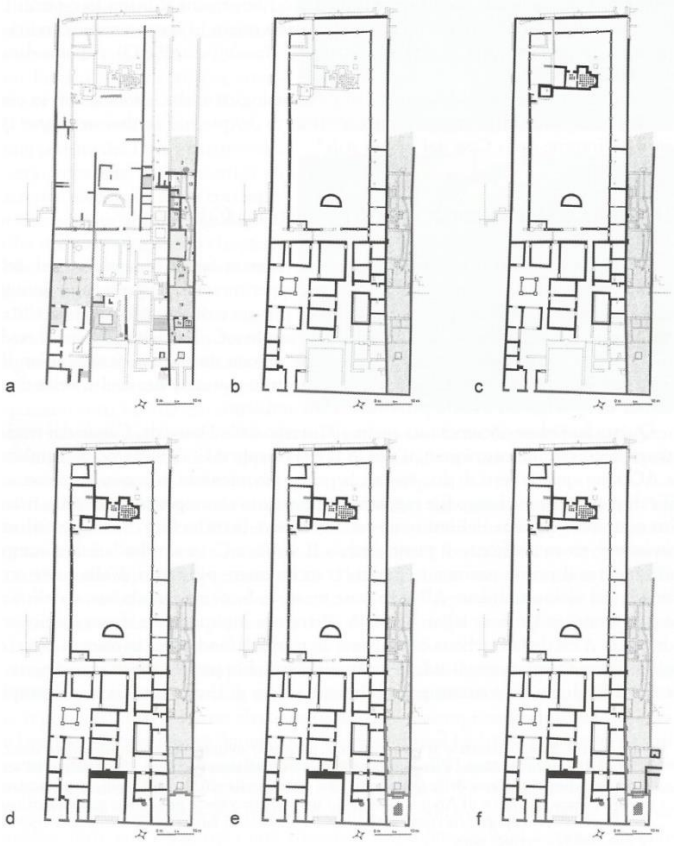


Figure 147 Different phases of the Domus dei Coiedii at Suasa: I c. BC – I c. AD (a), beginning II c. AD (b), second half II c. AD (c), first half III c. AD (d), second half III c. AD (e), IV c. AD (f) (After Campagnoli 2010, 321, fig. 2).

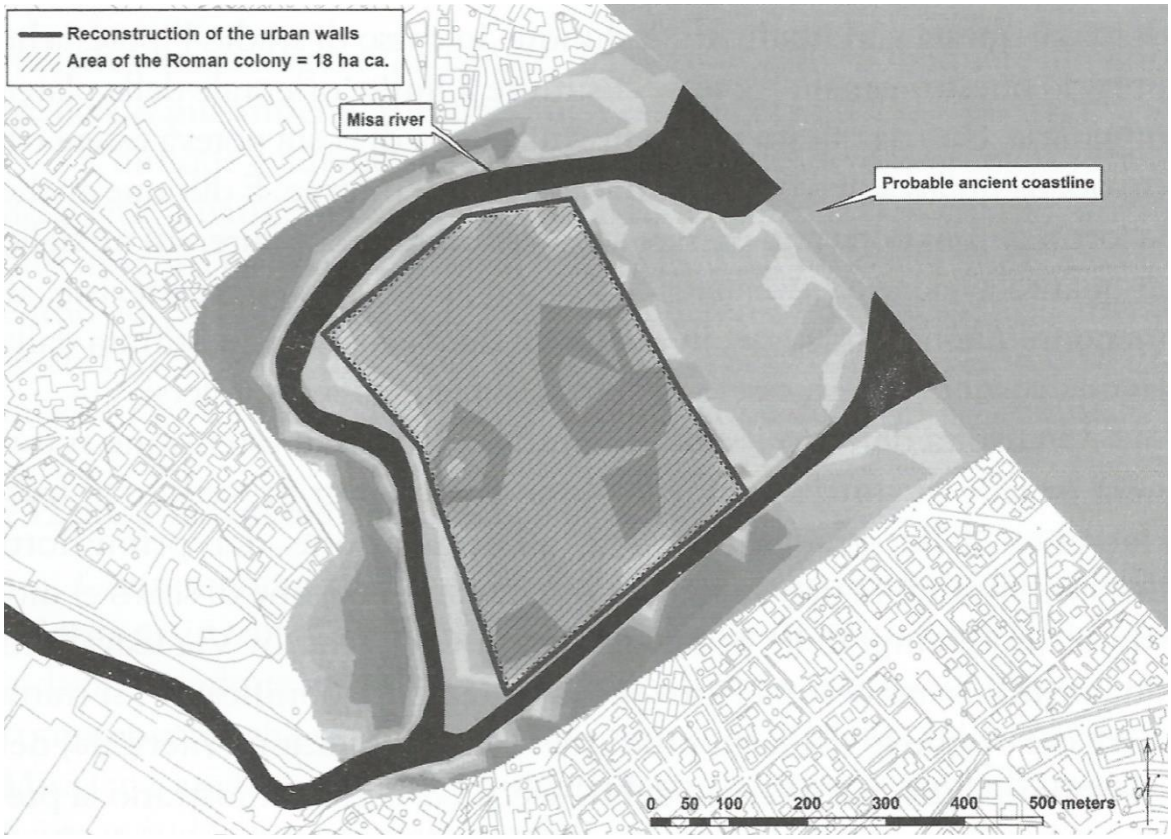


Figure 148 Reconstruction of the circuit wall of *Sena Gallica* (After Lepore 2013, 307, fig. 6).

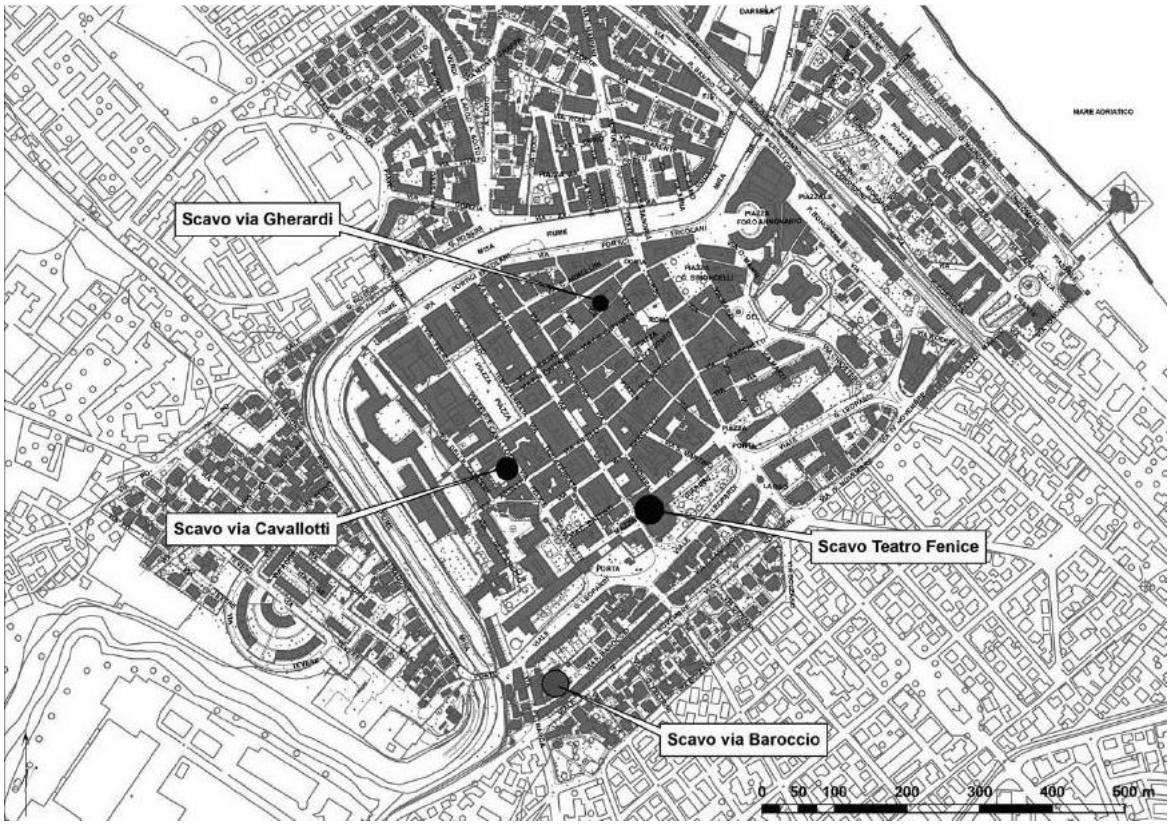


Figure 149 Map of Senigallia with indication of the various excavations carried out in recent years (After).

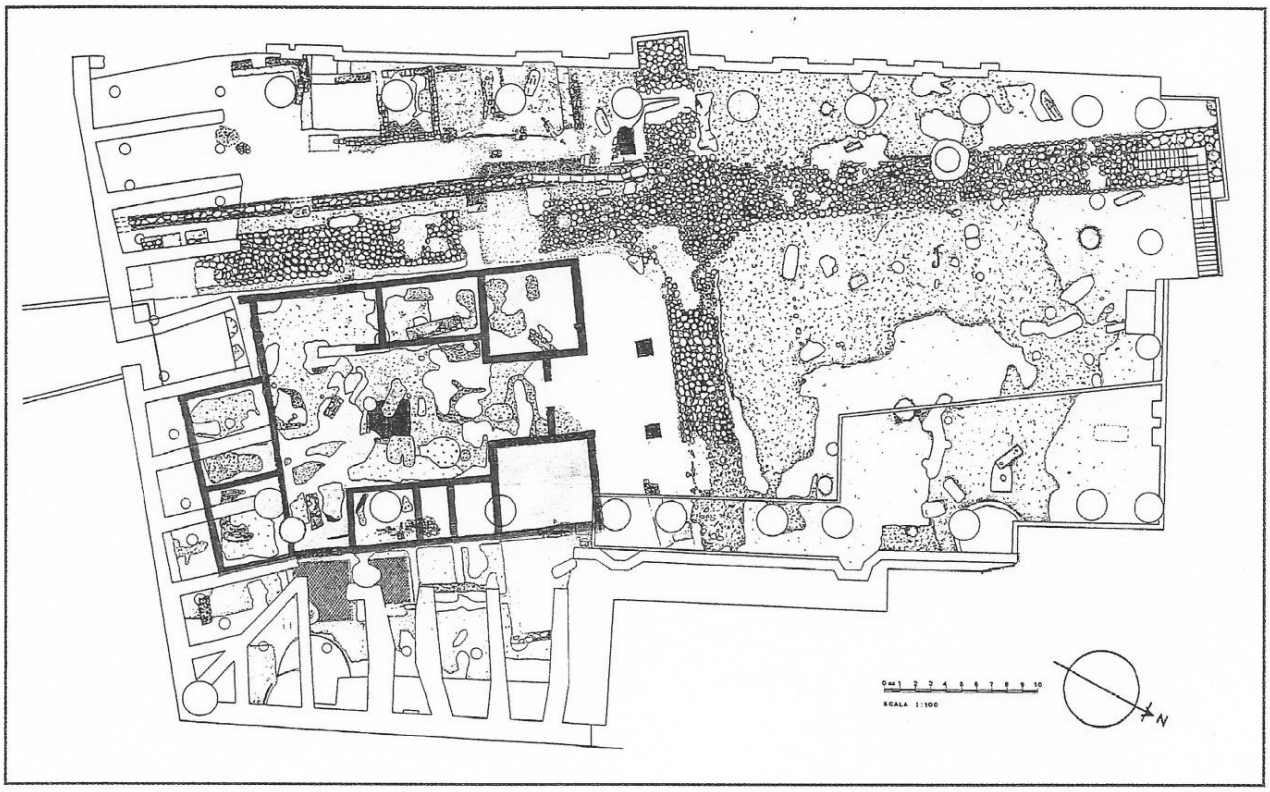


Figure 150 Plan of the domus in the area 'La Fenice' (Senigallia (After Salvini 2003, 22).

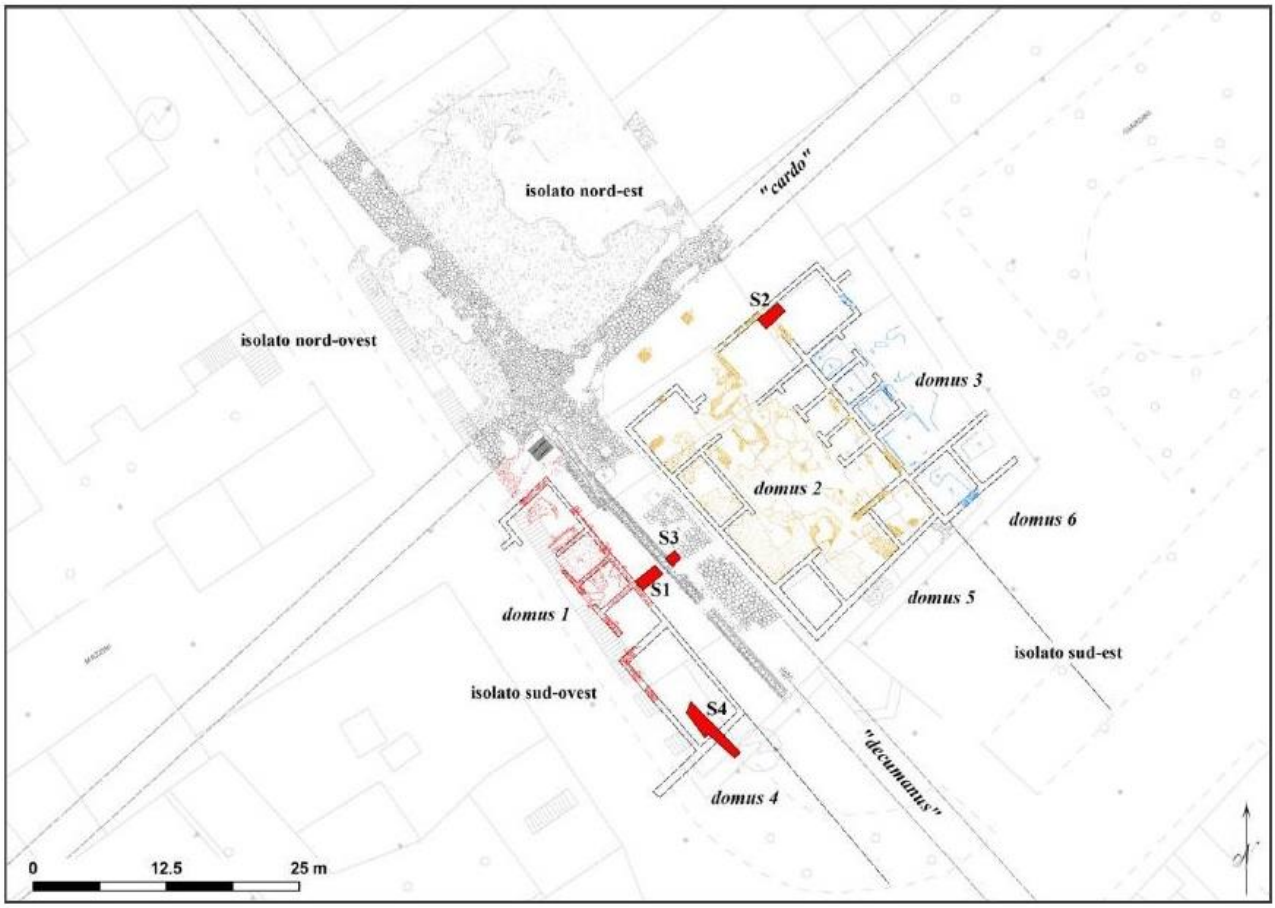


Figure 151 Plan of the residential quarter of Sena Gallica (After Lepore et al. 2014, Fig. 9).

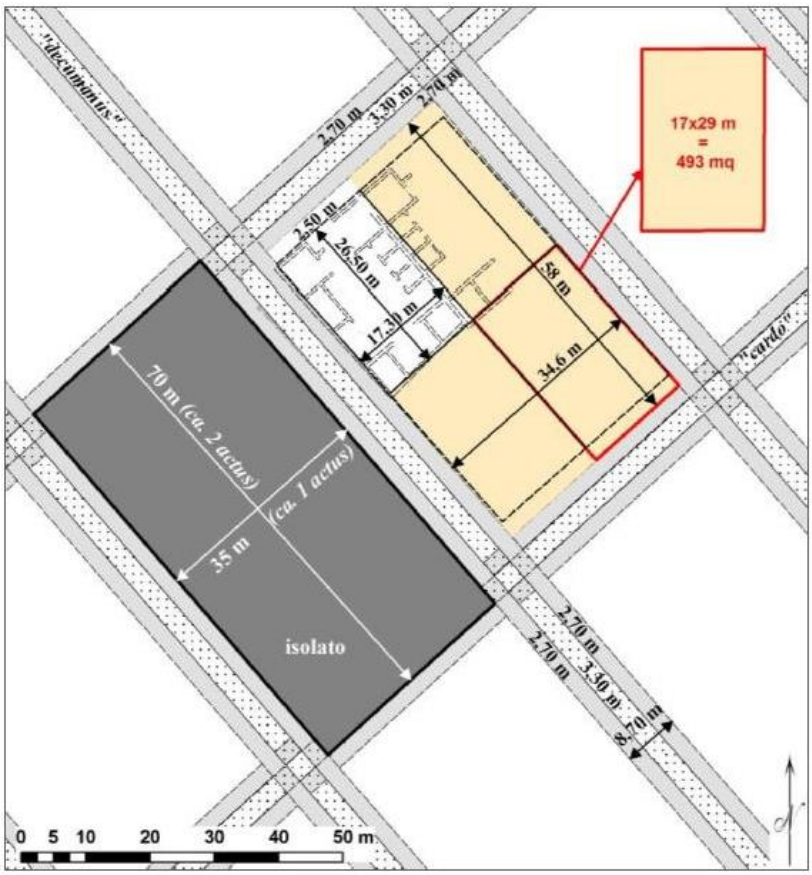


Figure 152 Reconstruction of the town plan of *Sena Gallica* (After Lepore et al. 2014, fig. 28).

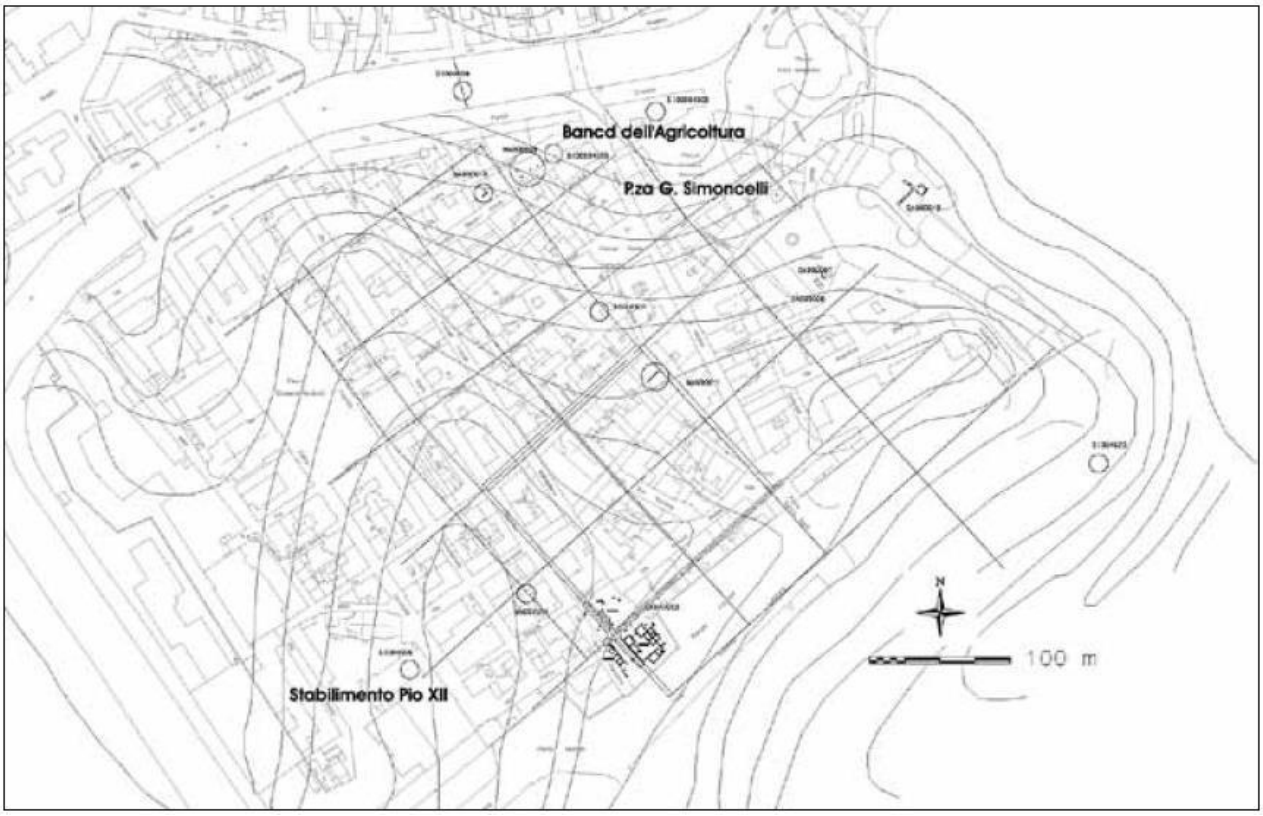


Figure 153 Reconstruction of the lay-out of *Sena Gallica* (After Perna 2012, 396, fig. 3).

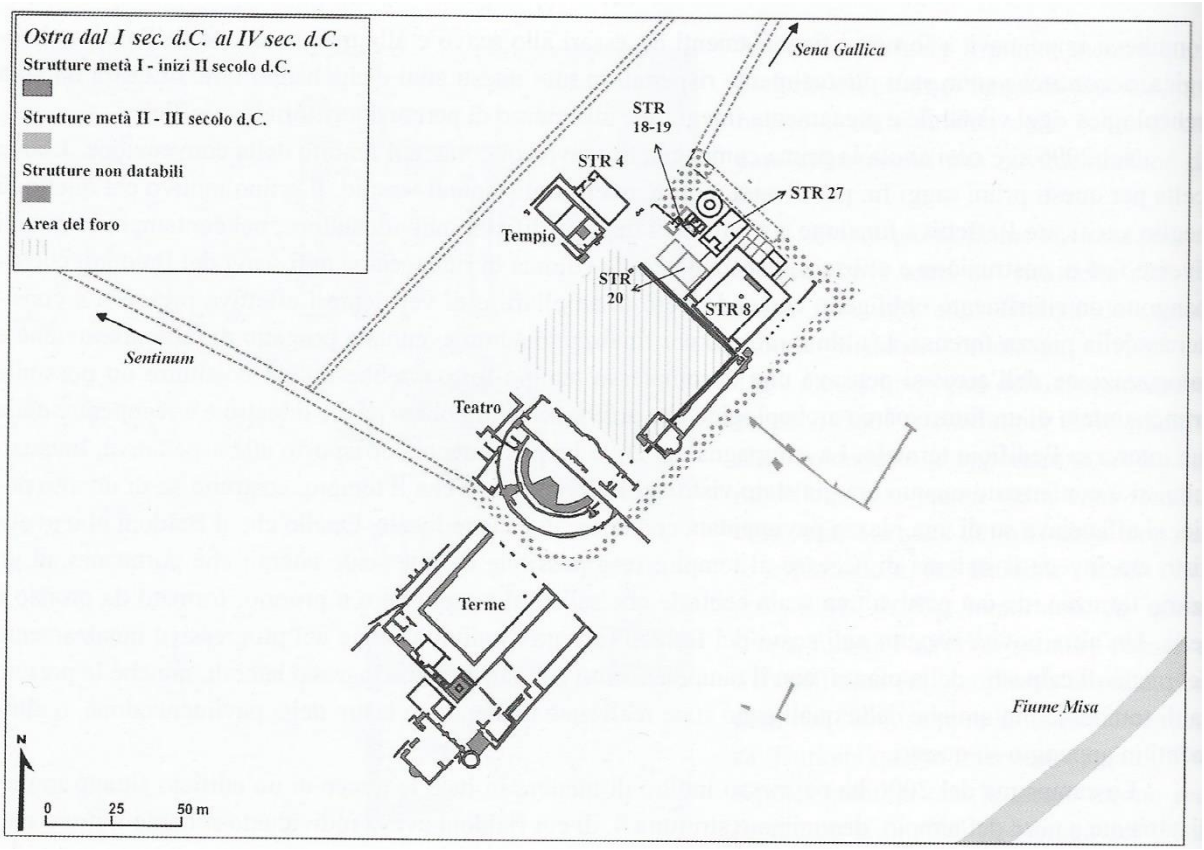


Figure 154 The monumental centre of *Ostra* (After Dall'Aglio et al. 2014, 836, fig. 6).

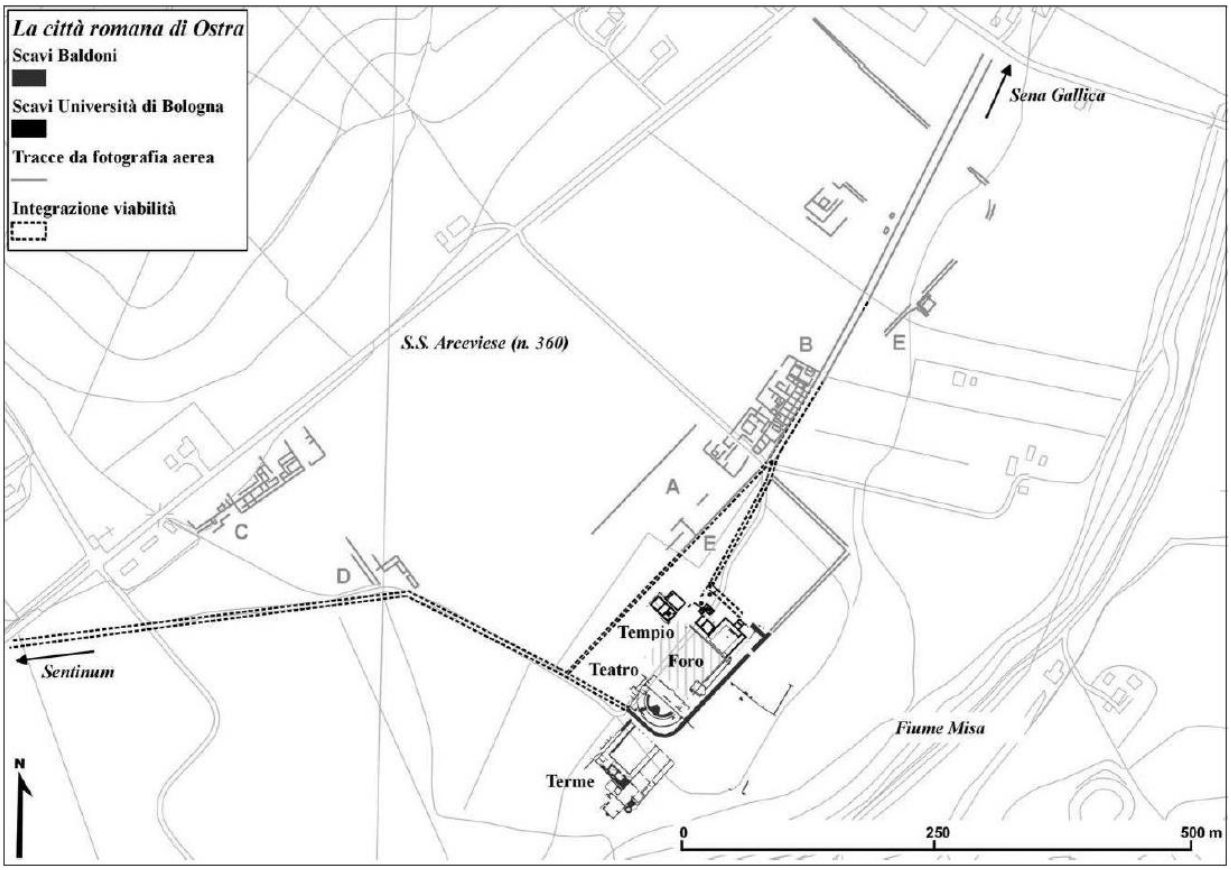


Figure 155 Map of the Roman *municipium* of *Ostra* (After Boschi/Silani 2012, 79, fig. 7).

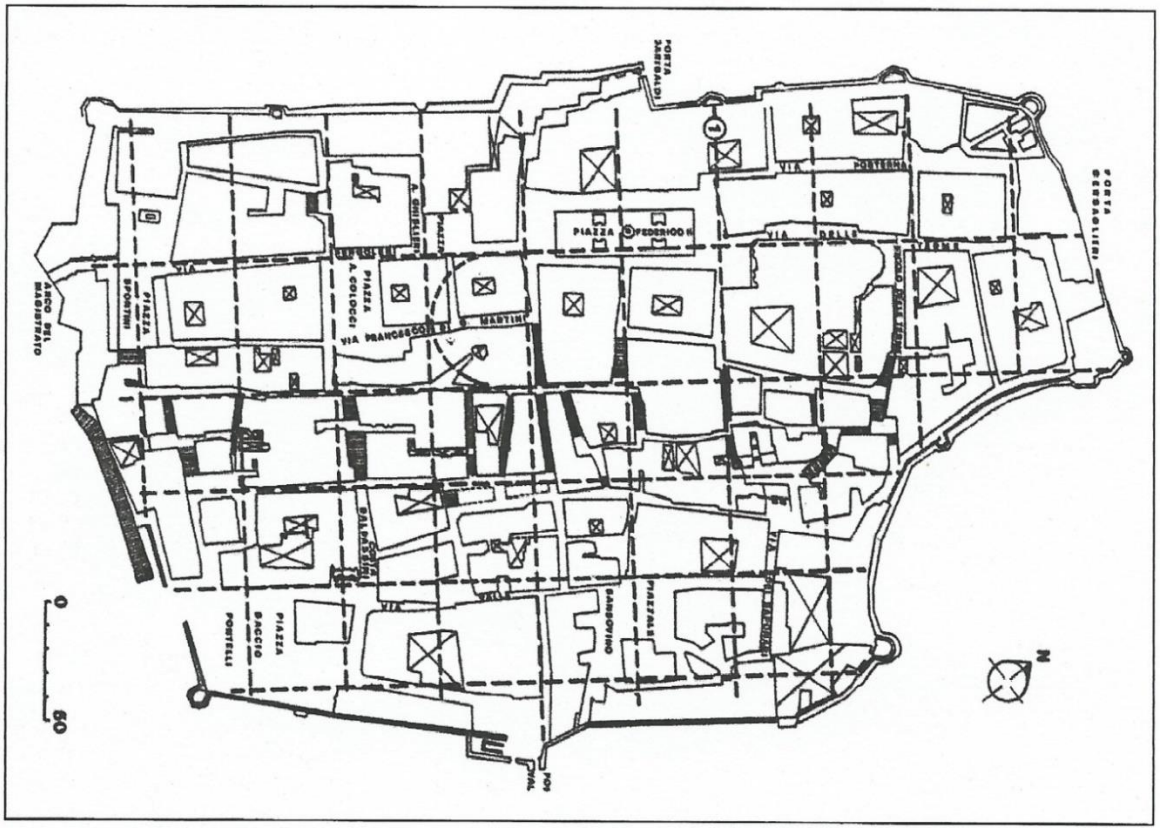


Figure 156 Reconstruction of the town plan of *Aesis* (After Luni/Cardinali 2009, 376, fig. 13).

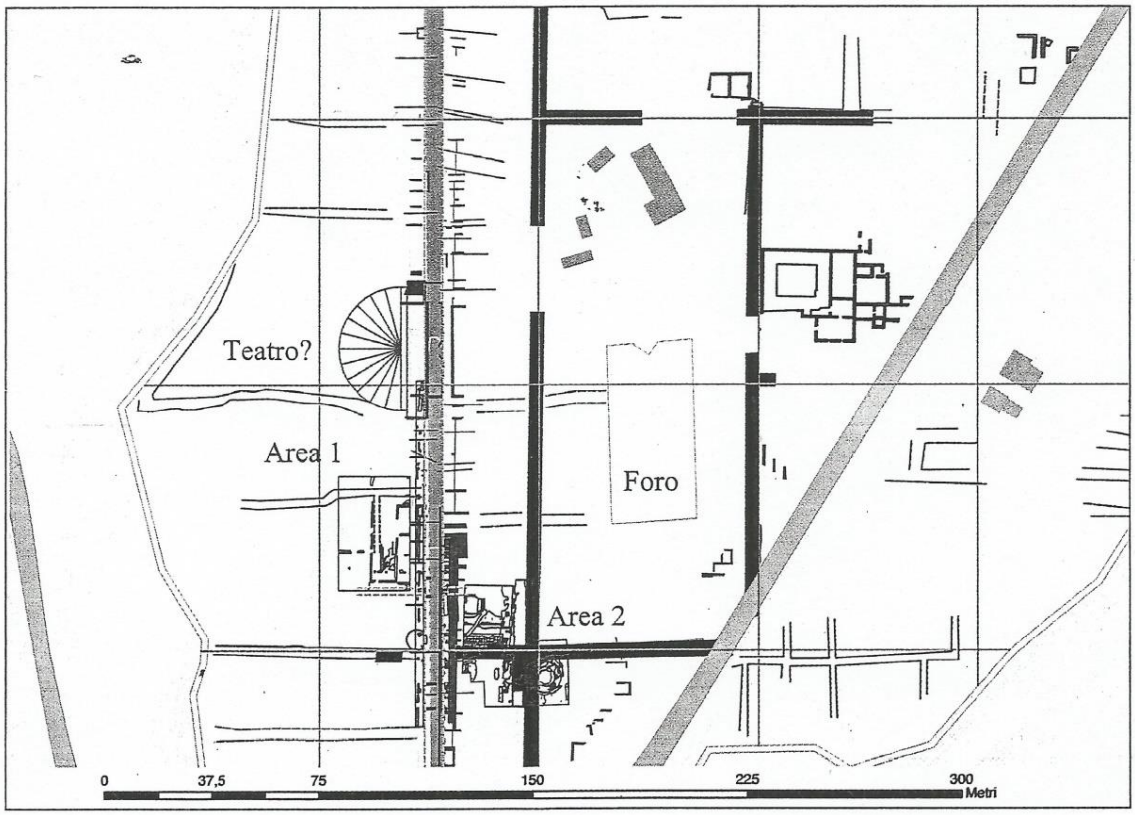


Figure 157 Map of the central area of *Sentinum* with indication of the possible theatre (After Medri 2008°, 215, fig. 3.1.14).

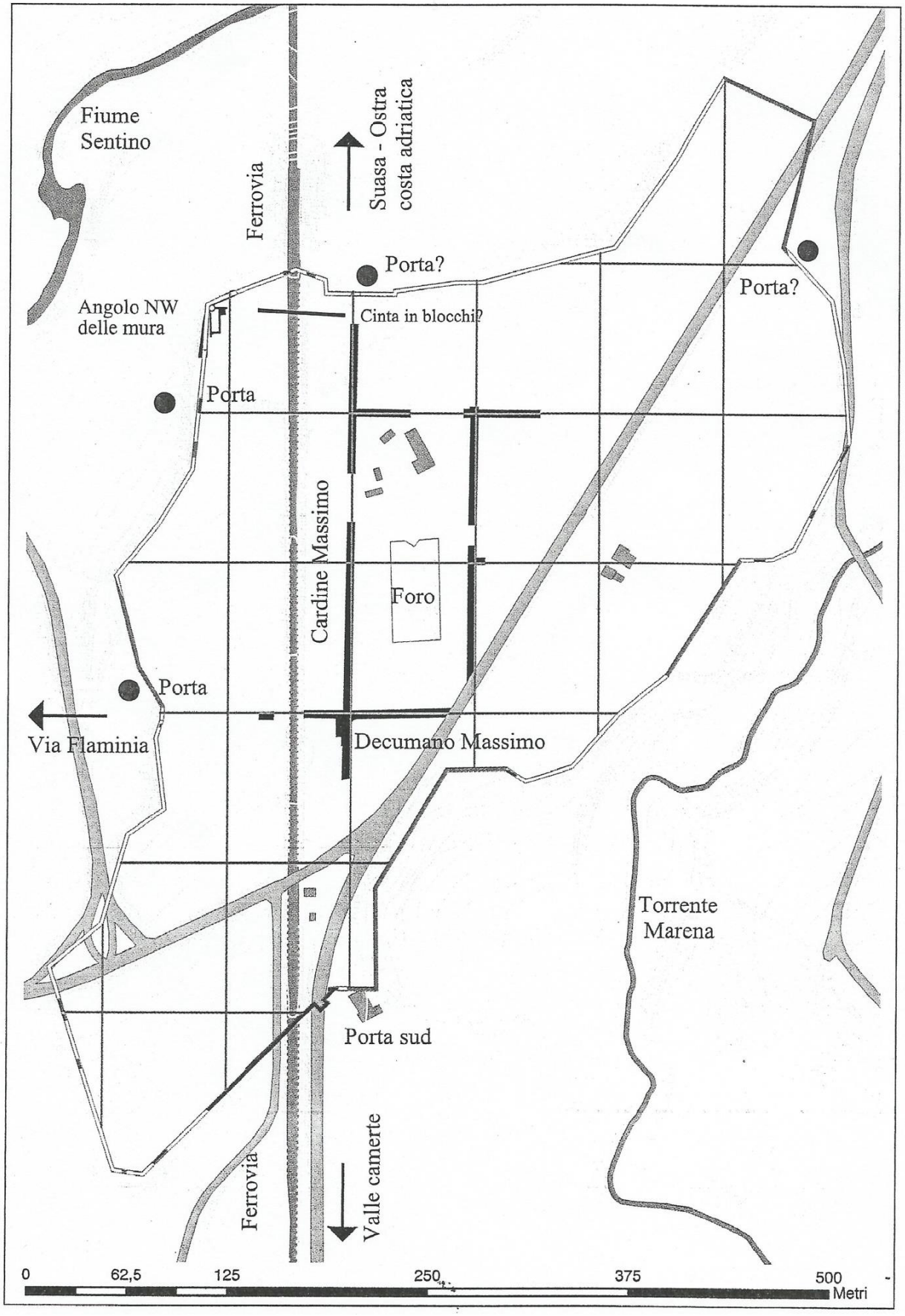


Figure 158 Map of *Sentinum* with the indication of the town wall, the town gates and the internal organisation into insulae (After Medri 2008, 206, fig. 3.1.8).

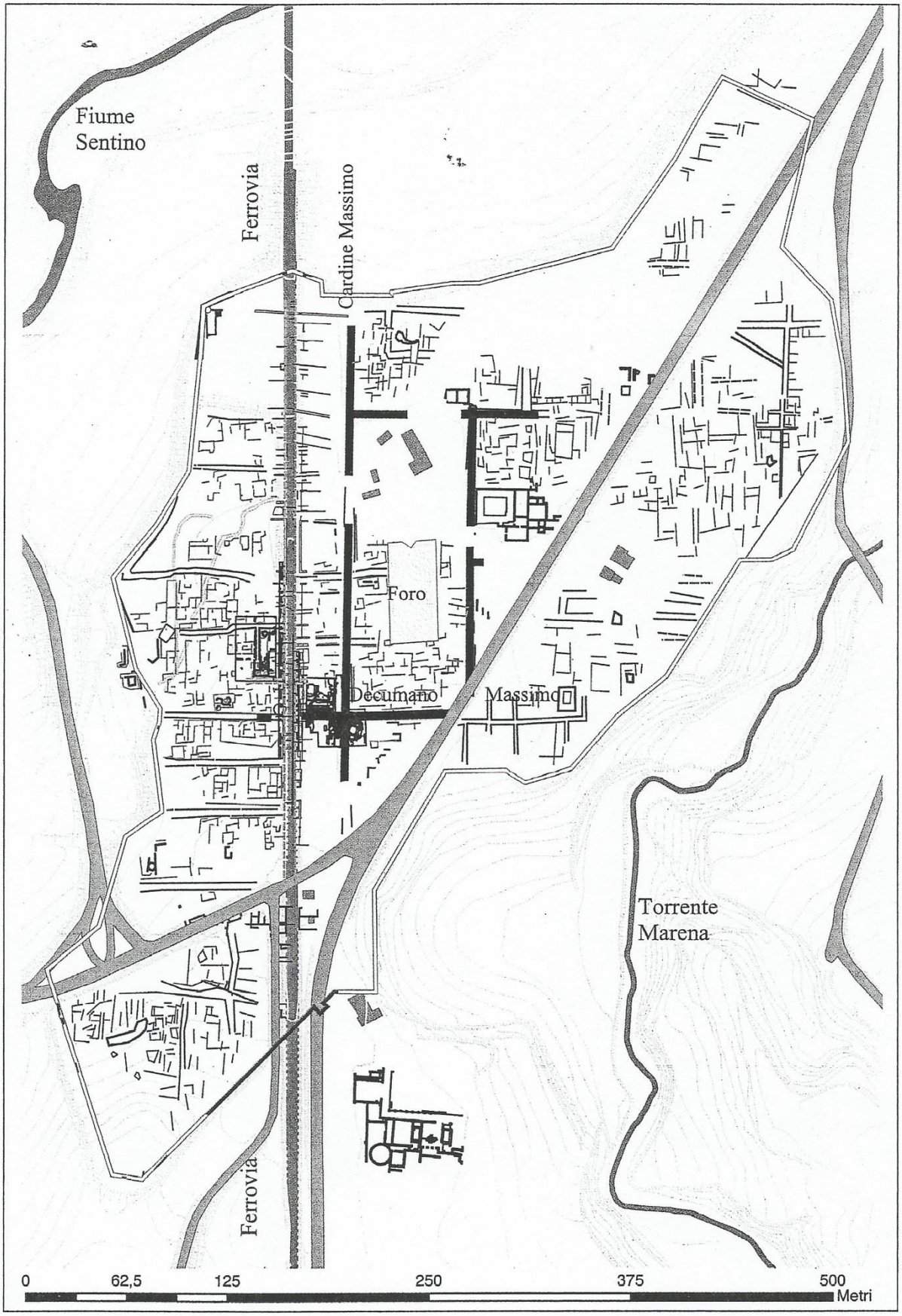


Figure 159 Updated map of *Sentinum* incorporating all data from old excavations and the geophysical surveys (After Medri 2008a, 213, fig. 3.1.12).

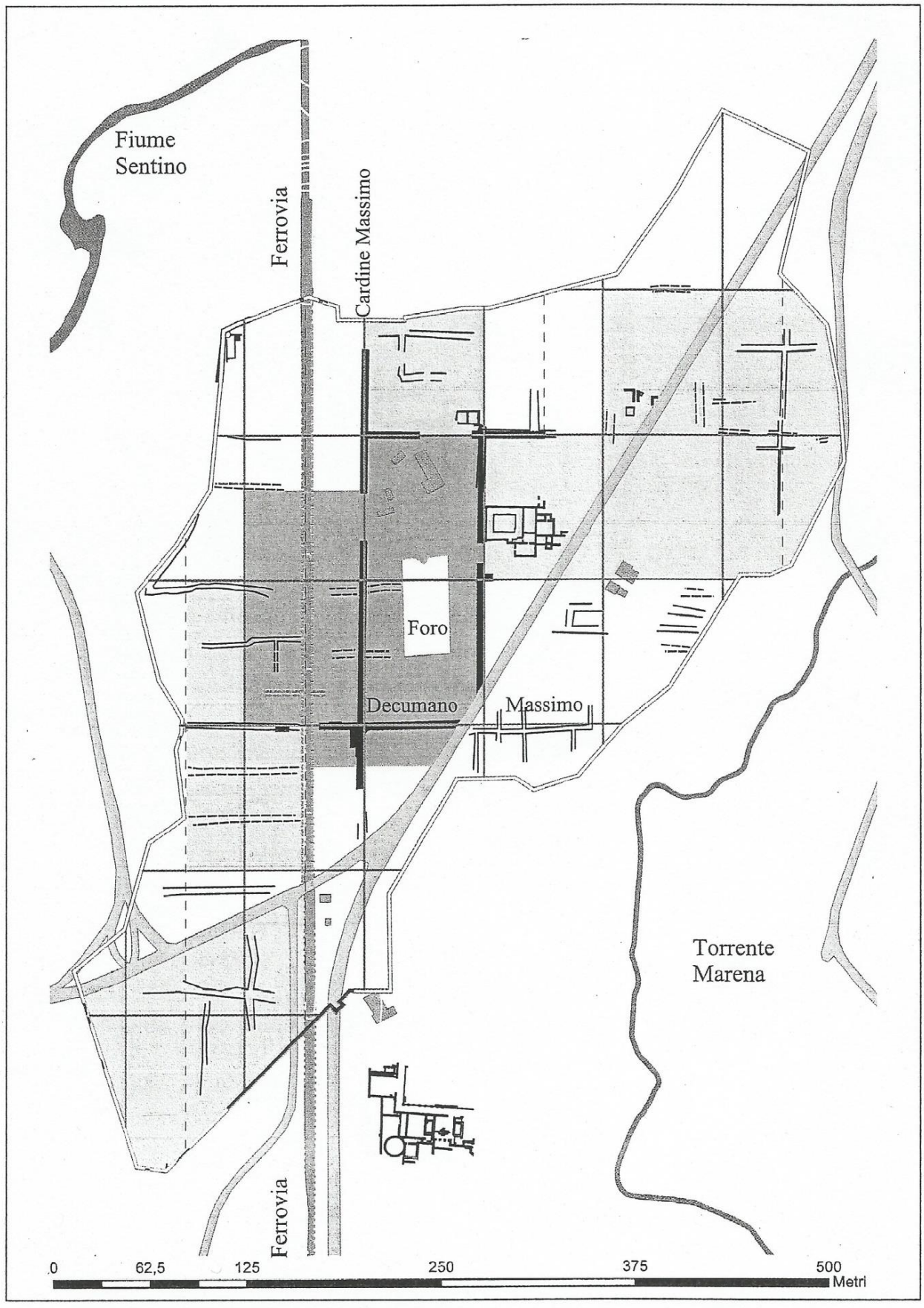


Figure 160 Map of *Sentinum* with indication of the distribution of space within the town area (After Medri 2008a, 214, fig. 3.1.13).

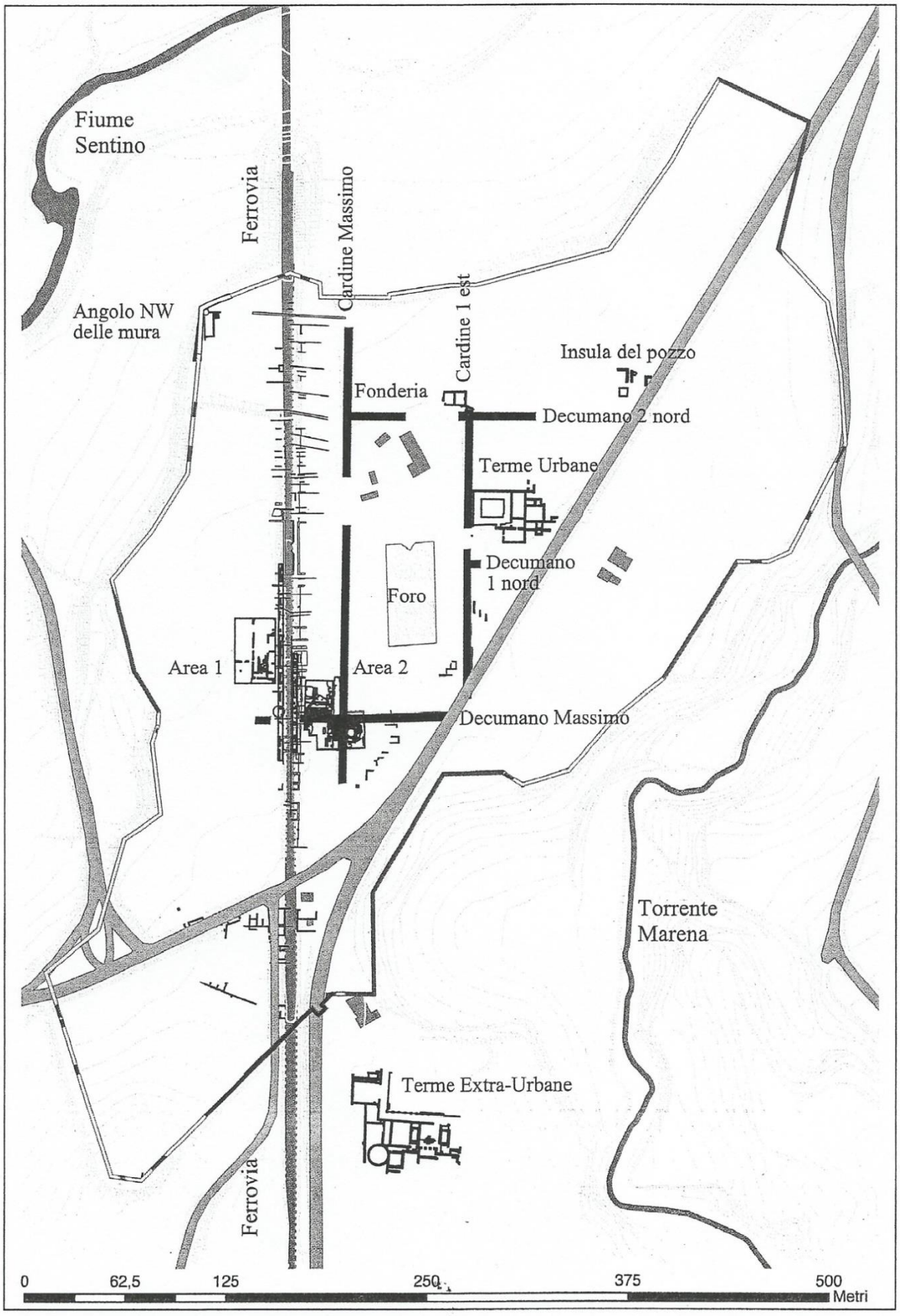


Figure 161 Map of *Sentinum* with indication of the structures known before the geophysical surveys and the newly excavated structures (After Medri 2008a, 200, fig. 3.1.1).

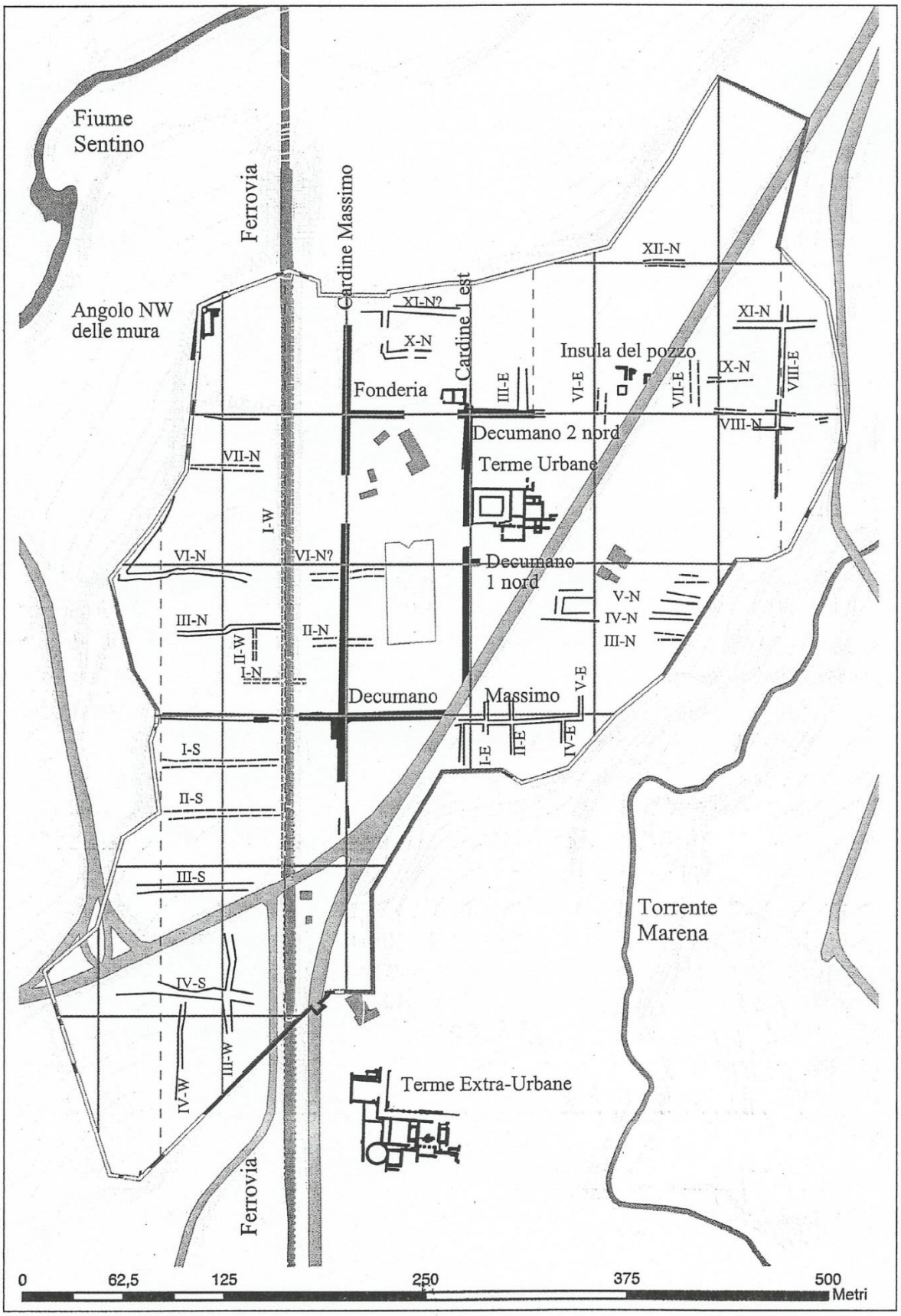


Figure 162 Map of *Sentinum* with indications of the streets and the *insulae* on the basis of the archaeological remains and the geophysical surveys (After Medri 2008a, 210, fig. 3.1.10).

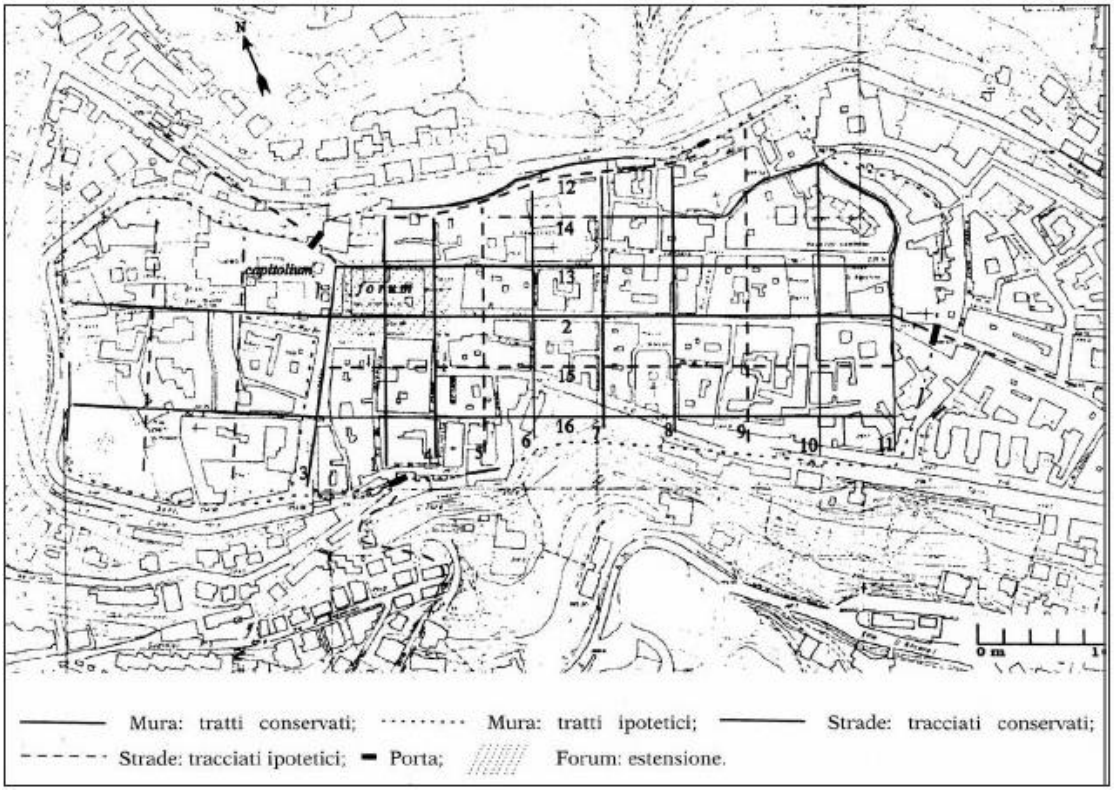


Figure 163 Reconstruction of the plan of *Auximum* (After Destro 1997, 108, fig. 4).

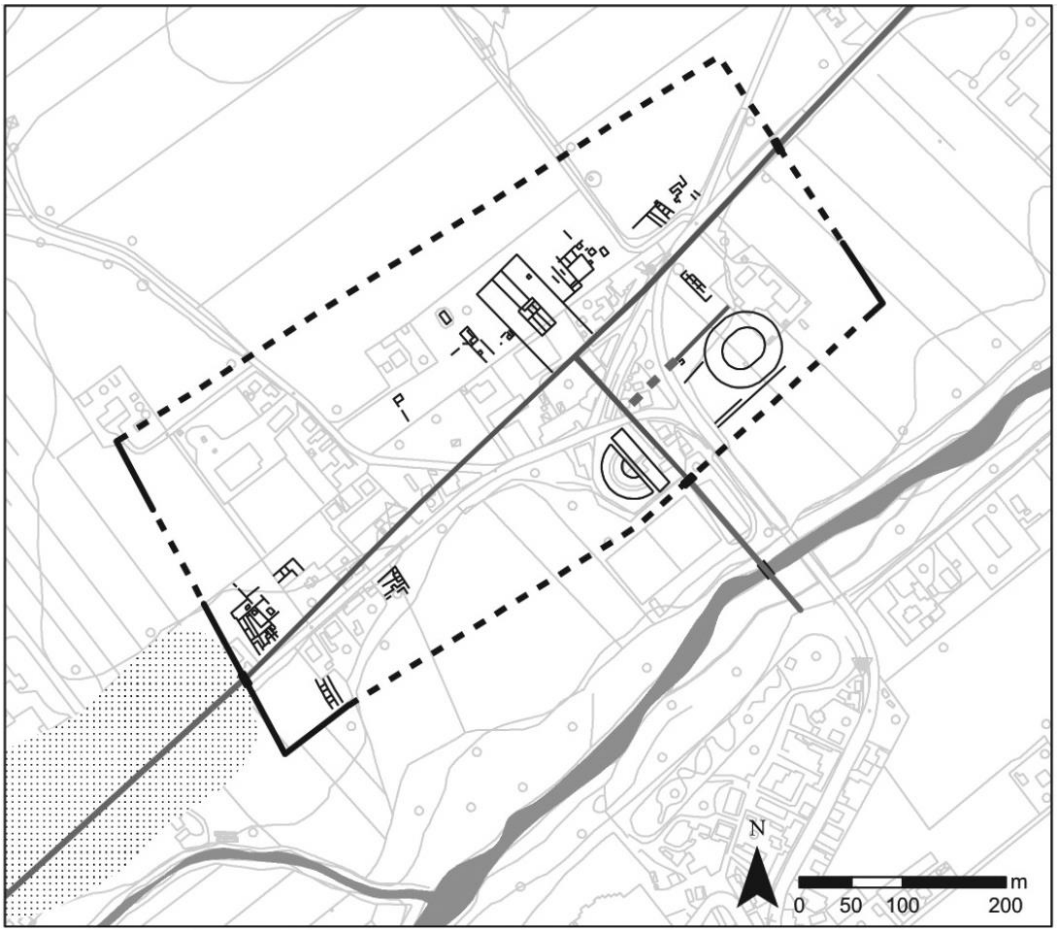
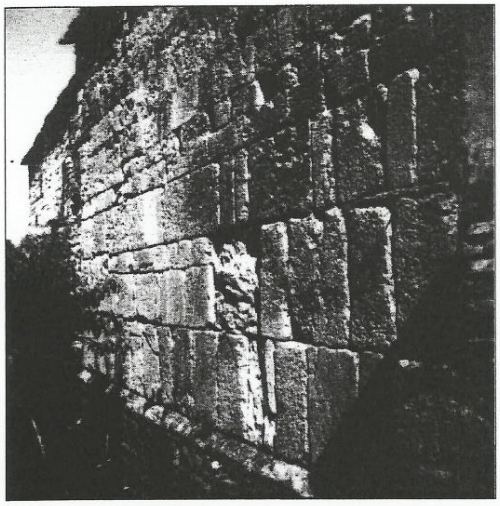
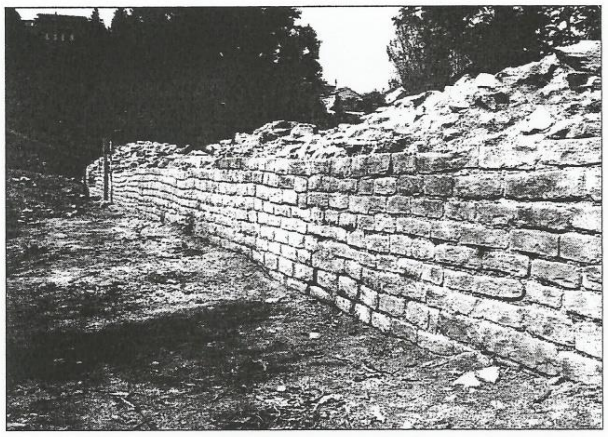


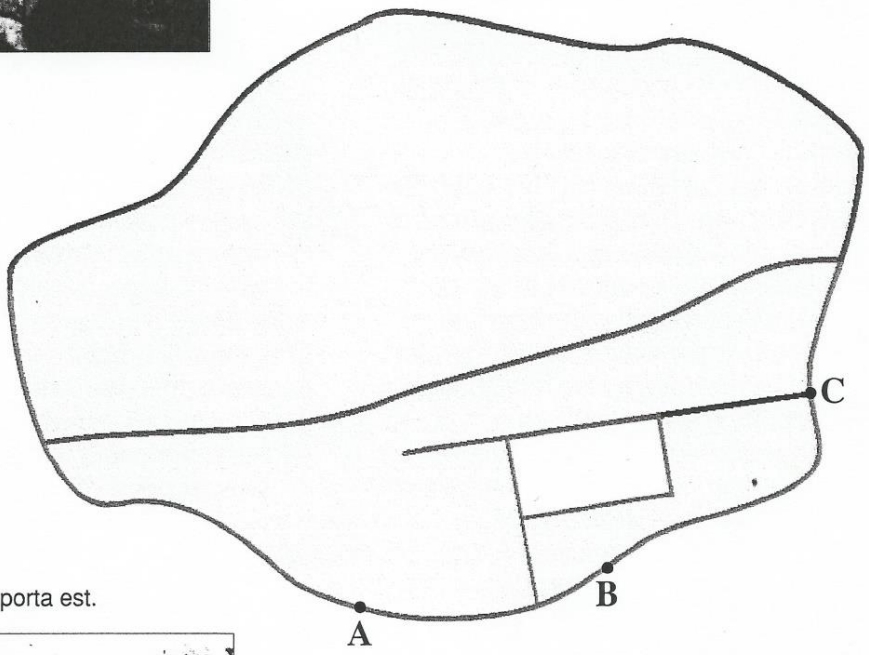
Figure 164 Map of *Ricina* (After Vermeulen 2012a, 342, fig. 3).



Borgo S. Lorenzo - chiesa:
muro settentrionale.

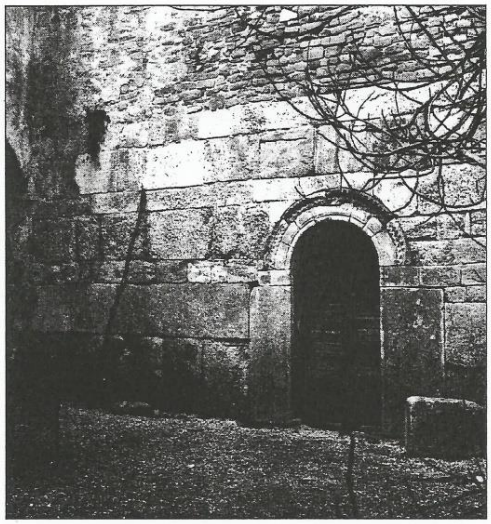


Cingulum - Mura cittadine: lato nord.



Cingulum - Mura cittadine: porta est.





Borgo S. Lorenzo - chiesa: muro meridionale.

CINTA MURARIA
CINTA MURARIA PRIMA IPOTESI
CINTA MURARIA SECONDA IPOTESI
FORO
A - B - C - PORTE

Figure 165 Reconstruction of the urban lay-out of *Cingulum* (Borgo S. Lorenzo) (After Percossi Serenelli 1998, 66, fig. 39).

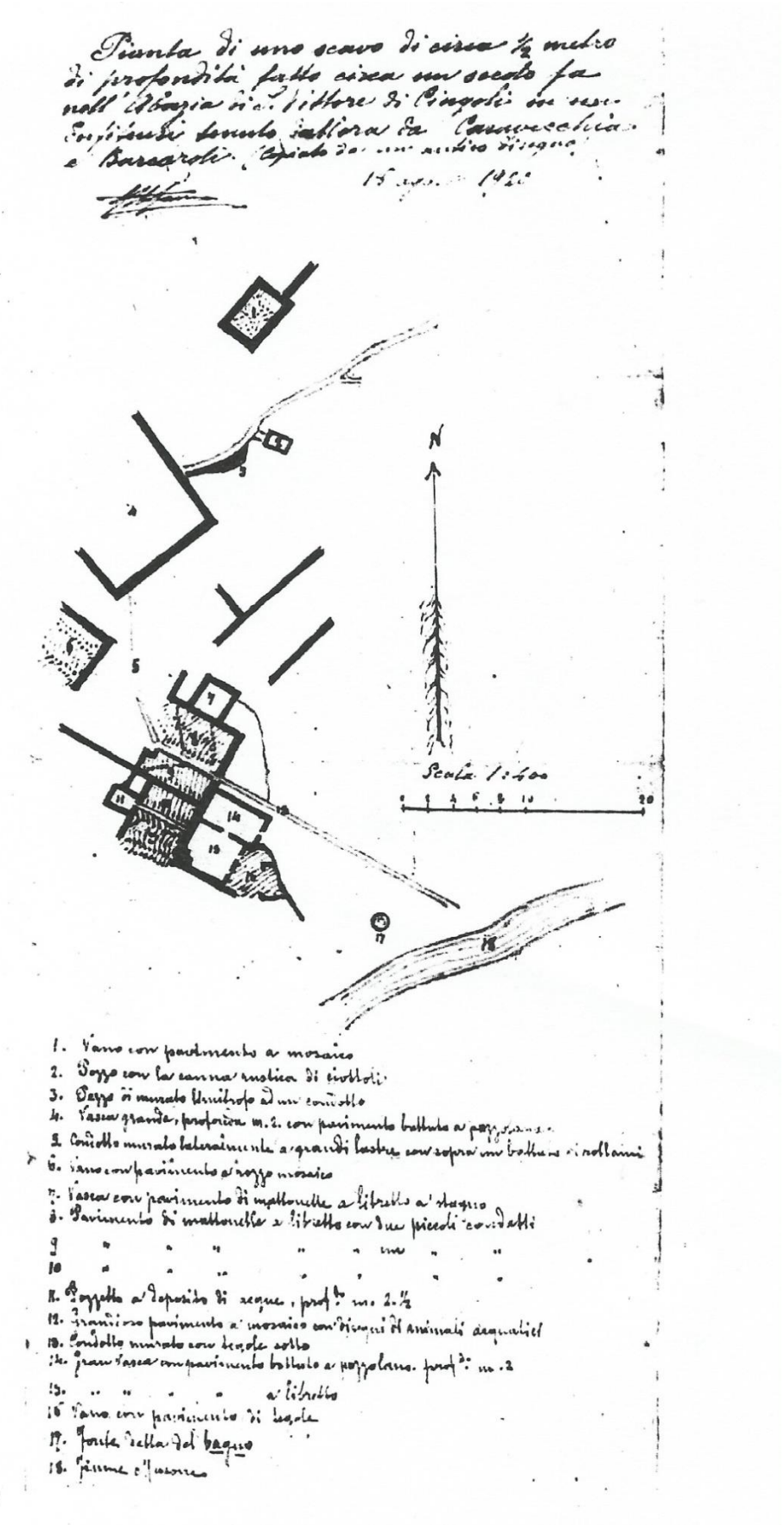


Figure 166 Map of the excavated structures at S. Vittore di Cingoli (Planina) (After Marchegiani 2004, 87, Fig. 120).

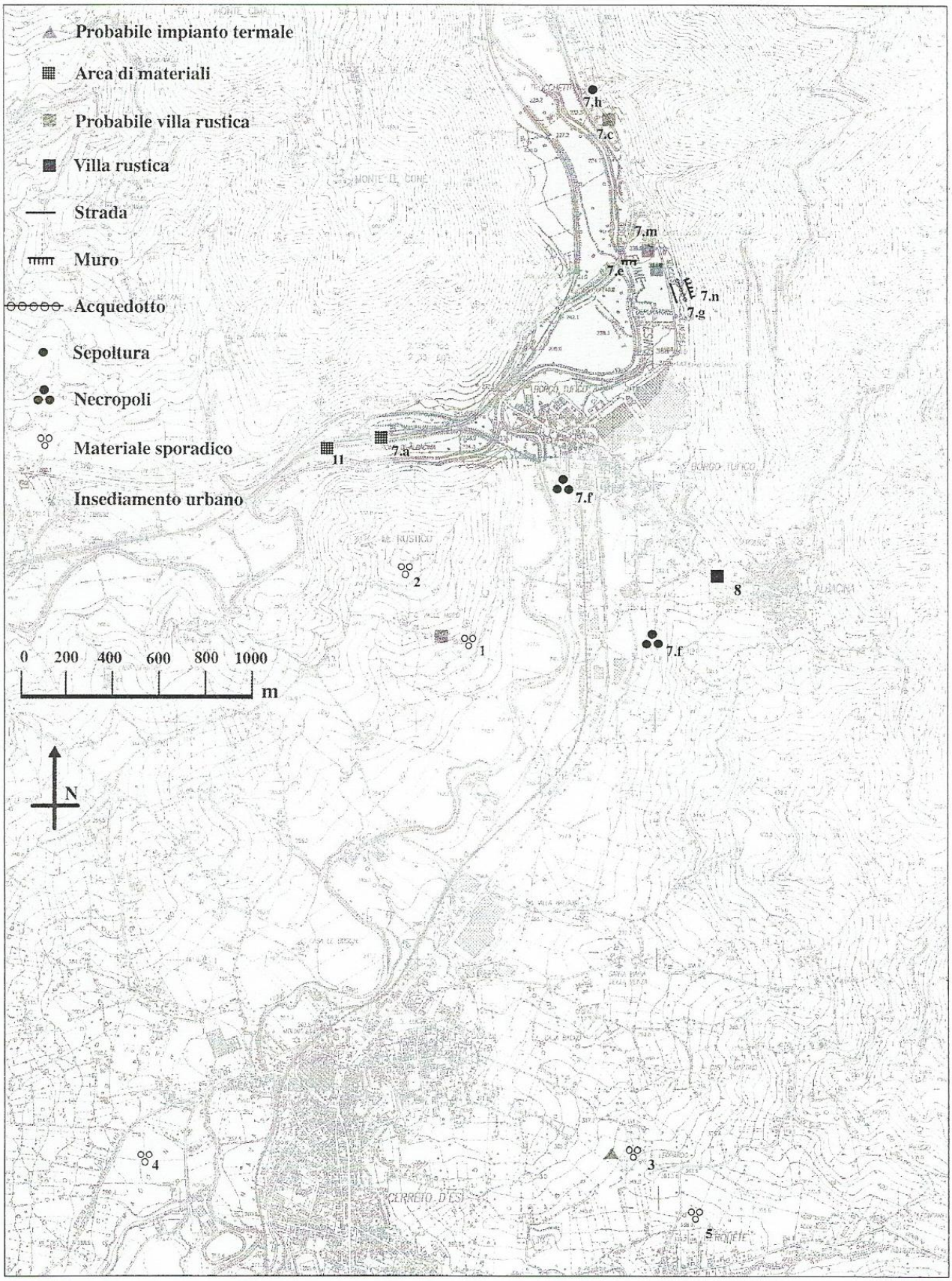


Figure 167 Map of *Tuficum* and surroundings (After Venanzioni 2005, 41; Fig. 1).

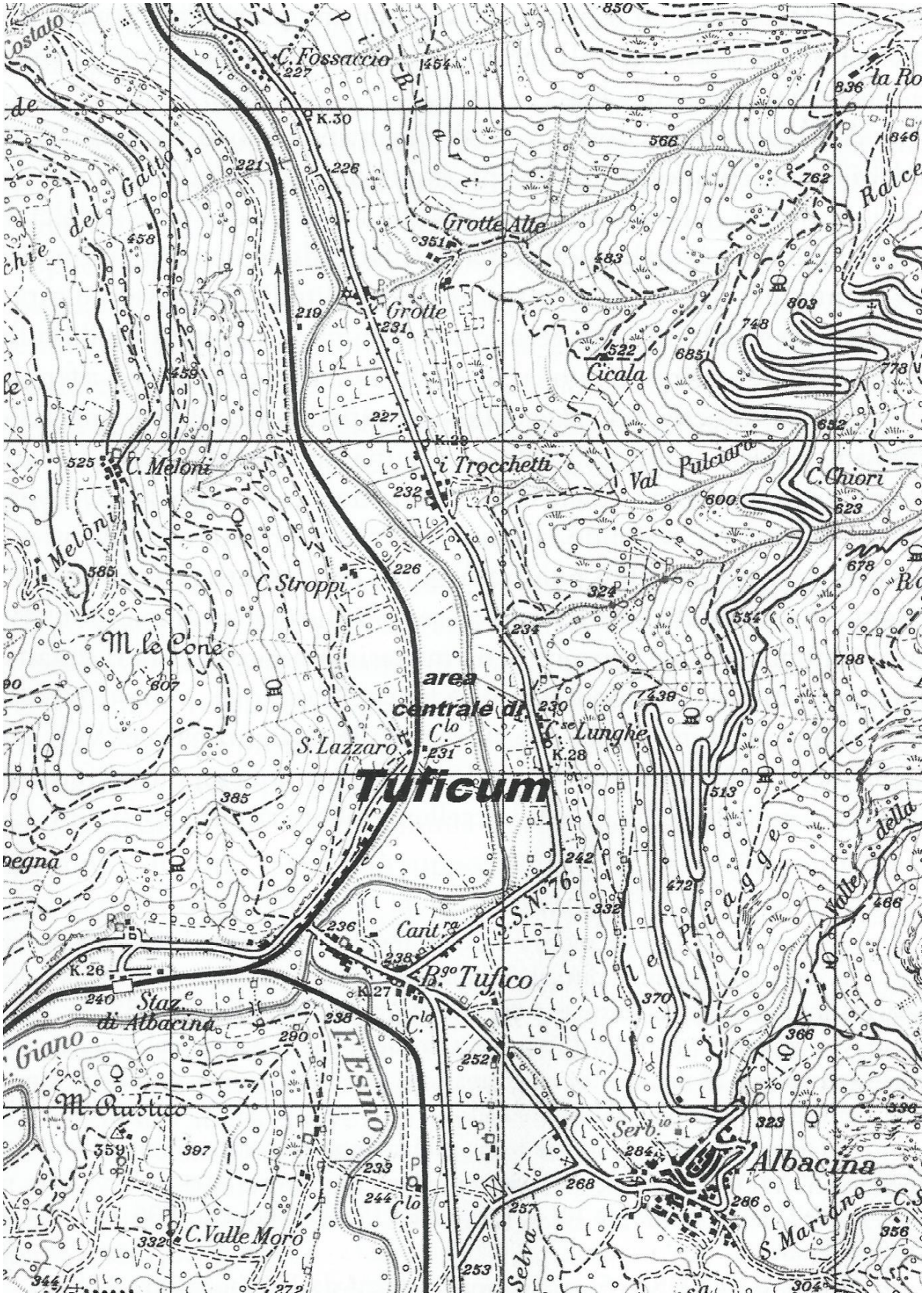


Figure 168 Location of the Roman town of *Tuficum* (Borgo Tufico) (After Baratta 2013, 35, fig. 1).

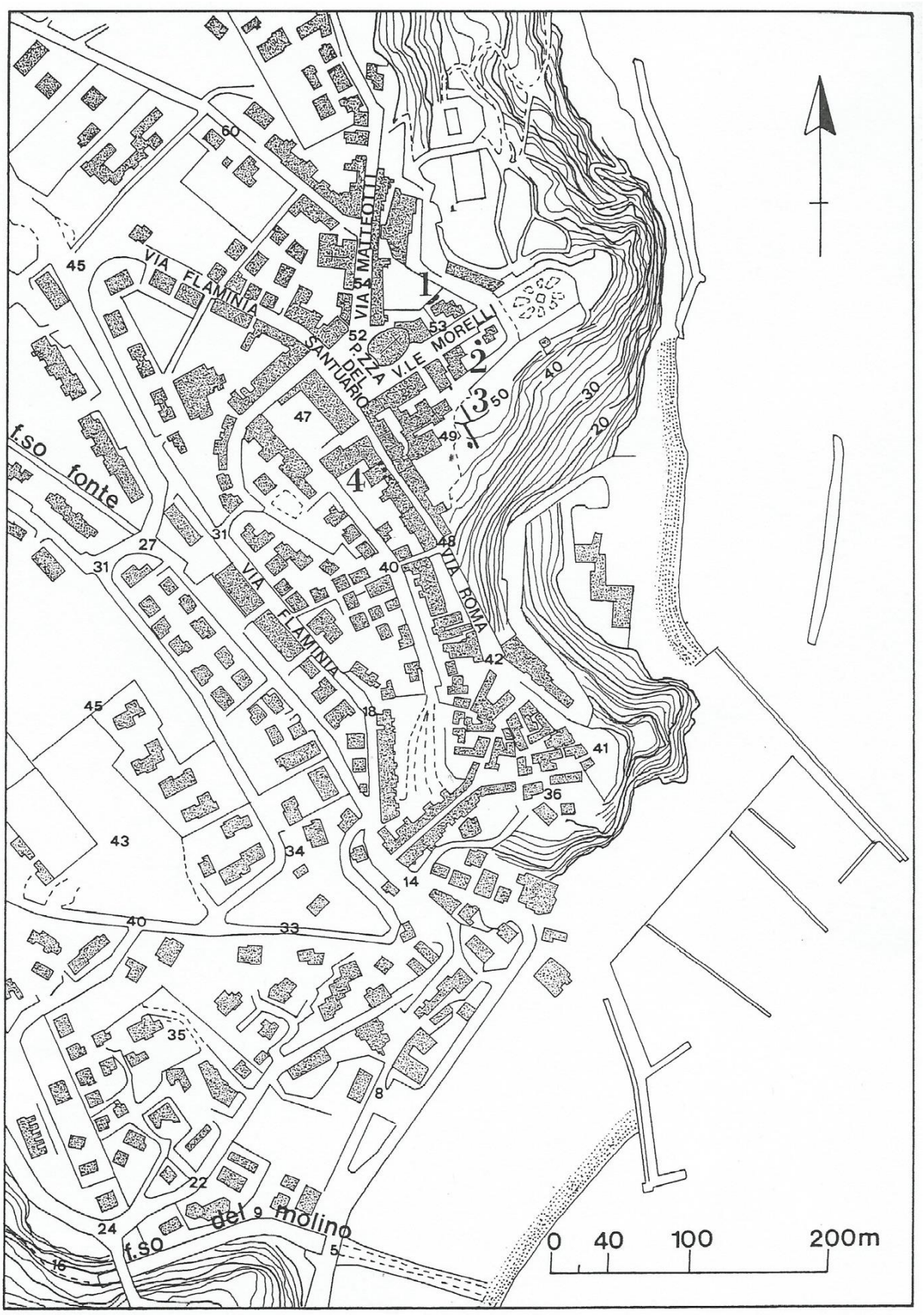


Figure 169 Map with the indication of the Roman structures found within the modern centre of Numana (After Lilli 2002, 486, fig. 22).

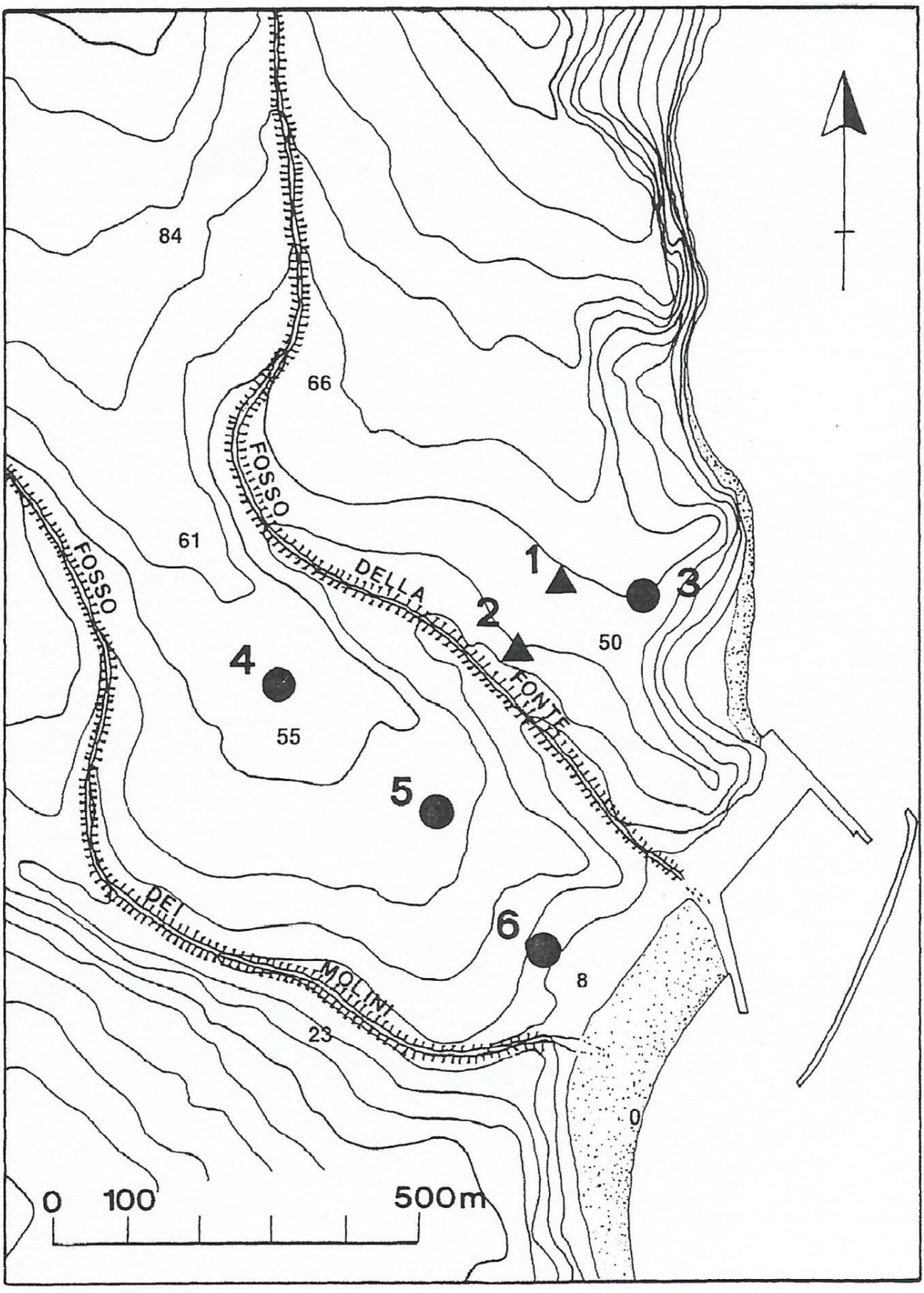


Figure 170 Topographical map of Numana (After Lilli 2002, 484, fig. 21).

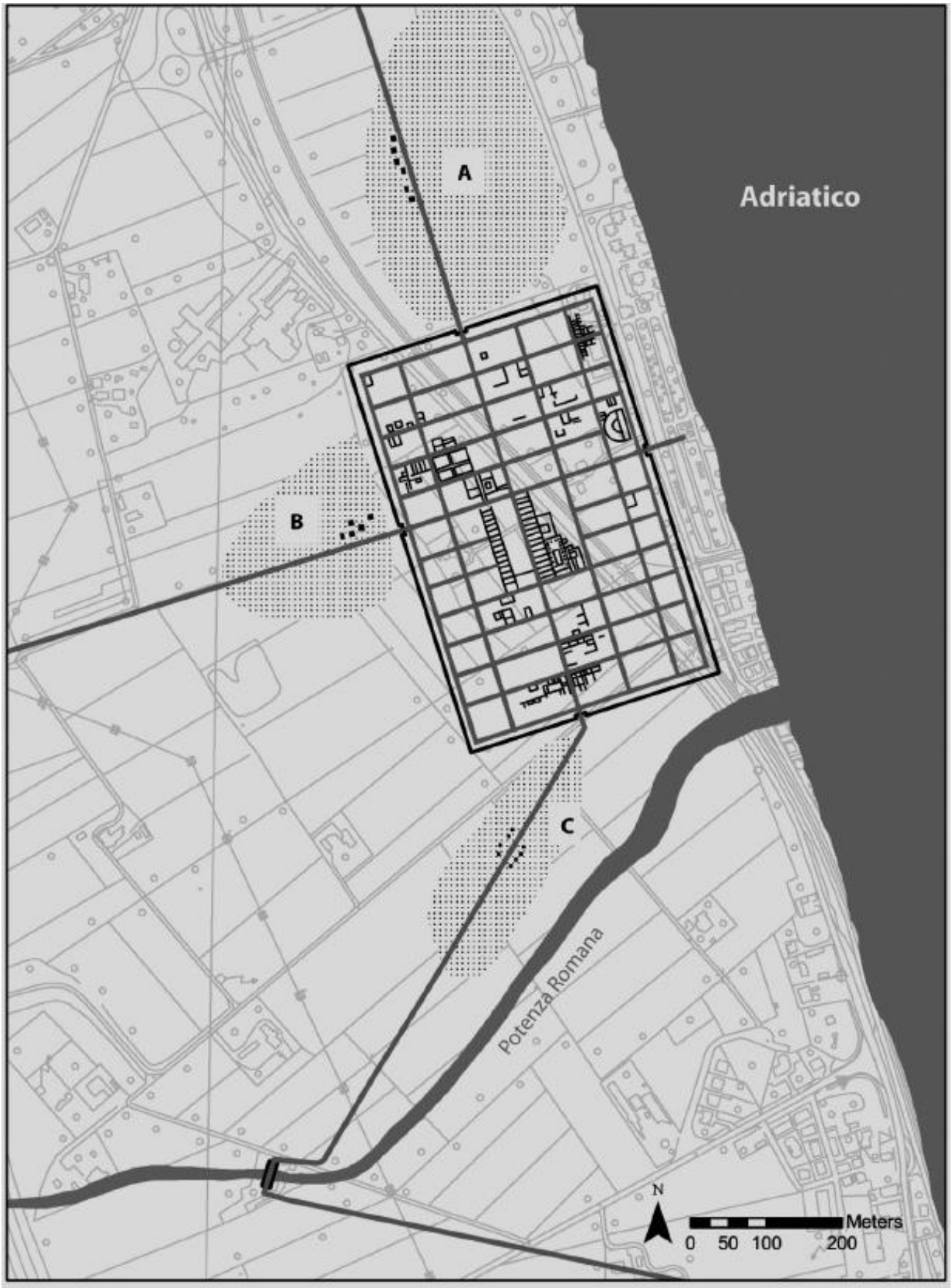


Figure 171 Map of Potentia (After Vermeulen et al. 2013, 73, Fig. 1).



Figure 172 Density of Late Republican gloss ware at *Potentia* (After Vermeulen 2008,247, fig. 6).



Figure 173 Density of Early Imperial terra sigillata at *Potentia* (After Vermeulen 2008, 247, fig. 7).



Figure 174 Density of Late Roman fine ware at *Potentia* (After Vermeulen 2008, 249, fig. 8).

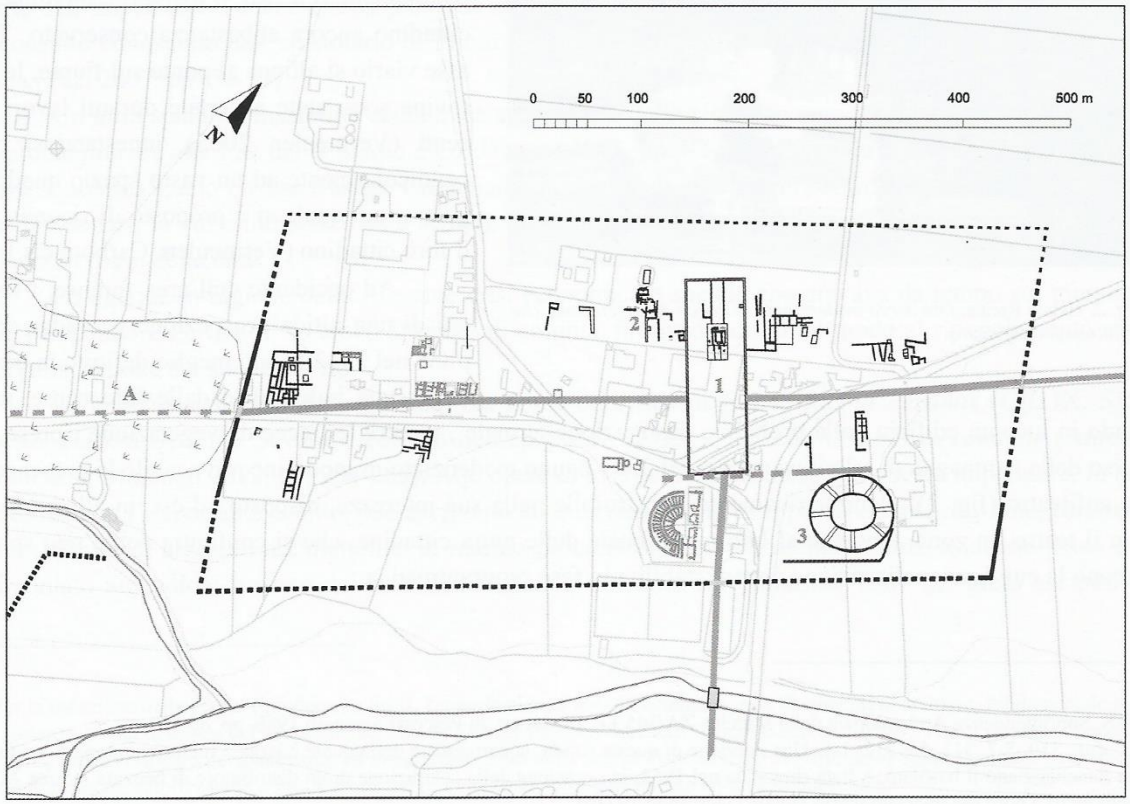


Figure 175 Map of Ricina (After Carboni/Vermeulen 2014, 929, fig. 1).

