New Light on the Commercial Landscape of Roman Cities: the Contribution of Non-invasive Survey

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The cities of Pompeii, Ostia and Herculaneum have provided us with an exceptional image of Roman urban life. These cities have revealed an almost complete street network and sequence of buildings. Therefore, they turned out to be excellent case studies in the analysis of the spatial organization and functional zoning of Roman cities. Over the past decades the urban economy and the patterning of space of these cities has been investigated intensively.[1] Especially a paradigm shift in the study of Roman urbanism, the Spatial Turn, provoked a more detailed study of the spatial relationship between economic buildings and their urban environment. The study of the embedment of commercial and industrial infrastructure in the urban fabric became a hot topic. Distribution maps, that highlighted the spread of economic space in the city, were being created and compared to one another and in this way trends of urban zoning were exposed.[2] More recently, other sites have been taken into account as well.[3]

However, cities that were mapped and visually reconstructed by means of non-invasive full coverage surveys, an integration of surface, geophysical, and topographical survey and aerial photography, have been left out of the picture almost completely, while the great potential of this approach for the study of Roman urbanism, and in particular for the evaluation of economic space, has been demonstrated sufficiently the past decades. In this article a full contribution of these non-intrusive techniques for the study of Roman urban economic space will be argued.

The Emergence of Non-Invasive Techniques in Archaeological Research

The 1988 paper 'Mediterranean Survey and the City' by Bintliff and Snodgrass illustrated the potential of archaeological field survey for the investigation of lost ancient cities.[4] The underlying message of the article, a call for the employment of non-destructive survey in the study of ancient urbanism, resulted in a great number of field projects organized throughout the Mediterranean world. From 1996–2001 a joint project of the DAI and the American Academy in Rome was set up to study, by way of geophysical prospection, the unexcavated zones of Ostia.[5] In Italy The British School at Rome initiated the Tiber Valley Project in 1997 and achieved remarkable results, again with large scale geophysics, on green-field sites such as Falerii Novi, Ocriculum and Portus.[6] In 2000 a team from Ghent University launched The Potenza Valley Survey Project, an intensive rural and urban survey in an Adriatic Valley, employing a wide variety of non-invasive techniques on four abandoned cities.[7] Also in the wider Roman world urban survey projects were set up, e.g. Sagalassos, Sikyon, Leptiminus, Silchester and Wroxeter.[8]

Published in: Miko Flohr – Nicolas Monteix (Eds.), Shops, Workshops and Urban Economic History in the Roman World, Panel 8.3, Archaeology and Economy in the Ancient World 42 (Heidelberg, Propylaeum 2020) 17–30.
DOI: *https://doi.org/10.11588/propylaeum.573*

These innovative studies have led to the emergence of an *urban landscape archaeology*, a recognition that a combination of non-destructive methods could result in a complete mapping of ancient towns.[9] This caused a major break with traditional archaeological research, which was for quite some time solely dominated by excavation and was concerned with the study of individual architectural structures, providing only selective information on certain parts of the city but not taking into account its broader development and character.[10] The importance of attaining a full overview of Roman town plans is undeniable. Not only do these give us the opportunity to determine more reasonably, which zones could be of interest for excavation and permit us to prepare more targeted questions before actually excavating, these also make it possible to detect spatial and functional patterns.[11] In what way can non-destructive methods now exactly detect economic space?

Surface surveys, ideally performed on agricultural land, during which all kinds of material are collected – ranging from building material and pottery to industrial waste and other products of manufacture - enable us to create distribution maps informing us on processes of functional zoning.[12] Aerial photography can detect buried archaeological features in the form of soil-, crop- or shadow marks on the ground, allowing specific building structures in the urban fabric to be discerned.[13] Geophysical survey techniques are capable of generating an image of the surface with multiple anomalies, a projection of buried structures. According to their physical characteristics and their specific form these can be interpreted in a very reliable way.[14] Notably magnetometer survey, with its ability to detect variations in the magnetism of the soil – a reflection of not only walls and roads, but more importantly of productive installations like furnaces, kilns and hearths, can expose important parts of the functional topography of cities. In this way industrial or artisanal districts can be distinguished from the more public and private quarters of the city.[15] It is especially a combination of these non-invasive techniques that will lead to a better understanding of the embedment of economic space in the wider urban complex.

