

# Investigating the impact of Roman urbanisation on the landscape of the Potenza Valley: A Report on Fieldwork in 2007

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## *Abstract*

*This paper reports on a set of intensive interdisciplinary field operations by a Belgian team of Ghent University in 2007 in the Marche region of central Adriatic Italy. Most of the interventions, comprising geophysical prospections, geomorphologic observations, aerial photography, surface artifact surveys, excavations, topographic surveys and pottery studies, aim at a better understanding of the developing Romanisation of this part of Picenum and the rapid urbanization of the area from the late Republic onwards. Quite spectacular are the results of combined remote sensing work on such towns as the coastal colony *Potentia* and the interior municipium *Trea*, with unusually detailed mapping of the majority of public and private town structures. In *Potentia* these intra-site and peri-urban surveys are now also being checked in the field with focused excavations on a town gate and an amphora workshop. Also important are original contributions towards a better comprehension of the town-landscape nexus, involving the discovery of roads, cemeteries, aqueducts and quarries discovered near the four Roman cities. Finally new observations concerning the pre-Roman situation of centrally organized settlement and its links with the establishment of more Roman style towns, add much to the debate about the relatively late urbanization of this Adriatic region.*

## INTRODUCTION (FV)

Since 2000 a team from Ghent University<sup>1</sup> actively investigates the occupation history of the valley of the river Potenza in the central part of the Italian region Marche. Main objectives of this multi-disciplinary archaeological research are the study of settlement change and of the evolution of complexity of society during the Picene (Iron Age), Roman and early Medieval periods (ca 1000 BC-1000 AD). During the first years of fieldwork most activities were concentrated on a diachronic approach of the rural areas within this 80 km long valley between the Apennines and the Adriatic Sea.<sup>2</sup> In 2006 a second phase of intensive fieldwork started, now with a clear emphasis on the Roman period and on the development in space and time of the four Roman towns in the valley, their late Iron Age precursors and their systematically exploited hinterland.<sup>3</sup> Different aspects of Roman town formation and of the impact of Romanisation and urbanisation on the Potenza valley landscape will be studied, in close relation with the Central Italian background and developments between the 3<sup>rd</sup> century BC and the end of Roman dominance.

In this report the PVS team wishes to present the main results of a wide range of field activities deployed in the valley of the Potenza during 2007.<sup>4</sup> They were partly obtained thanks to intensive collaboration with invited teams of geophysical and topographical experts from the Archaeological Prospection Services of Southampton, the British School at Rome, the Katholieke Hogeschool Gent and the University of Ljubljana.<sup>5</sup>

As is reflected in the present report this year's geo-archaeological field investigations generally centred on the lower and middle valley of the Potenza. All four towns located in these parts from East to West, namely *Potentia*, *Ricina*, *Trea* and *Septempeda*, were systematically monitored from the air, with aerial photography missions in spring and summer. In the lower valley, the coastal town of *Potentia* was the object of much attention. Several remote sensing operations were conducted here and excavations, partly to control the survey results, started in a western part of the town area. Some of the preliminary results of these digs are also presented here. Furthermore, a trial excavation was initiated on an amphora production site in the suburban area of the colony, on the territory

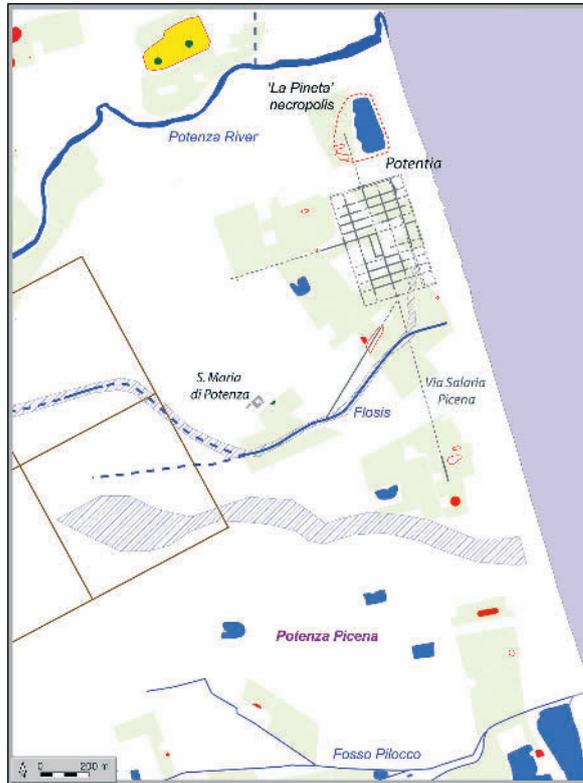


Fig. 1. River mouth area in the lower Potenza valley during Roman times with integration of the most important geo-archaeological data: the colony of Potentia, the road network, suburban settlements and cemeteries and the Roman course of the river Potenza (ancient Flosis).