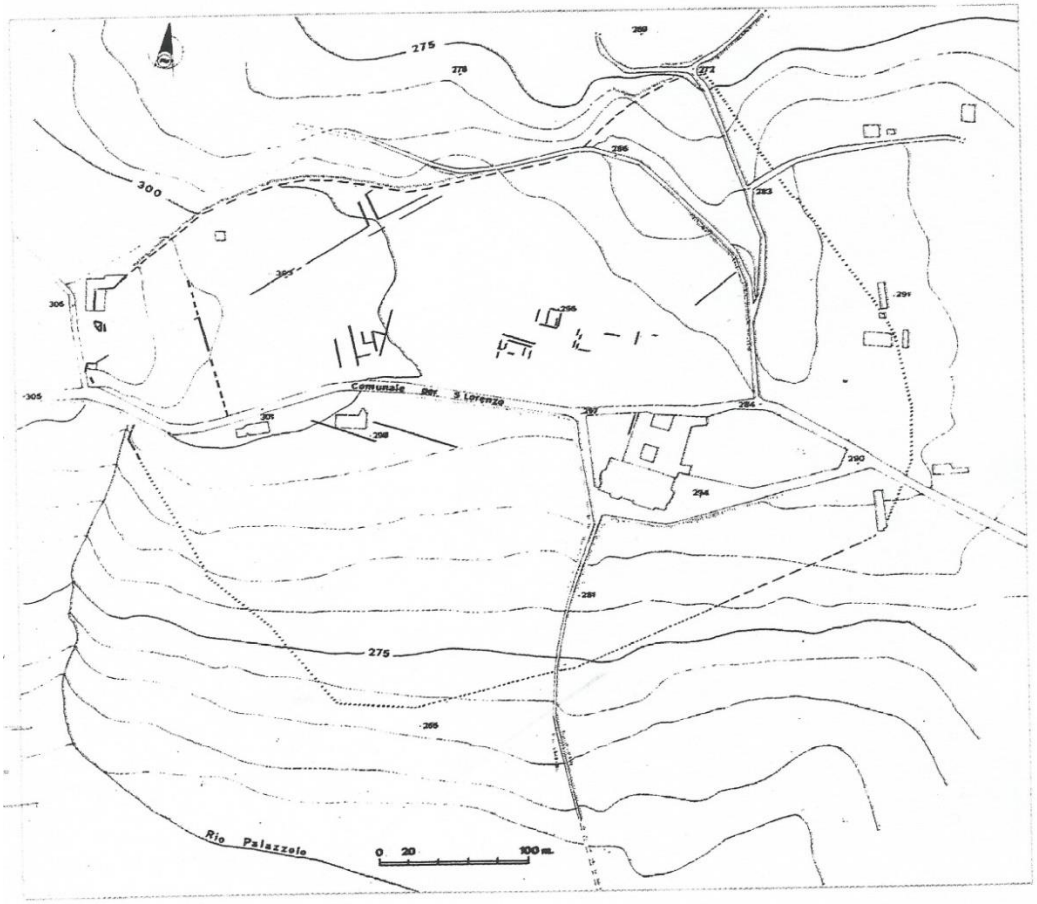


Figure 176 Map of the first reconstruction of Trea (After Fabrini 2003b, 161, Fig.29).

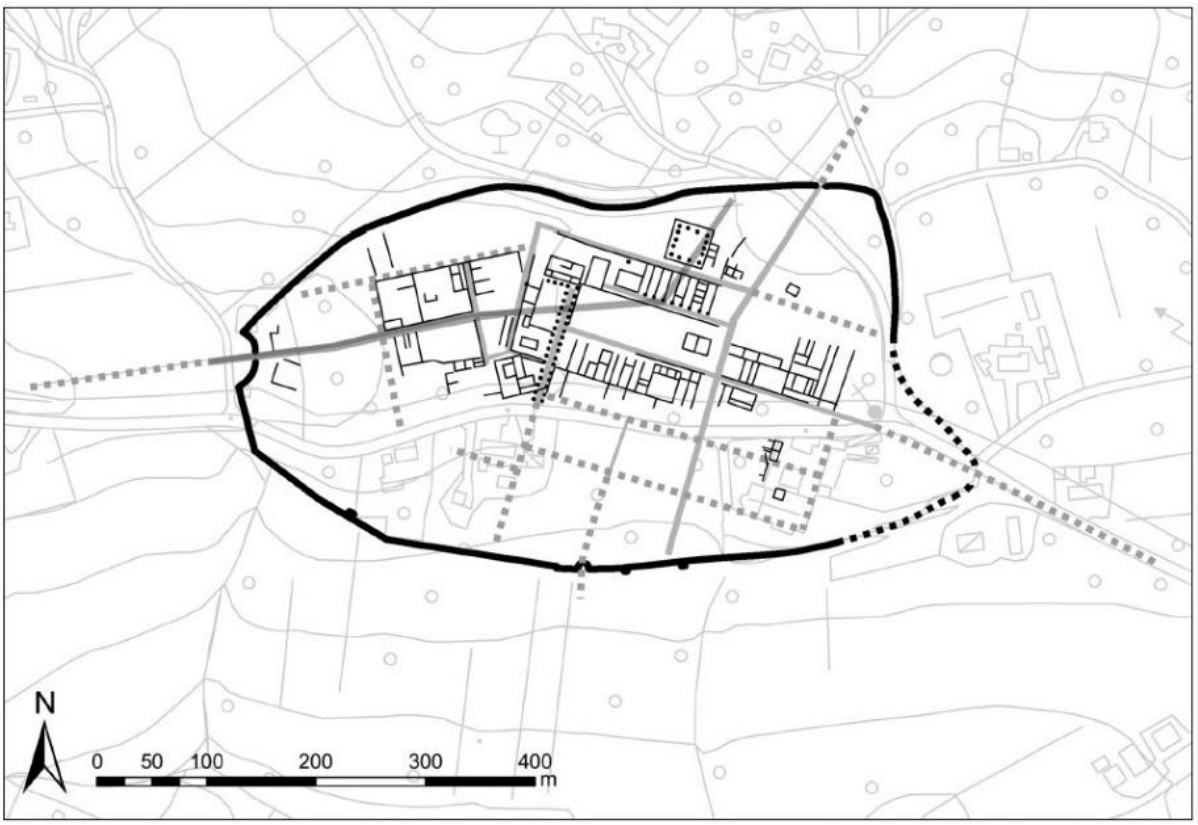


Figure 177 Map of the Roman *municipium* of *Trea* (After Vermeulen et al. 2012, 272, fig. 12.9).



Figure 178 Map of Trea with indication of the surface finds registered during the 2010 PVS campaign (After Vermeulen et al. 2012, 276, fig. 12.10).

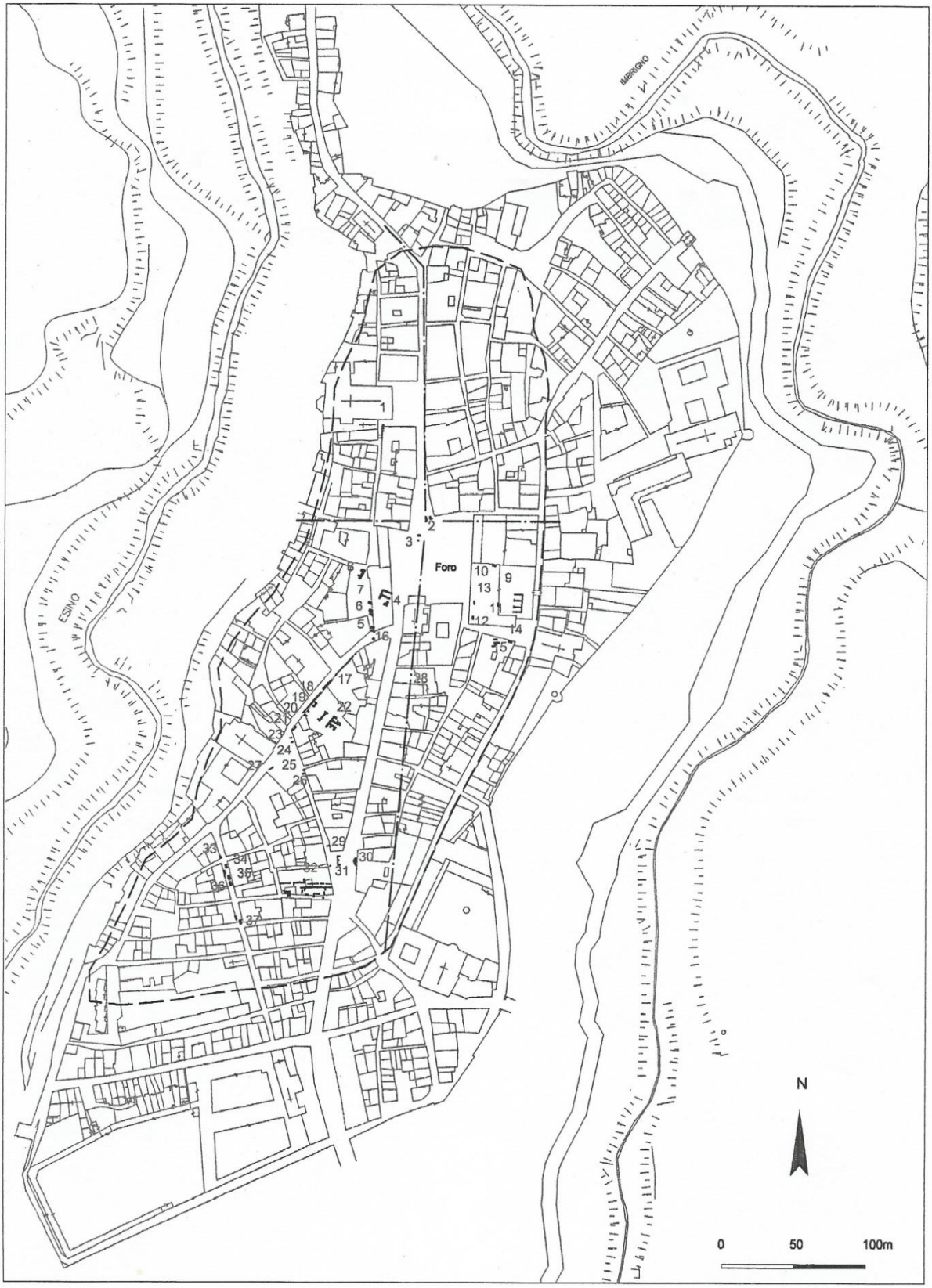


Figure 179 Map of *Matilica* with the indication of the possible limits of the urban area, the *forum*, the Imperial bath complex (22), the *domus* under the Palazzo Chierichetti (32), the *domus* under the Palazzo Ottoni (9-13), the *domus* under the Palazzo del Governo and the Piazza Leopardi (4-8), and the two street sections (2, 17) (After Biocco 2000, fig. 53).

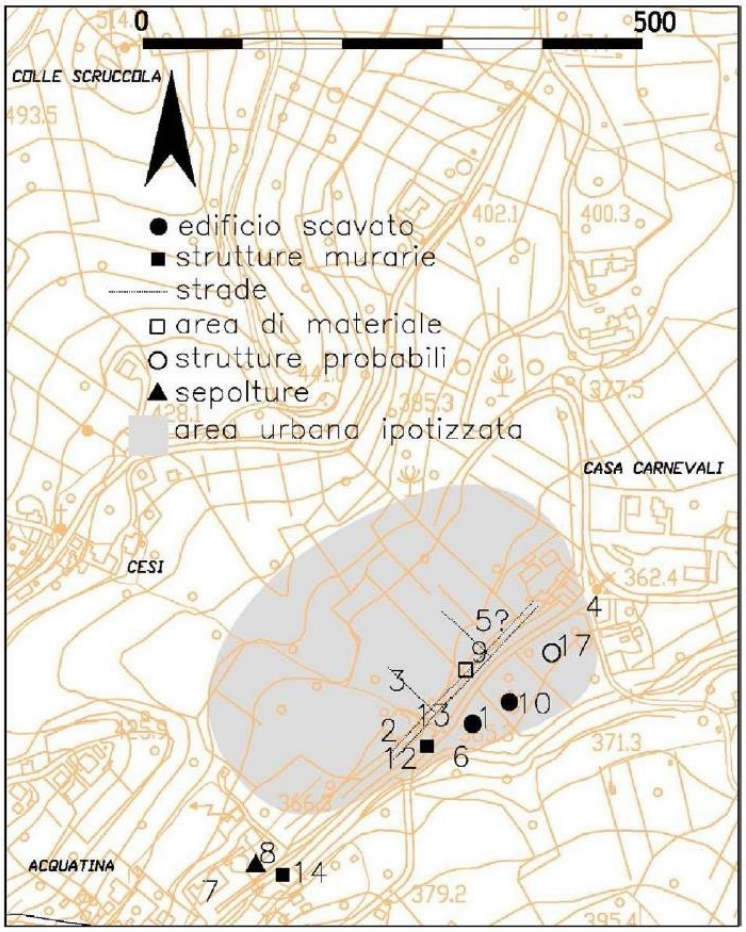


Figure 180 *Attidium* (After Pandolfi 2009, 42).



Figure 181 Map of *Urbs Salvia* with the indication of the Late Republican town (After Perna 2012, 397, fig. 6).

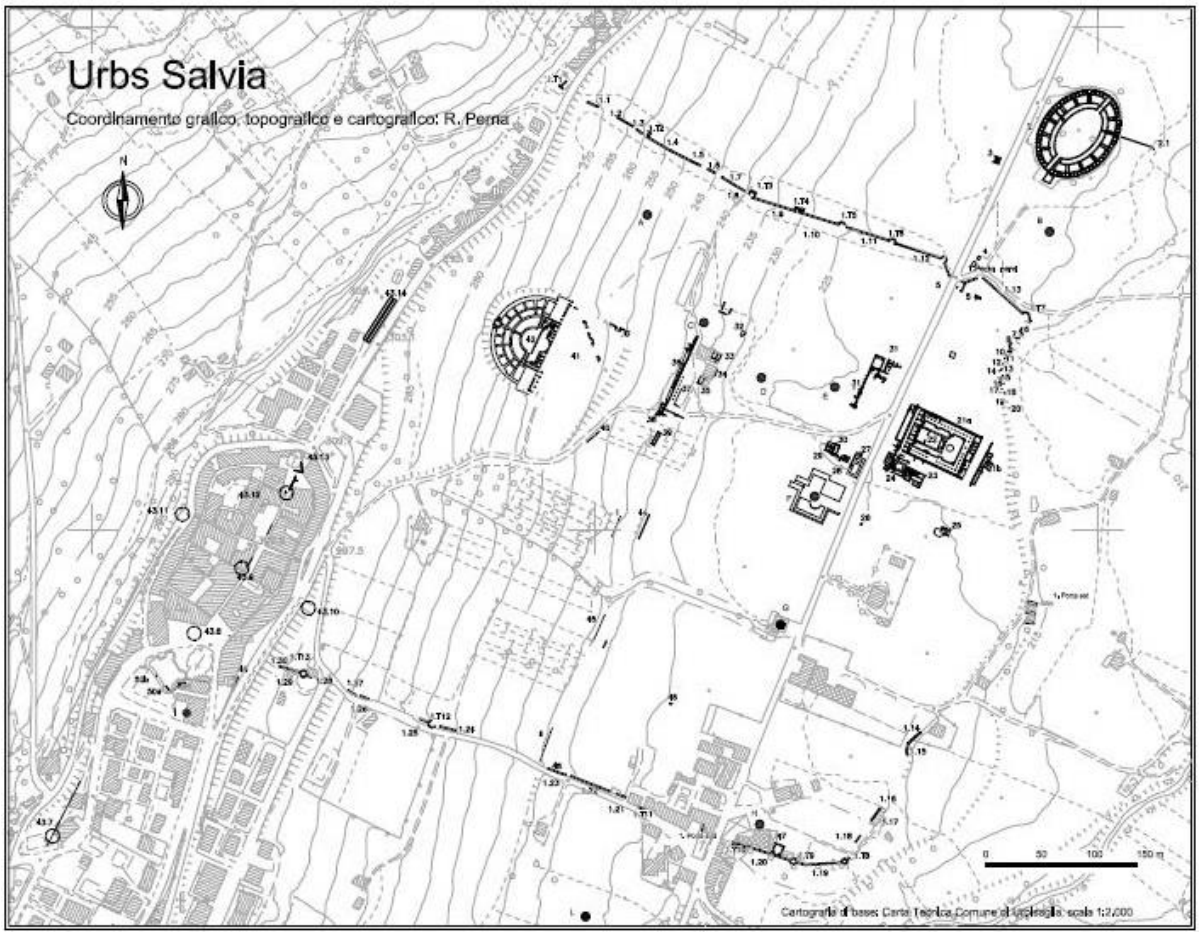


Figure 182 Map of *Urbs Salvia* (After Perna 2006).

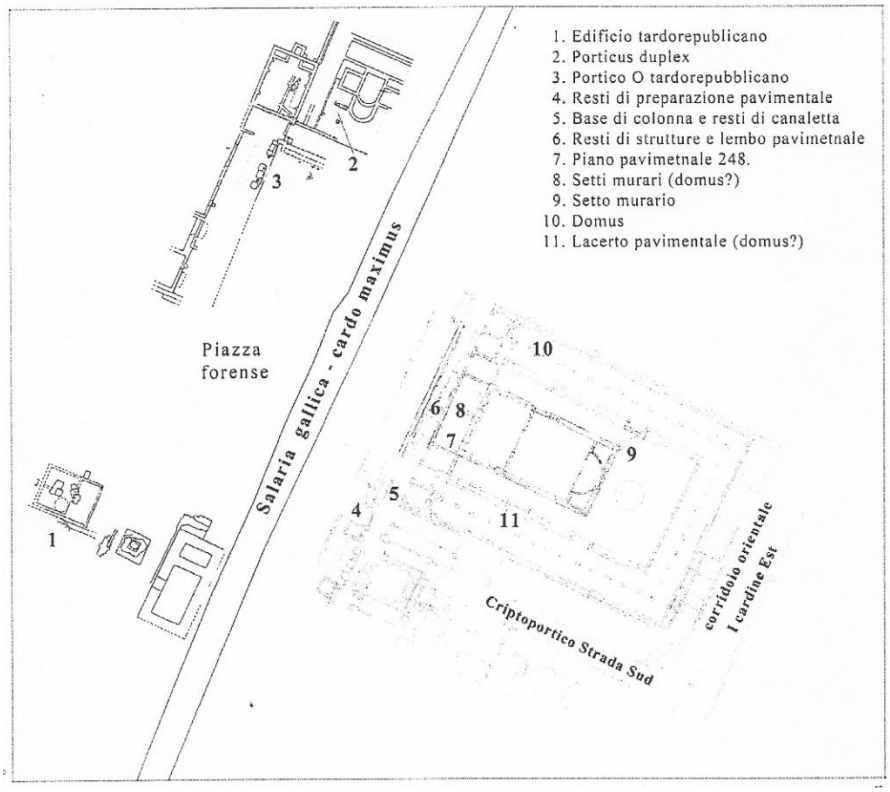


Figure 183 Map of the central *forum* area of *Urbs Salvia* (After Fabrini 2013a, 65, fig. 28).

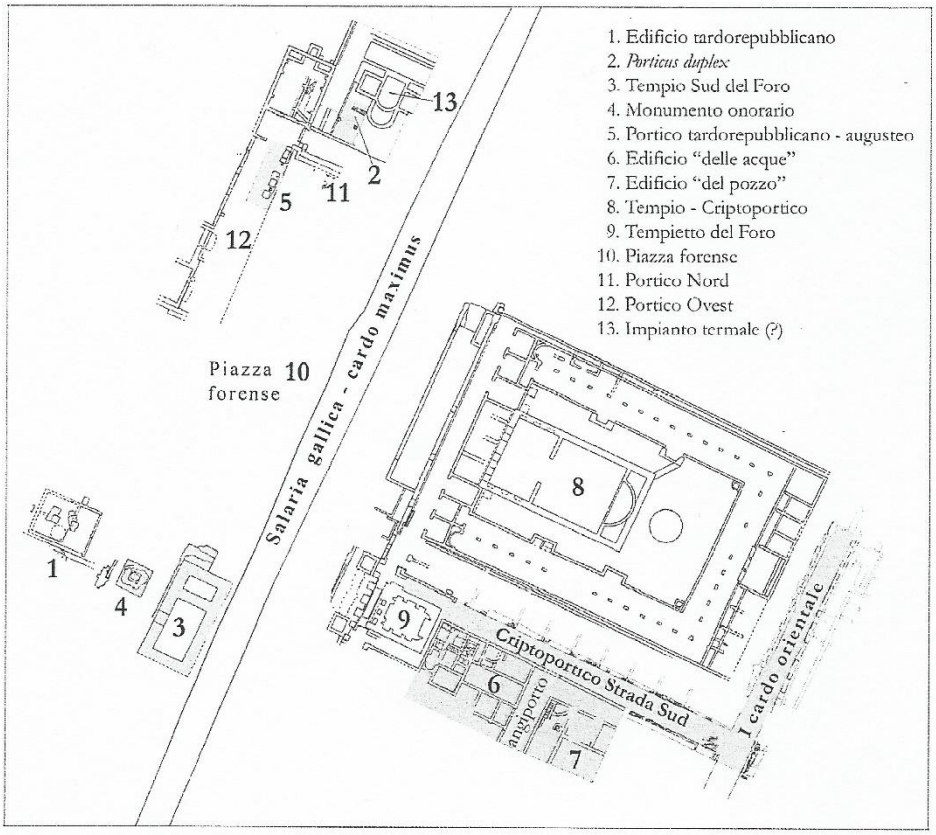


Figure 184 Central *forum* area of *Urbs Salvia* (After Fabrini 2013a, 70, fig. 34).

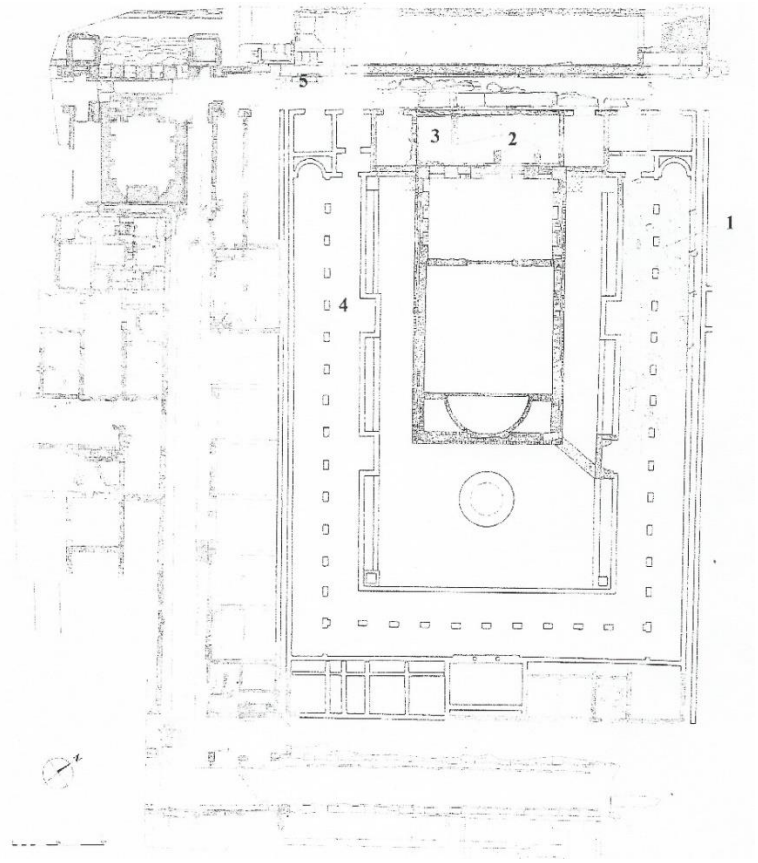


Figure 185 Remains of house structures under the Imperial temple complex of Urbs Salvia (After Montali 2013, 120, fig. 1).

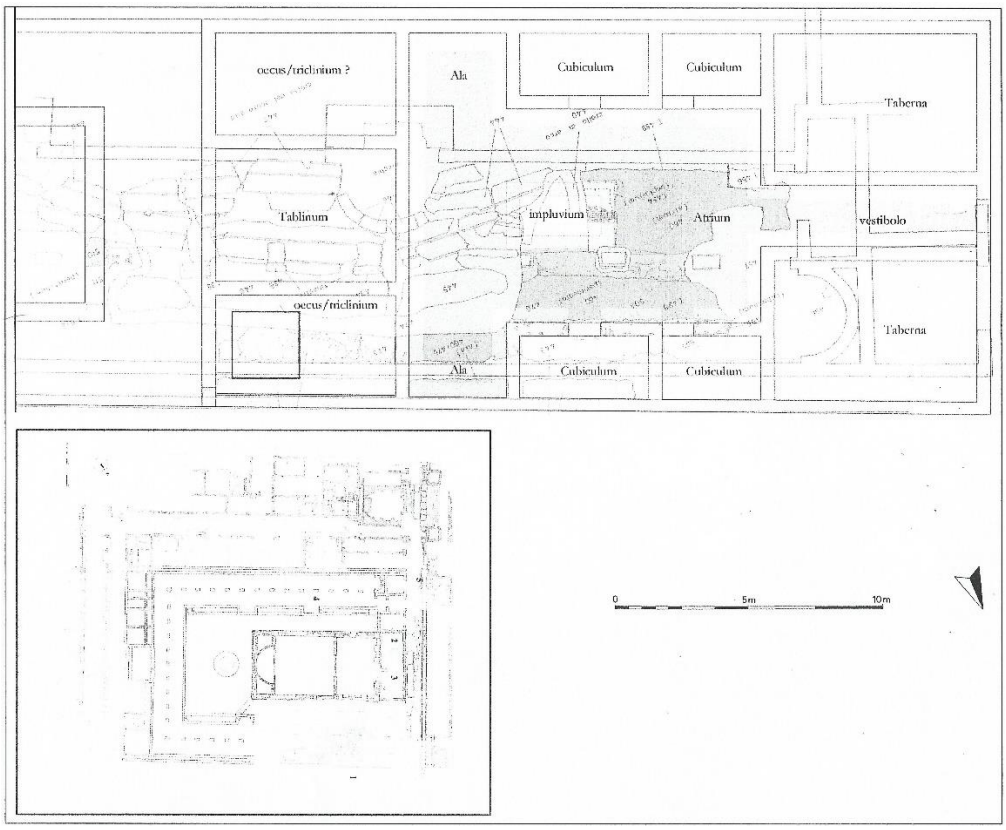


Figure 186 Reconstruction of the Republican *domus* under the Imperial temple complex of *Urbs Salvia* (After Montali 2013, 132, fig. 16).

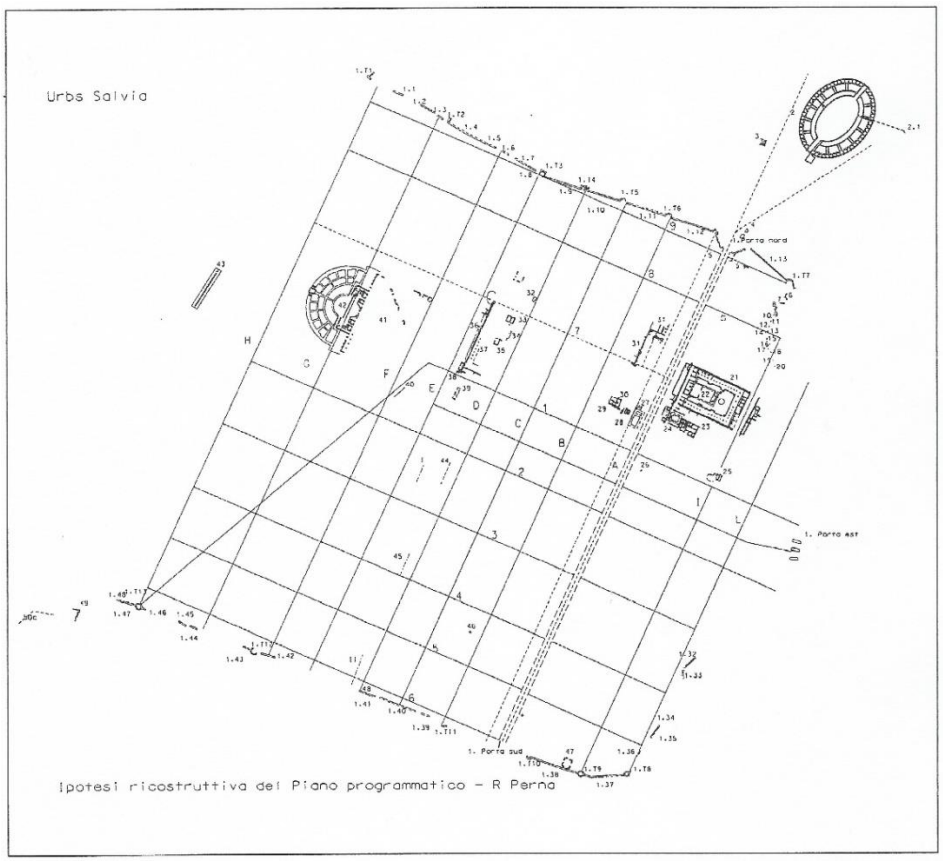


Figure 187 Reconstruction of the town plan of *Urbs Salvia* (After Perna 2013b, 249, fig. 20-.

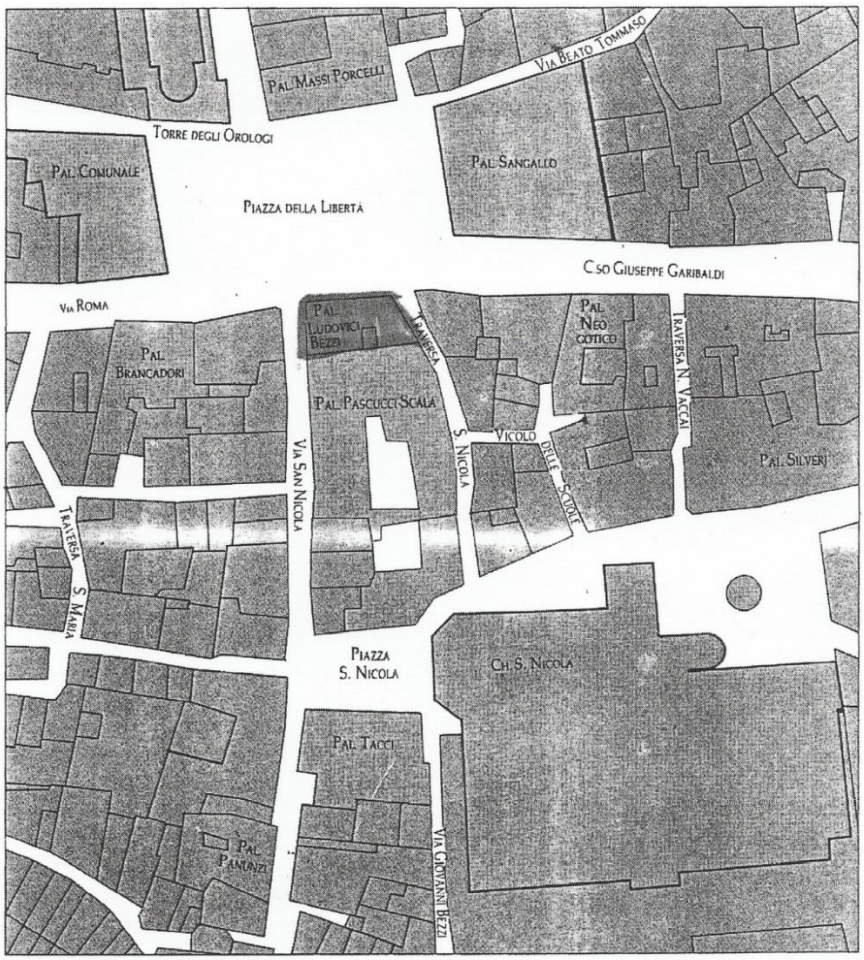


Figure 188 Indication of the excavations under the Palazzo Ludovico Bezzi in the town centre of Tolentino (After Lassi Secondari 1988, 188, fig. 18).

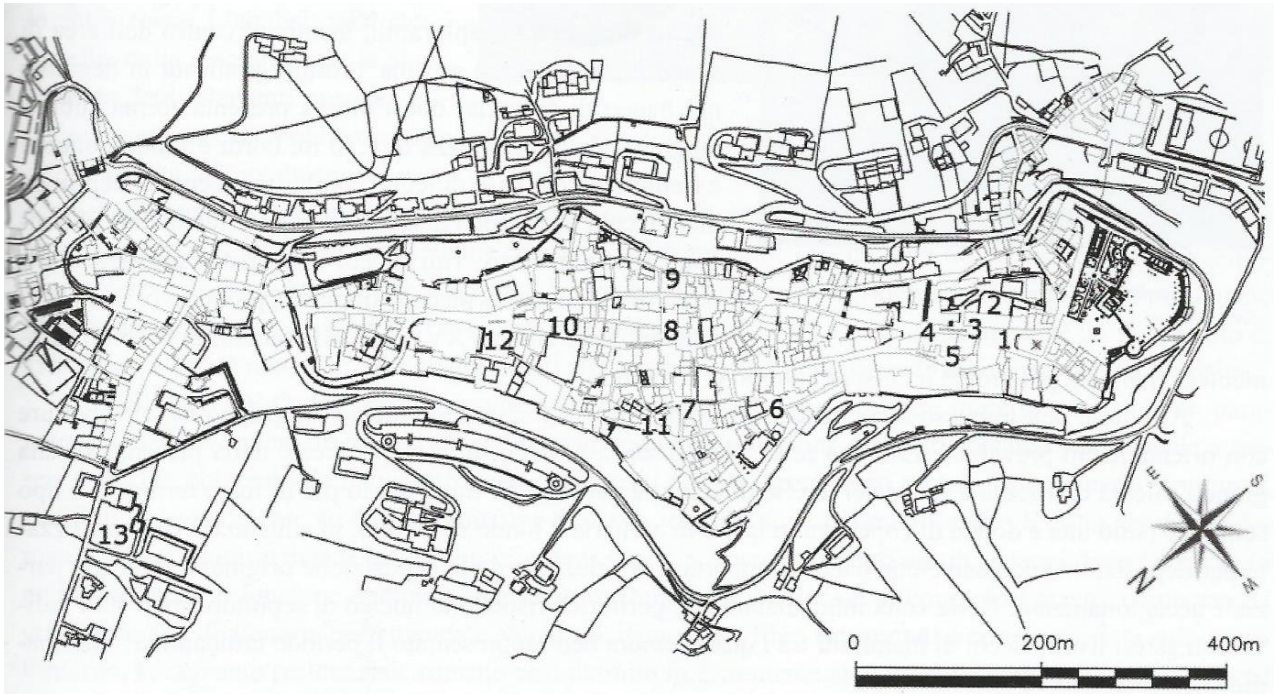


Figure 189 Map of Camerino with indication of recent archaeological finds (2006-2011) (After Silvestrini/Antongirolami/D'Ulizia 2014, 659, fig. 1).



Figure 190 Map of Camerino with the indication of the remains of the Roman town (After Lilli 2001, 140, fig. 14).

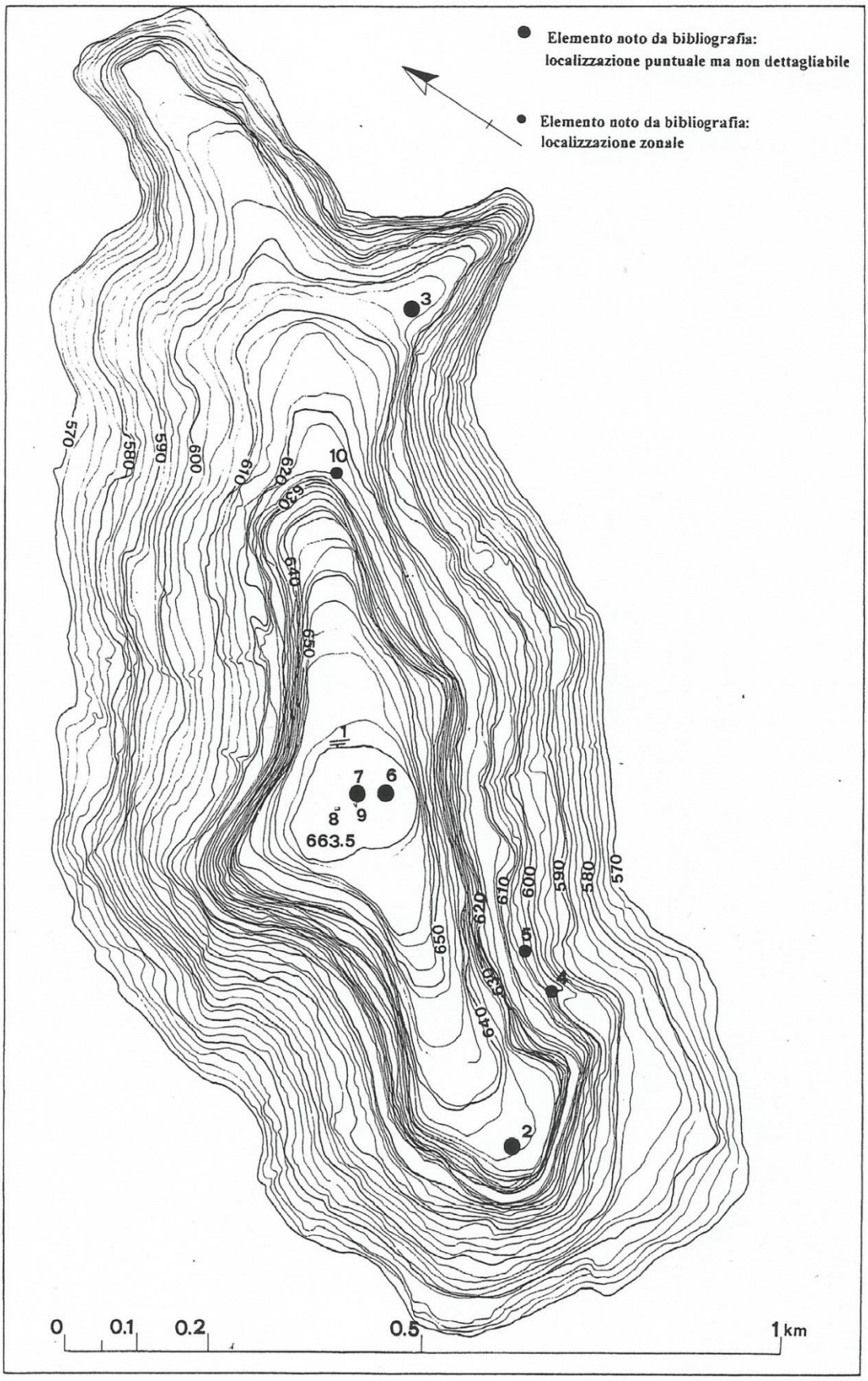


Figure 191 Morphological map of Camerino with the indication of the Roman remains (After Lilli 2001, 141, fig. 15).

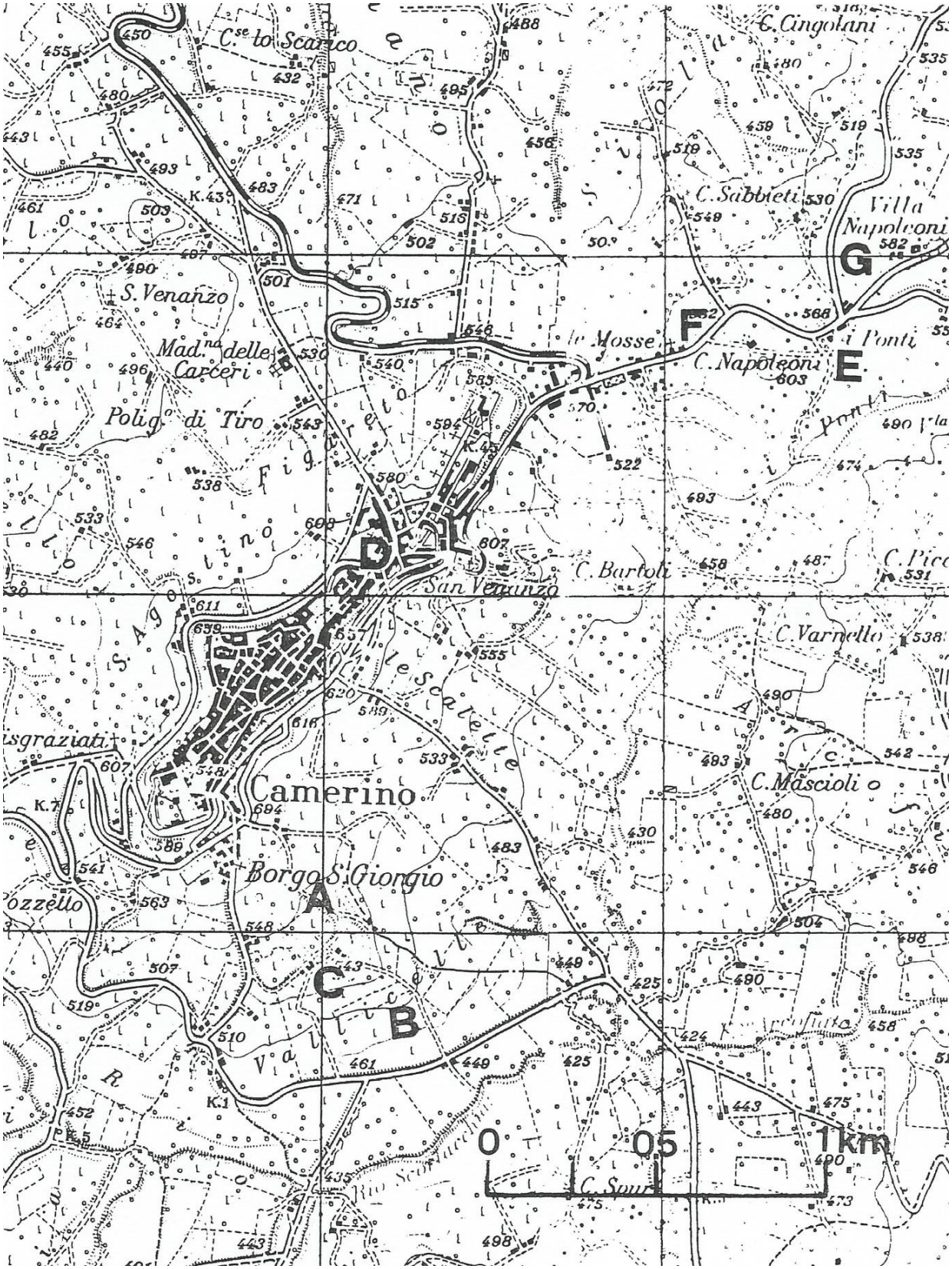


Figure 192 Topographical map of the area around Camerino (After Lilli 2001, 134, fig. 10).

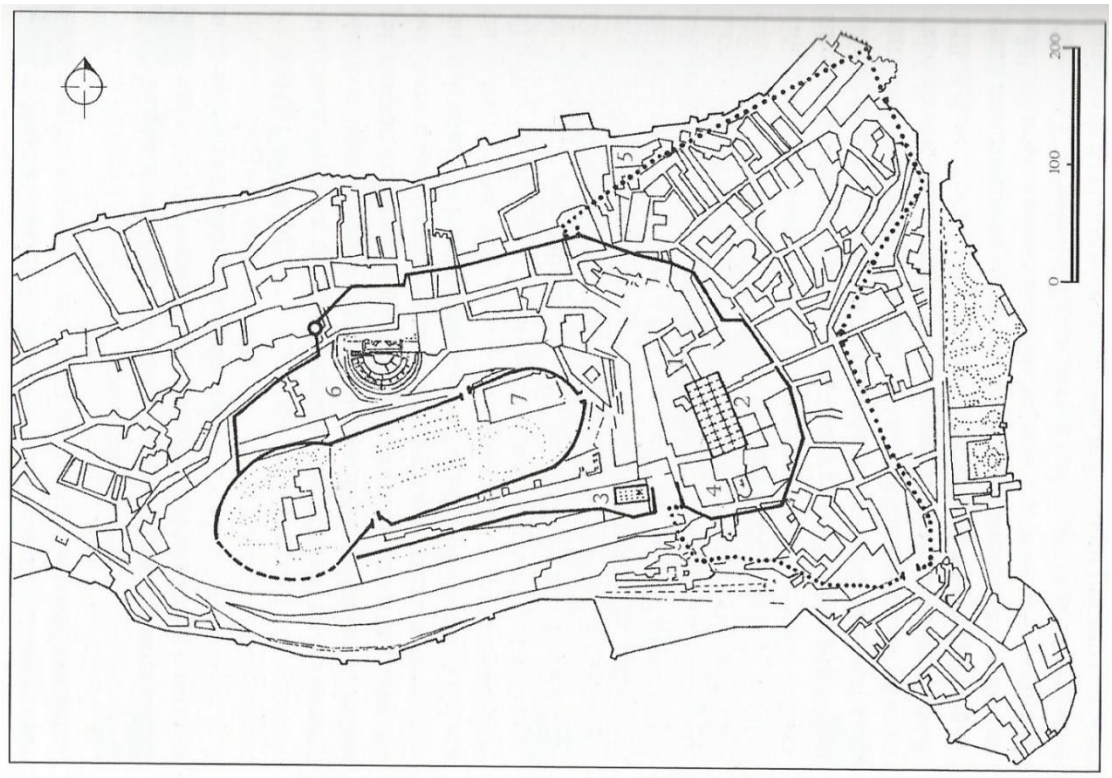


Figure 193 Map of modern Fermo with indication of the *forum* (1), large cistern (2), small cistern (3), thermal complex (4), nymphaeum (5), theatre (6), and paleochristian basilica (7) (After Sisani 2006, 370).

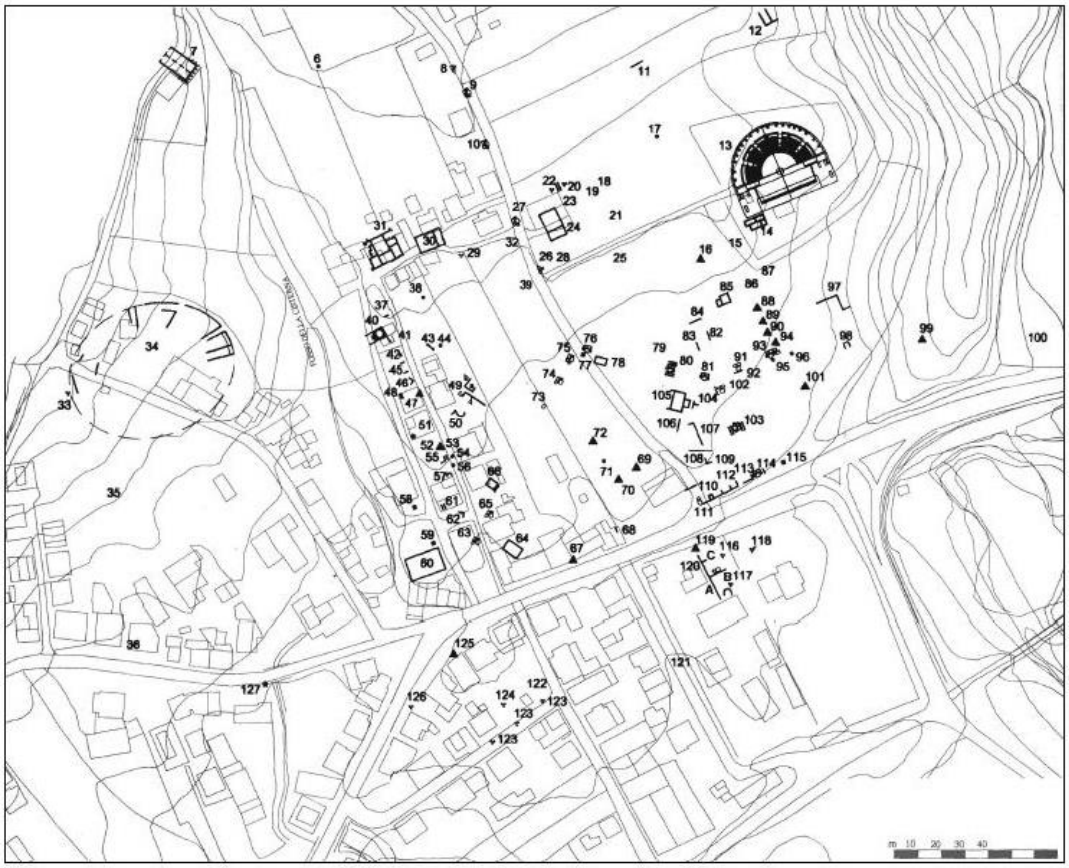


Figure 194 Map of *Falerio* (After Maraldi 2002).

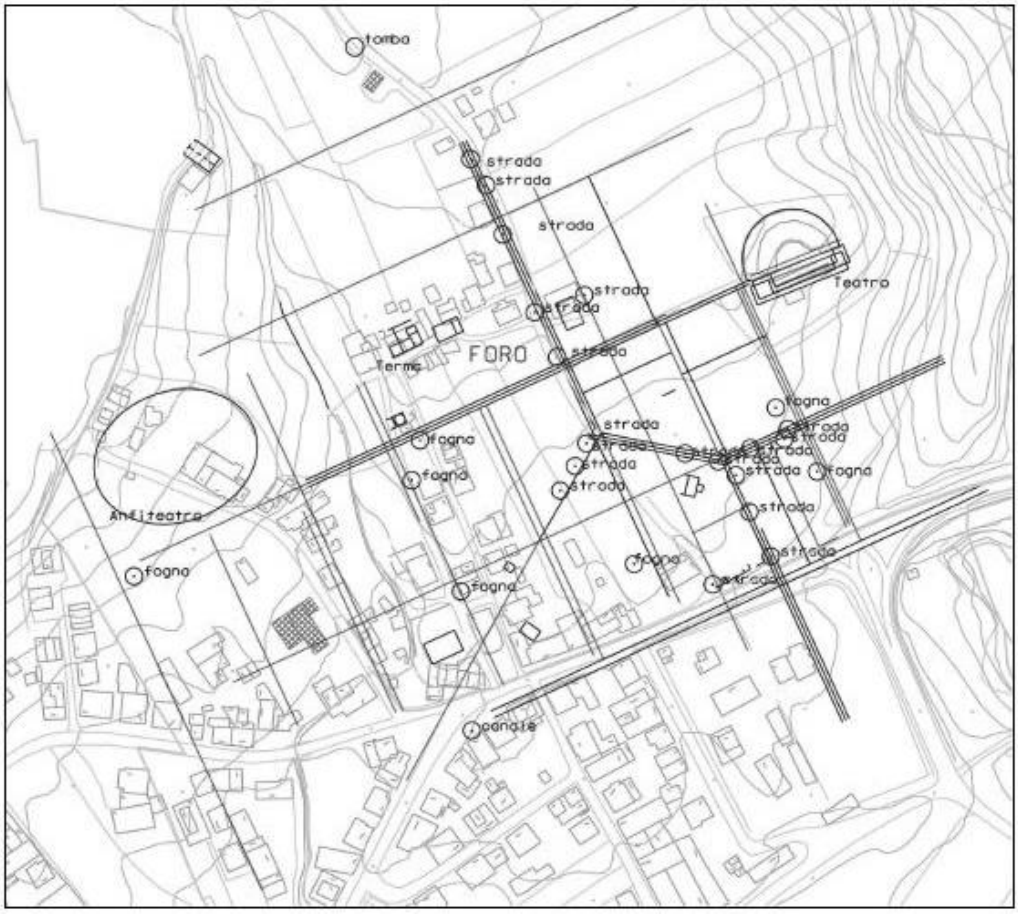


Figure 195 Map of the reconstructed street grid of *Falerio* (After Perna 2012, 408, fig. 25).

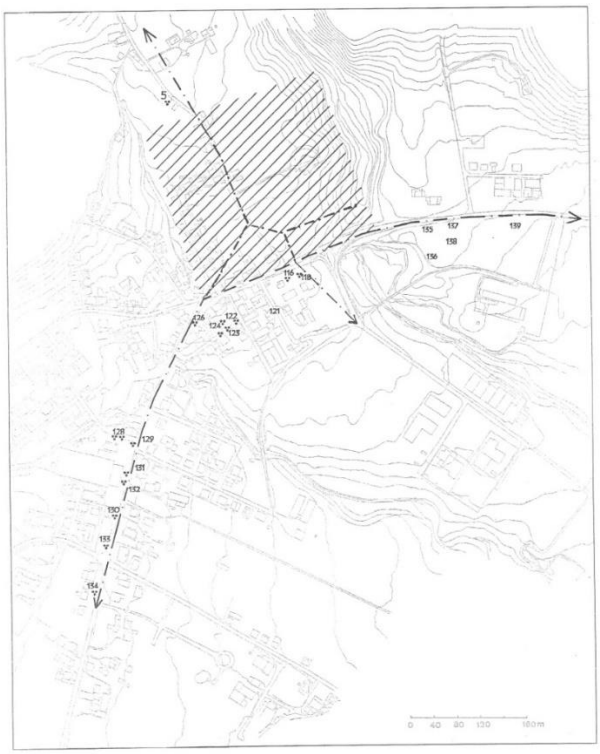


Figure 196 Map of Falerio with the indication of the Roman cemeteries (After Maraldi 2002, 95, fig. 102).

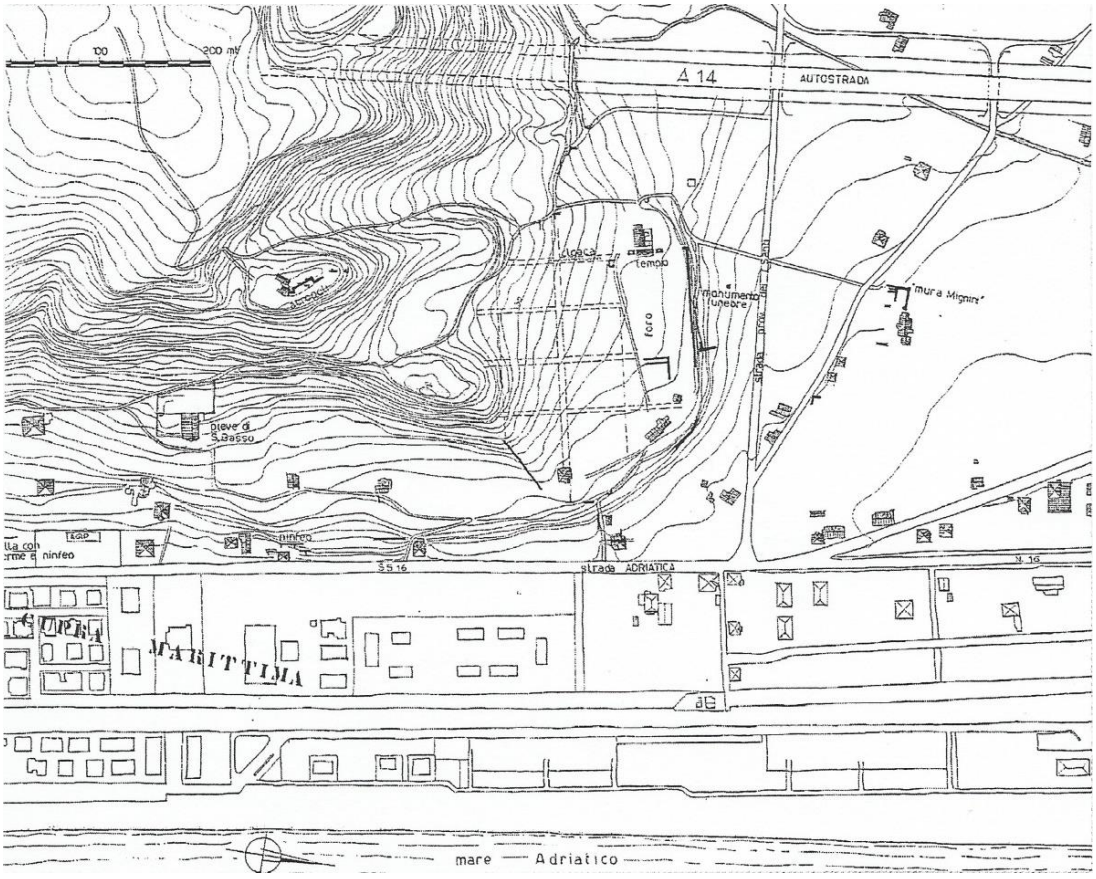


Figure 197 Map of the remains of *Cupra Maritima* (After Percossi 2003, 141, fig. 7).

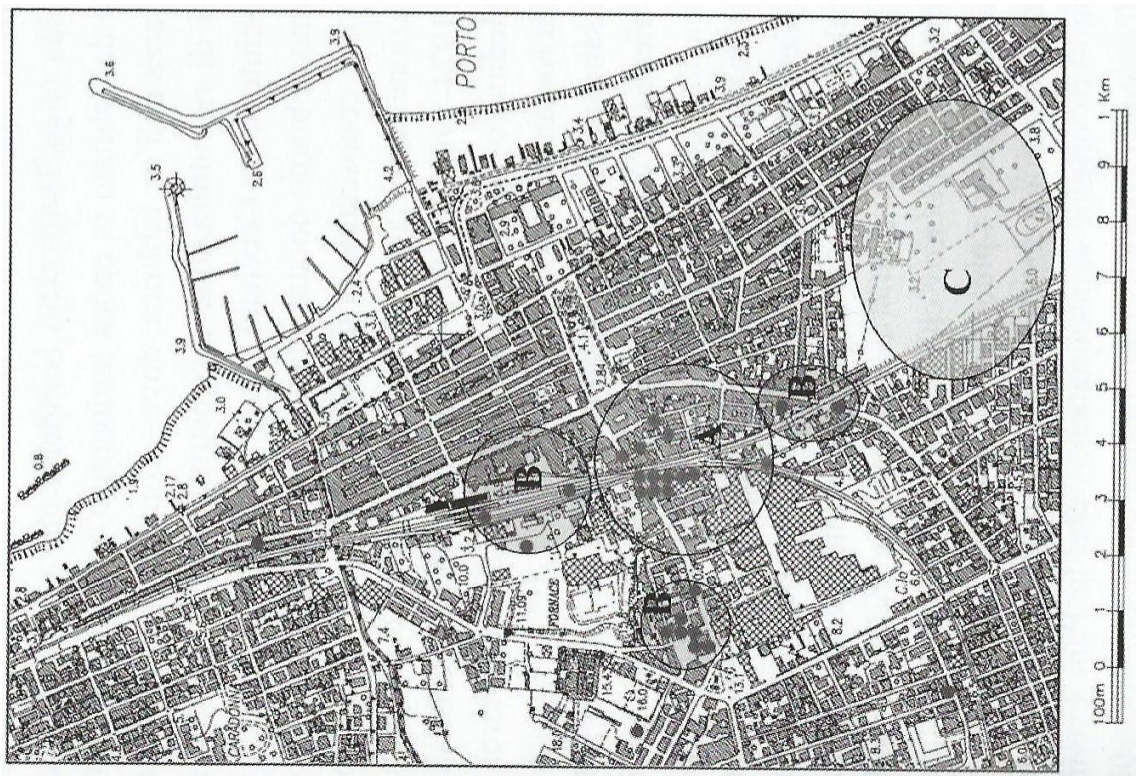


Figure 198 Map of modern Civitanova Marche (Cluana) with indication of the main archaeological areas: residential (A), funerary (B), and harbour zone (C) (After Profumo 2014, 749, fig. 24).

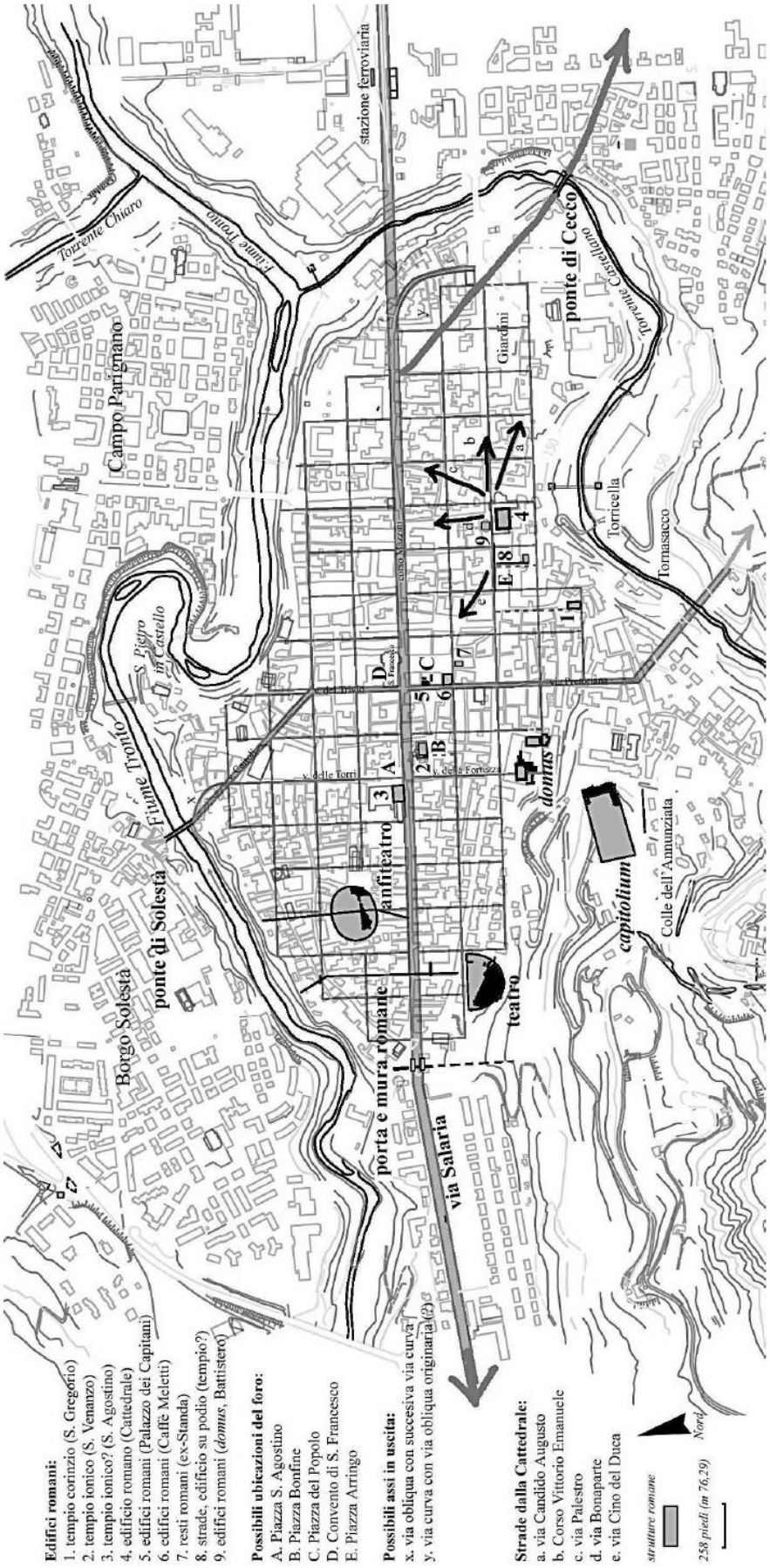


Figure 199 Map of *Asculum* (After Giorgi 2005, 210, fig. 2).

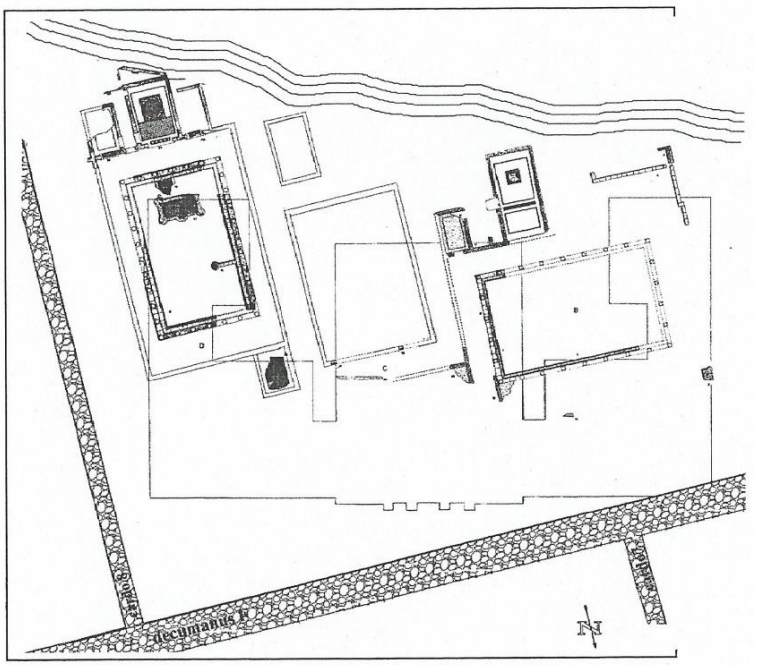


Figure 200 Reconstruction of the three domus buildings at Ascoli Piceno (After Profumo 2009, 518, fig. 16).

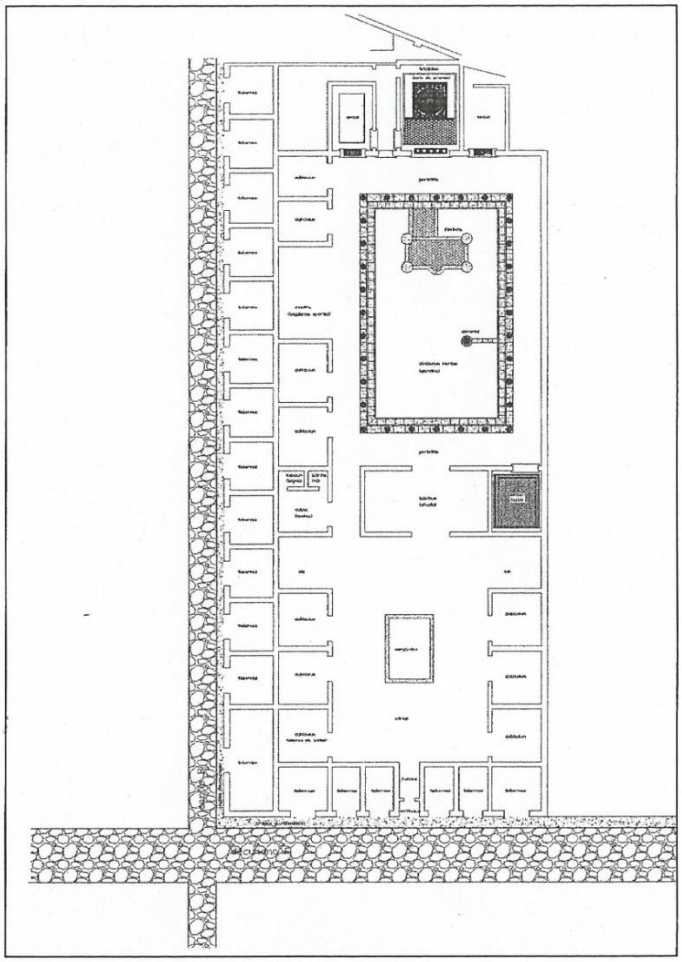


Figure 201 Reconstruction of the first *domus* at Ascoli Piceno (After Profumo 2009, 519, fig. 17).

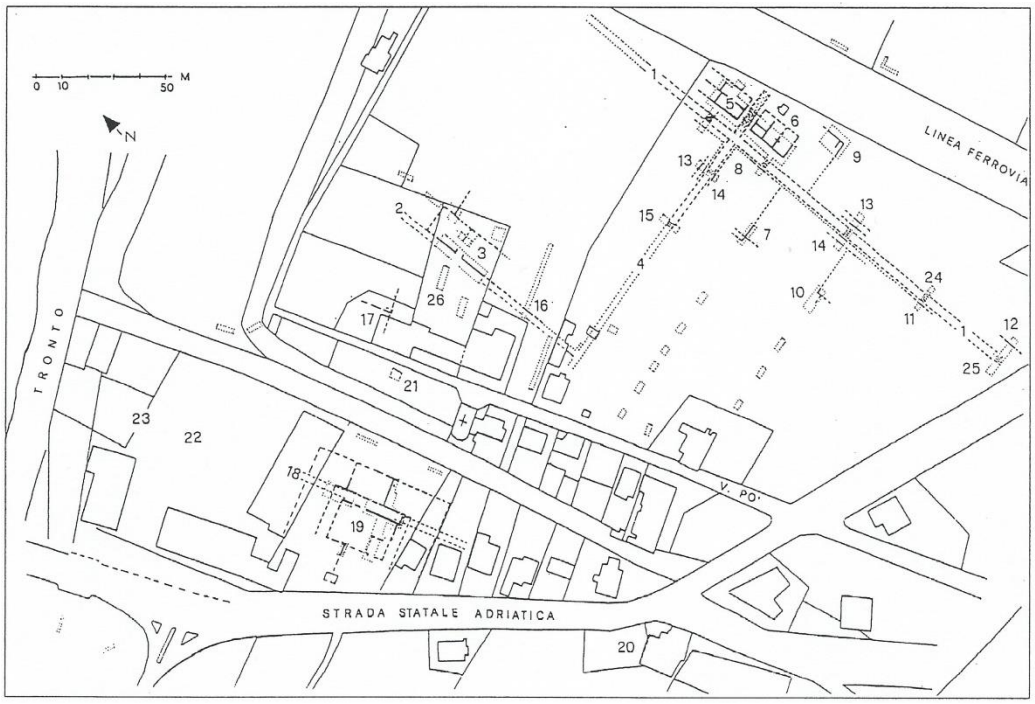


Figure 202 Map with indication of the remains of *Castrum Truentinum* in Case Feriozzi di Martinsicuro (After Staffa 1998, 37, fig. 9).



Figure 203 General topographical map of the lower Tronto river basin near Case Feriozzi di Martinsicuro (After Staffa 1998, 35, fig. 8).

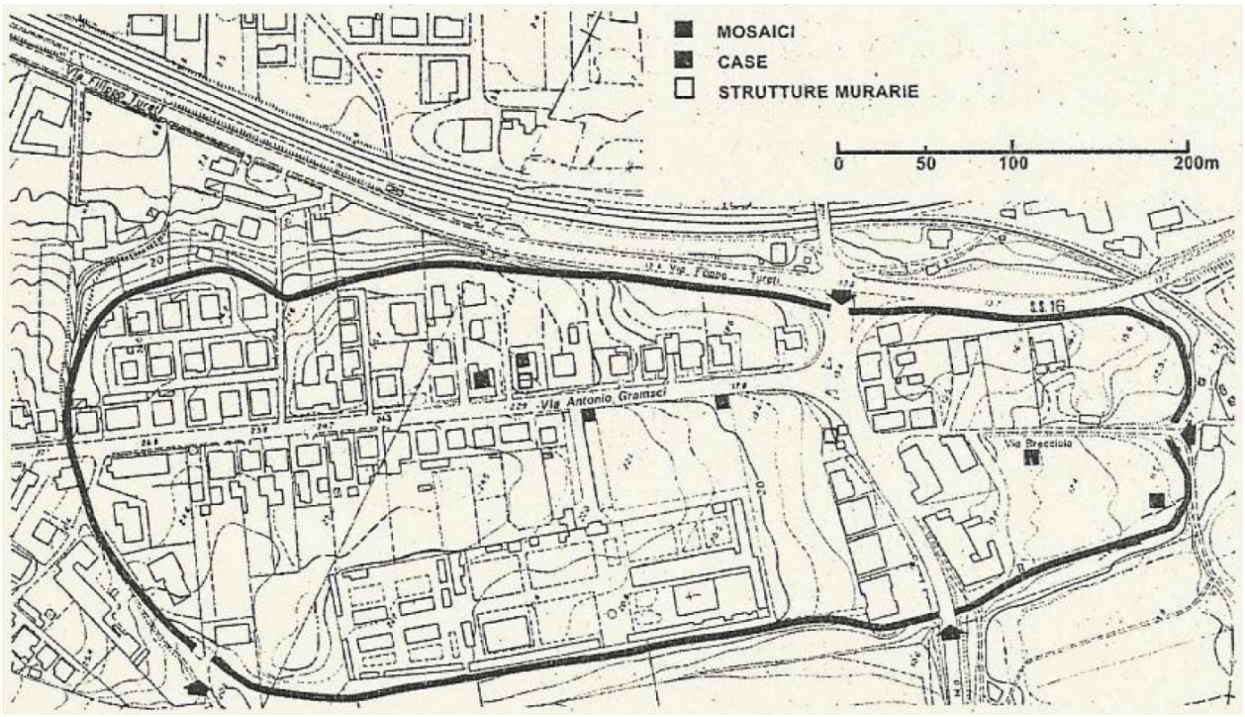


Figure 204 Map of *Castrum Novum* (After Angeletti 2006, 174, 272).

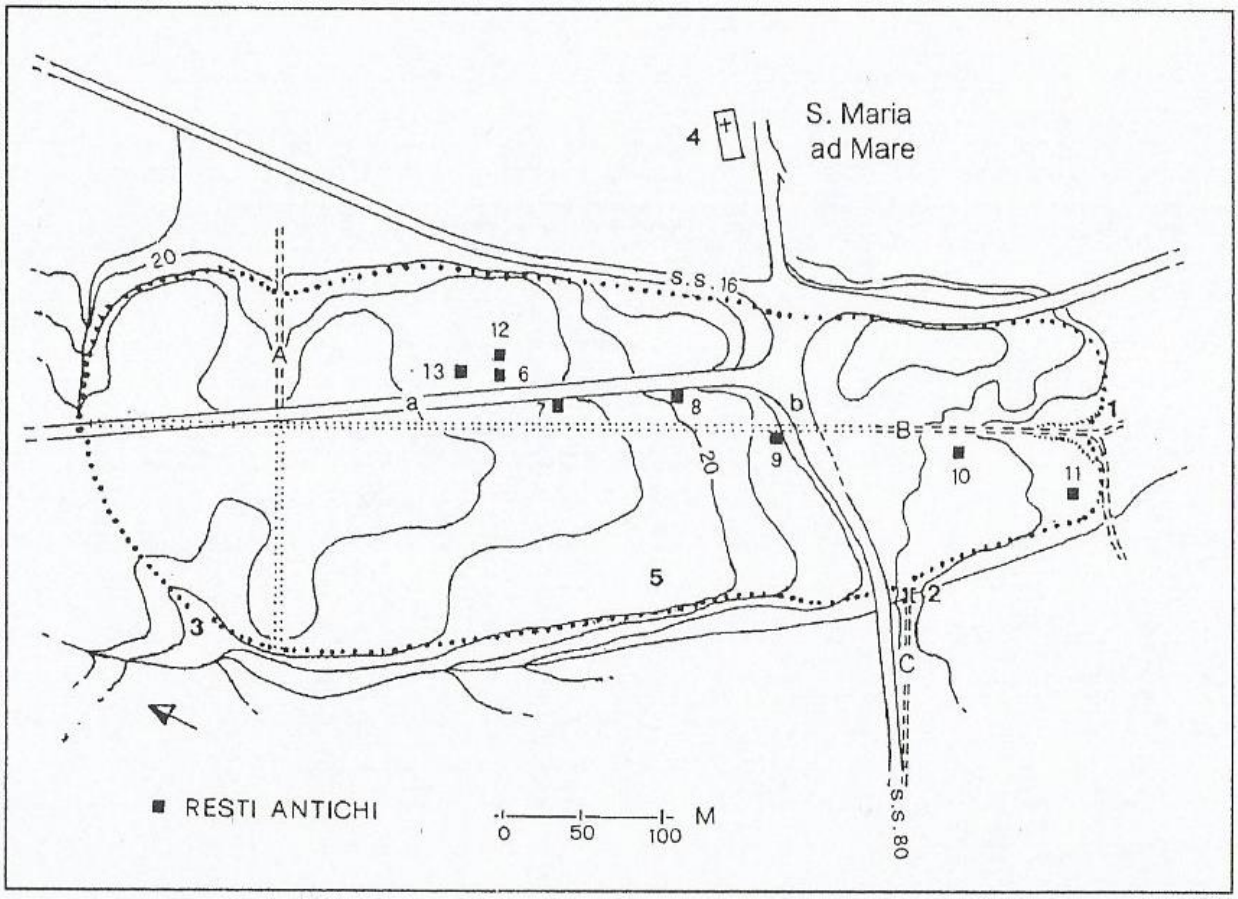


Figure 205 Map of *Castrum Novum* (After Staffa 2002, 31, fig. 9).

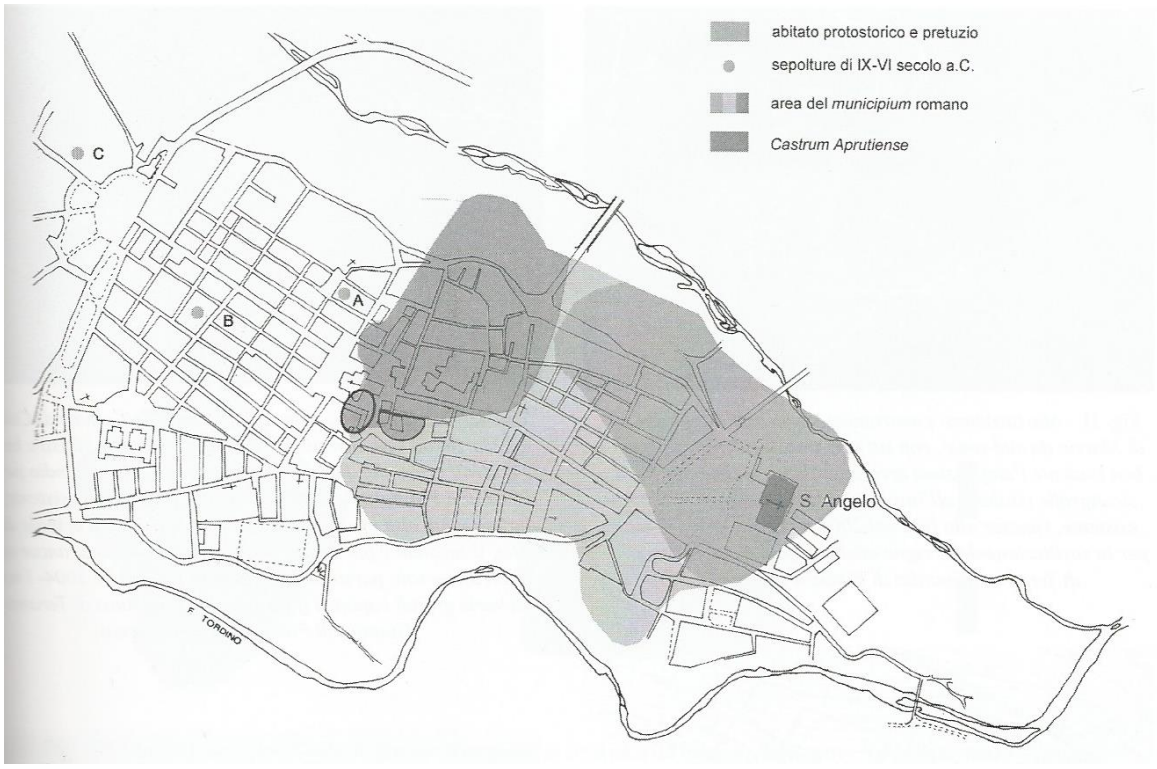


Figure 206 Map of Interamnia Praetuttiorum (Teramo) (After Staffa 1998).

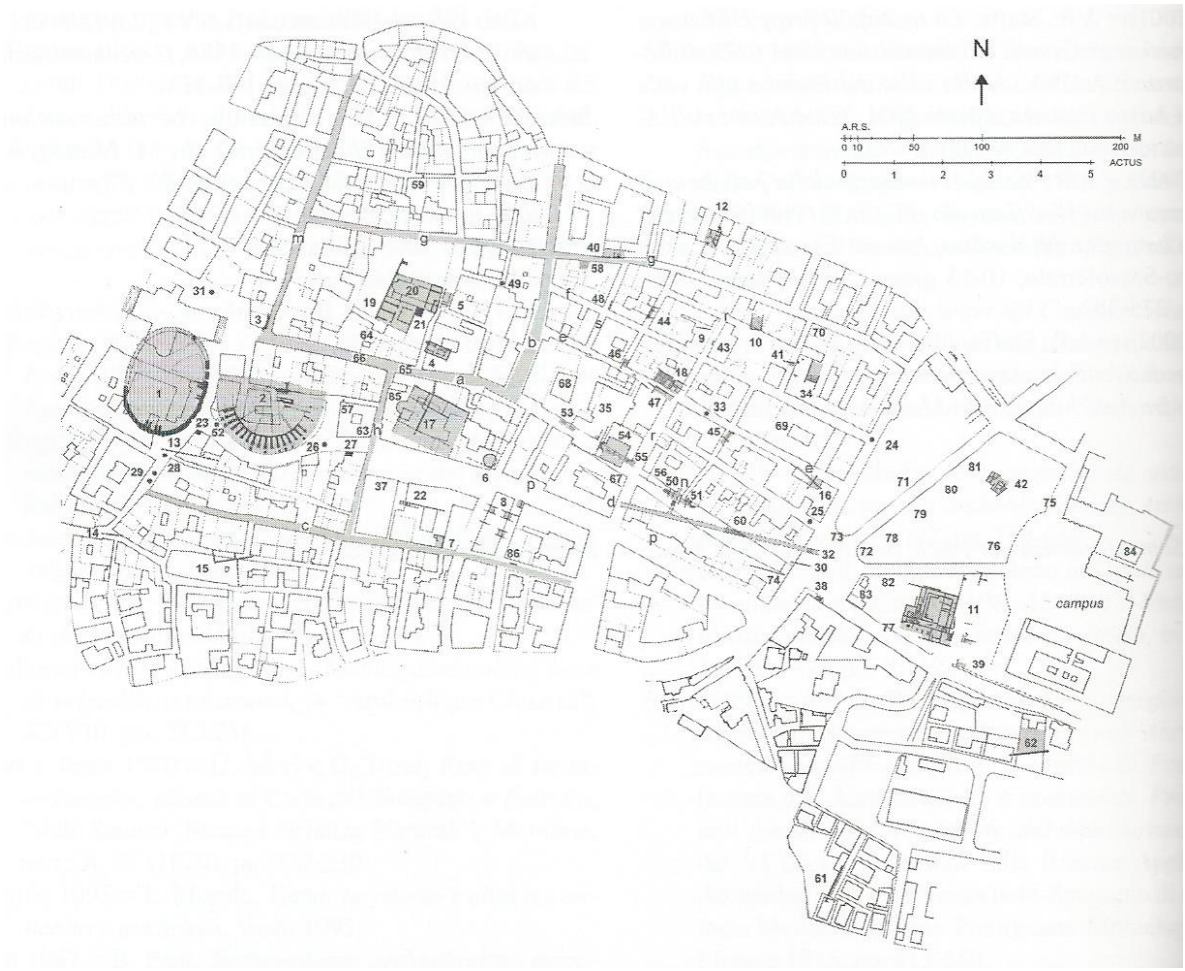


Figure 207 Map of *Interamnia Praetuttiorum* (Teramo) (After Staffa 1998).

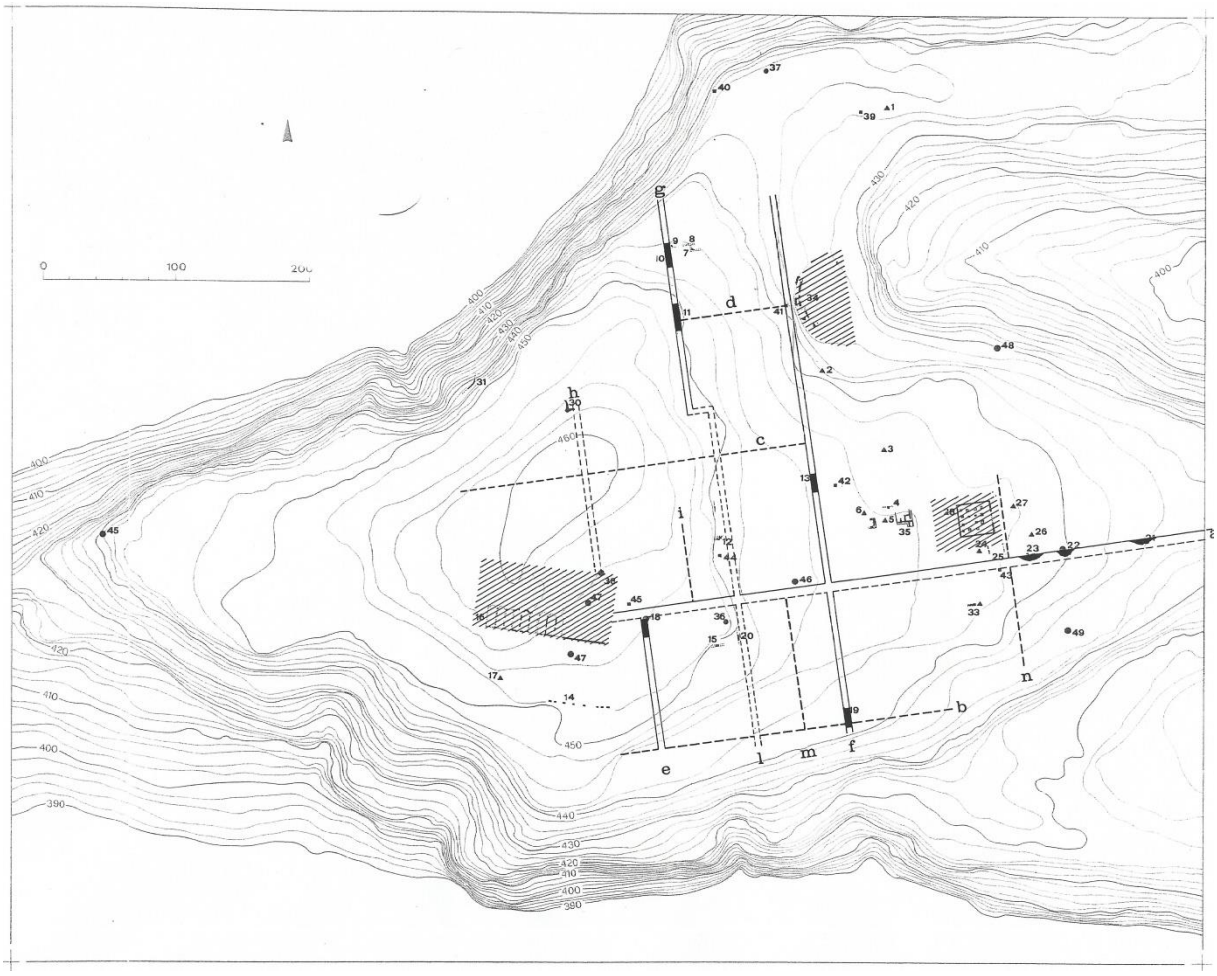


Figure 208 Town map of *Hatria* (Atri) (After Azzena 1987, fig. 85).

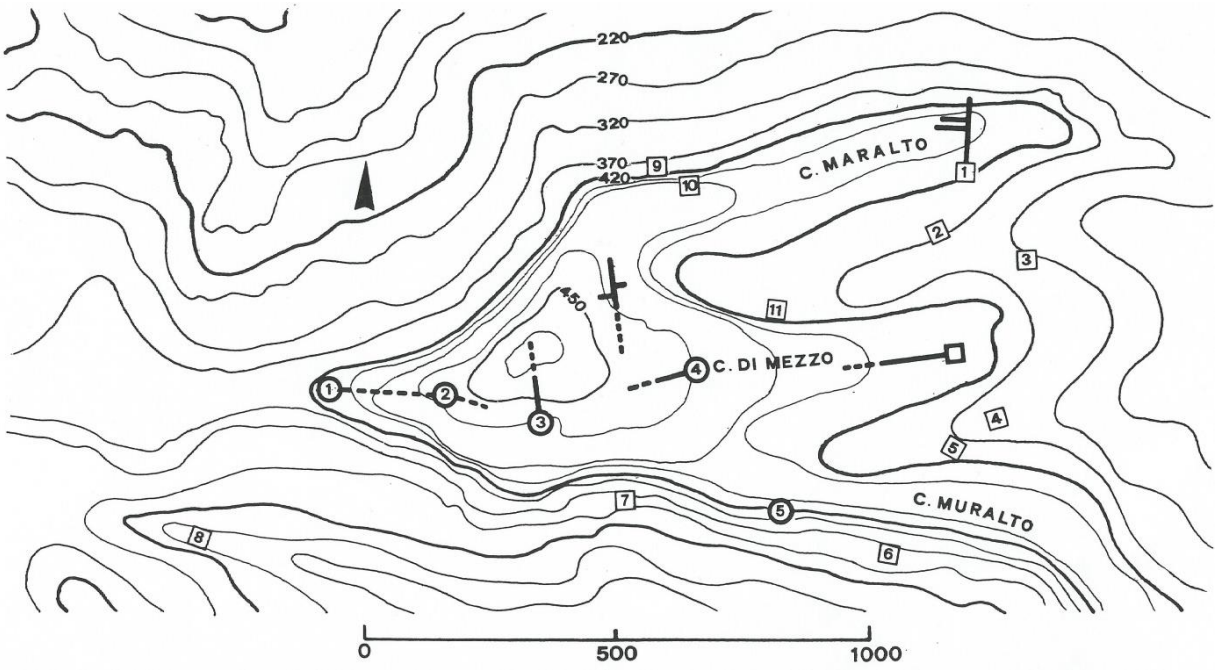


Figure 209 Topographical map of Atri with the indication of the three eastern hills (After Azzena 1987, 66, fig. 73).