Let us elaborate on several sites to demonstrate how economic space can be scanned in surface surveys, aerial photography and geophysical data, and how in certain cases this led to diagnostic interpretations on functional urban zoning.

Economic Infrastructure Investigated through Non-Invasive Techniques

When studying the maps achieved by aerial photography and geophysical survey an in-depth knowledge of Roman architecture is necessary. To that end a consideration of excavation results of sites over the entire Roman world is highly important as these produced plans of almost all known types of buildings. These plans can subsequently be taken as a starting point for the identification of structures with similar formal characteristics in the aerial and geophysical maps. Within the category of Roman buildings with a predominant economic

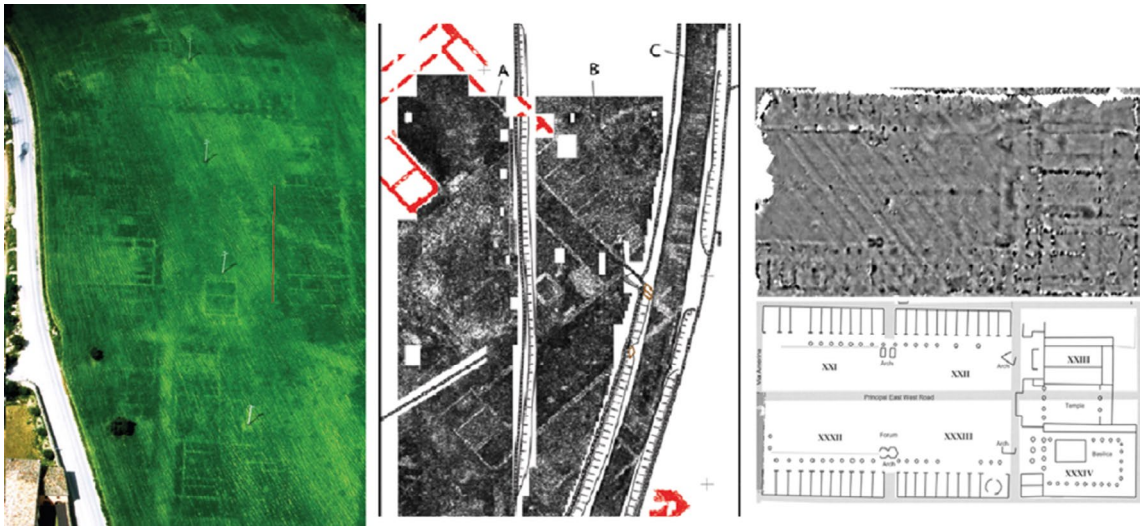

Fig. 1: *Tabernae* identified through aerial photography on the forum of Trea, and through geophysical prospection on the fora of Ammaia and Falerii Novi (from left to right).

function, especially *tabernae*, *macella* and *horrea* are relatively easily recognizable, because these structures have a very characteristic layout.

Tabernae are defined by a simple elongated plan, normally with a rectangular room connected to the street, often including a back room. *Macella* are identified through their mostly rectangular or quadrangular courtyard, fully or partially surrounded with *tabernae* and often with a round building or *tholos* in the middle. *Horrea* also consisted in most Roman urban contexts of an open courtyard with rooms surrounding it and closed off by a robust outer wall, or as a common second type shows, with narrow rooms of great depth opening on the same side.[16]

Not only the layout of these buildings can be a hint for their identification, but also their topographical position within the cityscape. *Tabernae* were generally located on the *forum*, aligned the principal streets of the city and were built into other public structures or residences. *Macella* are in most cases to be found on the forum or nearby, often on one of the main streets. In a few cities the *macellum* is situated more outside the administrative heart of the city.[17] *Horrea* were certainly most present in harbor cities where they clustered around the rivers, yet they are often found distributed over the entire city.[18]