Recanati developed. Through a combination of surveys by the PVS-team,<sup>6</sup> involving extensive aerial photography, studies of archive aerial photographs and systematic intensive surface collection survey, and punctual excavations undertaken in two areas by the *Soprintendenza per i Beni Archeologici delle Marche*,<sup>7</sup> much is now known about the layout of the town (fig. 1). The aerial photographs have predominantly revealed the road layout of the colony and the evidence confirms that *Potentia* has a regular street grid layout oriented on a NNW-SSE alignment. The wall, enclosing the circa 18 ha large rectangular town, has also been identified in most areas and the position of at least three (north, south and west) gates is now known. Some internal structures are visible in the aerial photographs and the excavations in the monumental centre unearthed a Republican temple complex bounded by a portico and surrounded by other buildings. Excavations in the vicinity of the temple complex revealed shops fronting onto the *decumanus maximus* and various other structures, some with mosaic flooring. The excavations indicated that the town centre had been partly rebuilt in the late 3<sup>rd</sup> and 4<sup>th</sup> century AD, while the intensive surface collection survey and study of materials confirmed a chronology dating from the Late Republican to the Late Imperial period, with a gradual abandonment from the 6<sup>th</sup> century onwards.

#### *New topographic observations (FV, GV, SDS)*

Previously<sup>8</sup> we have demonstrated that active aerial photography from a low flying aircraft, taking oblique (digital) images, is one of the major survey techniques being applied with success in the Potenza valley. New material, from monitoring flights in 2007 over *Potentia* concerns a number of traces, mostly crop marks, observed west and south of the ancient town area. In the central western area of the urban core, the much stressed growth of grass and crops during the period April-July gave away a very clear and more than 100 m long trace of the incoming *decumanus maximus* (fig. 2). Revealed from the air is an almost 10 m wide linear strip of crop marks indicating the road bed, before and after entering the west gate (see further). *Extra muros* it displays a central darker feature to

of present day Potenza Picena.

In the middle valley we focused our activities on the two towns positioned on a *diverticulum* of the *Via Flaminia*, connecting Nocera Umbra with the harbour town Ancona. Both Roman *municipia*, known as *Trea* and *Septempeda*, and the Iron Age hilltop site of Monte Pitino, located in an intermediate position between the Roman towns, were subjected to different degrees of surface survey. In this report we present the most important results from this first campaign of integrated geophysical, geomorphological and artefact surveys on these three sites that are crucial for understanding the evolution of grouped and complex settlements in this part of the valley.

#### THE ROMAN COLONY OF *POTENTIA* AND ITS HINTERLAND

The colony of *Potentia* (founded in 184 BC) is situated about 100m from the present Adriatic coast on a beach ridge near the original mouth of the river Potenza, south of the modern town of Porto Recanati. Its valley bottom site is now mostly taken in by agricultural land, as the city was abandoned in early medieval times for locations on nearby hilltops, where the towns of Potenza Picena and



Fig. 2. Detailed aerial view from the north of the wide linear crop mark in grassland (upper left) and grain (right) of the decumanus maximus in the extramural area near the W-gate of Potentia.



Fig. 3. View from the northwest of the crop marks associated with Roman and post-Roman river beds of the Potenza at its ancient mouth, south of the colony. Some features are probably associated with harbour facilities.

be interpreted as the drainage system, which later on, at a considerable distance from the town wall, changes into a lateral ditch. Along this important extra mural road, connecting the town with its *centuriatio* system and ultimately along the Potenza plain with the *Via Flaminia*, we remarked at least three probable traces of large funeral monuments. As is the case with the so-called ‘Toraccio’, a still standing *opus caementicium* core of a Roman funerary monument at several hundred meters west of town, this new information clearly confirms the presence in this area of a major cemetery, logically bound to the outgoing road (fig. 1).

Immediately south of the urban centre, crop marks in grain fields showed clearer than ever the position of several ancient flood streams of the river Potenza (fig. 3). As was demonstrated through

earlier geomorphologic research (Goethals et al. 2006), they represent several phases of the Roman and post-Roman river bed. Some indications on the 2007 photographs point towards the presence of harbour facilities in this area, quite close to the southern gate of the town. If confirmed by further fieldwork we would have proof for the existence of a harbour area at the river mouth in direct connection with one of the main entrances to the town and with the road leading towards an attested stone bridge over the Potenza at Casa dell’Arco (fig. 1).