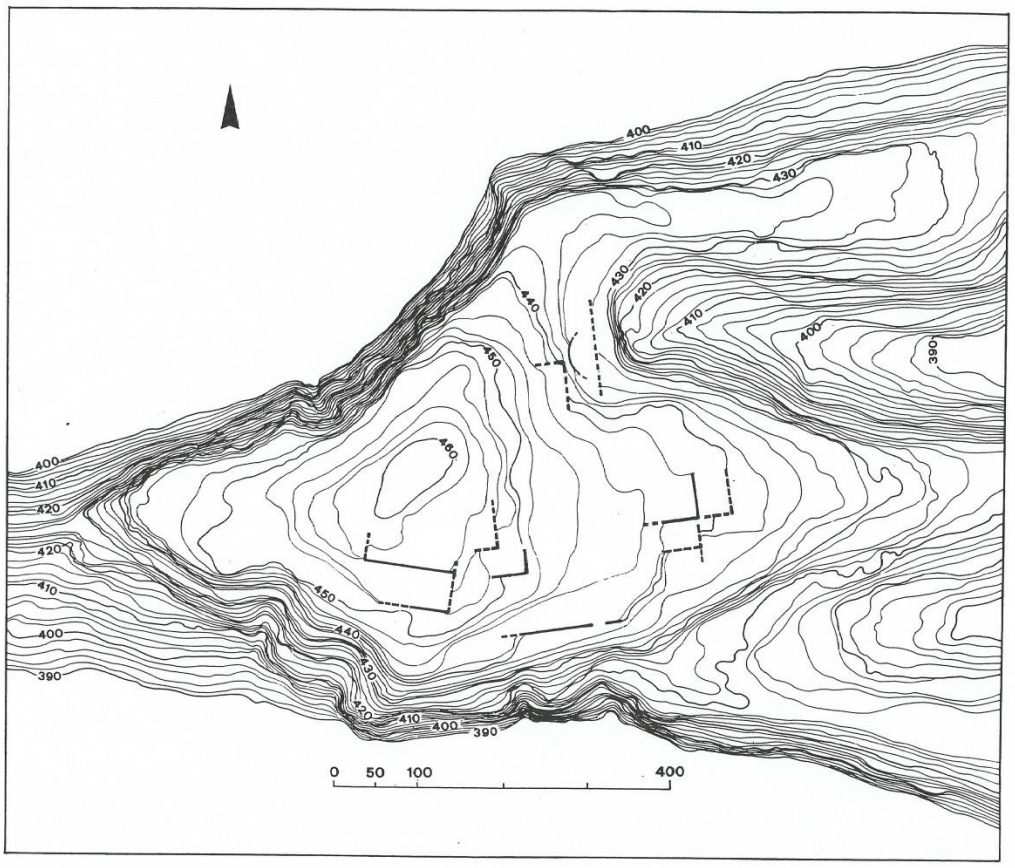


Figure 210 Map of Atri with the indication of the identified terrace works (After Azzena 1987, 68, fig. 74).

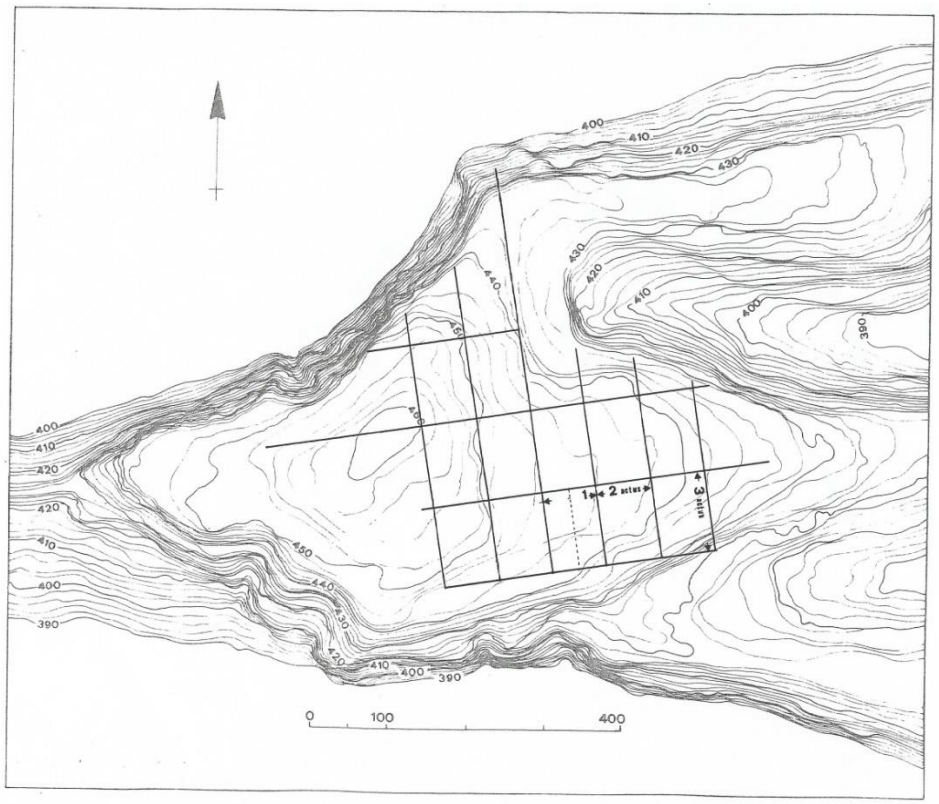


Figure 211 Reconstruction of the street grid of *Hatria* (After Azzena 1987, 88, fig. 86).

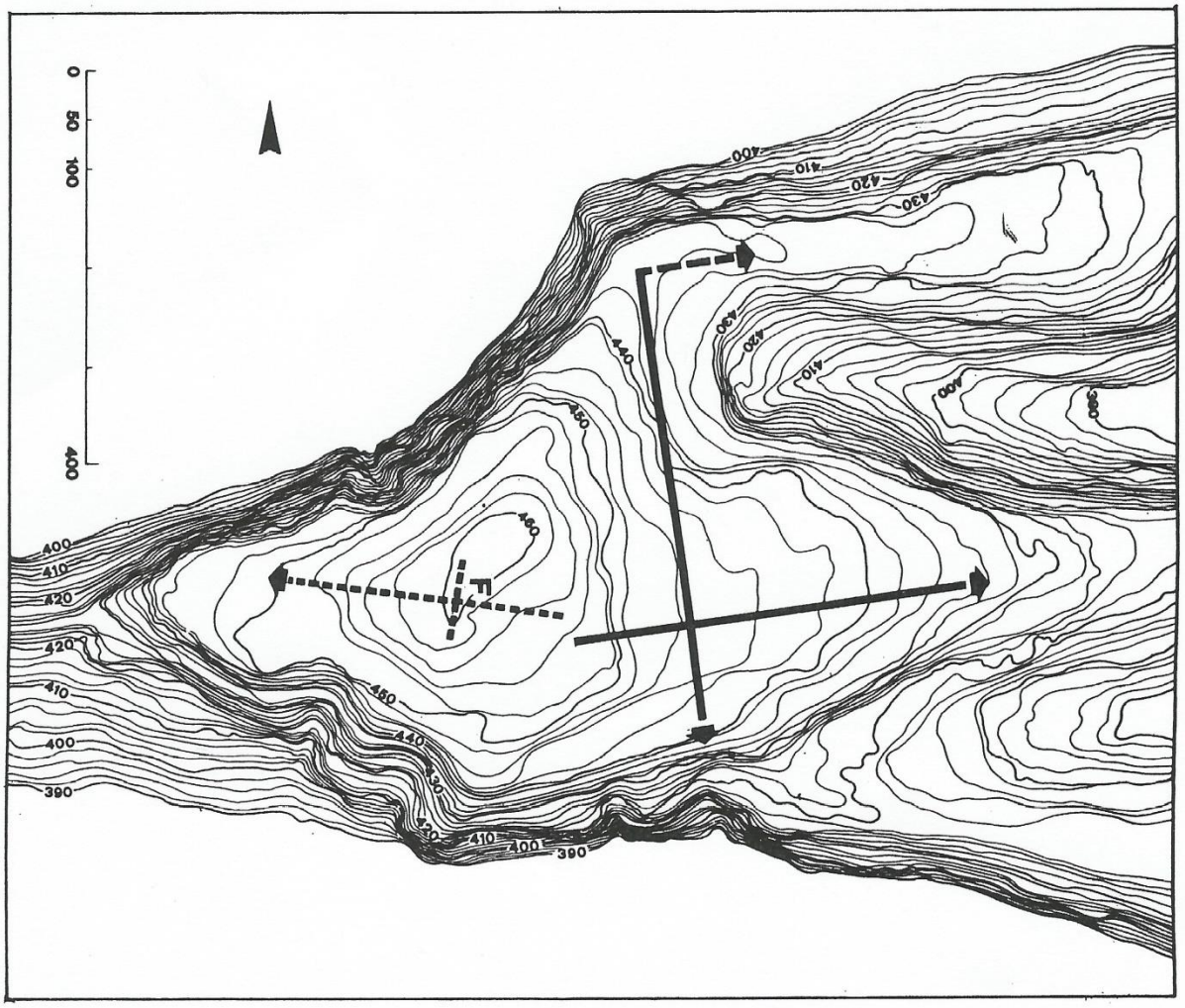


Figure 212 Map of Atri with the indication of the two street axes (After Azzena 1987, 69, fig. 75).

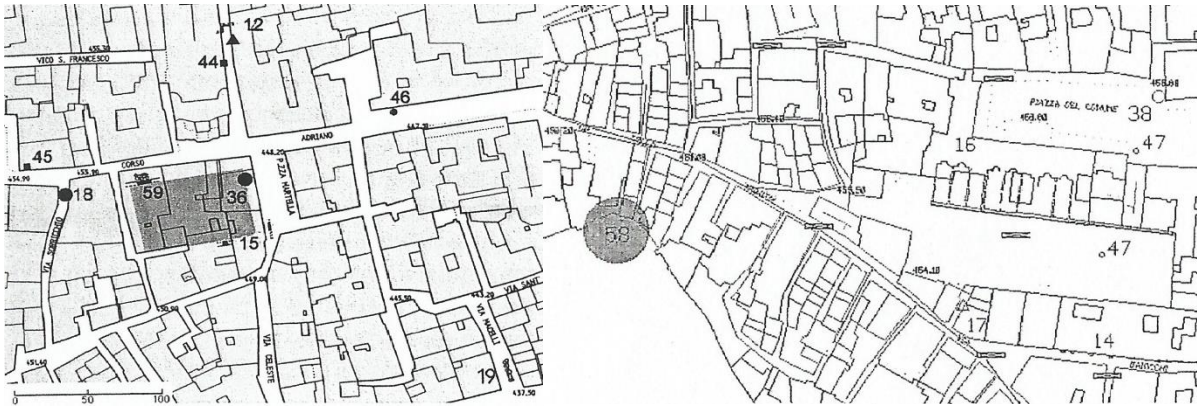


Figure 213 Atri, *forum* and new circuit wall section of *Hatria* (After Azzena 2006, 37, fig. 11; 28, fig. 2).

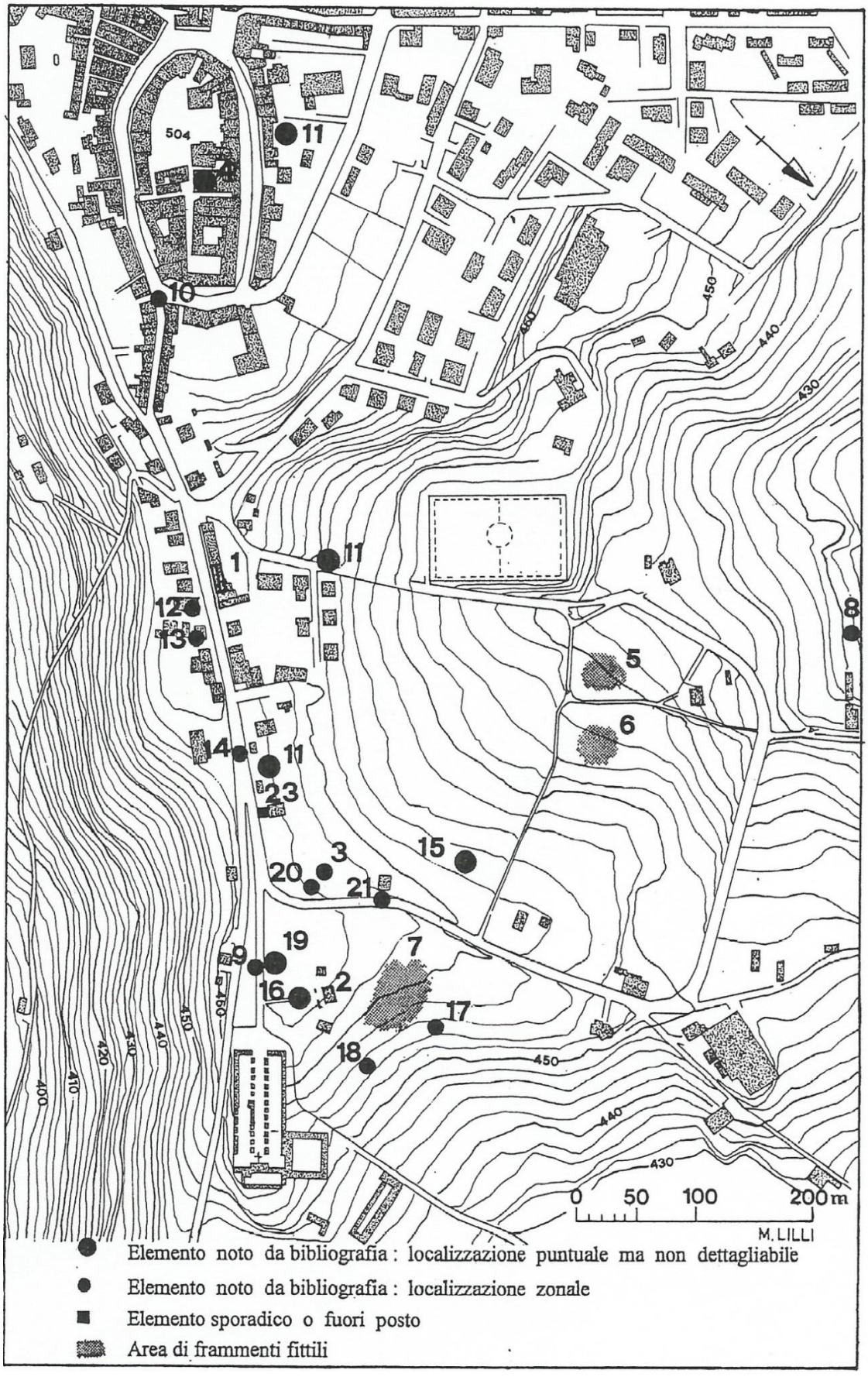


Figure 214 Map of Cupra Montana with indication of the remains belonging to the Roman town (After Lilli 2000, 210, fig. 15).

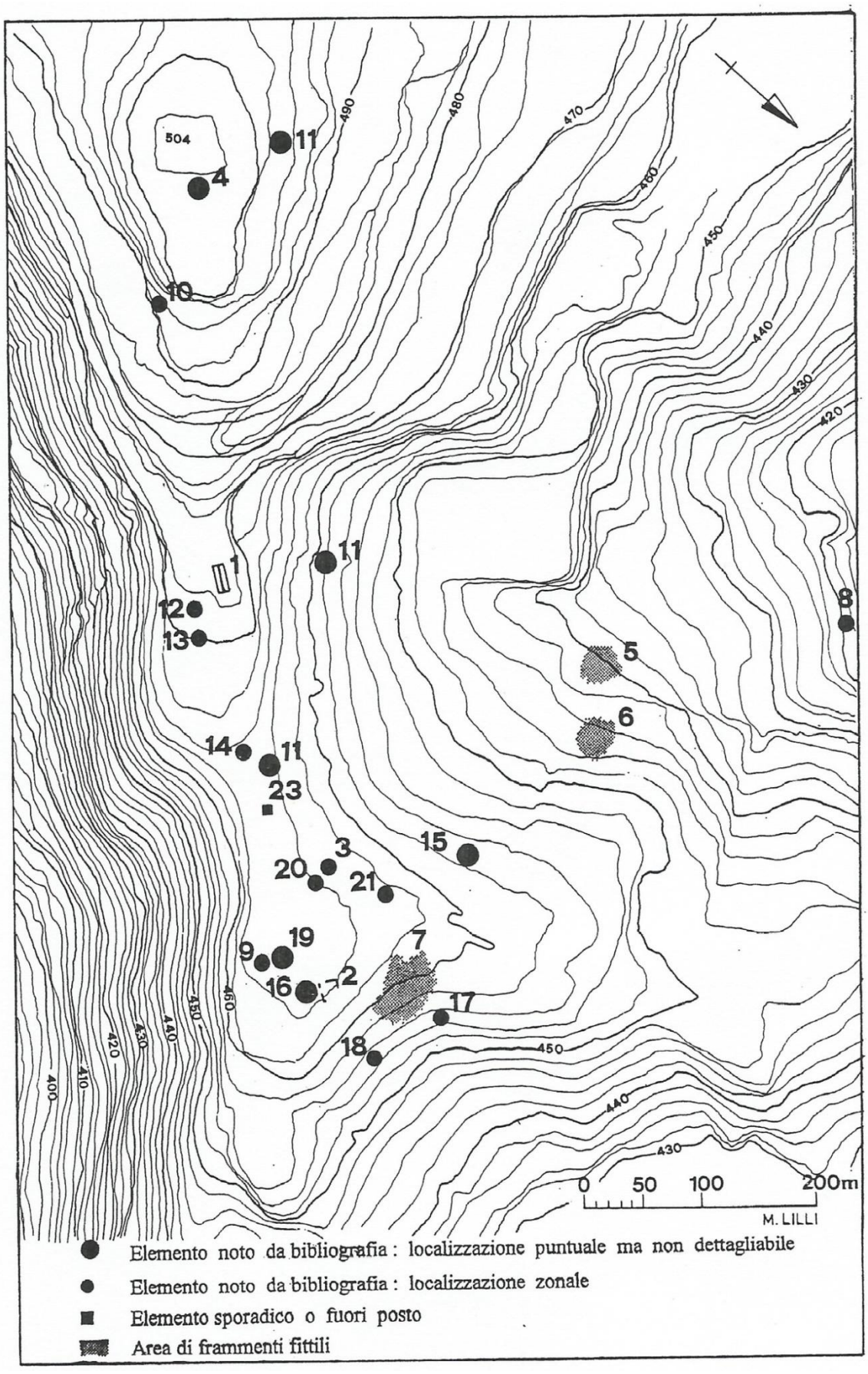


Figure 215 Topographical map of Cupra Montana (After Lilli 2000, 212, fig. 16).

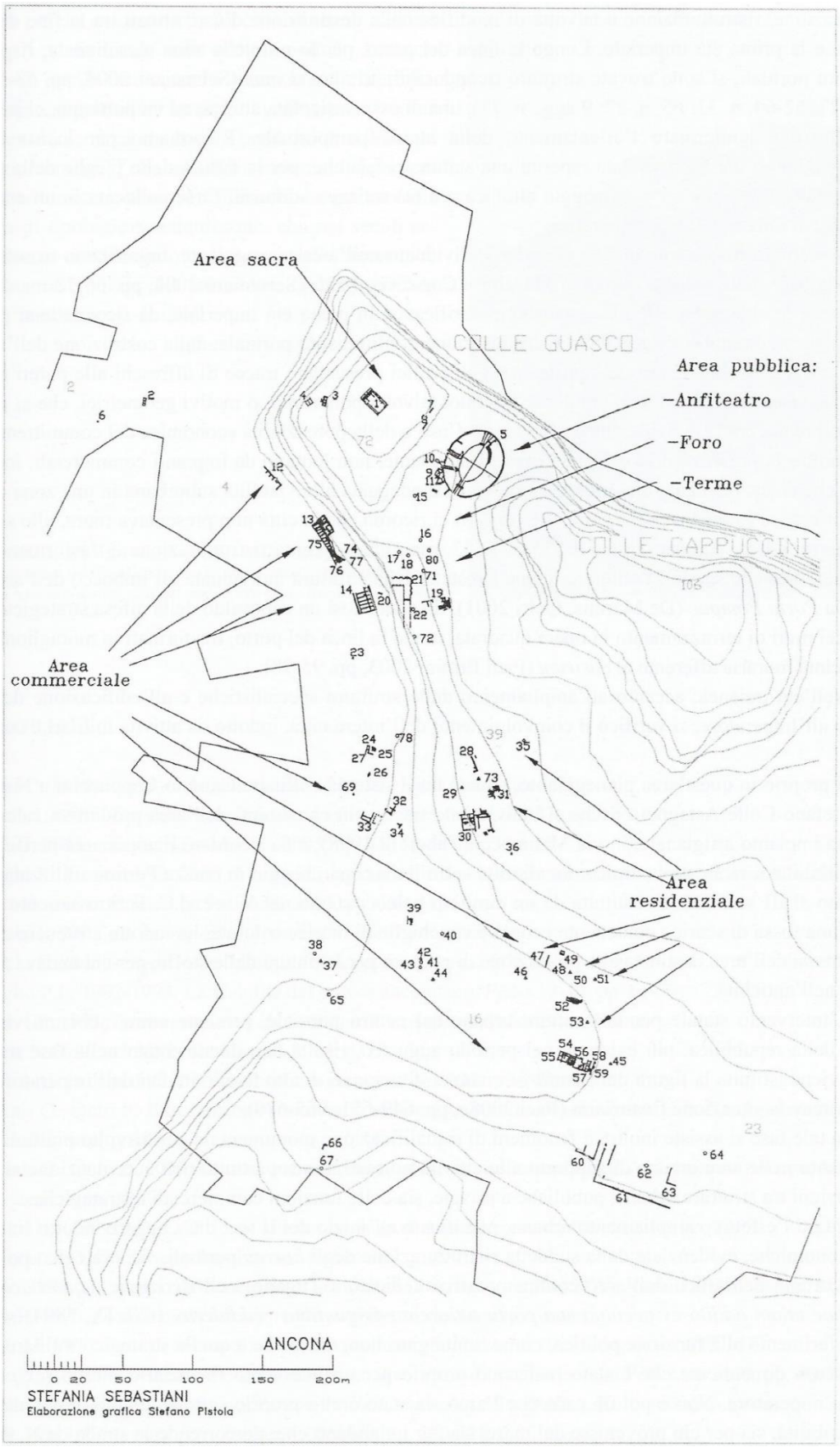


Figure 216 Map of Roman Ancona with indication of the archaeological finds (After Sebastiani 2014, 585, fig. 2).

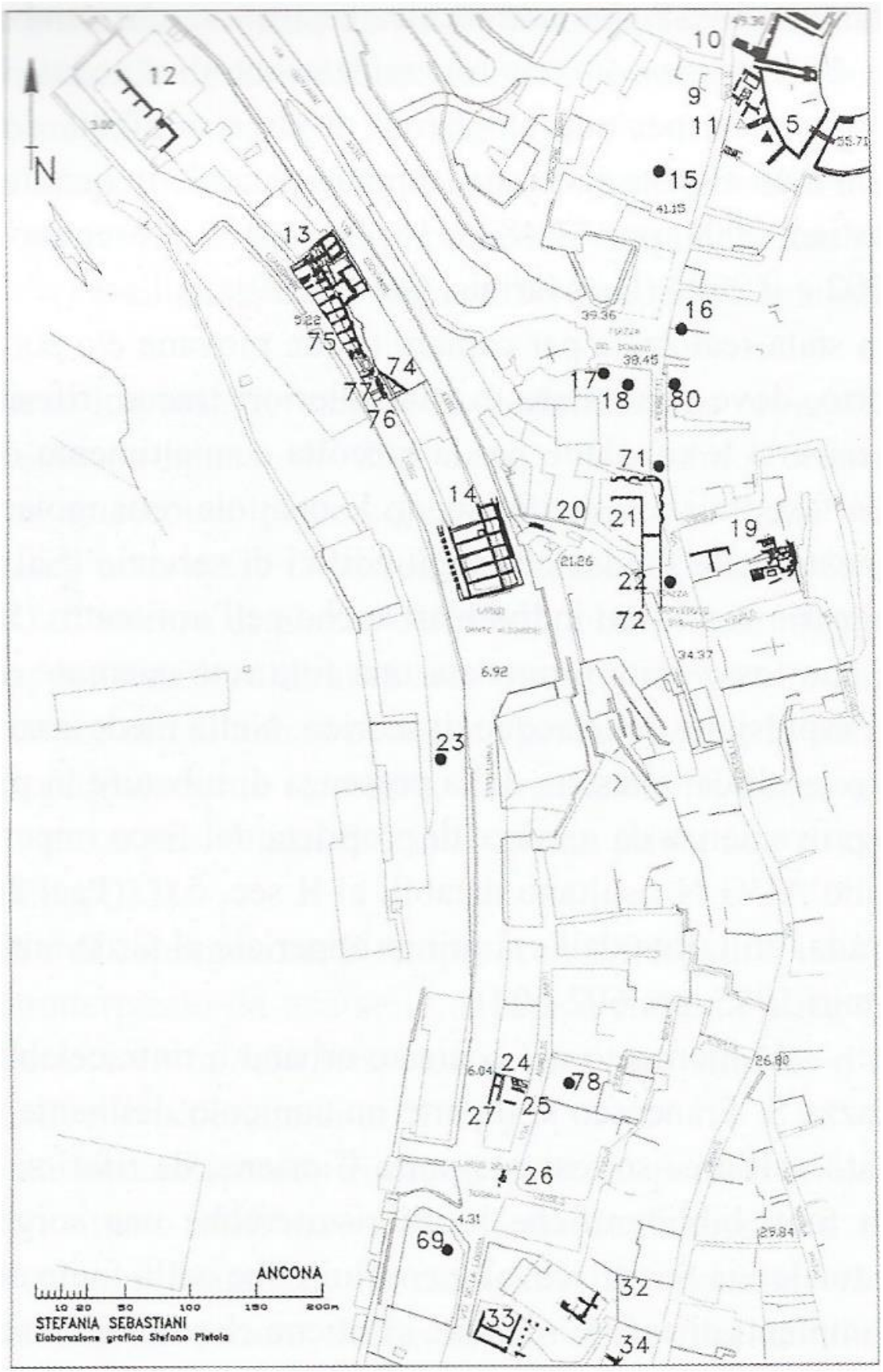


Figure 217 Section map of Roman Ancona with focus on the harbour zone and the town centre (After Sebastiani 2014, 579, fig. 1).



Figure 218 Map of Roman Ancona with indication of the main functional areas: commercial space (1), sacral space (2), private space (3), public space (4), Late Republican tombs (5) (After Sebastiani 1996, 93, fig. 84).

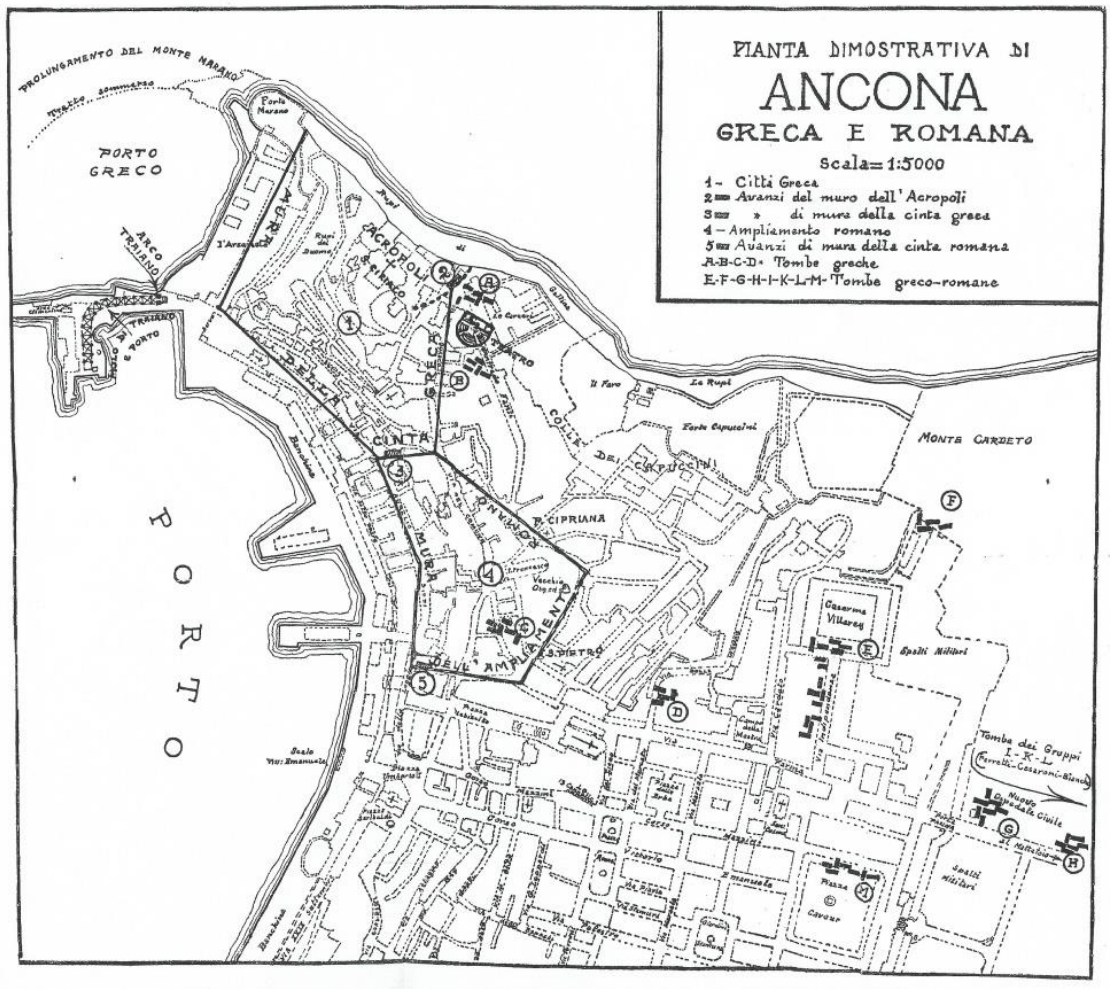


Figure 219 Hypothetical reconstruction of the urban area of Roman Ancona (After Dall'Osso 1975).

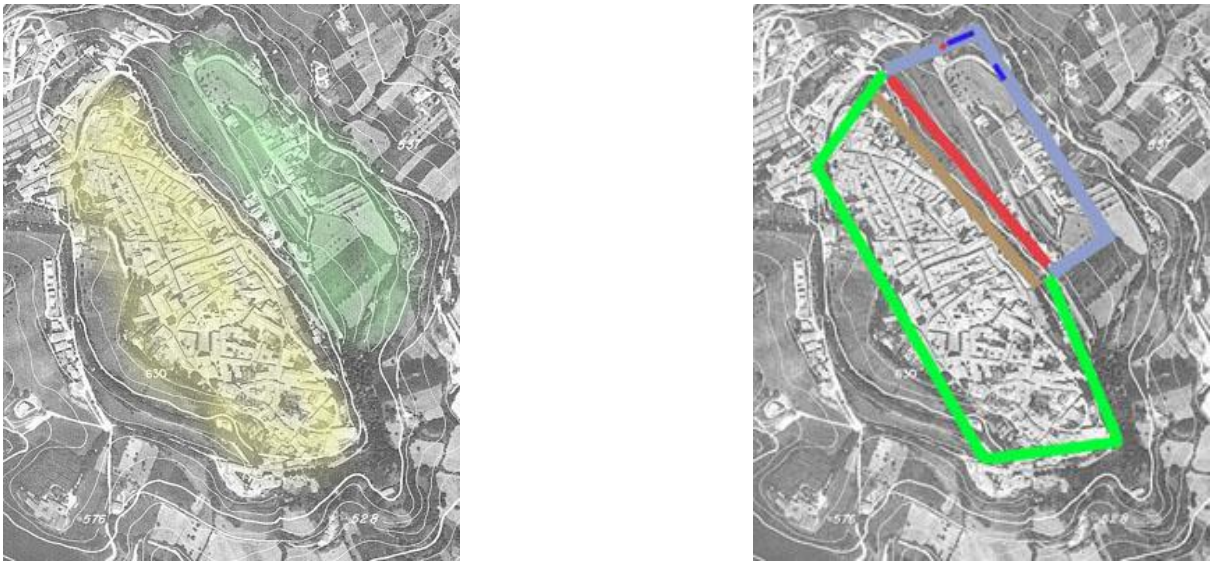


Figure 220 (A, left) Borgo S. Lorenzo (green) and the medieval town of Cingoli (yellow); (B, right) small hypothesis (blue) and large hypothesis (green and blue) (After http://www.antiqui.it/doc/archeologia/rom/urba.htm).

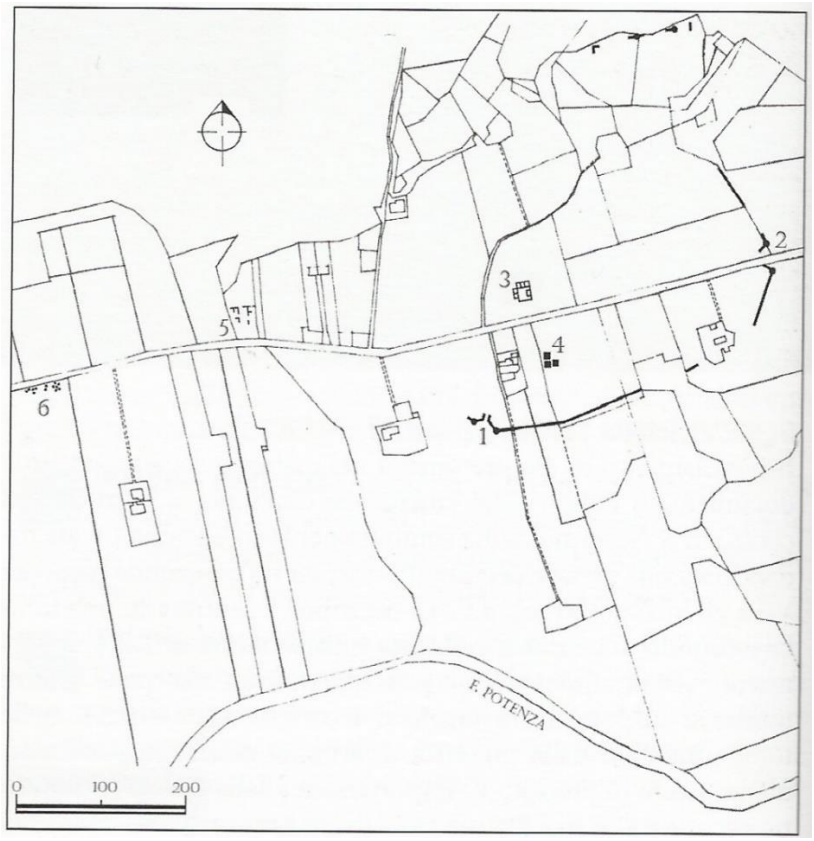


Figure 221 Map of the urban area of Roman Septempeda with indication of the known town gates (1, 2), the thermal complex (3), a domus (4), an extra-mural artisanal quarter (5), and the cemetery (6) (After Sisani 2006, 328).

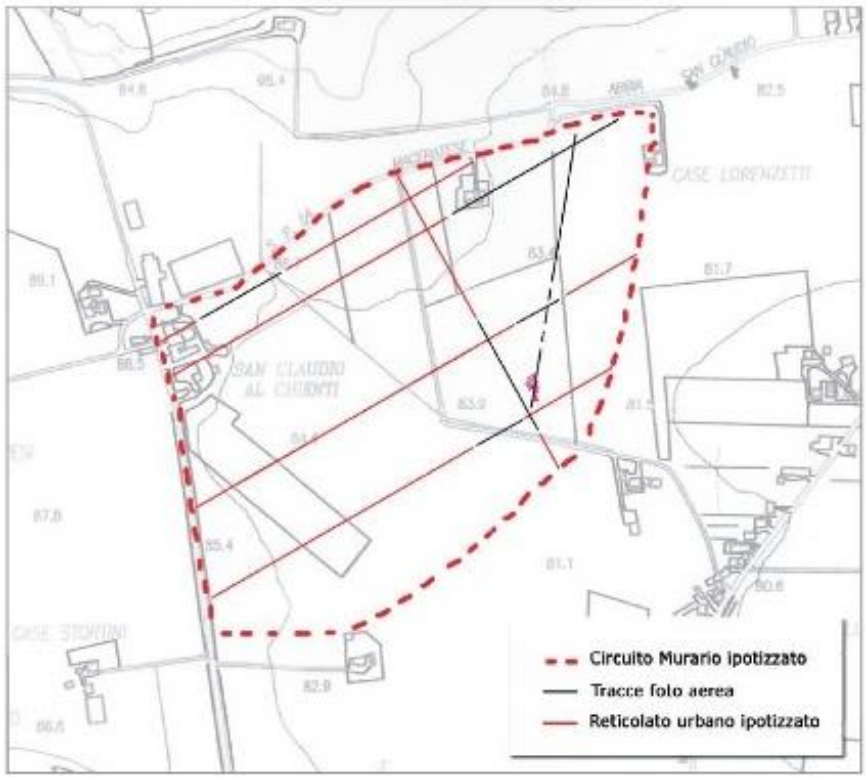


Figure 222 Hypothetical reconstruction of the town plan of *Pausulae* (After Mangani/Perna 2014, 71).

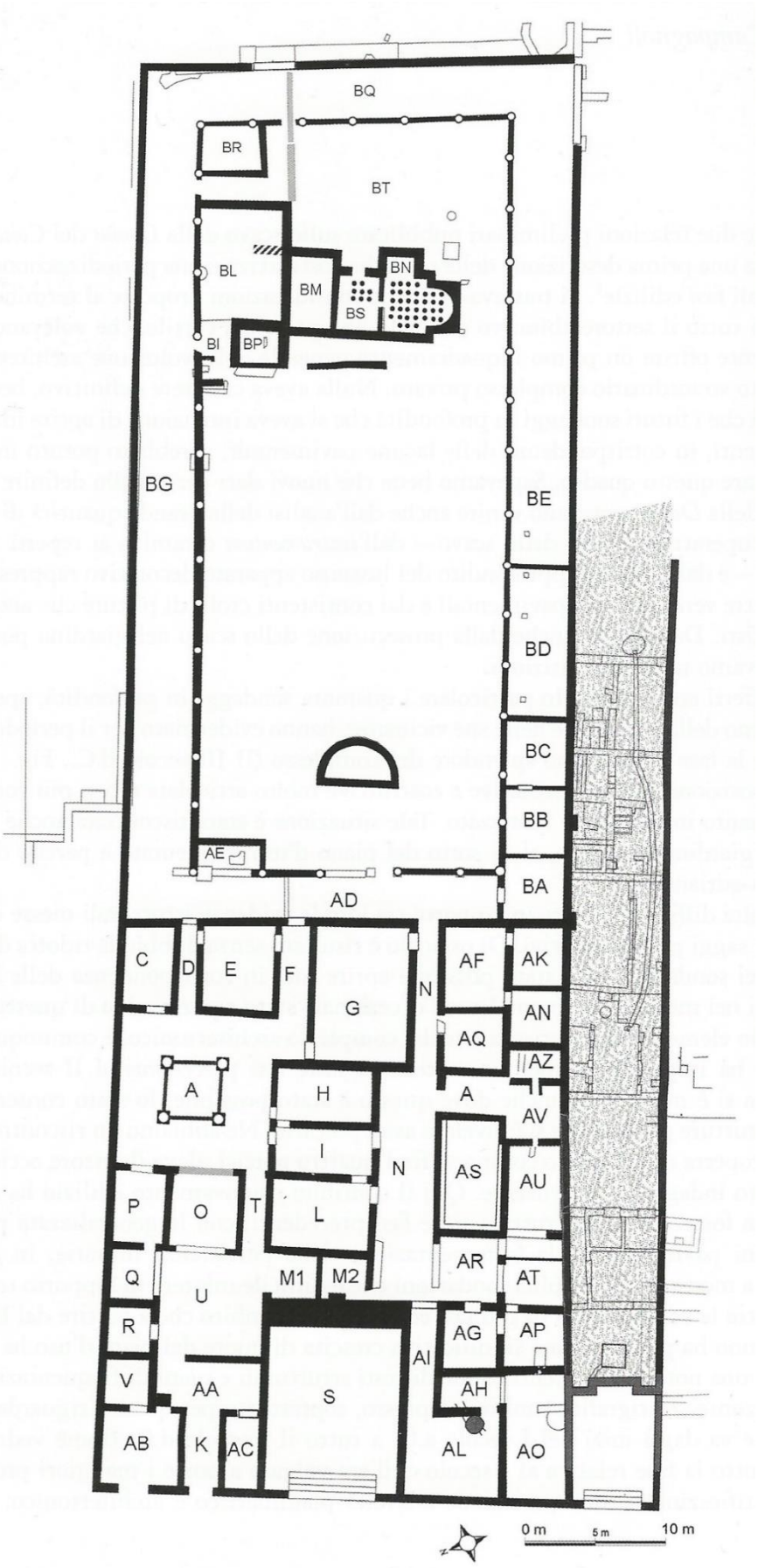


Figure 223 The Imperial Domus dei Coiedii at Suasa (After Campagnoli 2010, 320, fig. 1).

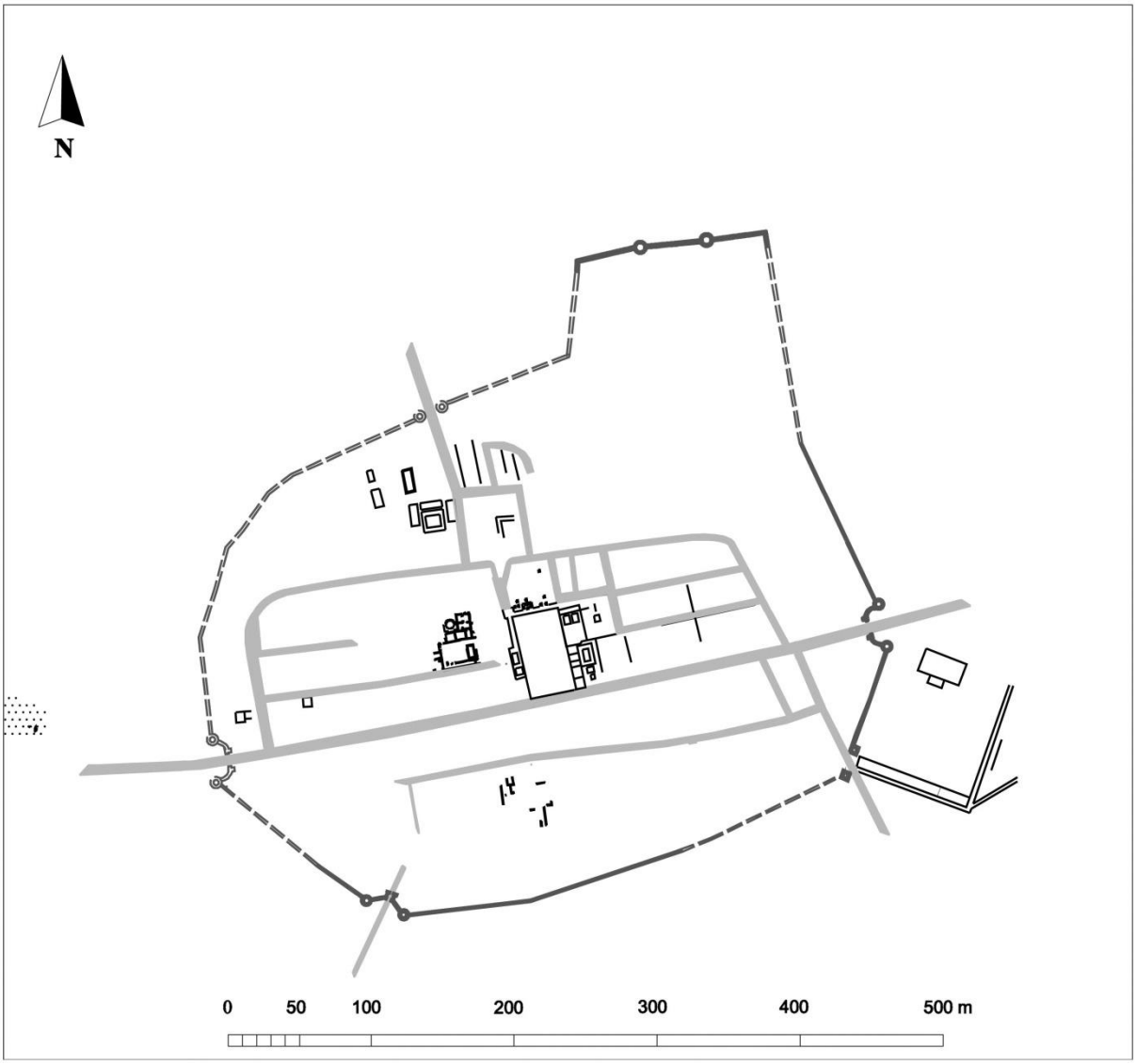


Figure 224 Reconstruction of the town plan of Septempeda (Kindly provided by F. Vermeulen, unpublished).

Part 3 Food and land

Chapter 4
Modelling consumption patterns

"Cereals, vines and olives, what Braudel called the 'eternal trinity', provided the basis of the traditional agricultural and dietary regime. This statement seems unexceptionable, but some analysis and interpretation are required."

(Garnsey 1999, 13)

4.1 Introduction

Scholarly discussions on ancient dietary rules have repeatedly stressed the extreme difficulty with which the daily food intake of the Romans may proportionally be translated into specific quantities and products. One problem is the paucity of direct ancient evidence to rely on. Indeed, there are only a handful of written sources that shed some light on the food requirements of the Italian people in Late Republican and Early/High Imperial times. Another major issue is the generally biased nature of these sources towards either the eating habits of the wealthier classes, or the food rations of military men and soldiers; neither of them being particularly representative of the majority of the population of Roman Italy. Third, there has been some discussion on how we should interpret these food rations; i.e. as actual consumption figures, or rather as allowances that were considered sufficient for maintaining one or several persons over a certain amount of time. This is a crucial issue, as it has obvious consequences for using these figures as the basis for determining food intakes in antiquity. Finally, per capita food intakes were not constant, but were bound to have fluctuated according to differences in status, working circumstances, age and sex, or because of varying environmental conditions. It goes without saying that these variables are all nearly

impossible to model for antiquity, although palaeodietary studies are now providing us with some useful insights in these matters (see *infra*).

As difficult as it is to put approximate figures on what the Romans ate each day, it should still be possible to weave together the various pieces of textual and archaeological information into a coherent picture that allows for outlining models of consumption that approach some form of probability. In a way, this is a standard practice that has been used by many scholars before for a number of regions in the ancient Mediterranean, and this is precisely what I intend to do in this chapter for the central Adriatic part of Italy. The first section will surf throughout the rich tradition of scholarly work that exists on the subject, while at the same time putting emphasis on some older and newer bits of evidence that may enhance our understanding of the eating habits and the dietary proportions of the urban and rural population of this area; as well as how these aspects may have changed over time. Next, the second section will use the guidelines outlined by the FAO (Food and Agriculture Organization of the United Nations) regarding human energy requirements in order to put forward figures for the minimum, mean and maximum daily calorific intakes of these people. Based on these observations and calculations, the third section will then set-up urban consumption models for both the Late Republican and the Early/High Imperial period. Finally, in order to effectively assess the impact of the urban demand in the area, a concluding section will incorporate the subsistence needs of the rural population.

4.2 What Romans ate and how much they ate of it

4.2.1 Cereals

It is generally accepted that the bulk of the average daily food intake in Roman times consisted of cereals, consumed in the form of porridge, bread or flat-cakes. The dominant role of this crop in the ancient diet is largely an historical matter, which is in part the result of geologic and climatic determinism, but also linked to the absence of a significant rival staple crop.[1] This centrality is well-reflected in the ancient textual sources, which frequently put an emphasis on grain – in particular wheat and barley – in food rations for both citizens, soldiers and slaves. A fundamental and often cited piece of literary information to this regard is Cato's advice on the food rations for his slaves:

[1] Rickman 1980a, 3-4; Garnsey 1999, 18.

> "(LVI) Rations for the hands: four modii of wheat in winter, and in summer four and a half for the field hands. The overseer, the housekeeper, the foreman, and the shepherd should receive three. The chaingang should have a ration of four pounds of bread through the winter, increasing to five when they begin to work the vines, and dropping back to four when the figs ripen. (LVII) Wine ration for the hands: for three months following the vintage let them drink afterwine. In the fourth month issue a hemina a day, that is 2 ½ congii a month; in the fifth, sixth, seventh, and eight months a sextarius a day, that is, 5 congii a month; in the ninth, tenth, eleventh and twelfth months 3 heminae a day, that is, an amphora a month. In addition, issue 3 ½ congii per person for the Saturnalia and the Compitalia. Total of wine for each person per year, 7 quadrantals; and an additional amount for the chain-gang proportioned to their work. Ten quadrantals of wine per person is not an excessive allowance for the year. (LVIII) Relish for the hands: store all the windfall olives you can, and later the mature olives which will yield very little oil. Issue them sparingly and make them last as long as possible. When they are used up, issue fish-pickle and vinegar, and a pint of oil a month per person. A modius of salt a year per person is sufficient."[2]
>
> (*Cato*, *Agr. Orig.* 56-58)

The text mentions food portions consisting almost entirely of wheat – likely provided in the form of bread – mixed with smaller amounts of wine and olive oil, and supplemented with olives, fish-paste and vinegar. For his fieldworkers, Cato recommends rations of four and a half *modii* of wheat per month in the summer, and four *modii* in the winter. Slaves that had less demanding tasks – such as supervisors, managers, shepherds, etc. – received only three *modii* per month. As such, Cato's hardest working slaves would have consumed between 48 and 54 *modii* of wheat, while the annual minimum rations would have been 36 *modii*. Reconverted into kilograms, this would have meant an annual grain intake of either 320-360 kg or 240 kg per slave. On a daily basis, this translates in approximately 0.87-0.98 kg per person for the former category, and 0.66 kg per person for the latter.[3] In addition to cereals, wine rations were also given according to different proportions throughout the year. In total, they would have amounted to an annual intake of ca. 181 litres, which is about half a litre a day. Finally, the monthly ration of olive oil was about half a litre; a ration that would have resulted in an annual intake of six litres, or ca. 0.016 litres each day. Turned into calories, the application of Cato's rations would have meant a total daily calorific intake between 2,686 and 3,755 calories, consisting of

[2] All English translations from the work of Cato in this thesis have been taken from the edition of W.D. Hooper and H.B. Ash (Loeb Classical Library).

[3] The conversion of *modii* into kilograms is based on the assumption that 1 *modius* equals 6,67 kg (Rickman 1980b, 261, referring to Pliny HN 18.66, who considers a *modius* of wheat to weigh about 6.5-7 kg).

ca. 82-87 % cereals, 9-13 % wine, and 4-5 % olive oil (*Table* 18).[4] Cato's directions hint at the regular addition of olives, fish-sauce and vinegar to this standard Mediterranean triad, but their potential contribution cannot be quantified on the basis of the text.

Table 18 Proportionally daily intake of cereals, wine and oil of a Roman slave, based on Cato.

Cereals			Wine			Olive oil			Total cal.
Kg	Cal.	%	l	Cal	%	l	Cal	%	
0.66	2,204	81.7	0.5	352	13	0.016	130	5.3	2,686
0.87	2,906	85.5	0.5	352	10.4	0.016	130	4.1	3,388
0.98	3,273	86.9	0.5	352	9.3	0.016	130	3.8	3,755

Another important source is Polybius, who mentions the commonly applied rations of wheat and barley for both Roman and allied military men in the 3rd-2nd century BC:

> "The allowance of corn to a foot-soldier is about two-thirds of an Attic medimnus a month, a cavalry-soldier receives seven medimni of barley and two of wheat. Of the allies the infantry receives the same, the cavalry one and one-third medimnus of wheat and five of barley, these rations being a free gift to the allies; but in the case of the Romans the quaestor deducts from their pay the price fixed for their corn and clothes and any additional arm they require."[5]
>
> (Pol., *Hist.* 6.39.13-14)

According to Polybius, a Roman infantryman received 2/3 of an Attic *medimnus* on a monthly basis; i.e. about 4 *modii* of wheat, a figure on par with the ration provided by Cato for his slaves. The Roman cavalrymen, however, received seven *medimni* of barley (42 *modii* or 280 kg) and two *medimni* of wheat (12 *modii* or 80 kg) each month. The rations for the allied infantrymen were the same, but those of the cavalrymen were lower, with only 1 1/3 *medimnus* of wheat (8 *modii* or 53 kg) and five *medimni* of barley (30 *modii* or 200 kg).[6] Reconverted into calories, this would have meant a daily intake equal to ca. 2,906 calories (0.87 kg) for the infantrymen, and an intake between 5,812 and 8,784 calories (1.74-2.63 kg) for the cavalrymen. The disproportionate barley rations – between ca. 6.58 and 9.21 kg per day – are thought to have been intended for the horses of the soldiers.[7] Two further Roman ancient sources mention a monthly ration of 5 *modii* of wheat (33 kg) per person: Seneca recommends it with regard to the food requirements of a slave (*Ep.* 8.70), while

[4] Based on the assumption that 1 kg of cereals equals 3,340 calories, 1 l of wine equals 704 calories, and 1 l of olive oil equals 8,100 calories.

[5] The English translation has been taken from the edition of W.R. Paton (Loeb Classical Library).

[6] The reconversions are based on Foxhall/Forbes 1982, 84; and Roth 1999, 18-19.

[7] Foxhall/Forbes 1982.

the amount is also mentioned in the Augustan *Lex Frumentaria* as a monthly allowance for each head of a Roman household:

> "By this law they have valued the liberty of all of you at five (modii) per man, an allowance not much greater than prison rations."
>
> (Sall. *Hist.* 3.48.19)

Following the ancient sources, most studies on ancient eating habits nowadays work with monthly rations of three to five *modii* in their calculations (*Table* 19).

Table 19 Wheat rations according to some ancient and modern sources.

Source	Monthly ration		Annual ration		Daily ration			Beneficiary
	modii	kg	*modii*	kg	*modii*	kg	Cal.	
Cato *Agr. Orig.* 56	4	27	48	320	0.13	0.87	2,906	Slaves
	4.5	30	54	360	0.15	0.98	3,273	Slaves
	3	20	36	240	0.09	0.66	2,204	Peasant
Pol. *Hist.* 6.39.13-14	42	280	504	3,362	1.38	9.21	30,761	Cavalrymen
	30	200	360	2,400	0.99	6.58	21,977	Cavalrymen
	12	80	144	960	0.39	2.63	8,784	Cavalrymen
	8	53	96	636	0.26	1.74	5,812	Cavalrymen
	4	27	48	320	0.13	0.87	2,906	Infantrymen
Seneca, *Ep.* 8.70	5	33	60	400	0.16	1.08	3,607	Slaves
Sallust, *Hist.* 3.48.19	5	33	60	400	0.16	1.08	3,607	Adult males
Labisch 1975, 31-33	5	33	60	400	0.16	1.08	3,607	Soldiers
Le Roux 1994, 408	4	27	48	320	0.13	0.87	2,906	Soldiers
Kissel 1995, 35	3	20	36	240	0.09	0.66	2,204	Soldiers
Junkelmann 1997, 91	4	27	48	320	0.13	0.87	2,906	Soldiers

Based on this and other comparative evidence from pre-industrial peasant-driven societies, it is commonly assumed that in antiquity at least 60 % of the daily calories were delivered by cereals. The bar has been set by Peter Garnsey, who based his estimate on the diet of Italian peasants in the 1960's.[8] A recent study by Lin Foxhall and Hamish Forbes concluded that it was unlikely that Greeks and Romans took more than 70-75 % of their energy requirements from cereals.[9] Most studies on ancient dietary proportions work with a similar range of figures.[10] One notable exception is Willem Jongman, who – on the

[8] Garnsey 1999, 12.

[9] Foxhall/Forbes 1982.

[10] To mention only a few examples, see Garnsey/Whittaker 1983 (70-75 %); White 1988 (70-75 %); Brothwell 1988 (70 %); and Gallant 1991 (65-70 %).

basis of Cato's guidelines regarding the food rations for his slaves – considered a cereal component in the 80-85 % range.[11] Recently, Jongman has also opened-up the door for an entirely different model in which only 50 % of the daily calories came from cereals.[12] A gap of 35% between the estimated minimum and maximum values for cereal proportions is clearly a significant issue in ancient food modelling, but more than anything else, these differing models illustrate well the general difficulty with which actual rates of cereal consumption may be established for antiquity.

However, it does seem reasonable to assume that the proportional importance of cereals within the personal diet varied according to status or working circumstances. It has been noted before that Cato's larger wheat rations of 4-4.5 *modii* (26.7-30 kg) per month for his field slaves and the smaller ones of 3 *modii* (20 kg) for his high-status slaves may be linked to either a lower level of physical activity of the latter, or to their supposed access to a more varied diet with a lower cereal component.[13] A similar line of reasoning may be applied for the monthly ration of five *modii* (33.4 kg) of wheat mentioned by Seneca with regard to the food requirements of a slave (*Ep.* 8.70), but also by the Augustan *Lex Frumentaria* as the monthly allowance for each head of a Roman household (Sall. *Hist.* 3.48.19). Some ground for such a perspective may also come from the food rations of Roman soldiers – a particular class of hard-working men – whose minimum wheat portions were fixed at 4 *modii* per month by Polybius (*Hist.* 6.39.13-14). Furthermore, cereals were relatively 'cheap' calories, as opposed to other high-caloric foodstuffs such as wine and olive oil which involved the input of more labour and capital.[14] As such, it seems logical that grain made-up a larger proportion of a poor man's meal than of a rich man's one. This is an important factor when modelling the consumption needs of town populations, as we might expect urban dwellers to have had more financial means for – and easier access to – a richer diet than countrymen. They were also less likely to perform the hard physical labour typically required from peasants, slaves or military men on a daily basis. If we need to apply one order of magnitude then, we might put the cereal intakes of town residents closer to the 60 % limit than to the 85 % one. The opposite might be true for rural dwellers, while an intermediate figure may be supposed for town-based farmers that were involved in day-commuting.[15]

[11] Jongman 1988, 79-80.

[12] This model is based on the assumption that the Romans received almost half of their daily calories from wine, olives and olive oil combined; see Jongman 2007, 602-604; for a counterargument, see Hin 2013, 27, note 26; for further discussion, see *infra*, section 4.1.2 on food requirements.

[13] Foxhall/Forbes 1982, 63-64.

[14] Jongman 2007, 602-605; see also *infra*, section 4.1.2 on food requirement.

[15] Garnsey 1998, 112-113.

An interesting question is whether these people were all eating the same kind of cereals. Farmers probably cultivated a wide range of cereal types, but the most widespread ones seem to have been emmer wheat (*triticum dicoccum*) and bread wheat (*triticum aestivum* or *triticum vulgare*).[16] The reasons for their prevalence are mostly practical and environmental in nature. Indeed, being a very adaptable and high-tolerance husked wheat, emmer was a high-yielding grain that could be grown in many areas of the Mediterranean. The nakedness and the softness of bread wheat, on the other hand, made it into an ideal candidate for making bread.[17] There has been some discussion on the role of barley in the Roman diet. Based on some of our literary sources, it must have been cultivated on an important scale, but its principal role is thought to have lain in animal fodder, rather than in human consumption.[18] One scholar has recently proposed that barley constituted as much as half of all cereals grown in Roman Italy.[19] While barley has indeed the advantage over wheat to have a shorter vegetation cycle – an aspect that made the crop more suitable for cultivation in higher and climatically more instable areas of the peninsula – its lower nutritious value will have made for an unlikely candidate as the main cereal crop grown on a national basis.[20] Currently, its position among the cereals grown in Roman times for human consumption is more considered to have been that of a 'back-up measure' in times of shortages or harvest failures.[21]

A similar line of reasoning has traditionally been applied to millet, whose reputation as a substandard cereal kind has contributed much to the assumption of its overall marginal role in human consumption in Roman times.[22] The natural characteristics of millet – i.e. very drought resistant, easy to grow and early ripening – and its ability to be stored for longer periods than wheat, have inspired scholars to consider this grain as the cereal *par excellence* for the poor, as opposed to wheat for the wealthier.[23] Some confirmation for this hypothesis seemingly comes from isotopic analyses carried out on

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[16] We know of the existence of at least four other wheat varieties in use in Roman Italy: spelt (*triticum spelta*), *durum wheat* (*triticum durum*), einkorn (*triticum monococcum*), and club wheat (*triticum compactum*) (Spurr 1986, 10-17); for the cultivation of inferior cereals like millet, see Spurr 1986, 89-102.

[17] Rickman 1980a, 3-7; Spurr 1986, 11-13, 15; Jongman 2007, 603.

[18] Spurr 1986, 14-15, referring mainly to Columella. Just as with Polybius' figures, the generous barley rations mentioned in the writing-tablets from the military fort at Carlisle are thought to have been intended for the horses of the soldiers (Tomlin 1998).

[19] Morley 2001, 56, motivated by the search for a higher overall carrying capacity of Roman agriculture in Italy and inspired by Garnsey 1988, 102-104.

[20] Hin 2013, 26-27. For the less nutritious value of barley, see Garnsey 1988, 51, 102-104; and Wrigley 2006.

[21] Spurr 1986, 14-15, referring to Pliny the Younger and Columella.

[22] Spurr 1983; Nenci 1999.

[23] For millet's longer storage capacity than wheat, see Varro, *Rust.* 57.2.3; and Col. *RR*, 2.9.18; for its low sowing rate in seed, see again Col. *RR*, 2.9.18; see further Spurr 1986; and Erdkamp 2005, 73, 148, in particular note 11, 157-158, 191, 224.

skeletal remains from two cemeteries in the immediate vicinity of Rome: Casal Bertone, a periurban graveyard from the 2nd-3rd century AD, and Castellaccio Europarco, a suburban necropolis from the 1st-3rd century AD. Among the many interesting results of this recent investigation, one of the most striking ones was the difference in levels of millet consumption between the two cemeteries. Indeed, it turned out that the people buried in the Europarco graveyard had consumed larger amounts of millet in their lifetime than those buried in the Casal Bertone cemetery. As the former was situated further away from Rome than the latter, one possible explanation could be that the Europarco individuals were farmers or rural dwellers with a lower status than the individuals buried just outside the city walls of Rome in the Bertone necropolis.[24] Even with all the difficulties involved with interpreting this kind of analyses in a straightforward way, these first results suggest that we are only beginning to understand the consumption of millet in Roman times, and that future palaeodietary studies may shed some new light on the role of this 'inferior' grain.[25]

In the end, however, no cereal crop will have been cultivated according to complete monocultural regimes, but rather mixed with other minor cereals; while in certain areas some grains may have been preferred over others. In the mountainous parts of central Adriatic Italy, for instance, the cultivation of spelt must have played an important role as a substitute for wheat. According to Pliny, this low-demanding grain was used to make the famous Picenian bread; i.e. a hardy bread in the form of a long roll that was consumed by soaking it in milk or honey-water[26]:

> "The Ancona country still retains the popularity it won in the invention of bread from using groats as the material; this bread is steeped for nine days and on the tenth day they knead it up with raisin juice into the shape of a long roll and put it in earthenware pots and bake it in ovens, the pots breaking in the process. It is not used for food unless it has been soaked, for which chiefly milk or honey-water is employed."[27]
>
> (Pliny, *HN* 18.27.106)

[24] Although it has been pointed out that the C4 plant traces (millet) found in the bones of these humans may also be the result of the consumption of meat foddered on millet (Killgrove/Tykot 2013).

[25] Millet was three times more common than barley among the archaeobotanical macro-remains recovered from *Insula* VI.1 at *Pompeii* (1st century BC – 1st century AD) (Murphy/Thompson/Fuller 2013, 413-414).

[26] Cristofori 2004, 38-39.

[27] All English translations of the work of Pliny in this thesis have been taken from the edition of H. Rackham (Loeb Classical Library).

4.2.2 Wine and oil

This already complicated picture becomes even more so when we consider the non-cereal part of the diet. How do we fill-in the remaining 15-40 % of the daily calories? Given the environmental circumstances of the Mediterranean basin, vines and olives were and are the natural companions of cereals. Olives could be pickled, grapes were sometimes candied, both could be consumed in fresh or dried form, but in most cases they were processed into wine and olive oil.[28] It is a common view that both crops combined were responsible for 5 to 20 % of the daily food intake in antiquity. This is based mainly on the wine and oil rations given by Cato to his slaves, which amounted to ca. 9-13 % and 4-5 % respectively of the total food portions (*Agr. Orig.* 56-58).[29] Incidentally, Cato's account is also the only ancient textual source that provides us with actual consumption figures: 0.5 litres of wine and 0.016 litres of olive oil per day; i.e. 352 and 130 calories respectively.[30]

Despite this paucity of evidence, estimates for the annual per capita wine and oil consumption in antiquity have been put forward by several scholars. On the presumption that olive oil was used for many purposes other than eating and cooking, David Mattingly has estimated the annual consumption of oil for one person around 20-25 litres, or between 0.054 l (437 cal.) and 0.068 l (551 cal.) each day.[31] Similarly, by including hygiene and medicines to the range of personal consumption needs, Jean-Pierre Brun has assessed the total annual consumption of oil per person rather around 50 litres; i.e. about 0.14 l per day (1,134 cal.).[32] Again, Lin Foxhall has estimated the total annual consumption of an Athenian household – including oil for food, bathing and lightning – around 200 to 330 litres per year, or some 40 to 60 litres per person.[33] Her calculations would result in daily oil intakes between 0.11 and 0.16 l, representing some 891-1,296 calories. Following Cato, André Tchernia has argued for an annual wine consumption per male person in Late Republican and Early Imperial Rome between 140 and 180 litres, while female persons would have consumed about half of these quantities (70-90 l).[34] The respective daily values would be ca. 0.4 (270 cal.) and 0.5 litres (352 cal.) for men, and ca. 0.20 l (135 cal.) and 0.25 l (174 cal.) for women. An annual average of 100 l of wine per person – i.e. 0.27 l (193 cal.)

[28] Brun 2003, 48-49, 144-145; Foxhall 2007, 90-91, 134; Curtis 2008, 379.

[29] Based on this textual account, Willem Jongman estimated the contribution of wine to the diet at 10-15 %, and that of olive oil at 5 % (Jongman 1988, 79-80); Gallant estimates the contribution of wine, oil and meat at a combined 5-15 % (Gallant 1991).

[30] See *supra*, note 3.

[31] Mattingly 1988b, 34.

[32] Brun 2003, 169.

[33] Foxhall 2007, 86.

[34] Tchernia 1986, 26.

each day – is often used for Roman and pre-industrial consumption figures in the Mediterranean.[35]

Table 20 Total figures for daily food intakes based on ancient and modern estimates (all values are expressed in calories).

Cereals	Wine	Olive oil	Total
2,204	135	130	2,349
	352	1,296	3,852
2,906	135	130	3,171
	352	1,296	4,554
3,273	135	130	3,538
	352	1,296	4,921
3,607	135	130	3,872
	352	1,296	5,255

If we combine these different calorific estimates for wine and olive oil with the daily values for cereals derived from the ancient sources, we obtain total daily intakes ranging from 2,349 to 5,255 calories (*Table* 20). Inspired by the incompatibility of these two contrasting values – a consumption of 5,000 calories is nearly twice an average daily intake, which would imply that the Romans were either very fat or approaching bodybuilder status – Wim Jongman recently put forward an alternative view, in which the share of wine, olives and oil was as much as 50 %, with cereals forming the other half.[36] This model is mainly based on the assumption that the Romans drank about a quarter of a litre of heavy sweet wine a day, equal to about 452 calories. As noted by Saskia Hin, however, there seems to be a misconception in Jongman's calculations, as receiving that much calories from 0.25 l of wine implies the consumption of heavy port, and not of regular sweet wine.[37] Of course, as the Romans drank their wine diluted with water, it is quite possible that they drank very large amounts of it, comparable with later beer consumptions in medieval Europe. On the other hand, if the ratio wine water was about 50/50, the calorific values of the drink would also have been halved.[38]

If Romans effectively consumed about 25% of their daily calories in the form of olive oil – as Jongman suggests – this would mean an intake of 0.05 litres or 405 calories per

[35] For references, see Jongman 2003, 113-114, note 61.

[36] Jongman 2007, 602-604.

[37] Hin 2013, 27, note 26, where she puts the caloric level of 1 litre of sweet wine at ca. 900 calories, as opposed to Jongman, who assumes ca. 1650 calories per litre. The caloric content of one litre of 'normal' red wine is even lower with ca. 704 calories.

[38] Tchernia/Brun 1999.

day.[39] Such an intake of olive oil is again quite high, but at least plausible considering the fact that around the mid-20th century AD about 29 % of the daily calories of Cretan people were still provided by olive oil.[40] On the flip side, Arnaldo Marcone has recently argued for an alimentary role of olive oil in Roman times inferior to that of today because of technological restrictions in antiquity.[41] While it is true that ancient presses could not achieve the pressure levels of today's installations – Marcone compares a ratio of 2.3 kg of olive oil for an hour's work in antiquity with the eightfold return attained by modern presses within the same timeframe – David Mattingly has already shown that Roman presses were able to match the outcomes of modern ones over a longer period of operating time.[42] As such, Marcone's argument is invalid.

Besides, it is easy to underestimate the role of a product that today is essentially confined to the kitchen sphere. Its use in antiquity was far more widespread and olive oil proved to be a primary source for lightning, hygiene, rituals, and perfume or medicine preparations. All these activities combined may have boosted considerably the consumption levels of this yellowish green liquid. Both Mattingly, Brun and Foxhall clearly include these secondary purposes into their calculations, and as such their estimates may not be that incompatible as they seem. At the same time, we should not ignore the fact that other products too could assure the fatty component of the diet, in particular animal fat. It is probably wise then to keep an open mind and to discard neither a high nor a low proportional model for olive oil consumption in Roman Italy.

All the same, it is likely that the importance of both wine and olive oil in the diet differed slightly from one region to another, even within the Italian peninsula. It suffices to take a look at the map of the distribution of food cultures in Roman Italy published in the second volume of *'La Storia dell'Agricoltura Italiana'* in order to have an approximate idea of their varying prominence in Italian agriculture. Built on both textual and archaeological evidence, the map highlights – perhaps unsurprisingly – the lesser suitability of mountainous areas such as the Apennines for both crops, as well as the lesser presence of oleoculture in northern Italy (*Figure* 225).[43] I have already alluded to the differing importance of both cultures in central Adriatic Italy, where they were most dominant in the coastal and middle valley areas and gradually diminished towards the more inland areas and the Apennines.[44] While perhaps minimal, such differences are bound to have had some impact on the presence of these products in the daily diet.

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[39] One kilogram of olives equals about 8,878 calories; the caloric content of olive oil is somewhat lower at ca. 8,100 calories (Mattingly 1988b, 33-34; Goodchild 2007, 338; Jongman 2007, 603).

[40] Garnsey 1999.

[41] Marcone 2002, 451.

[42] Mattingly 1998c; 1993.

[43] For a full description of the map, see Forni 2002a, 76-83.

[44] See *supra,* Chapter 2, section 2.3.3 Distribution in the landscape.

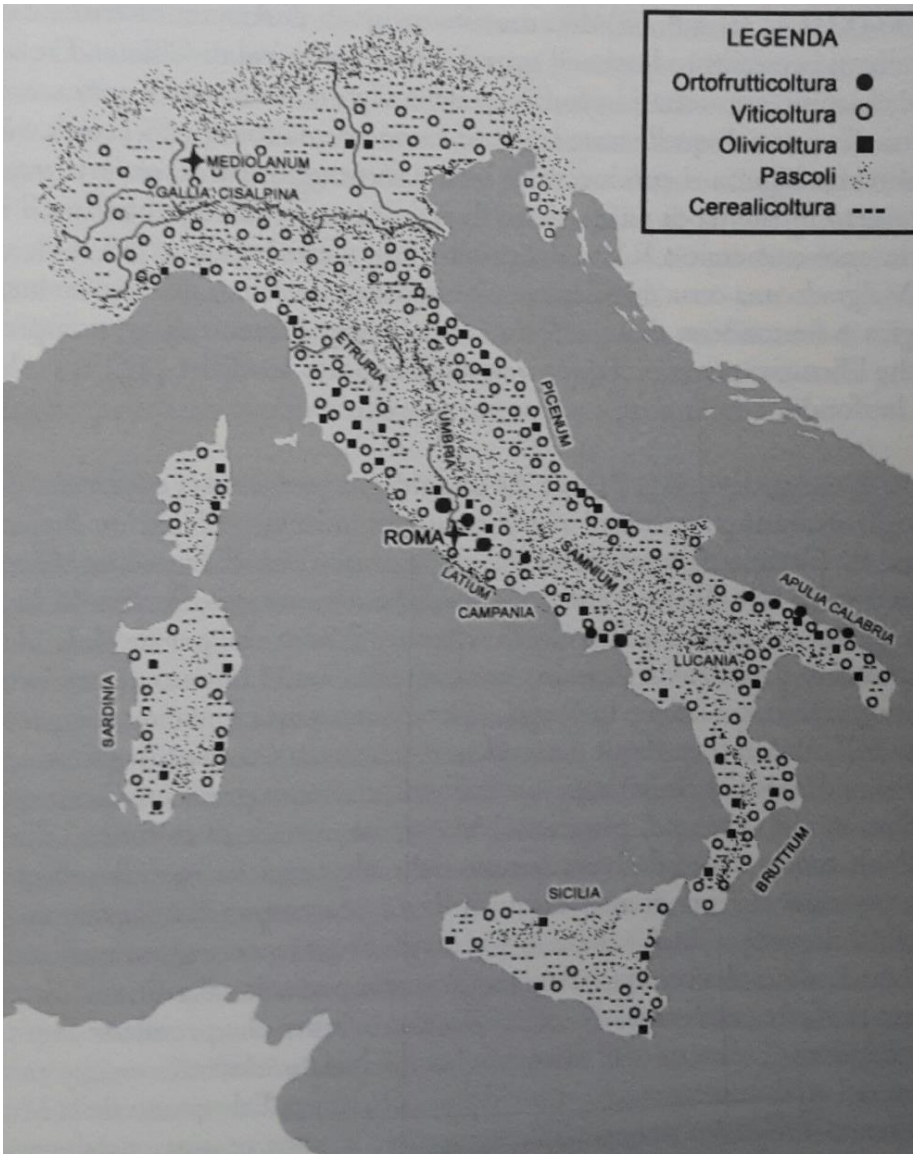


Figure 225 Distribution of food cultures in Roman Italy (After Forni 2002a, 79, Tav. 2).

But again, much will have depended on where a person lived, and under which circumstances he lived. Olives, for instance, were the traditional poor man's food and as such had a prominent place within the peasant's diet.[45] This is normal as olives offered the same high nutritional value as olive oil without the interference of an expensive oil press.[46] But better quality olives also enriched the rich man's table. This must certainly have been the case in central Adriatic Italy, as the region is known to have produced some of the finest green and black table olives for eating.[47] It is harder to have an idea about the extent to which wine and oil were a part of the daily diet of peasants and slaves. The

[45] Amouretti 1986; Marcone 2002.

[46] For the excellent nutritional value of olives, see Lanza et al. 2010.

[47] See *supra*, Chapter 2, section on olives for export.

fact that Cato reserved some space for both liquids in the food rations for his slaves illustrates that they at least had access to these products on occasion (*Agr. Orig.* 56-58). It is hereby worthwhile to remember that the Roman wine sector knew both high and low quality wines, and that the latter could be bought relatively cheaply in the towns.[48] Furthermore, the production of smallish amounts of wine and olive oil for domestic purposes did not require permanent and costly pressing equipment, but could be achieved with more primitive tools such as portable wooden treading casks or stone rollers.[49] While certainly not 'good' wines and oils, they may have covered the basic needs of a household.

There is more archaeological and textual evidence in favour of substantial wine consumption in Italian towns, especially in the Early Imperial period.[50] To a certain extent, this kind of behaviour might be expected from places where higher living standards, larger availability of – and easier access to – such foodstuffs coincide. This is precisely the point made by Nicolas Purcell in his seminal article on wine consumption in Early Imperial Italy, where he refers to the classical work of French viticulturist Roger Dion for sketching a picture in which even the urban poor drank substantial amounts of cheap wine from the nearby suburban vineyards.[51] The same goes for olive oil, whose use as a source of soap and lightning will have found a larger market in the houses, bath complexes and gymnasia of the towns than in the dwellings of countrymen.[52] To sum things up, if we would like to search contexts within Roman Italy in which the daily rate of wine and oil consumption was more in the 25-50 % range than in the 5-15 % range, those would be found more likely in the towns than in the countryside.

4.2.3 Vegetables and fruit

Dominant as it was, this Mediterranean triad was further supplemented with a variety of foodstuffs, in the first place dry legumes or pulses, and perhaps to a lesser degree vegetables, herbs, fruits and nuts. The prominent position herein of dry legumes – i.e.

[48] Duncan-Jones 1982, 34-35, referring to passages from Pliny (*HN* 17.35.213) and Martial (*Epigr*. 3.56-57); see also Garnsey 1998, 241. On the differentiation of the Roman wine market, see Tchernia 1986, 37-39; see also Brun 2003, 98-99.

[49] Rossiter 1981, 348; Amouretti 1986, 158-162; Brun 1986, 45; Mattingly 1988a, 157; Foxhall 2007, 132, 178-181.

[50] For a discussion of some archaeological and other evidence in favour of substantial wine consumption in Italian towns, especially in the Early Imperial period, see Unwin 1991, 124-128; see also Garnsey 1998, 241, referring to Suet. *Aug.* 42.

[51] Purcell 1985, in particular 17, note 82, referring to Dion 1959, 490-491.

[52] Incidentally, recent archaeological research at *Pompeii* has revealed an increase in the presence of olive remains in the 1st century AD (Murphy/Thompson/Fuller 2013).

broad beans, peas, chickpeas, lentils, lupines and vetches – is apparent from the written sources.[53] While some textual accounts might give us the impression that legumes or pulses were rather considered to be "poor food", others indicate that they also played a part in other people's diet, in particular military men.[54] This is actually unsurprising, as legumes were a major source of protein in antiquity and must have been an essential component of the food intake of soldiers, for whom intense physical activities were part of the daily routine. In addition, the Romans also developed an elaborate tradition of horticulture. Several poems vividly list a wide array of vegetables and herbs commonly grown in suburban garden plots: cabbages, beets, parsnips, leeks, lettuces, radishes, pumpkins, etc.[55] Fruticulture too was a common activity and the most popular fruit trees were figs, pears and apples.[56] We know from Strabo (*Geogr*. 5.4.2) that the central Adriatic region was especially adapted to fruit farming – with the Picenian territory being renowned in particular for its pears (Pliny, *HN* 15.15.55) and apples (Horace, *Sat.* 2.3.272-273; 4.70-71; Juvenal, *Juv.* 11.73-76) – and we might easily imagine many urban or rural garden in this area to have housed one or several fruit trees.

Still, despite their omnipresence in Roman literature, it remains difficult to assess the actual share of vegetables and fruits in the daily diet. Gallant has estimated that combined they were responsible for ca. 20-25 % of the food intake in antiquity, while Foxhall and Forbes simply considered them part of the 20-25 % non-cereal part of the diet.[57] Inspired by a wealth of archaeological and textual evidence, Geoffrey Kron has recently argued for specialised large-scale fruit production and trade – and as such considerable fruit consumption in the Roman world.[58] Given the relative ease with which many fruit trees could be grown towards acceptable yields, it is indeed likely that fruit was available to most classes of Roman society. But this is beyond the question. The issue is not whether

[53] As has been noted and discussed by Spurr 1986, 103-116; Garnsey 1999, 15; and Forni 2002, 127-128.

[54] White 1970a, 189-190; Spurr 1986, 106; Brothwell 1988, 249; and Roth 1999, 33, who refers to analyses of plant remains from legionary forts and a passage from Plutarch (*Vit. Crass.* 19.5) – mentioning legumes and salt as rations – in order to argue for considerable legume consumption by Roman soldiers; see also Davies 1971, 132-134; and Junkelmann 1997, 137-141.

[55] For examples, see Morley 1996, 88, who refers to Martial *Epigr*. 3.47 and 7.31; and Marcone 2002, 450, referring to Virgil's poem '*Moretum*' from the *Appendix Vergiliana* (*App. Verg.*)

[56] Figs and dates were found in tombs at *Fanum Fortunae* (Baldelli 2005, 29). For Late Republican Italy, we know of the existence of plum trees, cherry trees, pomegranates, quince trees and apricot trees; the presence of peach trees, medlar trees and even cedar trees is also attested from Early Imperial times onwards (Forni 2002, 152-153); although the consumption of citrus fruits is not thought to have been of great importance in Roman times (Brothwell 1988, 250, 253-254; and in his footsteps Goodchild 2007, 312). Overviews of the various fruits that circulated in Roman Italy – whether imported or cultivated domestically – can be found in the works of Cato (*Agr. Orig.* 143.3), Columella (*Rust.* 5.10), and Pliny (*HN*, 15.9-16); see also Kron 2012, 165.

[57] Gallant 1991: Foxhall/Forbes 1982.

[58] Kron 2012, 163-165, with references.

only a few or many people consumed fruit products – or if the choice in fruit was ample or restricted – but rather whether the latter will have made a significant contribution to the diet calorie-wise. Indeed, while some fruits are highly nutritional, the calorific value of many of them is negligible. In other words, they will surely have rendered the diet of many people more varied and healthier, but they are unlikely to have played a decisive role in their daily energy requirements. It is hereby highly indicative that fruits – as well as vegetables other than dry legumes for that matter– are absent from the standard rations for military troops and slaves, with only Cato providing the latter with some variety in the form of figs (*RR* 56-58).[59] Be that as it may, we should not over interpret the silence of our sources and we might reasonably expect some variation to have occurred in the diet of most people; if only for the intrinsic detrimental aspects of a heavily grain-based diet.[60]. Then again, specialised horticultural and fruticultural activities tended to be concentrated in the suburban areas of the Italian towns, assuring a naturally greater availability of vegetables and fruits in the latter's' immediate vicinity.

4.2.4 Meat

A much more relevant but also complicated matter is the level of meat consumption in Roman times. The gravitas of the issue lies within the potential role of meat as a healthy protein-rich calorie supplement – 100 g of boiled pork meat or bacon, for instance, equals about 320-325 calories, while 100 g of boiled beef contains about 200 calories – meaning that it has the capacity to influence, or even push back, the consumption levels of high-calorific staple crops, such as cereals.[61] The ancient textual evidence highlights the preponderance of pigs, sheep, goats and cattle within Roman livestock.[62] A crucial question is whether these animals were kept primarily for secondary purposes – i.e. oxen primarily used as traction animals, or sheep and goats being kept for their wool and skin, or for the production of by-products like milk and cheese – or whether they were bred

[59] Fruits have occasionally been attested on Roman military camps, but their presence is usually explained by personal acquisition by the soldiers themselves (Davison 1989, 243; Junkelmann 1997, 142; see also Roth 1999, 42). The absence of rationed salad plants might be explained by their having a low nutritional value.

[60] Rickman 1980a, 7; Garnsey 1999; although our view might be too pessimistic to this regard (Goodchild 2007, 311). Variation was certainly also the role played by more 'exotic' products and spices, such as garlic and coriander (Virgil, *App. Verg.*, *Moretum*), or honey, pepper and salt (the latter are included among the legionary supplies mentioned in the Vindolanda writing-tablets; see Bowman/Thomas 1994, 33, with references to the individual tablets).

[61] Numbers taken from McCance/Widdowson 1991. Compare these values with the calorific value of cereals, which amounts to ca. 334 calories per 100 gr (see *supra*).

[62] White 1970, 272-327; Pasquinucci 2002; MacKinnon 2004.

with meat consumption in mind. Following the ancient literary sources, traditional scholarship has argued consistently in favour of the former and as such has minimalized the overall role of meat in the ancient diet.[63] A hereby much-stressed drawback for the Mediterranean in antiquity was the cost of animal breeding; i.e. the fact that it took-up a large amount of valuable land – especially in the case of sheep, goats and cattle – that could otherwise have been used for cultivating more land-efficient terrestrial resources, together with the added financial cost for maintaining and feeding one or several animals.[64] An exception was made for pork – in particular pigs as sacrificial meat and sucking-pig as a delicacy for the rich – and for the Roman army, which is known to have consumed meat in respectable quantities.[65]

Recent advancements in archaeozoological research, however, have significantly changed this picture. The influential analyses by Anthony King and Michael MacKinnon in particular – who have both studied a large number of faunal assemblages from settlement sites in Roman Italy and the wider Roman Empire – have contributed much to the work of scholars like Geoffrey Kron and Willem Jongman, who now argue for large-scale meat production and consumption in Roman Italy, especially during the last century of the Republic and the first two centuries of the Empire.[66] Statistics calculated from bone assemblages hereby confirm the literary sources in general – i.e. the prevalence of pigs, caprine species and cattle – and the numeral dominance of pigs within both urban and rural contexts in Central and Northern Italy in particular.[67] This latter pattern has been interpreted by Jongman as the proliferation of the popularity of pork meat in Roman urban contexts – especially in central and northern Italy; a popularity that he himself explains by the low-energy- and space requirements of pig raising, in this way making

[63] White 1970, 276-277; Garnsey 1999, 16-17, 122-127.

[64] According to Cato, the annual food requirement of a pair of oxen could be satisfied with 120 *modii* of lupines or 240 *modii* of mast, 520 pounds of hay, 20 *modii* of beans and 30 *modii* of vetch (*Agr. Orig.* 60).

[65] Pasquinucci 2002, 161-163. The role of pork in the kitchen of the rich is largely based on its prominent place in Apicius' cooking manual. The importance of meat within the diet of Roman soldiers was first stressed by Davies 1971; for another good discussion, see Roth 1999, 27-32, who illustrates the popularity of beef among Roman soldiers. The writing-tablets from the military fort at Vindolanda mention the supply of a variety of meat products: young pig, ham, pork-fat, bacon, and roe-deer (Bowman/Thomas 1994, 33). Polybius mentions the northern Italian Po-plain as the main source for pigs meant to feed the Roman army (*Hist.* 2.15.2-3; 6.31.12).

[66] King 1999; MacKinnon 2004; Kron 2002; 2008; Jongman 2007, 604-605, 613-614, in particular Figure 22.1.

[67] Barker 1982, 85, Table 2, where pigs represent 40 % of all animals counted, sheep/goats 30 % and cattle 10%; King 1999, 169, Table 1, indicating a percentage of ca. 65 % pig, 25 % sheep/goat, and 10 % cattle for Western central Italy; for Northern Italy, the respective figures are ca. 39 %, 32 % and 29 %; the figures for Southern Italy are different, with 39 % pig, 49 % sheep/goat and 12 % cattle. The same Table also illustrates how pigs outnumber sheep, goats and cattle in both towns/*vici* (54 %/31 %/15%) and villas/rural sites (49 %/39 %/12 %). According to another study by MacKinnon, pigs consistently dominated the bone assemblages from rural sites in central and northern Italy (MacKinnon 2001, 656; see also Erdkamp 2005, 76).

them ideally suitable for feeding urbanised pre-industrial societies with a high population density like the Early Roman Empire.[68]

It is indeed true that the keeping of pigs within urban or suburban milieus – as opposed to sheep, goats or cattle – is the more logical choice, as the latter species are all herbivores that demand a large amount of space and plant resources, while the former are low-space omnivores that can be fed on all kinds of waste.[69] Some further ground for Jongman's claim may also come from Southern Italy, where sheep and goats – and not pigs – apparently dominate the studied bone assemblages, in an area of the peninsula that was less densely populated and urbanised than the central and northern parts of Italy.[70] Still, some caution may be advised against Jongman's view, as oxen provide a considerably larger amount of meat per animal than pigs or caprine species do.[71] In practice, this means that a numeral dominance in individual species may not translate automatically into a majority in meat weight. In fact, in his analysis of animal bones from a 5th century deposit near the foot of the Palatine in Rome, Graham Barker calculated that numeral-wise pigs were the animals most represented, while cattle the least represented. Converted into amounts of meat, however, it turned out that cattle were the dominant species, with pigs now playing second fiddle, followed closely by sheep and goats.[72] A similar observation was made by Kron regarding Anthony King's survey of bone assemblages in central and northern Italy, where pigs indeed surpass sheep, goats and cattle in both urban and rural contexts in number, but not necessarily in overall meat weight.[73] The potential importance of beef consumption is further stressed by Kron by pointing towards the archaeozoological evidence for the slaughtering of cattle as juveniles or young adults – a credible indication for their main use as meat – as well as the overall large size and well-being of Roman livestock.[74] As such, the role of beef consumption might currently still be underestimated.

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[68] Jongman 2007, 605, note 63, as opposed to King, who considers it more a cultural phenomenon (King 1999). An increase in the frequency of pork in the diet has been attested in the faunal assemblages of *Pompeii* for the 1st century AD (Richardson 2006).

[69] Although bone studies from Roman Italy seem to indicate that pigs consumed within urban contexts were fed on a largely herbivorous diet (Prowse et al. 2004, 267; Craig et al. 2009, 580).

[70] Duncan-Jones 1982, 337-339, and Table 9; Jongman 1988, 68-72, and Table 1, both based on Nissen 1883-1902; see also Bekker-Nielsen 1989, 21-22; and De Ligt 2012. It is, however, no coincidence that the landscape of southern Italy was more adapted to pastoral activities.

[71] Today, an average ox provides ca. 180-225 kg of meat, while a pig provides only 35-112 kg of meat; sheep/goats usually deliver 15-25 kg of meat (Roth 1999, 29-30).

[72] Barker 1982, 85, Table 2, based on the assumption that the amount of meat per cattle was ca. 225 kg, that of pigs 45 kg, and that of sheep/goats 30 kg.

[73] Kron 2002, 61-62.

[74] Kron 2008, in particular 74-79; an improvement in cattle breed in the Early Empire is also argued for by MacKinnon 2001.