In particular *tabernae*, because they were built so widespread across the city and have such a distinctive form, appear clearly in the non-invasive survey record. The *forum* of Potentia, reconstructed by a combination of aerial photography, geophysical survey and excavations, was bordered on both long sides by *tabernae*. An aerial photograph of Trea reveals how the forum was partly surrounded by shops. The same accounts for Ammaia, where ground-penetrating radar has shown how both sides were aligned with *tabernae*. At Falerii Novi the magnetometer survey has demonstrated that the forum square was enclosed by no less than 40 shops (fig. 1).[19]

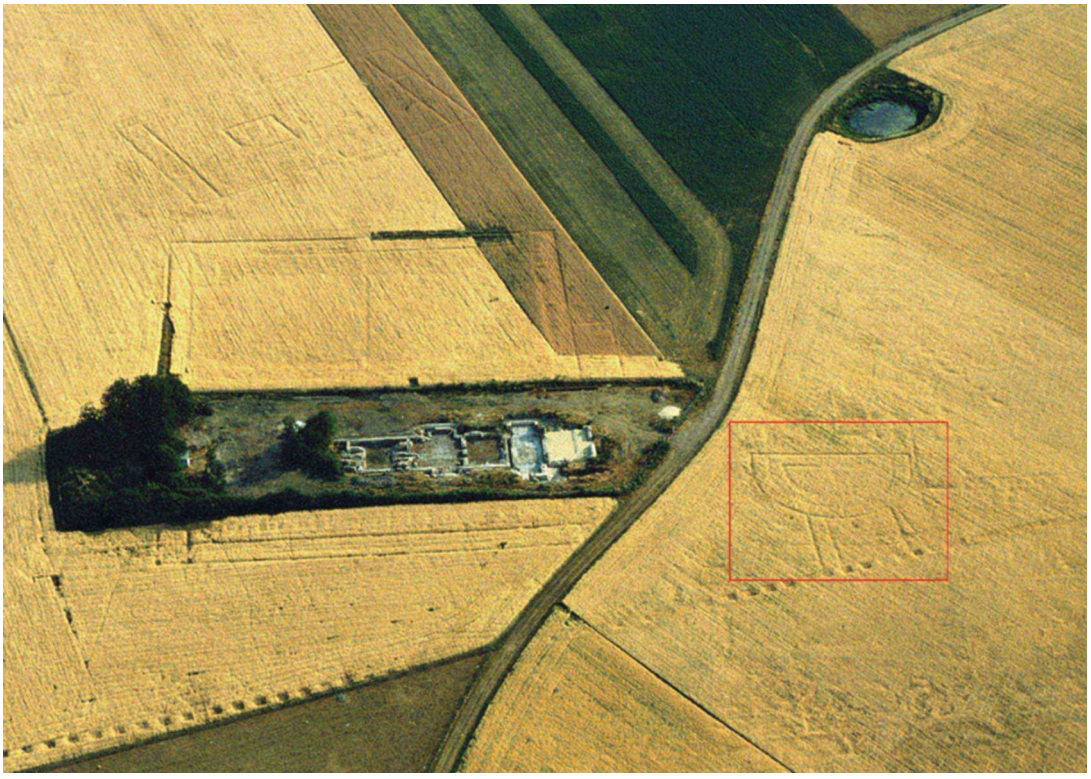

Fig. 2: Aerial photograph of a *macellum* at Vieil- Évreux.