This river mouth area clearly delineates the southern edge of town, a phenomenon which is also reflected in the micro-topography of the beach ridge on which *Potentia* was erected. The geology of the sandy beach ridge shows the presence of local gravel beds lying under a thin layer of alluvial clay. To understand the exact topographic setting of the urban area we finalised during the 2007 field season a detailed micro-topographic map of the site.<sup>9</sup> This image (fig. 4) shows very clearly the configuration of the beach ridge on which the rectangular town plan was imposed. It is an oblong, almost oval area, only centrally connected to the slightly higher interior land of the Potenza plain west of the city. Interesting is also the remarkable central depression, which as we know from earlier geophysical prospections coincides with the area of the forum. The possible relationship of other small anomalies in the beach ridge topography with archaeological structures needs to be investigated further.

#### Geophysical surveys on Potentia (SH, LV)

##### Magnetometer survey (SH)

Between the 6<sup>th</sup> and 15<sup>th</sup> September 2007, a magnetic survey was undertaken by the Archaeological Prospection Services of Southampton (APSS) and The British School at Rome.<sup>10</sup> The survey aimed at locating and mapping the remains of sub-surface archaeological features in the southern and eastern parts of the town, which were the only remaining intra-mural areas still to be surveyed with this technique.<sup>11</sup> For this survey, grids of 30 m by 30 m were set out. They were orientated to ensure that the survey traverses crossed the line of potential archaeological features known from aerial photography at an angle of approximately 30 degrees.<sup>12</sup>

The results of the 2007 magnetometer survey were successful in developing and expanding upon the information gleaned from the 2004-2005 survey and extended our knowledge of the town’s

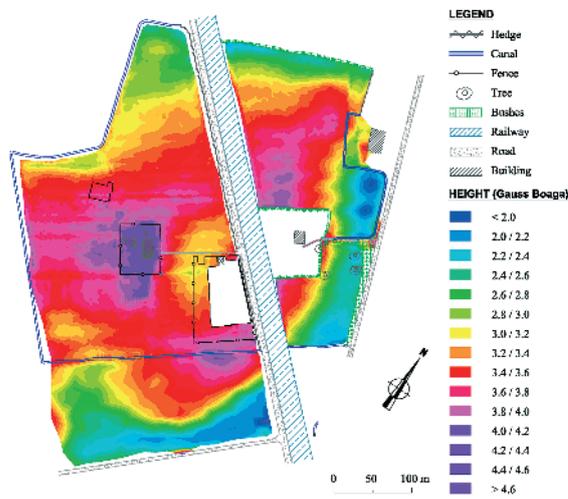


Fig. 4. Digital elevation model of the microtopography in the urban area of Potentia.

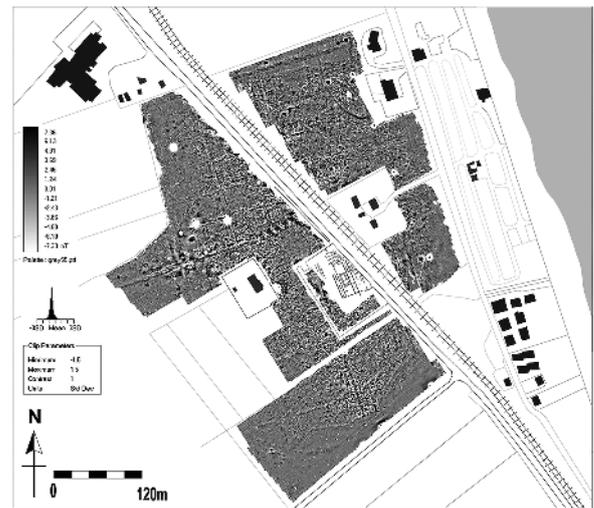


Fig. 5. Magnetometer results of three prospecting campaigns in and around Potentia.

layout to the east of the railway line (fig. 5). The layout of the town clearly emerges from the survey results and a number of buildings, streets and open areas can be identified that in many instances add clarity to the findings from the previous season's work (fig. 6).

Overall, the street layout in the eastern half of the town conforms to the grid system defined by aerial photographs and the magnetometer survey of the western half of the town. The *insulae* located between the streets lack clarity with regard to the definition of individual buildings but some structures can be seen. It is thought that the effect of ploughing and the presence of vast quantities of building material within the soil mask the detection of buried structures. In some areas the magnetometer survey has successfully confirmed the presence of roads missing from the aerial photographs. The southern edge of the town to the west of the railway clearly demonstrates the destructive forces of the flooding river. This quadrant of the town has simply been washed away and the flood line is clearly visible. This phenomenon can also be seen in the southeast corner of the survey as the roads, buildings and general 'noise' or urban remains stop abruptly in this area.