Regardless of how we decide to read the archaeozoological evidence, two main patterns are reasonably clear: meat consumption had a much more prominent role within the Roman diet than previously thought; and animal bones occur on both urban and rural sites. The latter pattern is especially revealing, as the consistent presence of pigs – i.e. animals that were purely bred for their meat – on rural sites suggests that meat consumption was not confined to urban contexts. Admittedly, some of these rural sites were high-status villas that may have been involved in pig breeding for the urban market, but the trend is also apparent among the smaller rural dwellings.[75] Indeed, we seem far removed from the pessimistic picture sketched by Virgil in his poem '*Moretum*' of the poor peasant Simylus, who could not afford to eat meat and only kept a few oxen to plough his fields (*App. Verg., Moretum.*). While this will undoubtedly have been true for some misfortunate peasants, these faunal assemblages actually confirm no more than what was already suggested on the basis of comparative evidence; i.e. that peasants had to be very poor not to have at least one pig running on their farm.[76]

More than a debate on whether the Romans were vegetarians or not, the focus thus needs to be put on differentiating places of higher meat consumption from places of lower consumption. In other words, where was meat more likely to contribute on a daily, or at least regular, basis to the calorific intake of people? This is a matter that was ultimately determined by cost. Indeed, meat was an expensive commodity in Roman times that probably could not be afforded on a daily basis by the poorest members of society. The answer, therefore, undoubtedly lies in the towns, where we might reasonably expect to find a higher concentration of financially stronger people, able to consume meat at rates high enough to influence their cereal intakes. To this regard, the discussion on pork vs beef is all the more interesting, as the latter was less expensive than the former.[77] This means that poorer urban households too – 'poor' in the sense that they could not always afford more esteemed pork meat, but still 'rich' enough to provide themselves with cheaper meat such as beef – might have had regular access to meat. This difference actually seems to be reflected in the archaeozoological evidence from some or our Roman urban contexts, where pork apparently dominated the wealthier quarters of the town, and beef, mutton and goat the lower-class households.[78] Obviously, more work needs to be done before such patterns may become quantifiably clear, and we currently lack comparable contexts from the central Adriatic towns, but it might be useful to

[75] We might refer here to the recent overview provided by Ghisleni/Vaccaro/Bowes 2011, 124-126, Table 8, regarding the presence of animal bones on rural sites in Tuscany. We might think that Varro is referring to these kinds of high-status rural dwellings when taking swine keeping for granted on farms (*Rust.* 2.4.3).

[76] Delano-Smith 1979, 219; Goodchild 2007, 240.

[77] We can deduct from Diocletian's price edict that beef, mutton and goat were about 50 % cheaper than pork (Bökönyi 1984, 103).

[78] Kron 2002, 61-62, referring to the town of *Augusta Raurica* in particular, and Roman Italy in general.

incorporate the issue in future land models, as the breeding of cattle has larger consequences in terms of land availability than the keeping of pigs.

4.2.5 Fish

A final element that has received renewed attention through the analysis of human skeletal remains is the consumption of fish. Until very recently, the potential role of fish within the Roman diet was obscure, with most scholarly attention devoted to the impressive trade in *garum* or fish-sauce.[79] Nevertheless, there is a large amount of literary and archaeological evidence that indicates that the Romans developed a highly profitable tradition of pisciculture around a wide variety of salt- and freshwater fish species from the 1st century BC onwards.[80] Even more than meat, fresh and good quality fish was a luxury product that was only within reach of the rich.[81] According to Columella, salt-water fish was preferred above freshwater fish (*Rust.* 8.17.15), with the most popular kinds being red and grey mullet, moray eel, turbot, sturgeon, tunny, sea bass, parrot-wrasse and gilthead.[82] Their popularity is well-reflected in the fish prices from Diocletian's edict, were salt-water species were labelled with higher prices than freshwater ones.[83] Patterns of fish consumption among the lower classes are less clear. Ordinary salted fish was considerably cheaper on the market than fresh fish and this is the type of fish we might assume lower urban classes to have consumed when possible. Still, despite the ubiquity of the Mediterranean, there is currently no evidence to suggest that the Italians were massive fish eaters in Roman times. Indeed, it is difficult to imagine how in antiquity fish ever would have been anything more than a supplement within the traditional dietary regimes, and even then only for the wealthier households.

Even so, it seems natural that its role was more prominent among people who came in regular contact with water, such as coastal populations and the inhabitants of portal towns, fishermen, or people living close to rivers and lakes. To this regard, the introduction of palaeodietary studies has opened-up new possibilities. An interesting case is *Portus Romae*, an important portal town along the Tyrrhenian shore of central Italy.

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[79] See, for instance, Ponsich 1988; Curtis 1991; 2001, 317-321, 403-417; and 2008, 385-386, 403-416; Purcell 1995; Bekker-Nielsen 2005; and Beer 2010. An excellent bibliography on *garum* productions and fish industries in Roman times can be found on the website of The Oxford Roman Economy Project (http://oxrep.classics.ox.ac.uk/bibliographies/fish_industries_garum_production_bibliography/).

[80] Marzano 2013b.

[81] Déry 1998, with various references to ancient literature; see also Pasquinucci 2002, 169-170.

[82] Overviews can be found in Pliny's Natural History and Columella's agricultural handbook; see also Désy 1998, 100-105; and Bekker-Nielsen 2005; 2010, 198.

[83] For the price edict, see Déry 1998, 112, note 5.

Here, isotopic analyses on skeletal remains from the 1st-3rd century AD cemetery of Isola Sacra revealed the prevalence of a diet consisting of both terrestrial and marine resources. While the bulk of the food intake apparently still consisted of the former, the latter nevertheless formed an important component of their diet.[84] Similar results were obtained from isotopic analyses on a group of humans among the individuals buried at the Imperial necropolis of Velia, a coastal town lying on the southern west coast of Italy.[85] These results contrast with those obtained from the individuals buried in the Casal Bertone and Castellaccio Europarco graveyards around Rome, where the diet was made-up entirely of terrestrial sources (see *supra*). Such observations clearly attest that marine resources formed a higher proportion of the diet of coastal populations than those of inland populations.

4.3 Guidelines for estimating food needs in Roman times

4.3.1 Introducing the problem

Besides the difficulty with which the composition of the ancient diet may be deciphered, another major issue is how much food – and thus how many calories – a person consumed on a daily basis in antiquity. It goes without saying that the number of calories required per day is not constant, but fluctuates according to a number of parameters. The main variables that influence daily caloric intakes are five: stature, weight, age, gender and the level of physical activity. Logically, taller and heavier persons need more energy than smaller and leaner ones, children and elderly people need less than adults, men more than women, and more active persons require more energy than less active ones.[86] For instance, according to the FAO (Food and Agricultural Organization of the United Nations) 1985 report on Energy and Protein Requirements, a male of 35 years of age, weighing 65 kg and measuring 172 cm needs about 2,490 calories when he performs heavy work. Then again, an adult male of 25 years of age with the same weight and height needs only 2,580 calories when he is involved in light activity work, like for instance, office tasks. The same goes for adult females, with housewives needing fewer calories (1,990) than rural women (2,235) (*Table* 21).[87]

[84] Prowse et al. 2004.

[85] Said group are thought to have been fishermen (Craig et al. 2009; Crowe et al. 2010).

[86] In the case of infants, additional energy is required for growth, while women need supplementary energy in periods of pregnancy and lactation (FAO 1973; 1985; 2004).

[87] FAO 1985.

Table 21 Examples of modern energy requirements according to the FAO 1985 report on Energy and Protein Requirements.

Activity	Gender	Age	Weight (kg)	Height (cm)	Calories
Light activity work	Male	25	65	172	2,580
Moderate activity work	Male	25	58	161	2,780
Heavy work	Male	35	65	172	3,490
Healthy, retired elderly person	Male	75	60	160	1,960
Housewife	Female	25	55	150	1,990
Rural woman	Female	35	50	160	2,235

In a way then, it is easier to calculate the energy requirements of a particular group of people, i.e. persons who tend to have roughly the same levels in height, weight, age and sex, or persons that perform the same type of occupational activity. A good example is military men. According to the Recommended Daily Allowance of the United States Army, for instance, a soldier of 16-19 years of age with average weight and height (175.2 cm) needs about 3,600 calories per day. Soldiers of 25 years of age with the same weight and height need about 3,200 calories. More than actual consumption rates of modern American soldiers, these are amounts that the army considers adequate for recruits to efficiently perform their duties on an annual basis, including periods of intense activity.[88] Jonathan P. Roth recently used these U.S. Army guidelines for establishing the potential food requirements of Roman soldiers. For his calculations, Roth took three parameters into account: body height, the age of recruitment, and the length of service; all variables whose values he determined from literary and archaeological sources. As such, Roth argued that the average Roman soldier of 30 years of age, measuring 170 cm and weighing 66 kg, needed an allowance of about 3,000 daily calories.[89] This is actually in line with the amount of calories (2,906) that Polybius' infantrymen would have received from a daily ration of four *modii* of wheat (see *supra*); a ration that has equally been interpreted as a reasonable daily allowance, rather than a precise consumption figure.[90]

Matters become a bit more complicated when we try to model the caloric needs of groups of people with a more heterogeneous character. An often targeted group in antiquity are peasant families.[91] Not only was the daily physical labour of subsistence farmers of a different kind than those of soldiers, but peasant households typically also

[88] U.S. Army 1961.

[89] Roth 1999, 9-13, with references.

[90] Foxhall/Forbes 1982. A similar daily provisioning rate of 0.87 kg of grain (2,906 cal.) is cited by Herodotus for soldiers (*Hist.* 7.18; 7.2).

[91] Previous estimates for the food needs of peasant households in antiquity, mostly estimated in equivalents of wheat, include Brunt 1971, 194: and Hopkins 1978, 39, note 52; 1980, 118, note 51; and 1983, 84.

included women, children and elderly people, all persons with differing caloric requirements. The issue is well illustrated by Paul Erdkamp's model of the annual requirements of an average household. Erdkamp' starts from the monthly allowance of four *modii* of wheat from Polybius and Cato. Adjusted for the needs of a rural family with 2- adults and 3-4 children – that is assuming a more varied diet than soldiers and the presence of women and children – he estimates the total annual consumption of grain for a peasant family between 105 and 185 *modii*; with adults consuming 30-35 *modii* and children 15-20 *modii* per year.[92] This implies monthly requirements of 2.5-2.9 *modii* (16.7-19.3 kg) for the adults and 1.25-1.67 *modii* (8.3-11.1 kg) for the children, or 0.08-0.09 (0.55-0.64 kg) and 0.04-0.05 *modii* (0.27-0.36 kg) respectively on a daily basis. Translated into calories, the calorific intake for adults is 1,830-2,132 calories, those for children is 915-1,217 (*Table* 22). While perhaps a useful exercise within the wider scope of Erdkamp's study – i.e. to acquire a better understanding of the scale and organisation of the Roman grain market – the derived daily calories offer little ground for further exploring the overall food requirements of farmers. As mentioned before, Cato's and Polybius' allowances are a shaky basis for calculating actual consumption needs, while the issue of what made-up the remaining calories is not touched-upon. Besides, the textual and archaeological sources actually give no reason to assume that the diet of Roman soldiers was less varied than those of farmers to begin with, quite the contrary in fact.[93]

Table 22 Estimated grain requirements for a rural household (Based on Erdkamp 2005, 48-49).

Type	Annual			Daily		
	Mod.	Kg	Cal.	Mod.	Kg.	Cal.
Adult	30-35	200-233	668,000-778,220	0.08-0.09	0.55-0.64	1,830-2,132
Child	15-20	100-133	334,000-444,220	0.04-0.05	0.27-0.36	915-1,217
Family	105-185	700-1,234	2,338,000-4,121,560	0.29-0.51	1.91-3.38	6,405-11,292

A more elaborate model is that of Nathan Rosenstein for Mid-Republican peasant farms. Rosenstein uses the 1985 FAO statistics for estimating the minimum and maximum caloric requirements of a hypothetical household consisting of a father aged 50, a mother aged 40, one son of 15 years, another of 20 years, and one daughter of 10 years. According to said FAO report, depending on their level of physical activity, adult males between 18 and 30 years of age and weighing 65 kg need between 2,990 and 3,530 calories each day. Adult males between 30 and 60 years of age with the same weight need between 2,900 and 3,380 calories, again depending on whether they perform moderate or heavy work. A

[92] Erdkamp 2005, 48-49.

[93] Roth 1999, 7-44.

much lower amount of 2,170-2,400 calories per day is required by adult females between 30 and 60 years of age and weighing 55 kg.[94] As such, these are the calorific requirements used by Rosenstein for the 20 year old son, the father and the mother. For the 15-year old son, he considers a required calorific intake between 2,650 and 2,900 calories; for the daughter 1.950-2,350 calories. All calorific values take into account that the family members performed moderate to heavy work on a daily basis; i.e. levels of occupational activities that fall under subsistence farming strategies.[95] Assuming that the diet consisted entirely out of cereals, Rosenstein posits that the family needed between 1,384 and 1,591 kg of wheat on an annual basis; i.e. between 115-133 kg (17-20 *modii*) per month, or 3.79-4.36 kg per day (*Table* 23).

Table 23 Estimated daily and annual calorific intakes for a peasant family (Based on Rosenstein 2004, 66-71).

Type	Calorific intake				Wheat (kg)	
	Daily		Annual		Daily	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Father	2,900	3,380	1,058,500	1,233,700	0.87	1.01
Mother	2,170	2,400	792,050	876,000	0.65	0.72
Son 1	2,990	3,530	1,091,350	1,288,450	0.90	1.06
Son 2	2,650	2,900	967,250	1,058,500	0.79	0.87
Daughter	1,950	2,350	711,750	857,750	0.58	0.70
Total	12,660	14,560	4,620,900	5,314,400	3.79	4.36
Average	**2,532**	**2,912**	**924,180**	**1,062,880**	**0.76**	**0.87**

Table 24 Daily nutritional requirements of a Roman farmer (After Goodchild 2007, 320, Table 7.11, based in part on FAO 1985, tab. 9-11).

Daily activity	BMR	Hours	Calories required dependent on workload		
			Light	Moderate	Heavy
In bed at 1.0x BMR	63.97	8	511.76	511.76	511.76
Occupational activities at 1.7/2.7/3.8 BMR	63.97	9	978.74	1,554.47	2,187.77
Socially desirable and household tasks at 3.0 x BMR	63.97	3	575.73	575.73	575.73
Residual time at 1.4 x BMR	63.97	4	358.23	358.23	358.23
Totals based on BMR calculation (HG)		**24**	**2,425**	**3,000**	**3,634**

[94] Energy and Protein Requirements: Report of a Joint FAO/WHO/UNU/ Expert Consultation; see also Rosenstein 2004, 66-67.

[95] Rosenstein 2004, 66-71.

Starting from estimated required minimum and maximum calorific intakes, rather than from 'fixed' ancient food portions, Rosenstein's figures offer a better starting point for modelling the food requirements of a peasant household. However, his model is based entirely on modern energy requirements derived from people that might have different anthropometric features – and thus different (higher) calorific needs – than Roman farmers. This works will within the scope of Rosenstein's study – i.e. developing a worst-case scenario regarding consumption vs. production on a Roman farm – but holds the risk of overestimating the actual food requirements of a peasant household. In a way, the same could be said of the eternally-cited 1982 article by Lin Foxhall and Hamish Forbes on the role of grain as a staple food in antiquity. In order to define the number of calories per day needed by human beings in antiquity, Foxhall and Forbes use the FAO 1973 guidelines on Energy and Protein Requirements for 'moderately active' (2,852 cal.), 'very active' (3,337 cal.) and 'exceptionally active' (3,822 cal.) adult males. In a second model, they also use these guidelines for outlining the calorific needs of a hypothetical household of six at 15,495 calories.[96]Another example is Dennis Kehoe, who – following the work of Foxhall and Forbes – posits a mean daily need of 0.58 kg of wheat (1,937 cal.) per person on the basis of the assumption that wheat was responsible for 75 % of the daily calorific intake in antiquity, with the latter estimated at ca. 2,582 calories; i.e. the mean daily need of Foxhall and Forbes' hypothetical household.[97]

A more useful methodology to this regard was recently developed by Helen Goodchild in her study on the potential carrying capacity of the Middle Tiber Valley in Roman times. In order to outline the implications of both a poorly and well-fed rural population, Goodchild starts from the ancient skeletal evidence from *Herculaneum*, *Pompeii* and *Isola Sacra* to estimate the height, weight and BMR (Basal Metabolic Rate) of Roman agricultural workers.[98] She then uses these figures in conjunction with the same FAO statistics in order to estimate the daily nutritional requirements of a hypothetical Roman farmer, assuming both a light, moderate and heavy workload, and a nine-hour working day; with the latter derived from ethnographic parallels (*Table* 24). Next, she recalibrates these figures according to the annual agricultural workload outlined by Columella in his

[96] The calorific needs of the adult male are based on a man aged 20-39, weighing 62 kg. The hypothetical family used by Foxhall and Forbes consist of one very active female of 52 kg and 60-69 years of age (1,947 cal.), one very active adult male of 62 kg and 20-39 years (3,337 cal.), one very active adult female of 52 kg and 20-39 years of age (2,434 cal.), one very active male child of 13-15 years of age (3,237 cal.), one female child of 10-12 years (2,350 cal.), and one child of 7-9 years of age (2, 190 cal.) (Forbes/Foxhall 1982, 48-49, based on FAO 1973).

[97] Kehoe 1988, 14-15.

[98] Weight is calculated from height by using the Body Mass Index (in this case = 20-25) through the formula: weight in kg = (height^3/10,000) x Body Mass Index; the BMR is calculated by the standard Harris-Benedict formula for male adults: BMR (per day) = 66.4730 + (13.7516 x weight in kilos) + (5.0033 x height in cm) – (6.7550 x age in years) (Goodchild 2007, 317-319).

agricultural handbook (*Rust.* 2.7.8-9). As such, she calculates the average daily energy requirements of a Roman farmer at 3,283 calories (*Table* 25). She then repeats the operation for female adults, assuming the same workload as those used for the male adults. Finally – by combining the figures for both males and females, and through the modelling of a variety of height, weight and age ranges – she estimates the absolute minimum and maximum figures for the daily food intake of Roman farmers as a whole – i.e. male and female combined – between 1,951 and 3,798 calories (*Table* 26).[99]

Table 25 Energy requirements of a Roman farmer based on Columella (After Goodchild 2007, 321, Table 7.12).

Columella's working year	Workload	Days	FAO Energy requirement (kcal)
Main agricultural tasks	Heavy	190	690,364.2
Bad weather/holidays	Moderate	30	90,005.79
Rest after sowing	Light	30	72,733.89
Remaining days	Moderate	115	345,022.2
Total annual energy required			1,198,126
Mean daily energy required			3,283

Table 26 Worst- and best-case scenarios for food intakes by Roman rural dwellers (After Goodchild 2007, 324, Table 7.13).

	Men		Women		Both	
	Min	Max	Min	Max	Min	Max
3 hour day	2,068.89	3,115.17	1,832.36	2,891.29	1,950	3,003.23
9 hour day	2,616.69	3,940.00	2,317.53	3,656.84	2,467.11	3,798.42

The strength of Goodchild's study mainly lies within the combination of the FWO data with ancient skeletal and textual evidence and as such undoubtedly offers the best way to explore the potential food requirements of ancient populations. Therefore, this methodology is further elaborated on in the following sections with regard to the urban population of central Adriatic Italy.

[99] These figures include both the lowest intake for a 3 hour work day and the highest intake for a 9 hour work day (Goodchild 2007, Table 7.13); see also Goodchild 2005, 48-49; 2007, 317-324; 2009, 784-785; and Goodchild/Witcher 2010, 207.

4.3.2 Assessing energy requirements of Roman urban dwellers

Human energy requirements are defined by the FAO as *"the amount of food energy needed to balance energy expenditure in order to maintain body size, body composition and a level of necessary and desirable physical activity consistent with long-term good health".*[100] In other words, human beings need a certain amount of calories in order to compensate for the energy expended on the maintenance of their vital bodily functions and the performance of physical activities throughout the day. As mentioned above, the main parameters influencing these needs are body height, weight, age, sex and the level of physical activity. Together, the first four variables influence the Basic Metabolic Rate or BMR of a person; i.e. the minimal amount of energy required in order to keep going the basal metabolism processes of a human body. This includes the energy needed for maintaining a series of functions essential for life, like cell functions, the upkeep of body temperature, brain function, etc. In doing so, the BMR is responsible for 45 to 70 M of all energy that is expended by a person over a period of 24 hours.[101] The BMR is traditionally calculated by using the Harris-Benedict equations for men and women and may be expressed in Kilocalories (kcal) or Megajoules (MJ):[102]

BMR (men) = 66.473 + (13.7516 x weight in kg) + (5.0033 x height in cm) – (6.7550 x age in years)

BMR (women) = 655.0955 + (9.5634 x weight in kg) + (1.8496 x height in cm) – (4.6765 x age in years)

For instance, a male adult of 25 years of age, weighing 55 kg and measuring 160 cm would have a BMR of 1,454.76 calories or 6.09 MJ; a female adult of the same height and weight would have a BMR of 1,427.11 calories or 5.98 MJ.

In order to outline a range of possible BMR for antiquity, we thus need information on height, weight and age. Data regarding the first parameter may be collected from ancient skeletal evidence. Measurable skeletal material from Roman archaeological contexts in Italy is still relatively scarce, but some progress has been made in recent years. For instance, a recent study by Geoffrey Kron on 49 bone studies from Italy between 500 BC and AD 500 focused on evidence regarding the stature of adult males. Kron's analysis

[100] FAO 2004, 4.

[101] FAO 2004, 7, 9.

[102] Harris/Benedict 1918; 1919.

revealed mean heights between 163.5 and 172.7 cm for the individual sites, resulting in an overall mean height of 168.3 cm.[103] Another study by Monica Giannecchini and Jacopo Moggi-Cecchi focused in particular on stature evidence from archaeological bone samples of central Italy between the Iron Age and Medieval times. Five of the seventeen contexts examined were Roman Age burial sites located in Lazio, Molise and Marche. For these sites, mean heights between 164.2 and 165.4 cm were established for men, and between 149.5 and 153.2 cm for women. The derived overall mean values for stature in Roman times were 164.4 and 152.1 cm for men and women respectively (*Table* 27). The most interesting data for the purposes of this study logically come from the Roman town of *Suasa*, where mean heights of 164.7 and 153.2 cm were noted for men and women respectively.[104] Further information for the study area in particular is also available from five other cemeteries: Porto Recanati (*Potentia*), Urbino (*Urvinum*), Fano (*Fanum Fortunae*), Civitanova Marche, and Fossombrone (*Forum Sempronii*). For adult men, the mean heights range between 163.3 (Porto Recanati) and 168.5 cm (Fano); for women they range from 150.0 (Urbino) to 157.4 cm (Porto Recanati). The data from Fossombrone were collected from a preliminary excavation report of a late antique cemetery positioned within the circuit wall of the Roman town, but the height ranges are too general in order to further use them in this chapter.[105] All values are listed in the table below (*Table* 28).

Table 27 Mean stature estimates derived from skeletal evidence in central Italy (After Giannecchini/Cecchi-Moggi 2008).

Site	Region	Chronology	Mean height (cm)	
			M	W
Via Basiliano	Lazio	II-III c. AD	164.7	151.1
Lucrezia Romana	Lazio	I-III c. AD	165.4	152.9
Lucius Feroniae	Lazio	I-III c. AD	164.2	152.3
Suasa	Marche	III-V c. AD	164.7	153.2
Quadrella	Molise	I-IV c. AD	164.3	149.5
Mean values			**164.4**	**152.1**

The next step is then to derive the possible weight of these individuals from their height by using their BMI or Body Mass Index. Obviously, it is impossible to measure the BMI of people in antiquity directly, but values of 18.9 and 24.5 are nowadays considered

[103] Kron 2005, in particular 73-74, Table 1; see also Kron 2008, 80-81.

[104] Giannecchini/Moggi-Cecchi 2008.

[105] They are also exceptionally high and I would not be surprised if lower heights would result after closer examination (Mei/Gobbi 2014, 944).

to be the lower and upper limits for a healthy BMI on an individual level. A mean value of 21 has recently been proposed by the FAO as an acceptable figure on the level of the population as a whole.[106] We cannot know whether or not people effectively had a healthy BMI in Roman times – and in many cases they probably did not – but by including both the lower and the higher end of the acceptable range it becomes at least possible to outline the implications of both a poorly and well-fed urban population. Therefore, BMI values of 18.9, 21 and 24.5 are used for the calculations in this chapter by applying the following formula:

Weight in kg = (height²/10,000) x BMI (= Body Mass Index)

For instance, an adult male of 163.3 cm (Porto Recanati figure) – according to a BMI value of 18.5, 21 or 24.9 – might have had a body weight of 49, 56 or 66 kg. Assuming that he was 25 years of age, his BMR would have ranged from 1,388.47 to 1,622.24 calories. Based on the available central Adriatic skeletal evidence, a range of possible BMR figures was outlined for the study area. In particular, models were created for a minimum male height of 163.3 (Porto Recanati) and a maximum height of 168.5 cm (Fano); the minimal female height taken into consideration was 150.0 (Urbino) and the maximum height 157.4 cm (Porto Recanati). For reasons of completeness and clarity, calculations were also performed for a male height of 164.7 cm (*Suasa*) and a female height of 153.2 cm (*Suasa*). Three age groups were included in the models: 18-29 (18-25-29 years of age), 30-59 (30-45-59 years of age), and 60+ (60-65-70 years of age). The details of all these calculations may be found in Appendix IV (*Appendi*x IV – Caloric requirements).

Table 28 Information on stature in Marche derived from long bones of skeletal remains.

Site	Chronology	Mean height (cm)		References
		M	W	
Porto Recanati	III BC – IV c. AD	164.2 163.3	156.6 157.4	Capitanio 1968; 1974a; 1974b; Mercando et al. 1974
Urbino	I-III c. AD	164.5	150.0	Corrain et al. 1982; Mercando et al. 1985
Fano	II-III c. AD	168.5	\	Corrain et al. 1982
Civitanova Marche	IV c. AD	165.3	152.3	Corrain et al. 1982; Erspamer 1985
Fossombrone	IV-VII c. AD	170-180	160-170	Mei/Gobbi 2014

[106] FAO 2004, 40.

After the BMR, the second most influential parameter on daily energy expenditure is the Physical Activity Level or PAL. This is especially so for adults, as their BMR is relatively constant and no more energy is required for growth. The FAO 1973/1985 reports simply classified the PAL of adult persons according to their involvement in light, moderate or heavy occupational activities.[107] The 2004 report somewhat modified this classification and instead opted to rank the physical activity levels according to certain 'lifestyles', as such combining both 'obligatory' and 'discretionary' activities carried out in the course of the day.[108] As with the 1985 report, the categories used in this classification are three:[109]

1. **Sedentary or light activity lifestyle**: persons that fall under this category generally have occupations that do not demand much physical effort. In addition, they are not required to walk long distances, generally use motor vehicles for transportation, do not exercise or participate in sports regularly, and spend most of their leisure time sitting or standing, all this with little body displacement (e.g. talking, reading, watching television, listening to the radio, using computers). A good example is male office workers in urban areas, who only occasionally engage in physically demanding activities during or outside working hours. Another example may be rural women living in villages that have some facilities, like electricity, piped water and nearby paved roads. These women spend most of their time selling produce at home or in the marketplace, or doing light household tasks and take care for their children in or around their houses.
2. **Active or moderately active lifestyle**: this category of people has occupations that are not strenuous in terms of energy demands, but do involve more energy expenditure than that described for sedentary lifestyles. For instance, they can be persons with sedentary occupations who regularly spend a certain amount of time in moderate to vigorous physical activities, during either the obligatory or the discretionary part of their daily routine. This may be the daily performance of one hour (either continuous or in several sessions throughout the day) of moderate to vigorous exercise such as jogging, running, cycling, aerobic dancing or various sports activities. In fact, all these activities can raise a person's average PAL from 1.55 (which corresponds to the sedentary category, see *infra*) to 1.75 (the moderately active category). Moderately active lifestyles are also connected with certain 'physical' occupations, like masons and

[107] FAO 1973; 1985.

[108] With the term 'obligatory', reference is made to activities such as work, school and other demands made on people by their economic, social and cultural environment; 'discretionary' activities, on the other hand, include personal tasks, household affairs, leisure time, etc. (FAO 2004, 7).

[109] The following definitions are taken in part from the FAO 2004 report, 39.

construction workers, or rural women in villages that are less developed than in the previous category, where performing agricultural tasks or walking long distance to fetch water and fuelwood are a fixed part of the daily routine.

3. **Vigorous or vigorously active lifestyle**: persons that attain this type of lifestyle engage regularly in strenuous work or in strenuous leisure activities for several hours. Good examples are women with non-sedentary occupations, or that swim or dance an average of two hours a day, or non-mechanised agricultural labourers who work with a machete, hoe or axe for several hours daily and walk long distance over rugged terrains, often carrying heavy loads.

For each of these three categories, the FAO assigned a range of daily PAL values: 1.40-1.69 for the sedentary lifestyle, 1.70-1.99 for the active lifestyle, and 2.00-2.40 for the vigorous lifestyle.[110] Also, for each lifestyle, the FAO outlined a list of typical activities associated with a certain style and their corresponding average PAL values attained by a person living according to that particular style: 1.53 for the sedentary level, 1.76 for the active, and 2.25 for the vigorous one (*Table* 29; 30; 31; 32). Obviously, the determining factor for ascribing a certain person's lifestyle to one of the three categories is the intensity of this person's habitual physical activity in the course of a 24-hour period; i.e. the more intense it is, the higher the PAL value.

Table 29 PAL ranges and mean PAL values according to different lifestyles (After FAO 2004, Table 5.3).

Category	PAL range	Mean PAL
Sedentary or light activity lifestyle	1.40-1.69	1.53
Active or moderately active lifestyle	1.70-1.99	1.76
Vigorous or vigorously active lifestyle	2.00-2.40	2.25

These lists were then used as basis for estimating the mean PAL value of Roman town dwellers. Of course, the daily activities listed by the FAO are a reflection of modern living practices and cannot be extrapolated directly to the pre-industrial Roman era. What we can imagine is that Roman towns housed a mixture of individuals – or groups of individuals – that had lifestyles comparable to the three classes distinguished by the FAO. Indeed, Roman towns were typically 'melting-pots', populated by a wide range of human beings, either free or slaved, young and old, belonging to lower or higher social classes, or involved in different occupational activities. For central Adriatic Italy, the latter

[110] Pal values higher than 2.40 cannot be maintained over longer periods of time, but may be manageable during shorter periods of intense physical activity. An illustration may be cycling games that last for several weeks (FAO 2004, 39).

matter is well-illustrated by a recent study of Alessando Cristofori on the epigraphic record of *Picenum*. These textual sources mention persons involved in a variety of occupations, mostly administrative in nature (managers, magistrates, public notaries, delegates, overseers, financial controllers, secretaries, clerks) – and thus comparable to the living conditions falling under the sedentary or light activity lifestyle – but also artisans and other workshop personnel, various traders and dealers, sportsmen and musicians (gladiators, ball players, trumpeters), soldiers, farmers, servants and bailiffs, or people involved in the construction industry (architects, builders, carpenters, plaster workers) and the medical sector (surgeons, nurses).[111] These jobs reflect social positions and levels of physical activity that may easily be associated with either moderately or vigorously active lifestyles, as these people spent different amounts of energy in the course of their daily activities, and thus had varying energy needs.

Table 30 Estimated mean daily energy expenditure of Roman town dwellers with a sedentary or light activity lifestyle, recalibrated from the modern FAO figures (Based on FAO 2004, 36, Table 5.1).

Main daily activities	Time allocation (hours)		Energy cost (PAR)		Time x energy cost		Mean PAL (TxE/24)	
	M	R	M	R	M	R	M	R
Sleeping	8	8	1	1	8.0	8.0		
Personal care	1	1	2.3	2.3	2.3	2.3		
Eating	1	1	1.5	1.5	1.5	1.5		
Cooking	1	1	2.1	2.1	2.1	2.1		
Work (sitting)	8	8	1.5	1.5	12.0	12		
Non-mechanised domestic chores	\	1	\	2.3	\	2.3		
General Household work	1	\	2.8	\	2.8	\		
Driving car to/from work	1	\	2.0	\	2.0	\		
Walking at various paces without a load	1	3	3.2	3.2	3.2	9.6		
Light leisure activities	2	1	1.4	1.4	2.8	1.4		
Totals	**24**	**24**			**36.7**	**39.2**	**1.53**	**1.63**

Still, in order for the FAO lists to be applicable, they first need to be adapted to the circumstances in antiquity. For instance, the original tables attribute a one hour time-period to activities such as 'driving car to/from work' or 'commuting to/from work on the bus', while reserving only one hour for 'walking at varying paces without a load'.

[111] Cristofori 2004.

These were replaced by three hours of 'walking' in order to reflect the fact that people displaced themselves mostly on foot within urban contexts in antiquity. Other modifications include the omitting of 'general household work' in favour of 'non-mechanised domestic tasks', and the reducing of leisure time from 3-4 hours in modern times to only one hour in antiquity. In the end, this resulted in higher mean PAL values of 1.63 for the sedentary lifestyle, 1.87 for the active lifestyle, and 2.35 for the vigorous lifestyle (*Table* 30; 31; 32). This was considered adapted for the likelihood that people in antiquity had an overall harsher and physically more demanding lifestyle than modern individuals.

As such, for adults, the total amount of energy required each day (TEE = Total Energy Expenditure) may be calculated by multiplying the BMR with the daily PAL value:

TEE = BMR x PAL.

Table 31 Estimated mean daily energy expenditure of Roman town dwellers with an active or moderately active lifestyle, recalibrated from the modern FAO figures (Based on FAO 2004, 36, Table 5.1).

Main daily activities	Time allocation (hours)		Energy cost (PAR)		Time x energy cost		Mean PAL (TxE/24)	
	M	R	M	R	M	R	M	R
Sleeping	8	8	1	1	8.0	8.0		
Personal care	1	1	2.3	2.3	2.3	2.3		
Eating	1	1	1.5	1.5	1.5	1.5		
Cooking	\	1	\	2.1	\	2.1		
Work (standing, carrying light loads)	8	8	2.2	1.5	17.6	17.6		
Non-mechanised domestic chores	\	1	\	2.3	\	2.3		
Commuting to/from work on the bus	1	\	1.2	\	1.2	\		
Walking at various paces without a load	1	3	3.2	3.2	3.2	9.6		
Low intensity aerobic exercise	1	\	4.2	\	4.2	\		
Light leisure activities	3	1	1.4	1.4	4.2	1.4		
Totals	**24**	**24**			**42.2**	**44.8**	**1.76**	**1.87**

For instance, a male adult of 25 years, weighing 56 kg and measuring 163.3 cm (Porto Recanati figure), with a BMR of 1,484.72 calories would have had a daily energy requirement between 2,078.61 and 2,509.18 calories when involved in a sedentary

lifestyle, but 2,524.02-2,954.59 calories with an active lifestyle, or 2,969.44-3,563.33 calories with a vigorous lifestyle. Based on the mean PAL values calculated for the Roman period, the average caloric requirements of this person would have been 2,420.09 (sedentary lifestyle), 2,776.43 (moderately active lifestyle), or 3,489.09 calories (vigorously active lifestyle) (*Appendix* IV, *Table* 81; 82; 83, scenario 2b). The details of all the calculations may be found in Appendix IV, but the main results are visualised in the table below (*Table* 33).

Table 32 Estimated mean daily energy expenditure of Roman town dwellers with a vigorous or vigorously active lifestyle, recalibrated from the FAO figures (Based on FAO 2006, 36, Table 5.1).

Main daily activities	Time allocation (hours)		Energy cost (PAR)		Time x energy cost		Mean PAL (TxE/24)	
	M	R	M	R	M	R	M	R
Sleeping	8	8	1	1	8.0	8.0		
Personal care	1	1	2.3	2.3	2.3	2.3		
Eating	1	1	1.4	1.4	1.4	1.4		
Cooking	1	1	2.1	2.1	2.1	2.1		
Work (non-mechanized, agricultural)	6	6	4.1	4.1	24.6	24.6		
Collecting water/wood	1	\	4.4	\	4.4	\		
Non-mechanised domestic chores	1	3	1	2.3	2.3	6.9		
Walking at various paces without a load	1	3	3.2	3.2	3.2	9.6		
Light leisure activities	4	1	1.4	1.4	5.6	1.4		
Totals	**24**	**24**			**53.9**	**56.3**	**2.25**	**2.35**

Table 33 Minimum and maximum caloric requirements for men and women between 18 and 70 years of age in Roman urban contexts in central Adriatic Italy.

PAL	Men		Women		Men/Women	
	Min	Max	Min	Max	Min	Max
1.40-2.40	1,518	4,234	1,410	3,492	**1,464**	**3,863**
1.63/1.87/2.35	1,768	4,146	1,641	3,419	**1,705**	**3,783**

When taking into consideration the whole range of PAL values – i.e. from a minimum value of 1.40 up to a maximum value of 2.40 – the caloric requirements for Roman male urban dwellers range from 1,518 to 4,324 kcal; for female persons they range between 1,410 and 3,492 kcal. If we take into account only the mean values – which are most likely to reflect the living circumstances of urban dwellers in Roman Italy – the caloric needs

range from 1,768 to 4,146 kcal for men and from 1,641 to 3,419 kcal for women. Combined, this means that urban dwellers in central Adriatic Italy were likely to require between 1,705 and 3,783 calories per day; with figures of 1,464 and 3,863 kcal as absolute minima and maxima (*Table* 33). These are the values then on which we will base the urban consumption model outlined in the following section. The dietary proportions that will be used in this model are 60% cereals, 15% wine, 10% olive oil, and 15% vegetables, fruits, meat and fish. For olive oil, extra amounts will be incorporated into the model for purposes other than food consumption, such as bathing and lightning. The reasons for choosing these percentages have been amply discussed in the previous section of this chapter and do not require further elaboration (see *supra*).

4.4 Setting-up an urban consumption model

As recalled, the urban population figures calculated in the previous chapter were 61,117-102,357 persons for the Late Republican period and 82,725-123,800 persons for the Early/High Imperial period. The archaeological evidence hereby suggested that the lower estimates might be more indicative for the former period, while the higher estimates might better reflect the situation in the latter period, especially when suburbs started to develop from the Augustan period onwards (see *supra*). In order to explore the implications of both lower and higher urban populations, I therefore decided to assign the lower estimates to the Republican era (Scenario 1), and the higher estimates to the Imperial era (Scenario 2), with the chronological cut-off situated around the mid-1st century BC. For each of these two scenarios, we can now outline the amounts of food required on an annual basis by applying the estimated dietary proportions to the minimum and maximum daily caloric needs calculated in the previous section. Only the values adapted to the circumstances in antiquity will be modelled. As the purpose of this chapter lies mainly in modelling the relationship between cereals, wine and olive oil, only these foodstuffs will be incorporated into further models (*Table* 34).[112]

For Scenario 1 (Late Republican period), cereal needs were between ca. 6.8 and 15 million kg, wine needs between 7.9 and 17.8 million litres, and oil needs between ca. 0.5 and 1 million litres when taking into account a population figure of 61,117 (A); with a

[112] As mentioned earlier in this chapter, modelling the implications of the remaining 15% of the diet – especially meat consumption – would certainly be a useful exercise, but would require a work on its own and the issue cannot be discussed here (see *supra*).

population of 82,725 (B), cereal needs were between ca. 9.2 and 20.3 million kg, wine needs were ca. 10.7 to 24.1 million litres, and oil needs ca. 0.6- 1.4 million litres (*Table* 35). For Scenario 2 (Early/High Imperial period), the respective needs were 11.4-25.1 million kg of cereals, 13.3-29.8 million litres of wine, and 0.8-1.7 million litres of oil when based on a population figure of 102,357 (A); while a population of 123,800 (B) required 13.8-30.3 million kg of cereals, 16-36 million litres of wine, and 0.9-2 million litres of olive oil (*Table* 36).

Table 34 Minimum and maximum annual requirements in cereals, wine and olive oil.

Kcal	Cereals (60%)		Wine (15%)		Oil (10%)	
Daily	Kcal	Kg	Kcal	l	Kcal	l
1,705-3,783	1,023-2,270	0.31-0.68	256-568	0.36-0.81	171-378	0.021-0.046
1,464-3,863	878-2,318	0.26-0.69	220-580	0.31-0.82	146-386	0.018-0.048
Monthly	**Cereals (Kg)**		**Wine (l)**		**Oil (l)**	
51,150-113,490	9.3-20.4		10.8-24.3		0.63-1.38	
43,920-115,890	7.8-20.7		9.3-24.6		0.48-1.44	
Annually	**Cereals (Kg)**		**Wine (l)**		**Oil (l)**	
613,800-1,361,880	111.6-244.8		129.6-291.6		7.6-16.6	
527,040-1,390,680	93.6-248.4		111.6-295.2		5.8-17.3	

Table 35 Estimated annual food requirements based on the lower urban population figures (Scenario 1) (the non-food component of olive oil is excluded).

Annual Kcal.	Population	Wheat (kg)	Wine (l)	Oil (l)
613,800-1,361,880	61,117 (A)	6,820,657.2-14,961,441.6	7,920,763.2-17,821,717.2	464,489.2-1,014,542.2
	82,725 (B)	9,232,110-20,251,080	10,721,160-24,122,610	628,710-1,373,235

Table 36 Estimated annual food requirements based on the higher urban population figures (Scenario 2) (the non-food component of olive oil is excluded).

Annual Kcal.	Population	Wheat (kg)	Wine (l)	Oil (l)
613,800-1,361,880	102,357 (A)	11,423,041.2-25,056,993.6	13,265,467.2-29,847,301	777,913.2-1,699,126.2
	123,800 (B)	13,816,080-30,306,240	16,044,480-36,100,080	940,880-2,055,080

A final reflection is reserved for the use of olive oil other than as a food source. As may be noted, a per capita consumption figure of 7-16 litres on an annual basis is far below the 20-60 litres suggested by scholars like David Mattingly, Jean-Pierre Brun and Lin Foxhall (see *supra*). Still, it is difficult to quantify the amounts of oil that were 'consumed' by a person annually in the form of soaps, perfumes and medicines. We can only imagine how widespread its use must have been in urban bath houses and temples. A useful order of magnitude, however, may come from the employment of olive oil for purposes of lightning. Recent experiments with ancient oil lamps have shown that on average an oil lamp consumed about 8g of oil per hour, which is the equivalent of 71.7 kcal.[113] Over a 24 hour-period, the use of such a lamp would thus have equalled a calorific value of ca. 1,720 kcal. Of course, oil lamps were only used for a few hours a day, but even with a daily minimum time of 4 hours of lightning, the caloric requirement would have been 104,633 kcal, or ca. 12.9 litres of oil per year. As most households will have possessed at least one oil lamp – and some undoubtedly more – it might not be unreasonable to assume at least an extra 10 l of olive oil per person on an annual basis, including applications connected with hygiene and personal care.[114] For our model, this would mean an addition of 611,170-827,250 litres for the Late Republican period (Scenario 1: A, B) and of 1,023,570-1,238,000 litres for the Early/High Imperial period (Scenario 2: A, B).

4.5 Including the rural component

In order to effectively appraise the impact of such an urban demand for cereals, wine and olive oil, it is important to understand to which extent their territories were able to satisfy it; could they generate sufficient surpluses after subtracting the needs of the rural population. Fully investigating the size and evolution of the rural population of central Adriatic Italy throughout Late Republican and Early Imperial times would have required a study on its own – or at least a separate chapter – and while I would have liked to delve deeper into the issue, time restrictions prevented me from doing so. Still, some order of magnitude is obviously required here and therefore I would like to dedicate the final part of this chapter to a brief reflection on some commonly used urbanisation rates for central

[113] Wunderlich 2003, 256; Crnobrnja 2008, 411.

[114] It should be noted here that oil lamps are known from rural contexts too in the area, as has been ascertained by finds in the potenza valley (Vermeulen et al. 2005, 54-58, with several examples) and southern Marche (Menchelli 2012).

Italy in Roman times, together with a quick look at some of the recent rural survey evidence provided by the PVS (Potenza Valley Survey) and the PSPS (Pisa South Picenum Survey) projects.[115] Based on this information, I will propose a preliminary rural population model for both the Late Republican (R1) and the Early/High Imperial (R2) period, as well as a subsistence model inspired by the discussion on dietary patterns and food requirements in the first section of this chapter.

4.5.1 The size of the rural population

Demographic studies on the ancient world have conventionally applied urbanisation rates between 15 and 20% for Roman Italy as whole in the Augustan or Early Imperial period.[116] For central and southern Italy in particular, Luuk de Ligt has recently argued for a slightly higher rate in the 17.9-21.1% range, with the exclusion of Rome and Ostia.[117] Taking into considerations such rates, this would imply a rural population somewhere between 392,061.6-551,500 (EI urban population of 82,725) and 586,729.9-825,333.3 (EI urban population of 123,800) people for the Early/High Imperial period. With the same urbanisation rates applied to the Late Republican period, based on the figures calculated in the previous chapter, the rural population would have ranged from 289,654-407,446.7 (LR urban population of 61,117) to 485,104.3-682,380 (LR urban population of 102,357) people.

One way to examine the validity of such proportions is to look at the rural survey evidence recently collected within the framework of the Potenza Valley Survey and Pisa South Picenum Survey projects. In fact, the complementary surveys carried out by the former project in the territories of the four towns in the Potenza valley – *Potentia*, *Ricina*, *Trea* and *Septempeda* – resulted in the registration of 84 rather well-dated Roman rural sites for the lower, middle and upper sections of the valley combined (*Figure* 226). In terms of site densities, this resulted in 11.73 sites/km² for the upper valley (3.15 km² survey transect), 3.73 sites/km² for the middle valley (3.7 km² transect) and 8.24 sites/km² for the lower valley (4 km² transect).[118]

A detailed demographic reconstruction based on more recent survey results is currently being prepared by the PVS, but for the time being a first order of magnitude can be derived from a reconstruction recently attempted by Peter De Graaf in his 2012

[115] A third survey project – the Upper Esino Valley Survey – was excluded from this discussion, as only preliminary data have until now been published and no final publication of the survey results is currently available (Pearce et al. 2009).

[116] Hopkins 1978; Lo Cascio 1999, 164-165.

[117] De Ligt 2012, 238-240. These suggested percentages are based on a close examination of the physical lay-out of Roman towns.

[118] Vermeulen/Mlekuz 2012, 211, Table 20.1.

volume on urban and rural demography in Roman Italy. Indeed, based on these preliminary PVS results, De Graaf has aspired a reconstruction of the rural population in the valley in both the Late Republican and the Early Imperial period. Following the size of the surface scatters, De Graaf started by subdividing the recorded sites into six categories: small farm (1), farm (2), large farm/small villa (3), *villa rustica* (4), roadside settlement (5), and *vicus* (6). Taking into account the chronological information, he then set up site densities per category for both Late Republican period and Early Imperial times. Next, these densities were extrapolated to the total valley area of the Potenza river (400 km²) in order to propose overall site numbers for each period (*Table* 37).

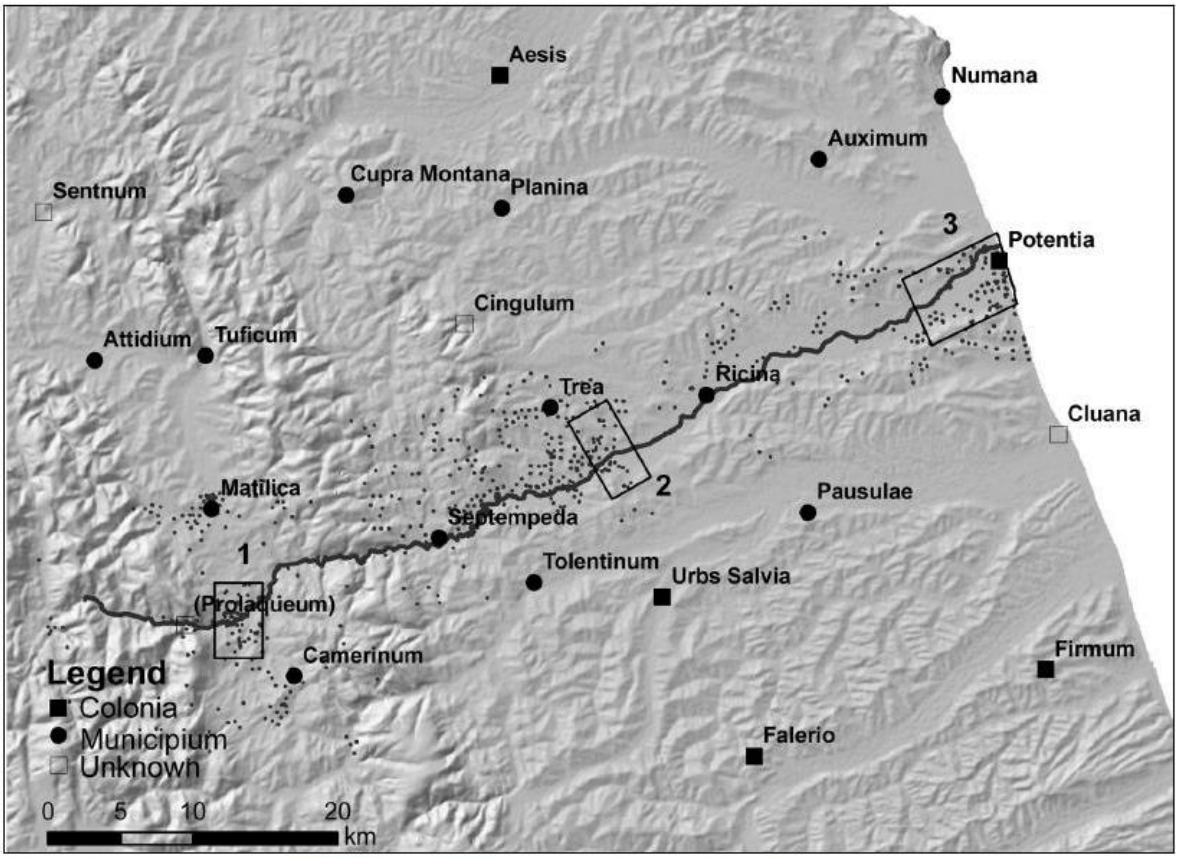


Figure 226 The distribution of Roman rural settlement in the Potenza valley (After Vermeulen/Mlekuz 2012, 212, fig. 20.2).

When assigning a number of inhabitants per site type, De Graaf considered two scenarios: in a first scenario, he put the small farms and farms in one group, and the large farms and *villae rusticae* in another; in a second scenario, the first three categories were grouped together and the *villae rusticae* were counted separately. Under the first scenario, he arrived at a density of 1 farm and 2 *villae*/km² in the Late Republican period, and 3.5 farms and 2.8 *villae*/km² for the Early Imperial period; with the second scenario, there were 2.1 farms and 0.8 villae/km² for the LR period, and 5.2 farms and 1.0 villa/km² for the EI period. The corresponding household sizes used by De Graaf were 5.5 people for

farms and 20 people for villas. As such, he arrived at a total rural population between 15,339 and 21,835 people for the Late Republican period, and a population of 25,115-35,726 for the Early Imperial period. These figures translated into densities of 38-55 persons/km² and 63-89 persons/km² respectively.[119] This means that not only was the central Adriatic region one of the more densely urbanised areas of Roman Italy in the Early/High Imperial period, it would also have had one of the more crowded rural territories of the peninsula.

Table 37 Site densities and total number of sites for the Late Republican and Early Imperial periods in the Potenza valley (After De Graaf 2012, 47, Table 6.6).

Site type	Upper	Middle	Lower	Late Republic Total	Sites/km²	Potenza valley
Small farm	1	0	0	1	0.09	37
Farm	5	2	3	10	0.93	373
Large farm/small villa	4	2	6	12	1.12	448
Villa rustica	2	1	6	9	0.84	336
Roadside settlement	0	1	1	2	0.19	75
Vicus	0	0	0	0	0.00	0
Site type	**Upper**	**Middle**	**Lower**	**1st Century AD total**	**Sites/km²**	**Potenza valley**
Small farm	9	2	5	16	1.49	597
Farm	13	4	4	21	1.96	784
Large farm/small villa	10	3	6	19	1.77	709
Villa rustica	2	3	6	11	1.03	410
Roadside settlement	0	1	1	2	0.19	75
Vicus	0	1	0	1	0.09	37

Still, before moving on, some remarks need to be made to De Graaf's methodology and calculations. Considering the extent of surface scatters as straightforwardly reflecting the size of the underlying rural site remains an intrinsic weakness of field survey data.[120] I would not go as far as Walter Scheidel in considering survey data to be practically worthless as a basis for population estimates, but it is nevertheless true that – when deriving demographic information from survey results – the incorporation of a series of assumptions remains a required step. The often arbitrary – and therefore potentially

[119] De Graaf 2012, 45-49.

[120] Scholars like Walter Scheidel, Dominic Rathbone and Luuk De Ligt have been keen to stress these and other drawbacks of survey data with regard to their possible contribution to demographic discussions (Scheidel 2008, 49-54; Rathbone 2008; De Ligt 2012, 249-254; see also Launaro 2011, 69).

erroneous – classification of sites into farms (small and large) and villas is one such assumption. Another one is the assignment of fixed household sizes to each of these categories. Precise chronology too is a recurrent problem.[121] The application of possible recovery rates – i.e. the extent to which the number of registered sites reflects the actual number of sites present in the landscape – is also a tricky matter.[122] For instance, in this case De Graaf assumed a 100% recovery rate for the surveys. This is unrealistically optimistic, especially when considering the lower valley transect close to the river mouth of the Potenza, where a succession of anthropogenic and natural processes in post-antique times has significantly changed the landscape since the Roman era. In essence, these processes have resulted in a wide array of physical transformations that have both eroded and buried Roman rural occupation under layers of sediment, meaning that the survey results may not accurately reflect the situation in Roman times.[123] In fact, only a handful of sites have until now been registered through surface work in the lower valley plain, but another site has recently been identified at a depth of ca. 1 m on the occasion of a random dig.[124] On the flip side, the surveyed zones are all closely located to the Roman towns in the valley and it is possible that more remote areas further away were not that densely occupied, compensating as such for possibly too low site densities in the surveyed areas.

Assessing the size of the rural population on the basis of survey data is thus a highly complicated matter, but there is currently no other way to acquire some apprehension of

[121] In the case of the Upper Esino Valley Survey, the scarcity of fine wares prevented the researchers from subdividing the Roman Age sites further into chronological subclasses (Pearce et al. 2009).

[122] The many variables that influence survey recovery rates cannot be discussed here, but for an insightful and stimulating discussion, see Witcher 2011.

[123] In Roman times, the typically hilly Adriatic valley-landscape consisted of meandering rivers that entered a series of lagoons and swamps at the junction with the sea (Coltorti 1997, 317). The low sandbanks that separated these waters from the sea were used by the Romans to construct settlements and interconnecting roads (Vermeulen/De Dapper/Goethals 2006, 76). However, from ca. AD 100 onwards – and especially between the 15th and the 19th century – an always increasing anthropogenic deforestation for purposes of land reclamation caused the degradation of the hill slopes and the filling of the river valleys with sediment (Coltorti 1997; Goethals/De Dapper/Vermeulen 2005). At the river mouths, these sediments gradually filled-up the swamps and lagoons along the coast. Between the 16th and the 19th century, this process was accompanied by a rapid progradation of the coast (Giarizzo 1963; Ortolani/Alfieri 1978; Jacobelli et al. 1982; Anselmi 1986; see also Coltorti 1997 and Goethals/De Dapper/Vermeulen 2005). Especially in the lower reaches of the rivers, the interaction of these two phenomena led to the creation of the so-called braidplain river system (Coltorti 1997). In addition, many rivers were artificially diverted or rectified. At the beginning of the 20th century, a reduction in erosion and thus in sediment supply occurred. This was mainly because of the introduction of the 'alberata'-system in Italian agriculture and the accompanying anti-erosion measures, like artificial drainages for protection against flooding and artificial levees for extending areas suitable for cultivation (Coltorti 1997; Goethals/De Dapper/Vermeulen 2005).

[124] Personal communication Frank Vermeulen and Patrick Monsieur.

scale on the potential size of the rural population in central Adriatic Italy. Leaving aside precise population figures, De Graaf's reconstruction at least suggests that for a large part of the Late Republican period the rural population was significantly lower than in the Early/High Imperial period. Incidentally, the same impression comes from the survey results of the Pisa South Picenum Survey project in the territory of the Roman town of *Firmum Picenum* /Fermo (*Ager Firmanus*).[125] No specific site numbers could be retrieved from the available publication, but the registered site numbers do indicate an overall lower number of rural sites in the Late Republican period than in the Early/High Imperial period (*Table* 38).[126] Besides, these patterns in the survey evidence seem to coincide well with some of the epigraphic sources, which offer indications for a heavily populated countryside in the territories of *Asculum* and *Pisaurum* precisely from the Augustan Age onwards.[127]

Table 38 Number of rural sites registered by the PSPS projects in the *Ager Firmanus* (After Menchelli 2012, 174, Tabella 1).

Site type	II-I c. BC	End I c. BC-II c. AD	III-VI c. AD	VI-VII c. AD
Villa	20	50	15	8
Large farm/small villa	13	34	8	\
Farm	23	99	17	3
Small farm	6	40	4	\
Settlement	6	6	6	2
Off-site	11	15	8	4
Totals	**79**	**244**	**58**	**17**

Just like for the urban populations then, we might use De Graaf's density figures for outlining two scenarios: a first one with densities of 38-55 persons/km² and a second one with densities of 63-89 persons/km². Again, the first scenario may be more indicative for the Late Republican period (R1), while the second scenario could be more indicative for the Early and High Imperial periods (R2). Extrapolated to the total study area – i.e. 11,314 km² for the Marche region and Abruzzo Teramano combined – this would result in rural population figures between 429,932-622,270 (R1) and 712,782-1,006,946 (R2) people respectively; i.e. urbanisation rates of 14.2-13.3 (R1) and 14.4-12.3% (R2). As such, the derived urbanisation rates are decisively lower than the ones used until now for central and southern Italy in the Imperial period (see *supra*). This would confirm what seemed to

[125] For the locations of the towns mentioned here, see supra Chapter 3, *Figure* 129.
[126] Menchelli 2012.
[127] Paci 1996-1997; Campagnoli/Giorgi 2003, note 118.

be suggested in the previous chapter by the urban archaeological record for these towns in the Early/High Imperial period; i.e. that they were mostly service centres with a considerable amount of space reserved for public and commercial functions, while their actual habitation component was rather modest, implying that most people lived in the countryside, either in the immediate surroundings of these towns or further afield.

4.5.2 Outlining a subsistence model

For the derived subsistence model, only PAL values associated with moderately or vigorously active lifestyles will be taken into consideration, as farmers may considered to have had an overall more burdening lifestyle than town dwellers. The dietary proportions used are 75% cereals, 5% wine, 5% olive oil and 15% vegetables and fruits. While meat and fish might have been available in some cases, I decided not to incorporate these food products percentagewise into the rural consumption model. These percentages are inspired by the dietary patterns outlined in the first section of this chapter, assuming that the diet of peasants was less varied than those of town residents, with the former also relying more on cheaper calories. Finally, no additional olive oil was added for non-food purposes, as one might expect people in the countryside to have had a less luxurious lifestyle than urban dwellers.

With the parameters outlined above, the required cereal needs for the rural population in the Late Republican period (R1) were between ca. 68 and 132 million kg, wine needs were 21-41 million litres, and oil needs were 1.8-3.5 million litres when taking into account a rural population figure of 429,932 people; with a population of 622,270 people, cereal needs were between 98 and 190 million kg, wine needs were ca. 31-60 million litres, and oil needs ca. 2.6 to 5.1 million litres. For the Early/High Imperial period (R2), the respective requirements were ca. 113-218 million kg of cereals, 36-69 million litres of wine and 3-6 million litres of olive oil when based on a population figure of 712,782; while a population of 1,006,942 required ca. 159-308 million kg of cereals, 51-98 million litres of wine and 4.3-8.3 million litres of oil (*Table* 39).

The requirements of the urban and rural populations combined are outlined at the end of the table. Regarding cereal needs, these were ca. 75-147 million kg or 108-211 million kg for the LR period, and ca. 124-243 or 173-338 million kg for the EI period. For wine needs, the amounts were ca. 30-60 or 42-85 million litres for the LR era and 49-99 or 67-134 million litres for the EI era. Oil needs were ca. 3-5 or 4-7 million litres for the LR and 5-9 or 7-12 million litres for the EI, including the non-food component for the urban population (*Table* 39).

4.6 Conclusion

In this chapter, I have attempted to model the consumption needs of the urban population of central Adriatic Italy between Late Republican and Early Imperial times. The basis for my calculations was a reconstruction of the Roman dietary pattern and an assessment of the minimum and maximum daily caloric requirements of an urban dweller in antiquity. The parameters that were fixed for my calculations were 1,705 and 3,783 calories per day for men and women combined. The applied dietary patterns were 60% cereals, 15% wine, 10% olive oil and 15% vegetables, fruits, meat and fish. The matching food intakes for the lower population figures (60,000-80,000) were ca. 6 to 20 million kg of wheat, 7 to 24 million litres of wine and 0.5 to 1.4 million litres of oil. For the higher population figures (100,000-120,000), these were 11 to 30 million kg of wheat, 13 to 36 million litres of wine and 0.7 to 2 million litres of olive oil.

This reconstruction was complemented with a rural subsistence model in order to appreciate fully the impact of the urban community on the surrounding countryside. Although definitely requiring further work, a brief examination of the available rural survey data seemed to imply that a demographic evolution similar to that of the towns – i.e. population growth between the Late Republican and the Early/High Imperial period – may be supposed for the rural population in the area. The current reconstruction suggests that the size of said population was in the 430,000-620,000 range in the former timespan (14-13% urbanisation rate), and in the 710,000-1,000,000 range for the Early/High Imperial period (14-12% urbanisation rate). The applied caloric parameters were 1,956 and 3,783 calories per day for men and women combined. The dietary patterns were 75% cereals, 5% wine, 5% olive oil and 15% vegetables and fruits. The food intakes calculated as such were 68 to 190 million kg of wheat, 21 to 60 million litres of wine and 1.8 to 5 million litres of oil when taking into account the lower figures; for the higher figures they were 112 to 308 million kg of wheat, 35 to 97 million litres of wine and 3 to 8 million litres of oil. With urban and rural needs put together, wheat needs were 74 to 201 million kg, wine needs were 29 to 84 million litres and oil needs were 2.9 to 7 million litres for the lower population figures; for the higher population figures they were 124 to 338 million kg (wheat), 49 to 133 million litres (wine) and 4.8 to 11 million litres (oil).

More than anything else, the results obtained as such form the starting point for our next chapter, in which I will try to determine the amount of land that was needed in order to produce the necessary quantities of food for both the urban and rural population. Said amounts may then be compared with the size of the study area in order to get an idea of the 'consumption' burden on the lands.

Table 39 Calculations of the food requirements of the rural and urban population of central Adriatic Italy in the Late Republican and the Early/High Imperial period. The food needs for the rural population only are indicated with R1A-B and R2A-B (R1 = Late Republican; R2 = Early/High Imperial) (A = low population figure; B = high population figure). The needs for the urban and rural populations combined are indicated with LR (Late Republican) and EI (Early/High Imperial) (1 = low population figure; 2 = high population figure). For the combined needs, the oil amounts include the non-food component from the urban population.

Kcal	Cereals (75%)		Wine (5%)		Oil (5%)	
Daily	Kcal	Kg	Kcal	l	Kcal	l
1,956-3,783	1,467-2,837	0.44-0.85	98-189	0.14-0.27	98-189	0.012-0.023
Monthly	Cereals (Kg)		Wine (l)		Oil (l)	
58,680-113,490	13.2-25.5		4.2-8.1		0.36-0.69	
Annually	Cereals (Kg)		Wine (l)		Oil (l)	
704,160-1,361,880	158.4-306		50.4-97.2		4.3-8.3	
Population (Rural)	Wheat (kg)		Wine (l)		Oil (l)	
429,932 (R1A)	68,101,229-131,559,192		21,668,573-41,789,390		1,848,708-3,568,436	
622,270 (R1B)	98,567,568-190,414,620		31,362,408-60,484,644		2,675,761-5,164,841	
712,782 (R2A)	112,904,669-218,111,292		35,924,213-69,282,410		3,064,963-5,916,091	
1,006,942 (R2B)	159,499,613-308,124,252		50,749,877-97,874,762		4,329,851-8,357,619	
Total population (Urban+rural)	Wheat (kg)		Wine (l)		Oil (l)	
491,049 (LR1)	74,921,887-146,520,634		29,589,336-59,611,107		2,924,314-5,194,148	
704,995 (LR2)	107,799,678-210,665,700		42,083,568-84,607,254		4,131,721-7,365,326	
815,139 (EI1)	124,327,711-243,168,286		49,189,680-99,129,711		4,866,446-8,638,787	
1,130,742 (EI2)	173,315,693-338,430,492		66,794,357-133,974,842		6,508,731-11,650,699	

Chapter 5
Agricultural productivity and land availability in central Adriatic Italy

5.1 The issue of crop estimation in antiquity

Crop estimation may be defined as the practice of projecting as accurately as possible the quantity of a certain crop that can be harvested from a portion of agricultural land. In modern agriculture, this is done by painstakingly registering annual harvest data and modelling the many factors that influence them with the aid of specifically designed computer applications year by year. It goes without saying that such a massive amount of meticulously monitored data is not available for antiquity, making the quantification of the annual output of arable lands, vine plantations or olive groves a rather tricky exercise. The only direct information is provided by the texts of the ancient agronomists, whose yield figures have often been questioned for their accuracy or representativeness and as such continue to be a matter of debate until today.[1] Indeed, recurrent problems with regard to the textual evidence for ancient yields are their geographic restrictions – they often refer to a few specific areas of Italy – their tendency to stress the extraordinary rather than the normality, and the lack of indications for the parameters that influenced their yields (see *infra*). Therefore, an often attempted methodology in historical and archaeological land studies is the use of comparative evidence from post-antique time periods up until the pre-industrial era. A recent overview of Italian agriculture in Roman and medieval times has warned against the uncritical comparison of such data with

[1] Many works could be cited here, but classic accounts on ancient cereal yields include White 1963; Evans 1981; Spurr 1986, 82-85; and Erdkamp 2005, 34-38, all with further references. The issue of wine yields is discussed by scholars like Billiard 1913; Martin 1971, 370-373; Duncan-Jones 1982, 39-48; Carandini 1988, 235-265 (see *infra*).

ancient yield numbers, as the former sources – just like their Roman counterparts – might have been biased because of the underlying intentions of the author(s), or by the nature of the texts in which they appear.[2] While I fully acknowledge this statement, there is simply no other way for complementing and evaluating the few yield figures we have for antiquity.[3]

Then again – as yields are ultimately a matter of environmental conditions, cultivation strategies and agricultural knowhow – there is little use in confronting the ancient evidence randomly with later data and some conditions must be fulfilled in order for the latter to be useful as comparative material. First, the data need to be as regional as possible, which in our case means that we should concentrate our efforts mainly on the Marche region and northern Abruzzo. Second, the periods from which we choose to collect the data need to approximate the farming conditions of the Roman era, which implies to take a look at time periods that were characterised by low-technology and labour-based farming practices, while at the same time still approaching the efficiency and expertise of Roman farming that is so well reflected in the ancient textual sources. In fact, is has been argued repeatedly that Medieval sources are not a good place to start, as the era marked a considerable regression in agricultural knowhow compared to Roman antiquity, meaning that only later periods should be taken into consideration.[4] And third, we would also like for these data to approach some form of sampling validity, i.e. preferably in the form of annual statistics over longer periods of time. In practice then, this implies to take a look at central Adriatic agriculture between the mid-17th century and the first half of the 20th century; a period in which the limited value of mechanisation and the low-scale use of industrial farming techniques made Italy – as far as food production was concerned – still very much a pre-industrial society in those times. Especially in the 19th century, 70% of the population lived in the countryside and more than half of the population worked in the agricultural sector. In the Marche region in particular, around the mid-19th century, this sector was still highly labour-intensive and often made-use of outdated agricultural tools.[5]

Fortunately, the period is also rather well-documented for the Marche region. In 1631, the area was annexed into the Papal State (*Stato Pontificio*) and it remained so until 1860, when the battle of Castelfidardo made a definite end to the ecclesial dominance in the region. As such, some information on yields is available through the archival records of

[2] Forni 2002b, 438-440.

[3] Although one promising area of research is experimental archaeology (Reynolds 1984, 106-109; and Seavoy 1986; see also Forni 2002b, 441-442).

[4] De Martino 1979; 1984; Forni 2002b.

[5] Pedrocco 1976-77; Anselmi 1978; Sirago 1995; Zattini 1921a; and 1921b; Pellegrini 2003.

churches, monasteries, and other Papal properties.[6] Besides, during the Papal reign in the Marche region several rural estimations (*Revisione dell'Estimo Rustico*) were carried out in the provinces of Ancona, Macerata, Fermo, Ascoli, Pesaro and Urbino. The results of these estimations were mainly published by G. Grassellini between 1842 and 1846 and include some useful information for the purposes of our study.[7] Also, after the installation of the Kingdom of Italy in 1861, the Marche region was included in the so-called 'Inchiesta Agraria Jacini', an extensive parliamentary inquiry carried out between 1877 and 1886, whose main goal was to examine the conditions of the Italian agricultural sector.[8] By far the best information, however, comes from the *Annuario Statistico Italiano* for the period between 1909 and 1939.[9] Further useful sources include the *Prontuario dell'Agricoltore* – an Italian agricultural manual published in 1897, and again in 1952 – and the International Yearbook of Agricultural Statistics (1909-1921) and the *Enciclopedia Italiana* (1937).

In a way then, the first part of this chapter is 'classical' in its set-up, in a sense that it is centred on an analysis of the ancient and comparative textual evidence for harvest sizes in central Adriatic Italy, this in order to model how much wheat, wine or olive oil a hectare of agricultural land could potentially produce in the area in Roman times. I will first take a look at the evidence for cereal yields, before moving on to wine and oil yields.[10] For each crop, I will make a distinction between two types of yield models: a monocultural one in which the crop in question is expected to occupy a separate piece of land; and a mixed model with intercultivation of tree crops (vines, olive trees) and cereals on the same piece of land. This distinction is important, as the first type may be considered more typical for intensive strategies meant to maximize profits – in particular here with regard to the commercial production for extra-regional markets – while the second type may be more adapted in cases of self-sufficiency, or for situations in which local consumption levels required large amounts of land to be managed in a more efficient way.

Once established, the second part of the chapter will then set-up the land requirement model by combining the obtained range of yield figures with the urban and rural consumption figures outlined in the previous chapters. The overall purpose is to come to

[6] Dal Pane 1959; Paci 1975; Pedrocco 1976-1977; Castagnari/Lipparoni 1976; Fioretti 1979; and Anselmi 1985.

[7] Grassellini 1842; 1843; 1846.

[8] Caracciolo 1958; Anselmi 1978.

[9] The annuario starts from 1878, but does not contain useful data to work with until 1908 (Ministero di Agricoltura, Industria e Commercio. Direzione della Statistica Generale 1881; 1887; 1891; 1893; 1896; 1897; 1900; Direzione Generale della Statistica e del Lavoro 1912-1916; Ufficio Centrale di Statistica 1918; 1919; Ministero dell'Economia Nazionale. Direzione Generale della Statistica 1925; Presidenza del Consiglio dei Ministri. Istituto Centrale di Statistica 1926; Presidenza del Consiglio dei Ministri. Istituto Centrale di Statistica del Regno d'Italia 1927; Istituto Centrale di Statistica del Regno d'Italia 1928; 1929).

[10] As mentioned in the previous chapter, modelling the land needs of vegetables, fruits and meat would certainly be a useful exercise, but given their smaller importance in the diet and the difficulties in modelling them for antiquity, it was decided not to incorporate these elements into the land requirement model.

a model that shows how much land was theoretically needed to produce the amounts of wine, oil and wheat that were required to feed the urban and rural population in the area over time; and that pinpoints the periods in which said needs caused the most – or the least – amount of land pressure.

5.2 How much the land can give us

5.2.1 Cereals

The issue of cereal yields in antiquity

The productivity of cereal lands in Roman times is since long a subject of much debate among ancient historians and archaeologists. This is not the place to elaborate extensively on the many discussions that already exist on the matter – for this one may refer to the classic accounts by Carmine Ampolo, Francesco De Martino, M.S. Spurr, K.D. White and J.K. Evans, or to the recent excellent reviews by Gaetano Forni and Paul Erdkamp; only to name a few – but some basic understanding of the nature of the problem is nevertheless required.[11] The obvious starting point is the information provided by the ancient textual sources, which is limited to three accounts by Cicero, Varro and Columella. Cicero mentions seed yields of 10:1 and 8:1 for wheat when speaking of the fertile Leontini district; i.e. modern Lentini in the province of Syracuse (Sicily) (Cic. *Verr.* 3.112). As the author postulates an initial seed amount of one *medimnus* (6 *modii*) per *iugerum* – that is 24 *modii* per hectare – the expected harvest would have ranged around 1,280-1,600 kg of wheat per hectare; that is a net yield of ca. 1,120-1,440 kg after detracting the seed required for the following year.[12] According to Varro, yields of 10:1 and 15:1 were attainable in some parts of Etruria, while the area around Sybaris (Gulf of Taranto) was able to yield even 100:1 (Varro, *Rust.* 1.44.1).[13] Varro also considers different sowing rates according to the type of cereals sown: 5 *modii* per *iugerum* for wheat, 6 for barley, and 10 for spelt. With his postulated yield ratios, such amounts would imply attainable yields of

[11] Ampolo 1980; De Martino 1979; 1984; Spurr 1986; White 1963; 1970b; Evans 1981, 429-431; and Forni 2002b; Erdkamp 2005, 34-37, with the latter two in particular discussing the proper use of later medieval and pre-industrial data as comparative evidence. Other discourses include Pritchard 1972, 648 ff; Garnsey/Saller 1987, 79-80; and Sallares 1991, 375-380.

[12] For the conversion of *modii* into kilograms, see Chapter 4, note 2; one *iugerum* approximately equals 0.25 ha (Frayn 1979, 11).

[13] Pliny mentions the same yield ratio of 100:1 for wider Sicily, Andalusia (Spain) and Egypt (Pliny, *HN* 18.21.95).

200-300 *modii* (ca. 1,300-2,000 kg) per hectare for wheat, 240-360 *modii* (1,600-2,400 kg) for barley, and 400-600 *modii* (2,670-4,000 kg) for spelt; net yields would have been 180-280 (1,200-1870 kg), 216-336 (1,440-2,240 kg), and 360-560 *modii* (2,400-3,735 kg) respectively. An important point made by Varro is the influence of soil conditions on seed yield, as he considers different circumstances – in particular rich vs. thin ground – to cause similar seed amounts result in different harvest sizes.

Both Cicero's and Varro's figures have been a source of much controversy, but what seems to be clear is – while undoubtedly referring to attainable yields – they represent yields that were decisively above average – if not exceptionable in nature – alluding to either very fertile areas (Cicero) or the suitable lands of wealthy farmers (Varro).[14] Some contrast is provided by Columella, who mentions a much lower yield ratio of 4:1 for grain crops in most parts of Italy (*Rust.* 3.3.4). Again, this ratio has been much debated. One hypothesis posits that Columella's figure refers to the annual yield for grain crops within a rotating two-field system, as such producing a harvest only biennially; that would be 8:1 over a period of two years or 4:1 for each year.[15] A somewhat more credible alternative is the scenario proposed by K.D. White, who interprets Columella's low ratio as the yield of an *arbustum*; i.e. a field system in which cereals were intercultivated with vines trained upon rows of trees, naturally resulting in an overall lower yield (see *infra*).[16] Most support, however, has been given to T. Frank's theory, in which Columella's low yield is largely explained by the author's motivation, which lies in the first place in the promotion of viticulture to the detriment of cereal cultivation.[17] While probably too pessimistic then, one could argue that his figure may be closer to the average yields that could be obtained on an annual basis than the ones provided by Cicero and Varro, or at least more representative for the poorer soils with which less fortunate peasants or farmers in less fertile areas were confronted daily.

Still, this short overview of the ancient literary evidence makes it perfectly clear that on the basis of the available Roman yields alone, it is difficult to set-up realistic yield models for cereal lands in central Adriatic Italy. Being extraordinary rather than average yields – in both positive and negative terms – is hereby not the only drawback. Another problem is that they only refer to a few specific and very fertile areas of Italy: Sicily, the Gulf of Taranto and Tuscany (*Etruria*). Besides, there are many parameters that influence the amount of cereals that may be harvested from a hectare of agricultural land, seed

[14] In fact, comparative evidence from Mediterranean Europe seemingly confirms Cicero's and Varro's yields to be representative for either very fertile or highly suitable soils for cereals (Erdkamp 2005, 43-44).

[15] Evans 1980, 135; also Forni 2002b, 445; contra Evans, see Erdkamp 2005, 38.

[16] White 1963; see also Spurr 1986, 83, who discards White's theory; and Forni 2002b, 445.

[17] For the argument, see Frank 1940, V, 141; see also Garnsey/Saller 1987, 79; Pleket 1990, 78; and 1993, 327; and Erdkamp 2005, 37-38.

amount being one of them, but also environmental conditions such as land and climate – wheat yields in particular depend heavily on the amount of rainfall – and human interventions like terrain preparation, fertilisation and cultivation strategies; all variables that are almost impossible to model for antiquity.[18]

Comparative evidence

Therefore, in order to form some sort of compensation, I assembled a series of historical sources for the Marche region and northern Abruzzo, dated between the second half of the 17th century and the first half of the 20th century.[19] An important study by Renzo Paci in 1975 was able to deduce a number of seed/yield ratios for grain from the *Archivio di Stato di Pesaro* (A.S.Ps.) for ten localities in the Marche region between 1675 and 1800 (*Appendix* IV, Table 97).[20] A few patterns in particular are worth mentioning here. First, over a period of 126 years, most yield ratios range between 2:1 and 5:1. Second, higher yield ratios above 6:1 do occur in the area, but only a mere 24 times among all 510 recorded ratios. When they occur, however, they seem to do so most frequently in the medium hill areas. Third, ratios above 10:1 almost never occur, with the exception of the coastal town of Senigallia in 1675 (13.81:1) and 1734 (11.11:1), and the high hill locality of Gubbio in 1731 (10.01:1) and 1734 (11.93:1). And fourth, very low ratios below 2:1 are equally rare (15 times) and are only registered for the higher hilly or mountainous areas (*Appendix* IV, *Table* 97). These patterns are equally reflected in the derived average seed/yield ratios for each period of five years. Again, most average ratios range between 2:1 and 5:1; average ratios of 6:1 are only surpassed occasionally – and only in the low and medium hill areas – and the few cases of an average ratio below 2:1 are confined to the higher hilly areas. Another striking – but not unexpected – pattern is the overall decrease of yield ratios towards the hilly and mountainous areas of the middle and upper river valley sections, where average ratios only surpass 4:1 in a few cases, but mostly range between 2-3:1; this in contrast to the lower hills and plains, where 4-5:1 ratios occur more frequently (*Appendix* IV, Table 98). The same decreasing pattern – although less pronounced – may also be noticed in the derived averages for the whole 126-year period (*Table* 40).

Another source is the *Libro dei Raccolti* from the *Fondo della Fraternità della Carità di Urbino*, dated between 1662 and 1690 and studied by Romano Ruggeri in 1977.[21] The book in question deals with some 34 small farm estates, owned by the Fraternità and spread out mostly over the hilly belts surrounding the middle valley town of Urbino. Ruggeri's

[18] Forni 2002b, 442.

[19] Some of these data can be found in a more elaborate form in Appendix IV.

[20] Paci 1975.

[21] Ruggeri 1977.

study of the grain production of 21 of these farms for the six-year period between 1684 and 1690 revealed seed/yield ratios as low as 1.1:1 and as high as 10.8:1. Most ratios, however, circled the 1-4:1 range; with higher ratios only occurring occasionally (*Table* 41). In terms of overall grain production over a period of 14 years – that is all farms combined – ratios had attained a minimum value of 2.2:1 and a maximum of 7.1:1; again rather exceptional yields than average ones. The majority ranged between 4:1 and 5:1 (*Table* 42). Some information is also available for the upper valley territory of Fabriano in the late 18th century. Through a study of the *Archivio Storico Comunale di Fabriano* for the second half of the 18th century, Giancarlo Castagnari and Nora Lipparoni were able to establish that seed/yield ratios were on average 4:1 in the plains, 3:1 in the hilly areas, and 2:1 in the mountainous zones.[22] Similar ratios are also known for the same locality in the second half of the 19th century: 5:1 in the plains, 4.5:1 in the hills and 2:1 in the mountains.[23]

Table 40 Derived average seed/yield ratios for ten localities in the Marche region for the 126-year period between 1675 and 1800 (in part after Paci 1975, 143-144, Tavola 2) (for the full list of yield figures, see Appendix IV, Table 97; 98).

Landscape	Locality	Average seed/yield ratio over126 years
Plains and low hills	Pesaro	3.75:1
	Senigallia	5.39:1
Medium hills	Cagli	3.34:1
	Fossombrone	4.47:1
	Pergola	4.87:1
	Sant'Angelo	3.39:1
High hills and mountains	Gubbio	3.83:1
	Montefeltro	3.07:1
	San Vito	3.14:1
	Urbino	3.16:1

Another study by Luigi Dal Pane – using the administrative documents from the Pontifical Sate in 1751 – has presented a series of grain harvest sizes and seed amounts for a number of localities in the Marche region, situated in various landscape zones.[24] Said numbers were re-elaborated by Sergio Anselmi, who in this way derived a range of seed/yield ratios for said localities that range between 3:1 and 6:1, with the lowest values

[22] Castagnari/Lipparoni 1976, 202-203.

[23] Marcoaldi 1874, 24; Fioretti 1979, 1107.

[24] Dal Pane 1959.

attained in the hilly/mountainous areas around Ascoli Piceno, Fabriano, Matelica and Montalto, and the highest in the zone between Jesi and Monte Marciano (*Table* 43).[25]

Table 41 Derived seed/yield ratios for individual farm estates from the Libro dei Raccolti (After Ruggeri 1977, 226, Tav. IV).

Farm estate	Period	Seed/yield ratio	
		Min.	Max.
Mezzullo	1684-1690	1.9:1	6:1
Ca Mariotto	"	3.1:1	6.8:1
Ca Chiappino	"	3.5:1	8.4:1
Ca Stocco	"	1.7:1	3.8:1
Case Nuove	"	1.5:1	3.7:1
Monticelli	"	1.5:1	3.5:1
Ca Rosello	"	1.3:1	3.5:1
Lancia Molino	"	1.1:1	3.3:1
Riceci	"	2.2:1	3.6:1
Ca Il Fattore	"	3.2:1	5.7:1
Fantasia	"	3.1:1	5:1
Petriccio	"	1.5:1	2.8:1
Schiavonia	"	5.2:1	10.8:1
S. Martino	"	2.1:1	4.5:1
S. Lazzaro	"	2.5:1	4.1:1
Mondolce	"	1.2:1	3:1
Monte l'Olivo	"	2:1	7.3:1
Salsula	"	2:1	4.1:1
Colcello	"	4:1	9.6:1
Risciolo	"	4.3:1	8:1
Magliano	"	2.8:1	6:1

Turning further into the last quarter of the 19th century, some information on yield behaviour and seed/yield ratios is also available through the Inchiesta Agraria Jacini. In fact, for the Marche region, the Inchiesta established that a ratio of 3:1 was all that could be expected in the mountainous areas of the region, with harvest failures frequently occurring in bad years; the maximum attainable ratios in the sub-mountainous and hilly areas ranged between 5:1 and 6:1; and a ratio of 8:1 could only be obtained in the plains.[26]

[25] Anselmi 1985.

[26] Atti Inch. Jac. 1884, 384; Pedrocco 1976, 308.

The Inchiesta also provides an average ratio figure for the province of Teramo in northern Abruzzo: 4:1.[27]

Table 42 Overall seed/yield ratios derived from the Libro dei Raccolti (After Ruggeri 1977, 254, Tav. III) (* values are expressed in staia).

Year	Seed*	Yield*	Ratio
1662	175	799	4.5:1
1663	170	725	4.2:1
1664	143	663	4.6:1
1665	157	710	4.5:1
1666	160	842	5.2:1
1667	130	928	7.1:1
1668	155	859	5.5:1
1684	210	936	4.4:1
1685	170	708	4.1:1
1686	357	969	2.7:1
1687	345	1,480	4.2:1
1688	271	1,500	5.5:1
1689	214	885	4.1:1
1690	252	822	2.2:1

As there is no reason to assume that yield ratios in Roman times were significantly higher than those registered for 17th, 18th and 19th century Marche, this short overview may suffices to illustrate how it is unlikely that yield ratios of 7:1 and 8:1 may have been the norm for the Roman period, let alone exceptionally high ratios of 10:1 or 20:1. This is not to say that such yields could not have been attained, but only in occasional circumstances. More likely, yield ratios will have ranged between 2:1 and 6:1, depending on the location in the landscape. In fact, if we would apply these yield ratios to the Roman period in Marche – and considering a recommended sowing rate of 20 *modii* (ca. 130 kg) per hectare (Varro) – we would obtain average yields between 650 and 780 kg for the lower valley areas (5-6:1), 520-650 kg for the middle valley areas (4-5:1), and 260-390 kg in the higher valley zones (2-3:1) per hectare of agricultural land. From these amounts, however, seed for the next season needed to be detracted, meaning that net yields ranged between 520-650 kg/ha in the lower areas, 390-520 kg in the middle areas, and 130-260 kg in the higher areas. Combined, this means that overall average yields ranged between ca.

[27] Atti Inch. Jac. 1886, 85.

475 and 605 kg/ha, and average net yields between ca. 345 and 475 kg/ha.[28] As such, these are the lower and upper yield figures that will be used for the cereal yield model in this chapter.

Table 43 Yield/seed numbers and their derived ratios for a number of localities in the Marche region in 1751 (After Dal Pane 1959, 273, Tavola VII; and Anselmi 1985, Tab. 1.5) (in this case, one rubbio equals 210 kg and one quintal 100 kg).

Locality	Yield		Seed		Ratio
	Rubbi	Quintali	Rubbi	Quintali	
Ancona	32,000	67,200	8,000	16,800	4:1
Ascoli Piceno	19,600	41,160	5,600	11,760	3.5:1
Civitanova	8,250	17,325	1,650	3,465	5:1
Fabriano	10,257	22,106	3,509	7,368	3:1
Fano	20,000	42,000	4,000	8,400	5:1
Fermo	76,464	160,574	19,116	40,143	4:1
Macerata	186,175	390,968	40,173	84,363	4.6:1
Jesi	46,750	98,175	8,500	17,850	5.5:1
Loreto	3,390	7,119	678	1,423	5:1
Matelica	4,315	9,061	1,233	2,589	3.5:1
Montalto	26,026	54,655	7,436	15,615	3.5:1
Monte Cosaro	4,655	9,775	931	1,955	5:1
Monte Marciano	2,700	5,670	450	945	6:1
San Severino	11,296	23,722	2,824	5,930	4:1

Obviously, the above numbers refer to fields that were only occupied by cereals. It was common practice in Italy to intercultivate cereals with vines or olive trees (see *infra*) – a practice that will obviously have affected wheat yields per hectare – but there is no consensus on the precise impact of this cultivation technique on cereal harvest sizes.[29] Columella's advice to sow 1/5 more seed for cereal fields populated with trees may suggest that the author considered such fields to lose about 1/5 of their harvest compared to intensive fields when sown according to normal rates:

[28] Such yields are actually close to the commonly assumed net yield of 400 kg/ha; which is considered to be a representative average figure for most areas of the Mediterranean in Roman times on the basis of the use of a two-field system (Spurr 1986; see also Jongman 2003, 115; and Kehoe 2007, 551).

[29] White 1963; Goodchild 2007.

> "Among other things, too, we should not overlook the fact that a field planted with trees for supporting vines requires one fifth more seed than a treeless and open field."[30]
>
> (Col., *Rust.* 2.9.6).

With regard to eventual yields, this would have meant a loss of ca. 130-150 kg for the lower valley areas, 100-130 kg for the middle valley areas and 50-80 kg for the higher valley areas. As such, yields would have ranged between ca. 520-630 kg (lower area), 420-520 kg (middle area) and 210-310 kg (higher area) per hectare; net yields were ca. 390-500 kg, 290-390 kg and 80-180 kg/ha respectively. Combined, overall yields ranged between ca. 380-485 kg/ha; overall net yields were ca. 250 and 355 kg/ha. Alternatively, one could assume that gross yields were the same as in intensive fields when applying the higher sowing rates of 24 *modii* (ca. 160 kg) per hectare. As such, however, net yields would still have been slightly lower: 490-620 kg for the lower valley areas, 360-490 kg for the middle areas and 100-230 kg/ha for the higher areas. Combined, this makes overall net yields for tree fields range between ca. 315 and 445 kg/ha. Only the latter extensive model will be outlined in the next section.

5.2.2 Grapes

How to read the ancient textual evidence

Just as with cereals, the basic insights into the potential performance of Italian viticulture in Late Republican and Early Imperial times are provided by the texts of the ancient agronomists. The earliest indications are given by Cato, who foresaw storage vats for holding five vintages totalling 800 *cullei* – or ca. 4,135 hl – for his vineyard of 100 *iugera* near *Casinum* (*Agr. Orig.* 11.1); in this way hinting at a maximum annual yield of 1.6 *cullei* of wine per *iugerum*, or ca. 33 hl/ha.[31] Another one of Cato's works, the *Origines*, is cited by Varro regarding harvests of 10 and 15 *cullei* per *iugerum* in the *Ager Gallicus* and *Gallia Cisalpina* (*Rust.* 1.2.7- 8); that is ca. 205-310 hl/ha. These yields are later quoted again by Pliny (*HN* 14.5.52) and Columella (*Rust.* 3.3.7).[32] Columella in particular addresses the

[30] All English translations from the work of Columella in this thesis have been taken from the editions by Harrison Boyd Ash, and E.S. Forster and Edward H. Heffner (Loeb Classical Library).

[31] Based on the assumption that one *culleus* equals c. 517 litres (Duncan-Jones 1982, 372), and one *iugerum* approximately equals 0.25 ha (Frayn 1979, 11). Frank misinterpreted this passage by assuming five harvests of 800 *cullei* each, implying an annual yield of 8 *cullei* per *iugerum* (c. 165 hl) (Frank 1940, I, 163).