The *macellum* however seems to be a harder structure to identify: even though it has a typical layout, it is also characterized by a huge architectural variety, meaning that no two *macella* are the same. For instance at the Gallo-Roman sanctuary of Vieil-Evreux aerial photography revealed a semi-circular monument, at first sight not at all identifiable as a *macellum* (fig. 2). Yet during excavation the architectural aspects of the structure became obvious: a semi-circular wall with 13 shops and in the middle a water supply. Especially the presence of animal waste and ovens in the vicinity of the building, datable before and after the use of the building and related to food production, support this identification. Moreover, the building is comparable to other *macella* with a hemicycle plan, for instance the one of Thamugadi or Gightis.[20]

Horrea have been observed by means of aerial photography and geophysical survey at a number of sites in the Mediterranean. At the Gallo-Roman site of Novioregum, modern Barzan, a large *horreum* has been found by aerial photography in the 1970s and excavated since 2003.[21] At Ostia magnetometer surveys have proven the existence of a large number of *horrea* on top of the already multiple excavated examples. The storage buildings seem to be concentrated mostly along the river harbor.[22] Since 2006 more surveys have been conducted at Ostia, more precisely at the Isola Sacra, the artificial island between Portus and Ostia. Remarkable results were obtained immediately north

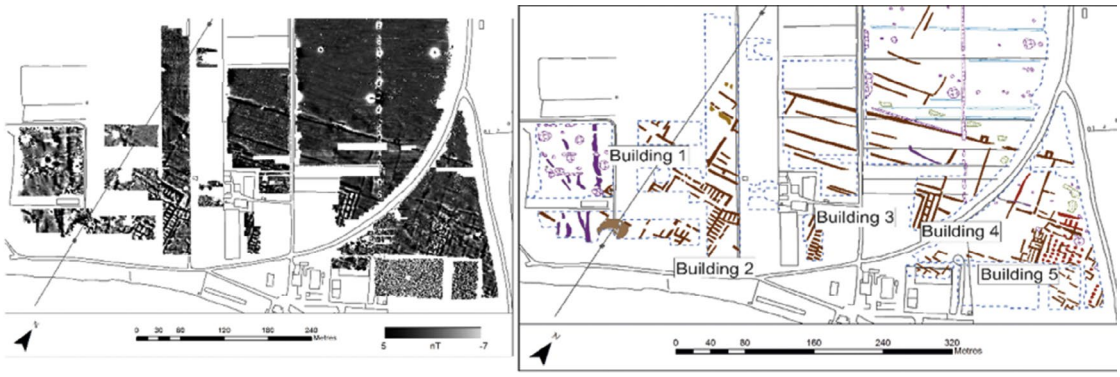

Fig. 3: Magnetometer survey in the southern part of Isola Sacra (Ostia) and interpretation of several warehouses.

of the Tiber, where several large warehouses were observed (fig. 3).[23] At Nauportus, a huge amount of *horrea* was revealed by geophysical surveys. A market place, 30% of which was dedicated to storage buildings, was detected by for instance geoelectric mapping (fig. 4). Next to *horrea*, also individual shops were built on the market.[24] *Horrea* were equally revealed at the port city of Aquileia. The economic character of this city is attested through geophysical surveys, magnetometer and ground penetrating radar, conducted since 2011.[25] Apart from the excavated harbor in the eastern part of the city, a second harbor has been revealed by geophysical techniques in the western *suburbium*, surrounded by warehouses.[26]

Functional Zoning Investigated through Non-Invasive Techniques

By using a combination of non-invasive techniques, patterns of functional zoning can be detected. Remarkable results were achieved at several Roman North African sites, for instance the harbor city of Leptiminus. An intensive field survey was performed and based on the distribution of the artifacts a distinction could be made between different functional zones.[27] In the western and eastern area high clusters of ceramic and kiln waste were detected, suggesting that these were zones, where ceramic production took place. The presence of kilns here was confirmed by the magnetometer survey, of which several examples have been excavated. Nearby, slag deposits from ironworking were found, related to iron smelting and smithing. It is clear that industrial buildings were limited to the periphery of the city, while the public center remained free of these activities.[28]

The harbor city of Meninx has been subjected to a combination of non-invasive techniques.[29] The city is known especially for its purple dye production, hence the great finds of crushed murex shells over the urban surface. Next to this, coarse ware and amphora wasters were dispersed across the site, often linked to concentrations of kilns.[30]

Fig. 4: Geoelectric mapping image of market square and *horrea* at Nauportus.