The presence of a linear positive anomaly (fig. 6, *m145* and *m146*) running parallel to one of the *cardines* appears to confirm the observation of a wide ditch and bank that would have originally demarcated the eastern extent of the primary phase of the town dating to its initial construction in 184 BC. This feature was supplanted, according to Livy, by the construction of the town wall



Fig. 6. Interpretation of the magnetometer survey in Potentia.

in 174 BC further to the east, thereby expanding the urban area of the colony.<sup>13</sup> The continuation of the town wall in the eastern part of the survey area is much more distinct than in the west. The northern course of the circuit wall (fig. 6, *m111* and *m112*) is marked by a strong positive anomaly that becomes wider to the west suggesting that this section of the wall may have been dismantled. The eastern course of the town wall (fig. 6, *m113* and *m114*) is clearly visible although the possible (but still unproven) east marine gate is not evident in the results.

Perhaps the most pertinent discovery is the

area	excavation area	NE area	area near temple
antenna frequency (MHz)	250 and 500	500	250 and 500
traverse direction (parallel)	NE-SW (250 MHz) NW-SE (500 MHz)	W-E	SE-NW
operation mode	odometer (automatic distance measuring)		
inline distance between traces	0.05 m		
crossline distance between the profiles	0.5 m (250 MHz) and 0.25 m (500 MHz)		
sample interval within a trace	400 ps (250 MHz) and 200 ps (500 MHz)		
time window	100 ns (250 MHz) and 80 ns (500 MHz)		
number of stacked traces	8		
prospected surface	1200 m <sup>2</sup> (250 MHz) 345 m <sup>2</sup> (500 MHz)	2500 m <sup>2</sup>	1140 m <sup>2</sup> (250 MHz) 330 m <sup>2</sup> (500 MHz)
prospection time	4 days	5 days	3 days

Table 1. Methodology of the GPR prospection at Potentia.

presence of a semicircular anomaly (fig. 6, m144) immediately east of the deserted farm building that occupies some space in this eastern part of town. The anomaly is presumed to be the trace of a theatre or *odeon*. The potential natural syncline of the landscape may account for its position and slight distortion to the alignment of the rest of the towns' layout. Comparative evidence derives from sites such as *Herculaneum* where the theatre clearly lies on slightly different orientation to the neighbouring streets. Measuring 30 m in length and about 28 m wide, the *Potentia* theatre would be relatively compact in size, but Roman theatres and *odeons* vary in proportions, and the well known *odeon* in Pompeii is just a little over these dimensions (de Vos 1988, 63).

Finally, a strange curvilinear anomaly in the northeastern part of the city (fig. 6, m147) presents an interesting dilemma. Usually, geophysical survey results can reveal very little about the chronology of structures (Keay et al. 2000, 9). However, in this instance it appears as though this feature postdates the layout of the town since it does not respect the alignment and appears to cut through the rigid orientation of the city grid.

#### Testing the georadar in Potentia (LV)

From 26 June until 14 July 2007, a ground-penetrating radar (GPR) survey was carried out by the PVS-team on three zones of *Potentia*. The first area had been identified as the possible location of the west gate of the colony on the basis of previous magnetometer and resistance surveys and aerial photographs. The aim of the GPR survey was to provide complementary information to the magnetometer and resistance surveys and to plan the excavation of the gate (see below). In the sec-

ond and the third area, respectively north and east of the presumed forum square, relatively clear building plans had been revealed by the magnetometer survey and here again the aim was to obtain additional information, in particular on the depth of the structures and the functions of the buildings.

With GPR, a three-dimensional model of the archaeological structures can be obtained. The technique has been used to detect walls, floors, roads, ditches and voids. The instrument used at *Potentia* was the Sensors & Software pulse EKKO PRO with 250 and 500 MHz antennas. The details on the survey methodology have been summarised in table 1.

Like the resistance survey, the GPR was used successfully to map the *decumanus maximus* running out of *Potentia* (fig. 7). Interestingly, the GPR imagery not only shows very clearly the east-west road, but also a north-south structure with the same characteristics, suggesting another possible road. The contrast between the soil and the remains of the town wall and gate, however, later well revealed by the excavations (see below), was much weaker and remained virtually undetected by the GPR.