[32] For *Gallia Cisalpina*, Varro refers to a yield of 300 *amphorae*. As one *amphora* equals c. 25.9 l (Duncan-Jones 1982, 372), the yield would approximately have been 15 *cullei*. Columella refers to both Cato and Varro and mentions a yield of 600 *urnae* for *Gallia Cisalpina* and the *Ager Gallicus*. One *urna* equals ½ *amphora* or c. 12.9 litres (Duncan-

question of yield in great detail. Following *Graecinus*, he postulates that every vineyard should at least yield one *culleus* of wine per *iugerum* (ca. 21hl/ha), while yields of 1.5 and 2 *cullei/iugerum* (ca. 31-41 hl/ha) may be attained without much effort (*Rust.* 3.3.7). He himself is of opinion that every vine grower should at least aim for a minimum yield of 3 *cullei/iugerum* (ca. 62 hl/ha), while yields of 5 and 8 *cullei* (ca. 103-165 hl/ha) are attainable in very good vineyards (*Rust.* 3.3.3; -11).[33] Most of these yields seem to be based on Columella's own experiences in his vineyards at *Ceretanum*, but the latter figure relates to the estate of Seneca in the surroundings of *Nomentum*; a property also mentioned by Pliny for its frequent wine yields of 7 *cullei/iugerum* (ca. 145 hl/ha) (*HN* 14.5.52). All known yield figures are assembled in the table below (*Table* 44).

Table 44 Ancient wine yields retrieved from the texts of the ancient agronomists.

Reference	Yield/*iugerum* (*cullei*)	Yield/*iugerum* (hl)	Yield/ha (hl)	Region
Cato, *Agr. Orig.* 11.1	1.6	8.3	33	*Latium*
Cato, *Origines*	10	51.7	206.8	*Ager Gallicus*
Varro, *Rust.* 1.2.7.8	15	77.7	310.8	*Gallia Cisalpina*
Columella, *Rust.* 3.3.2 (after Cato and Varro)	15	77.7	310.8	*Gallia Cisalpina*
Columella, *Rust.* 3.3.3	8	41.4	165.4	*Latium*
Columella, *Rust.* 3.3.3	5	25.8	103.4	*Etruria*
Columella, *Rust.* 3.3.7	1.5	7.8	31	*Etruria*
Columella, *Rust.* 3.3.7	2	10.4	41.4	*Etruria*
Columella, *Rust.* 3.3.7 (after Graecinus);-10	1	5.2	20.8	*Etruria*
Columella, *Rust.* 3.3.11	3	15.5	62	*Etruria*
Pliny, *HN* 14.5.52	7	36.2	144.7	*Latium*
Pliny, *HN* 14.5.52 (after Cato)	10	51.7	206.8	*Ager Gallicus*

Jones 1982, 372). Billiard assumes that reference is here made to the small *culleus*, as such resulting in a much lower yield of c. 75 hl /ha (Billiard 1913, 133). Salomon suggests that this older version of the *culleus* – equalling c. 1.94 hl – was actually used by all the agronomists for their wine yield calculations (Salomon 1964, 30-31; see also Martin 1971, 371, note 1). However, as noted by Duncan-Jones (Duncan-Jones 1982, 45, note 1), there is no ground for such a presumption. The fact that – in his contract for the sale of wine in the jar – Cato clearly states that 41 *urnae* (c. 528.9 l) must be delivered for every *culleus* sold makes this even more unlikely (*Agr. Orig.* 148); see also White 1975, 145).

[33] On the economics of Columella's yield figures, see Martin 1971, 370-373; and Duncan-Jones 1982, 39-48. See also Carandini 1988, 235-265.

As informative as these figures may be, using them to model the possible annual yield of a Roman vine plantation in central Adriatic Italy is highly problematic. Indeed, in many ways the ancient wine yields suffer from the same defects as the cereal yields. I have already alluded to Columella's tendency to promote the profitability of viticulture (see *supra*), but the problem runs deeper. As with cereals, the numbers mentioned in the agricultural manuals only refer to a few specific areas of Italy. Cato's vineyard was located on his estate in the surroundings of *Casinum*, a town situated in the damp and foggy valley area of the Liri River in south-eastern *Latium*. Varro's farm was situated in roughly the same area. The estate of Seneca in *Nomentum* also lay in *Latium*. Columella's figures refer to his estate in *Ceretanum*, a property most likely located in *Etruria*. Finally, the record yields mentioned by all the agronomists only concern the *Ager Gallicus* and *Gallia Cisalpina* in central/north-eastern Italy. At best then, their figures inform us about some attainable yields in these particular areas, but not much more.

Table 45 Extraction rates for the Marche (1911-1938). For a more elaborate version of the period 1911-1927, see Appendix IV, Table 103; for the period 1933-1938 (intensive vineyards only), see Appendix IV, Table 107).

Year	Total grape production (kg)	Total wine production (hl)	Extraction rate (%)
1911	335,900,000	2,200,000	66
1912	357,600,000	2,369,000	66
1913	331,900,000	2,214,000	67
1914	257,900,000	1,700,000	65
1915	91,400,000	573,000	63
1916	262,900,000	1,733,000	66
1917	414,700,000	2,650,000	64
1918	161,400,000	1,024,000	64
1922	319,500,000	2,135,000	67
1923	421,100,000	2,765,000	65
1924	299,700,000	1,899,000	64
1925	270,300,000	1,811,000	66
1926	209,900,000	1,316,000	62
1927	189,500,000	1,162,000	60
1928	249,650,000	1,583,900	63.4
1929	298,400,000	2,027,000	67.9
1930	196,300,000	1,265,000	64.4
1931	184,200,000	1,142,000	62
1933	206,700,000	1,310,000	63.4
1935	371,600,000	2,401,000	64.6
1936	353,000,000	2,284,000	64.7

1937	240,300,000	1,468,000	61.1
1938	350,400,000	2,296,000	65.5

Another issue is that the ancient authors merely mention the yields in amounts of wine – and never in amounts of grapes – which means that their numbers represent the yields after the operations of treading and pressing. This is a crucial matter, as extraction rates for grape weight to wine are influenced by two parameters: the characteristics of the berries and the efficiency of the applied processing techniques. The used cultivar can be especially influential for yield, as it determines the number of clusters and the berry weight – and thus the cluster weight – as well as the amount of juice that may be squeezed out of a certain grape.[34] Not only do some varieties contain more juice than others, but the amount of juice that can be squeezed out of a berry also depends on the characteristics of its skin. Naturally, berries with harder skins are more difficult to squeeze out completely than berries with softer skins that break more easily. This is not very much an issue in today's mechanised viniculture, but in Roman times it determined considerably the amount of juice that could be obtained through foot treading and pressing.

With regard to the extraction efficiency of the pressing operation, in today's age of mechanised grape processing some 80 l of must is on average extracted from 100 kg of grapes in commercial viticulture in the Marche region; i.e. an extraction rate of ca. 80% or 0.8 l per kg.[35] This is somewhat higher than the rates achieved by contemporary local small-scale farmers, who generally obtain between 0.6 and 0.7 l of wine per kg (60-70 %) through the use of more traditional machinery.[36] The yield figures reported for the area around Ascoli Piceno in southern Marche at the end of the 19th century indicate even lower extraction rates between 40 and 60% (04-0.6 l/kg) for the pre-industrial era of winemaking in the region.[37] For the first half of the 20th century, extraction rates in Marche commonly ranged between 60 and 70 % (*Table* 45). While we do not have any direct information for extraction rates in Roman times, experimental pressing operations carried out with a reconstructed Roman press at Mas des Tourelles in Beaucaire (Gard

[34] For instance, a survey carried out in some central and western Kentuckian vineyards in 2004-2006 showed that the average cluster weight could differ as much as 0.16 kg between some important grape cultivars, with the smallest variety having a cluster weight of ca. 0.08 kg and the largest variety one of ca. 0.24 kg. As cluster weight is the result of both size and weight of singular berries, this has also consequences for the amount of juice that is obtained during processing (Kaan Kurtural/O'Daniel 2007).

[35] Ricci 2005, 124.

[36] During the 2012 and 2013 summer campaigns of the PVS in the Potenza valley, a series of interviews was carried out by the author with local farmers.

[37] The Inchiesta Agraria Jacini mentions yields of 26 and 42 hl per ha, extracted from 60 and 70 quintals of grapes respectively (one quintal equals 100 kg) (Inch. Agr. Jac. 1884, 723).

department in the Languedoc-Roussillon region in southern France) over a period of four years (1995-1998) showed that it was possible to extract between 0.5 and 0.7 l of wine per kg of grapes (50-70 %) through treading and pressing combined.[38] Taking into account the latter extraction figures, this would imply that Columella's minimum yield of 21 hl/ha could be the result of a grape harvest of 3,000 or 4,000 kg of grapes. On the whole, the wine yields provided by the ancient agronomists could thus be translated into grape yields between as little as 3,000/4,000 kg and as much as 44,000/62,000 kg of grapes per hectare of viticultural land (*Table* 46). These huge discrepancies make it difficult to base potential yield models on their figures alone.

Table 46 Wine yields according to the ancient agronomists and derived potential grape yields.

Reference	Yield/ha (hl)	Yield/ha (kg)				
		40%	50%	60%	70%	80%
Cato, *Agr. Orig.* 11.1	33	8,250	6,600	5,500	4,700	4,125
Cato, *Origines* (Varro, *Rust.* 1.2.7-8)	206.8 310.8	51,700 77,700	41,360 62,160	34,470 51,800	29,545 44,400	25,850 38,850
Columella, *Rust.* 3.3.2 (after Cato and Varro)	310.8	77,700	62,160	51,800	44,400	38,850
Columella, *Rust.* 3.3.3	165.4	41,350	33,080	27,570	23,630	20,675
Columella, *Rust.* 3.3.3	103.4	25,850	20,680	17,230	14,770	12,925
Columella, Rust. 3.3.7	31	7,750	6,200	5,170	4,430	3,875
Columella, *Rust.* 3.3.7	41.4	10,350	8,280	6,900	5,915	5,175
Columella, *Rust.* 3.3.7 (after Graecinus); -10	20.8	5,200	4,160	3,470	2,970	2,600
Columella, *Rust.* 3.3.11	62	15,500	12,400	10,335	8,860	7,750
Pliny, *HN* 14.5.52	144.7	36,175	28,940	24,115	20,670	18,000
Pliny, *HN* 14.5.52 (after Cato)	206.8	51,700	41,360	34,470	29,545	25,850

A source of particular great debate among historians and archaeologists has been the specific nature of these numbers and their degree of representativeness. Indeed, on many occasions, comparisons have been made with more recent historical figures for France and Italy in order to evaluate the authority of the Roman agronomists. Based on such comparative evidence from 19th century France, for instance, Raymond Billiard

[38] Tchernia/Brun 1999, 104. Their results are comparable with the comparative tests performed by Khalil and Al-Nammari in the Amman region, which indicated that late antique (ancient) presses were probably capable of achieving an average extraction rate of 0.68 l/kg (Khalil/Al-Nammari 2000, 48).

interpreted their figures as adequately providing us with a series of potential yields ranging from the absolute minimum to the extraordinary maximum. For this statement, Billiard referred to the *Statistique Agricole Annuelle de la France* for the decade between 1887 and 1897, quoting an average yield of 18 hl/ha – i.e. ca. 0.9 *cullei/iugerum* – a bottom yield of 2 hl/ha (ca. 0.1 *cullei/iugerum*) and an upper yield of 54 hl/ha (ca. 2.6 *cullei/iugerum*). However, he also noted that yields of 200 hl/ha (ca. 9.7 *cullei/iugerum*) occurred on a regular basis. As such, Billiard reasoned, Columella's figure of 1 *culleus* was a good bottom yield, while all numbers between 5 and 15 *cullei/iugerum* would represent very good to exceptional yields; medium yields would have ranged between 2 and 4 *cullei/iugerum*.[39] Some 70 years later, André Tchernia arrived at similar conclusions through his comparisons with yield statistics for 18th, 19th and 20th century France, which suggested that yields between 100 and 300 hl/ha represented indeed record yields, while harvests between 17-19 hl/ha (18th/19th century) and 30-34 hl/ha (20th century) – i.e. between 0.8-0.9 and 1.5-2 *cullei/iugerum* – could be considered representative averages.[40]

Based on wine statistics from Italy for the period between 1909 and 1936, however, Richard Duncan-Jones did not believe that even the medium yields postulated by Billiard and Tchernia were attained on a regular basis in Roman times. The basis of this assertion came from the production figures provided by the *Encyclopedia Italiana* for areas with vine monoculture, which showed that the average yield over a period of four years was a mere 6 hl/ha (ca. 0.3 *cullei/iugerum*). Duncan-Jones cited in particular Calabria, where the derived yield was ca. 0.6 *cullei/iugerum*. Accordingly, he discarded Columella's recommended return of 3 *cullei* per *iugerum* and assumed that the annual average yield of a Roman vineyard had more likely been around 1 *culleus/iugerum*.[41] However, a quick look at the original source – the *Annuario Statistico Italiano* of 1936 – learns that this assumption is based on the misconception that the average total yield given for the period between 1931 and 1934 represents the harvests obtained from vineyards in monoculture (totalling a surface of 39,000 ha), while the figure actually relates to the combined yield of both intensive monocultural and extensive mixed vine plantations (totalling another 54,000 ha). The grape yield in Calabria for vine monoculture only in 1935 was actually 3,440 kg/ha. As the extraction rate for that year was about 60%, this would have resulted in 2,064 l/ha or ca. 1 *culleus/iugerum*.[42]

[39] Billiard 1913, 134, 135, note 1.

[40] Tchernia 1986, 359-360, referring to Galtier 1960 and Lachiver 1982. Soils in the Languedoc region apparently did not yield more than 35 hl/ha, even on good soils. Record yields of 102 hl and 200 hl/ha are also mentioned.

[41] Duncan-Jones 1982, 45. Based on this and other scholarly work, a figure of 2,000-2,100 l/ha is often used by ancient historians and archaeologists for indicating the minimum or even average yield of a Roman vineyard in Italy (for examples, see Jongman 1988, 132; and Carandini 1988, 92 (Settefinestre); see also Kron 2012, 159).

[42] Ann. Stat. Ital. 1936.

Table 47 Some overall wine yield figures for Marche and Teramo (1881-1927) (values are expressed in hl) (After ASI 1881-1928). For a more elaborate version of these data, see Appendix IV, Tables 99-103.

	Pesaro	Ancona	Macerata	Ascoli Piceno	Teramo
1881	13	13	14	15	11
1883	13.8	14.4	18.1	13.5	13.5
1884	5	6.6	10.2	12.2	3.9
1885	11.6	6.9	10.2	13.7	6.6
1886	16.2	16	20.3	18.2	10.8
1891	9.2	8.2	13	7.6	13.1
1894	6.4	5	6.5	4.7	6.9
1889-1890	13.7	10.5	12	7.2	11
			Marche region		
1911			5.8		
1912			6.2		
1913			5.8		
1914			4.4		
1915			1.5		
1916			4.5		
1917			6.9		
1918			2.7		
1922			5.6		
1923			7.2		
1924			5		
1925			4.7		
1926			3.4		
1927			3		

The same issue of incompatibility arises when we look at some the evidence for wine yields in the Marche region and northern Abruzzo in the 18th and 19th century. At the end of the 18th century, for instance, the data provided by the *Archivio Storico Comunale di Fabriano* mention a wine yield of ca. 14 hl/ha for the year 1795, but this is a yield for a piece of land in which the vine was intercultivated with other cultures- mostly cereals – without indications for the respective proportions of each culture.[43] The same goes for

[43] Castagnari/Lipparoni 1976, 208, note 37. The vine plantations in the territory of Fabriano covered a total surface area of 550.2.230 *some* (825 ha), while the overall wine production is reported to have been 13,774 *some* in 1795 (c. 11,708 hl) (Castagnari/Lipparoni 1976, 208, note 37, based on the data from the Archivio Storico Comunale di Fabriano; A.S.C.F., Ragguaglio). The conversions are based on the surface *soma* of Fabriano, which equalled c. 15,000 m² (Anselmi 1988, 17), while the liquid *soma* equalled 85 l (Bofondi 1855, 80).

the average yield of 13 hl/ha calculated by Ottavio Ottavi for the Marche region and Umbria in 1885 on the basis of the data provided by the *Ministero d'Agricoltura* in 1881, as well as for the intra-regional averages of 14 hl and 11 hl/ha for the provinces of Macerata and Teramo respectively; all figures whose value as comparative evidence is limited, as they only represent overall production numbers in which no distinction has been made between the revenues from intensive vineyards and those from extensive 'mixed' vine plantations.[44] Similar issues touch some of the results of the contemporarily conducted *Inchiesta Agraria Jacini*, where the average annual yield of ca. 13 hl/ha provided for the province of Ancona is again based on the combined produce from both tree-wedded vine plantations – called 'alberata', a vine growing system almost identical to the Roman *arbustum* in which vines were trained upon rows of trees in combination with the intercultivation of cereals (see *infra*) – and proper vineyards.[45] Again, many yield figures listed for the area in the *Annuario Statistico Italiano* between 1881 and 1927 – ranging from 1.5 to 20.3 hl/ha – suffer from the same defects, as they only mention overall yields and thus cannot be used to forthrightly assess the validity of the ancient yields (*Table* 47).

More than anything else then, the above overview makes it abundantly clear how difficult it is to straightforwardly compare ancient yields with more recent historical figures. Much has to do with the fact that we are not aware of the specific structural conditions of the vine plantations to which the agronomists' numbers – and often those of their later counterparts too – refer. This is a significant issue, as yields can vary considerably because of different cultivation or planting strategies. An important determining factor is hereby whether the vine is grown intensively – i.e. arranged in rows that occupy a separate piece of land – or in a more extensive way mixed with other crops on the same field. In fact, a recent work on the history of Italian agriculture in antiquity has suggested that the lower yield figures mentioned in the Roman treatises (20.8-62 hl/ha) all refer to mixed vine plantations, while the higher figures – albeit still exceptional harvests – would represent the yields of intensive vineyards (103.4-310.8 hl/ha).[46] As such, extensive yields would on average have amounted to about 20% (1/5) of intensive yields, with the highest ratio being ca. 60% (3/5) and the lowest 7% (1/10) (see *supra*, *Table* 44).

The point that the lay-out of the vine plantation itself must have been an important parameter influencing wine yields per piece of land in antiquity is certainly valid. Some meaningful perspective to this regard may be gained by looking at some of the figures for both extensive and intensive wine yields in the area, as derived from the *Annuario Statistico Italiano* for the period between 1927 and 1932. In fact, these figures suggest that

[44] Ottavi 1885, 6, 48. . The same goes for the overall yield figure provided by Peyre for Italy in 1920 (Peyre 1922), whose comparative applicability on Roman viticulture was rightly dismissed by Tchernia (Tchernia 1986, 360).
[45] Inch. Agr. Jac. 1884, 713.
[46] Forni 2002a, 145.

the intensive/extensive ratio commonly ranged between 11 and 22%, with the most occurring values circling around 12-13% (*Table* 48). About the same order of magnitude can be seen in some data from the *Inchiesta Agraria Jacini* regarding the province of Fermo, where yields from mixed plantations – i.e. 'folignata' fields (a type of 'alberata' system with vines linked to fruit trees) or fields in which vine rows were planted between trees – amounted to ca. 10-18% (2.5-3 hl/ha for the former and 4.5 hl/ha for the latter) of the yields from intensive vineyards (ca. 25 hl/ha).[47] For the vineyards in the province of Ascoli Piceno, the agrarian survey gives yields between 26 and 42 hl/ha.[48] These data suggest that – in order to start building credible wine yield figures for the area in antiquity – we need to make a firm distinction between intensive and extensive viticultural systems.

Table 48 Some differences between extensive and intensive wine yields for the Marche region (1927-1932) (After ASI 1928-1932). For a more elaborate version of these data, see Appendix IV, Tables 104-106.

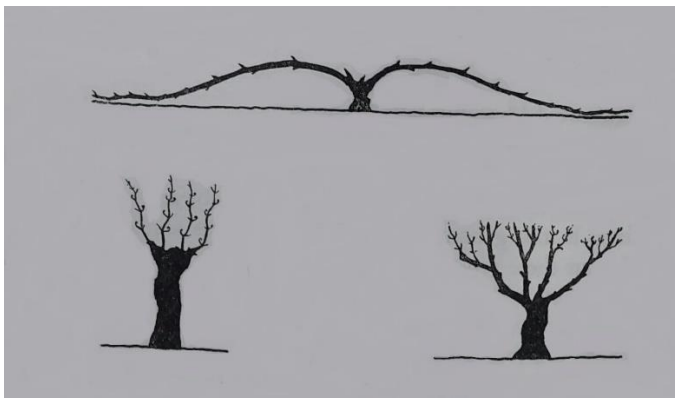
Year	Grape yield (kg/ha)		Ratio (%)
	Int.	Ext.	
Marche region			
1928	4,869	650	13.3
1929	4,902	718	14.6
1930	3,687	470	12.7
1931	3,764	431	11.5
1932	5,681	1,045	18.4
Marche region (mountainous areas)			
1927	2,095	390	18.6
1928	3,204	568	17.7
1929	2,580	567	22
1930	1,852	385	20.8
1931	1,901	314	16.5
Marche region (hilly areas)			
1927	3,823	478	12.5
1928	5,506	693	12.6
1929	5,652	771	13.6
1930	4,288	674	15.7
1931	4,296	474	11

[47] Inch. Agr. Jac. 1884, 750.

[48] Inch. Agr. Jac. 1884, 723.

Intensive vs. extensive viticulture in Roman Italy

The texts of the ancient agronomists elucidate that Roman farmers knew of many ways in which to train and cultivate the vine.[49] Vines that were arranged intensively in rows that occupied a separate piece of land were referred to with the term '*vinea*' – which literally translates as 'vineyard' – and their most pronounced advocate was clearly Columella (*Rust.* 3.5). Many kinds of *vinea* existed in Roman times. Varro, for instance, uses the term in order to refer to a wider variety of intensive vine plantations. In essence, he makes a distinction between vines that were low-grown without props (*sine pedamento*) (*Figure* 227; 228), and vines that were trained with the aid of props; i.e. 'yoked'. The latter system, according to the author, could be further subdivided into vines that were trained vertically (*pedamenta* or stakes) (*Figure* 229, left), and those that were trained transversely (*iuga* or yokes) (*Figure* 229, right). For transversely trained vines, Varro further distinguishes between four sub-types according to the materials used for making the yokes (trellises): wooden poles, reeds, cords or vines. He does the same for the vines trained vertically, by subdividing the possible props (stakes) into four categories: heavy oak or juniper posts (*ridica*), strong branches (*pertica*), reeds and again vines (*Rust.* 1.8). The other authors more or less refer to similar systems, with Columella in particular describing vine training systems on several occasions (*Rust.* 4.12; 16.3-4; 17; 19; 26) and Pliny sorting vineyards into five subtypes that echo Varro's classification: low-grown with the branches lying on the ground (1), vines standing on their own without props (2) (*Figure* 227; 228), standing vines with props (*adminiculum*) but without a cross-bar (*iugum*) (3) (*Figure* 229, l), propped vines with a single cross-bar (4) (*Figure* 229, r), or vines arranged in a rectangle with four bars (*vitis compluviata*) (5) (*Figure* 230) (*HN* 17.35.164-166).



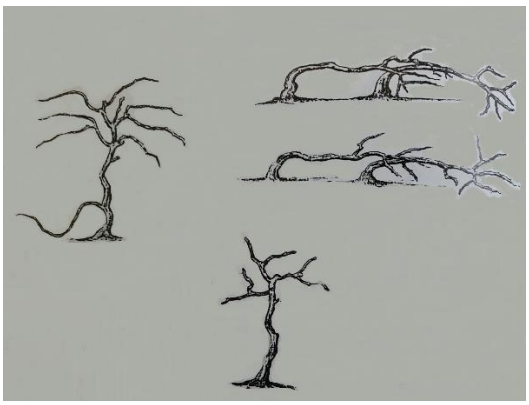
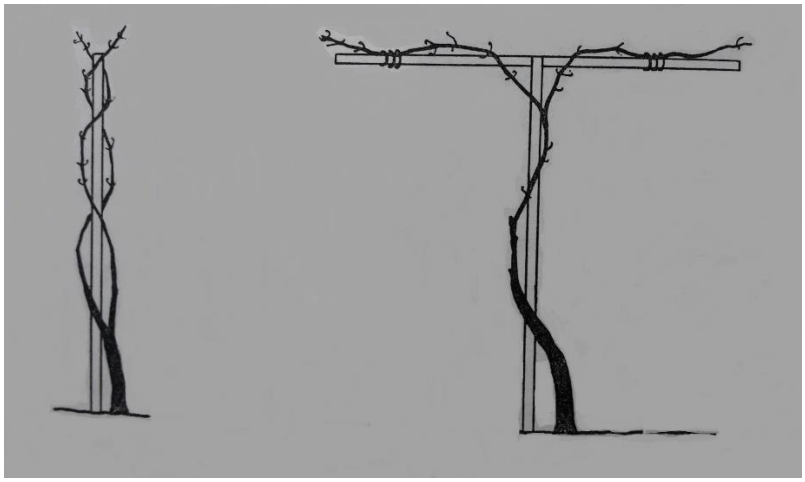


Figure 227 Low-grown vines (above) and vines trained without props (After White 1970, 234, Fig. 2).

Figure 228 Low-grown vines (right upper corner) and vines trained without props (After Forni 1996, 112, Fig. 21).

[49] For an overview, see White 1970, 231-236.



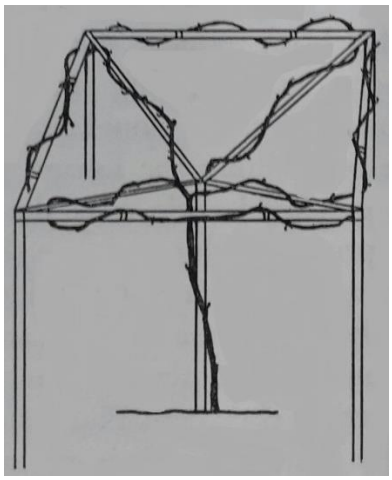


Figure 229 Standing vines with (right) or without a cross-bar (left) (After White 1970, 234, Fig. 2).

Figure 230 Vines arranged in a rectangle with four bars (After White 1970, 235, Fig. 2).

The extensive category also had various forms. Pliny, for instance, mentions a type of extensive vine plantation characteristic for *Umbria* and *Marsia*, called *porculetum*, in which vines were planted in rows at a distance of 20 ft (ca. 6 m), in this way allowing ample space for the cultivation of cereals in between (*HN* 17.35.171).[50] However, the most widespread and discussed form of extensive viticulture – especially in central and northern Italy – was the *arbustum*, a vine-growing system in which vines were trained upon rows of trees, whether or not in combination with the intercultivation of cereals (*Figure* 231; 232).[51] Both Pliny and Columella sum up the kind of trees that were best suited for this purpose. Columella makes a distinction between two types of *arbustum:* a native Italian one called the '*arbustum Italicum*', and a Gallic type originating from northern Italy and named '*arbustum Gallicum*'. Regarding the first type, Columella places the poplar tree first, but indicates that the elm is actually preferred by most people. In places where the elm flourishes less, the ash tree is used (*Rust.* 5.6.5). The second type, thus Columella, only occurred in Cisalpine Gaul and made use of smaller trees, mostly the cranberry tree, but also the cornel-tree, the horn-beam, the mountain-ash and the willow (*Rust.* 5.7.1). Pliny' list of suitable trees differs slightly and is more elaborate. Once again, the first spot is reserved for the elm, after which the black poplar, the ash, the fig and the olive tree follow.[52] Only to the north of the Po River, trees like the cornel, the cranberry tree, the lime, the maple, the rowan, the hornbeam or the oak were used. The willow was only used

[50] Archaeological examples of this type of vine plantations may have been attested in Musarna (Viterbo), where traces for vine rows were attested placed at distances between 4/5 and 9,90 m, also with 6,60 m (Broise/Jolivet 1995, 112). Also in Puglia such traces with even wider spacings were found (Quilici 1992, 117-129); and in the *Ager Ficulensis*, where distances of 20ft were also recorded (Calci/Sorella 1995, 122).

[51] For references and comments, see White 1970. See also Braconi 2008a; 2008b; 2010; 2012.

[52] According to Pliny, the selection of suitable trees was based on height and foliage density (*HN*, 17.35.200).

in the area around *Venezia* for reasons of soil humidity (*HN*, 17.35.200-201). Finally, the matter is also touched upon by Varro, who mentions the use of maple trees for this purpose around *Mediolanum* (Milan), while the people of *Canusium* (Canosa di Puglia) prefer fig trees (*Rust.* 1.8.3-4).



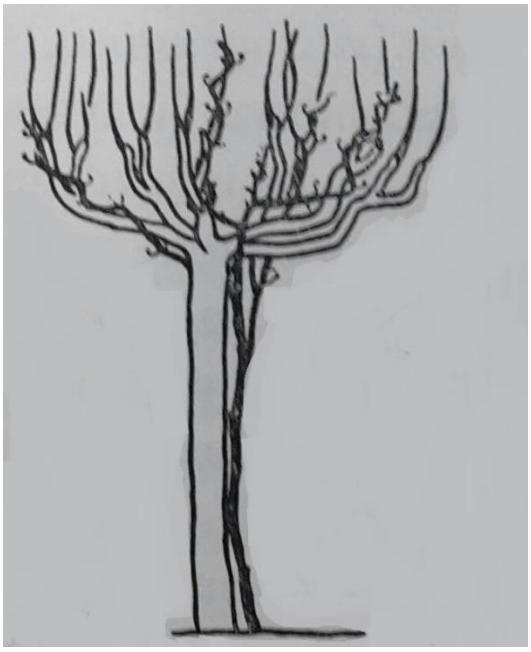


Figure 231 Vines grown on trees (After Forni 1996, 113, Fig. 21).
Figure 232 Vines grown on trees (After White 1970, 235, Fig. 2).

Both Columella and Pliny give advice on the most suitable grape varieties for either the *vinea* or the *arbustum*. Many cultivars can do well on both systems, but some varieties fare better on one system than on the other. Pliny, for instance, particularly mentions that the *Albuelis* vine produces more fruit at the top of the trees, while the *Visulla* vine does the same on the bottom branches (*HN* 14.4.31.). Of the *Aminian* cultivar family, the 'smaller twin sister' variety (*Gemellarum minor*) usually only flourishes when it is trained on trees, while the 'elder sister' variety (*Aminaea maior*) is also less likely to suffer damage when trained on trees than on wooden frames (*HN* 14.4.22). In fact, Columella does not consider the latter variety to be suitable for an *arbustum* – as he does for the *Visula* and the smaller *Argitis* variety, which both do well on trellises and frames – and rather advices the use of the smaller sister variety (*Rust.* 3.2.8), or like Pliny also the smaller twin sister (*Rust.* 3.2.11). Other varieties that do well on an *arbustum* according to Columella are the three Apian vines (*Apianae*) (*Rust.* 3.2.17), the Helvolan vines (*Helvolae*) and again the *Albuelis* (*Rust.* 3.2.23-24).[53] Cultivars suitable for *vinea* systems further include the *Helvenneca*, the *Ambrosia* and the *Escaria* (Pliny, *HN* 14.4); cultivars that may be used for

[53] For a list of grape varieties mentioned by ancient authors, see Appendix V.

both the *vinea* and the *arbustum* are the Nomentan (*Nomentanae*) and Apian (*Apianae*) varieties (Col. *Rust.* 3.2), and also the *Dactylides* (Pliny, *HN* 14.4).

Both authors further make interesting comments on the relationship between quantity and quality in these kinds of vine plantations. Columella advices farmers who eye the obtainment of high yields to concentrate their efforts on the lower sections of the trees, those who contrariwise desire high quality should try to mount the vines as high as possible on the trees (*Rust.* 5.6.24). The issue is even firmer expressed by Pliny, who is of opinion that in general not only are the choicer wines made from grapes at the top of the trees and the mass wines from those lowest down, but that high-class wine *tout court* can only be produced from vines on trees because of the beneficial effects of height and thus of better sun exposure (*HN* 17.35.199-200).

Given the existence of both vineyards and *arbusta* in Roman times, it is useful then to now take a closer look at the theoretical minimum and maximum yields of both types.

The productivity of Roman vine plantations in central Adriatic Italy

Vinea

The amount of grapes that may be obtained from a piece of vineyard land is basically determined by two factors: the produce of a single vine and the number of vines planted on the plot. The outcome of the former depends on the size and the weight of the individual berries, the number of berries per cluster and the number of clusters per vine. The weight and the number of berries seem to be primarily affected by soil type and in lesser degree by climate.[54] Overall cluster weight, however, can also differ significantly according to cultivar. Within vineyards, the number of vines varies to some degree because of different soil and climatic conditions, or because of the use of either moderate or vigorous grape varieties. One could say that the general rule of thumb is that vines are planted further apart in poorer soils and hot/dry climates, while they are planted closer to each other in richer soils and cooler/humid environments. Varieties of moderate growth are also planted at closer spacings than varieties of vigorous growth.[55] Still, by far the most important factor influencing row and vine spacings in modern intensive viticulture is cost, as the ease and economy of vineyard operations are directly proportional to the number of vines present on a certain plot. It determines not only the initial costs (e.g. the number of required vines, stakes or poles, planting time and labour,

[54] For instance, a recent study on terroir in the French Bordeaux region indicated that vine yields in the area were mostly affected by soil type, with yields on sandy soils being much higher than on clayey (32%) or gravelly soils (62%) (Van Leeuwen et al. 2004).

[55] Winkler et al. 1974, 234-245.

training, etc.), but also maintenance and harvest operations (again mainly labour and time).[56]

A somewhat similar picture emerges from the texts of the ancient agronomists. For instance, it is clear that soil type is the main factor in the various row and vine spacings proposed by Pliny: five ft. (ca. 1.50 m) between every two vines in soils of medium density, four ft. (ca. 1.20 m) in rich soils, and eight ft. (ca. 2.40 m) in thin soils. The influence of climate is also touched upon by Pliny, as he recommends to plant vines further apart in rainy and misty areas, but closer together in drier regions:

> "The space between every two vines in a soil of medium density should be five feet, and in rich soil four feet at least, and in a thin soil eight feet at most...vines should be planted further apart in a rainy and misty district but closer together in a dry one."[57]
>
> (Pliny, *HN* 14.35.171-173).

Soil type is also important for Columella and his advised spacing of six ft. (ca. 1.80 m) for soils of medium fertility is almost identical to Pliny's. With regard to lean and fat soils, however, his reasoning contradicts Pliny, as he reserves the narrower spacing (5 ft.) for poor soils and the wider one (7 ft.) for rich soils:

> "The planting, then, is made preferably in prepared ground that is well cleaned and harrowed and levelled off, leaving five feet between the rows in lean ground, and six feet in medium soil. But in fat soil intervals of seven feet must be allowed, so as to leave greater space of open ground over which the numerous and far-reaching branches of firm wood may spread themselves."[58]
>
> (Col., *Rust.* 3.15.1).

Still, Columella is much more concerned with the practical and financial aspects of vineyard work when it comes down to determining row and vine spacings. Indeed, in a vineyard that is cultivated with oxen and plough, he says, wider intervals should be left than when it is simply turned by man with the hoe. For the latter technique, Columella sets the minimum and maximum distances at five (1.50 m) and seven ft. (2.10 m) respectively, while for the former equipment distances range between seven and ten ft. (3 m). In any case, row spacings should never be wider than ten feet, or narrower than four feet (1.20 m). With regard to vine spacings within the rows, the smallest distance allowed is three ft (0.90 m):

---

[56] Winkler et al. 1974, 243-244.

[57] All English translations from the work of Pliny in this thesis have been taken from the edition by H. Rackham (Loeb Classical Library).

[58] All the English translations from the work of Columella in this thesis have been taken from the editions by Harrison Boyd Ash, and E.S. Forster and Edward H. Heffner (Loeb Classical Library).

> "Then leaving a space, according to each man's habit of cultivating with either plough or two-pronged mattock, they set the next row. And if the earth is merely turned by a spade-man, the minimum distance between the rows is five feet, and seven is the maximum; but if with oxen and plough, the minimum is seven feet, while ten is large enough. Yet some set all their vines at ten-foot intervals, in the form of a quincunx, so that the ground may be broken up by diagonal and cross ploughing in the manner of fallow land."
>
> (Col., *Rust.* 3.13.3).

> "As to the spaces between the rows we have this much advice to offer, that farmers should understand that, if they intend to cultivate their vineyards with the plough, wider intervals must be left, but they can be narrower if hoes are used; but they should never be wider than ten feet or narrower than four. Many people, however, arrange the rows so as to leave two or at most three feet in a straight line between the plants, while on the other hand they make the transverse spaces wider, so that the digger or plough-man may pass freely."
>
> (Col., *Rust.* 5.5.3).

> "In a vineyard which is planted very closely, the vines are planted with five feet between them in every direction; but if more widely, at intervals of seven or eight feet. The widest space ever allowed, in order that a plough may be easily used, is fixed at ten feet."
>
> (Col., Rust. *OT* 4.4).

From the text, it is clear that Columella mainly has total vineyard cost in mind when reviewing the various intensive planting schemes with spacings ranging as wide from 3x5 ft. to 10x10 ft, resulting in densities between 2,025 and 325 vines/*iugerum* (ca. 8,100 – 1,300 vines/ha) (*Table* 50). Indeed, as more vines logically implied both higher initial, maintenance and harvest costs, he advised farmers to make their investments wisely and to decide for themselves how many vines were to be planted on a certain plot in proportion to their expected returns, taking into account the nature and the potential of the chosen area:

> "But these methods of planting vineyards, as we have given them, are ours to employ or reject according to the nature and favourableness of each region."
>
> (Col., *Rust.* 3.13.5).

A more regional perspective for the Marche region in particular can be gained by looking at some statistical data for the area in modern times. In fact, for a large portion of the Marchegian vineyards between 1970 and 1990, vine rows were placed at an average distance of 3m (10ft). More recently, however, there has been a growing tendency to set them closer to each other at a distance of ca. 2m (c. 7ft). On the other hand, the average distance between vines on a single row in the period 1970-1990 was 2m, but in the more

intensive vineyards of today they are mostly reduced to 1-1.50m (ca. 3-5ft).[59] Still, various planting schemes are in use in the area nowadays, with spacings generally ranging from 0.75x2m (c. 2.5x7ft) to 3x3m (10x10ft), resulting in densities between 6,667 and 1,111 vines/ha (ca. 1,666-277 vines/*iugerum*) (*Table* 49). Also here, the choice for a particular density depends very much on the relationship between the costs and the expected returns/benefits of the vineyard during its lifespan. However, tests performed in several vineyards in the area have proven that vine spacings within the rows of 1-1.50m are also the most ideal distances in this particular environment, as they ensure both a good productive equilibrium – and thus a good yield – and an adequate ripening, in this way maintaining quality. Furthermore, data gathered within experimental vineyards in the Marche have also shown that the narrowing of the vine spacings from 1.50 to 0.50 m still causes a proportional reduction of yield per vine, but no longer has a positive effect on quality. Therefore, spacings below 0.75m – i.e. below 2.5ft – are generally not considered beneficial.[60]

During the summers of 2012 and 2013 information was also gathered on vine and row spacings in several small-scale vineyards in the lower and middle Potenza valley (*Table* 51). The various vine and row spacings recorded ranged from 0.80x1.50m (ca. 3x5ft) to 3x3.50m (ca. 10x11ft), resulting in densities between 8,333 and 952 vines/ha (ca. 2080-240 vines/*iugerum*). The differences in row spacings were mostly related to the choice for either manual or mechanical agricultural equipment in the vineyard, being wider in the latter case and narrower in the former. In fact, in most of the cases, farmers seem to have adopted vine spacings of 1-1.50m (ca. 4-5ft) and row spacings of 1.50-2m (ca. 5-7ft) for most of the vineyards recorded during the fieldwork.

Table 49 Various operational vine densities per hectare in today's Marche region (After Ricci 2005).

Vine spacing (m)	Row spacing (m)				
	2	2.25	2.50	2.75	3
0.75	**6,667**	5,926	5,333	4,848	4,444
1	5,000	4,444	4,000	3,636	3,333
1.25	4,000	3,555	3,200	2,909	2,667
1.50	3,333	2,963	2,667	2,424	2,222
2	2,500	2,222	2,000	1,818	1,667
2.50	2,000	1,778	1,600	1,455	1,333
3	1,667	1,481	1,333	1,212	**1,111**

[59] Ricci 2005, 81-83.

[60] Ricci 2005, 82-83. It is interesting to note that Columella was searching for the same balance between quantity and quality in his cultivation guidelines (Santon 1996).

All these data then seem to coincide rather well with the minimum and maximum spacings of 3x5 and 10x10ft proposed by Columella. As such, it was decided that they represented acceptable lower and higher limits for the potential yield map for intensive viticulture; i.e. based on densities between 8,100 and 1,300 vines/ha. The most ideal spacings in the area can be considered to have ranged between 1x1.50m (ca. 4x5ft) and 1.50x2m (5x7ft); i.e. densities between ca. 6,100 and 3,300 vines/ha.

Table 50 Vine spacings recommended by the ancient agronomists.

Source	Vine/tree spacing		Row spacing		Vine/tree density		Type
	feet	m	feet	m	per iugerum	per ha	
Columella, *RR*, V, 3, 5	3	0.90	5	1.50	2,025	**8,100**	*Vinea*
Columella, *RR*, V, 3, 6	4	1.20	4	1.20	1,891	7,564	*Vinea*
Columella, *RR*, V, 3, 6	4	1.20	5	1.50	1,525	6,100	*Vinea*
Columella, *RR*, V, 3, 7	5	1.50	5	1.50	1,225	4,900	*Vinea*
Columella, *RR*, V, 3, 7	6	1.80	6	1.80	861	3,444	*Vinea*
Columella, *RR*, V, 3, 8	7	2.10	7	2.10	630	2,520	*Vinea*
Columella, *RR*, V, 3, 8	8	2.40	8	2.40	496	1,984	*Vinea*
Columella, *RR*, V, 3, 9	9	2.70	9	2.70	378	1,512	*Vinea*
Columella, *RR*, V, 3, 10	10	3	10	3	325	**1,300**	*Vinea*
Columella, *RR*, V, 6, 11	20	6	20	6	91	**364**	*Arbustum Italicum*
Columella, *RR*, V, 6, 11	40	12	40	12	28	**112**	*Arbustum Italicum*
Columella, RR, V, 7, 3	20	6	20	6	91	364	*Arbustum Gallicum*
Columella, RR, V, 7, 3	40	12	20	6	49	196	*Arbustum Gallicum*
Columella, RR, OT, XVI, 2	40	12	40	12	28	112	*Arbustum Italicum*
Pliny, *HN*, XVII, 35, 171	4	1.20	4	1.20	1,891	7,564	*Vinea*
Pliny, *HN*, XVII, 35, 171	5	1.50	5	1.50	1,225	6,100	*Vinea*
Pliny, *HN*, XVII, 35, 171	8	2.40	8	2.40	496	1,984	*Vinea*
Pliny, *HN*, XVII, 35, 171	\	\	20	6	\	\	*Porculetum*
Pliny, HN, XVII, 35, 202	20	6	20	6	91	364	*Arbustum*
Pliny, HN, XVII, 35, 202	40	12	20	6	49	196	*Arbustum*
Palladius, III, 10, 1	2.5	0.75	2.5	0.75	4,753	**19,012**	*Vinea*
Palladius, III, 10, 1	3	0.90	3	0.90	3,321	13,284	*Vinea*

Unfortunately, the agricultural manuals do not offer much information on individual vine yields. For vineyards, Columella proudly speaks of a vine bearing more than 2,000 clusters, but offers no further information on the particular yield. He does, however,

mention a harvest of seven *cullei* (ca. 36 hl) from 800 grafted young vine stocks on his own vineyard in *Ceretanum*, which is about 4.5 litres of wine, or ca. 6.5-7.5 kg of grapes per vine (60-70% extraction rate, see *supra*) (*Rust.* 3.3.3). It is difficult to consider this figure as representative for a common vine yield in Roman Italy, as it seems exceptionally high for young vines. Also, individual vine yields – that is weight and the number of clusters per vine – are again heavily influenced by a wide range of factors, such as soil, climate, cultivar, training systems, planting densities, etc. This makes it very difficult to reconstruct individual vine yield figures for antiquity.

Nevertheless, the influence between climate and cultivar is an aspect highlighted by the ancient sources. Columella in particular offers his opinion on this matter:

> "To cold or foggy conditions he will adapt two varieties of vine, either the early ripe, whose fruits mature before cold weather, or those with firm and hard berries, whose clusters drop their blossoms during the foggy season and are presently ripened by freezing weather and frosts, as those of other grapes are ripened by warmth. To a windy and unsettled climate also he will boldly commit the same hardy vines and those of the hard-berried variety. On the other hand, he will entrust to a warm climate the more delicate and heavier-bearing sorts. For a dry climate he will select such as are rotted by rains or continual dews; for a dewy one, those that suffer in dry weather; for one subject to hailstorms, those that have tough and broad leaves for the better protection of the fruit. A calm and clear-skied region does not refuse to admit any kind of vine, though most suitably one whose clusters or berries fall quickly."
>
> (Col., *Rust.* 3.1.7)

For cold, foggy or windy conditions – i.e. conditions that are similar to those reigning over large parts of the central Adriatic area, especially in the coastal and lower valley zones – Columella advices the use of vines that either ripe early – that is before the cold weather arrives – or that have firm and hard berries that drop their blossoms during the foggy seasons and ripen by freeze or frost.[61] From his catalogue of grape varieties, we may deduce that the best cultivars to this respect were the highly prolific Nomentan vines (*Nomentanae*), as these endured rains and winds very well, dropped their flowers early and thus ripened sooner (*Rust.* 3.2.14-15). Other vines with similar characteristics that would have been suitable for said climatic conditions were the Apian vines (*Apianae*) and the Basilic vines (*Basilicae*); again two very productive cultivars (*Rust.* 3.2.17-20). Pliny also recommends said Nomentan and Apian vines (*HN* 14.23-24), but further adds the Allobrogian (*Allobrogica*) (*HN* 14.4.26), the Faecenian (*Faecenia*), the Biturigian (*Biturigiaca*) (*HN* 14.27), the Spionian (*Spionia*) (*HN* 14.4.34), the larger Aminian (*Aminia maius*), the

[61] A similar advice is given by Pliny (*HN* 17.2.22-23).

Murgentine (*Murgentina*), the Apician (*Apicia*), and the Lucanian vines (*Lucana*) (HN 14.4.46) to the pallet of suitable varieties. The last four cultivars are also considered suitable by Cato (*Rust.* 6.4) (*Table* 52). The fact that these were mostly prolific varieties – that is yielding a large amount of fruit – gives some gravitas to the impressive yield figures for areas like *Gallia Cisalpina* and the *Ager Gallicus*, and thus gives the impression that individual vine yields in the central Adriatic area were rather at the high end. But what is high and what is low?

Table 51 Spacings in small-scale vineyards in the Potenza valley (2012-2013) (information collect by the author).

Vine spacing (m)	Row spacing (m)					
	1.50	**2**	**2.20**	**2.50**	**3**	**3.50**
0.80	**8,333**	6,250	5,681	5,000	4,166	3,571
1	6,666	5,000	4,545	4,000	3,333	2,857
1.20	5,555	4,166	3,787	3,333	2,777	2,380
1.50	4,444	3,333	3,030	2,666	2,222	1,904
1.80	3,703	2,777	2,525	2,222	1,851	1,587
2	3,333	2,500	2,272	2,000	1,666	1,428
3	2,222	1,666	1,515	1,333	1,111	**952**

Table 52 List of suitable cultivars for central Adriatic area on the basis of the information provided by the ancient authors.

Parameter	Cultivar
Environmental/climatic conditions	*Allobrogica*, *Aminia maius*, ***Apiana***, *Apicia*, *Basilica*, *Biturigiaca*, *Faecenia*, *Lucana*, *Murgentina*, ***Nomentana***, *Spionia*
Training system (*arbustum*)	*Aminaea*, ***Apiana***, *Albuelis*, *Dactylides*, *Helvola*, ***Nomentana***, (*Visulla*),
Explicit mentioning	*Bananica*, *Itriola*, *Picena*, *Pumila*

Table 53 Yields for 100 low-yielding vines in 1952 in Lombardy, Northern Italy (After Niccoli/Fanti 1952, 607).

Terrain	Yield (kg)			Yield/vine (kg)		
	Good vines	Medium vines	Bad vines	Good vines	Medium vines	Bad vines
Good fertility	200	100	50	**2**	1	0.50
Medium fertility	150	60	40	1.50	0.60	0.40
Low fertility	60	30	15	0.60	**0.30**	0.60

Some further insights to this regard may be gained by looking at two editions of the *Prontuario dell'Agricoltore*. In fact, the effect of grape type – i.e. low-yielding vs. prolific ones – on individual vine yields becomes quite clear when looking at the data for Lombardy in 1952. There, low-yielding vines yielded between 0.30 kg and 2 kg per vine, but prolific vines yielded between 2 and 8 kg per vine (*Table* 53; 54).

Table 54 Yields for 100 prolific vines in 1952 in Lombardy, Northern Italy (After Niccoli/Fanti 1952, 607).

Terrain	Yield (kg)			Yield/vine (kg)		
	Good vines	Medium vines	Bad vines	Good vines	Medium vines	Bad vines
Good fertility	800	600	400	**8**	6	4
Medium fertility	600	450	300	6	4.50	3
Low fertility	400	300	200	4	3	**2**

Table 55 Average yields for 100 vines in central Italy in 1952 (After Niccoli/Fanti 1952, 610, Tabella LXXXVII).

Age	Terrain	Minimum yield (kg)	Maximum yield (kg)	Minimum yield/vine (kg)	Maximum Yield/vine (kg)
ca. 10 years	Good fertility	30	37	0.30	**0.37**
	Medium fertility	27	34	0.27	0.34
	Low fertility	24	30	**0.24**	0.30
Medium age	Good fertility	134	190	**1.34**	**1.90**
	Medium fertility	100	160	1.00	1.60
	Low fertility	51	114	**0.51**	1.14
Later years	Good fertility	46	55	0.46	**0.55**
	Medium fertility	24	30	0.24	0.30
	Low fertility	19	20	**0.19**	0.20

Of course, cultivar is not the only parameter influencing individual vine yields. Age is a factor too. In fact, in the lower Veneto area in northern in Italy 1952, the average yield for vines between 10 and 25 years of age was ca. 2.3 kg with a planting density of 5,000 vines/ha (1,250 vines/*iugerum*). Then again, in the Casalese area (Piemonte) mature vines planted with a density of 4,000 vines/ha on fertile land had a somewhat higher average

yield of 3.75 kg. In medium and poor soils, average yields decreased to less than 2 kg or even 1 kg per vine.[62]

The combined effects of age and soil fertility are also clear in some other data for central Italy in 1952. There, depending on the nature of the soil, average yields ranged between 0.24 and 0.37 kg for vines of ≤ 10 years old; between 0.51 and 1.90 kg when of medium age; and 0.19-0.55 in later years. As such, the best yields – i.e. 1.34-1.90 kg/vine – were only reached with vines in their prime maturity on soils with good fertility. In the very worst conditions, young and older vines only yielded between 0.19 and 0.24kg per vine (*Table* 55). To some extent, however, the relatively low individual yields must be ascribed to the fact that vineyards usually had higher planting densities in this area; i.e. ca. 6,000-10,000 vines/ha (1,500-2,500 vines/*iugerum*) compared to 4,000-5,000 vines/ha in Lombardy and the Veneto area in Northern Italy.[63]

Table 56 Yields for 100 vines in Tuscany at the end of the 19th century (After Niccoli 1897, 298-299).

Age	Terrain	Minimum yield (kg)	Maximum yield (kg)	Minimum yield/vine (kg)	Maximum yield/vine (kg)
10 years	High fertility	35	57	0.35	**0.57**
	Medium fertility	27	34	0.27	0.34
	Low fertility	14	20	**0.14**	0.20
Medium age	High fertility	180	190	1.80	**1.90**
	Medium fertility	134	144	1.34	1.44
	Low fertility	51	60	**0.51**	0.60
Old age	High fertility	46	55	0.46	**0.55**
	Medium fertility	24	30	0.24	0.30
	Low fertility	19	25	**0.19**	0.25

A similar story may be reconstructed from the data provided by the *Prontuario* for Tuscany and Umbria in 1897. For Tuscany, the highest individual yields of 1.80-1.90 kg are attained on good soils by vines of medium/optimal age; most yields, however, are lower and range between 0.14 and 0.60 kg per vine (*Table* 56). For Umbria, the same pattern may be noticed, as the marked differences in vine yield in relation to the age of the vines and

[62] Niccoli/Fanti 1952, 608.

[63] Niccoli/Fanti 1952, 610.

the fertility of the soil are again quite apparent. The highest yields of 2.56-3.14 kg/vine are only attained on good soils by vines between 26 and 35 years of age. For the 16-25 and the 36-45 year categories, yields are lower and range between ca. 0.50 and 1.80 kg/vine. For the youngest and the oldest vines, yields are again lower and range between ca. 0.25 and 0.65 kg per vine (*Table* 57).

For today's Marche region, some individual vine yields were also gathered during the fieldwork in the lower and middle Potenza valley in 2012 and 2013. They generally attest higher yields between 3 and 10 kg per vine because of the use of better fertilisers and improved cultivation techniques in modern times. Once again, the highest yields (6.5-9.2 kg/vine) are attested for vines of medium age (20-40 years); the lowest yields (3-4 kg/vine) belong to younger (15 years) and older (50 years) vines (*Table* 58).

Table 57 Yields for 100 vines in Umbria at the end of the 19th century (After Niccoli/Fanti 1897, 298).

Age (years)	Terrain	Minimum yield (kg)	Maximum yield (kg)	Minimum yield/vine (kg)	Maximum Yield/vine (kg)
6-15	Good fertility	54	66	0.54	**0.66**
	Medium fertility	42	48	0.42	0.48
	Low fertility	24	36	**0.24**	0.36
16-25	Good fertility	142	172	1.42	**1,72**
	Medium fertility	110	126	1.10	1,26
	Low fertility	62	94	**0.62**	0.94
26-35	Good fertility	256	314	2.56	**3.14**
	Medium fertility	200	228	2	2.28
	Low fertility	114	172	**1.14**	1.72
36-45	Good fertility	112	138	1.12	**1.38**
	Medium fertility	88	100	0.88	1
	Low fertility	50	76	**0.50**	0.76
46-55	Good fertility	54	66	0.50	**0.66**
	Medium fertility	42	48	0.42	0.48
	Low fertility	24	36	**0.24**	0.36

Despite all the problems that are associated with these data, what they at least seems to illustrate is that Columella's yield of 6.5-7.5 kg of grapes per vine was indeed an exceptional yield figure rather than a representative average one, only attainable with very prolific vines in their best years and on very good lands. Besides, just like their modern counterparts, Roman vineyards will commonly have housed a mixture of age categories, making it again unlikely that all vines within a plantation attained such high

yields. Even with the frequent use of prolific varieties in the central Adriatic area (see *supra*), it seems more reasonable then to base the potential intensive yield map for viticulture on individual vine yields between minima of 1-2 kg and maxima of 3-4 kg of grapes per vine. Again, lower or higher yields probably occurred – in particular influenced by higher or lower planting densities, or by the fertility of the soil – but modelling all these parameters for antiquity would lead us too far into unsubstantiated territory, and would add little to the representativity of an overall intensive yield model for the central Adriatic area.

Table 58 Vine yields for the Potenza valley in 2012-2012 (information collected by the author).

Nr. of vines	Age (years)	Yield (kg)	Yield/vine (kg)
230	40	1,500-1,600	6.5-6.9
150	15	600-700	4-4.6
140	\	1,000	7
130	18/20	1,000-1,200	7.7-9.2
100	\	1,000	10
100	50	300-400	3-4
70	\	500	7
45	20	300	6.6

Arbustum

For an extensive plantation of the *arbustum* type, yields are determined by the number of trees, the number of vines linked to each tree and the individual yield of a vine. Regarding the first parameter, ancient authors recommend tree and row spacings of either 20x20 ft (6x6m) or 40x40ft (12x12m), resulting in 91 and 28 trees per *iugerum* respectively; i.e. ca. 364-112 trees per hectare (*Table* 50). Both Columella (*Rust.* 5.6.11) and Pliny (*HN* 17.35.202) indicate that the choice for either the wider or the narrower spacing mainly depended on whether or not the land between the trees was used for cereal cultivation, and hence was determined by the fertility of the soil. For the *arbustum Gallicum* in particular – i.e. the variant with smaller trees only occurring in *Gallia Cisalpina* – spacings of 20x20ft (364 trees/ha) and 20x40ft (196 trees/ha) are proposed by both Columella and Pliny in relation to the (non-) cultivation of cereals on the plot:

> "But if we have in view the sowing of cereals also, the trees should be placed, if the soil is rich, at intervals of forty feet from one another, but if it is thin and nothing is planted in it, at intervals of twenty feet."
>
> (Col., *Rust.* 5.6.11)

> "If no cereal is sown amongst the dwarf trees, spaces of twenty feet are left on either side; but if one indulges in crops, forty feet are left on one side and twenty on the other."
>
> (Col. *Rust.* 5.7.3)

> "The proper space between the trees, if the soil is to be ploughed, is forty feet behind and in front and twenty feet at the sides, but if it is not to be ploughed, twenty feet every way."
>
> (Pliny, *HN* 17.35.202)

According to Columella, the best spacing was considered 40ft, because such a distance was not only beneficial for the development of both the trees and the vines, but also ensured the diminishment of the harmful effects of excessive shade on the other crops of the land:

> "Trees for supporting vines are best arranged at intervals of forty feet; for then both the trees themselves and the vine trained upon them will thrive better and produce better fruit; crops, too, which are grown in the plantation will suffer less harm from the shade."
>
> (Col., *Rust.* OT 16.2)

The two editions of the *Prontuario dell'Agricoltore* offer some further comparative evidence for tree and row spacings in traditional tree-wedded vine plantations in northern and central Italy at the end of the 19th century and the middle of the 20th century. In 1897, in the Po plain, row spacings ranged between 20 and 25m (ca. 67-83ft), while trees were planted within the rows at a distance of 5m (ca. 17ft).[64] In 1952, in the same area, row spacings were 20-30m (ca. 67-100ft) and tree spacings 4-6m (ca. 13-20ft). Such distances ensured tree densities ranging from 50 to 125 trees/ha (ca. 12-31 trees/*iugerum*), but most of the time densities circled a figure of 80-100 trees/ha (ca. 20-25 trees/*iugerum*).[65] In central Italy, on the other hand, densities were generally higher, with a minimum of 80-120 trees/ha (20-30 trees/*iugerum*), but with most densities ranging between 150-200 trees/ha (37-50 trees/*iugerum*), and sometimes even attaining 300 trees/ha (75 trees/*iugerum*).[66] Similar densities ranging from ca. 85 to 212 trees/ha were also common until the 1980's in the 'alberata' fields of the Potenza valley in central Marche, where row spacings of 8 (27ft), 12.5 (42ft) and 20m (67ft) respectively have been recorded, together with average tree spacings of 6m (20ft).[67]

[64] Niccoli 1897, 300.

[65] Niccoli/Fanti 1952, 608.

[66] Niccoli/Fanti 1952, 608.

[67] Personal observation and interviews with local farmers during the summers of 2012 and 2013.

For the extensive yield model, a minimum density of ca. 110 trees per hectare will be used, as this was the recommended density by both Columella and Pliny. Furthermore, based on the data from the *Prontuario* and the fieldwork in the Potenza valley, it may be considered a representative average density for central and northern Italy in general, and the Marche region in particular. A density of 300 trees per hectare is also modelled, as this is the highest density mentioned for the area in pre-industrial times and close to the highest density allowed by both Pliny and Columella (364 trees/ha).

The information on individual tree yields for antiquity is scarce. The only tangible data comes from Strabo, who claims that one tree-vine could produce ca. 40 liters of wine (55-67 kg with an extraction rate of 60-70%) (*Geogr.*, II, 1, 14). Strabo, however, is not referring to Italy, but to the land of *Hyrcania*, an extremely fertile strip of land along the Caspian Sea (*Geogr.*, XI, 7, 2), where it was common practice to lavishly guide the vines to great heights onto rows of trees.[68] Still, the high profitability of training vines on elm trees is also praised by Varro, who speaks about a yield of several small baskets (corbulas) of grapes per tree-vine in the area near *Crustumerium*, a town in *Latium* near the Sabine territory (*RR*, I, 15). The equivalent amount of grapes of such a basket, however, is unclear. The measurement of the vintage 'per basket' (*per corbem*) seems to have been a common way for indicating the size of the grape harvest in Roman Italy, but several sub-types existed and none of them had standard sizes.[69] Still, Varro is probably referring to the baskets that were used during the actual gathering of the grapes. These were much smaller than the baskets that were subsequently used for transporting the grapes from the field to the treading floors.[70] The latter are referred to as '*corbulas Amerinas*' by Cato, who foresees 20 of them for a single vintage of 160 *cullei* (*RR*, XI, 5); the equivalent of ca. 830 hl of wine or ca. 127,000 kg of grapes (65% extraction rate). As the number of baskets was probably calculated for holding the result of one day of grape gathering, their size can be estimated at ca. 180 kg each.[71] Because of the required manageability of vintage baskets, Varro's *corbulae* were probably only 1/6 or 1/5 of their size – that is ca. 30-36 kg (20-25 l) – or even smaller. However, as no definite size can be put on these baskets, such calculations are doomed to remain largely theoretical exercises. Also, in the light of other yield figures provided by the ancient agronomists, it is quite likely that Strabo is providing us here with a rather exceptional yield, rather than a common one.

A better way to outline realistic yield models for *arbustum* fields is to start from the number of vines per tree and the yield of single vines. Pliny is the only author who provides us with some information on the approximate number of vines that could be trained on each tree in Roman Italy. He recalls that farmers often grew as much as ten

[68] This area coincides with parts of today's Iran and Turkmenistan.

[69] White 1975, 56-59.

[70] White 1975, 112.

[71] Based on a vintage season of ca. 5 weeks (35 days), and thus a total of 3600 kg of grapes/day.

vines against each tree, while at the same time he condemns the practice of training less than three vines (*HN* 17.35.202-203). According to the *Prontuario*, 4 to 5 vines were commonly attached to each tree in extensive vine plantations in the areas around Bologna and Modena in Emilia Romagna at the end of the 19th century. For Tuscany in 1897, an exceptional yield is mentioned for a single field maple with 4-5 vines attached to it yielding 90-100 kg of grapes; i.e. between 18 and 29 kg of grapes per vine.[72] On a more general level, however, it is clear that tree yields were much lower, with the highest yields attained per vine on field maples being 3.08-4.40 kg in their best years and on good or decent soils, while most yields ranged between ca. 0.30 and 1 kg of grapes per vine (*Table* 59).

Table 59 Yields for 100 sites trained on field maples in Tuscany at the end of the 19th century (After Niccoli 1897, 298-299) (yields are expressed in kg).

Age	Terrain	Minimum yield	Maximum yield	Minimum yield/vine	Maximum yield/vine
10 years	High fertility	98	105	0.98	1.05
	Medium fertility	64	72	0.64	0.72
	Low fertility	75	92	0.75	0.92
Medium age	High fertility	340	440	**3.40**	**4.40**
	Medium fertility	308	332	**3.08**	**3.32**
	Low fertility	96	108	0.96	1.08
Old age	High fertility	75	92	0.75	0.92
	Medium fertility	48	61	0.48	0.61
	Low fertility	29	34	0.29	0.34

Table 60 Yields for 100 trees with each 4-5 vines attached in the Bologna area (After Niccoli 1897, 299) (yields are expressed in kg).

Age	Terrain	Min. yield	Max. yield	Min. yield/tree	Max. yield/tree	Min. yield/vine	Max. yield/vine
6-15	High fertility	50	70	0.50	0.70	0.13	0.18
	Medium fertility	40	59	0.40	0.59	0.10	0.15
	Low fertility	20	35	**0.20**	**0.35**	**0.05**	**0.09**
16-25	High fertility	140	175	1.40	1.75	0.35	0.44
	Medium fertility	110	125	1.10	1.25	0.28	0.32

[72] Niccoli 1897, 299.

	Low fertility	50	95	0.50	0.95	0.13	0.24
26-	High fertility	250	315	**2.50**	**3.15**	**0.63**	**0.79**
45	Medium fertility	200	230	2	2.30	0.50	0.58
	Low fertility	115	170	1.15	1.70	0.29	0.43
46-	High fertility	140	175	1.40	1/75	0.35	0.44
55	Medium fertility	110	125	1.10	1.25	0.28	0.32
	Low fertility	50	95	0.50	0.95	0.13	0.24

Table 61 Yields for 100 trees with each 4-5 vines attached in the Modena area (Emilia Romagna) (After Niccoli 1897, 299) (yields are expressed in kg).

Age	Terrain	Min. yield	Max. yield	Min. yield/tree	Max. yield/tree	Min. yield/vine	Max. yield/vine
6-15	High fertility	54	65	0.54	0.65	0.14	0.17
	Medium fertility	42	48	0.42	0.48	0.10	0.12
	Low fertility	24	36	**0.24**	**0.36**	**0.06**	**0.09**
16-	High fertility	142	172	1.42	1.72	0.36	0.43
25	Medium fertility	110	126	1.10	1.26	0.28	0.32
	Low fertility	62	94	0.62	0.94	0.16	0.24
26-	High fertility	256	314	**2.56**	**3.14**	**0.64**	**0.79**
35	Medium fertility	200	228	2	2.28	0.50	0.57
	Low fertility	114	172	1.14	1.72	0.29	0.43

Table 62 Yields for 100 vines in their full maturity trained upon poplar trees in Lombardy (After Niccoli 1897, 299) (yields are expressed in kg).

Terrain	Min. yield	Med. yield	Max. yield	Min. yield/tree	Med. yield/tree	Max. yield/tree
High fertility	400	600	800	**4**	**6**	**8**
Medium fertility	300	450	600	3	4.50	6
Low fertility	200	300	400	**2**	3	4

Table 63 Yields for 100 poplar trees in Lombardy in their age of full maturity (After Niccoli 1897, 300).

Type	Minimum yield (kg)	Medium yield (kg)	Maximum yield (kg)	Min. yield/tree (kg)	Med. yield/tree (kg)	Max. yield/tree (kg)
Very good poplars	400	500	600	4	5	**6**
Medium poplars	250	300	320	2.50	3	3.20
Bad poplars	100	150	200	**1**	1.50	2

Table 64 Theoretical yields for the Marche region between 1928 and 1932 (In part after ASI 1928-1932).

Year	Yield (Kg/ha)	Yield/tree (kg), based on a density of		
		100 trees	200 trees	300 trees
Marche region				
1928	650	6.5	3.25	2.17
1929	718	7.2	3.59	2.39
1930	470	4.7	2.35	1.57
1931	431	4.3	2.16	**1.44**
1932	1,045	**10.5**	5.23	3.48
Marche region (mountainous areas)				
1927	390	3.9	1.95	1.3
1928	568	**5.7**	2.84	1.89
1929	567	5.7	2.84	1.89
1930	385	3.9	1.93	1.28
1931	314	3.1	1.57	**1.05**
Marche region (hilly areas)				
1927	478	4.8	2.39	1.59
1928	693	6.9	3.47	2.31
1929	771	**7.7**	3.86	2.57
1930	674	6.7	3.37	2.25
1931	474	4.7	2.37	**1.58**
Average	**575.2**	**5.75**	**2.88**	**1.92**

The data for Bologna and Modena further show that very low yields were actually quite common for vines trained on trees: 0.05-0.79 kg per vine for the former area and 0.06-0.79 kg for the latter. Hence, with 4-5 vines attached to each tree, total tree yields were equally low: 0.20-3.15 kg per tree in the former and 0.24-3.14 kg per tree in the latter (*Table* 60; 61). For northern Italy, the situation seems somewhat better, with trees generally attaining higher yields. The data for Lombardy, for instance, indicate individual tree

yields between 2 and 8 kg of grapes (*Table* 62). Other data from the same region show that the yield of the vines/trees is proportional to their age. In fact, between their 4th and 12th year, the production of vines on very good poplar trees rises from 0.04 kg to 4 kg of grapes per tree; between their 13th and 84th year, these poplars each produce between 4 and 6 kg of grapes; for the same life period, lesser poplars yield between 2.50 and 3.20 kg and bad poplars between 1 and 2 kg (*Table* 63).

For the area around Mantova in 1952, the *Prontuario* mentions much higher numbers for poplar trees with vines: 21 kg of grapes in fertile lands and 16 kg of grapes in less fertile and light soils. Likewise, for the wider Po valley, maximum poplar tree production is 30-35 kg of grapes per tree, medium production 22-25 kg or 15-16 kg, and low production 10-12 kg. Based on these numbers – and taken into consideration a common planting density of 80-100 trees/ha – the *Prontuario* derives overall yield figures of 2,000-2,500 kg of grapes per hectare (14-16 hl) on fertile lands, 1,200-1.600 kg (9-10 hl) on medium fertile soils, and 700-1,000 kg (5-6 hl) on lean ground.[73] More than anything else, however, these numbers illustrate well the extreme profitability of this vine cultivation system in combination with poplar trees in the Po plain.[74] However, based on the aforementioned data for Bologna, Modena and Lombardy, it is unlikely that such high yields were common in the central Adriatic area. In fact, when we return to the yield data for extensive viticulture in Marche between 1928 and 1932 presented in Table 48 (see *supra*), a quick theoretical exercise with planting densities between 100 and 300 trees shows that most of the time singular tree yields will more likely have ranged between ca. 2 and 6 kg of grapes (*Table* 64). These are the lower and higher figures then that will be used for the extensive yield model.

5.2.3 Olives

The issue of variability

Contrary to cereals and grapes, the ancient sources remain silent about the productivity of olive groves in Roman Italy. Pliny remarks that some trees in Africa are called 'thousand-pounders' because of the enormous amount of oil they produce, but he is describing a very local phenomenon that does not bear any resemblance to the situation on the peninsula (Pliny, *HN* 17.19.93). One reason for the agronomists' silence is certainly the difficulty with which the annual output of olive groves may be predicted on a regular

[73] Niccoli/Fanti 1952, 608. The conversions from grapes to wine are based on an exctraction rate of 65-70%.

[74] They also show how Strabo's yield figure of 55-67 kg was probably attainable, but again only in exceptional circumstances. The efficiency of the poplar tree may in part explain its popularity among writers like Pliny and Columella (see *supra*).

basis. Columella in particular highlights the unpredictable nature of the tree and its tendency to bear fruit only once in a two-year period:

> "For although it does not bear fruit year after year but generally in alternate years..."
>
> (Col., *Rust.* 5.8.2)

> "When the olive grove is established and has reached maturity, you must divide it into two parts, so that they may be clothed with fruit in alternate years; for the olive tree does not produce an abundance two years in succession. When the ground underneath has not been sown with a crop, the tree is putting forth its shoots; when the ground is full of sown crop, the tree is bearing fruit; the olive-grove, therefore, being thus divided, gives an equal return every year."
>
> (Col., *Rust.* 5.9.11-12)

> "It happens also frequently that, though the trees are thriving well, they fail to bear fruit."
>
> (Col., *Rust.* 5.9.16)

> "Olive trees also often refuse to bear fruit because of the badness of the soil."
>
> (Col., *Rust.* 5.9.16)

Table 65 Overall olive yields for the Marche region (1881-1994) (After ASI 1881-1886).

Province	Area (ha)	Total oil production (hl)				Yield/ha (l)			
		1881	1883	1884	1885	1881	1883	1884	1885
Pesaro	3,081	10,168	3,855	1,200	2,700	330	125	**39**	88
Ancona	6,402	13,445	4,327	6,270	5,130	210	68	98	80
Macerata	4,410	14,994	8,070	13,589	9,525	**340**	183	308	216
Ascoli Piceno	6,695	13,390	8,824	8,710	12,060	200	132	130	180
Teramo	15,300	45,900	29,927	38,780	44,320	300	196	253	290

Table 66 Some olive tree planting strategies according to ancient authors.

Source	Distance (ft)	Distance (m)	Trees/ha	Region
Cato, *Agr. Orig.* 6.1	25	7.4	180	Italy
Cato, *Agr. Orig.* 6.1	30	8.9	126	Italy
Columella, Rust. *OT* 17.3	60	17.8	30	Spain
Columella, *Rust.* 5.9.7	60x40	17.8x11.8	47	Spain
Columella, Rust. 5.9.7	25	7.4	180	Italy
Pliny, *HN* 17.93-94	25	7.4	180	Italy
Pliny, *HN* 17.93-94	30	8.9	120	Italy

Pliny, *HN* 17.93-94	45	13.3	56	Africa
Pliny, *HN* 17.93-94	75	22.2	20	Africa
Palladius *Rust.* 3.18	15	4.4	500	Italy
Palladius *Rust.* 3.18	20	5.9	285	Italy
Palladius *Rust.* 3.18	25	7.4	120	Italy
Palladius *Rust.* 3.18	45	13.3	56	Italy

It also does not help that olive yields – even more than vine yields for that matter – could vary enormously because of regional (or local) geologic and climatic conditions, or because of differing cultivars, cultivation methods and planting strategies.[75] Looking once again at some regional data for the central Adriatic area in later historical periods is a good starting point. For the period between 1881 and 1884, the *Annuario* mentions overall yield figures – i.e. combining the harvests from both mixed and specialised olive plantations – ranging mostly between 100 and 300 liters per hectare (*Table* 65). For the period between 1909 and 1929, yield data only concern mixed olive groves, reporting harvests of 23-79 kg of olives per hectare, or 3-13 l of oil/ha. For 1929-1932, data for both intensive and extensive oleoculture are known: 400-2,000 kg/ha (66-312 l/ha) for the former and 15-47 kg/ha (2.5-8 l/ha) for the latter (*Appendix* IV, *Table* 108). The data mentioned in the Inchiesta are few and difficult to interpret. The report mentions an average yield of 210 l/ha for the province of Ancona, but it is not clear whether olive or oil yield is intended here, nor is there any indication regarding the referred type of plantation.[76] The same report talks about extensive mixed olive plantations near Macerata that are said to be yielding on average around 13-19 kg of olives, but no unit of area is specified.[77] For the territory of Fermo, the report puts the average yield for olive trees arranged within an alberata field at ca. 358 kg of olives/ha (400 l/ha) when spaced at intervals of 16-20 m (i.e. a density of ca. 30 trees). As such, each tree would have had an average yield of 11.9 kg of olives.[78]

Despite their difficulties, these comparative data make clear once again that there is a considerable difference in yield between intensive and extensive olive groves, and that yield thus reasonably depends on the number of trees planted per plot and on the individual yield of the trees. Factors that may influence the spacings of olive trees include soil quality, rainfall, location in the landscape or also the envisaged size of the trees.[79] For

[75] For a good discussion of this matter, see Mattingly 1994.

[76] Inch. Agr. Jac. 1884, 713.

[77] Inch. Agr. Jac. 1884,

[78] Inch. Agr. Jac. 1884, 742. Based on the extraction ratios mentioned in the Annuario, such an olive yield would have translated in ca. 55-70 l of oil/ha (see *Appendix* IV, *Table* 108).

[79] Mattingly 1994.

instance, in contemporary olive groves in Israel, trees are planted 8 to 10 m from each other within an intercultivated regime, resulting in densities between 100 and 140 trees per hectare.[80] Then again, comparative ethnographic evidence for Tunisia suggests that in the more arid zones of the country low planting densities of 20-60 trees per hectare are related to the limited amount of available rainwater. Today, in Syria, between 120 and 150 trees are planted on irrigated fields, while some 100 a 115 trees are planted on traditional rain fed fields.[81] In the Sabine region of central Italy, the highest densities (95-120 trees/ha) occur on the highest locations in order to compensate for lower yields per tree.[82]

There is no consensus about the amount of space that was left between olive trees in antiquity. A density of 100 trees per ha is noted in an inscription from Heraclea in *Lucania* (Gulf of Taranto).[83] Archaeological traces in Roman North Africa suggest planting distances of 9x9 m resulting in a density of 140 trees per ha.[84] The various schemes provided by the ancient authors indicate spacings for olive trees that range from 4.4 to 22 m, resulting in planting densities that could range from 20 to 500 trees per ha. In most cases, however, a planting density between 100 and 200 trees per ha seems to have been the norm (*Table* 66). One important parameter influencing these distances, according to Columella, is the applied cultivation strategy, as he advises olive trees grown in combination with cereals to be planted at distances of 60 ft (17.8m), while the distances in intensive olive groves are only 25 ft (7.4m):

> "On ground which is rich and fit for growing corn the space between the rows ought to be sixty feet in one direction and forty in the other: if the soil is poor and not suitable for crops, twenty-five feet."
>
> (Col., *Rust.* 5.9.7)

A distance of 60ft is also recommended by the same author for letting the trees develop according to their full potential:

> "Olive-trees should be arranged with sixty feet between them so that they may have room to grow in breadth; for those which run to height become feeble and bear little fruit."
>
> (Col., *Rust. OT* 17.3)

No ancient source actually mentions the amount of olives produced by a singular olive tree, but in contemporary oleoculture, an average between 10 and 20 kg per tree is

[80] Frankel 1994, 23.

[81] www.internationaloliveoil.org (accessed on 28.09.2012).

[82] Mattingly 1994, 93-95.

[83] Dareste/Haussoullier/Reinach 1895.

[84] Barbery/Delhoum 1982, 39; Peyras 1975, 213.

considered normal in most years. Such yields, for example, have been recorded for France. Similar yields are known for Spain (15-25 kg), Italy (14.8 kg), Palestine (10-30 kg) and also Syria (12-25 kg). Average annual yields in Tunisia are somewhat lower, ranging from 6kg in the North to 14.2 kg in the South. An equally low average yield of 5.6 kg is also known for Greece (Methana). Very low figures between 3.3 and 6.5 kg of olives per tree have been proposed by Frank and White for Roman Italy. A standard extraction rate of 25% would then imply very low yields between 0.8 and 1.6 kg of oil/tree. Based on comparative evidence, Osborne proposed somewhat higher yields of 1.5-4 kg of oil per tree for ancient Greece. Based on a 25% oil/olive rate, this would imply yields between 6 and 16 kg of olives/tree.

Table 67 Oil production per tree near Perugia in the 1950's (re-elaborated from Niccoli/Fanti 1952, 618, Tabella LXXXIX) (values are expressed in kg).

Level of fertility	2nd period (13-30 years)		3rd period (31-50 years)		4th period (51-200/300 years)
	Min.	Max.	Min.	Max.	Average
1	0.17	0.34	0.34	0.68	0.68
2	0.23	0.41	0.41	0.84	0.84
3	0.24	0.48	0.75	1.02	1.02
4	0.27	0.54	0.55	1.19	1.19
5	0.35	0.61	0.62	1.36	1.36
6	0.34	0.68	0.69	1.53	1.53
7	0.37	0.75	0.76	1.77	1.70
8	0.41	0.81	0.82	1.86	1.87
9	0.44	0.88	0.89	2.03	2.03

While extremely variable from year to year, the amount of olives/oil that may be subtracted from a tree typically depends on the age of the trees and the type of cultivar grown. The influence of the former parameter is quite clear through some data for the area around Perugia in the 1950's. For the first life-period (1-12 years) the trees are practically unproductive; for the second period (13-30 years) yields range between 0.17 and 0.88 kg of oil per tree, depending on the level of fertility of the olive grove; for the third period (31-50 years) yields are higher and range between 0.34 and 2.03 kg of oil/tree; the highest average yields are obtained in the fourth period (51-300 years) with an average harvest of 0.68-2.03 kg (*Table* 67). The data for Tuscany, on the other hand, illustrate well the influence of cultivar, with the amount of oil/olive in the pulp ranging from 0.27 to 0.53 gr according to the type of olive variety.[85] The same awareness stems

[85] Niccoli/Fanti 1952, 619, Tabella XCI.

from the accounts of the ancient agronomists, with Columella listing nine types of olive cultivars and praising the Sergian for the quantity of its oil and the Licinian for its quality (Col., *Rust.* 5.8.4).[86]

Modern day small-scale oleoculture in Marche

In order to get a more local perspective on planting densities and potential tree yields, a series of terrain checks and interviews were carried out with local small-scale farmers in the lower and middle Potenza valley in the Marche region during the 2012 and 2013 summer campaigns of the PVS project. The aim of this kind of ethnographic research is not to present fixed strategies and yield figures that can be extrapolated directly to Roman agricultural practices. Rather its purpose lies in achieving a better understanding of the agricultural choices and yield possibilities in this particular environment. Such a comprehension may help us to model Roman oleoculture in the area in a more accurate and credible way, and may prevent us from making erroneous reconstructions. The accounts of this fieldwork may be found below; the data are summarised in *Table* 68.

Pierino Monachesi (Casa Piacampo) (1)

Pierino Monachesi owns a large arable field (5-12 ha) located on the middle southern slope of the Colle Burchio plateau, located in the lower Potenza valley, approximately 2.5 km from the Adriatic coast. Pierino grows olives for subsistence purposes. The olives are processed by a local oil factory. The field is located in the vicinity of a Roman rural settlement (2nd century BC – 5th century AD) situated a bit further to the east. The olive trees are situated on the middle-southern slope of the plateau. The olive grove consists of ca. 34-40 irregularly spaced trees scattered over an arable field of ca. 5 ha, each more than 300 years old. According to Pierino, each tree may yield between 20 and 30 kg of olives annually; i.e. between 4 and 6 litres of oil. In bad years, this can be 5 kg (1 l), but in exceptionally good years 50 kg (10 l). On average, he considers a yield between 20 and 25 kg of olives/tree to be normal. These figures imply a total annual potential yield between 200 and 2,000 kg (40-400 l); or an average yield between 800 and 1,000 kg (160-200 l) for the entire plot. Accordingly, yields per hectare range between 40 and 400 kg (8-80 l), or 160-200 kg (32-40 l) averagely. According to Monachesi, the amount of oil represents between 15 and 20% of the original volume of olives.

Giuseppe Stocchi (2)

On a plot, equally situated on the southern slope of the Colle Burchio plateau, a bit further to the east than Monachesi's plot, approximately 2.3 km from the sea, farmer Giuseppe

[86] For a full list of ancient olive varieties mentioned by the ancient authors, see *Appendix* V.

Stocchi also cultivated olives and grapes for subsistence purposes. The olives are processed by a local oil factory. His plot extends over a large part of the middle and the lower slope in southern direction and partially covers the aforementioned Roman rural settlement. The relatively large olive grove is located towards the lower southern slope of the flank and extends over an area of 1.5-2 ha, housing some 400 trees. According to Stocchi, his olive grove annually yields an average of 70 quintals of olives (7,000 kg), or between 7 and 8 quintals of oil (700-800 l) (ca. 12%). These figures imply an individual yield of ca. 17.5 kg/tree, or 2.5 l/tree.

Balduino and Ivano Apis (Casa Apis) (3)

The Apis family has a long tradition of viticulture and oleoculture and Ivano Apis still owns and cultivates a vineyard and an olive grove. Balduino Apis, however, recently ceased his wine production. Their lands are located in the valley bottom section immediately to the right of the Potenza river, somewhat further inland than the previous sites, approximately 4 km from the coast. Their property is situated on a slightly elevated piece of terrain and is protected by an artificial dam along the Potenza river. The remains of a Roman rural settlement (2nd century BC-5th century AD), a farm or a small villa, have been found on their lands. The olive groves are situated on flat land in the valley bottom section to the right of the Potenza river. The olives are processed by a local oil factory. The olive grove consists of ca. 50 trees and yields between 10 and 19 quintals of olives annually (1,000-1,900 kg). The average lies between 12 and 13 quintals (1,200-1,300 kg). Each quintal (100 kg) produces ca. 15 l of oil (15%). This implies an annual production between 150 and 285 l of oil, which translates in an annual singular tree yield between 20 and 38 kg, or 3-5.6 litres.

Treia monastery, site of the Roman town of Trea (4)

The gardener of the monastery, Giancarlo Cingolani, informs me about the small olive grove of the monastery, consisting of ca. 40-42 trees that are ca. 20-25 years old. Each tree yields between 20 and 25 kg of olives annually. In bad years, this can be 15 kg or less. The variety grown is Leccino. Concerning the ratio olives/oil, 100 kg of olives yield about 10/11 kg of oil (10-11%). The soil on which the olive grove is situated drains well, even after days of heavy rain, and the terrain is relatively flat. The olive grove is distrusted along the two sides of the garden and one side clearly has more bad olives than the other side, caused by the lesser protection against the cold northern wind that affects the trees.

Silvano Parenti (5)

In the same area, local farmer Silvano Parenti has an olive grove of ca. 80 to 85 trees on a plot of 4.5 ha. The olive grove is located on loose soils, because – as Silvano remarks – olive trees do not grow well on clayey soils. Most trees are ca. 50 years old, but some are

more than 100 years old. He mainly grows the varieties Leccino and Sargano. He has an average yield of ca. 30 kg of olives per tree, or 5 l of oil. Olive yields, however, may vary between as less as 10 kg and as much as 90 kg. The earlier he harvests his olives, the more water they contain. For instance, if he harvest in November, the ratio oil/olives is ca. 12/13 kg of oil per quintal of olives; if he harvests in December, the ratio is 16/17 kg of oil per quintal. The harvest period always falls in November-December, but occasionally it extends into January and sometimes even February.

Ferdinando Scarre (6) (7)

Ferdinando has an olive grove of 18 trees that give a total of seven quintals of olives each year. The trees are between 20 and 30 years old; some younger, other 40 years old. In general, 100 kg of olives yield about 19 kg of oil; a small amount according to Ferdinando. The varieties grown are Leccino and Morcia. The harvest usually occurs at the beginning of November. Another farmer in the immediate vicinity of the Roman townsite of Trea has an olive grove of 30 trees that yield a total of five quintals of olives (could vary between 3 and 7 quintals). The trees are ca. 30 years old and the ratio is approximately 12 kg of oil for one quintal (100 kg) of olives. The varieties are Frantoio and Leccino. The soil is rather clayey.

Andino Piccini (8)

Andino Piccini owns a small olive grove of ca. 50 trees that are about 15 years old. The planting distance between the trees is 5x5m. The terrain is relatively flat and the soil is rather of the loose type. The olive variety is Leccino. He retains about 30 kg of olives from each tree; one quintal of olives yields ca. 15/16 kg of oil. Andino informs me that the earlier he harvests, the less oil and the more water there is in the olives. Also, he says, oleoculture is not so popular in the Marche region because of the climate, which is rather cold during the winter. In general, yields are not very spectacular and olives are only occasionally grown on a large scale.

Primo Schiavoni and Maria Feccia (9)

Primo Schiavoni has a small olive grove of ca. 83 trees that are between 9 and 10 years old. A few trees are almost 20 years old. He generally has a yield of about 8 to 10 kg of olives/tree. The varieties grown are Leccino, Raggiola and Pendolino. The distance between the olive trees is 5x5m. The ratio oil/olives is approximately 14 kg of oil per quintal of olives. Part of the olive grove is situated on clayey soil; another part on sandy soil, which only yields better when it rains. In general, the section of the olive grove on clayey soil yields more. Maria Feccia has a small olive grove consisting of ca. 45 trees, in part dispersed between her vines, and in part situated on a separate piece of land. She usually has some 2.8 quintals of olives; i.e. ca. 6 kg per tree.

Americo Vittorini (10)

Americo has an olive grove of 40 trees that gives between five and six quintals of olives on average (ca. 12.5-15 kg per tree). The trees are between 16 and 20 years old. The variety grown is Leccino. The soil is sandy. The olive harvest occurs around mid-November.

Table 68 Some data on modern small-scale oleoculture in the Marche region (information collected by the author).

Ex.	Plantation	Spacing (m)	Plot size (ha)	Nr. trees/ha	Tree yield		Yield/ha	
					Kg	L	Kg	L
1	Extensive	Irregular	5	34-40	20-30	4-6	680-1,200	136-240
2	Intensive	\	2	400	17.5	2.5	7,000	700-800
3	Extensive	\	\		20-38	3-5.6	\	\
4	Extensive	\	\	\	20-25	2-2.5	\	\
5	Mixed	\	4-5	80-85	10-30	1.5-4.5	800-2,550	120-382
6	Mixed	\	\	\	38	7.4	\	\
7	Mixed	\	\	\	10-23	1.2-2.8	\	\
8	Intensive	5x5	\	\	30	4.5 l	\	\
9	Intensive	5x5			8-10	1.1-1.4	\	\
10	\	\	\	\	12.5-15	\	\	\
11	Extensive	5x8-9	\	\	\	\	\	\
12	Intensive	3x4	\	\	\	\	\	\
13	Intensive	5x4.5-5	\	\	\	\	\	\

Additional data (11) (12) (13)

On the southern slope of the Colle Burchio, an olive grove mixed with cereals was attested. The distance between the trees was ca. 5 m; the distance between the rows between 8 and 9 m. Another olive grove, located on the lower northern slope of the plateau, had overall distances of 3-4m. In the vicinity of the Casa Apis site, another olive grove was attested with tree spacings of ca. 5m and row spacings of 4.5-5m.

To conclude, it seems that in the Marche region the spacing between olive trees generally lies around 3 to 5m, while the spacing between the rows depends on the

agricultural strategy applied: 4-5m in the case of intensive cultivation, 8-9m in the case of extensive mixed culture. This translates into ca. 30-80 trees per ha in mixed/extensive plantations and up to a maximum of 400 trees in intensive plantations. Individual oil yields per tree can vary between 10 and 40 kg (1.1-7.4 litres), but mostly range around 20 kg (3-4 litres). As such, total oil yields can reach 700-800 l/ha for very intensive olive groves (400 trees/ha), but fall between 100 and 400 l for more mixed and extensive plantations (*Table* 68).