The magnetometer prospection exposed a large part of the commercial infrastructure of the city. Not only the discovery of multiple *horrea*, several of which are excavated, but also the identification of a monumental *macellum* with surrounding *tabernae*, prove the high commercial character of the city (fig. 5). The latest magnetometer survey has defined high magnetic values in some of the *tabernae* surrounding the *macellum*, which could be an indication of floor heating or cooking.[31]

In Britain, a couple of sites provided detailed information on their commercial and industrial organization. At Wroxeter an intensive campaign of geophysical surveys, mostly magnetometry, ground penetrating radar and resistivity, was initiated in 1994, resulting in a complete plan of the ancient city. Previously defined as a *garden city* in which areas of open space dominated, the magnetometer has brought to light multiple anomalies connected to public, residential and industrial activities. The city was divided in functional zones, reflecting social and economic activities.[32] One zone seemed to be occupied by elite residences, while another one is interpreted as an area for the habitation of poor people or activities connected to agriculture.[33] What concerns the industrial activities in Wroxeter, and actually in Roman towns in general: these are expected to be located on the edges of the town so their negative effects on the city center are limited. Wroxeter seems to fit this picture, with kilns and large open spaces – possibly connected to tanning and fulling – situated on the periphery of the town.[34]

The town of Silchester was subjected to a large mapping project in 2005–2010, combining the results of all previous excavations, surface surveys, aerial photographs

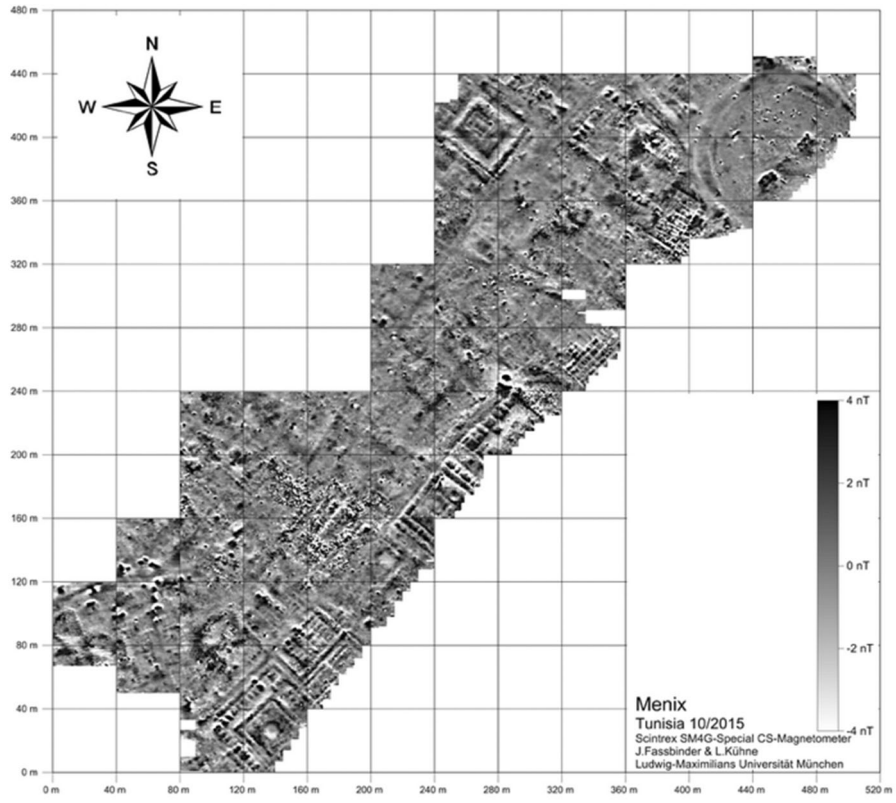

Fig. 5: Magnetometer survey at Meninx.