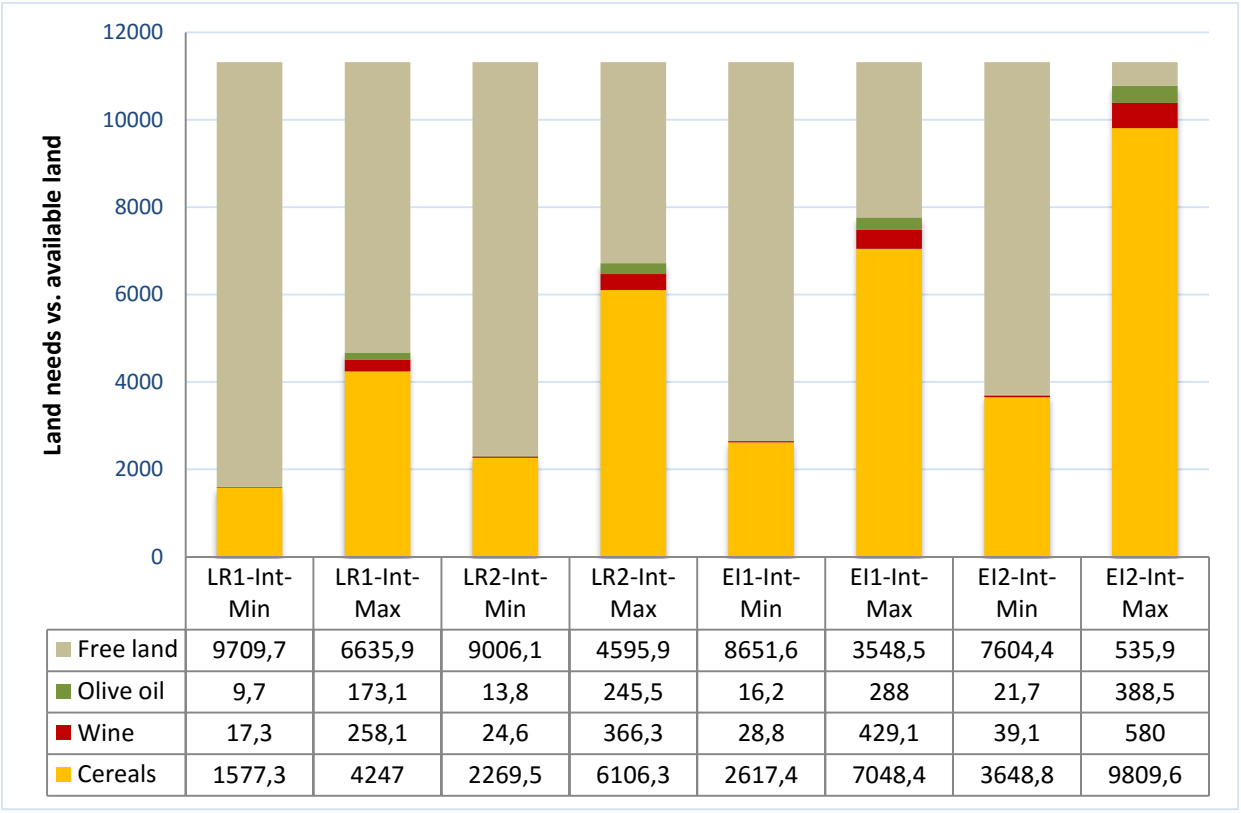
These data actually bode well with Columella's density of 30 trees/ha for extensive plantations. Incidentally, this is also the density mentioned for mixed plantations in the territory of Fermo towards the end of the 19th century (see *supra*), which in this case we may consider the minimum occupation of a mixed olive grove in our land requirement model. This is also the density mentioned for extensive plantations in the territory of Fermo towards the end of the 19th century (see *supra*). A relevant maximum density may be 80 trees/ha. For intensive plantations, a useful low density of 120 trees may be used, as this is the lowest density attested in the ancient sources for intensive plantations in Italy. Based on both ancient and modern evidence for the area a good higher density may be 400 trees/ha. With regard to individual tree yields, a range of 10-30 kg/tree is applied. Yields of 5 and 50 kg respectively may be considered extreme lows and highs that were only attainable under exceptional circumstances. Based on ancient and comparative evidence, it does not seem unreasonable to assume that Roman presses were capable of producing 20-25 kg of oil from 100 kg of olives (20-25%).[87] With a return of 25% oil/fruit after pressing and decanting then, individual tree yields ranged between 2-2.5 and 6-7.5 litres. Extreme lows and highs were 1-1.25 and 10-12.5 litres. Of course, as with viticulture, lower and higher yields may have occurred, especially in unproductive or record years, but such figures would add little to a model outlining representative olive yields for the area over a longer period of time.

5.3 Setting-up a land requirement model for central Adriatic Italy and pinpointing potential moments of land pressure

In short, what the above essay on potential land yields in the central Adriatic area of Italy has learned us is that in Roman times one hectare of agricultural land could probably either yield between 345 and 475 kg of wheat, or between 23.1-46.2 and 128.1-170.7

[87] Dar/Applebaum 1986, 183-185; Creswell 1965; Mattingly 1988c; 1993, 484; Brun 2003, 142-144.

hectolitres of wine, or 3 to 33 hectolitres of olive oil within an intensive cultivation regime and considered over a longer period of time. Based on mixed regimes in which cereals were intercultivated with trees/vines, one hectare potentially yielded 315-445 kg of wheat, 1.5-12.5 hectolitres of wine or 0.8-6 hectolitres of olive oil (*Appendix* IV, *Table* 109).[88] The implications of all these calculations for the required number of hectares devoted to the production of the three main food products within intensive regimes for urban and rural consumption between ca. 200 BC and AD 150-200 are visualised in the table below (*Table* 69).



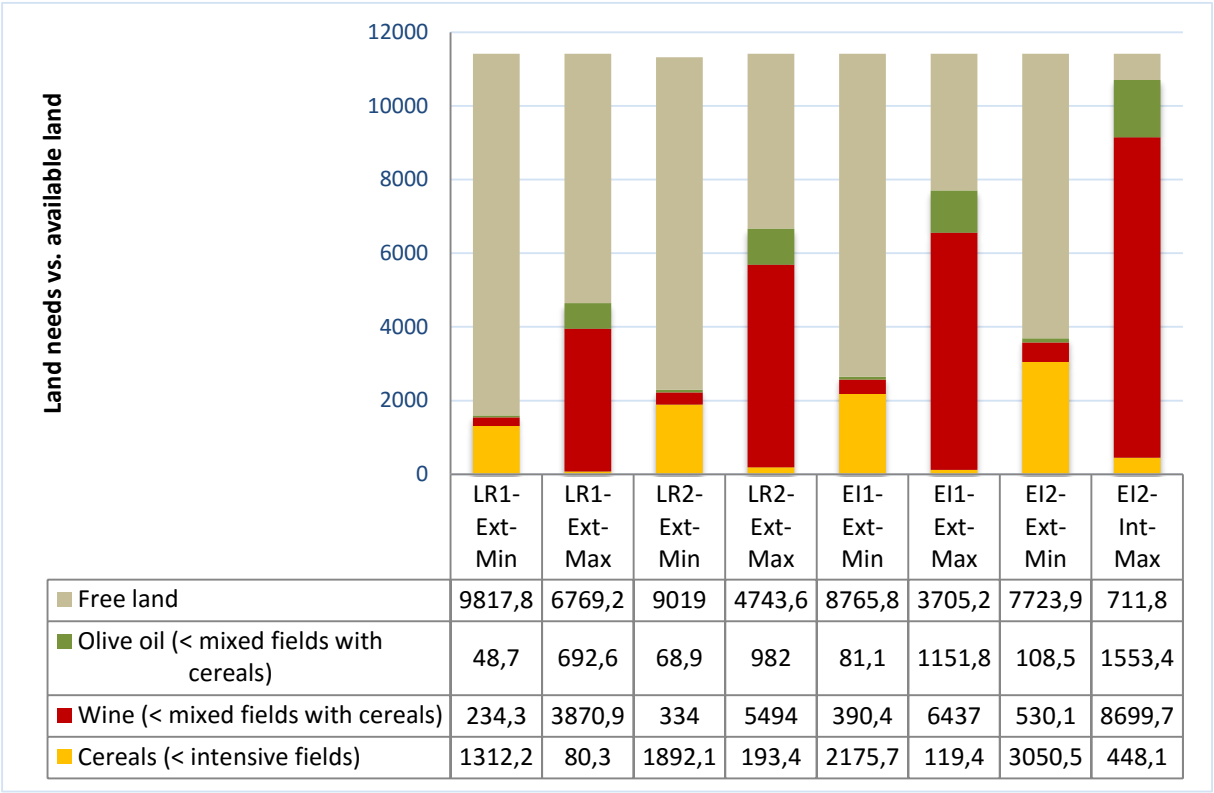
	LR1-Int-Min	LR1-Int-Max	LR2-Int-Min	LR2-Int-Max	EI1-Int-Min	EI1-Int-Max	EI2-Int-Min	EI2-Int-Max
Free land	9709,7	6635,9	9006,1	4595,9	8651,6	3548,5	7604,4	535,9
Olive oil	9,7	173,1	13,8	245,5	16,2	288	21,7	388,5
Wine	17,3	258,1	24,6	366,3	28,8	429,1	39,1	580
Cereals	1577,3	4247	2269,5	6106,3	2617,4	7048,4	3648,8	9809,6

Table 69 Minimum (Min) and maximum (Max) estimated land needs for the study area in the Late Republican (LR1+LR2) and the Early/High Imperial period (EI1+EI2) based on intensive cultivation regimes (values are expressed in km²).

What is represented are the absolute minimum and maximum requirements for each time period considered; i.e. the Late Republican (LR) era and the Early/High Imperial (EI) era. The lowest surface area hereby represents the requirements based on the lowest population figure combined with the lowest consumption figure combined with the highest yield/ha figures (*LR1-Int-Min*); the highest surface area is the result of the highest population figure in combination with the highest consumption figure and the lowest

[88] As it remains unclear how much cereal yields exactly would have suffered in terms of quantity when put into a mixed regime with trees, I have here opted for the gross yield figures identical to those of the intensive regime, but adapted to higher sowing rates and thus equal to slightly lower net yields (see *supra*).

yield/ha figures (*EI2-Int-Max*). For instance, with regard to the Late Republican period, some 1,577.3 km² of cereal land, 17.3 km² of vine land and 9.7 km² of olive land was required for a total population of 491,049 people (LR1) with minimum food requirements and maximum land productivity (*Int-Min*). Then again, for the same number of people, some 4,247 km² of cereal land, 258.1 km² of vine land and 173.1 km² of olive land was required when considering maximum food needs and minimum land productivity (*LR1-Int-Max*). As such, this left between 9,709.7 and 6,635.9 km² of land available for other purposes; i.e. 59-86% of all land in the study area (11,413 km²) (*Appendix* IV, *Table* 113). The same calculations were consequently made for the other population figures: 704,995 (LR2), 815,139 (EI1) and 1,130,742 (EI2).[89] The details of all these calculations may be found in *Appendix* IV, *Tables* 110-112.



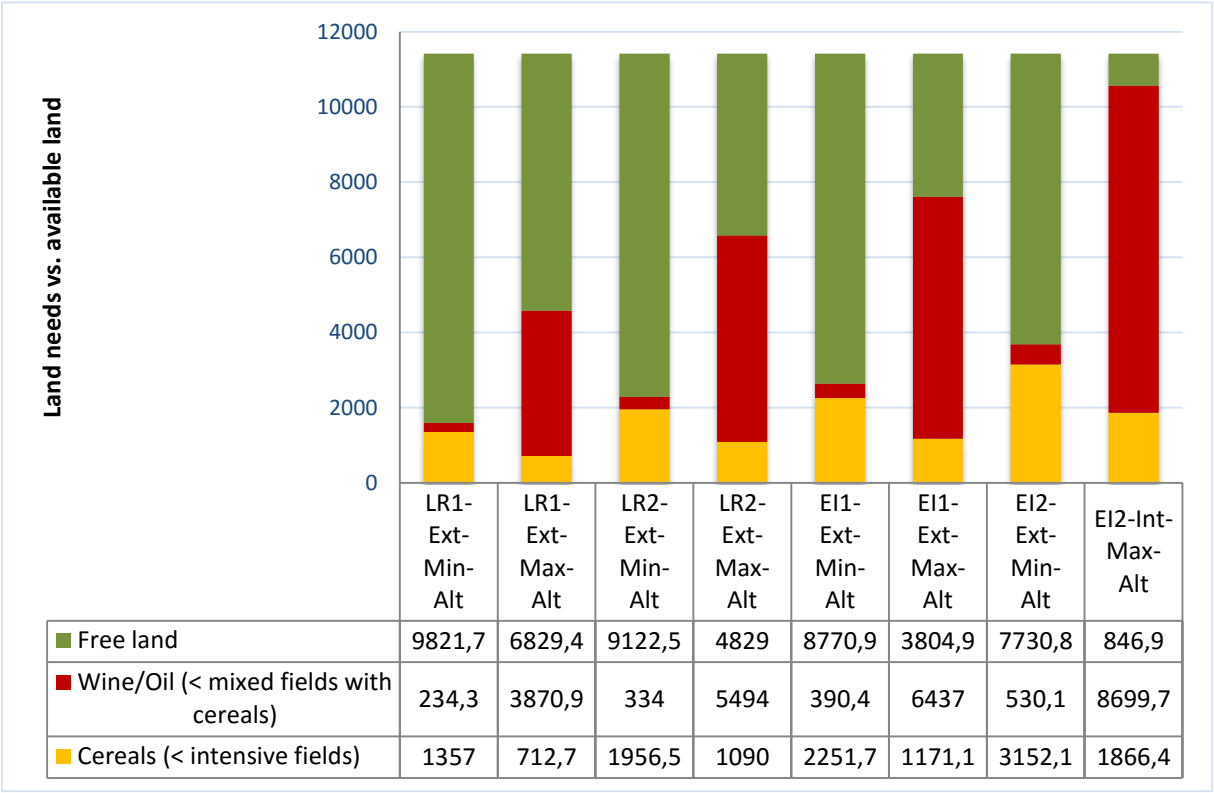
	LR1-Ext-Min	LR1-Ext-Max	LR2-Ext-Min	LR2-Ext-Max	EI1-Ext-Min	EI1-Ext-Max	EI2-Ext-Min	EI2-Int-Max
Free land	9817,8	6769,2	9019	4743,6	8765,8	3705,2	7723,9	711,8
Olive oil (< mixed fields with cereals)	48,7	692,6	68,9	982	81,1	1151,8	108,5	1553,4
Wine (< mixed fields with cereals)	234,3	3870,9	334	5494	390,4	6437	530,1	8699,7
Cereals (< intensive fields)	1312,2	80,3	1892,1	193,4	2175,7	119,4	3050,5	448,1

Table 70 Minimum (Min) and maximum (Max) estimated land needs for the study area in the Late Republican (LR1+LR2) and the Early/High Imperial period (EI1+EI2) based on mixed cultivation regimes of vine-trees and olive trees with cereals (values are expressed in km²).

The general trends, however, are immediately obvious. First, in all periods, wheat production required by far the largest amount of agricultural land, followed by the production of grapes and then olives. Second, unsurprisingly, as overall lands needs increased over time, the amount of land free from crops decreased. With the highest

[89] For details, see Chapter 4.

population figure used for Late Republican times (704,995), for instance, and based on maximum food requirements and minimum land productivity, some 4,595.9 km² of extra land remained available; i.e. 41% of all land in the study area. With the same conditions applied to the highest population figure for Early/High Imperial times (1,130,742), however, only some 535.9 km² of land remained free; i.e. a mere 5% (*Table* 69; *Appendix* IV, *Table* 113).



	LR1-Ext-Min-Alt	LR1-Ext-Max-Alt	LR2-Ext-Min-Alt	LR2-Ext-Max-Alt	EI1-Ext-Min-Alt	EI1-Ext-Max-Alt	EI2-Ext-Min-Alt	EI2-Int-Max-Alt
Free land	9821,7	6829,4	9122,5	4829	8770,9	3804,9	7730,8	846,9
Wine/Oil (< mixed fields with cereals)	234,3	3870,9	334	5494	390,4	6437	530,1	8699,7
Cereals (< intensive fields)	1357	712,7	1956,5	1090	2251,7	1171,1	3152,1	1866,4

Table 71 Minimum (Min) and maximum (Max) estimated land needs for the study area in the Late Republican (LR1+LR2) and the Early/High Imperial period (EI1+EI2) based on mixed cultivation regimes of vine-trees and olive trees with cereals (values are expressed in km²).

A largely similar picture appears when considering mixed regimes with vine-trees and olive trees intercultivated with cereals. Two notable differences are the lesser need of intensive cereal fields – especially with regard to the higher land requirements figures – and the overall slightly higher land availability, in particular from the 'LR2-Ext-Max' figures onwards, when some 100-175 km² of extra land becomes available when compared to the intensive regime model; i.e. some ca. 1-2% of extra land (*Table* 70; *Appendix* IV, *Table* 113). Some little bit more could be gained when olives trees were used for the training of the vines, as such combining the yields of vines and olives on the same mixed cereal plots (*Table* 71). Indeed, when cultivated in this way, extra land becomes available especially when considering the higher population and consumption levels in combination with the lower production figures (*Ext-Max-Alt*). The gain is the most pronounced in the *EI2-Ext-Max* column, where the amount of free land is some 300 km² higher than with the

intensive cultivation regime (ca. + 3%), and some 135 km² higher than with the mixed cultivation regimes of separate vine-trees and olive trees (ca. + 2%) (*Table* 71).

Admittedly, this is a largely theoretical exercise and the informed range of land requirements cannot be considered to straightforwardly represent actual land needs. We cannot be sure whether people actually consumed enough calories to maintain a healthy and energy-adequate diet. On top of it, not all land within the study area will have been used for the production of the three crops here considered. but was rather used for other purposes, like garden plots or pasture land, while the area will also have comprised woodlands and zones unsuitable for agricultural use. What they do allow, however, is to pinpoint moments in time when population/land pressure is likely to have played a more prominent role than in other periods; i.e. when said phenomena may have influenced the use and availability of agricultural land, limited the amount of land available for export-oriented production, and thus in particular when a rise in cereal land requirements affected the amount – and the kind – of land available for wine (and oil) production. From this perspective, the answer obviously lies in the Early/High Imperial period, when theoretical land needs were the highest and thus overall land pressure was greater than in the Late Republican period (*Tables* 69-71). As such, export possibilities for wine (and oil) were also smaller in the former period than in the latter one. The model also shows how the use of mixed cultivation regimes was not that relevant during moments of lower population/land pressure, but became advantageous when faced with higher population/land pressure; i.e. in particular from the beginning of the Imperial period onwards (*Tables* 71; 72). This is not to say that all fields will have been converted to mixed plantations – a dominant agricultural practice is never the only agricultural practice – but in certain areas it may have been a solution in order to cope with a growing population, while at the same time maintaining the possibility to export some of the wine (and oil) surpluses.

Outlined as such, the model further complements the patterns constructed for the amphora and press evidence in the first two chapters. Indeed, the moments of lower land pressure coincide with the circulation of the Greco-Italic and the Lamboglia 2; the periods of higher land pressure are concurrent with the diffusion of the Dressel 6A, the Dressel 2-4 and the flat-bottomed amphorae. The contrast with the press evidence is less pronounced, as the latter increases and remains steady in concordance with most of the land pressure curves, only to decrease slightly towards the higher theoretical land values (*Table* 72). These comparisons then seemingly confirm the idea that the period of maximum involvement of the central Adriatic area in the extra-regional wine market went along with a period of lower internal consumption pressure in the region; a situation that changed from the Early Imperial time onwards, when wine exports decreased and some development of the extra-regional oil business might have occurred. The press evidence, on the other hand, further shows that presses were not only erected for extra-regional production, but were also employed for supplying intra-regional markets.

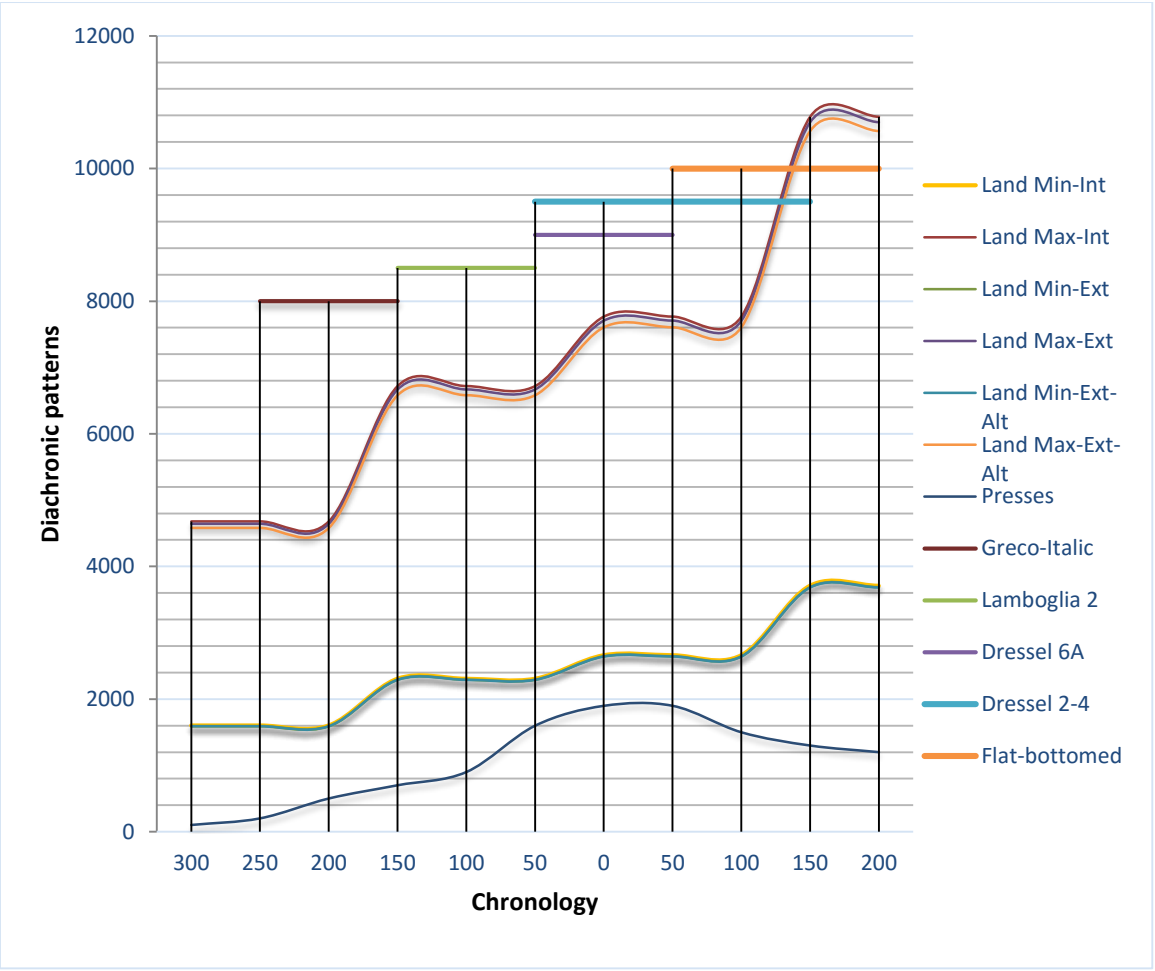


Table 72 Comparison between potential land needs (Land Min=minimum needs; Land Max=maximum needs), press numbers and circulating amphora types between ca. 300 BC and AD 200. Only the land needs reflect actual surfaces areas (expressed in km²); for reasons of presentation, the press numbers have been multiplied with 100, while the amphorae merely reflect their chronological circulation.

5.4 Conclusion

With this chapter, I have tried to model the theoretical productivity of cereal, vine and olive lands in central Adriatic Italy, for which I have mainly used ancient and comparative data from the Marche region and wider central and northern Italy. The results presented in the final section are the culmination of a reconstruction that started in chapter 3 with the reconstruction of the urban population. The main purpose of this reconstruction was to provide a framework for assessing the potential impact of intra-regional consumption (and thus land needs) on the wine and oil business over time, and thus to see to which extent some of our amphora and press patterns could be linked to internal developments in the area. The main points to remember from this exercise are five:

- If land pressure ever occurred in the central Adriatic area, than the Early/High Imperial period would be the most likely candidate timewise.
- If cereal land needs in particular ever limited the amount of land available for viticulture and oleoculture, than this would most likely have been the case in the Early/High Imperial period.
- One solution for the desire of combining higher internal land needs with the possibility of producing wine (and oil) for the market was the introduction of mixed regimes.
- The Early/High Imperial period marks a decreasing participation of the central Adriatic area in the extra-regional wine business, as reflected in the amphora evidence. It is also the period of minimal involvement in the international oil trade.
- Contrary to the former evidence, the remains of wine and oil presses attest the continuing production of these two liquids in the area on a substantial scale.

Reflecting on the potential nature and the impact of these evolutions on the viticultural and oleocultural sector of the area will be the subject of the concluding epilogue to this thesis.

Epilogue
Connecting the dots: population growth and agrarian change

The role of demography in interpreting archaeological patterns

The link between demography and agriculture in economies preceding the industrialisation era is a widely acknowledged feature of historical studies focusing on 13th-19th century Europe.[1] But despite Bruce W. Frier's almost desperate call for the deeper integration of population issues in Roman scholarship, a recent contribution by Neville Morley could do little more but to address the general lack thereof in socio-economic studies on classical antiquity.[2] However, the work of Walter Scheidel is a good reminder of how such constraints necessarily must have cast their shadow on the agro-economic developments in many parts of the Roman Empire.[3]

Thus, the model built over the course of the previous five chapters was set-up from this point of view; i.e. with the intention of creating an interpretative framework for evaluating the possible impact of local demographic conditions on the evolution of the wine and oil business in central Adriatic Italy between Late Republican and Early/High Imperial times. The main question was hereby whether regional demographic developments had anything to do with the diminishing exports of wine in amphorae from the Augustan period onwards, as well with the minimal involvement of the area in the Mediterranean oil trade in both Late Republican and Early/High Imperial times. This model was essentially constructed through an in-depth reading of the archaeological

[1] Grigg 1980.
[2] Frier 2001; Morley 2011.
[3] Scheidel 2001; 2008.

evidence regarding wine/oil production and transport; and by positioning the changes in this evidence against a theoretical population/land model inspired by the archaeological record.

Although the proposed link between the wide range of treated data has been briefly hinted at in the concluding sections of each chapter, it is probably useful to briefly recapitulate the main points and trends that have been highlighted throughout this exercise:

1. On condition that the calculations put forward in chapters 3, 4 and 5 with regard to population dynamics, food intakes and agricultural productivity have provided us with a useful scale with which to explore the possible effects of lower and higher population levels on the wine and oil trade in central Adriatic Italy, it would seem that the conditions for the prosperity of the latter were more favourable in the Late Republican period than in the Early/High Imperial one. Indeed, in whatever way you choose to read those calculations, there is a high degree of probability that between 40 and 85% of all land in the study area – i.e. all aggregate land and not actual agricultural land – was not needed for local food requirements in the former period. On the other hand, if local land requirements – and in particular local cereal-land requirements –rose as significantly as has been implied, and if this increase was mainly met by local production, the effects would have been as such that the amount of land available for export-oriented wine and oil production was reduced until 67 to 5% of the total territory when population- and consumption levels both reached their theoretical peak in the High Imperial period (*Appendix* IV, *Table* 113).[4]
2. In other words, in the first case, Roman farmers found themselves in a very favourable position with ample space for expanding and intensifying vine plantations in the wider Adriatic coastal area by selecting good viticultural lands from which maximum profits could be obtained. As such, these circumstances would have allowed for the area to participate to the full in the wider phenomenon of extra-regional wine commerce in the Late Republican period. It is this on-going intensification and expansion process that we see so well reflected in the amphora evidence discussed in the first chapter. In the second case, however, matters were rather different, with population pressure in town and country rendering it unlikely that in the 1st and 2nd century AD large amounts of local wine and oil could be exported on an annual basis towards external markets. This is not to say that such developments would have actually stopped the existing commercial wine and oil trade, but under such

[4] Based on intensive regimes with the lowest yield figure per hectare (EI2-Int-Max), see *supra* , Chapter 5).

circumstances the scale of this trade was bound to be much more modest, with a major portion of the surpluses being traded towards the towns in the region.

3. Taking into account some of the patterns that have been examined in chapters 1 and 2, such a process would actually bode well with an increasing co-existence of amphorae and barrels – with the latter eventually becoming the only carriers for wine (and oil?) in the central Adriatic area – and with the main chronological trends individuated in the press evidence, i.e. continuing wine and oil production on a substantial scale in the 1st-2nd century AD. Indeed, the 1st century AD numeral peak in the latter evidence – and the only minimal decrease in numbers in the following century – seemingly portends the ongoing vitality of a business, whose manufacturing process became more visible in the archaeological record than its distribution modii because of a major shift in market focus. This seems especially the case for olive oil production and containerization. In fact, while the available amphora evidence indicates minimal involvement of the study area in the overseas oil trade in the first two centuries of the Common Era – and even less so in the preceding centuries – about half of the product-identified presses in the area turned out to have been producing olive oil in the first place. Once again, if we take the theoretical oil needs by the urban population – in particular those proposed for the Early/High Imperial period, which could have been as high as two million litres (see *supra*, Chapter 4) – as a major incentive for their existence, much of this oil probably circulated in perishable skin containers, and not in amphorae.
4. The model also stresses how we should be open to interpreting the evolution of commercial viticulture and oleoculture in the area not as an isolated phenomenon, but rather as part of a much wider agrarian system, whose evolution was determined by local events in general, and by its capacity to sustain the local population in particular, especially with regard to cereal requirements.

In point of fact, the centrality of cereals in this story cannot be denied, as the effects of population growth would have been the most pronounced in associated cereal-land needs. This facet is most clear when visualising the demand according to theoretical intensive monocultural regimes, in which cereals steadily occupy between 90 and 98% of all required land in all scenarios considered, but the pattern roughly remains the same across mixed regimes; i.e. that cereals always occupy most of the land cultivated in combination with vines and/or olive trees (see *supra*, Chapter 5, *Tables* 69-71). In practice then, a growing population would have rendered in the first place the best cereal lands – i.e. alluvial plains and valley bottoms – increasingly scarce, and as such would have forced the expansion of cereal culture into the lower and higher hills in the area. Actually, we can see how this would have quickly become a problem in the Marche region, where

(alluvial) plains – i.e. coastal and internal combined – account for no more than 15% of the total territory, with the remaining 85% occupied by lower or higher hills and mountains (*Table* 73).

Table 73 Landscape zones and their respective proportions in the Marche region.

Landscape zone	Surface area (km²)	Share (%)
High mountains	2,350	24.16
Medium High Hills	2,817.25	28.96
Internal Plains	419.44	4.31
Low Hills	3,069.37	31.56
Coastal Alluvial Plains	587.74	6.05
Internal Alluvial Plains	482.81	4.97
TOTAL	9,727.17	100

In terms of actual surface areas, the issue is well-illustrated by a quick comparison of the sizes of some of the coastal plains – i.e. the areas most suitable for cereal growing – with the theoretical cereal-land requirements of the coastal/lower valley colonies in town and country over time. Together, these territories cover an area of 1,645 km²; the coastal plains on their territories amount to an aggregate 341 km² (*Figure* 233).[5] When taking into account both town and country dwellers in these areas, the combined cereal-land requirements were between ca. 238 and 914 km² with the *LR1-* and *LR2-Int* scenarios. With the *EI1-* and *EI2-Int* scenarios, however, they were between ca. 366 and 1,466 km².[6] This means that with the latter two models, not only would a larger portion of these town's territories have been required for satisfying the local cereal needs – i.e. between ca. 22 and 89% against 14 to 55% with the former two scenarios – but there is also a larger chance that the best cereal lands would have been intensively cultivated, meaning that they became increasingly scarce – or even no longer available – and upland areas would have needed to be included in order to respond to local needs. As the other coastal plains

[5] The theoretical territories of the these towns were calculated in Quantum GIS through the function 'Voronoi polygons'. The 'Voronoi' function is essentially the same as the 'Thiessen' function in ArcGIS, in the sense that it creates boundaries around a set of points in the landscape – in this case the central Adriatic towns within the Marche region and northern Abruzzo – as such dividing the latter into regions based on distance to points. Admittedly, this is a very theoretical and straightfowards subdivision that does not take into account parameters such as the size of the town (larger towns may have had larger territories and vice versa) and the nature of the surrounding landscape, but it suffices for the purposes of this exercise; i.e. to get an idea about the demographic pressure – and the urban and rural consumption burden – in the central Adriatic coastal territories over time.

[6] The surface areas with regard to cereal-land requirements are here calculated using the population, consumption and yield figures (intensive regimes only) from chapters 3 to 5.

along the central Adriatic shore all have comparable sizes between 20 and 95 km², the problem would have posed itself along the entire coast in the 1st-2nd century AD (*Table* 74).

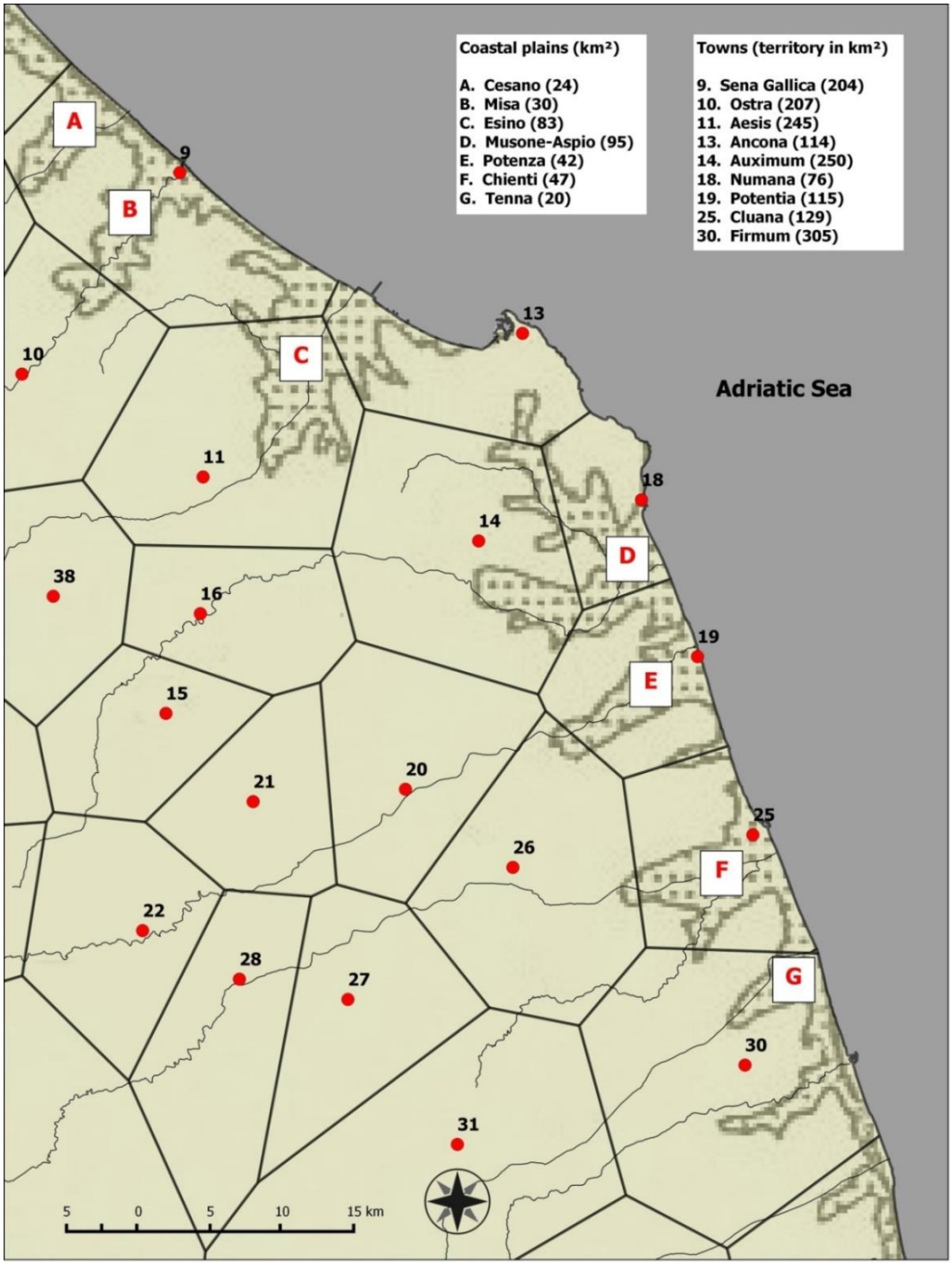


Figure 233 Some town territories in the lower valley areas with indication of the size of the coastal plain.

In practice, such an evolution must have made it impossible to maintain the intensive viticultural (and oleocultural) practices in use – especially in the lower transects of the valleys where wine was being produced for the extra-regional market – as it will have forced the expansion of cereal culture onto the lower and higher hills that sloped towards the sea; i.e. the lands most suitable for specialised and intensified viticulture (and

oleoculture). One can imagine then how a process of demographic growth in the area might have affected the way in which viticultural land (and oleocultural for that matter) was organised. As has been touched upon at the end of Chapter 5, one way to possibly cope with such a situation was to promote a widespread use of mixed regimes with vines and olive trees intercultivated with cereals on the same fields, in this way gaining space and maximizing combined output. A system that the Romans applied in particular for such purposes was the *arbustum* – or the *alberata/folignat*a as it was called in later times (see *supra*, Chapter 5) – and it is on this cultivation regime in particular that I would like to elaborate a bit more in the next section of this epilogue.

Table 74 Surface areas of the main coastal plains along the central Adriatic coast within the study area.

River	Coastal plain (km²)
Foglia	50
Metauro	68
Cesano	24
Misa	30
Esino	83
Musone	95
Potenza	42
Chienti	47
Tenna	20
Tronto	42
Tordino	20
Vomano	26

The practicality of the *arbustum* in central Adriatic Italy

As we have seen in Chapter 5, the viticultural accounts given by Columella and Pliny make it perfectly clear that *vinea* and *arbustum* coexisted with each other in Imperial Italy. One obvious difference between the two that has been highlighted throughout said chapter is yield. Indeed, both my calculations and comparative evidence for the Marche region in the 19th century indicate that vine plantations organised in the form of an *arbustum*/alberata yielded about 1/10 the amount of wine usually obtained from a proper vineyard (see *supra*, Chapter 5). This does not mean, however, that *arbustum* did not have

a place in commercial farming.[7] The Saserna brothers – despite their apparent reluctance for applying the cultivation technique – are quoted by Columella for their guidelines concerning the labour costs of an *arbustum* of 200 *iugera* (*Rust.* 2.7.7) and the system was highly approved by the agricultural writer Gnaeus Tremellius Scrofa (Col. *Rust.* 3.3.2; Plin., *HN* 17.35.199). Varro – quoting the same Scrofa – discusses the practice of arranging the trees within an *arbustum* according to so-called 'quincunxes, a regular triangular mode of planting trees that especially allowed for obtaining higher and better wine and cereal yields:

> "Scrofa continued: "With regard to the conformation due to cultivation, I maintain that the more regard is had for appearances the greater will be the profits: as, for instance, if those who have arbusta plant them in quincunxes, with regular rows and at moderate intervals. Thus our ancestors, on the same amount of land but not so well laid out, made less wine and grain than we do, and of a poorer quality; for plants which are placed exactly where each should be take up less ground and screen each other less from the sun, the moon and the air.""[8]
>
> (Varro, *Rust.* 1.7.2)

The method is also mentioned by Cicero (*Sen.* 59.14) and by Pliny, who stresses the air-passing advantages and the pleasant sight of the system:

> "In spacing out trees and plantations and planning vineyards the diagonal arrangement of rows is commonly adopted and is essential, begin not only advantageous in allowing the passage of air, but also agreeable in appearance, as in whatever direction you look at the plantation a row of trees stretches out in a straight line."
>
> (Pliny, *HN* 17.15.78).

This sort of arrangement was actually quite common during the 19th and 20th century in the Marche and Umbria in the denser alberata plantations.[9] Its application in Roman times is significant, as it provides a clear indication that yield and quality were issues with which some of the Italian farmers practising the *arbustum* were concerned, and thus that some commercial motives were behind their concerns. In fact, the mentioning by Varro of arranging the trees within a plantation more systematically must explicitly be seen as a measure for increasing the yields by planting more trees on the same field. Other ways in which an *arbustum* plantation could be potentially 'intensified' was by training more

[7] The matter is briefly touched upon by Tchernia 1986, 114.

[8] In the translation by W.D. Hooper and H.B. Ash – which has been used in this thesis for all passages from the texts of Cato and Varro – '*arbustum*' is translated as orchard, which could be considered the more general translation of the term, but the text makes it perfectly clear that specific reference is made here to this particular type of vine plantation.

[9] Desplanques 1959, 37.

vines on a single tree, or simply by using higher trees; with both techniques resulting in higher yields per tree. Especially revealing to this regard is a passage by Pliny, wherein the author recalls the great heights of the poplar trees in *Campania* and the associated dangers which made vine vintagers include the costs of a funeral and a grave in their contract (*HN* 14.2.10); a matter well-imaginable when seeing contemporary specimens (*Figure* 234). In short, what the literary evidence seems to suggest is that from Varro's time onwards (mid-1st century BC) farmers had begun to perfect the *arbustum* and that is must have reached its most organised form in the course of the 1st century AD.[10]



Figure 234 Contemporary poplar tree-wedded plantation in Campania (After Di Gennaro 2013, 449, Fig. 20.7).

Still, no one could deny that in the end vineyards (*vinea*) were far more profitable than tree-wedded plantations, meaning that for the latter cultivation system to be commercially attractive, it needed to have other raisons d'être too. One such reason was that *arbustum*/alberata fields compensated their lesser profits with lower labour costs than those of vineyards, and with the advantage of supplementary crops.[11] Indeed, one of the benefits of the tree-wedded vine – or the "*vite maritata*" as it is called in Italian – was

[10] At least based on the detailed accounts provided by Pliny and Columella , who both elaborate on planting instructions, the most suitable grape varieties and the preferred types of trees for supporting vines, see *supra*, Chapter 5).

[11] Duncan-Jones 1982, 39, 59.

that it allowed for the vines to profit from a fertile soil that had already been prepared for cereal culture and where their natural characteristics as a climbing plant could be exploited to the full; meaning that relatively high results could be obtained with minimal investments.[12] Even more important, the cultivation regime also offered farmers the possibility to obtain a wide range of resources from the same piece of land, in the first place cereals and grapes, but also other crops such as fruits, wood and foliage.[13] The use of fruit trees like olive trees and fig trees for supporting the vines is mentioned in the ancient sources and the employment of apple and pear trees is known for later periods.[14] The cultivation of all four species in the area is attested in the Roman literary sources and one can easily imagine how these trees were used for said purpose in central Adriatic Italy in antiquity (see *supra*, Chapter 4). According to Pliny, other kinds of trees – like the elm and the black poplar – were popular for their height and lower density of leaves; characteristics that were beneficial for the development of good quality wines (*HN* 17.25.200).[15] But these trees were also potential sources for wood and foliage – in the latter case especially the Atinian elm and the poplar in Roman times because of their higher foliage density (Pliny, *HN* 17.25.200) – with which farmers could feed their animals.[16] In fact, the mentioning by Pliny of yet another advantage of the *arbustum* – namely the protection of the vines from snooping animals – suggests that the space between the trees was also used as pasture land; a purpose also mentioned in later historical accounts.[17] In short, one aspect that made the *arbustum*/alberata a particularly attractive cultivation system was it being an extremely developed and low-cost variant of polyculture which enabled to combine respectable viticulture (and sometimes oleoculture) with a wide range of agricultural practices.

Of course, the choice between *vinea* and *arbustum* was not only a matter of economical and practical factors. Varro in particular expresses his opinion on this matter and suggests that one of the main raisons for selecting one or the other was in fact soil moisture:

> "In Italy, the people of Reate practice this custom (*i.e. arbustum*). This variation in culture is caused chiefly by the fact that the nature of the soil makes a great

[12] Pliny already mentions the beneficial effects of cultivating cereals and vines on the same ground (*HN* 17.35.203); see further Desplanques 1959; 1975; and Forni 2002a, 140. The alberata as an economical way of vine growing is a recurrent theme in 19th century agricultural/historical treatises, as for instance Filippo Re 1815, I, 188; or Galli 1840, 223; and Berti-Pichat 1851-1870, III, 1529.

[13] Braconi 2004; Vernelli 2008.

[14] For antiquity, see *supra* Chapter 5; for later periods, see Cercone 2008, 34. The olive tree is ranked fifth in Pliny's classification of trees suitable for training vines (*HN* 17.35.200).

[15] See also *supra*, Chapter 5.

[16] Desplanques 1959; 1969; 1975.

[17] Pliny, *HN* 17.35.203; for the 19th century, see Galli 1840, 222-223; and Desplanques 1975.

> difference; where this is naturally humid the vine must be trained higher, because while the wine is forming and ripening it does not need water, as it does in the cup, but sun. And that is the chief reason, I think, that the vines climb up trees."
>
> (Varro, *Rust.* 1.8.6)

Virgil expresses a similar opinion regarding the areas in which vines needed to be trained much higher – preferably with the aid of trees – in his Georgics:

> "But if a soil exhales thin mists and curling vapours, if it drinks in moisture and throws if off again at will, if it always clothes itself in the verdure of its own grass, and harms not the steel with scurf and salt rust, that is the one to wreath your elms in joyous vines..."
>
> (Virgil, *G.* 2.217-221)

The damaging effects of excessive rainfall, fog or high soil humidity on grapes are well-known today. One of the chief problems associated with such environmental conditions is the promotion of fungal diseases which ultimately cause the vine to die.[18] The ancients too were familiar with the issue, as is illustrated by Strabo's account of viticulture in the marshy environments around Ravenna, where vines apparently yielded fruit quickly and in great quantities, but did not live beyond the age of 4-5 years (*Geogr.* 5.1.7).[19] Other than meeting well with the plant's natural climbing tendency, the training of vines high in trees in these areas was thus an excellent solution for protecting the grapes from these harmful environmental circumstances. Indeed, it is no coincidence that most references to the use of *arbustum* concern northern Italy (*Gallia Cisalpina*) – in particular the Po plain (Milan, Novara, Piacenza, Ravenna) and the Veneto/Trento area – and to a lesser extent central (Rieti, *Ager Caecubus* in *Latium*) and southern Italy (Canosa di Puglia, Campania); i.e. mostly in in lower and flatter areas with a high level of humidity and rainy and foggy weather conditions, especially in the bottom valley floors (Plin., *HN* 14.3.34).[20] The attainability of exceptionally high yields in the *Ager Gallicus* – as documented by the ancient agronomists (see *supra*, Chapter 5) – suggests that similar environmental conditions characterised the marshy central Adriatic coastal area in Roman times, and thus that this region too was not unfamiliar with the *arbustum*.[21]

[18] Jackson 2008,

[19] Columella too refers to the marshy grounds near Ravenna (*Rust.* 3.13.8).

[20] Forni 2002a, 140-142. Both Strabo (*Geogr.* 5.3.5) and Martial (*Epigr.* 13.115) express their amazement with regard to the excellent Caecuban wine, which was made from vines that were grown on poplar trees in the marshy coastal grounds of the *Ager Caecubus* in *Latium Adjectum*.

[21] In antiquity, the typically hilly central Adriatic valley landscape consisted of meandering rivers that entered a series of lagoons and swamps at the junction with the sea (Coltorti 1997, 317).

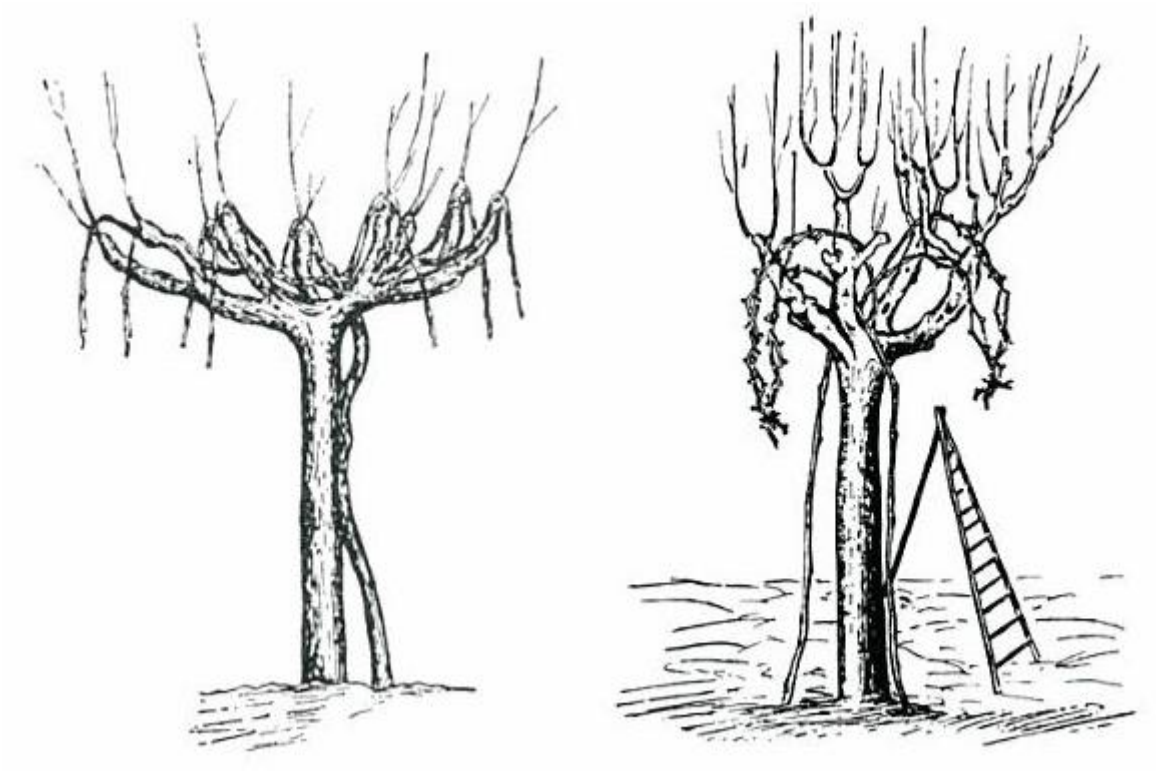


Figure 235 The alberata toscana with one or two vines attached to the tree (After Eynard/Dalmasso 2004, 406, Fig. 196-197).

Later historical accounts seemingly confirm this picture of environmental and/or climatic determinism. Indeed, the 'alberata' or 'folignata' was particularly widespread in many central and northern Italian regions in early modern times – i.e. including Marche, Abruzzo Teramano, Umbria, Tuscany, Emilia Romagna and the Po plain – for organising vine plantations in the flatter zones of the plains and valley floors.[22] Several sub-types existed, but in essence they all applied the same principle of attaching the vines to the trees and letting them grow between the latter on a certain distance from the ground (*Figures* 235-237). Today, these systems belong to agricultural history, but they remained in use until the middle of the previous century and some remnants can still be seen in the landscape (Figures 238 and 239).

[22] In a classical work on the history of the Italian agricultural landscape, Emilio Sereni has linked the diffusion of the *arbustum* and later the *alberata* in these areas of central and northern Italy not only to those particular environmental conditions, but also to the expansion of the Etruscan civilisation (Sereni 1961, 40-43). See also Tchernia 1986, 114; and Forni 2002a, 145. Based on a study by M. Ortolani in 1960, it seems that the southern limit of the alberata system along the Adriatic coast was to be situated somewhere between the Sangro and Trigno rivers, at the border between Abruzzo and Molise (Desplanques 1975, 606).

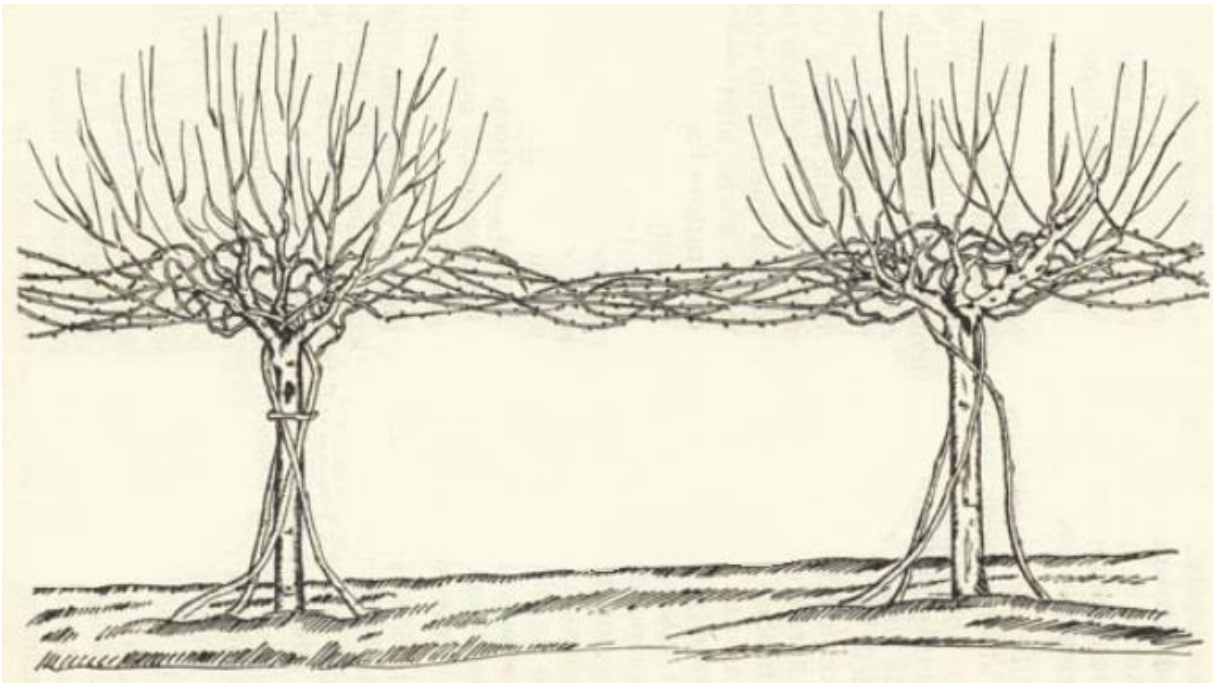


Figure 236 The alberata marchigiana with vines linked in the form of garlands (After Eynard/Dalmasso 2004, 407, Fig. 198).

For Marche in particular, a nice description is offered by Andrea Bacci in what is considered one of the prime oenological studies of the Early Modern period: "*De naturali vinorum historia, de vinis Italiae et de conviviis antiquorum"*. In this work, the author describes the region at the end of the 16th century as an area with fertile, flat and humid lands, where the lower and colder zones in particular suffer from excessive humidity and fog, as such requiring vines to be trained higher on trees; i.e organised in the form of an 'alberata' or 'folignata'.[23] In essence, these systems were nothing more than adoptions and adaptions of two vine cultivation techniques that had been in use in Marche and Emilia Romagna since the 13th century AD: the '*piantata*' in which vines were trained upon rows of trees such as elms, maples, willows and poplars positioned along the borders of roads and smaller tracts; and the '*coltura promiscua*', whereby vines were cultivated in combination with arable or pasture land.[24] Together, they formed a type of plantation that would retain its popularity in these areas until the mid-19th century, after which the system was gradually abandoned and replaced by the intensive vineyard.

[23] Bacci 1596, Vol. 7, 63-90.

[24] Vernelli 2003; 2008.

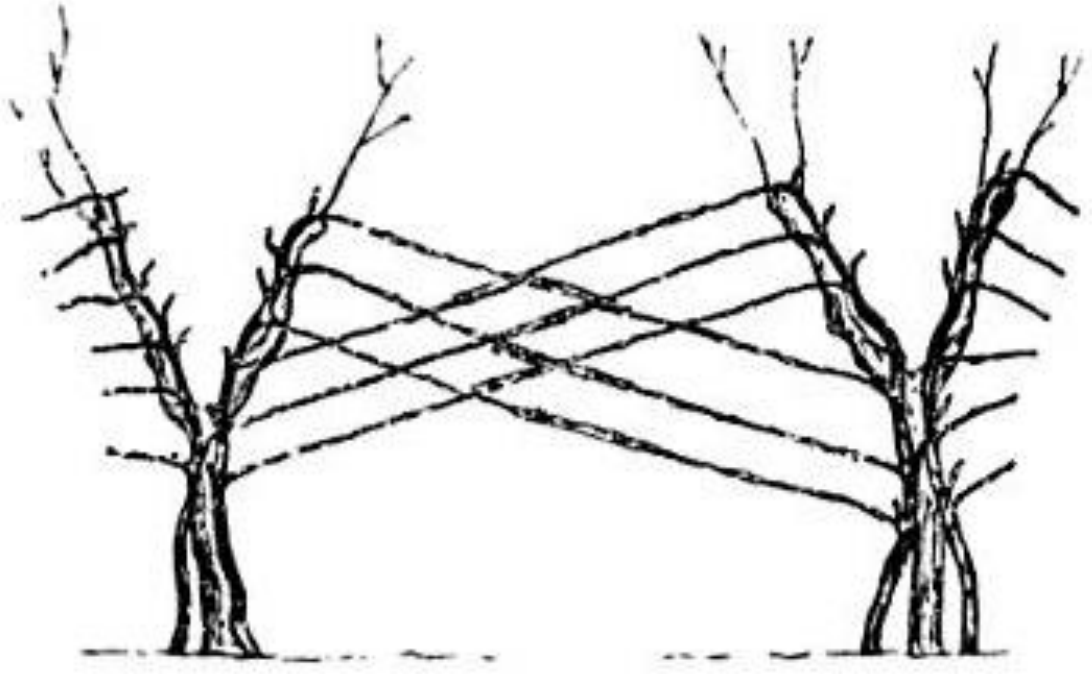


Figure 237 The alberata bolognese (Emilia) (After Eynard/Dalmasso 2004, 408, Fig. 199).

This is not to say that lower-trained vines arranged in more intensive vine plantations were ever a stranger to these regions. In fact, the many historical accounts on agriculture in the central Adriatic area make it perfectly clear that vineyards and alberata fields coexisted with each other throughout the entire early modern period with varying proportional shares.[25] We can easily imagine how a similar scenario must have developed in the Roman period, with this system in particular being more popular in places where drainage, humidity and fog were less of a problem, like on hill slopes and higher plateaus; i.e. lands that – just like today – were more suitable for specialised intensive viticulture (*Figure* 240). Then again, Pliny's instructions regarding the best cultivation practices for tree-wedded vines illustrates how by his time the *arbustum* was not necessarily confined to damply and foggy plains:

> "On hills and in dry lands the stages of the elms are spread out at a height of eight feet, and on plains and in damp localities at twelve feet."
>
> (Pliny, *HN* 17.35.201)

[25] For the Marche region in particular, see Gobbi 2003; Paci, R. 2002; 2003; and Vernelli 2003; 2008.



Figure 238 Remnants of vines placed between trees in Marche, near San Severino Marche in the middle Potenza valley (Photo author).

Pliny's guidelines indicate that in the 1st century AD the *arbustum* had reached a distribution radius that surpassed its natural habitat, suggesting that the system had underwent some kind of expansion. One wonders then what were some of the reasons behind this evolution. Some meaningful perspective may come from the circumstances in which the alberata gained ground over the vineyard in the Marche region in the 15th and 16th century. As this period was marked by significant urban population growth in the region, a massive request for cereals – not only from the many Marchegian towns, but also by larger cities such as Rome and Venice – caused significant land pressure in the area, as such promoting the cultivation of almost every available piece of uncultivated land, but also the reorganisation of land that was already under cultivation. It was especially through the latter process that a substantial portion of vineyard land was transformed into alberata or folignata fields; as such altering the dominant vine cultivation techniques in order to meet with the huge demand for cereals, while at the same time taking into account the equally substantial demand for wine.[26] Indeed, as we have seen earlier, one important advantage of the alberata was that it allowed for the extension of viticulture into the low-lying, flat, humid and foggy lands of the lower valley sections and the coastal plains, in this way compensating for the loss of vineyard land.

[26] Vernelli 2003; 2008; Paci 2003.

Thus, the so-called 'cerealisation' of Marchegian agriculture in the course of the 15th and 16th century did not mean the end of substantial viticulture tout court, but it did mean the reduction of intensive vineyard culture and the expansion of extensive viticulture.[27]



Figure 239 An isolated stretch of vines linked to fig trees in Marche, near Urbisaglia (Macerata) (Photo author).

One wonders then if a somewhat similar process may have occurred in Early/High Imperial central Adriatic Italy. Such a scenario would certainly bode well with the model that has been built-up in the course of this thesis: i.e. an ever growing request for local cereals as a result of a demographic growth that the many Roman towns in the area were experiencing alongside an ever-growing rural population. Also, we might easily imagine how such developments would have led to serious problems of land scarcity in the area, causing farmers to look desperately for new cultivable land, or to rearrange the land that was already under cultivation. One particular concern hereby in the Roman period would have been the need to conciliate the huge demand for cereals with the equally important demand for wine. One solution may thus have been to reorganise the way in which the vine was cultivated in many parts of the region. Just as in 15th and 16th century Marche then, an expansion of the *arbustum* could have been promoted by a growing demand for

[27] Paci 2003.

cereals in central Adriatic Italy, this often at the expense of vineyards in the lower and most fertile parts of the valleys.



Figure 240 Intensive vineyard in Marche near Potenza Picena, San Girio in the lower Potenza valley (Photo author).

Obvious consequences for such a shift in viticultural and agricultural practices would have been yield and quality. Indeed, while said developments would not have stopped the existing commercial wine trade per se, surpluses were bound to be much more modest and a substantial portion of these will have been traded towards the towns in the area, often in perishable containers. As has been discussed in the first two chapters of this thesis, such an evolution is one way how to read the available amphora and press evidence. Suchlike changes may also have altered the nature of the extra-regional wine trade. In fact, the appearance of proper wine nominations in textual sources during the time of Augustus and the 1st century AD indicates that, precisely from Early Imperial times onwards, *Picenum* apparently produced some well-known quality wines that were especially popular overseas.[28] It seems indicative then that, according to Pliny, such wines were best made from vines trained on trees within an *arbustum* (*HN* 17.3.5).[29]

[28] See *supra*, Chapter 2.

[29] See *supra*, Chapter 5. It is worth remembering here that some of today's Italian quality wines, such as the Chianti or the Brunello di Montalcino, actually have their roots in the alberata (Braconi 2004, 79).

Focusing on quality instead of quantity might have been a reasonable strategy for some rich farmers to keep moving an overseas wine trade that could no longer produce the same large amounts as before because of evolving demographic and commercial circumstances. However, one might also imagine how a combination of local land pressure and a large demand for local wine would have stimulated others to maximize their returns under less than ideal conditions. Against the background of such transformations, one might better understand some of Columella's complaints in AD 69 about the disrepute of proper vineyard culture in this period in some areas of central Italy:

> "Why then is viticulture in disrepute? Not, indeed, through its own fault, but because of human failings, says Graecinus; in the first place because no one takes pains in searching after cuttings, and for that reason most **people plant vineyards of the worst sort**; and then they do not nourish their vines, once planted, in such a way as to let them gain strength and shoot out before they wither; and if they do happen to grow, they are careless in the matter of cultivation. Even at the very start **they think that it makes no difference what kind of ground they plant; or rather they pick out the very worst section of their lands, as though such ground alone were particularly fit for this plant because incapable of producing anything else**. … Most people, in fact, **strive for the richest possible yield** at the earliest moment; they make no provision for the time to come, but, as if living merely from day to day, they put such demands upon their vines and load them so heavily with young shoots as to show no regard for succeeding generations." (my emphasis)
>
> (Col., *Rust.* 3.3.4-6)

In the past, this much debated elegy by Columella has been seen as an act of defence against those who did no longer consider viticulture a profitable business, or as a confirmation of the idea that Italian viticulture had become increasingly unproductive, as such requiring imports from the provinces.[30] Others have continued this pessimistic route by linking the supposed discredit of viticulture to the sector's increasing inability to find an outlet in extra-Italian markets, as such marking one of the first signs of the economic emancipation of the provinces.[31] The agronomist's description has also been interpreted as illustrating the resistance by a few to the widespread expansion of vineyards in the 1st century AD, or simply the proliferation of a certain conservatism against a very speculative business.[32] Either way, both scenarios allegedly would have led to the redaction of Domitian's vine edict in AD 92 (Suet., *Dom.* 7), which should thus be

[30] Billiard 1913, 94-98; Martin 1971, 257-310, 370-375.

[31] Rostovtzeff 1926.

[32] Sirago 1958, 250-274; Garnsey/Saller 2014.

considered a protectionist measure, meant to 'save' Italian viticulture from a situation of overproduction into which the country had fallen because of the events described above.[33]

As we have seen in Chapter 1, however, the crisis theory leaves much to be desired, while Nicolas Purcell has convincingly argued for a picture of viticultural bloom in the 1st century AD on the basis of the known literary evidence.[34] In fact, what Columella is actually describing here is not a total downfall of Italian viticulture, but rather the decreasing popularity of a particular vine cultivation system – i.e. the intensive vineyard or *vinea* – in a time in which its use was no longer considered lucrative or practical in every situation. The remaining bits of Columella's discourse make this quite clear, as his motivation clearly stems from an increasing use of other land regimes at the expense of vineyards:

> "Now, before discoursing on the planting of vines, I think it not out of place to lay down, as a sort of foundation for the coming discussion, the principle that we would have carefully weighed and investigated in advance **whether viticulture will enrich the proprietor**; for it is well-nigh purposeless as yet to give directions for planting vines, as long as the prior question is not yet affirmatively answered – **whether vines should be kept at all**. And most people would be **doubtful on this point**, to such an extent that many would avoid and dread such an ordering of their land, and **would consider it preferable to own meadows and pastures, or woodland** for cutting; for in the matter of **arbustum**[35] there has been no little dispute even among authorities, Saserna being unfavourable to this kind of land, and Tremelius approving it most highly. ... Meanwhile those devoted to the study of agriculture must be informed of one thing first of all – **that the return from vineyards is a very rich one**. ... and with me, that eight hundred grafted stocks of less than two years yielded seven *cullei*, or that first-class vineyards produced a hundred amphorae to the *iugerum*, when **meadows, pastures, and woodland** seem to do very well by the owner if they bring in a hundred sesterces for every *iugerum*. **For we can hardly recall a time when grain crops, throughout at least the greater part of Italy, returned a yield of four to one**." (my emphasis)
>
> (Coll., *Rust.* 3.3.1-3)

Columella's firm juxtaposition between vineyards on the one side and meadows, pastures, *arbustum* plantations and grain fields on the other side suggests that the former

[33] Tchernia 1986, 4, referring to Sirago 1958 and Rostovtzeff 1926.

[34] Purcell 1985.

[35] In the translation by Harrison Boyd Ash, the term '*arbustum*' is translated as "ground planted with trees for the support of vines". While this translation is correct, I here preferred to keep the actual term for purposes of clarity.

were losing ground due to the proliferation of the latter; a process that must have been quite a thorn in the side of a purist oenophile like Columella.[36] However, the growing success of some of these other cultivation regimes – especially here the *arbustum* and grain fields – would be totally understandable when taking into account some of the red lines throughout this thesis; i.e. local population growth and a particular increase in cereal-land needs in many parts of central Italy.[37] Besides, as has been mentioned in the introduction of this thesis, the negative behaviour described by the author with regard to the abundant use of poor lands for installing vineyards is a typical sign for periods of enduring population pressure, leading farmers to keep the better soils for cereals or other crops, while moving vines to less fertile soils.[38] Columella might not have agreed, but the adoption of the *arbustum* was probably a good way to continue cultivating the vine on a fairly large scale in central Adriatic Italy – and some other parts of the peninsula – in times of land scarcity.

To this regard, a final consideration may be given to a viticultural treatise on the wines of Ancona at the beginning of the 19th century by Giovanni de Brignoli di Brunnhoff: '*Istruzione sul miglioramento de vini nel Dipartimento del Metauro*' (1808-1809). In his work, Brunnhoff remarks the poor quality of the once famous wines from Ancona. The reasons for this deterioration, according to the author, include the low quality of the vines itself, the uncritical mixing of different varieties, the often premature harvest, and the bad custody of the vineyard; all flaws that are stimulated by the farmers' desire to produce as much wine as possible, often at the expense of its quality.[39] A similarity with Columella's remarks is immediately apparent, but Brunnhoff's linked discussion on the validity of the widespread distribution of the alberata in this period is all the more interesting. The author cites the frequent mists and copious dews in the area as one of the main reasons for the system's popularity, but at the same time he doubts that the hanging of vines higher in trees sufficiently compensates the damaging effects of said environmental conditions on the plants (see *supra*).[40]

Once again, Brunnhoff's discourse reveals the concerns of a dedicated oenologist towards the use of a cultivation regime other than that of the vineyard, but the omnipresence of the system in the region at the beginning of the 19th century might be better understood when once again considering the demographic framework. Indeed, it seems no coincidence that Brunnhoff's comments appear in a period marked by

[36] Santon 1996.

[37] From this point of view, Domitian's edict may rather have been inspired by a shortage for cereals in Italy than by provincial viticultural competition (Purcell 1985).

[38] Grigg 1980; Van Leeuwen/Seguin 2006.

[39] Brunnhoff 1808-09, 10.

[40] Bunnhoff 1808-09, 14-15.

considerable population growth in Italy in general, but in the Marche region in particular. Between 1770 and 1861, the male Italian population grew from 17 million to 26.1 million.[41] In the Marche region, the same period saw the population rise from ca. 600,000 to 900,000 people. With regard to the first half of the 19th century in particular – i.e. between 1816 and 1853 – the trend is quite obvious in the demographic evolution reconstructed by Sergio Anselmi for the provinces of Pesaro-Urbino, Ancona, Camerino, Macerata, Fermo and Ascoli Piceno (*Table* 75).[42]

Table 75 Population growth (1816-1853) and population density (1853) in the provinces of the Marche region in the 19th century.

Province	1816	1833	1844	1853	Population growth 1816-1853 (%)	Density/km² (1853)
Pesaro-Urbino	198,145	225,806	235,386	257,751	30.08	71
Ancona	147,355	158,159	167,119	176,519	19.72	155
Camerino	31,136	36,592	37,705	42,991	39.07	52
Macerata	197,313	220,130	233,004	243,104	23.20	105
Fermo	77,089	89,404	104,003	110,321	43.10	127
Ascoli Piceno	69,058	78,946	83,980	91,916	33.09	75

One could say then that in periods when local population pressure required local agriculture to produce sufficient amounts of the common foodstuffs – i.e. in the first place cereals, vines and olives, but also the other contributors to the diet such as fruits and vegetables – the application of the alberata had proven to be a successful way to conciliate the maintenance of a respectable wine production with an efficient use of all available agricultural land in a certain territory. It is possible then that similar processes were at work in Roman times and that such processes had promoted the diffusion of the *arbustum* in several parts of central Italy. This went at the expense of vineyards, which were no longer the obvious choice, as local conditions now hindered exploiting external demand for central Italian wine to the full.

[41] Anselmi 1989.

[42] Anselmi 1978, 76-77, 80-81.

The nature of local oleoculture

A final note is reserved for the place of olives within this story. The archaeological evidence reviewed in the first two chapters of this thesis suggests that central Adriatic oleoculture was never the subject of intensification processes similar to those attested for viticulture in the area; i.e. driven by the possibility to maximize profits with the eye on provisioning provincial consumption markets. Indeed, based on the amphora record, olive oil never reached the high levels of the overseas wine trade in the Late Republican and Early/High Imperial periods. Furthermore, ancient authors do not seem to have been that concerned with oleoculture in this area and Pliny does not include the region among those producing important quantities within Roman Italy (*HN* 14.3.16). Rather, it seems that the region was more appreciated for its excellent table olives, exported to Rome and even to north-eastern Gaul.[43]

Rather than pointing to a lack of actual demand, it was suggested at the end of the first chapter that this might be an indication of an inferior quality of the oil, or of a scarcity of suitable olive land in the area. Judging from the present-day conditions of the business, there might be some truth in such a statement. In fact, from a climatic point of view, the Marche is a region lying at the limit of the suitable cultivation radius within Italy, coinciding with what is labelled nowadays as the medium and cold sub-areas (*Figure* 241). Practically speaking, the inclusion of the region in these sub-areas means that – while the oil can be of good quality – it is difficult to attain high levels of productivity, with olive trees often suffering damage from recurrent cold weather conditions, especially in the cold sub-area. The small coastal section of the region falling under the medium sub-area has somewhat better circumstances, but irrigation is nevertheless required to attain maximum productivity.[44]

Unsurprisingly, these circumstances have translated into the Marche being one of the lowest olive oil producing regions of Italy, with under 10,000 ha of land devoted to oleoculture and an average annual production of ca. 4,000,000 litres.[45] In terms of landscape organisation, this means that in Marche we mostly encounter low-density olive orchards, with olive trees typically scattered throughout the landscape without a fixed pattern (*Figure* 242). Only rarely do we find more densely planted olive groves, with most of the latter being located in the coastal and middle sections of the valleys (*Figure* 243).

[43] See *supra*, Chapter 1.

[44] Fontanazza 2005.

[45] Alfei et al. 2004. Compare these figures to the 250,000-300,000 tonnes of olive oil produced each year in Puglia, the 150,000 tonnes in Calabria, or the 50,000 tonnes in Sicily, where oleoculture covers surfaces of 370,000, 186,000 and 160,000 ha respectively (Fontanazza 2005).



Figure 241 Distribution of olive-cultivation areas in Italy with reference to climate (the study area is indicated by a red circle) (After Fontanazza 2005, 15, Fig. 3).

The picture that we got from the press evidence in the second chapter, however, seems to suggest that olive oil production was not totally insignificant in the area. Based on the population/land model from the following chapters, the possibility was then raised that said business was rather dictated by local incentives, than by external markets. The widest extension of oleoculture would then have occurred in the Early/High Imperial period, stimulated by the growing food and land needs of the urban (and rural) population in the region. As we have seen, this could have been done by simply planting olive trees dispersed within cereal fields, or in a more systematic way through using these trees as vine supports within *arbustum* plantations. Ironically then, the expansion of oleoculture in the area would have received a boost from Augustan times onwards, allowing farmers to occasionally export what was potentially left over after satisfying the needs of the local population. Of course, one can never be sure, but such an evolution would bode well with the oil amphora evidence discussed in the first chapter, and with some of our literary evidence, which mentions the production of quality olives in *Picenum* precisely from that period onwards.

Concluding remarks and future research prospects

In this thesis, I have tried to explore the diachronic relationship between extra-regional export, intra-regional consumption and viticultural/oleocultural traditions in the central Adriatic area of Italy between the Late Republic and the Early/High Empire. The main aim has hereby been to stimulate the debate on the fundamental modifications that shaped central Italian agriculture in the period under consideration. Admittedly, the speculative component of the story line that has been set-out is considerable, but – as stressed in the introduction of this work – it was never my intention to claim historical exactitude. Instead, I have argued that the cross-fertilisation between the amphora evidence, the press remains and the reconstructed population/land model implies that at least 'something' happened in the course of the 1st-2nd century AD that significantly reshaped the central Adriatic wine and oil sector; and that said 'something' may somehow be linked to developments in intra-regional demography and food supply, rather than merely to the disappearance of the provincial markets. Finally, with this epilogue, I have suggested that those changes may have comprised an increase in the distribution of *arbustum* and low-density olive orchards in the area in the Early/High Imperial period.

This leaves us with the question of how we could proceed in investigating these research topics. One obvious way to further refine our models would be to look closer into what was possible in terms of viticulture, oleoculture and cereal cultivation in the area in Roman times within the limits imposed by the natural environment. For instance, we might assess the area's suitability for growing these crops through archaeological land evaluation; i.e. to create suitability maps for each of them through analysing different environmental aspects such as soil type, elevation, slope, aspect and sun exposure. While originating in modern land use, this methodology has already been applied in archaeology for determining the potential suitability of ancient landscapes for ancient land use.[46] The method is certainly not flawless – land evaluation in archaeology can only be performed in very general terms, as for antiquity we lack the necessary exact environmental and climatological data for carrying out quantitative analyses, while the landscape of today is no longer the landscape of the past and crops have often changed genetically throughout the centuries – but at least if offers a technique for polishing ancient yield models, as constructed for the area in Chapter 5.

I also think we need to understand better the recurring agricultural responses in the area for later historical periods, as they might further inform us about potential evolutions in the Roman period. The issue has briefly been touched upon in the course of

[46] Fedick 1995; Guidi et al. 1996; Van Joolen 2003; Farinetti 2009; Arnoldus-Huyzenveld/Pozzuo 2008; Goodchild 2007; 2009.

this epilogue, but some further research into this kind of comparative material is obviously required, in particular with regard to the relationship between demographic developments and agrarian change. After all, while we should obviously be careful to assume straightforward continuity between distinct pasts in the same area, it is unlikely that the central Adriatic habitat has changed so profoundly since Roman times that the agricultural choices made by different people in a similar environment under pre-industrial conditions would offer no guidance at all.[47]

Finally, with regard to our archaeological data, there are certainly improvements to be made in all categories. We might think hereby at more detailed amphora distribution maps, or better studied press contexts, but also at the invaluable urban and rural survey work that continues to be conducted in the area and whose results will undoubtedly allow us to refine demographic calculations for town and country in the future. One can also hope that palaeodietary studies will find their way to this part of Roman Italy, in this way opening-up new possibilities with regard to our knowledge of dietary patterns, and of the variation between them across time and space, but also according to gender, age and social class. And while reconstructing the Roman economy will always remain a continuous attempt to extract agro-economic meaning from what is essentially a collection of inconclusive archaeological, literary, comparative, circumstantial and theoretical evidence, we can only hold on to the conviction that each new piece of the puzzle might bring us closer to the historical truth.[48]

[47] A similar attitude is expressed by Horden/Purcell 2000, 463-466.

[48] Some observations in this epilogue have been published in Van Limbergen et al. 2016.



Figure 242 Typical low-density olive orchard in the Marche region, near modern San Severino Marche in the middle Potenza valley (Photo author).



Figure 243 Higher-density olive orchard in Marche, near Potenza Picena in the lower Potenza valley (Photo author).

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Chapter 1

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Chapter 2

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Chapter 4

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Appendices

Appendix I
Amphora findspots

Adriatic Greco-Italic

Italy (28): **Urbs Salvia** (Fabrini 2003a, 120), **Otranto** (Semeraro 1983, 197, br. 294, t. 93), **Valesio** (Boersma/Yntema 1989, 143-144, fig. 12), **Bari** (Volpe 1988, br. 800 and 801, fig. 554, 555), **Bisceglie – Salesio** (Volpe 1990, 241), **Barletta** (Kirigin 1994, 19, n° 5), **Margherita di Savoia** (Kirigin 1994, 19, n° 6), **Canosa**, **Ordona**, **Trinitapoli**, **Salapia**, **Manfredonia**, **Mattinata**, **Vieste** (Kirigin 1994, n° 7-13), **Tremiti** (Volpe 1989, 629-632; for **Punta della Vapore*** in particular, see De Juliis 1981, 19-20; and Ruegg 1971, n.3), **San Severo-Casone** (Kirigin 1994, n° 15), **Ancona** (Mercando 1976, 163, fig. 11, 182, and fig. 15, 184), **Spina** (De Luca De Marco 1979, 577-580, 585-586), **Adria** (Mangani 1982, 1985, 17, 72, 105), **Aquileia** (Cipriano/Carre 1987, 482, fig. 5; see also Kirigin 1994, 19, n° 1-19), **Grado*** (Tortorici 2000), **Torre Santa Sabina*** (Auriemma/Silvestrelli 2013, 445), S. **Catherina di Nardo*** (Auriemma 2004, 2, 14-18), **T. Sinfono*** (Auriemma/Silvestrelli 2013; OXREP), **Fano*** (Profumo 2003, 393), **Suasa** (Gamberini 2014, 542-544), and **Fermo** (Menchelli/Picchi 2014, 4, fig. 2.7).

Croatia (58): **Biskupija kod Cervara** (Vrsalovic 1979, 346), **Rt Pical** (Kirigin 1994, 19, n° 21), **Otok Sv. Nikola** (kod Poreca) (Kirigin 1994, 19, n° 22), **Limski Kanal** (Kirigin 1994, 19, n° 23), **Otok Vestar** (kod Rovinja), **Mala Sestrica** (kod Rovinja), **Rt Bumista** (uvala Cintinera), **Omisaljski** (otok Krk) (Kirigin 1994, 19, n° 24-27), **Kalic** (kod Senja) (Kirigin 1994), **Kamporska Draga** (otok Rab) (Kirigin 1994, 19, n° 29), **Maun** (Koehler 1982, 286, t. 79: 17, labelled as a late Corinthian B amphora), **Veliki Kamesnjak** (otok Kakan) (Kirigin 1994, 19, n° 31), **Oblik** (kod Zlarina) (Kirigin 1994, 10, n° 32), **Lozica*** (Rogoznica island) (Vrsalovic 1979, 200), **Svilan*** (Rogoznica island), **Arbanija** (otok Ciovo), **Barbarinac** (otocic pred Salonom) (Kirigin 1994, 19, n° 33-36), **Stobrec** (Faber 1983, 37, t. 5, br. 3, 4, 5 and 11), **Osejeva** (Makarska) (Kirigin 1994, 19, n° 38), **Srednjedalmatinski otoci**, **Bristova*** (Kirigin 1994, 19, n° 39), **Tor** (Zaninovic 1982, 68, t. 4: 7), **Stari grad*** (Hvar island) **Starogradski zaljev**, **Skoj od Pokojnega Dola*** (otok Hvar) (Kirigin 1994, 19, n° 42-44), (Petric 2002, 476), **Krava*** (island of Vis) (Vrsalovic 1979, 229; Radic Rossi 1993, 88-90, Jurisic 2000, 5, Petric 2002, 476), **Stoncica** (island of Vis) (Vrsalovic 1979, 233-234; Kirigin 1994, 19, n° 46), **Vlaska Njiva** (Kirigin 1983, 28-30), **Kamik** (Kirigin 1994, 19, n° 48), **Palagruza** (Kirigin 1994), **Scedro-Plocica** (Korculanski kanal), **Plocica** (Korculanski kanal), **Prizba** (otok Korcula) (Kirigin 1994, 19, n° 50-52), **Drasan** (otok Lastovo) (Kirigin 1994), **Marusica gradina** (Marovic 1980, 55-56, fig. 10, br. 3), **Butora** (otok Sipan), **Lopud**, and **Supetric** (Kirigin 1994, 20, n° 56-58); see also Kirigin 1994, 19-20, n° 20-54; 56-58; **Perna*** (island of Hvar) (Cambi 1969, 227-228; Vrsalovic 1979, 222; Radic Rossi 1993, 190); **Zecevo*** (Hvar) (Petric 2002, 479); **Lukavci*** (Petric 2002, 479); for a series of underwater

finds on the south side of the island of **Hvar***, see Petric 2002, 472, 476, 479. For the island of **Vis***, see also the sites of **Kamik od Zakomicih*** and **Stonca*** (Kirigin et al. 2006b), and **Luka*** (Jurisic 2000, 77; Kirigin et al. 2006b), **Stupisce-Gnjila** (Petric 2002, 472), and a shipwreck to the southeast of **Vis** (Petric 2002, 476), **Jelsa*** (Gaffney et al. 1997), **Pernat B*** (Matejcic/Orlic 1982, 164, fig. 4; Cambi 1989, 318-320), **Rab*** (Dautova Rusevljan 1975, 89-102), **Lastovo B** (Saplun) and **E*** (Jurisic 2006, 175-192), **Korcula*** (Carrazé 1975, 57, tav. V, 1-3); for the island of Cres, see the shipwrecks of **Vela Svitnja*** and **Cape Pernat*, Salvore*** (Vrsalovic 1974, 21, 53, 238, 240; and Parker 1992, n° 1044); **Punta Glavina*** (island of Rab) (also in **Nesactium** (Vidrih Perko 2006, 211, note 28.), and **Pula** (Pola) (Vidrih Perko 2006, 211, note 28).

Slovenia (1): **Sermin** (Vidrih Perko 2006, 211, note 28).

Bosnia and Herzegovina (1): **Osanici** (Stolac u Hercegovini) (Maric 1972-73, 182, t. 24: 3, 5; 25: 1-8; 1975-76, 39-42, t. 32); see also Kirigin 1994, 20, n° 55.

Montenegro (5): **Karatoc**, **Rose**, **Risan**, **Potez uvala Zanjica-Budva**, and **Ulcinj** (Kirigin 1994, 20, n° 59-63).

Albany (7): **Beltojë** (Lahi 1988, 77, t. 4: 39, 40), **Burrel** (Kurti 1987, 94, t. 8: 13), **Dyrrhachion** (Tartari 1982, 244-245, fig. 5, t. 1: 7, 8, 10; Hidri 1986, 119, t. 6: 1, 4, 5, 7), **Dimal** (Dautaj 1976, 157, t. 2:6), **Apollonia** (Tartari 1982, 245, 22), and **Phoenika** (Esquillini 2011a; 2011b).

Greece (4): **Prevaza** (Parker 1992, n° 904), **Delos, Corinth, Athens** (Lyding Will 1989, 302), and **Marëgëllic** (Ceka 1986, 79, br. 51-55, t. 6: 51-53),

Egypt: (1): **Alexandria** (Senol 2007).

Tunisia (1): **Carthage** (Lyding Will 1989, 302).

Lamboglia 2

Italy (123): Within the Marche region, they are known from **Nidastore di Arcevia** (Callender 1970, 139, n° 698; Branchesi 2011, 84), **Fossombrone** (unpublished depot), **Cesano di Senigallia** (Mercando 1979a, 117, fig. 29, s, v, y, 119, fig. 30 a-k, 124, fig. 33f, 126, fig. 35m, o-q, 127, fig. 36 o-q, 129, fig. 38l), **Suasa** (Saracino/Vergari 1997), **Senigallia** (Branchesi 2011, 83,2.2,, fig. 6; Lepore et al. 2012a; 2012b; Salvini 2003, 18), **Pesaro** (Bartolini 2008, 104), **Ancona*** (Parker 1992), **Ancona – porto romano** (Marengo 2007; Marengo/Paci 2008; Forti 2011; Paci 2013a), **Falconara**, **Civitanova Marche**, **Porto San Giorgio**, **Ascoli** (Profumo 1986, 42, 43, 45, 47), **Potenza Picena** (Mercando 1979d), **Urbs Salvia** (Fabrini 2003a, 119), **S. Benedetto del Tronto** (Mercando 1979, 176, fig. 89s), **Castelfidardo** (Mercando 1979b, 157, fig. 66a), **Porto Recanati** (Mercando 1979c, 247, fig. 147), **Cupra Marittima** (Fortini 1998, 75, fig. 13), for **Fano** and its territory, see Dolci Santià 1983: **Carrara** in the area of the Fornace Fucili poi Antinori (Sopr. Archeol. Ancona. Archivio, prat. n. 12, 1940), loc. La Chiusa o Torno, presso Cuccurano, 20 anfore (Sopr. Cit. prat. n. 25), terreno di proprietà A. Adanti a 2 km di Fano, Ponte Rosso, 15 anfore (Sopr. Cit. prat. 25, 1953); S. Cristina (1879), 28 amphorae; several sites in the territories of the Roman towns of **Potentia**, **Trea**, and **Ricina**, and **Fermo. Ricina** (Vermeulen et al. 2005, 43). Findspots in the whole of Italy include **Muracche di Tortoreto** (Lapenna 1996), **Fonte dell'Olmo di Roseto** (S. Martino) (Staffa 2002, 54), **Foce del Timavo** (Trieste) (Maselli Scotti 1982, 82-84, fig. 2,1), **Aquileia** (Maselli Scotti 1979, 353, 356, 363; Cipriano/Carre 1987, 483; Buora et al. 2007), **Aurisina** (Duino) (Maselli Scotti 1986-1987, 203), **Castelraimondo** (Guermandi 1995, 213-215), **Cattinara** (Maselli Scotti 1978, 151, Pl. 2: 1; 1979, 353, Fig. 1), **Locavaz** (Maselli Scotti 1980; 1982, 83-84; Carre 1985, 215; Cipriano/Carre 1989, 81), **Pozzuolo del Friuli** (Ciastiei) (Adam et al. 1986, 155), **Sevegliano** (Carre/Cipriano 1985; Buora et al. 2007), **Rivignano** (Udine) (Gomezel 1992, 533, n° 6, Musei Civici Inv. N° 265035), **Stella** (Udine) (Gomezel 1992, 533, n° 7, Antiq. Inv. N° 118869, 534, n° 8), **Palazzolo dello Stella** (Cipriano/Carre 1989, 97), **Pocenia** (Udine)

(Gomezel 1992, 535, n° 10, Lamb 2 or Dr 6A), **Vidulis** (excavations by F. Tassaux, unpublished), **Castelguglielmo** (Zerbinati 1970, 121, fig. 2), **Altino** (Marcello 1956, 33-35), **Este** (Pietrogrande 1883, 71, n° 163), **Padova** (Cipriano 1992; Cipriano et al. 1991; Pastore 1992; Pesavento Mattioli/Cipriano 1994; Cipriano/Mazzocchin 1992: 2011), **Alessandria** (Facchini 1995, 313), **Milano** (Lusuardi Siena 1971-74, p. 15, n° 20, tav. IV, 1, IX, 1, p. 13 n° 7, tav. III, 1, IX, 6; Baldacci 1967-68, 16-20, 14), **Alba Pompeia** (Bruno 1997, 517), **Brescia** (Buchi 1975, 253-255, tav. X, 1; Bruno/Bocchio 1999, 232), **Cremona** (Baldacci 1967-68, fig. 12; Pontiroli 1974, 130, n° 192, 131, n° 194, 133, n° 199, 138, n° 204; Arcari 1996, 186), **Calvatone** (*Bedriacum*) (Bruno 1995, 259, n. 100; Volonté 1996, 190-191), **Viadana** (Pasquinucci/Roffia/Tamassia 1984, 119, fig. 117, 133-134, fig. 125), **S. Lorenzo di Parabiago** (MI) (Scotti 1996, 163), **Vercelli** (Brecciaroli Taborelli 1987, tav. IV; Facchini 1996, 195), **Luni** (Siena 1977, 235, tav. 141, 19), **Albenga*** (Lamboglia 1952, 164-165, fig. 22-23), **Isola Gallinaria*** (Lamboglia 1961, 138-139), **Vintimiglia** (Albintimilium) (Lamboglia 1952, 165, note 5; 1955, fig. 18, p. 263), **Reggio Emilia** (Degani 1967, 15, fig. 11a), **Parma** (Marini Calvini 1974, 191-199), **Ferrara** (Cornelio Cassai 1983-84, 37, n° 6, tav. I), **Carpi** (Cipriano/Carre 1989, 97), **Bologna** (Bergamini 1980, 136-137, n° 800-802, tav. XXXVI-XXXVII, X), **Quaderna** (Bo) (Callender 1970, 139, n° 698; Branchesi 2011, 84), **Modena** (Scotti 1989, 91, fig. 61, 2), **Marzabotto** (De Maria et al. 1978, 110-111, fig. 45 114-118), **Settefinestre** (Ricci 1985, 74, Tav. 20, 10), **Sant'Andrea B*** (Isola d'Elba) (Martelli 1982, 75-76, fig. 51 c and 52), **Tarquinia*** (Gianfrotta 1982, 27), **Civitavecchia*** (Gianfrotta 1982, 24-25, fig. 40, 26, fig. 51, p. 30), **Nomentum** (Pala 1976, 25, n° 1,25, fig. 15), **Rome** (Museo Nazionele Romano and the depots of the Mercati Traianei, unpublished), **Ostia** (Zevi 1967, 23-25, fig. 2 and 3; Van Der Werff 1986, 103-107), **Corfinium** (L'Aquila) (Van Wonterghem 1984, 147, fig. 163), **Pompeii** (Bonghi Jovino 1984, 277, Tav. 151,5), **Lucera** (Foggia) (Volpe 1982-83, 27-28), **Ascoli Satriano** (Tinè Bertocchi 1985, 219, fig. 368), **Manfredonia** (Volpe 1982-83, 31; Mazzei 1984, 229, fig. 279; Volpe 1990, 246), **Ordona** (Volpe 1990, 236), **Barletta** (Bari) (Volpe 1982-83, 31; 1990, 241), **Bisceglie** (Salsello) (Volpe 1990, 241), **Margherita di Savoia** (Volpe 1990, 243-244), **Trinitapoli** (Volpe 1990, 245), **Mattinata** (Volpe 1990, 247), **Vieste** (Volpe 1990, 247), **Baia di Campi*** (Mazzei/Volpe 1987, 134; Volpe 1990, 247), **Canosa** (Volpe 1982-83, 32), **Porto Badisco*** (Brindisi) (Lamboglia 1974, 434), **Capo di Torre Cavallo*** (Sciarra 1966, 343-345; Parker 1992, 226), **Brindisi** (Sciarra 1976, 10, fig. 66), **Gallipoli** (Lecce) (Desy 1983, 182, Tav. III, 13-15), **Ugento** (Desy 1983, tav. IV, 17 and 20), **S. Caterina di Nardò*** (Volpe 1982-83, 32; OXREP), **Taranto** (Viola 1884, 123; Viola 1885, 282), **Olbia** (Leipunskaya 1995), **Reggio Calabria*** (Foti 1973, 10, fig. a), **Filicudi*** (Messina) (Albore Livadie 1985a, 95 and fig. 101), **Chiaro** (Catanzaro), (http://www.fastionline.org/micro_view.php?fst_cd=AIAC_1951&curcol= sea_cd-AIAC_2277), **Torretta di Crucoli** (Corrado 2009, Tabella 3), **Copia** (Sibari) (Battista Sangineto 2001, 210-211, note 47), **Blanda** (Palecastro di Tortora) (Battisto Sangineto 2006, 312), **Lipari*** (Albore Livadie 1985b, 39-40, fig. 17 d,e, e 19 a-d), **Siracusa** (Orsi 1913, 276-277, fig. 18,2), **Terrasini** (Palermo) (Purpura 1977, 56-57, fig. 5b), **Bocca Grande*** (Capri) (OXREP), **Cala Gadir II** (Pantelleria, Sicily) (Lattanzi 2007, 126; Selvaggio et al. 2009, 417-420), **Cala Palombara*** (Puglia) (OXREP), **Cala del Diavolo*** (Isola di Montecristo, Tuscany) (OXREP), **Caorle*** (Veneto) (Beltrame 2002, 456; Lattanzi 2007, 181), **Caprara*** (Puglia, Tremiti Island) (OXREP), **Li Galli – Vetara*** (Campania) (OXREP), **Mucurune*** (Puglia) (OXREP), **Pisa B*** (Bruni 2000; Camilli 2004), **Secca dei Mattoni*** (Lazio) (Parker 1992, 1060: Galli Ponza 1993), **Seleno*** (Calabria) (OXREP), **Torre Guaceto*** (Puglia) (Parker 1992, 1159), **Torre Melissa – Villaggio Sirio*** (Calabria) (OXREP), **Torre Sinfono*** (Puglia) (OXREP), **Torre Testa – Porto di Brindisi*** (Puglia) (OXREP), **Tre Senghe*** (Puglia, Tremiti islands) (Volpe 1990, 247-250; Parker 1992, 1176), **Punta della Contessa A*** (Brindisi), and Rasa (Istria) (Radic 1988-89; Pesavento Mattioli/Cipriano 1994, 520); see also Cipriano/Carre 1989, 97-98); and The Oxford Roman Economy Project

– Shipwrecks Database (http://oxrep.classics.ox.ac.uk/databases/shipwrecks_database/); **Venezia – Canale Caggian** (Canal 2013, 419, fig. 147.5, similar to the ones found on the shipwreck of Planier 3 and dated around the mid-1st-century BC, Tchernia 1969, 488, fig. 44; Bruno 1995, 29-30, fig. 10 stamp: ANTHIFADI; another examples comes from **Venezia-Palude dell'isola di S. Lorenzo di Ammiana** (Canal 2013, 414, fig. 146.61), similar to the ones from the shipwreck of la Cavalière, which is dated around 100 BC (Charlin et al. 1978, 18-23; Bruno 1995, 27, fig. 7), and **Visogliano** (Vizovlje) (Maselli Scotti 1979, 363; Horvat 1997, 125, n° 31, fig. 48).

Slovenia (6): For **Emona** (Ljubljana), see Bezezcky 1994a; 1994b; and Horvat 2008; for **Poetovio** (Ptuj), see again Bezeczky 1994a; and 1994b with references; for **Razdrto** (Bavdek 1996, sl. 8: 4; 9; 11: 8,9: see also http://iza.zrc-sazu.si/En/Raz_antika2.html), for **Sermin** (Horvat 1997, 125, n° 27, fig. 48) and **Fornace** (Stokin 1992, Pl. 4:4-7; 5:3; Horvat 1995, Fig. 4: 2-4; see also Horvat 1997); see also Horvat 1997, 124-125, n° 1-32, fig. 48, **Piran** (Punta) (Boltin-Tome 1979, 48-49, sl. 4: a,d).

Serbia (1): **Gomolova** (Ruma) (Bezezcky 1994a; 1994b).

Bosnia and Herzegovina (1): **Daorson** (Stolac) (Lindhagen 2009, 94-95, note 84).

Croatia (116): For undersea sites on **Vis** (**Host***, **Krava***, **Stonca***, **Luka***, **Stracine*** and **Stoncica***), see Kirigin et al. 2006a, 201, Fig. 8, Appendix 3, n° 43-49, with references; for the land site of **Ciovo-Partican**, see Kirigin et al. 2006a, Appendix 4, n° 4; for underwater and on-land sites with Lamboglia 2 on the island of **Hvar** (**Perna***, **Piscena***, **Parzanj***, **Studeni bok***, **Tarson***, **S. Kliment-Mociguzica***, **Stambedar***, **Rasnik***, **Stipanska***, **Planikovca***, **Piscene-S. Nedilja***, **Rasovatica***, **Zidigova***, **Prapatna***, **Blaca***, **Sucuraj***, **Galesnik***, **Maslinica***, **Galijola***, **Duga***, **Pelegrin***, **Lukavci***, **Ivonceve nijve**, **Stari Grad**, **Hvar**), see Kirigin et al. 2006a, 202, fig. 9, Appendix 3, n° 11-33, and Appendix 4, n° 9-11, with references; for the sites of **Bogomolje** and **Jelsa** on the same island, see Gaffney et al. 1997, 72, and 172-173. Other ship-sites known in the literature are **Rab*** (Dautova Rusevljan 1975, 89-102), **Privlaka*** (Brusic 1973, 419, tav. IX-X), **Capo Glavina** (Dautova-Rusevljan 1975), **Dubna**, **Omisalijska Luka*** (Matejcic 1976, 349, fig. A-D), **Pernat II*** (Matejcic/Orlic 1982, 164, fig. 4; Cambi 1989, 318-320), and **Stanici-Celina*** (Omis) (Cambi 1989, 315; Kirigin et al. 2006a, Appendix 3, n° 6). For **Korcula*** in general, see Carrazé 1975, 57, tav. V, 1-3; for an overview of underwater and land sites on the island (**Gradina-Vela Luka***, **Maslinova***, **Kremenjaca***, **Grscica***, **Mali i Veliki Prznjak***, **Bisace***, **Lucnjak***, **Badnjena***, **Tankaraca***, and **Kopila**), see Kirigin et al. 2006a, 215, Appendix 3, n° 50-58, and Appendix 4, n° 17; in general see also Cipriano/Carre 1989, 99. More recent identifications include the shipwrecks of **Lake Hutovo*** (Caplijna) (Zmaik/Miholjek 2013), **Drazica*** (Velebit) (Jurisic 2000, n° 6), **the island of Jaz*** (Rogoznica) (Jurisic 2000, n° 23; Koncani Uhac 2007, 364), **Tijascica*** (Jurisic 2000, n° 78; Koncani Uhac 2007, 364), and **Veli Porat*** (island of Scedro) (Jurisic 2006, 175-192); for an overview of underwater sites around **Scedro** (**Perna***, **Lovisce***, **Stori Stoni***, **Pribecica***, **Smokova***, **Carnjeni***, and on the southeast side of the **island***), see Kirigin et al. 2006a, 214-215, Appendix 3, n° 34-42. For the island of **Lastovo**, see Parker 1992, 571; and Jurisic 2006, 175-192 (**Lastovo B*/Saplun**); and Kirigin et al. 2006a, 215, Appendix 3, n° 59-60, and Appendix 4, n° 18) (**Baski rat***, **Donji Skolij II***, **Lastovo**). For sites on the island of Palagruza (**Galijula***, **Palagruza**), see Kirigin et al. 2006a, Appendix 3, n° 61; and Appendix 4, n° 19. A recent literature-survey of the Sibenik water area identified a further 12 ships at **Jadrija***, the **Channel of St. Anthony***, **Cape Gradina** near Murter*, **Cape Muljica*** (Rogoznica) (Kirigin et al. 2006a, Appendix 3, n° 3), the harbor of **Primosten***, **Prvic***, **Kopara Cove***, the **islet of Bavljenac***, and the islands of **Veliki Kamenisnjak***, **Kurba Vela***, **Vela Smokvica*** (Rogoznica) (Kirigin et al. 2006a, Appendix 3, n° 2), and **Zirje*** (Stupica) (Koncani Uhac 2007, 364-365, with cited references). Inland or coastal sites include **Rijeka** (Ursalovic 1974, 139, n° 105), **Pola** (Gnirs 1910b, 185-186, fig. 15; Mlakar 1980, last tav.; Starac 2008), **Narona** (Patsch 1908, 93, fig. 10; Cambi 1989, 318), **Salona** (Clairmont 1975, 208, 43), **Desilo**

(lake Hutovo Blato), **Cibalae** (Vinkovci) (Bezeczky 1994a: 1994b), **Podgora-Klokun*** and **Podgora-Caklje** (Kirigin et al. 2006a, Appendix 3, n° 8, and Appendix 4, n° 8), **Rt Ploca**, **Trogir**, **Resnik**; **Solin-Manastirine**, **Stobrec**, **Tucepi-Grad** (near Smihel (Horvat 1997, 124, n° 9, fig. 48), **Jadranovo** (Dautova-Rusevljan 1970, 161; 1975, 92), **Lopar** (near Vinodolski) (Dautova-Rusevljan 1970, 161; 1975, 90), **Nesactium** (north basilica) (Mihovilic 1984-1985, Pl. 9:2-3), **Omisalj bay** (Dautova-Rusevljan 1970, 161; 1975, 90; Matejcic/Orlic 1982, 163), **Osor** (Bijar, under the town walls, Stara Luka, old harbour, in Osor bay: the Boka point, Maestro point, Golub bay, Pirac bay, Radiboj bay on Kolo cape, Osor point) (Matejcic/Orlic 1982, 164), **Baska** (harbour) (Matejcic/Orlic 1982, 163, **Dubno** (near Baska) (Dautova-Rusevljan 1970, 161; 1975, 90; Matejcic/Orlic 1982, 163), **Senj** (Dautova-Rusevljan 1970, 161), **Sv. Martin pri Taru** (Horvat 1997, 125, n° 29, fig. 48), **Voz na otoku Krku** (Dautova-Rusevljan 1970, 161), **Sveti Klement**, **Vid**, **Marusica gradina**, and **Spila Nakovana** (Kirigin et al. 2006, Appendix 4, n° 1-3, 5-7, 12-15), and also **Jakirusa-Brela** (Kirigin et al. 2006a, Appendix 3, n° 7); in general see also Cipriano/Carre 1989, 99. For on-land sites on the island of **Solta**, see Kirigin et al. 2006a, 203: for the shipwreck of **Solta-Tatinja**, see *idem*, Appendix 3, n° 9. For the island of **Brac**, see *idem*, 203, and Appendix 3, n° 10 (**Sladiola***), for finds in the waters of **Rovinj**, see Starac 2006.

Montenegro (2): **Boka Kotorska 2** (Royal 2008; 2009), and **Kijac** (Matejcic/Orlic 1982, 164).

Albany (16): Examples are known at **Butrinto** (Ugolini 1942, 227-228; Shpuza 2007-2008); **Durazzo** (Durrës) (Tartari 1982, 246, fig. 8; 253, fig. 13; Shpuza 2007-2008; Anastasi/Goga Beqiraj/Hyseni 2012), **Porto Palermo**, **Kepi Triportit** (Capo Triporti), **Punta Ragusa** and **Baia di San Vasilio** (both on the island of Karaburun) (Volpe/Leone/Turchiano 2011), **Apollonia** (Lamboley/Vrekai 1999; Shpuza 2007-2008), **Shkodër** (Lahi 2009, 107; Shpuza 2007-2008), **Vlorë**, **Selcë**, **Lezhë** and **Sarande** (Shpuza 2007-2008), and in **Dimal** and **Antigoneia** (Saraqinisht) (Lahi 2009, 156), **Sazan*** (http://www.archive.xray-mag.com/content/roman-shipwreck-full-wine-jars-found-adriatic), and **Phoenika** (Esquillini 2011a; 2011b).

Greece (16): For **Athens**, see Grace 1961, fig. 36; for **Delos**, see Grace 1934, 294-295, P 285, 288, 498, fig. 3 and 4; Lyding Will 1970, 383, n° 1-4, 15, 18-22, tav. 45, , D 122 and 123; Empereur 1983, 882-886; and Tchernia 1986, 72; for **Rhodes** and **Cos**, see Tchernia 1986, 72, note 97; for **Thasos B***, see again Tchernia 1986, 72; and Parker 1992, 1147; for **Antikythera A***, see Grace 1965, fig. 1, n° 11; Parker 1992, 44; for finds on the **actual island**, see Quercia et al. 2011, 27, n° 41-42); for **Siphnos***, see Lawall 2006, 272; for **Tinos**, see Étienne et al. 1986, 255-256; for **Malta** (Tas-Silg), see Cipriano/Carre 1989, 99, referring to Ciasca 1967, 37, fig. 5.2. Other sites in Greece include **Pella** (Cipriano/Carre 1989, 99), **Corinth** (Romano 1994, 88, n° 67-69, fig. 13, pl. 26-27; Slane 2008, 237, note 3), **Aeropolis*** (Parker 1992, 54), **Argos** (Abadie-Reynal 1995, 2) **Cylene** (Desy 1989, 58, n° 320); see also Cipriano/Carre 1989, 99, and **Marëgëllic** (Ceka 1986).

Turkey (7): For **Ephesus** (Tetragona Agora, Serapeion, Terrace Houses), see Bezeczky 2001, 11, n° 5-6 and 124, Taf. 2: 5-6, 125, Taf. 3: 5-6; 18, n° 37-45, and 120, Taf. 8: 37-45; 2004, 88, fig. 1.6; 2006, fig. 6, 52; and 2010, 352, fig. 1, no. 2. Other sites in Turkey are **Bodrum** (unpublished; Tchernia 1986, 72, n. 97; Cipriano/Carre 1989, 99), **Pessinus** (Monsieur 2001, 75, 80, fig. 11 and 12; 2 fragments), **Halikarnassos** (Cipriano/Carre 1989, 99; Alpözen et al. 1995, 105), **Issos** (Rauh 2000, 183, note 38); **Alanya** (Sibella 2002, 8, fig. 10, Inv. No. 174.1.95), and **Kizil Burun*** (Izmir) (OXREP).

Israel (3): **Jerusalem** (Avigad 1970, 140, tav. 34 B; Finkielsztejn 2000, 213), **Herodium** (Avigad 1970, 140), and **Masada** (Avigad 1970, 140); see also Cipriano/Carre 1989, 99.

Egypt (2): For the shipwreck QB1* in **Alexandria** (Rocher du Diamant), see Empereur 1998a, 614-615; for the Lamboglia 2 present in the museum of **Alexandria**, see Tchernia 1986, 72, note 97; and Empereur 1998b, 396, fig. 8; see also Cipriano/Carre 1989, 99.

Tunisia (3): Examples are known from **Uzita** (Van der Werff 1982, 180-181, tav. 52, 5-6), **Bulla Regia** (Broise/Thébert 1993), and **Carthage** (Martin-Kilcher 1993, 307).

Morocco (2): Examples have been found at **Tetouan** (Cipriano/Carre 1989, 99) and **Dchar Jdid** (Akerraz et al. 1981, 206).

Libya (1): **Berenice** (Riley 1979, 152).

France (47): **Monaco*** (Fiori 1972, 116, fig. 1), **Cap Roux*** (Joncheray 1974, 164-165), **La Tradelière*** (Carrazé 1976, 72, fig. 6), **Chrétienne A*** (Benoit 1956, 30, and 25, fig. 2, 18), **Dramont A*** (Santamaria 1975, 185), **Ilôt Barthélémy *** (Liou/Pomey 1985, 570, fig. 22-23, n. 12), **Fourmigue C*** (Liou/Pomey 1985, 574, fig. 25, 3; Parker 1992, 425), **Cavalière*** (Charlin et al. 1978, 18-23, fig. 11,5; 12, 1-2; Parker 1992, 282), **La Madrague de Giens*** (Tchernia et al. 1978, 46, fig. 17, 1, 2), **Hyères*** (Tchernia 1969, 474-475, fig. 18), **Planier 3*** (Tchernia 1968-70, 60), **Plane 1*** (Lequément/Liou 1977, 588; Liou/Pomey 1985, 557, fig. 12), **Fos*** (Arch. Sous-marine s.l.c. de France 1985, 100, n° 428; Amar-Liou 1984, 157-159), **Martigues** (Chausserie Laprée/Nin/Domallain 1985, 38, n° 149), **Sète*** (Tchernia 1969, 492, fig. 48), **Région de Montpellier** (Lamour-Mayet 1980, n° 14-15; 1981, n° 57-61), **Côte languedocienne*** (Granier 1965, 258-259, fig. 6,2), and **Rogliano** (Corse) (Galup et al. 1973, 24, n. 330, fig. 33); see also Cipriano/Carre 1989, 98. More recent attestations in France include **Mouliets-et-Villemartin** (Gironde) (Benquet/Piot 2000, 156, Tableau 1, 158), the oppida of **Gergovie** and **Corrent** (Puy-de-Dôme) (Loughton/Jones 2000, 74), **Chrétienne M*** (Joncheray 1998; Olmer 2013, 320, fig. 5), **Saint-Amand-sur-Ornain** (Cul de Breuil, Meuse) (Olmer 2013); **Dramont C*** (Parker 1992, 373; Joncheray 1994; BS 1998=Garmy 1998, 52), **Anse de Montfort 1*** (BS 1995=Garmy 1995, 35), **Est Brescou*** (Brescou, Languedoc-Roussillon) (BS 2003, 55-56), **Sud Caveaux 1*** (Bouches-du-Rhône) (BS 1996, 84-86), **Est Perduto 2*** (BS 2005, 96-97), **Pointe de la Valle*** (Bouches-du-Rhône) (BS 1999=Gutherz 1999, 53; 2004, 73), and **Toulouse** (Benquet/Grizeaud 2009); see also Loughton 2003, who mentions a total of **47** findspots in France.

Spain (60): **Numantia** (Caceres) (Albrecht/Loeschcke 1942, 122, fig. 22), **Cadaqués** (Oliva Prat 1961, 242,, fig. 21), **Sa Nau Perduda*** (Foerster/Pascual 1970, 291, fig. 11, 300, fig. 15), **Azaila** (Cabré-Aguiló 1944, 97, tav. 60, n° 13, 15 and 16), **Benicarló**, **Burriana** and **Castellón** (Ribera Lacomba/Ripolles Alegre 1977, 159-160, and 161F, fig. 1.4, 1.4bis), **Provincia di Castellón*** (Fernandez Izquierdo 1980, 157, fig. 4.6, 168, fig. 8.3, 8.6, 178, fig. 10, 2-3, 187, fig. 13.6), **Torre de la Sal*** (Blanquez Perez 1982, 48, fig. 5-7; Fernandez Izquierdo 1986), **Sagunto** (Aranegui Gasco 1982, 87-88, tav. XXI, 2 and fig. 36.7), **Valencia*** (Martin/Saludes 1966, 164, fig. 10.3 and tav. IIIc, 166, fig. 12), **Mallorca** (González Serrano 1963, 209, fig 2.9), **Sant Jordi*** (Cerda Juan 1980, fig. 120-131); **Cáceres** (Castra Cecilia) (Beltrán Lloris 1970, 350, fig. 129.1), **Elche** (Beltrán Lloris 1970, 344, fig. 131), **Punta de Algas*** (Mas 1969-70, 410, fig. 2), **S. Pedro del Piñatar*** (Beltrán Lloris 1970, 354, fig. 130, 1-2), **Cabezo Agudo** (Fernández de Aviles 1942, 136, fig. 9), **Belo** (Domergue 1973, 49, n° 1820-1824, fig. 15, 56, n° 1291, fig. 18, 66, n° 1097-1098, fig. 22), and **Galicia*** (Tchernia, 1980, 305 and n. 5); see also Cipriano/Carre 1989, 98-99. Findspots from more recent publications include **El Molinete** (Carthago Nova, Murcia) (Molina Vidal 1997; 2013), **Punta Salines**, **Llafrac**, **Castell-Barri**, **Sant Feliu de Guixols**, **Turó Rodó**, **Blandae**, **Burriac**, **Iluro**, **Vilassar-Cabrera de Mar**, **Baetulo**, **Barcino**, **Les Sorres**, **Tarraco**, **Vinaroz**, **Las Piedras Barbadas**, **Alcocebre**, **Morro del Gos**, **Ben-Afelí**, **Columbretes**, **Almenara**, **Valentia**, **El Saler**, **Cullera**, **Ebussus**, **Dianium**, **Duanes**, **Tossal de la Cala**, **Villaioyosa**, **Lucentum**, **Portus Illicitanus**, **Guardamar**, **Isla Grosa**, **San Pedro del Pinatar**, **Rada del Estacio**, **El Mojón**, **Portman**, **Mazarrón** and **Emporion**, all lying along the Mediterranean coast of the Iberian peninsula (Molina Vidal 1997).

Portugal (1): **Mertola** (De Sa 1905, 99; Cipriano/Carre 1989, 99).

Germany (4): Tchernia 1986, 127, note 7 (**Neuss**, **Cologna**); and Lyding Will 1987 (**Manching**); and Albrecht/Loeschcke 1942, 101, tav. 17,6 and 18,3 (**Oberaden**).

Austria (4): Tchernia 1986, 69 (**Vienne**); and Schörgendorfer 1942, 64, tav. 44, n° 456 (**Enns**); for **Magdalensberg** in particular, see Maier-Maidl 1990, 64; 1992, 13; and Bezeczky 1994, 13,

Fig. 1 e,f; 1998, 228; for **Haltern**, see Loeschcke 1909, 257-258; **Gurina** (Jablonka 1992, Pl. 99, 1-4).

Picenian Dressel 6A

C. IUL POLY/BARBVL (11): Findspots in **ITALY** include **Fermo**, **Monterubbiano**, **Ascoli Piceno** (Brecciaroli Taborelli 1984, 73-75, 76-79), **Aquileia** (unpublished fragment from the museum, Inv. 171: Cipriano/Carre 1989, 99), **Verona** (Pesavento Mattioli 1998a, 317, n° 8; Pavoni/Belotti 2005, 186, n° 2), **Milano** (Mello et al. 1982, Tab. 1, M18; Brecciaroli Taborelli 1984, 76, n° 9), **Ivrea** (Barocelli 1918, 21; Brecciaroli Taborelli 1984, 76, n° 10), and **Vercelli** (Ferrero 1891, 53; Brecciaroli Taborelli 1984, 79, n° 11); for **Rome**, see CIL XV, 2, 3410; and Brecciaroli Taborelli 1984, 76, n° 5; Cafini/D'Alessandro 2010, 98; and D'Alessandro 2013, 356-357; for another stamp with (P)OLY from **Alba Pompeia**, see Bruno 1997, 530; for **LIBYA** (unpublished fragment), see C. Panella in Cipriano/Carre 1989, 99 (**Apollonia-Susa**).

BAR/ L. BAR (6): The stamp has been attested in its most simple form on an amphora at **Vercelli** (Ferrero 1891, 52), **Padova** (Mazzocchin/Tuzzato 2007, 131, n° 15b), and one at **Este** (Fiorelli 1885, 9); in association with L. LAET. ARG, it has been found at Este (Callegari 1928, 5, fig. 1-3) and **Monteu da Po** (Industria) (Ferrero 1903, 46); in association with SEX. IVL. ORP it is known from **Vercelli** (Ferrero 1891, 53, n° 10; see also Brecciaroli Taborelli 1984); a stamp with BARB, interpreted as being the initial part of Barbul(ae)//C. Iul(i) Poly (-) is also known from **Padova** (Mazzocchin/Tuzzato 2007, 131, n° 1).

T.H.B. (30): Findspots in Italy include **Verona** (*NSc* 1881; 12; Buchi 1967, 26-27, n° 3; Pesavento Mattioli 1998, 319, n° 40; Pavoni/Belotti 2005, 187, n° 5), **Aquileia** (Suppl. It, 1077, 8a; 1077, 76a; inventory of the museum), **Concordia** (*NSc* 1878, 54; Suppl. It. 1077, 8b; NSC1880, 428; Suppl. It. 1077, 76b), **Oderzo** (*NSC* 1883, 196; Suppl. It. 1077, 8c; Cipriano/Ferrarini 2001, 104, n° 9), **Altino** (7 ex.) (Marcello 1956, 106; Toniolo 1991, 202-203, and 334), **Este** (2 ex.) (NSc, 1885, 8; Suppl. It. 1077, 8d; NSc 1948, 4; Toniolo 1988, 51, n°28, and 47, n° 1 and fig. 1; Blanc-Bijon et al. 1998, n° 851 and 854), **Adria** (Toniolo 1987, 100, n° 16), **Pegognaga** (San Lorenzo-Mantova) (3 ex.) (NSc 1885, 31; Bottura 1992, 72, tav. 1.416; Toniolo 1996, 249, fig. 30.7 and 250, fig. 30.9), **Cremona** (Arcari 1996, 187), **Padova** (7 ex.) (Pastore 1992, 136, and 139, tav. 19, n° 102; Via Gattamelata, Via San Gaetano; Cipriano/Mazzocchin 2011, 357, Tabella 3, n° 7; 360, Tabella 4, n° 5) (via Acquette, Mazzocchin/Tuzzato 2007, 126, 131-132, n° 6 and 27), **Gavello** (Rovigo) (Zerbinati 1970, 120, n° I; Mordrzewska-Pianetti 2002, 398-399, figs. 5-7), **San Bellino** (Rovigo) (Zerbinati 1970, 125, n. I), **Bergamo** (Suppl. It. 1077, 8f), **Alba Pompeia** (Bruno 1997, 530), **Milano** (Baldacci 1967-68, 29, 37; Bruno/Bocchio 1991, 266, tav. CXV,n° 58), **Vercelli** (2 ex.) (*CIL*, V, 8112, 43a-b; *NSc* 1901, 314, Carre et al. 1995, n° 223), **Ivrea** (Baldacci 1967-68, 29, n° 37), **Tortona** (*NSc* 1897, 373; Blanc-Bijon et al. 1998, n° 853), **Modena** (*CIL*, XI, 6695, 46; Mongardi 2014), **Reggio Emilia** (*NSc* 1953, 216), **Boretto Reggio Emilia** (*NSc* 1932, 185-186), **Ordona** (Volpe 1990, 236; Blanc-Bijon et al. 1998, n° 852), **Vicenza** (3 ex.) (Mazzocchin 2013, 100, fig. 4.5a), **Novara** (Scafile 1980, 221), and **Ostia** (*NSc* 1913, 295; Zevi 1967, 22; and Hesnard 1980, 144). Outside Italy, the stamp has only been found in **Salzburg** (Heger 1986), **Carthage** (*CIL*, VIII, 22637, 47; Callender 1970, n° 1717, and fig. 24), **Athens** (*CIL*, III, 7309, 9), **Paphos** (Cyprus) (Sztetyllo 1991, 101, n° 246-247) and **Mainz** (Callender 1970, 258, n° 1717; Ehmig 2003, n° 251).

L. TARI/LTARI/LTARIRVFI/L.T.R (15): Dressel 6A examples have been found in **Fermo** (Marche) (*CIL* IX, 6080, 22), **Cecina** (Toscana) (*CIL* XI, 6695, 81, RVFI), **Reggio Emilia** (Emilia Romagna) (Degani 1967, 14, fig. 10), **Novara** (Piemonte) (Scafile 1980, 221), **Este** (Veneto) (*CIL* V, 8112, 78; and Toniolo 1988, 49; Blanc-Bijon et al. 1998, n° 879), **Aquileia** (Friuli-Venezia Giulia) (unpublished fragment in the museum, inventory nr. 171), **Carlino** (Udine) (Buora et al. 1989, n° 2, fig. 2; Blanc-Bijon et al. 1998, n° 880), **Val Pagliaga** (Altino

(Toniolo 1991, 52, fig. 83), **Cremona** (Arcari 1996, 187), **Padova** (Cipriano 1992, n° 232; Pesavento Mattioli/Cipriano 1994, 518, 2.2, and 519, 2.3; Pastore 1992, 136 and 139, tav. 17, fig. 101, and tav. 19, fig. 103-104; see also Mongardi 2014), **Pegognaga** (San Lorenzo) (Toniolo 1996, 247, figs. 30.6, 36.6), and **Rome** (D'Alessandro 2013, 358-359); see also Sasel 1982, 563; Carre 1985, 211, n. 12; Tchernia 1986, 131-132, 134, 192-193, 220; and Cipriano/Carre 1989, 86-87, 99; an example is also known from an unidentified amphora at **Tortoreto** (*CIL* IX, 6080, 32). Outside Italy, examples are known at the sites of **Magdalensberg** (Austria) (Egger 1959, 151; 1961, 180, n° 34; and Maier-Maidl 1992, 91-92) and **Sisak** (Croatia) (*CIL* III, 12010, 30; see also Sasel 1982; Sasel/Marusic 1984, 314; Tchernia 1986, 172; and Cipriano/Carre 1989, 99).

L. SALVI (19): The first findspots were assembled by Baldacci: **Aquileia** (unclassified; see also Zevi 1967, 26), **Verona**, **Ivrea** (*CIL* V, 8112, 75, unclassified), **Baggiovara** (Modena) (*CIL* IX, 6695, 83, unclassified), **Lomello** (Padova) (Baldacci 1967-68, 32, n° 50), and **Narona** (Croatia) (Baldacci 1967-68, 32, n° 50). On Dressel 6A types, the stamp has been further recognised in **Verona** (*CIL* V, 8112, 73; Pesavento Mattioli 1998, 318, nn. 21-22), **Aquileia** (Carre 1985, 223, n. 72, Inv. 278, 300), **Modena** (Blanc-Bijon et al. 1998, 134, n° 875), **Pisa** (Pesavento Mattioli et al. 2000, 146, n. 809), **Oderzo** (Veneto) (Cipriano/Ferrarini 2001, 112, n. 17) and **Peripato** (Taranto) (Palazzo 1988, 76, n° 9.2j, pl. 6 and 8; Blanc-Bijon et al. 1998, n° 876); another un-identified type in **Padova** also bared the name (Pesavento Mattioli 1992, 26); see also Branchesi 2007, 241, note 9. The inclusion of **SALV(I)** would further amplify the distribution area of these amphorae to **Cremona** (Lombardy) (Bruno 1995, 260, n° 101, Lamb. 2), **Padova** (Cipriano 1992, 64, tav. 4, fig. 18), **Carthage** (*CIL* VIII, 22637, 94a.b), **Henschir** (Tunisia) (*CIL* VIII, 22637, 94c; see also Desy 1989, 161, n° 1266, un-identified forms), and **Bibracte** (France) (Olmer 2003), and **Pula** (Istria) (Starac 2008, 122).

M. HER PICEN(T) (21): Said stamps have been found in **Aquileia** (*CIL* V, 8112, 44 a), **Altino** (Toniolo 1991, 81, and 180-181), **Duino** (Friuli-Venezia Giulia) (Tassaux 1983, 207, nt. 34a), Cividale (Friuli-Venezia Giulia) (*CIL* V, 8112, 44b), **Codroipo** (Friuli-Venezia Giulia) (Buora 1995, 183; 1999), **Este** (Veneto) (*NSC* 1928, 22; 1948, 4), **Padova** (Pesavento/Zanini 1993, 46-47; Cipriano/Mazzocchin 2011, 357, Tabella 3, n° 9 and 10; 360, Tabella 4, n° 3; Mongardi 2014), **S. Cesario sul Panaro** (*NSc* 1876, 67 = *CIL* XI, 6695, 49a-b), **Milano** (Bruno/Bocchio 1991, 266, tav. CXV, n° 56, and tav. CXXVI, n° 11-12), **Tortona** (Dertona) (Piemonte) (Antico Gallina 1989, 641; 1990, 209, n° 26; see also Andermahr 1998, 292, n. 1), **Modena** (Emilia Romagna) (*CIL* XI, 6695 49c), **Castelnuovo Rangone** (Modena) (Cardarelli/Malnati 2009, 24-25, scheda CR 12; see also Mongardi 2014), **Reggio Emilia** (Castelnovo di Sotto) (*CIL* XI, 6695, 49d-e), Parma (Emilia Romagna) (*CIL* XI, 6695, 49f; Fortini 1998, 48, note 67), **Brescia** (Lombardy) (Buchi 1975, 255, n. 2, tav. X, 2 a-b), **Verona** (Veneto) (Buchi 1973, 573-575, n. 14, tav. V, 14), **Canosa** (Puglia) (Volpe 1990, 238; Morizio 1990, 314, Instr. 27; Andermahr 1998, 292, n. 1), **Novara** (Scafile 1980, 221), and in **Rome** (*CIL* XV, 2, 3466 a-b). Outside Italy, these have been attested in **Magdalensberg** (Jobst/Piccottini 1986, 260, n. 2 and tav. XXIII), **Athens** (Greece) (*CIL* III, 7309, 10), **Carthage** (Tunisia) (*CIL* VIII, 10477, 4; 22637, 50a and b = Delattre 1894, 115, n° 36), and **Ephesus** (Turkey) (Bezezcky 2001, 11, n° 7 and 124, Taf. 2: 7, 125, Taf. 3: 7; 2010, 353).

M. HER PHA(E) (21): **Cupra Marittima** (Marche) (Fortini 1993, 126, 10, and 94, fig. 6), **Trieste** (Friuli-Venezia Giulia) (Sticotti 1908, 338), **Aquileia** (*NSc* 1930, 439), **Altino** (Veneto) (Marcello 1956, 106; Toniolo 1991, 180, n° 31, 48, fig. 67), **Este** (Callegari 1928, *NSc*, 4; Toniolo 1988, 47, n° 2, 50, n° 16), **Adria** (Veneto) (*CIL* V, 8112, 45a), **Verona** (Pesavento Mattioli 1998, 318, n° 26), **Oderzo** (Cipriano/Ferrarini 2001, 105, n° 10), **Padova** (Via Gattamelata, Via San Gaetano) (Cipriano/Mazzocchin 2011, Tabella 3, n° 8; 360, Tabella 4, n° 4), **Milano** (Lombardy) (Frova 1952, 73, n. 24), **Inveruno** (Lombardy) (Bertolone 1939, 43), **Tortona** (Piemonte) (*NSc* 1897, 373, n. 13, 380, n. 1; Baldacci 1967-68, 28; Antico Gallina 1989, 641; 1990, n° 25), **Ivrea** (Piemonte) (*BTorino* 2, 1918, 21), **Susa** (Piemonte) (*CIL* V, 8112, 45b), **Parma** (Cipriano/Carre 1989, 100), **Ferrara** (Emilia Romagna) (Guarnieri 1982, 74, n. 2),

Modena (Novi Sad) (Mongardi 2014), **Novara** (Scafile 1980, 221), and **Pompeii** (Campania) (*CIL* IV, 9653; Zevi 1968, 27); outside Italy: **Emona** (Bezeczky 1994b, 26-28), and **Magdalensberg** (Jobst/Piccottini 1973, 313, n. 4, tav. IX, 4; Bezeczky 1994b, 26-28).

M. HER PRISC (7): Trieste (*CIL* V, 8112, 46a), **Aquileia** (example in the museum, *S.I.* 1077, 117), **Mantova** (*CIL* V, 8112, 46b), **Modena** (Cipriano/Carre 1989, 100, referring to Carpi 1984, 97, fig. 21), **Bologna** (Emilia Romagna) (Scagliarini 1969, 159-160, n. 5), **Ordona** (**PRI**) (Volpe 1990, 237), and in **Rome** (*CIL* XV, 2, 3467); outside Italy again **Magdalensberg** (Jobst/Piccottini 1986, 269, n. 6 and tav. XXIX); see also Cipriano/Carre 1989, 100).

M. HER REN (1): **Cividale** (*CIL* V, 8112, 47).

HERENNIA (5): **Tortona** (*NSc* 1897, 373, 12; Baldacci 1967-68, 32; Antico Gallina 1989, 641; 1990, 209, n° 24), **Modena** (Novi Sad) (Mongardi 2014), **Ergastolo di Spilamberto** (Mongardi 2014), and **Concordia** (Belotti 2004, 48, n° 51; Mongardi 2014).

P. HERENNI (1): In **Padova**, a Dressel 6A with the stamp P. HERENNI is known from the drainage structure in Via Paoli (Cipriano/Mazzocchin 2011, 356, Tabella 1, n° 2).

HEREN. FLA (1): **Gojca** (Hvar) (Gaffney et al. 1997, 110).

SAFINIAEPICEN (15): In particular for **Padova**, see Cipriano 1992, n° 103, tav. 8, fig. 43, and n° 235, fig. 106; Pesavento Mattioli/Cipriano 1992, 521, 3.1, and 522, 3.2; and Mazzocchin/Tuzzato 2007, 126, 130-131, fig. 7, 3; for via A. Mario, see Pastore 1992, 109, n° 235 and fig. 106. Other sites include **Aquileia** (*SI* 1077, 130), **Este** (Toniolo 1988, 54, n° 43; *SI* 1077, 140; Blanc-**Bi**jon et al. 1998, n° 874), **Altino** (Toniolo 1991, 181, n° 32), **Vicenza** (Mazzocchin 2013, 103, fig. 4.9a), **Ostiglia** (Mantova) (Calzolari 1986, 117-120, 150-225, 119, n° 20), **Verona** (Pesavento Mattioli 1998, 318, n° 34; Pavoni/Belotti 2005, 187, n° 5), **Novara** (Scafile 1980, 221), **Imola** (Mongardi 2014, unpublished), **Modena** (Mongardi 2014, Novi Sad) and **Bologna** (*CIL* XI, 6695, 82a and 82b), **Vercelli** (*CIL* V, 8112, 74), **Suasa** (Gamberini 2011; 2014), and **Rome** (*CIL* XV, 3519; Ferrandes 2008, 251, fig. 2d-e; D'Alessandro 2013, 358-359). Outside Italy it has only been attested in **Carthage** (*CIL* VIII, 22637, 92-93).

Dressel 6A

Italy (47): Besides the aforementioned findspots of Dressel 6A, we can add further attestations in **Cupra Montana** (Polidori 2000, 196), **Fossombrone** (ca. 150 ex.) (Leone 2012), **Rome** (*CIL* XV, 4852; Carre 1985, 213; Hesnard 1980, 144); **Ostia** (Zevi/Pohl 1970, 127; Carre 1985, 213; and Hesnard 1980 for 42 examples at the depot of La Longarina), **Precenicco** (Udine) (Gomezel 1992, 531-532, n° 3; Ant. Inv. n° 2058, 534-535, n° 9, Musei Civici Inv. n° 265678), **S. Lorenzo di Parabiago** (MI) (Scotti 1996, 163), **Brescia** (Bruno 1996, 199), **Milano** (Bruno/Bocchio 1991, 266-267, Tav. CXIV-CXV), **Alba Pompeia** (CN) (Bruno 1997, 517-518), **Lodi Vecchio** (Cecchini/Ridolfi 2010), **Ghemme** (Spagnolo Garzoli 1996, 252), **Vercelli** (Facchini 1996, 195), **Verona** (*NSc* 1881, 12; Pavoni/Belotti 2005), **Chieri** (Riva 1987, 90-92), **Calvatone** (Bedriacum) (Volonté 1996, 191), **Cividate Camuno** (Bocchio 2004, 258), **Padova** (Cipriano et al. 1991; Cipriano 1992, n° 294; Pesavento Mattioli/Cipriano 1992, 523, n° 4: Pesavento Mattioli/Mazzocchin/Pavoni 1999; Mazzocchin et al. 2006; Cipriano/Mazzocchin 2011), **Modena** (Scotti 1989, 93, Fig. 60,3), **Ferrara** (Mesola) (Lodi 2014) (one fragment of a smaller northern Italian type, not the larger Picenian type), **Suasa** (Marche) (Saracino/Vergari 1997), **Pesaro** (Marche) (Bartolini 2008, 104-105), **Ancona** (Quiri 1985; Marengo 2007; Forti 2011), **Urbino** (Mercando 1982), **Potenza Picena** (Mercando et al. 1979d), **Cone di Arcevia** (Mercando 1979), **Porto Recanati** (Mercando 1979c), **Tavernelle** (Leone 2012, 220), **Fano** (Dolci Santià 1983, 123-125), **Senigallia** (Carre 2002, 82-86), **Civitanova Marche** (Profumo 1986, 45-46), **Porto S. Elpidio** (Profumo 1986, 45-46), **Porto S. Giorgio** (Profumo 1986, 45-46), **Cupra Marittima** (Fortini 1993, 91-95), **Fermo** (Lilli 1994-1995, 237), **Ordona** (Volpe 1990, 236), **Lucera** (Volpe 1990, 232), **San Paolo di Civitate** (Volpe 1990, 229), **Canosa** (Volpe 1990,

238), **Barletta** (Volpe 1990, 241), **Bisceglie** (Salsello) (Volpe 1990, 241), **Margherita di Savoia** (Volpe 1990, 247), **Trinitapoli** (Volpe 1990, 245), **Manfredonia** (Volpe 1990, 246), and **Mattinata** (Volpe 1990, 247), **Venezia** (Canale Rigà) (Lio Piccolo) (Canal 2013, 440, 163.1b), **Venezia-Palude Maggiore – canale Catene** (Canal 2013, 441, fig. 165.1), **Venezia – Canale Rigà – Lio Piccolo** (Canal 2013, 439, fig. 163.1a, stamp MCA AIS); **Venezia-Canale S. Felice – Argine** (Canal 2013, 260, fig. 113.4b).

Greece (1): **Antikythera** (Quercia et al. 2011, 28, n° 43).

France (1): **Toulouse** (Benquet/Grizeaud 2009).

Austria (1): **Magdalensberg** (Bezeczky 1998, 230).

Tunisia (1): **Carthage** (Delattre 1894; Carre 1985, 211; Martin-Kilcher 1993, 317, Abb. 1, n° 122).

Noricum and *Pannonia* (8): **Emona**, **Siscia**, **Sirmium**, **Salla**, **Savaria**, **Balaca**, **Lauriacum**, **Devin**; in general, see Bezeczky 1994b, 33, fig. 8.

Libya (1): **Leptis Magna-Silin** (Munzi et al. 2004).

Croatia (3): **Gojca** (Hvar) (Gaffney et al. 1997, 110), **Kopiste** (Lastovo) (Jurisic 2000, 12), **Lirica** (Peljesac peninsula) (Jurisic 2000, 12).

Funnel-shaped amphorae

Roman Italy (93): **Rome** (Cafini/D'Alessandro 2010), **Avigliana** (TO) (Brecciaroli Taborelli et al. 2000b, 210, and Tav. LXXI, n° 11 and 12), **Rosta** (TO) (Brecciaroli Taborelli et al. 2000a, 204), **Torino** (Quiri 2009), **Susa** (Debergh 1978-79, 56, A6), **Chieri** (TO) (Riva 1987, 101), **Ivrea** (Brecciaroli Taborelli 1998; Brecciaroli Taborelli et al. 2007), **Cerrione**, **loc. Cascina Vignazza** (BI) (Brecciaroli Taborelli 1996, Tav. LXXXIX, b), **Alba Pompeia** (CN) (Bruno 1997, 518-519), **Alba, Palazzo Calissano** (Cagnana 1994, 116, and Tav. XXXIV, 12), **Asti** (Zanda/Pejrani 1986, 104, n° 1; Zanda/Soma 1994, 177, n° 1, tav. XLIV, T. 13, n° 1, Hasta), **Vercelli, Monastero della Visitazione** (Panto 1984, 147, tav. LIX, n° 11; Facchini 1996, 196), **Alessandria, fraz. Villa del Foro** (Facchini 1995, 313, Tav. CXXVI, 16-17), **Ghemme, largo Gianoli** (NO) (Spagnolo Garzoli 1996, 252), **Libarna** (Bruno 1998), **Legnano** (MI) (Scotti 1994), **S. Lorenzo di Parabiago** (MI) (Scotti 1996, 167), **Como, Porta Pretoria** (Bruno 2005), **Como, vari scavi in città** (Jorio 2007), **Clastidium** (PV) (Vecchi 1999), **Milano** (Bruno/Bocchio 1991, 269-270) **Milano Metropolitana** (Bruno/Bocchio 1991, 269-270, tav. CXVI, n° 86-91; Bruno 2003), **Milano**, Università Cattolica (II livello) (Bruno/Bocchio 1991; Bruno 2003), **Chiavenna** (SO) (Mariotti 1989; Bruno 2005), **Cremona, via Massarotti** (Manzia 1996), **Calvatone/Bedriacum** (CR) (Volonté 1996, 192; Facchini 1997), **Brescia, S Giulia** (Bruno/Bocchio 1999, 232-233), **Brescia, Capitolium** (Bruno 2002), **Brescia, Liceo Arnaldo, ex Chiesa S. Barnaba** (Bruno 1996, 199-200), **Brescia, via A. Mario** (Bruno 1988), **Remedello** (Bruno 1996, 205, note 5), **Nave** (BS) (Jorio 1987, 185), **Cividate Camuno** (BS) (Bocchio 2004, 256, 259), **Salò** (BS) (Bruno 1989, 644, n° 6; 1996, 205, note 5), **Desenzano** (Bruno 1989, 644, n° 6), **Reggio Emilia** (Pellegrini et al. 1996), **Mantova** (Scalari 1999), **S. Lorenzo di Pegognaga** (MN) (Toniolo 1996), **Peschiera** (VR) (Benvenuti 1999-2000), **Verona, via Campofiore** (Pesavento Mattioli et al. 1999), **Verona, Collezione del Museo Archeologico** (Pavoni/Belotti 2005), **Verona, via Ponte Pietra** (Biondani 1998), **S. Maria di Zevio** (VR) (Salzani/Biondani 1999), **Covolo di Camposilvano** (VR) (Salzani 1998), **Trento, Palazzo Tabarelli** (Maurina 1995, 230-231; Oberosler 2002, 336, fig. 10.3), **Trento, Porta Vernonensis** (Perinelli 2002-2003, 33, 106-108), **Doss Zélor** (Val di Fiemme) (Panciera/Mengotti 1991, 151, fig. 172), **Monte S. Martino** (Bassi 2007, 270-272), **Ponte Gardena** (Dal Ri et al. 2013, 18, note 51), **Oberstimm** (Bezeczky 1987), **Padova, Roncaglia** (Pesavento Mattioli et al. 1993), **Padova, via Beato Pellegrino** (Mazzocchin/Pastore 1995), **Padova, via Paoli** (Ruta et al. 1999), **Padova città** (i depositi di Piazza Gasperi, Cipriano 1992, 62, and 69, Grafico 2; Pastore 1992), **Padova, largo Europa** (Pizzolo 1994-1995), **Padova, Museo Civico** (Zanini 1992-1993), **Padova, anfiteatro romano** (Mazzocchin et al. 2006), **Villadose** (RO) (Facchini/Marini 2008), **Adria** (RO) (*NSc* 1879, 105; Carre 1985),

Classe (RA) (Stoppioni 1990), **Laguna di Venezia I** (Roncaglia di Ponte San Nicolò) (Pesavento Mattioli et al. 1993), **Laguna di Venezia II**(Canale dei Bari – loc. Chiese Bruciate) (Canal 2013, 442, fig. 165.3), **Laguna di Venezia III** (Canale S. Felice) (Canal 2013,), **Laguna di Venezia IV**, (Canale Rigà) (Canal 2013, 440, fig. 163.1c), **Torcello** (VE) (Dorigo 1983), **Oderzo** (TV) (Cipriano/Ferrarini 2001), **Rimini** (Biondani 2005), **Altino** (VE) (Toniolo 1991), **Altino (VE), porta urbica** (Cipriano/Ferrarini 2001), **Littamum** (S. Candido, BZ) (Maurina 2005), **Caorle** (VE) (Cacciaguerra 1990; 1996), **Concordia** (VE), via Fornasatta (Belotti 2004), **Portogruaro** (VE) (Cacciaguerra 1990), **Castelraimondo** (UD) (Bonini 2009), **Aquileia** (UD) (Carre 1985; Scavi ad Aquileia 1994), **Aquileia,** Canale Anfora (unpublished), **Trieste, piazza Barbacan** (Maselli Scotti et al. 2003), **Cervignano** and **Treviso** (Tiussi 2010), **Porto Recanati** (Mercando 1974; 1979), **San Severino Marche** (Mercando 1974), **Cupra Maritima** (Fortini 1993), **Treia** (Vermeulen/Monsieur/Boullart 2001, 65, fig. 16, 22-23), **Fermo** (Menchelli 2012, 70; Menchelli/Picchi 2014, 11-12), **Suasa** (Gamberini 2014, 551, 3 examples), **Giulianova** (TE) *CIL* IX, 6080, 14), **Margherita di Savoia** (FG) (Volpe 1990, 244), **Rovigno** (Bezeczky 1987), **Loron** (Mazzocchin in Rosada 2005), and **Pola** (Carre 1985).

Pannonia: (11) **Vindobona** (Bezeczky 2005), **Carnuntum** (Bezeczky 2005), **Gorsium** (Bezeczky 1994c; 2005), **Emona** (Bezeczky 1987; 1994b; 2005), **Poetovio** (Bezeczky 1987; 2005), **Aquincum** (Bezeczky 2005), **Salla** (Zalalövö) (Bezeczky 1982-83, 155, pl. 5, and 375, n° 18-28; 1987; 2005; Kelemen 1988), **Savaria** (Kelemen 1988; Bezeczky 2005), **Tokod** (Kelemen 1988; Bezeczky 2005), **Mursa** (Bezeczky 1994d), and **Fluvio Frigido** (Aidussina) (Vidrih Perko/Zbona Trkman 2005).

Noricum: (3) **Magdalensberg** (Bezeczky 1994a; Schindler Kaudelka 2000), **Teurnia** (St. Peter im Holz) (*CIL* III, 12010, 27; Carre 1985), and **Villandro-Plunacker** (Dal Ri et al. 2013).

Germania Superior: (1) **Aventicum** (Avenches) (Ettlinger 1977, 11, and 13, fig. 1; Bezeczky 1987).

Raetia: (1) **Cambodunum** (Kempten) (Schimmer 2009).

Dalmatia: (3) **Skoljic*** (Unije) (Jurisic 2000, 22), **Narona** (Topic 2003), **Brjiuni** (Jurisic 2000, 22).

Greece: (2) **Corinth**, and **Athens** (both unpublished, see Mazzocchin 2009, 201, note 59).

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Italy: (21) **Suasa** (Gamberini 2014, 558-559), **Asti** (*CIL* V, 8111, 1), **Vercelli** (*CIL* V, 8111, 3; and Bruzza 1874, 185, n° 1-6), **Como** (Muffatti Musselli 1987, 190; Facchini/Leotta 2005, 164), **Chiavenna** (*CIL* V, 8111, 1; and Muffatti Musselli 1987, 190), **Milano** (Degrassi 1951, 49; Baldacci 1972b, 27, fig. 11, and 23; Bruno 1988, 330, gr. 2; Bruno/Bocchio 1991, 271; Bruno 2003, 86-87), **Cremona** (Arcari 1996, fig. 43), **Feltre**, **Concordia** (Muffatti Musselli 1987, 189), **Aquileia** (Carre 1985, 231; Muffatti Musselli 1987); **Aosta** (Pesavento Mattioli 2008, 337, note 11), **Alba** (Bruno 1997, 520), **Libarna** (Bruno 1988, 336, gr. 6), **Brescia** (Pesavento Mattioli 2008, 337, note 10), **Padova** (Cipriano/Mazzocchin/Pastore 1998), **Verona** (Pesavento Mattioli 2008, 338, note 13), **Oderzo** (Cipriano/Ferrarini 2001, 71), **Altino** (Toniolo 1991, 28-29, and 153, figs. 362-364), **Caorle** (Cacciaguerra 1996, 61-62, fig. 33), **Roncaglia** (Cipriano/Mazzocchin/Pastore 1998, 169-172), and **Portogruaro**.

Pannonia: (15) **Poetovio** (Ptuj) (Bezeczky 1987, 29, n° 276), **Salla** (Zalalovo) (Bezeczky 2005, 56), **Balatongyörök**, **Vindobona** (Vienna) (Schörgendorfer 1942, 63, n° 558, tav. 15; Bezeczky 2005, 77-78), **Gorsium** (Tac) (Bezeczky 1995, 42, fig. 2, n° 41-42), **Savaria** (Szombathely) (Bezeczky 1987, 30, n° 289, and fig. 27; Kelemen 1988, 142, n° 2, fig. 7), **Carnuntum** (Deutsch-Altenburg, Petronell) (Bezeczky 2005, 56), **Aquincum** (Budapest) (Bezeczky 1987, 30, tav. 13; Kelemen 1988, 144, n° 5, fig. 7), **Brigetio** (Szöny), **Azaum** (Almasfuzito) (Kelemen 1988, 144, n° 8, fig. 7), **Gerulata** (Rusovce) (Bezeczky 2005, 56), **Bruckneudorf**, **Parndorf** (Bezeczky 2005, 56), **Cibalae** (Vinkovci) (Ozanic 2005), and **Emona** (Bezeczky 1994a.

Noricum: (9) **Celeia** (Bezeczky 1987, 74, n° 275), **Flavia Solva** (Sakl-Oberthaler 1994, 10-11, Pl. 4,14-21; Bezeczky 2005, 56), **Wels** (Ovilava) (Polaschek 1936, c. 1040), **Aguntum** (Lienz) (Alzinger 1955, pl. 6, 149, pl. 49, and pl. 22.1), **Iuvavum** (Salzburg) (Heger 1973, 135), **Virunum** (Zabehlicky-Scheffenegger 1993, 266, Abb. 4,48; Bezeczky 2005, 55), **Aelium Cetium** (St. Pölten) (Bezeczky 2005, 56), **Magdalensberg** (Bezeczky 1994, 112-117, Abb. 43; Maier-Maidl 1992, 22), and **Ribnica** (Vidrih Perko 2006, 213).

Raetia: (2) **Augusta Vindelicorum** (Augsburg) (Ehmig 2000, 65-66), **Chur** (Martin-Kilcher 1991, 121, T 42, 63-68).

Dacia: (4) **Colonia Ulpia Traiana Dacica Sarmizegetusa**, **Cristesti**, ***castrum* of Romanasi**, and ***castrum* of Porolissum** (Ardet 2001, Abb. 3,1 – 3,5, with references).

Moesia: (2) **Singidunum** (Bjelajac 1996, 21, n° 23-24; Bezeczky 2005, 56), and **Viminacium**.

Germania superior: (1) **Vindonissa** (Windisch) (Howald/Meyer 1940, 132).

Egypt: (1) **Berenice** (R. Tomber in Bezeczky 2005).

Turkey: (2) **Pergamum** (S. Jaap in Bezeczky 2005, 55), and **Ephesus** (Bezeczky 2004, 85).

Appendix II
The urban population

Table 76 Informed estimated and derived dimensions of public buildings in the 40 towns of central Adriatic Italy (the percentages of the *forum* refer only to the dimensions of the actual square; red numbers refer to known dimensions; black numbers are derived averages; numbers indicated in green refer to dimensions not used in the specific town for reasons explained in the text).

N°																							
	m²	m²	%	m²	%	m²	%	m²		%		m²			%			m²	%	m²	%	m²	%
1	3,323	+4,433	1.7	2,870	1.5	6,390	3.4	633	3,666	0.3	1.9	74	202	540	0.04	0.1	0.3	1,050	0.6	603	0.3	710	0.4
2	3,323	+4,433	6.6	2,870	5.7	6,390	12.8	633	3,666	1.3	7.3	74	202	540	0.1	0.4	1.1	1,050	2.1	603	1.2	710	1.4
3	3,323	+4,433	4.2	3,750	4.7	6,390	8	633	3,666	0.8	4.6	74	202	540	0.09	0.3	0.7	1,050	1.3	603	0.8	710	0.9
4	3,323	+4,433	2.8	2,870	2.4	6,390	5.3	512	3,666	0.4	3	74	202	540	0.06	0.2	0.5	1,050	0.9	603	0.5	710	0.6

5	3,323	+4,433	1.3	**2,275**	**0.9**	**9,350**	**3.8**	633	3,666	0.3	1.5	74	202	540	0.03	0.08	0.2	1,050	0.4	603	0.2	710	0.3
6	3,323	+4,433	1.3	2,870	1.1	**5,560**	**2.2**	**1,208**	3,666	**0.5**	1.5	74	202	540	0.03	0.08	0.2	1,050	0.4	**400**	**0.2**	710	0.3
7.	3323	+4,433	3.7	2,870	3.2	6,390	7	633	3,666	0.7	4.1	74	202	540	0.08	0.2	0.6	1,050	1.2	603	0.7	710	0.8
8	**3,500**	**+4,000**	0.8	**1,500**	0.4	**7,550**	1.8	633	3,666	0.2	0.9	**70**	202	540	0.02	0.05	0.1	1,050	0.3	603	0.1	710	0.2
9	3,323	+4,433	1.8	2,870	1.6	6,390	3.6	633	3,666	0.4	2	**77**	202	540	**0.04**	0.1	0.3	1,050	0.6	603	0.3	710	0.4
10	**3,250**	+4,433	0.8	**1,750**	0.4	6,390	1.6	633	**5,200**	0.2	1.3	74	**200 300**	540	0.02	0.05 0.08	0.1	1,050	0.3	603	0.2	**900**	0.2
11	3,323	+4,433	3.3	**2,373**	2.4	6,390	6.4	633	3,666	0.6	3.7	74	202	540	0.07	0.2	0.5	1,050	1.1	603	0.6	710	0.7
12	**1,800**	**+1,150**	**1.2**	2,870	1.9	6,390	4.3	633	**3,800**	0.4	**2.5**	74	202	540	0.05	0.1	0.4	1,050	0.7	603	0.4	710	0.5
13	3,323	+4,433	2.8	2,870	2.5	**6,882**	**5.9**	633	3,666	0.5	3.2	74	202	**613**	0.06	0.2	0.5	1,050	0.9	603	0.5	710	0.6
14	3,323	+4,433	2.1	2,870	1.8	6,390	4	633	3,666	0.4	2.3	74	202	540	0.05	0.1	0.3	1,050	0.7	603	0.4	710	0.4
15	3,323	+4,433	2.2	2,870	1.9	6,390	4.3	633	3,666	0.4	2.4	74	202	540	0.05	0.1	0.4	1,050	0.7	603	0.4	710	0.5
16	3,323	+4,433	1.7	2,870	1.5	6,390	3.3	633	3,666	0.3	1.7	74	202	540	0.04	0.09	0.3	1,050	0.5	603	0.3	710	0.3
17	3,323	+4,433	1.7	2,870	1.4	6,390	3.2	633	3,666	0.3	1.8	74	202	540	0.04	0.1	0.3	1,050	0.5	603	0.3	710	0.4
18	3,323	+4,433	2.1	2,870	1.8	6,390	4	633	3,666	0.4	2.3	74	202	540	0.05	0.1	0.3	1,050	0.7	603	0.4	710	0.4
19	**3,600**	**+4,800**	**2**	**1,838**	**1**	6,390	3.6	633	3,666	0.3	2	74	**192 384**	540	0.04	**0.1 0.2**	0.3	1,050	0.6	**512**	**0.3**	**450 1,225**	**0.3 0.7**
20	3,323	+4,433	1.5	**3,600**	**1.6**	**5,600**	**2.5**	633	3,666	0.1	1.5	74	202	**594**	0.03	0.09	**0.3**	1,050	0.4	603	0.2	710	0.3

21	**3,500**	**+4,500**	**3.2**	2,870	2.6	6,390	5.8	633	3,666	0.6	3.7	74	**200**	**530** **710**	0.07	**0.2**	**0.5** **0.6**	**700**	**0.6**	**900**	**0.8**	**625**	**0.6**
22	3,323	+4,433	2.2	2,870	1.9	6,390	4.3	**900**	3,666	**0.6**	2.4	74	202	540	0.05	0.1	0.4	1,050	0.7	603	0.4	710	0.5
23	3,323	+4,433	2.8	2,870	2.4	6,390	5.3	**480**	3,666	**0.4**	3.1	74	202	540	0.06	0.2	0.5	1,050	0.9	603	0.5	710	0.6
24	3,323	+4,433	3.3	2,870	2.9	6,390	6.4	**175**	3,666	0.6	3.7	74	**162**	540	0.07	0.2	0.5	1,050	1.1	603	0.6	710	0.7
25	3,323	+4,433	1.7	2,870	1.5	6,390	3.3	633	3,666	0.3	1.7	74	202	540	0.04	0.09	0.3	1,050	0.5	603	0.3	710	0.3
26	3,323	+4,433	1.7	2,870	1.4	6,390	3.2	633	3,666	0.3	1.8	74	202	540	0.04	0.1	0.3	1,050	0.5	603	0.3	710	0.4
27	**2,213**	+4,433	**0.5**	**6,650**	**1.6**	**7,135**	**1.7**	633	3,666	0.2	0.9	74	202	540	0.02	0.05	0.1	1,050	0.3	603	0.1	710	0.2
28	3,323	+4,433	1.7	2,870	1.5	6,390	3.3	633	3,666	0.3	1.7	74	202	540	0.04	0.09	0.3	1,050	0.5	603	0.3	710	0.3
29	3,323	+4,433	1.7	2,870	1.4	6,390	3.2	633	3,666	0.3	1.8	74	202	540	0.04	0.1	0.3	1,050	0.5	603	0.3	710	0.4
30	3,323	+4,433	1.8	**1,500**	**0.8**	6,390	3.4	633	3,666	0.3	2	74	202	540	0.04	0.1	0.3	1,050	0.6	603	0.3	710	0.4
31	3,323	+4,433	3.7	**1,810**	2	**7,100**	7.8	**400**	3,666	0.4	4.1	74	202	540	0.08	0.2	0.6	1,050	1.2	603	0.7	710	0.8
32	**5,400**	+4,433	3.2	2,870	1.7	6,390	3.8	633	3,666	0.4	2.2	74	202	**406**	0.04	0.12	0.24	**1,403**	0.8	603	0.4	**344**	0.2
33	3,323	+4,433	0.8	**3,770**	**0.9**	**18,500**	**4.2**	633	3,666	0.1	0.8	74	**117** **246**	540	0.02	**0.03** **0.07**	0.1	1,050	0.2	603	0.1	710	0.2
34	3,323	+4,433	1.3	2,870	1.1	6,390	2.6	633	3,666	0.3	1.5	74	202	540	0.03	0.08	0.2	1,050	0.4	603	0.2	710	0.3
35	3,323	+4,433	2.4	2,870	2	6,390	4.6	633	3,666	0.5	2.7	74	202	540	0.05	0.1	0.4	1,050	0.8	603	0.4	710	0.5
36	3,323	+4,433	1.3	**4,050**	1.6	**4,144**	1.6	**300**	**2000**	**0.1**	**0.8**	74	202	540	0.03	0.08	0.2	1,050	0.4	603	0.2	710	0.3

37	3,323	+4,433	0.5	2,450	0.4	4,200	0.6	633	3,666	0.09	0.5	74	202	540	0.01	0.03	0.08	1,050	0.2	603	0.09	710	0.1
38	3,323	+4,433	1.4	2,870	1.2	6,390	2.8	633	3,666	0.3	1.6	74	202	540	0.03	0.09	0.2	1,050	0.5	603	0.3	710	0.3
39	3,323	+4,433	1.7	2,870	1.5	6,390	3.3	633	3,666	0.3	1.7	74	202	540	0.04	0.09	0.3	1,050	0.5	603	0.3	710	0.3
40	3,323	+4,433	1.7	2,870	1.5	6,390	3.3	633	3,666	0.3	1.7	74	202	540	0.04	0.09	0.3	1,050	0.5	603	0.3	710	0.3

Table 77 Estimated proportions of *insulae*, streets, public and private space (red numbers refer to known town areas).

Town		(Walled) urban area				*Insulae*			Street grid			Public space			Private space		
		Size		Growth		Total			Size			Size			Size		
		R/LR	EI/HI	ha	%	m²	ha	%	m²	ha	%	m²	Ha	%	m²	ha	%
1	*Pisaurum*	15.5	18.9	3.4	22	170,800	17.1	90.3	18,300	1.8	9.7	24,494	2.4	13	146,306	14.6	77.4
2	*Pitinum P.*	\	5	\	\	42,500	4.3	85	7,500	0.8	15	15,234	1.5	30.5	27,266	2.7	54.5
3	*Urvinum*	\	8	\	\	68,000	6.8	85	12,000	1.2	15	18,984	1.9	23.7	49,016	4.9	61.3
4	*Tifernum*	\	12	\	\	84,000	8.4	70	36,000	3.6	30	17,983	1.8	15	66,017	6.6	55
5	*Fanum*	9.3	25	15.7	169	200,000	20	80	50,000	5	20	42,272	4.3	16.9	157,728	15.8	63.1
6	*Forum*	\	25	\	\	212,500	20	80	37,500	3.8	15	39,038	3.9	15.6	173,462	17.3	69.4
7	*Pitinum M.*	\	9	\	\	76,500	7.7	85	13,500	1.4	15	18,104	1.8	20.1	58,396	5.8	64.9
8	*Suasa*	\	42	\	\	357,000	35.7	85	63,000	6.3	15	24,024	2.4	5.7	332,976	33.3	79.3
9	*Sena*	4.8	18	13.2	275	149,000	14.9	82.8	31,000	3.1	17.2	18,107	1.8	10.1	130,893	13.1	72.7
10	*Ostra*	\	39	\	\	331,500	33.2	85	58,500	5.9	15	22,131	2.2	5.7	309,369	31	79.3
11	*Aesis*	\	10	\	\	85,000	8.5	85	15,000	1.5	15	17,607	1.8	17.6	67,393	6.7	67.4
12	*Sentinum*	5	15	10	200	127,500	13.5	85	22,500	2.3	15	28,694	2.9	19.1	98,806	9.9	65.9

13	*Ancona*	6.8	11.6	4.8	70.6	98,600	9.9	85	17,400	1.7	15	25,059	2.5	21.6	73,541	7.4	63.4
14	*Auximum*	\	16	\	\	112,000	11.2	70	48,000	4.8	30	24,494	2.4	15.3	87,506	8.8	54.7
15	*Cingulum*	\	15	\	\	127,500	13.5	85	22,500	2.3	15	18,104	1.8	12	109,396	10.9	73
16	*Planina*	\	21	\	\	178,500	17.8	85	31,500	3.2	15	18,104	1.8	8.6	160,396	16	76.4
17	*Tuficum*	\	20	\	\	170,000	17	85	30,000	3	15	24,494	2.4	12.2	145,506	14.6	72.8
18	*Numana*	\	16	\	\	136,000	13.6	85	24,000	2.4	15	24,494	2.4	15.3	111,506	11.2	69.7
19	*Potentia*	16	18.4	2.4	15	132,300	13.2	71.9	51,700	5.2	28.1	21,671	2.2	11.8	110,629	11.1	60.1
20	*Ricina*	\	25	\	\	212,500	21.3	85	37,500	3.8	15	27,944	2.8	11.2	184,556	18.5	73.8
21	*Trea*	\	11	\	\	99,000	9.9	90	11,000	1.1	10	27,523	2.8	25	71,477	7.1	65
22	*Septempeda*	\	15	\	\	127,500	13.5	90	22,500	2.3	15	18,371	1.8	12.2	109,129	11	72.8
23	*Matilica*	\	12	\	\	108,000	10.8	90	12,000	1.2	10	17,951	1.8	15	90,049	9	75
24	*Attidium*	\	10	\	\	85,000	8.5	85	15,000	1.5	15	17,606	1.8	17.6	67,394	6.7	67.4
25	*Cluana*	\	21	\	\	178,500	17.8	85	31,500	3.2	15	18,104	1.8	8.6	160,396	16	76.4
26	*Pausulae*	\	20	\	\	170,000	17	85	30,000	3	15	18,104	1.8	9	151,896	15.2	76
27	*Urbs Salvia*	14.8	42	27.2	184	357,000	35.7	85	63,000	6.3	15	30,147	3	7.2	326,853	32.7	77.8
28	*Tolentinum*	\	21	\	\	178,500	17.8	85	31,500	3.2	15	18,104	1.8	8.6	160,396	16	76.4
29	*Camerinum*	\	20	\	\	170,000	17	85	30,000	3	15	24,494	2.4	12.2	145,506	14.6	72.8

30	***Firmum***	12	18.6	6.6	55	158,100	15.8	85	27,900	2.8	15	16,734	1.7	9	141,366	14.1	76
31	***Falerio***	\	9	\	\	81,000	8.1	90	9,000	0.9	10	23,911	2.4	26.6	57,089	5.7	63.4
32	***Cupra Mar.***	\	16.7	\	\	141,950	14.2	85	25,050	2.5	15	20,034	2	12	121,916	12.2	73
33	***Asculum***	\	43.7	\	\	394,990	39.5	90.4	42,010	4.2	9.6	38,214	3.8	8.7	356,776	35.7	81.7
34	***Castrum T.***	\	25	\	\	212,500	20	80	37,500	3.8	15	18,101	1.8	7.2	194,399	19.4	77.8
35	***Castrum N.***	\	13.8	\	\	117,300	11.7	85	20,700	2.1	15	18,104	1.8	13.1	99,196	9.9	71.9
36	***Interamnia***	6.3	26	19.7	298	221,000	22.1	85	39,000	3.9	15	21,429	2.1	8.2	199,571	20	76.8
37	***Hatria***	\	70	\	\	630,000	63	90	70,000	7	10	21,884	2.2	3.1	608,116	60.8	86.9
38	***Cupra Mon.***	\	23	\	\	195,500	20	85	34,500	3.5	15	18,104	1.8	7.8	177,396	17.7	77.1
39	***Beregra***	\	21	\	\	178,500	17.8	85	31,500	3.2	15	18,104	1.8	8.6	160,396	16	76.4
40	***Novana***	\	21	\	\	178,500	17.8	85	31,500	3.2	15	18,104	1.8	8.6	160,396	16	76.4

Table 78 Estimated urban population of central Adriatic Italy in the Early/High Imperial period.

Town		Urban area (ha)	Residential area (ha)	Population (estimated)	Density p/ha (residential area)	Density p/ha (total area)
1	*Pisaurum*	18.9	14.6	2,009-3,004	138-206	106-159
2	*Pitinum P.*	5	2.7	364-544	135-201-	73-109
3	*Urvinum*	8	4.9	677-1,012	138-207	85-127
4	*Tifernum*	12	6.6	888-1,328	135-201	74-111
5	*Fanum*	25	15.8	2,140-3,200	135-203	86-128
6	*Forum*	25	17.3	2,351-3516	136-203	94-141
7	*Pitinum M.*	9	5.8	808-1,208	139-208	90-134
8	*Suasa*	42	33.3	4,491-6,716	135-202	107-160
9	*Sena*	18	13.1	1,776-2,656	136-203	99-148
10	*Ostra*	39	31	3,758-5,688	121-183	96-146
11	*Aesis*	10	6.7	888-1,328	133-198	89-133
12	*Sentinum*	15	9.9	1,332-2,002	135-202	89-133
13	*Ancona*	11.6	7.4	968-1,448	131-196	83-125

14	***Auximum***	16	8.8	1,201-1,796	137-204	75-112
15	***Cingulum***	15	10.9	1,463-2,188	134-201	98-146
16	***Planina***	21	16	2,169-3,244	136-203	103-154
17	***Tuficum***	20	14.6	1,958-2,928	134-201	98-146
18	***Numana***	16	11.2	1,558-2,328	139-208	97-146
19	***Potentia***	18.4	11.1	1,514-2,264	137-204	82-123
20	***Ricina***	25	18.5	2,482-3,712	134-201	99-148
21	***Trea***	11	7.1	968-1,448	136-204	88-132
22	***Septempeda***	15	11	1,463-2,188	133-199	98-146
23	***Matilica***	12	9	1,201-1,796	133-200	100-150
24	***Attidium***	10	6.7	888-1,328	133-198	89-133
25	***Cluana***	21	16	2,169-3,244	136-203	103-154
26	***Pausulae***	20	15.2	2,038-3,048	134-201	102-152
27	***Urbs Salvia***	42	32.7	4,389-6,564	134-201	105-156
28	***Tolentinum***	21	16	2,169-3,244	136-203	103-154
29	***Camerinum***	20	14.6	1,958-2,928	134-201	98-146
30	***Firmum***	18.6	14.1	1,907-2,852	135-202	103-153

31	***Falerio***	9	5.7	757-1,132	133-199	84-126
32	***Cupra Mar.***	16.7	12.2	1,645-2,460	135-202	99-147
33	***Asculum***	43.7	35.7	4,804-7,184	135-201	110-164
34	***Castrum T.***	25	19.4	2,613-3,908	135-201	105-156
35	***Castrum N.***	13.8	9.9	1,332-2,002	135-202	97-145
36	***Interamnia***	26	20	2,664-3,984	133-199	102-153
37	***Hatria***	70	60.8	8,225-12,300	135-202	118-176
38	***Cupra Mon.***	23	17.7	2,402-3,592	136-203	104-156
39	***Beregra***	21	16	2,169-3,244	136-203	103-154
40	***Novana***	21	16	2,169-3,244	136-203	103-154
Total		**829.7**	**616**	**82,725-123,800**	**134-201**	**100-149**

Table 79 Estimated proportions of streets, public and private space in the 40 towns of central Adriatic Italy and their estimated populations in the Late Republican period.

N°	LR urban area (est.)		Street grid (est.)			Public space (est.)			Residential space (est.)			LR population (est.)		LR population (est.)		Imp. P p/ha
	m²	ha	m²	ha	%	m²	ha	%	m²	ha	%	Total	p/ha*	Total	p/ha*	
1	113,400	11.3	11,340	1.1	10	7,800	0.8	6.9	94,260	9.4	83.1	1,581-2,601	**84-138**	1,560-2,561	**83-136**	**106-159**
2	30,000	3	4,500	0.5	15	7,800	0.8	26	17,700	1.8	59	310-510	**62-102**	240-394	**48-79**	**73-109**
3	48,000	4.8	7,200	0.7	15	7,800	0.8	16.3	33,000	3.3	68.7	558-918	**70-115**	600-985	**75-123**	**85-127**
4	72,000	7.2	21,600	2.2	30	7,800	0.8	10.8	42,600	4.3	59.2	713-1,173	**59-98**	720-1,182	**60-99**	**74-111**
5	93,000	9.3	18,600	1.9	20	7,800	0.8	8.4	66,600	6.7	71.6	1,116-1,836	**45-74**	1,080-1,773	**43-71**	**86-128**
6	150,000	15	22,500	2.3	15	7,800	0.8	5.2	119,700	12	79,8	2,015-3,315	**81-132**	2,040-3,349	**82-134**	**94-141**
7	54,000	5.4	8,100	0.8	15	7,800	0.8	14.4	38,100	3.8	70.6	651-1,071	**72-119**	600-985	**67-109**	**90-134**
8	252,000	25.2	37,800	3.9	15	7,800	0.8	3.1	206,400	20.6	82	3,472-5,712	**83-136**	3,480-5,713	**83-136**	**107-160**
9	108,000	10.8	18,576	1.9	17.2	7,800	0.8	7.2	81,624	8.2	75.6	1,364-2,244	**76-125**	1,320-2,167	**73-120**	**99-148**
10	234,000	23.4	35,100	3.5	15	7,800	0.8	3.3	191,100	19.1	81.7	3,224-5,304	**83-136**	3,240-5,319	**83-136**	**96-146**
11	60,000	6	9,000	0.9	15	7,800	0.8	13	43,200	4.3	72	713-1,173	**71-117**	720-1,182	**72-118**	**89-133**
12	50,000	5	7,500	0.8	15	3,000	0.3	6	39,500	4	79	651-1,071	**43-71**	600-985	**40-66**	**89-133**

13	68,000	6.8	10,200	1	15	8,400	0.8	12	59,600	6	73	992-1,632	**86-141**	960-1,576	**83-136**	**83-125**
14	96,000	9.6	28,800	2.9	30	7,800	0.8	8.1	59,400	5.9	61.9	992-1,632	**62-102**	960-1,576	**60-99**	**75-112**
15	90,000	9	13,500	1.4	15	7,800	0.8	8.7	68,700	6.9	76.3	1,147-1,887	**76-126**	1,200-1,970	**80-131**	**98-146**
16	126,000	12.6	18,900	1.9	15	7,800	0.8	6.2	99,300	10	78.8	1,674-2,754	**80-131**	1,638-2,688	**78-128**	**103-154**
17	120,000	12	18,000	1.8	15	7,800	0.8	6.5	94,200	9.4	78.5	1,581-2,601	**79-130**	1,560-2,561	**78-128**	**98-146**
18	96,000	9.6	14,400	1.4	15	7,800	0.8	8.1	73,800	7.4	76.9	1,240-2,040	**77-128**	1,200-1,970	**75-123**	**97-146**
19	111,000	11.1	27,750	2.8	28.1	8,400	0.8	7.6	74,850	7.5	67.4	1,271-2,091	**69-113**	1,200-1,970	**65-107**	**82-123**
20	150,000	15	22,500	2.3	15	7,800	0.8	5.2	119,700	12	79.8	2,015-3,315	**81-133**	2,040-3,349	**82-134**	**97-145**
21	66,000	6.6	6,600	0.6	10	8,000	0.8	12.1	51,400	5.1	77.8	868-1,428	**79-130**	840-1,379	**76-125**	**88-132**
22	90,000	9	13,500	1.4	15	7,800	0.8	8.7	68,700	6.9	76.3	1,147-1,887	**76-126**	1,200-1,970	**80-131**	**98-146**
23	72,000	7.2	7,200	0.7	10	7,800	0.8	10.8	57,000	5.7	79.2	961-1,581	**80-132**	960-1,576	**80-131**	**100-150**
24	60,000	6	9,000	0.9	15	7,800	0.8	13	43,200	4.3	72	713-1,173	**71-117**	720-1,182	**72-118**	**89-133**
25	126,000	12.6	18,900	1.9	15	7,800	0.8	6.2	99,300	10	78.8	1,674-2,754	**80-131**	1,638-2,688	**78-128**	**103-154**
26	120,000	12	18,000	1.8	15	7,800	0.8	6.5	94,200	9.4	78.5	1,581-2,601	**79-130**	1,560-2,561	**78-128**	**102-152**
27	148,000	14.8	22,200	2.2	15	6,700	0.7	4.5	119,100	11.9	80.5	2,015-3,315	**48-79**	2,040-3,349	**49-80**	**105-156**
28	126,000	12.6	18,900	1.9	15	7,800	0.8	6.2	99,300	10	78.8	1,674-2,754	**80-131**	1,638-2,688	**78-128**	**103-154**
29	120,000	12	18,000	1.8	15	7,800	0.8	6.5	94,200	9.4	78.5	1,581-2,601	**79-130**	1,560-2,561	**78-128**	**98-146**

30	120,000	12	18,000	1.8	15	7,800	0.8	6.5	94,200	9.4	78.5	1,581-2,601	**85-139**	1,560-2,561	**84-138**	**103-153**
31	54,000	5.4	5,400	0.5	10	7,800	0.8	14.4	40,800	4.1	75.6	682-1,122	**76-125**	720-1,182	**80-131**	**84-126**
32	100,200	10	15,030	1.5	15	7,800	0.8		77,370	7.7		1,302-2,142	**78-128**	1,320-2,167	**79-130**	**99-147**
33	262,200	26.2	25,171	2.5	9.6	7,800	0.8		229,229	23		3,875-6,375	**89-146**	3,840-6,304	**88-144**	**110-164**
34	150,000	15	22,500	2.3	15	7,800	0.8		119,700	12		2,015-3,315	**81-132**	2,040-3,349	**82-134**	**105-156**
35	82,800	8.3	12,420	1.2	15	7,800	0.8		62,580	6.3		1,054-1,734	**76-126**	1,080-1,773	**78-128**	**97-145**
36	63,000	6.3	9,450	0.9	15	7,800	0.8		45,750	4.6		775-1,275	**30-49**	720-1,182	**28-45**	**102-153**
37	420,000	42	42,000	4.2	10	7,800	0.8		370,200	37		6,231-10,251	**89-146**	6,240-10,244	**89-146**	**118-176**
38	138,000	13.8	20,700	2.1	15	7,800	0.8		109,500	11		1,860-3,060	**81-133**	1,800-2,955	**78-128**	**104-156**
39	126,000	12.6	18,900	1.9	15	7,800	0.8	6.2	99,300	10	78.8	1,674-2,754	**80-131**	1,638-2,688	**78-128**	**103-154**
40	126,000	12.6	18,900	1.9	15	7,800	0.8	6.2	99,300	10	78.8	1,674-2,754	**80-131**	1,638-2,688	**78-128**	**103-154**
T		**469.1**								**351.9**		**61,117-102,357**	**75-123**	**61,710-101,302**	**74-119**	**97-149**

Appendix III
Caloric requirements

Table 80 Estimated BMR for Roman male and female adults of 18-30/30-59/>60 years of age in central Adriatic Italy (towns).

Height (cm)	Weight (kg)			Age (years)			BMR (Kcal.)								
	1	2	3	a	b	c	1a	1b	1c	2a	2b	2c	3a	3b	3c
163.3 (M)	49	**56**	66	18	**25**	29	1,435.75	1,388.47	1,361.45	1,532.29	**1,484.72**	1,457.71	1,669.53	1,622.24	1,595.22
164.7 (M)	50	**57**	68	18	**25**	29	1,456.51	1,409.27	1,382.20	1,552.77	**1,505.48**	1.478.46	1.704.04	1,656.75	1,629.73
157.4 (F)	46	**52**	62	18	**25**	29	1,301.96	1,269.23	1,250.52	1,359.34	**1,326.61**	1,307.90	1,455.03	1,422.30	1,403.59
153.2 (F)	43	**49**	58	18	**25**	29	1,265.54	1,232.81	1,214.10	1,322.93	**1,290.19**	1,271.49	1,409.01	1,376.27	1,357.57
Height (cm)	Weight (kg)			Age (years)			BMR (Kcal.)								