and accompanying it with a large scale geophysical survey, to provide us with one of the most complete Roman town plans.[35] Multiple strip-buildings, which functioned as *tabernae*, were identified clustering along the main east-west street (fig. 6). The lack of this type of building in other parts of the town is a sign of zonation: this was the most important street and was thus an excellent location for selling and buying. *Tabernae* were also found around the forum, but not so much in connection with residences, as is the case in most cities in the Mediterranean world. As in Wroxeter, the geophysical survey at Silchester provided possible proof for activities of tanning or fulling in the form of 80–100 tanning pits southwest of the town.[36]

At Sagalassos, located in Turkey, a combination of large-scale excavations, surface surveys and geophysical survey, exposed how the city was divided in different zones: a monumental center bordered by residential zones to the east and west, and artisanal areas situated in the periphery of the city on the southwestern and eastern side. A dominant artisanal activity at Sagalassos was pottery production, strongly reflected in kilns and other workshop infrastructure detected by geophysical survey. At least 25 workshops and 89 kilns were identified by geophysics. The southwestern zone was more focused on metal working, as confirmed by geochemical analyses.[37] Sagalassos

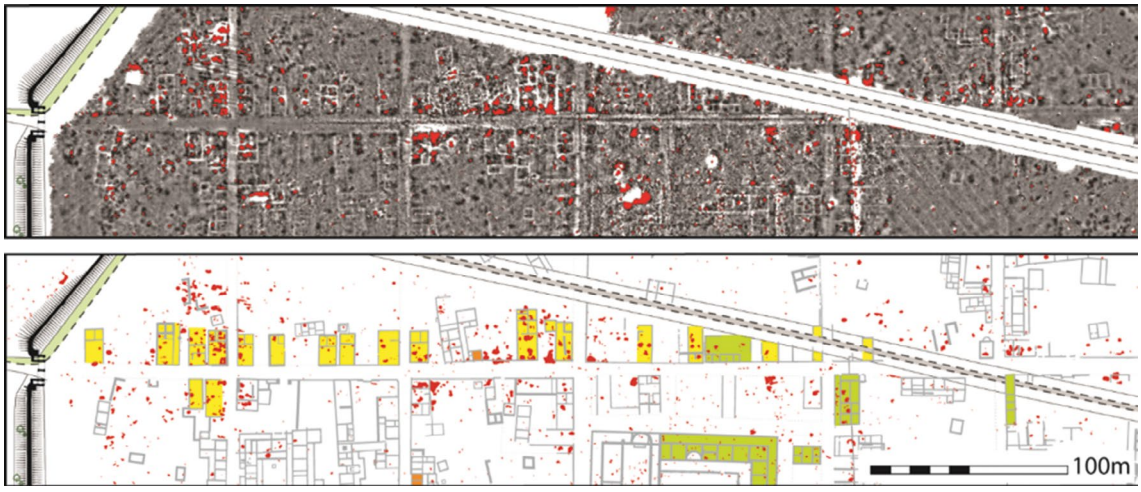

Fig. 6: Strip-buildings (yellow) along the main east-west road at Silchester. Other *tabernae* (green) are visible.

is thus a clear case study of how non-invasive approaches can show that industrial activities were confined to the peripheral areas of the city.

Conclusions

The last three decades non-invasive techniques have undoubtedly experienced an upsurge in archaeology. Apart from generating an overall view of the street network of buried cityscapes, these techniques have the possibility to detect a wide array of building structures, reflecting on different domains of Roman city life.[38] As has been demonstrated, the economic sphere is strongly attested in the form of specific building structures, material remains, or of course a combination of both. Moreover, these techniques have the great potential to detect patterns of (economic) functional zoning, therefore they should in the future definitely be taken into account more in the study of Roman economic space.

Notes

[1] Eschebach 1970; Raper 1977; Ruddell 1964; Mayeske 1972; Gassner 1986; Gralfs 1988; Bakker 1999.

[2] Gulino 1987; La Torre 1988; Laurence 1994; Ellis 2004; Delaine 2005; Flohr 2007; Monteix 2010.

[3] Laurence – Newsome 2011; Kaiser 2011; Flohr – Wilson 2017 (especially part III); Wilson – Flohr 2016 (notably the section 'Space', which is concentrated on the context of economic activities in Roman cities). Amraoui 2017.