	1	2	3	a	b	c	1a	1b	1c	2a	2b	2c	3a	3b	3c
163.3 (M)	49	**56**	66	30	**45**	59	1,354.69	1,253.37	1,158.80	1,450.95	**1,349.63**	1,255.06	1,588.47	1,487.14	1,392.57
164.7 (M)	50	**57**	68	30	**45**	59	1,375.45	1,274.12	1179.55	1,471.71	**1,370.38**	1.275.81	1.622.98	1,521.65	1,427.08
157.4 (F)	46	**52**	62	30	**45**	59	1,245.84	1,175.70	1,110.23	1,303.22	**1,233.08**	1,167.61	1,398.91	1,328.77	1,263.30
153.2 (F)	43	**49**	58	30	**45**	59	1,209.42	1,139.28	1,073.81	1,266.81	**1,197.66**	1,131.19	1,352.89	1,282.74	1,217.27

Height (cm)	Weight (kg)			Age (years)			BMR (Kcal.)								
	1	2	3	a	b	c	1a	1b	1c	2a	2b	2c	3a	3b	3c
163.3 (M)	49	**56**	66	60	**65**	70	1,152.04	1,118.27	1,084.49	1,248.30	**1,214.53**	1,180.75	1,385.82	1,352.04	1,318.27
164.7 (M)	50	**57**	68	60	**65**	70	1,172.80	1,139.02	1,105.25	1,269.06	**1,235.28**	1.201.51	1.420.33	1,386.55	1,352.78
157.4 (F)	46	**52**	62	60	**65**	70	1,105.55	1,082.17	1,058.78	1,162.93	**1,139.55**	1,116.16	1,258.62	1,235.24	1,211.85
153.2 (F)	43	**49**	58	60	**65**	70	1,069.13	1,045.75	1,022.36	1,126.51	**1,103.13**	1,079.75	1,212.59	1,189.22	1,165.83

Table 81 Estimated energy requirements for Roman male and female adults of 18-29 years of age with a sedentary or light activity lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c		1.40			1.63			1.69	
M1	1,435.75	1,388.47	1,361.45	2,010.05	1,943.86	1,906.03	2,340.27	2,263.21	2,219.16	2,426.42	2,346.51	2,300.85
M2	1,456.51	1,409.27	1,382.20	2,039.11	1,972.98	1,935.08	2,374.11	2,297.11	2,252.99	2,461.50	2,381.67	2,335.92
F1	1,301.96	1,269.23	1,250.52	1,822.74	1,776.92	1,750.73	2,122.20	2,068.85	2,038.35	2,200.31	2,145	2,113.38
F2	1,265.54	1,232.81	1,214.10	1,771.76	1,725.93	1,699.74	2,062.83	2,009.48	1,978.98	2,138.76	2,083.45	2,051.83
	2a	2b	2c		1.40			1.63			1.69	
M1	1,532.29	**1,484.72**	1,457.71	2,145.21	2,078.61	2,040.79	2,497.63	**2,420.09**	2,376.07	2,589.57	2,509.18	2,463.53
M2	1,552.77	**1,505.48**	1.478.46	2,173.88	2,107.67	2,069.84	2,531.02	**2,453.93**	2,409.89	2,624.18	2,544.26	2,498.60
F1	1,359.34	**1,326.61**	1,307.90	1,903.08	1,857.25	1,831.06	2,215.72	**2,162.37**	2,131.88	2,297.28	2,241.97	2,210.35
F2	1,322.93	**1,290.19**	1,271.49	1,852.10	1,806.27	1,780.09	2,156.38	**2,103.01**	2,072.53	2,235.75	2,180.42	2,148.82
	3a	3b	3c		1.40			1.63			1.69	
M1	1,669.53	1,622.24	1,595.22	2,337.34	2,271.14	2,233.31	2,721.33	2,644.25	2,600.21	2,821.51	2,741.59	2,695.92
M2	1.704.04	1,656.75	1,629.73	2,385.66	2,319.45	2,281.62	2,777.59	2,700.50	2,656.46	2,879.83	2.799.91	2,754.23
F1	1,455.03	1,422.30	1,403.59	2,037.04	1,991.22	1,965.03	2,371.70	2,318.35	2,287.85	2,459	2,403.69	2,372.07
F2	1,409.01	1,376.27	1,357.57	1,972.61	1,926.78	1,900.60	2,296.69	2,243.32	2,212.84	2,381.23	2,325.90	2,294.30

Table 82 Estimated energy requirements for Roman male and female adults of 18-29 years of age with an active or moderately active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.70			1.87			1.99		
M1	1,435.75	1,388.47	1,361.45	2,440.78	2,360.40	2,314.47	2,684.85	2,596.44	2,545.91	2,857.14	2,763.05	2,709.29
M2	1,456.51	1,409.27	1,382.20	2,476.07	2,395.76	2,349.74	2,723.67	2,635.34	2,584.71	2,898.45	2,804.45	2,750.58
F1	1,301.96	1,269.23	1,250.52	2,213.33	2,157.69	2,125.88	2,434,67	2,373.46	2,338.47	2,590.90	2,525.77	2,488.53
F2	1,265.54	1,232.81	1,214.10	2,151.42	2,095.78	2,063.97	2,366.56	2,305.36	2,270.37	2,518.42	2,453.29	2,416.06
	2a	2b	2c	1.70			1.87			1.99		
M1	1,532.29	**1,484.72**	1,457.71	2,604.89	2,524.02	2,478.11	2,865.38	**2,776.43**	2,725.92	3,049.26	2,954.59	2,900.84
M2	1,552.77	**1,505.48**	1.478.46	2,639.71	2,559.32	2,513.38	2,903.68	**2,815.25**	2,764.72	3,090.01	2,995.91	2,942.14
F1	1,359.34	**1,326.61**	1,307.90	2,310.88	2,255.24	2,223.43	2,541.97	**2,480.76**	2,445.77	2,705.09	2,639.95	2,602.72
F2	1,322.93	**1,290.19**	1,271.49	2,248.98	2,193.32	2,161.53	2,473.88	**2,412.66**	2,377.69	2,632.63	2,567.48	2,530.27
	3a	3b	3c	1.70			1.87			1.99		
M1	1,669.53	1,622.24	1,595.22	2,838.20	2,757.81	2,711.87	3,122.02	3,033.59	2,983.06	3,322.36	3,228.26	3,174.49
,M2	1.704.04	1,656.75	1,629.73	2,896.87	2,816.48	2,770.54	3,186.56	3,098.12	3,047.60	3,391.04	3,296.93	3,243.16
F1	1,455.03	1,422.30	1,403.59	2,473.55	2,417.91	2,386.10	2,720.91	2,659.70	2,624.71	2,895.51	2,830.38	2,793.14
F2	1,409.01	1,376.27	1,357.57	2,395.32	2,339.66	2,307.87	2,634.85	2,573.63	2,538.66	2,803.93	2,738.78	2,701.56

Table 83 Estimated energy requirements for Roman male and female adults of 18-29 years of age with a vigorous or vigorously active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c		2.00			2.35			2.40	
M1	1,435.75	1,388.47	1,361.45	2,871.5	2,776.94	2,722.9	3,374.01	3,262.90	3,199.41	3,445.8	3,332.33	3,267.48
M2	1,456.51	1,409.27	1,382.20	2,913.02	2,818.54	2,764.4	3,422.80	3,311.78	3,248.17	3,495.63	3,382.25	3,317.28
F1	1,301.96	1,269.23	1,250.52	2,603.92	2,538.46	2,501.04	3,059.606	2,982.69	2,938.72	3,124.70	3,046.15	3,001.25
F2	1,265.54	1,232.81	1,214.10	2,531.08	2,465.62	2,428.2	2,974.02	2,897.10	2,853.14	3,037.30	2,958.74	2,913.84
	2a	2b	2c		2.00			2.35			2.40	
M1	1,532.29	**1,484.72**	1,457.71	3,064.58	2,969.44	2,915.42	3,600.88	**3,489.09**	3,425.62	3,677.50	3,563.33	3,498.50
M2	1,552.77	**1,505.48**	1.478.46	3,105.54	3,010.96	2,956.92	3,649.01	**3,537.88**	3,474.38	3,726.65	3,613.15	3,548.30
F1	1,359.34	**1,326.61**	1,307.90	2,718.68	2,653.22	2,615.8	3,194.45	**3,117.53**	3,073.57	3,262.42	3,183.86	3,138.96
F2	1,322.93	**1,290.19**	1,271.49	2,645.86	2,580.38	2,542.98	3,108.89	**3,031.95**	2,988	3,175.03	3,096.46	3,051.58
	3a	3b	3c		2.00			2.35			2.40	
M1	1,669.53	1,622.24	1,595.22	3,339.06	3,244.48	3,190.44	3,923.40	3,812.26	3,748.77	4,006.87	3,893.38	3,828.53
M2	1.704.04	1,656.75	1,629.73	3,408.08	3,313.5	3,259.46	4,004.49	3,893.36	3,829.87	4,089.70	3,976.2	3,911.35
F1	1,455.03	1,422.30	1,403.59	2,910.06	2,844.6	2,807.18	3,419.32	3,342.41	3,298.44	3,492.07	3,413.52	3,368.62
F2	1,409.01	1,376.27	1,357.57	2,818.02	2,752.54	2,715.14	3,311.17	3,234.24	3,190.29	3,381.62	3,303.05	3,258.17

Table 84 Estimated energy requirements for Roman male and female adults of 30-59 years of age with a sedentary or light activity lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.40			1.63			1.69		
M1	1,354.69	1,253.37	1,158.80	1,896.57	1,754.72	1,622.32	2,208.15	2,042.99	1,888.84	2,289.43	2118,19	1,958.37
M2	1,375.45	1,274.12	1,179.55	1,925.63	1,783.77	1,651.37	2,241.98	2,076.82	1,922.67	2,324.51	2153,26	1,993.44
F1	1,245.84	1,175.70	1,110.23	1,744.18	1,645.98	1,554.32	2,030.72	1,916.39	1,809.68	2,105.50	1986,93	1,876.29
F2	1,209.42	1,139.28	1,073.81	1,693.19	1,594.99	1,503.33	1,971.36	1,857.02	1,750.31	2,043.47	1925,38	1,814.74
	2a	2b	2c	1.40			1.63			1.69		
M1	1,450.95	**1,349.63**	1,255.06	2,031.33	1,889.48	1,757.08	2,365.05	**2,199.90**	2,045.75	2,452.11	2,280.87	2,121.05
M2	1,471.71	**1,370.38**	1.275.81	2,060.39	1,918.53	1,786.13	2,398.89	**2,233.72**	2,079.57	2,487.19	2,315.94	2,156.12
F1	1,303.22	**1,233.08**	1,167.61	1,824.51	1,726.31	1,634.65	2,124.25	**2,009.92**	1,903.20	2,202.44	2,083.91	1,973.26
F2	1,266.81	**1,197.66**	1,131.19	1,773.53	1,676.72	1,583.67	2,064.9	**1,952.19**	1,843.84	2,140.91	2,024.04	1,911.71
	3a	3b	3c	1.40			1.63			1.69		
M1	1,588.47	1,487.14	1,392.57	2,223.86	2,081	1,949.60	2,589.21	2,424.04	2,269.89	2,684.51	2513,27	2,353.44
M2	1.622.98	1,521.65	1,427.08	2,272.17	2,130.31	1,997.91	2,645.46	2,480.29	2,326.14	2,742.84	2571,59	2,411.77
F1	1,398.91	1,328.77	1,263.30	1,958.47	1,860.28	1,768.62	2,280.22	2,165.90	2,059.18	2,364.16	2245,62	2,134.98
F2	1,352.89	1,282.74	1,217.27	1,894.05	1,795.84	1,704.18	2,205.21	2,090.87	1,984.15	2,286.38	2167,83	2,057.19

Table 85 Estimated energy requirements for Roman male and female adults of 30-59 years of age with an active or moderately active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.70			1.87			1.99		
M1	1,354.69	1,253.37	1,158.80	2,302.97	2130,73	1,969.96	2,533.27	2,343.80	2,166,96	2,695.83	2,494.21	2,306.01
M2	1,375.45	1,274.12	1179.55	2,338.27	2,166	2,005.24	2,572.09	2,382.60	2,205.76	2,737.15	2,535.50	2,347.31
F1	1,245.84	1,175.70	1,110.23	2,117.93	1,998.69	1,887.39	2,329.72	2,198.56	2,076.13	2,479.22	2,339.64	2,209.36
F2	1,209.42	1,139.28	1,073.81	2,056.01	1,936.78	1,825.48	2,261.62	2,130.45	2,008.03	2,406.75	2,267.17	2,136.88
	2a	2b	2c	1.70			1.87			1.99		
M1	1,450.95	**1,349.63**	1,255.06	2,466.62	2,294.37	2,133.60	2,713.28	**2,523.81**	2,346.96	2,887.39	2,685.76	2,497.57
M2	1,471.71	**1,370.38**	1.275.81	2,501.91	2,329.65	2,168.88	2,752.10	**2,562.61**	2,385.77	2,928.71	2,727.06	2,538,86
F1	1,303.22	**1,233.08**	1,167.61	2,215.47	2,096.24	1,984.94	2,437.02	**2,2305.86**	2,183.43	2,593.41	2,453.81	2,323.54
F2	1,266.81	**1,197.66**	1,131.19	2,153.58	2,036.02	1,923.02	2,368.94	**2,239.62**	2,115.33	2,520.95	2,383.34	2,251.07
	3a	3b	3c	1.70			1.87			1.99		
M1	1,588.47	1,487.14	1,392.57	2,700.40	2,528.14	2,367.37	2,970.44	2,780.95	2,604.11	3,161.06	2,959.41	2,771.21
M2	1.622.98	1,521.65	1,427.08	2,759.07	2,586.81	2,426.04	3,034.97	2,845.49	2,668.64	3,229.73	3,028.08	2,839.89
F1	1,398.91	1,328.77	1,263.30	2,378.15	2,258.91	2,147.61	2,615.96	2,484.8	2,362.37	2,783.83	2,644.25	2,513.97
F2	1,352.89	1,282.74	1,217.27	2,299.91	2,180.66	2,069.36	2,529.90	2,398.72	2,276.30	2,692.25	2,552.65	2,422.37

Table 86 Estimated energy requirements for Roman male and female adults of 30-59 years of age with a vigorous or vigorously active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	2.00			2.35			2.40		
M1	1,354.69	1,253.37	1,158.80	2,709.38	2,506.74	2,317.6	3,183.52	2,945.42	2,723.18	3,251.27	3,008.09	2,781.12
M2	1,375.45	1,274.12	1179.55	2,750.9	2,548.24	2,359.1	3,232.31	2,994.18	2,771.94	3,301.08	3,057.89	2,830.92
F1	1,245.84	1,175.70	1,110.23	2,491.68	2,351.4	2,220.46	2,927.73	2,762.90	2,609.04	2,990.02	2,821.68	2,664.55
F2	1,209.42	1,139.28	1,073.81	2,418.84	2,278.56	2,147.62	2,842.14	2,677.31	2,523.54	2,902.61	2,734.27	2,577.14
	2a	2b	2c	2.00			2.35			2.40		
M1	1,450.95	**1,349.63**	1,255.06	2,901.9	2,699.26	2,510.12	3,409.73	**3,171.63**	2,949.39	3,482.28	3,239.11	3,012.14
M2	1,471.71	**1,370.38**	1.275.81	2,943.42	2,740.76	2,551.62	3,458.52	**3,220.39**	2,998.15	2,532.11	3,288.91	3,061.94
F1	1,303.22	**1,233.08**	1,167.61	2,606.44	2,466.16	2,335.22	3,062.57	**2,897.74**	2,743.88	3,127.73	2,959.39	2,802.26
F2	1,266.81	**1,197.66**	1,131.19	2,533.62	2,395.32	2,262.38	2,977	**2,814.50**	2,658.30	3,040.34	2,874.38	2,714.86
	3a	3b	3c	2.00			2.35			2.40		
M1	1,588.47	1,487.14	1,392.57	3,176.94	2,974.28	2,785.14	3,732.91	3,494.78	3,272.54	3,812.15	3,569.14	3,342.17
M2	1.622.98	1,521.65	1,427.08	3,245.96	3,043.3	2,854.16	3,814	3,575.88	3,353.64	3,895.15	3,651.96	3,424.99
F1	1,398.91	1,328.77	1,263.30	2,797.82	2,657.54	2,526.6	3,287.44	3,122.61	2,968.76	3,357.38	3,189.05	3,031.92
F2	1,352.89	1,282.74	1,217.27	2,705.78	2,565.48	2,434.54	3,179.29	3,014.44	2,860.59	3,246.94	3,078.58	2,921.45

Table 87 Estimated energy requirements for Roman male and female adults of >60 years of age with a sedentary or light activity lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.40			1.63			1.69		
M1	1,152.04	1,118.27	1,084.49	1,612,87	1,565.58	1,518.29	1,877.83	1,822.78	1,767.72	1,946.95	1,889.88	1,832.79
M2	1,172.80	1,139.02	1,105.25	1,641,92	1,594.63	1,547.35	1,911.66	1,856.60	1,801.56	1,982.03	1,924.94	1,867.87
F1	1,105.55	1,082.17	1,058.78	1,547,77	1,515.04	1,482.29	1,802.05	1,763.94	1,725.81	1,868.38	1,828.87	1,789.34
F2	1,069.13	1,045.75	1,022.36	1,496,78	1,464.05	1,431.30	1,742.69	1,704.57	1,666.45	1,806.83	1,767.32	1,727.79
	2a	2b	2c	1.40			1.63			1.69		
M1	1,248.30	**1,214.53**	1,180.75	1,747.62	1,700.34	1,653.05	2,034.73	**1,979.68**	1,924.62	2,109.63	2,052.56	1,995.47
M2	1,269.06	**1,235.28**	1.201.51	1,776,68	1,729.39	1,682.11	2,068.57	**2,013.51**	1,958.46	2,144.71	2,087.62	2,030.55
F1	1,162.93	**1,139.55**	1,116.16	1,628,10	1,595.37	1,562.62	1,895.58	**1,857.47**	1,819.34	1,965.35	1,925.84	1,886.31
F2	1,126.51	**1,103.13**	1,079.75	1,577,11	1,544.38	1,511.65	1,836.21	**1,798.10**	1,759.99	1,903.80	1,864.29	1,824.78
	3a	3b	3c	1.40			1.63			1.69		
M1	1,385.82	1,352.04	1,318.27	1,940.15	1,892.86	1,845.59	2,258.89	2,203.83	2,148.78	2,342.04	2,284	2,227.88
M2	1.420.33	1,386.55	1,352.78	1,988.46	1,941.17	1,893.89	2,315.14	2,260.07	2,205.03	2,400.36	2,343.27	2,286.20
F1	1,258.62	1,235.24	1,211.85	1,762.07	1,729.34	1,696.59	2,051.55	2,013.44	1,975.32	2,127.07	2,087.56	2,048.03
F2	1,212.59	1,189.22	1,165.83	1,697.63	1,664.91	1,632.16	1,976.52	1,938.43	1,900.30	2,049.27	2,009.78	1,970.25

Table 88 Estimated energy requirements for Roman male and female adults of >60 years of age with an active or moderately active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.70			1.87			1.99		
M1	1,152.04	1,118.27	1,084.49	1,958.47	1,901.06	1,843.63	2,154.32	2,091.17	2,028,00	2,292.56	2,225.36	2,158.14
M2	1,172.80	1,139.02	1,105.25	1,993.76	1,936.33	1,878.92	2,193.14	2,129.97	2,066.82	2,333.87	2,266.65	2,199.45
F1	1,105.55	1,082.17	1,058.78	1,879.44	1,839.69	1,799.93	2,067.38	2,023.66	1,979.92	2,200.05	2,153.52	2,106.97
F2	1,069.13	1,045.75	1,022.36	1,817.52	1,777.78	1,738.01	1,999.27	1,955.55	1,911.81	2,127.57	2,081.04	2,034.49
	2a	2b	2c	1.70			1.87			1.99		
M1	1,248.30	**1,214.53**	1,180.75	2,122.11	2,064.71	2,007.28	2,334.32	**2,271.17**	2,208.00	2,484.12	2,416.92	2,349.69
M2	1,269.06	**1,235.28**	1.201.51	2,157.40	2,099.98	2,042.57	2,373.14	**2,309.97**	2,246.82	2,525.43	2,458.21	2,391
F1	1,162.93	**1,139.55**	1,116.16	1,976.98	1,937.24	1,897.47	2,174.68	**2,130.96**	2,087.22	2,314.23	2,267.71	2,221.16
F2	1,126.51	**1,103.13**	1,079.75	1,915.07	1,875.32	1,835.58	2,106.57	**2,062.85**	2,019.13	2,241.76	2,195.23	2,148.70
	3a	3b	3c	1.70			1.87			1.99		
M1	1,385.82	1,352.04	1,318.27	2,355.89	2,298.47	2,241.06	2,591.48	2,528.32	2,465.17	2,757.78	2,690.56	2,623.36
M2	1.420.33	1,386.55	1,352.78	2,414.56	2,357.14	2,299.73	2,656.02	2,592.85	2,529.70	2,826.46	2,759.23	2,692.03
F1	1,258.62	1,235.24	1,211.85	2,139.65	2,099.91	2,060.15	2,353.62	2,309.90	2,266.16	2,504.65	2,458.13	2,411.58
F2	1,212.59	1,189.22	1,165.83	2,061.40	2,021.67	1,981.91	2,267.54	2,223.84	2,180.10	2,413.05	2,366.55	2,320.02

Table 89 Estimated energy requirements for Roman male and female adults of >60 years of age with a vigorous or vigorously active lifestyle.

M/F	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c		2.00			2.35			2.40	
M1	1,152.04	1,118.27	1,084.49	2,304.08	2,236.54	2,168.98	2,707.29	2,627.94	2,548.55	2,764.90	2,683.85	2,602.78
M2	1,172.80	1,139.02	1,105.25	2,345.6	2,278.04	2,210.5	2,756.08	2,676.70	2,597.34	2,814.72	2,733.65	2,652.6
F1	1,105.55	1,082.17	1,058.78	2,211.1	2,164.34	2,117.56	2,598.04	2,543.1	2,488.13	2,653.32	2,597.21	2,541.07
F2	1,069.13	1,045.75	1,022.36	2,138.26	2,091.5	2,044.72	2,512.46	2,457.51	2,402.55	2,565.91	2,509.8	2,453.66
	2a	2b	2c		2.00			2.35			2.40	
M1	1,248.30	**1,214.53**	1,180.75	2,496.6	2,429.06	2,361.5	2,933.51	**2,854.15**	2,773.76	2,995.92	2,914.87	2,833.8
M2	1,269.06	**1,235.28**	1.201.51	2,538.12	2,470.56	2,403.02	2,982.29	**2,902.91**	2,823.55	3,045.74	2,964.67	2,883.62
F1	1,162.93	**1,139.55**	1,116.16	2,325.86	2,279.1	2,232.32	2,732.89	**2,677.36**	2,622.98	2,791.03	2,734.92	2,678.78
F2	1,126.51	**1,103.13**	1,079.75	2,253.02	2,206.26	2,159.5	2,647.30	**2,592.36**	2,537.41	2,703.63	2,647.51	2,591.4
	3a	3b	3c		2.00			2.35			2.40	
M1	1,385.82	1,352.04	1,318.27	2,771.64	2,704.08	2,636.54	3,256.68	3,177.29	3,097.93	3,325.97	3,244.90	3,163.85
M2	1.420.33	1,386.55	1,352.78	2,840.66	2,773.1	2,705.56	3,337.78	3,258.39	3,179.03	3,408.79	3,327.72	3,246.67
F1	1,258.62	1,235.24	1,211.85	2,517.24	2,470.48	2,423.7	2,957.76	2,902.81	2,847.85	3,020.69	2,964.58	2,908.44
F2	1,212.59	1,189.22	1,165.83	2,425.18	2,378.44	2,331.66	2,849.59	2,794.67	2,739.70	2,910.22	2,854.13	2,797.99

Table 90 Estimated BMR for Roman male and female adults of 18-30/30-59/>60 years of age in central Adriatic Italy.

Height (cm)	Weight (kg)			Age (years)			BMR (Kcal.)								
	1	2	3	a	b	c	1a	1b	1c	2a	2b	2c	3a	3b	3c
				18	**25**	29	1,516.77	1,469.49	1,442.47	1,613.04	**1,565.75**	1,538.73	1,764.30	1,717.02	1,690.00
168.5 (M)	53	**60**	71	30	**45**	59	1,435.71	1,334.39	1,239.82	1,531.98	**1,430.65**	1,336.08	1,683.22	1,581.92	1,487.35
				60	**65**	70	1,233.06	1,199.29	1,165.51	1,329.33	**1,295.55**	1,261.78	1,480.59	1,446.82	1,413.04
				18	**25**	29	1,250.02	1,217.29	1,198.58	1,297.84	**1,265.10**	1,246.40	1,383.91	1,351.17	1,332.47
150.0 (F)	42	**47**	56	30	**45**	59	1,193.90	1,123.76	1,058,28	1,241.72	**1,171.57**	1,106.10	1,327.79	1,257.64	1,192.17
				60	**65**	70	1,053.61	1,030.23	1,006.84	1,101.43	**1,078.04**	1,054.66	1,187.50	1,164.11	1,140.73

Table 91 Estimated energy requirements for Roman male adults of 18-30/30-59/>60 years of age with a sedentary lifestyle.

M (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c		1.40			1.63			1.69	
	1,516.77	1,469.49	1,442.47	2,123.48	2,057.29	2,019.46	2,472.34	2,395.27	2,351.23	2,563.34	2,483.44	2,437.77
168.5	1,435.71	1,334.39	1,239.82	2,009.99	1,868.15	1,735.75	2,340.21	2,175.06	2,020.91	2,426.35	2,225.12	2,095.30
	1,233.06	1,199.29	1,165.51	1,726.28	1,679.01	1,631.71	2,009.89	1,954.84	1,899.78	2,083.87	2,026.8	1,969.71
	2a	2b	2c		1.40			1.63			1.69	
	1,613.04	**1,565.75**	1,538.73	2,258.26	2,192.05	2,154.22	2,629.26	**2,552.17**	2,508.13	2,726.04	2,646.12	2,600.45
168.5	1,531.98	**1,430.65**	1,336.08	2,144.77	2,002.91	1,870.51	2,497.13	**2,331.96**	2,177.81	2,589.05	2,417.80	2,257.98
	1,329.33	**1,295.55**	1,261.78	1,861.06	1,813.88	1,766.49	2,166.81	**2,111.75**	2,056.70	2,246.57	2,189.48	2,132.41
	3a	3b	3c		1.40			1.63			1.69	
	1,764.30	1,717.02	1,690.00	2,470.02	2,403.83	2,366	2,875.81	2,798.74	2,754.7	2,981.67	2,901.76	2,856.1
168.5	1,683.22	1,581.92	1,487.35	2,356.51	2,214.69	2,082.29	2,743.65	2,578.53	2,424.38	2,844.64	2,673.45	2,513.62
	1,480.59	1,446.82	1,413.04	2,072.83	2,025.55	1,978.26	2,413.36	2,358.32	2,303.26	2,502.20	2,445.13	2,388.04

Table 92 Estimated energy requirements for Roman male adults of 18-30/30-59/>60 years of age with a moderately active lifestyle.

M (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.70			1.87			1.99		
168.5	1,516.77	1,469.49	1,442.47	2,578.51	2,498.13	2,452.20	2,836.36	2,724.94	2,697.42	3,018.37	2,924.29	2,870.52
	1,435.71	1,334.39	1,239.82	2,440.71	2,268.46	2,107.69	2,684.78	2,495.31	2,318.46	2,857.06	2,655.44	2,467.24
	1,233.06	1,199.29	1,165.51	2,096.20	2,038.79	1,981.37	2,305.82	2,242.67	2,179.50	2,453.79	2,386.59	2,319.37
	2a	2b	2c	1.70			1.87			1.99		
168.5	1,613.04	**1,565.75**	1,538.73	2,742.17	2,661.78	2,615.84	3,016.39	**2,927.95**	2,877.43	3,209.95	3,115.84	3,062.07
	1,531.98	**1,430.65**	1,336.08	2,604.37	2,432,11	2,271.34	2,864.80	**2,675.32**	2,498.47	3,048.64	2,846.99	2,658.80
	1,329.33	**1,295.55**	1,261.78	2,259.86	2,202.44	2,145.03	2,485.85	**2,422.68**	2,359.53	2,645.37	2,578.15	2,510.94
	3a	3b	3c	1.70			1.87			1.99		
168.5	1,764.30	1,717.02	1,690.00	2,999.31	2,918.93	2,873	3,299.24	3,210.83	3,160.3	3,510.96	3,416.87	3,363.1
	1,683.22	1,581.92	1,487.35	2,861.47	2,689.26	2,528.50	3,147.62	2,958.19	2,781.35	3,349.61	3,148.02	2,959.83
	1,480.59	1,446.82	1,413.04	2,517.00	2,459.59	2,402.17	2,768.70	2,705.55	2,642.39	2,946.37	2,879.17	2,811.95

Table 93 Estimated energy requirements for Roman male adults of 18-30/30-59/>60 years of age with a vigorously active lifestyle.

M (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	2.00			2.35			2.40		
168.5	1,516.77	1,469.49	1,442.47	3,033.54	2,938.98	2,884.94	3,564.41	3,453.30	3,389.81	3,640.25	3,526.78	3,461.93
	1,435.71	1,334.39	1,239.82	2,871.42	2,668,78	2,479.64	3,373.92	3,135.82	2,913.58	3,445.70	3,202.54	2,975.57
	1,233.06	1,199.29	1,165.51	2,466.12	2,398.58	2,331.02	2,897.69	2,818.33	2,738.95	2,959.34	2,878.30	2,797.22
	2a	2b	2c	2.00			2.35			2.40		
168.5	1,613.04	**1,565.75**	1,538.73	3,226.08	3,131.5	3,077.46	3,790.64	**3,679.51**	3,616.02	3,871.30	3,757.8	3,692.95
	1,531.98	**1,430.65**	1,336.08	3,063.96	2,861.3	2,672.16	3,600.15	**3,362.03**	3,139.79	3,676.75	3,433.56	3,206.59
	1,329.33	**1,295.55**	1,261.78	2,658.66	2,591.1	2,523.56	3,123.93	**3,044.54**	2,965.18	3,190.39	3,109.32	3,028.27
	3a	3b	3c	2.00			2.35			2.40		
168.5	1,764.30	1,717.02	1,690.00	3,528.6	3,434.04	3,380	4,146.11	4,035.00	3,971.5	4,234.32	4,120.85	4,056
	1,683.22	1,581.92	1,487.35	3,366.44	3,163.84	2,974.7	3,955.57	3,717.51	3,495.27	4,039.73	3,796.61	3,569.64
	1,480.59	1,446.82	1,413.04	2,961.18	2,893.64	2,826.08	3,479.39	3,400.03	3,320.64	3,553.42	3,472.37	3,391.30

Table 94 Estimated energy requirements for Roman female adults of 18-30/30-59/>60 years of age with a sedentary lifestyle.

F (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.40			1.63			1.69		
150	1,250.02	1,217.29	1,198.58	1,750.03	1,704.21	1,678.01	2,037.53	1,984.18	1,953.69	2,112.53	2,057.22	2,025.6
	1,193.90	1,123.76	1,058,28	1,671.46	1,573.26	1,481.60	1,946.06	1,831.73	1,725,00	2,017.69	1,899.15	1,788.49
	1,053.61	1,030.23	1,006.84	1,475.05	1,442.32	1,409.58	1,717.38	1,679.28	1,641.15	1,780.60	1,741.09	1,701.56
	2a	2b	2c	1.40			1.63			1.69		
150	1,297.84	**1,265.10**	1,246.40	1,816.98	1,771.14	1,744.96	2,115.48	**2,062.11**	2,031.63	2,193.35	2,138.02	2,106.42
	1,241.72	**1,171.57**	1,106.10	1,738.41	1,640.20	1,548.54	2,024.00	**1,909.66**	1,802.94	2,098.51	1,979.95	1,869.31
	1,101.43	**1,078.04**	1,054.66	1,542.00	1,509.26	1,476.52	1,795.33	**1,757.21**	1,719.10	1,861.42	1,821.89	1,782.38
	3a	3b	3c	1.40			1.63			1.69		
150	1,383.91	1,351.17	1,332.47	1,937.47	1,891.64	1,865.46	2,255.77	2,202.41	2,171.93	2,338.81	2,283.48	2,251.87
	1,327.79	1,257.64	1,192.17	1,858.91	1,760.70	1,669.04	2,164.30	2,049.95	1,943.24	2,243.97	2,125.41	2,014.77
	1,187.50	1,164.11	1,140.73	1,662.5	1,629.76	1,597.02	1,935.63	1,897.50	1,859.39	2,006.88	1,967.35	1,927.83

Table 95 Estimated energy requirements for Roman female adults of 18-30/30-59/>60 years of age with a moderately active lifestyle.

F (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	1.70			1.87			1.99		
150	1,250.02	1,217.29	1,198.58	2,125.03	2,069.40	2,037.59	2,337.54	2,276.33	2,241.35	2,487.54	2,422.41	2,385.17
	1,193.90	1,123.76	1,058,28	2,029.63	1,910.40	1,799.08	2,232.59	2,101.43	1,978.98	2,375.86	2,236.28	2,105.98
	1,053.61	1,030.23	1,006.84	1,791.14	1,751.39	1,711.63	1,970.25	1,926.53	1,882.79	2,096.68	2,050.16	2,003.61
	2a	2b	2c	1.70			1.87			1.99		
150	1,297.84	**1,265.10**	1,246.40	2,206.33	2,150.67	2,118.88	2,426.96	**2,365.74**	2,330.77	2,582.71	2,517.55	2,480.34
	1,241.72	**1,171.57**	1,106.10	2,110.92	1,991.67	1,880.37	2,322.02	**2,190.84**	2,068.41	2,471.02	2,331.42	2,201.14
	1,101.43	**1,078.04**	1,054.66	1,872.43	1,832.67	1,792.92	2,059.67	**2,015.94**	1,972.21	2,191.85	2,145.3	2,098.77
	3a	3b	3c	1.70			1.87			1.99		
150	1,383.91	1,351.17	1,332.47	2,352.65	2,296.99	2,265.20	2,587.91	2,526.69	2,491.72	2,753.98	2,688.83	2,651.62
	1,327.79	1,257.64	1,192.17	2,257.24	2,137.99	2,026.69	2,482.97	2,351.79	2,229.36	2,462.30	2,502.70	2,372.42
	1,187.50	1,164.11	1,140.73	2,018.75	1,978.99	1,939.24	2,220.62	2,176.89	2,133.17	2,363.13	2,316.58	2,270.05

Table 96 Estimated energy requirements for Roman female adults of 18-30/30-59/>60 years of age with a vigorously active lifestyle.

F (cm)	BMR (kcal.)			TEE (Kcal.) (based on PAL value)								
	1a	1b	1c	2.00			2.35			2.40		
150	1,250.02	1,217.29	1,198.58	2,500.04	2,434.58	2,397.16	2,937.55	2,860.63	2,816.67	3,000.05	2,921.50	2,876.59
	1,193.90	1,123.76	1,058,28	2,387.8	2,247.52	2,116.56	2,805.67	2,640.84	2,486.96	2,865.36	2,697.02	2,539.87
	1,053.61	1,030.23	1,006.84	2,107.22	2,060.46	2,013.68	2,475.98	2,421.04	2,366.07	2,528.66	2,472.55	2,416.42
150	2a	2b	2c	2.00			2.35			2.40		
	1,297.84	**1,265.10**	1,246.40	2,595.68	2,530.2	2,492.8	3,049.92	**2,972.99**	2,929.04	3,114.82	3,036.24	2,991.36
	1,241.72	**1,171.57**	1,106.10	2,483.44	2,343.14	2,212.2	2,918.04	**2,753.19**	2,599.34	2,980.13	2,811.77	2,654.64
	1,101.43	**1,078.04**	1,054.66	2,202.86	2,156.08	2,109.32	2,588.36	**2,533.39**	2,478.45	2,643.43	2,587.30	2,531.18
150	3a	3b	3c	2.00			2.35			2.40		
	1,383.91	1,351.17	1,332.47	2,767.82	2,702.34	2,664.94	3,252.19	3,175.25	3,131.31	3,321.39	3,242.81	3,197.93
	1,327.79	1,257.64	1,192.17	2,655.58	2,515.28	2,384.34	3,120.31	2,955.45	2,801.6	2,186.70	3,018.34	2,861.21
	1,187.50	1,164.11	1,140.73	2375	2,328.22	2,281.46	2,790.63	2,735.66	2,680.72	2,850	2,793.87	2,737.75

Appendix IV
Land requirements

Table 97 Seed/yield ratios for ten localities in the Marche region between 1675 and 1800 (Based on the Archivio di Stato di Pesaro; After Paci 1975, 143-144, Tavola 2).

Year	Plains/low hills		Medium hills				High hills/mountains			
	Pesaro	Senigallia	Cagli	Fossombrone	Pergola	Sant'Angelo	Gubbio	Montefeltro	San Vito	Urbino
1675	4.50	13.82	4.12	4.81	7.46	\	\	3.13	2.04	3.05
1676	3.91	4.41	3.55	3.96	3.88	3.25	7.35	\	1.72	2.66
1677	2.70	2.20	2.47	2.49	2.66	2.45	3.40	3.53	1.41	2.29
1678	\	3.08	3.27	3.11	4.58	\	\	1.48	\	\
1679	\	3.34	4.44	5.16	4.12	2.97	4.64	2.70	1.96	2.82
1680	\	\	\	5.98	\	3.04	\	4.67	2.25	\
1681	3.21	4.93	4.53	\	5.17	3.79	3.95	\	3.07	3.91
1682	3.82	3.87	4.38	7.59	4.24	\	2.13	4.18	2.44	2.84
1683	4.05	5.32	4.09	4.47	4.21	\	\	2.79	2.20	2.85

1684	\	4.37	4.54	\	3.72	\	\	\	2.60	2.51
1685	3.22	4.04	3.68	5.02	3.81	5.92	4.57	2.79	3.09	2.46
1686	3.48	3.47	4.38	6.29	4.24	4.84	1.68	3.37	3.11	3.45
1688	\	4.82	7.43	8.52	5.06	\	5.28	4.36	4.43	4.62
1689	3.99	7.34	3.79	5.66	6.52	3.65	3.06	4.08	3.29	3.19
1690	3.76	4.85	3.00	5.06	7.38	4.18	2.57	3.44	\	3.95
1691	5.11	7.29	4.66	4.89	5.89	5.37	2.67	4.06	2.14	3.17
1692	3.58	4.55	2.10	3.47	4.64	\	2.90	2.28	2.70	2.73
1693	3.23	4.54	4.66	2.60	4.86	2.83	2.61	2.26	3.42	2.23
1694	4.20	5.42	4.40	4.25	\	\	2.56	2.44	3.88	3.25
1695	\	4.57	\	\	\	\	\	\	\	\
1696	\	\	2.77	3.54	5.88	\	\	\	2.20	2.98
1697	3.61	5.27	3.91	3.78	4.66	3.81	3.58	2.90	2.51	3.18
1698	3.98	\	3.92	\	6.38	3.84	4.44	\	3.48	4.43
1699	\	\	3.77	3.58	5.94	2.82	2.05	\	2.53	2.99
1700	\	5.31	2.84	4.30	\	2.54	3.23	2.52	4.62	\
1701	3.96	5.29	2.89	3.09	\	2.92	2.59	2.64	3.33	\
1702	5.01	5.45	4.40	4.20	4.35	3.93	3.61	\	4.41	\
1703	\	5.51	4.49	4.63	5.14	4.74	\	\	3.63	3.33
1704	4.09	4.66	3.26	4.49	5.29	3.60	1.99	2.95	2.86	3.24
1705	3.76	5.64	3.61	5.10	6.99	2.17	3.21	2.13	2.12	3.36
1706	3.59	7.03	2.91	6.13	4.80	2.43	2.39	2.72	3.45	3.41
1709	3.35	4.60	2.94	5.89	4.90	1.74	2.87	3.24	4.25	4.03
1710	\	\	\	6.32	3.75	\	2.74	2.41	\	\
1711	\	\	3.71	7.04	6.50	\	2.83	4.42	2.80	2.94

1713	3.36	\	2.04	4.89	8.01	1.98	2.07	3.15	3.17	2.53
1714	4.95	\	2.69	\	5.88	\	\	\	\	\
1715	\	\	2.01	\	\	\	\	\	\	\
1718	2.65	\	2.58	3.24	3.85	2.16	1.92	2.95	2.94	2.23
1719	3.59	\	3.16	5.83	4.99	2.94	4.89	2.95	3.71	3.33
1720	5.55	\	\	4.31	4.85	3.80	2.23	\	4.12	\
1721	5.05	\	3.48	5.35	5.94	2.23	2.32	3.65	4.61	2.59
1722	\	\	2.41	2.95	2.68	1.94	3.04	2.96	2.49	2.22
1723	3.63	\	2.76	4.53	5.16	2.36	4.24	3.82	3.23	2.95
1724	3.48	\	2.38	3.05	3.44	1.67	3.14	3.20	2.29	2.86
1725	3.49	\	2.83	\	5.53	5.51	6.21	3.38	3.65	\
1726	\	3.47	3.70	4.93	6.54	4.27	5.90	1.60	\	4.03
1727	\	\	3.06	3.82	5.29	\	5.88	1.95	\	3.44
1728	3.01	\	2.52	3.38	4.53	4.03	2.55	3.45	3.15	2.71
1729	\	\	3.50	4.38	5.73	\	\	3.13	3.32	3.22
1730	\	\	3.35	4.03	\	4.20	\	2.94	4.10	3.85
1731	3.43	\	2.76	4.29	5.20	4.25	10.01	2.06	3.21	3.22
1732	2.73	4.73	2.20	3.40	4.17	3.75	2.88	2.33	2.56	2.80
1733	5.10	\	2.11	3.28	4.09	2.59	6.27	2.86	3.13	4.71
1734	4.15	11.11	2.18	4.89	5.37	4.49	11.93	4.01	3.80	3.81
1735	\	\	\	2.79	\	\	\	\	\	2.43
1736	\	7.95	\	\	\	3.14	8.64	\	3.30	3.70
1743	\	\	3.31	\	\	\	\	\	\	3.06
1759	2.42	5.93	4.88	2.87	3.57	2.20	4.15	\	3.25	3.84
1763	2.70	6.15	2.83	2.89	3.46	2.92	4.21	2.35	2.09	\

1765	2.93	\	\	2.91	\	2.40	2.26	1.92	2.64	3.18
1766	\	\	\	\	\	\	1.85	\	\	\
1767	\	\	2.17	\	\	4.19	6.46	2.76	\	\
1772	3.13	\	3.26	3.89	\	3.51	3.14	2.52	\	\
1773	4.41	\	3.07	7.80	\	\	3.10	2.68	2.82	3.22
1774	\	\	\	\	\	\	\	\	\	2.84
1790	\	\	3.12	\	\	\	\	\	\	\
1791	\	\	2.14	\	\	\	\	\	\	\
1792	\	\	2.90	\	\	4.04	\	\	\	2.67
1793	3.76	\	2.90	4.21	2.92	3.78	\	5.25	3.99	3.21
1794	\	4.69	2.49	3.35	1.99	3.37	2.32	3.83	2.72	\
1795	3.20	4.90	3.10	3.69	3.11	3.89	2.63	3.83	3.73	\
1797	4.26	\	\	\	\	3.85	\	4.36	\	\
1800	\	\	\	\	\	\	\	2.36	3.78	\

Table 98 Average seed/yield ratios for periods of five years in ten localities in the Marche region between 1675 and 1800 (After Paci 1975, 145, Tavola 3).

Year	Plains/low hills		Medium hills				High hills/mountains			
	Pesaro	Senigallia	Cagli	Fossombrone	Pergola	Sant'Angelo	Gubbio	Montefeltro	San Vito	Urbino
1675-79	3.70	3.25	3.57	3.90	4.54	2.89	5.13	2.71	1.78	3.60
1680-84	3.69	4.62	4.38	**6.01**	4.33	3.41	3.04	3.88	2.51	3.02
1685-89	3.56	4.91	4.82	**6.37**	4.90	4.80	3.64	3.65	3.48	3.43
1690-94	3.97	5.33	3.76	4.05	5.69	3.09	2.66	2.89	3.03	3.06
1695-99	3.79	4.91	3.79	3.63	5.71	3.49	3.35	2.90	2.68	3.39
1700-04	4.35	5.24	3.57	4.14	4.92	3.54	2.85	2.70	3.77	3.28
1705-09	3.56	5.75	3.15	5.70	5.56	2.11	2.82	2.69	3.27	3.60
1710-14	4.17	\	2.81	**6.08**	**6.03**	1.98	2.54	3.32	2.98	2.73
1715-19	3.12	\	2.58	4.53	4.42	2.55	1.92	2.95	3.32	2.78
1720-24	4.42	\	2.75	4.03	4.41	2.40	2.99	3.40	3.34	2.65
1725-29	3.25	3.47	3.12	4.12	5.52	4.15	4.77	2.70	3.37	3.35
1735-36	\	7.93	\	2.79	\	3.14	\	\	3.30	3.06
1759	2.42	5.93	4.88	2.87	3.57	2.20	4.15	\	3.25	3.84
1763	2.70	**6.15**	2.83	2.89	3.45	2.92	4.21	3.52	2.09	\
1765-67	\	\	2.17	2.91	\	3.29	2.05	2.34	2.64	3.18
1790-94	3.76	4.19	2.71	3.78	2.45	3.73	2.32	4.54	3.53	2.94
1795-1800	3.73	4.90	3.10	3.69	3.11	3.87	2.63	3.51	3.75	\

= calculated derived data

= estimated derived data

Table 99 Overall wine yields in Marche/Teramo (1881-1884) (After ASI 1881, 250, Tav. II; and ASI 1886, 854-855, Tav. I).

Province	Area (ha)	Total wine production (hl)			Yield/ha (hl)			Yield/iug. (c.)		
		1881	1883	1884	1881	1883	1884	1881	1883	1884
Pesaro	19,615	254,995	270,422	100,056	13	13.8	5	0.63	0.67	0.24
Ancona	22,449	291,837	323,660	147,075	13	14.4	6.6	0.63	0.70	0.32
Macerata	27,444	384,216	497,042	278,580	14	18.1	10.2	0.68	0.88	0.49
Ascoli Piceno	25,326	379,890	342,015	307,760	15	13.5	12.2	0.73	0.65	0.59
Teramo	71,250	783,750	959,075	275,450	11	13.5	3.9	0.53	0.65	0.19

Table 100 Overall wine yields in Marche/Teramo (1885-1886) (After ASI 1886, 854-855, Tav. I).

Province	Area (ha)	Total wine production (hl)		Yield/ha (hl)		Yield/iug. (c.)	
		1885	1886	1885	1886	1885	1886
Pesaro	19,615	227,400	318,400	11.6	16.2	0.56	0.78
Ancona	22,449	155,400	358,000	6.9	16	0.33	0.78
Macerata	27,444	278,580	557,200	10.2	20.3	0.49	0.98
Ascoli Piceno	25,326	346,230	461,600	13.7	18.2	0.59	0.88
Teramo	71,250	468,265	771,300	6.6	10.8	0.19	0.52

Table 101 Overall wine yields in Marche/Teramo (1891/1894) (After ASI 1892, Tav. I, p. 380-81; ASI 1895, Tav. I, p. 350-51, 352-53).

Province	Area (ha)		Total wine production (hl)		Yield/ha (hl)		Yield/*iug.* (*c.*)	
	1891	1894	1891	1894	1891	1894	1891	1894
Pesaro	42,104	46,629	385,568	296,948	9.2	6.4	0.44	0.31
Ancona	37,016	38,973	301,689	195,342	8.2	5	0.40	0.24
Macerata	42,362	47,707	548,787	310,873	13	6.5	0.63	0.31
Ascoli Piceno	55,022	55,563	420,836	259,177	7.6	4.7	0.37	0.23
Teramo	34,120	32,468	448,643	224,396	13.1	6.9	0.63	0.33

Table 102 Average overall wine yields in Marche/Teramo (1879-1883) (After 1889-1890, Tav. I, 634-37).

Province	Cultivated surface (ha)	Average production (hl)	Average yield/ha (hl)	Average yield/*iug.* (*c.*)
Pesaro	22,125	303,292	13.7	0.66
Ancona	26,795	281,327	10.5	0.51
Macerata	40,306	480,313	12	0.58
Ascoli Piceno	55,439	401,187	7.2	0.35
Teramo	50,535	550,890	11	0.53

Table 103 Overall yield figures for the Marche (1911-1927) (After ASI 1911-1928).

Year	Area (ha)	Ext. (ha)	Int. (ha)	Ratio (%)	Total yield		Total yield		Grape/wine ratio (%)	Wine yield (*c./iug.*)
					Grapes (kg)	Wine (hl)	Grapes (kg/ha)	Wine (hl/ha)		
1911	382,000	376,600	5,700	98.5/1.5	335,900,000	2,200,000	879	5.8	66	0.28
1912	382,800	377,100	5,700	Id.	357,600,000	2,369,000	934	6.2	66	0.30
1913	382,200	376,600	5,600	Id.	331,900,000	2,214,000	868	5.8	67	0.28
1914	382,900	377,300	5,600	Id.	257,900,000	1,700,000	674	4.4	65	0.21
1915	383,000	377,300	5,700	Id.	91,400,000	573,000	239	1.5	63	0.07
1916	383,300	377,600	5,700	Id.	262,900,000	1,733,000	686	4.5	66	0.22
1917	383,200	377,300	5,900	Id.	414,700,000	2,650,000	1,082	6.9	64	0.33
1918	383,600	377,700	5,800	Id.	161,400,000	1,024,000	421	2.7	64	0.13
1922	381,600	375,600	6,000	98.4/1.6	319,500,000	2,135,000	837	5.6	67	0.27
1923	382,600	376,500	6,100	Id.	421,100,000	2,765,000	1,101	7.2	65	0.35
1924	382,600	376,500	6,100	Id.	299,700,000	1,899,000	783	5	64	0.24
1925	381,700	375,500	6,200	Id.	270,300,000	1,811,000	708	4.7	66	0.23
1926	381,600	375,500	6,100	Id.	209,900,000	1,316,000	550	3.4	62	0.16
1927	381,700	375,600	6,100	Id.	189,500,000	1,162,000	496	3	60	0.15

Table 104 Extensive and intensive grape yields for the Marche (1928-1932) (After ASI 1929-1933).

Year	Area (ha)		Grape yield (kg)		Grape yield (kg/ha)		Wine yield (hl/ha) (65%)		Wine yield (*c./iug.*)	
	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.
1928	375,600	6,100	244,200,000	29,700,000	650	4,869	4.3	31.6	0.21	1.53
1929	379,900	6,100	272,700,000	29,900,000	718	4,902	4.7	31.9	0.23	1.54
1930	379,936	6,021	178,500,000	22,200,000	470	3,687	3.1	24	0.15	1.16
1931	373,357	7,199	160,800,000	27,100,000	431	3,764	2.8	24.5	0.14	1.18
1932	359,586	8,643	375,900,000	49,100,000	1,045	5,681	6.8	36.9	1.32	1.54

Table 105 Extensive and intensive yields for mountainous areas in the Marche (1927-1931) (After ASI 1928-1932).

Year	Area (ha)		Grape yield (kg)		Grape yield (kg/ha)		Wine yield (hl/ha) (65%)		Wine yield (*c./iug.*)	
	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.
1927	111,090	1,690	43,340,000	3,540,000	390	2,095	2.5	13.6	0.12	0.66
1928	111,090	1,670	63,100,000	5,350,000	568	3,204	3.7	20.8	0.18	1
1929	98,700	1,500	56,010,000	3,870,000	567	2,580	3.7	16.8	0.18	0.81
1930	93,743	1,474	36,130,000	2,730,000	385	1,852	2.5	12	0.12	0.58
1931	100,647	1,631	31,600,000	3,100,000	314	1,901	2	12.4	0.10	0.60

Table 106 Extensive and intensive yields for hilly areas in the Marche (1927-1931) (After ASI 1928-1932).

Year	Area (ha)		Grape yield (kg)		Grape yield (kg/ha)		Wine yield (hl/ha) (65%)		Wine yield (*c./iug.*)	
	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.
1927	261,510	4,410	125,060,000	16,860,000	478	3,823	3.1	24.8	0.15	1.20
1928	261,510	4,430	181,140,000	24,390,000	693	5,506	4.5	35.8	0.22	1.73
1929	281,200	4,600	216,690,000	26,000,000	771	5,652	5	36.8	0.24	1.78
1930	211,193	4,503	142,410,000	19,310,000	674	4,288	4.4	27.9	0.21	1.35
1931	272,710	5,563	129,200,000	23,900,000	474	4,296	3.1	27.9	0.15	1.35

Table 107 Intensive wine yields for the Marche (1933-1938) (After ASI 1934-1939).

Year	Area (ha)		Total grape yield (kg)	Total wine yield (hl)	Grape/wine ratio (%)	Grape yield (int.) (kg/ha)	Wine yield (int.) (hl/ha)	Wine yield (int.) (*c./iug.*)
	Ext.	Int.						
1933	359,600	8,600	206,700,000	1,310,000	63.4	3,040	19.3	0.93
1935	362,200	8,700	371,600,000	2,401,000	64.6	5,670	36.6	1.78
1936	362,200	8,700	353,000,000	2,284,000	64.7	5,320	34.4	1.66
1937	362,100	8,700	240,300,000	1,468,000	61.1	6,110	37.3	1.80
1938	362,600	11,700	350,400,000	2,296,000	65.5	4,560	29.9	1.45

Table 108 Yield data for olive groves within an extensive and an intensive regime in Marche (1909-1932) (After ASI 1909-1933).

Year	Area (ha)		Total yield				Yield/ha				Ratio (%)
			Olives (Kg)		Oil (l)		Olives (Kg)		Oil (l)		
	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	
1909	178,580	\	6,460,000	\	1,057,000	\	36.17	\	5.92	\	16.37
1910	178,580	\	9,140,000	\	1,340,000	\	51.18	\	7.50	\	14.65
1911	178,580	\	5,600,000	\	840,000	\	31.36	\	4.70	\	14.99
1912	172,300	\	7,000,000	\	900,000	\	40.63	\	5.22	\	12.85
1913	172,300	\	6,800,000	\	1,160,000	\	39.47	\	6.73	\	17.05
1914	174,300	\	6,000,000	\	1,100,000	\	34.42	\	6.31	\	18.33
1915	172,600	\	7,200,000	\	1,150,000	\	41.71	\	6.66	\	15.97
1916	172,600	\	4,000,000	\	600,000	\	**23.17**	\	**3.48**	\	15.02
1917	172,700	\	13,600,000	\	2,300,000	\	**78.75**	\	**13.32**	\	16.91
1918	172,700	\	11,200,000	\	1,800,000	\	64.85	\	10.42	\	16.07
1919	172,700	\	9,300,000	\	1,400,000	\	53.85	\	8.11	\	15.14
1920	172,700	\	8,400,000	\	1,400,000	\	48.64	\	8.11	\	16.67
1921	172,700	\	7,800,000	\	1,300,000	\	45.17	\	7.53	\	16.67
1922	172,700	\	11,900,000	\	2,000,000	\	68.91	\	11.58	\	16.80
1923	172,700	\	15,100,000	\	2,900,000	\	87.43	\	16.79	\	19.20
1924	172,700	\	9,700,000	\	1,900,000	\	56.17	\	11	\	19.58
1925	172,800	\	6,400,000	\	1,250,000	\	37.04	\	7.23	\	19.52
1926	172,600	\	12,200,000	\	1,900,000	\	70.68	\	11	\	15.56
1927	172,500	\	10,200,000	\	1,440,000	\	59.16	\	8.35	\	14.11
1928	172,400	\	10,000,000	\	1,560,000	\	58	\	9.05	\	15.60
1929	172,508	5	4,130,000	10,000	640,000	1,560	23.94	**2,000**	3.73	**312**	15.59
1930	173,140	604	2,640,000	760,000	448,433	129,256	**15.25**	1,258	**2.59**	214	17
1931	173,140	604	8,160,000	910,000	1,419,748	158,248	**47.13**	1,507	**8.20**	262	17.4
1932	163,000	1,000	6,900,000	400,000	1,131,220	66,000	42.33	**400**	6.94	**66**	16.4

Table 109 Informed yield model for intensive and extensive vine and olive plantations in central Adriatic Italy.

Vineyard											
Planting density/ha Vines	Yield/ha (kg), based on yield/vine (kg)		Yield/ha (litres), based on an extraction rate of (%)				Yield/ha (hl)			
			50 (1)		70 (2)		1		2	
	1-2 (A)	3-4 (B)	A	B	A	B	A	B	A	B
1,300	1,300-2,600	3,900-5,200	650-1,300	1,950-2,600	910-1,820	2,730-3,640	6.5-13	19.5-26	9.1-18.2	27.3-36.4
3,300	3,300-6,600	9,900-13,200	1,650-3,300	4,950-6,600	2,310-4,620	6,930-9,240	16.5-33	49.5-66	23.1-46.2	69.3-92.4
6,100	6,100-12,200	18,300-24,400	3,050-6,100	9,150-12,200	4,270-8,540	12,810-17,080	30.5-61	91.5-122	42.7-85.4	128.1-170.8
8,100	8,100-16,200	24,300-32,400	4,050-8,100	12,150-16,200	5,670-11,340	17,010-22,680	40.5-81	121.5-162	56.7-113.4	170.1-226.8
Arbustum										
Planting density/ha Trees	Yield/ha (kg,), based on yield/tree (kg)		Yield/ha (litres), based on an extraction rate of (%)				Yield/ha (hl)			
			50 (1)		70 (2)		1		2	
	2 (A)	6 (B)	A	B	A	B	A	B	A	B
110	220	660	110	330	154	462	1.1	3.3	1.5	4.6
300	600	1,800	300	900	420	1,260	3	9	4.2	12.6
Intensive olive grove										
Planting density/ha Trees	Yield/ha (kg,), based on yield/tree (kg)				Yield/ha (litres), based on an extraction rate of (%)				Yield/ha (hl)			
					25							
	5 (A)	10 (B)	30 (C)	50 (D)	A	B	C	D	A	B	C	D
120	600	1,200	3,600	6,000	150	300	900	1,500	1.5	3	9	15
400	2,000	4,000	12,000	20,000	500	1,000	3,000	5,000	5	10	30	50
Extensive olive grove												
30	150	300	900	1,500	37.5	75	225	375	0.4	0.8	2.3	3.8
80	400	800	2,400	4,000	100	200	600	1,000	1	2	6	10

Table 110 Lands needs for the urban and rural population of central Adriatic Italy in Late Republican (LR1+LR2) and Early/High Imperial times (EI1+EI2) with regard to olive oil (intensive+extensive regime) (Pop = Population).

Pop	Olive oil needs (l)		Land needs (ha), based on an intensive regime with yields of (hl/ha)							
	Low	High	Low				High			
	Low	High	3	9	10	30	3	9	10	30
LR1	2,924,314	5,194,148	9,747.7	3,249.2	2,924.3	974.8	17,313.8	5,771.3	5,194.2	1,731.4
LR2	4,131,721	7,365,326	13,772.4	4,580.8	4,131.7	1,377.2	24,551.1	8,183.7	7,365.3	2,455.1
EI1	4,866,446	8,638,787	16,221.5	5,407.2	4,866.5	1,622.2	28,796	9,598.7	8,638.8	2,879.6
EI2	6,508,731	11,650,699	21,695.8	7,231.9	6,508.7	2,169.6	38,845.7	12,945.2	11,650.7	3,883.6
Pop	Low	High	Land needs (km²), based on an intensive regime with yields of (hl/ha)							
LR1	2,924,314	5,194,148	97.5	32.5	29.2	**9.7**	173.1	57.7	51.9	17.3
LR2	4,131,721	7,365,326	137.7	45.8	41.3	13.8	245.5	81.8	73.7	24.6
EI1	4,866,446	8,638,787	162.2	54.1	48.7	16.2	288	96	86.4	28.8
EI2	6,508,731	11,650,699	217	72.3	65.1	21.7	**388.5**	129.4	116.5	38.8
Pop	Low	High	Land needs (ha), based on an extensive regime with yields of (hl/ha)							
			Low				High			
			0.8	2	2.3	6	0.8	2	2.3	6
LR1	2,924,314	5,194,148	38,990.9	14,621.6	12,997	4,873.9	69,255.3	25,970.7	23,085.1	8,656.9
LR2	4,131,721	7,365,326	55,089.6	20,658.6	18,363.2	6,886.2	98,204.3	36,826.6	32,734.8	12,275.5
EI1	4,866,446	8,638,787	64,885.9	24,332.3	21,628.6	8,110.7	115,183.8	43,193.9	38,394.6	14,398
EI2	6,508,731	11,650,699	86,783.1	32,543.7	28,927.7	10,847.9	155,342.7	58,253.5	51,780.9	19,417.8
Pop	Low	High	Land needs (km²), based on an extensive regime with yields of (hl/ha)							
LR1	2,924,314	5,194,148	389.9	146.2	130	**48.7**	692.6	259.7	230.9	86.6
LR2	4,131,721	7,365,326	550.9	206.6	183.6	68.9	982	368.3	327.3	122.8
EI1	4,866,446	8,638,787	648.9	243.3	216.3	81.1	1,151.8	432	384	144
EI2	6,508,731	11,650,699	867.8	325.4	289.3	108.5	**1553.4**	582.5	517.8	194.2

Table 111 Lands needs for the urban and rural population of central Adriatic Italy in Late Republican (LR1+LR2) and Early/High Imperial times (EI1+EI2) with regard to wine (intensive+extensive regime) (Pop = population).

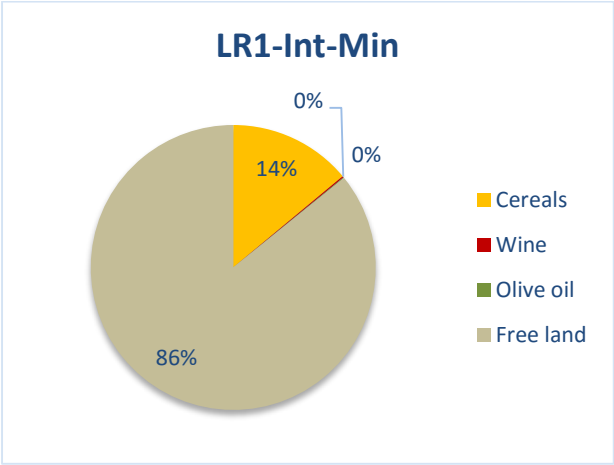
Pop	Wine needs (l)		Land needs (ha), based on an intensive regime with yields of (hl/ha)							
	Low	High	Low				High			
			23.1-46.2	42.7-85.4	69.3-92.4	128.1-170.8	23.1-46.2	42.7-85.4	69.3-92.4	128.1-170.8
LR1	29,589,336	59,611,107	12,809.2-6,404.6	6,929.6-3,464.8	4,269.7-3,202.3	2,309.9-1,732.4	25,805.7-12,902.8	13,960.4-6,980.2	8,601.9-6,451.4	4,653.5-3,490.1
LR2	42,083,568	84,607,254	18,218-9,109	9,855.6-4,927.8	6,072.7-4,554.5	3,285.2-2,463.9	36,626.5-18,313.3	19,814.3-9,907.2	12,208.8-9,156.6	6,604.8-4,953.6
EI1	49,189,680	99,129,711	21,294.2-10,647.1	11,519.8-5,760	7,098.1-5,323.6	3,839.9-2,880	42,913.3-21,456.6	23,215.4-11,607.7	14,304.4-10,728.3	7,738.5-5,803.8
EI2	66,794,357	133,974,842	28,915.3-14,457.7	15,642.7-7,821.4	9,638.4-7,228.8	5,214.2-3,910.7	57,997.8-28,998.9	31,375.8-15,687.9	19,332.6-14,499.4	10,458.6-7,844
Pop	Low	High	Land needs (km²), based on an intensive regime with yields of (hl/ha)							
LR1	29,589,336	59,611,107	128.1-64	69.3-34.6	42.7-32	**23.1-17.3**	258.1-129	139.6-69.8	86-64.5	46.5-34.9
LR2	42,083,568	84,607,254	182.2-91.1	98.6-49.3	60.7-45.5	32.9-24.6	366.3-183.1	198.1-99.1	122.1-91.6	66-49.5
EI1	49,189,680	99,129,711	212.9-106.5	115.2-57.6	71-53.2	38.4-28.8	429.1-214.6	232.2-116.1	143-107.3	77.4-58
EI2	66,794,357	133,974,842	289.2-144.6	156.4-78.2	96.4-72.3	52.1-39.1	**580-290**	313.8-156.9	193.3-145	104.6-78.4
Pop	Wine needs (l)		Land needs (ha), based on an extensive regime with yields of (hl/ha)							
	Low	High	Low				High			
			1.5	4.2	4.6	12.6	1.5	4.2	4.6	12.6
LR1	29,589,336	59,611,107	192,138.5	70,450.8	64,046.2	23,483.6	387,085.1	141,931.2	129,028.4	47,310.4
LR2	42,083,568	84,607,254	273,269.9	100,199	91,090	33,399.7	549,397.8	201,445.8	183,132.6	67,148.6
EI1	49,189,680	99,129,711	319,413.5	117,118.3	106,471.2	39,039.4	643,699.4	236,023.1	214,566.5	78,674.4
EI2	66,794,357	133,974,842	433,729.6	159,034.2	144,576.5	53,011.4	869,966.5	318,987.8	289,988.8	106,329.2
Pop	Low	High	Land needs (km²), based on an extensive regime with yields of (hl/ha)							
LR1	29,589,336	59,611,107	1,921.4	704.5	640.5	**234.8**	3,870.9	1,419.3	1,290.3	473.1
LR2	42,083,568	84,607,254	2,732.7	1,002	910.9	334	5,494	2,014.5	1,831.3	671.5
EI1	49,189,680	99,129,711	3,194.1	1,171.2	1,064.7	390.4	6,437	2,360.2	2,145.7	786.7
EI2	66,794,357	133,974,842	4,337.3	1,590.3	1,445.8	530.1	**8,699.7**	3,189.9	2,899.9	1,063.3

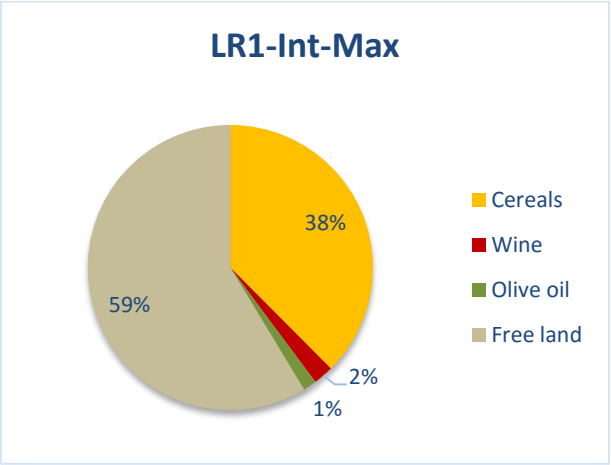
Table 112 Lands needs for the urban and rural population of central Adriatic Italy in Late Republican (LR1+LR2) and Early/High Imperial times (EI1+EI2) with regard to cereal needs (intensive+extensive regime) (Pop = Population).

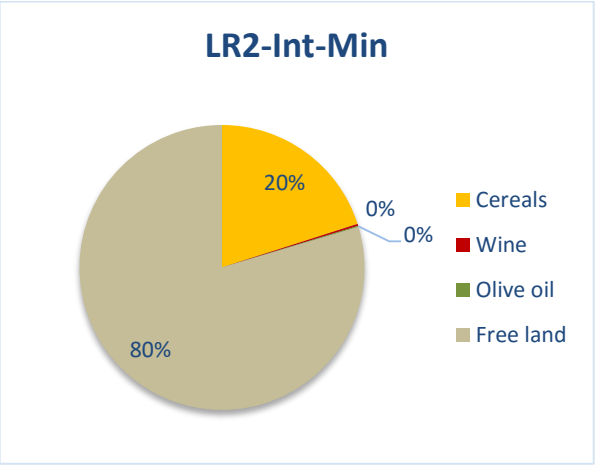
Pop	Wheat needs (l)		Land needs (ha), based on an intensive regime with yields of (kg/ha)			
	Low	High	Low		High	
			345	475	345	475
LR1	74,921,887	146,520,634	217,164.9	157,730.3	424,697.5	308,464.5
LR2	107,799,678	210,665,700	312,462.8	226,946.7	610,625.2	443,506.7
EI1	124,327,711	243,168,286	360,370.2	261,742.5	704,835.6	511,933.2
EI2	173,315,693	338,430,492	502,364.3	364,875.1	980,957.9	712,485.2
Pop	Low	High	Land needs (km²), based on an intensive regime with yields of (kg/ha)			
LR1	74,921,887	146,520,634	2,171.6	1,577.3	4,247	3,084.6
LR2	107,799,678	210,665,700	3,124.6	2,269.5	6,106.3	4,435.1
EI1	124,327,711	243,168,286	3,603.7	2,617.4	7,048.4	5,119.3
EI2	173,315,693	338,430,492	5,023.6	3,648.8	9,809.6	7,124.9

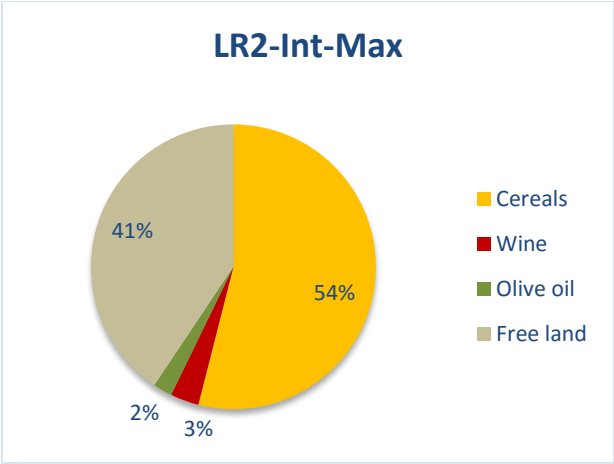
Pop	Low	High	Land needs (ha), based on an extensive regime with yields of (kg/ha)							
			Low				High			
			250	315	355	445	250	315	355	445
LR1	74,921,887	146,520,634	299,687.5	237,847.3	211,047.6	168,363.8	586,082.5	465,144.9	412,734.2	329,259.9
LR2	107,799,678	210,665,700	431,198.7	342,221.2	303,661.1	242,246.5	884,662.8	668,780	593,424.5	473,406.1
EI1	124,327,711	243,168,286	497,310.8	394.691.1	350,218.9	279,388.1	972,673.1	771,962.8	684,981.1	546,445.6
EI2	173,315,693	338,430,492	693,262.8	550,208.5	488,213.2	389,473.5	1,353,722	1,074,382.5	953,325.3	760,518
Pop	Low	High	Land needs (km²), based on an intensive regime with yields of (kg/ha)							
LR1	74,921,887	146,520,634	2,996.9	2,378.5	2,110.5	1,683.6	5,860.8	4,651.4	4,127.3	3,392.6
LR2	107,799,678	210,665,700	4,312	3,422.2	3,036.6	2,422.5	8,846.6	6,687.8	5,934.2	4,734.1
EI1	124,327,711	243,168,286	4,973.1	3,946.1	3,502.2	2,793.9	9,726.7	7,719.6	6,849.8	5,464.5
EI2	173,315,693	338,430,492	6,932.6	5,502.9	4,882.1	3,894.7	13,537.2	10,743.8	9,533.3	7,605.2

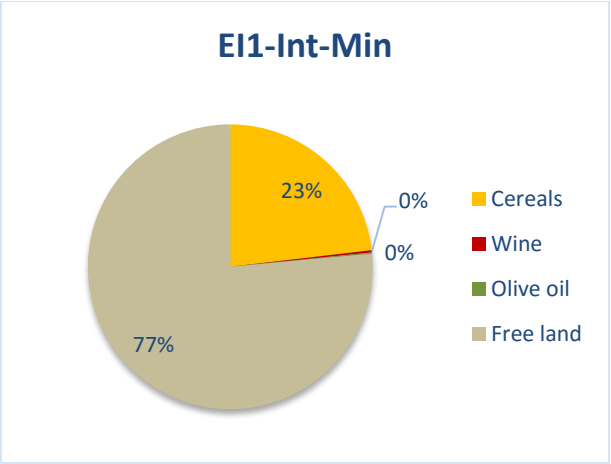
Table 113 Minimum (Min) and maximum (Max) land needs expressed in percentages for the study area in the Late Rebublican (LR1+LR2) and the Early/High Imperial period (EI1+EI2) based on intensive (Int-Min/Max) and extensive (Ext-Min/Max) cultivation regimes.

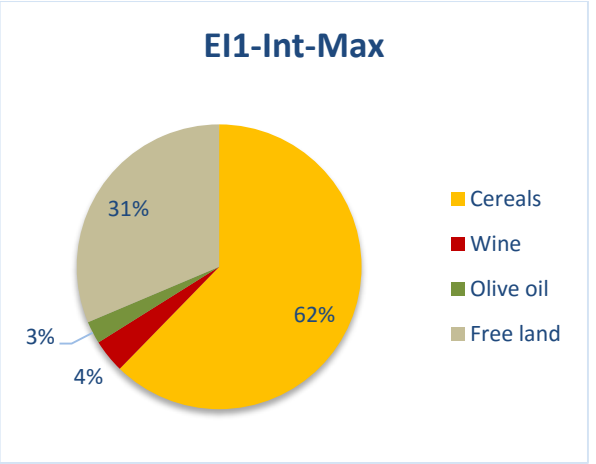


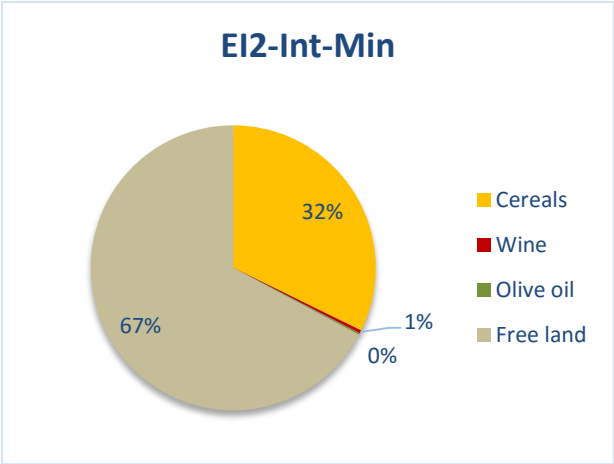


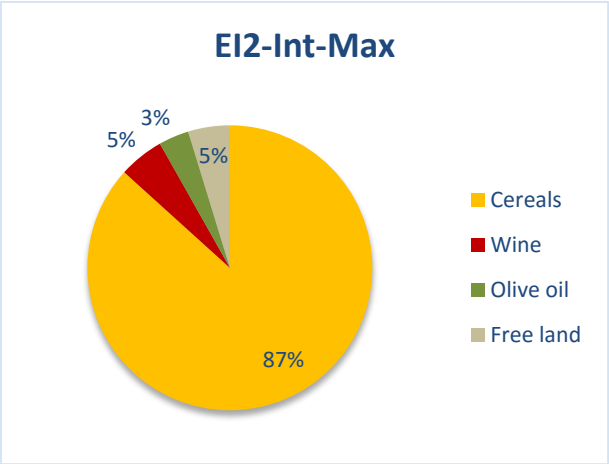


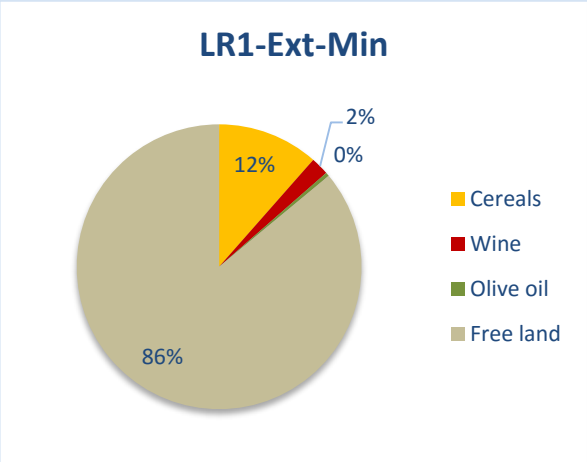


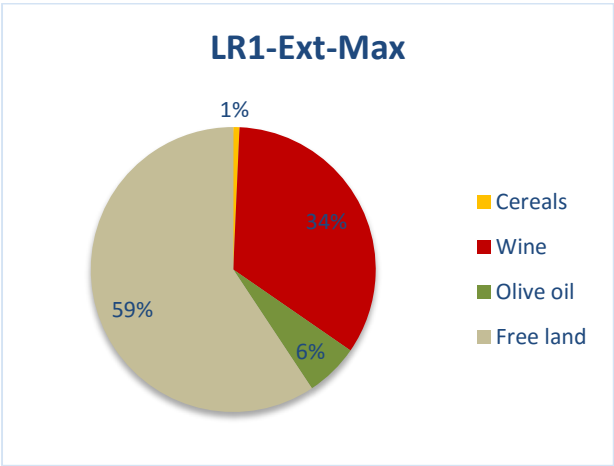


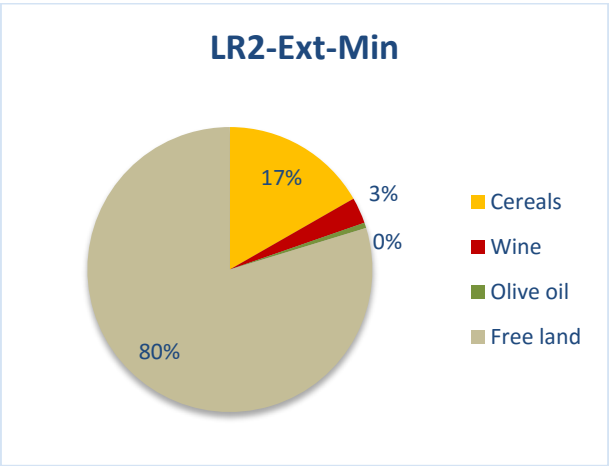


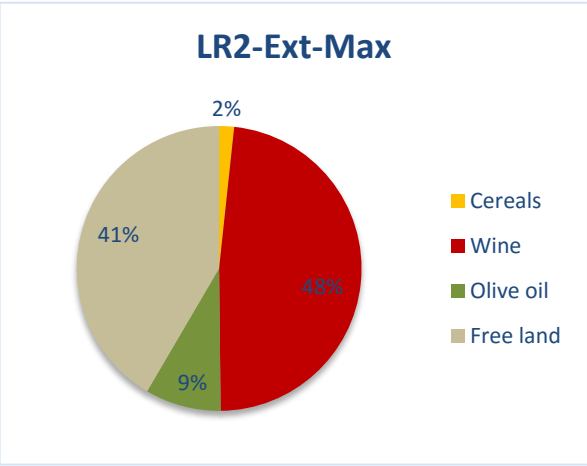

EI2-Int-Min
32%
1%
0%
67%
Cereals
Wine
Olive oil
Free land

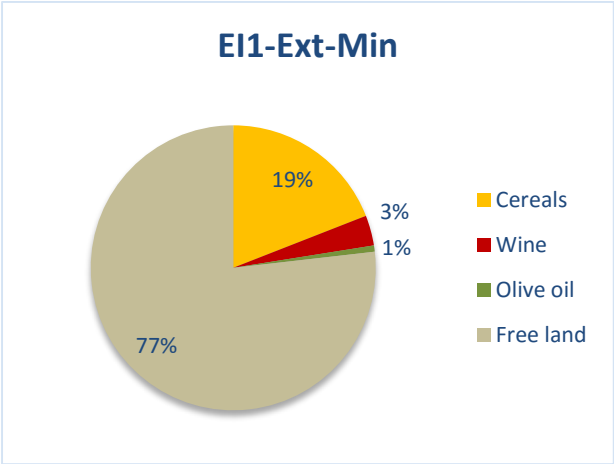

EI2-Int-Max
3%
5%
5%
87%
Cereals
Wine
Olive oil
Free land

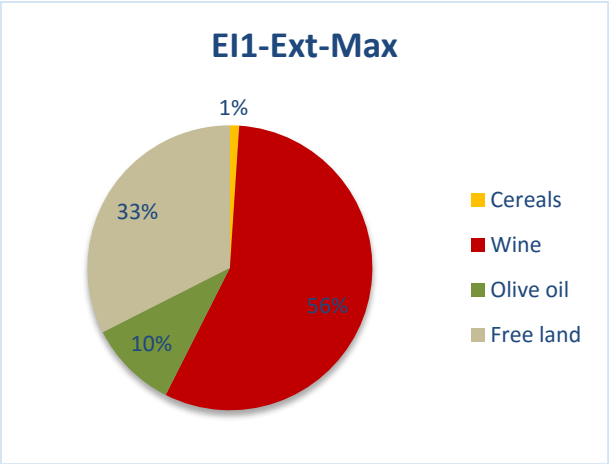

LR1-Ext-Min
2%
0%
12%
86%
Cereals
Wine
Olive oil
Free land

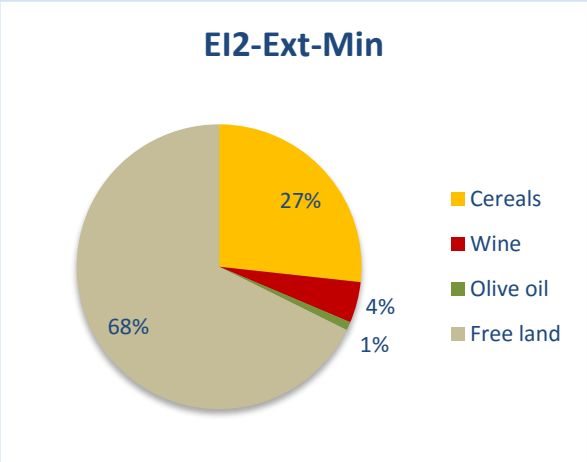

LR1-Ext-Max
1%
34%
59%
6%
Cereals
Wine
Olive oil
Free land

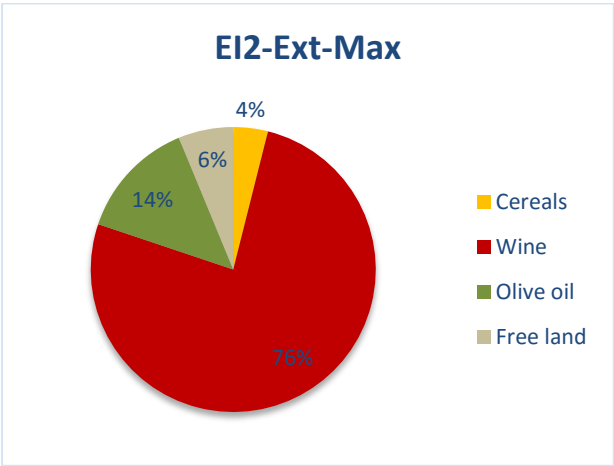

LR2-Ext-Min
17%
3%
0%
80%
Cereals
Wine
Olive oil
Free land

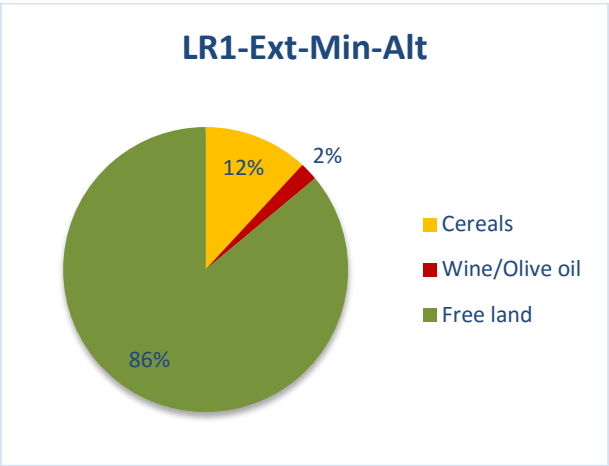

LR2-Ext-Max
2%
41%
48%
9%
Cereals
Wine
Olive oil
Free land

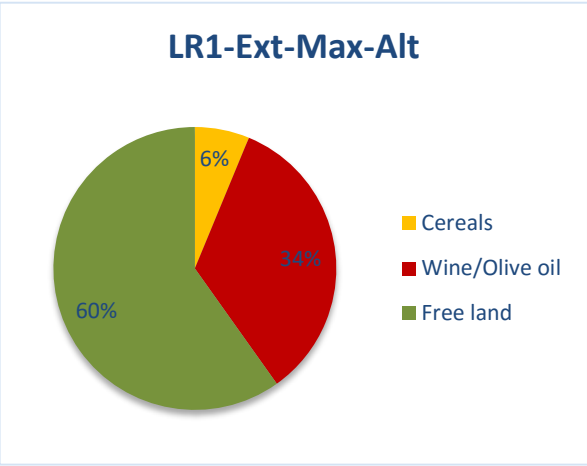

EI1-Ext-Min
19%
3%
1%
77%
Cereals
Wine
Olive oil
Free land

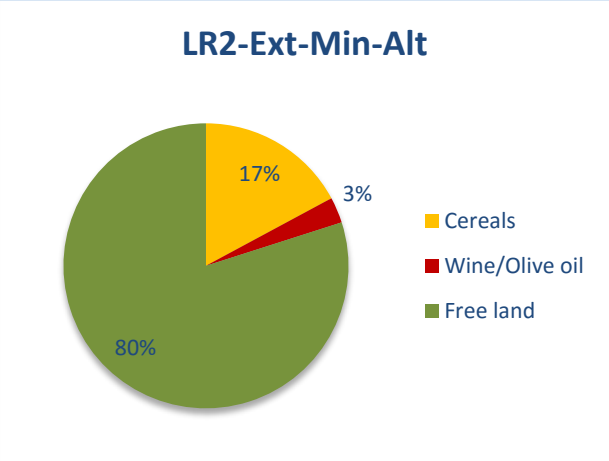

EI1-Ext-Max
1%
33%
56%
10%
Cereals
Wine
Olive oil
Free land

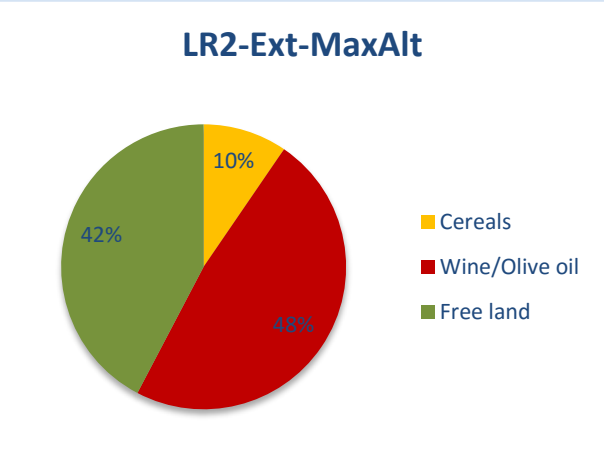

EI2-Ext-Min
27%
4%
1%
68%
Cereals
Wine
Olive oil
Free land

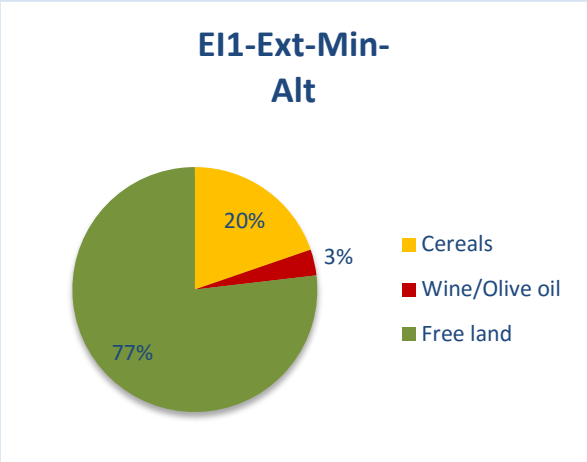

EI2-Ext-Max
4%
6%
14%
76%
Cereals
Wine
Olive oil
Free land

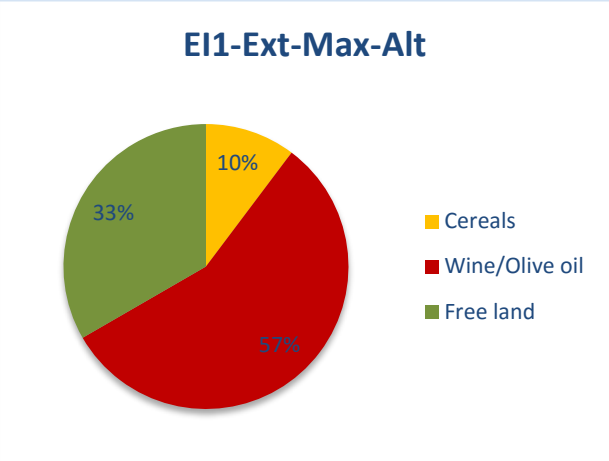

LR1-Ext-Min-Alt
12%
2%
86%
Cereals
Wine/Olive oil
Free land

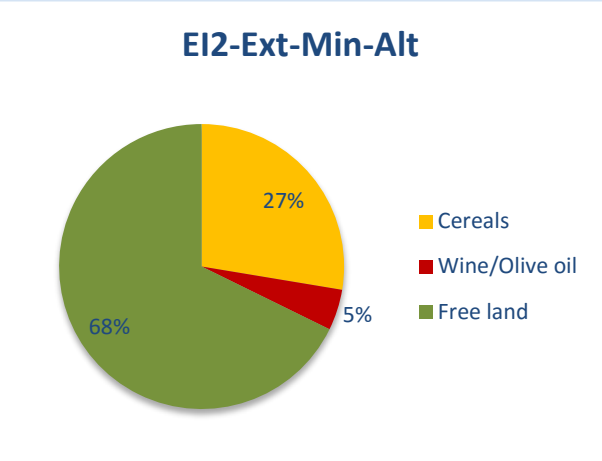

LR1-Ext-Max-Alt
6%
34%
60%
Cereals
Wine/Olive oil
Free land

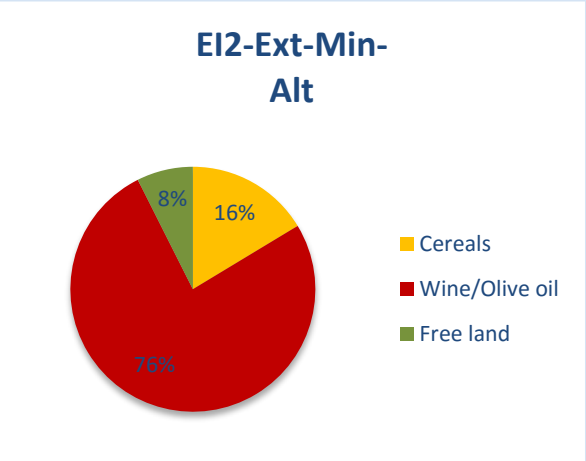

LR2-Ext-Min-Alt
17%
3%
80%
Cereals
Wine/Olive oil
Free land


LR2-Ext-MaxAlt
10%
42%
48%
Cereals
Wine/Olive oil
Free land


EI1-Ext-Min-Alt
20%
3%
77%
Cereals
Wine/Olive oil
Free land


EI1-Ext-Max-Alt
10%
33%
57%
Cereals
Wine/Olive oil
Free land


EI2-Ext-Min-Alt
27%
5%
68%
Cereals
Wine/Olive oil
Free land


EI2-Ext-Min-Alt
8%
16%
76%
Cereals
Wine/Olive oil
Free land

Appendix IV
List of ancient grape and olive varieties

Grapes

Cato (*RR*, VI, 1)

Aminia maius (large Aminian)
Aminia minuscula (small Aminian)
Apicia (Apician)
Gemina Eugenia (double Eugeneum)
Helvia minuscula (small Helvian)
Lucana (Lucanian)
Murgentina (Murgentian)

Virgil (*Georgics*, II, 91-109)

Ammineae (Amminean)
Argitis (Argitis)
Bumastus (Bumast = full-breasted)
Falerna (Falernian)
Lagea (Lagean)
Mareotides
Phanaea (Phanaean)
Precia (Precian)
Psithia (Psithian)
Purpurea (Purple)
Rhaetica (Rhaetian)
Rhodia (Rhodian)
Thasia (Thasian)
Tmolia (Tmolian)

Columella (*RR*, III, 2, 1-29)

Allobrogica (Allobrogian)
Albuelis (Albuelis)
Aminea (Aminean)
Apiana (Apian)
Arcelaca (Arcelacan)
Argitis minor (smaller Argitis)
Basilica (Basilic)
Biturica (Bituric)
Bumastus (Bumast = full-breasted)
Ceraunia (Ceraunian)
Cydonita (Cydonitan = quince-grape)
Dactylique (Dactyl)
Dracontion (Dracontion)
Eugenia (Eugenian)
Fereola (Fereolan)
Fregellana (Fragellan)
Helvenaca (Helvenacan)
Helvola (Helvolan)
Horconia (Horconian)
Inerticula (Inerticulan = *amethystos*)
Irtiola (Irtiolan)
Libyca (Libyan)
Mareotica (Mareotic)
Merica (Merican)
Murgentina (Murgentine = Pompeian)
Nomentana (Nomentan)
Numisiana (Numisian)
Pergulana (Pergulan)
Pretia (Pretian)
Psithia (Psithian)
Purpurea (Purple)
Rhaetica (Rhaetian)
Rhodia (Rhodian)
Sophortia (Sophortian)
Spionia (Spionian)
Stephanita (Stephanitan = coronary)
Thasia (Thasian)
Tripedanea (Tripedanean = three-foot)
Unciaria (Unciarian = ounce-weight)
Venucula (Venuculan = Scirpulan/Sticulan)
Visula (Visula)

Pliny (*NH*, XIV, 4, 21-43)

Aegia (Aegian)
Albuelis (Albuelis)
Alexandrina (Alexandrian)
Allobrogica (Allobrogian)
Alopecis (Alopecis)
Ambrosia (Ambrosian)
Aminaea (Aminaea)
Aminea nigra/Syriaca (black Aminean)
Apiana (Apian = bee-vine)

Arceraca/Argitis (Arceracan)
Asinusca (donkey-grape)
Balisca (Balisca = coccolobis)
Bananica (Bananican)
Biturigiaca (< Bourges or Bordeaux)
Buciona (mouthful)
Calventina (Calventine)
Capnios (smoke-grape)
Carbonica (charcoal-vine)
Cinerea (ashy grape)
Columbina (pigeon-vine)
Conseminea (crossed vine < Arretio/Arezzo)
Coronario (garland grape)
Dactylides (Dactylis)
Escaria (table grapes)
Etesiaca (seasonal vine <Arretio/Arezzo)
Eugenia (Eugenian)
Faecenia (Faecenian)
Falerna (Falernan)
Forenses (market grapes)
Gallica (grape from Gaul)
Graecula (Greek < Chios or Thasos)
Helvennaca (Helvennacan)
Helvola (Helvolan)
Hispana (Spanish grape)
Horconia (Horconian)
Inerticula/sobria (good for nothing, sober)
Itriola (Itriolan)
Lagea (Lagean)
Mareotida (Maraeotid)
Mettica (Mettican)
Murgentina/Pompeiana (Murgentine)
Nomentana (Nomentan = Mentana)
Oleaginea (olive-grape)
Pariana (vine of Paros)
Perusinia (Perusinian)
Picena (vine of Picenum)
Picina (pitch grape)
Pompeiana (Pompeian)
Praecia (Praecian)
Pumila (dwarf-vine)
Purpurea bimammia (Purple)
Rabuscula (dusky grape)
Raetica (Raetic)
Rhaetia (Rhaetian)
Rhodia (Rhodian)
Scirpula (rush vine)
Sopina (vine of Florentia = Florence)
Spionia (Spionian)
Streptis (revolving grape)
Surrentina (< Sorrento)
Talpona (mole-vine < Arretio/Arezzo)
Tharrupia (< hills of Thurii)
Thasia (Thasian)
Tiburtina (< Tibur/Tivoli)
Tripedanea (three-foot vine)
Tudertibus (vine of Tuscis = Todi)
Uncialis (one-ounce grape)
Venicula/Surcula/Scapula (Veniculan)
Vinaciola (Vinaciolan)
Visulla (Visulla)

Olives

Cato (RR, VI, 1)

Albiceres (waxy-white)
Colminia (Colminian)
Orcita (Orcites)
Posea (Posean)
Sallentina (Sallentine)
Sergiana (Sergian)

Columella (RR, V, 8, 3)

Cercitis (Shuttle)
Culminia (Culminian)
Licinia (Licinian)
Murtea (Myrtle)
Nevia (Nevian)
Orchis/Orcita (Orchis)
Posia/Pausia (Posian)
Regia (Royal)
Sergia (Sergian)