[4] Bintliff – Snodgrass 1988.

[5] Martin et al. 2002, 259.
[6] Keay et al. 2000; Keay – Paroli 2011; Hay et al. 2013; Millett 2013, 24; Johnson 2013, 8.
[7] Vermeulen et al. 2017.
[8] Neubauer – Eder-Hinterleitner 1997; Buteux et al. 2000; Lolos et al. 2007; Mattingly et al. 2011; Clarke – Robinson 2011; Martens et al. 2012.
[9] Christie 2012, 25 f.
[10] Millett 2013, 26.
[11] Vermeulen et al. 2012, viiii; Boschi 2016, 87.
[12] Mattingly et al. 2001, 73–75.
[13] Van Limbergen et al. 2017, 17 f.
[14] Keay et al. 2004, 228; Millett 2013, 29.
[15] Keay et al. 2004, 227; Johnson 2013, 10; Boschi 2016, 93.
[16] Rickman 1971, 148. 153; Holleran 2012, 71 f. 100 f. 161.
[17] De Ruyt 1983, 326–330; Holleran 2012, 101 f.
[18] Geophysical survey at Portus, Ostia and Aquileia has proven that warehouses were built close to rivers, yet at Ostia and Rome, among other examples, *horrea* were scattered throughout the street network.
[19] Keay et al. 2000, 35–39; Verdonck – Taelman 2012, 71; Vermeulen et al. 2017, 91.
[20] Guyard – Bertaudière 2011, 29, 35 f.; Bourgois et al. 2015, 89.
[21] These results remain unpublished (http://www.fa-barzan.fr/decouvrir/visite-guidee/les-entrepots/).
[22] Heinzelmann 2002, 104 (Pl. IV.2). 112–114.
[23] Germoni et al. 2015.
[24] Horvat 2008, 116.
[25] Groh 2016.
[26] Groh 2012, 1–3. 5. 7 f.
[27] Mattingly et al. 2001, 74.
[28] Minor production took place within the centre, but this is related to re-use in later periods. Clarke – Robinson 2011, 97–103. 109 f.; Mattingly et al. 2001, 75 f. 80. A variety of economic activities were identified. For more information on these economic activities I refer to Mattingly et al. 2011, 205–272.
[29] From 1996–2006 Meninx was part of the project 'An Island through Time: Jerba Studies', in which small excavations were combined with magnetometer survey. Starting from 2015 a new project was launched 'The Urban Structure of Ancient Meninx', during which a large-scale magnetometer survey was conducted.
[30] Wilson 2002, 251; Fentress et al. 2009, 136.
[31] Fentress et al. 2009, 154–157; Lambers et al. 2017, 135–137.
[32] Buteux et al. 2000, 69–80; Gaffney et al. 2000, 81–99.
[33] Gaffney et al. 2000, 95.
[34] Buteux et al. 2000, 74; Gaffney et al. 2000, 96; Results in White, Gaffney, Gaffney 2013.
[35] Creighton – Fry 2016, 37–47.
[36] Creighton – Fry 2016, 407–409. 416 f.
[37] Martens et al. 2012, 89; Poblome 2016, 395.
[38] E.g. social, residential, political, entertainment, religious, economic.

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Fig. 1: Trea: F. Vermeulen et al. 2017, 92 fig. 59; Ammaia: L. Verdonck – D. Taelman 2012, 72 fig. 47; Falerii Novi: S. Keay et al. 2000, 36 f. figs. 25. 26. – Fig. 2: Copyright S. Bertaudière & L. Guyard. – Fig. 3: P. Germoni et al. 2015, 227. 229 figs. 11. 13. – Fig. 4: B. Mušič – J. Horvat 2007, 224 fig. 4a. – Fig. 5: J.W.E. Fassbinder – L. Lambers 2017, 135 fig. 1. – Fig. 6: J. Creighton – R. Fry 2016, 409 fig. 15.1.

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