In the area of the presumed bath complex, north of the forum, the GPR survey added little to the information known from the magnetometer survey, except for a few building traces west of the bath complex and clearer limits of the *decumanus maximus*. The contrasts detected were very weak and it is remarkable that only the shallow depth slices (up to approximately 40 cm) revealed archaeological features. This can only partly be explained by the poor conservation state of the remains (see the magnetometer survey). A high clay and moisture content of the soil may account for a high atten-

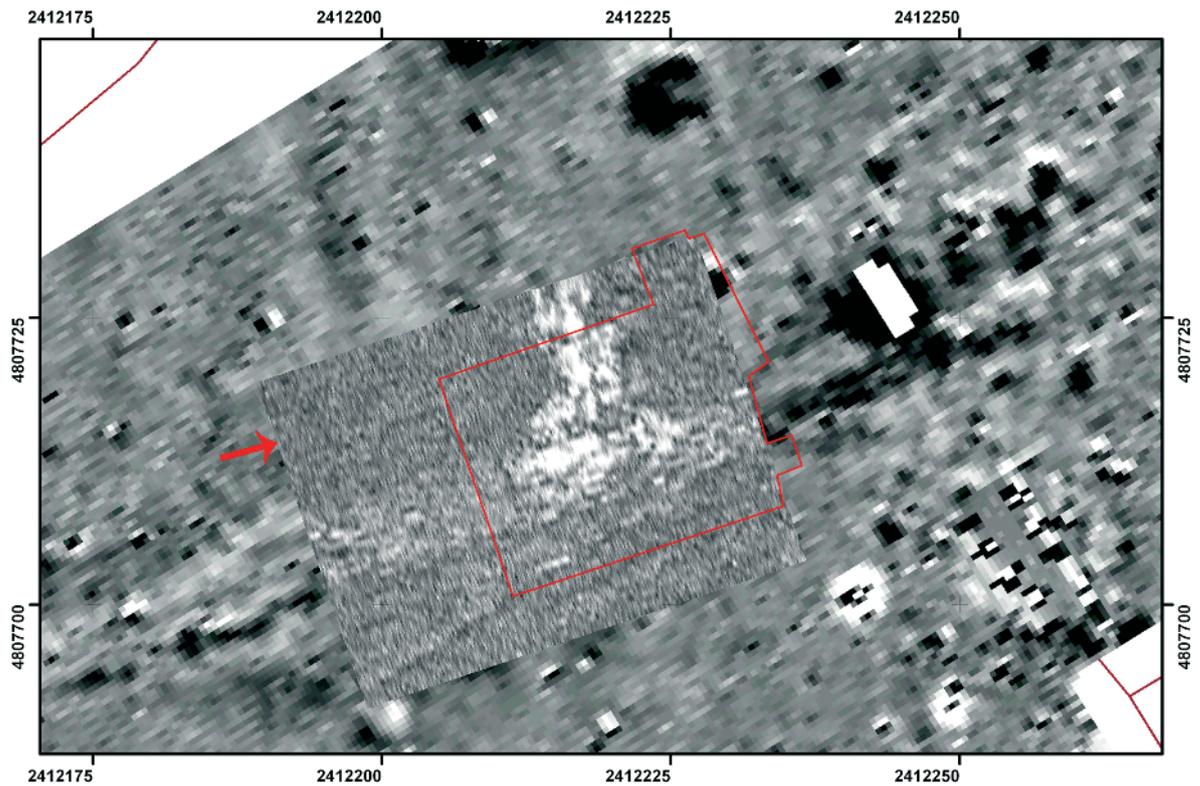


Fig. 7. GPR depth-slice of 50-60 cm, superimposed on the magnetometer data gathered by the Archaeological Prospection Services of Southampton and the British School at Rome. The excavation area is indicated in red.

uation of the energy and hence a low depth penetration.

In the third area (fig. 8), near the excavated temple complex, the GPR survey confirmed the results from the magnetometer prospection and identified some additional building structures south and southwest of the sanctuary. They are closely related to the road running parallel to the west of the Republican sanctuary and to the forum square presumed to lie to the west of it. That the 500 MHz antenna was able to detect these features may be explained by their proximity to the excavation trench. Often the area around a trench has dried out, allowing for a better depth penetration compared to the rest of the site.

*Excavations near the western gate of the city (FC, SD, FV, HV, PM)*

In July 2007 a first excavation campaign was carried out by the Department of Archaeology of Ghent University on the legally protected part of the site of the Roman colony of *Potentia* (so-called Casa Storani site).<sup>14</sup> The investigated area consists of a 20 m by 20 m trench, in a second phase ex-

tended eastward by a strip of about 5 m wide (figs. 9, 10). After removing the circa 45 cm deep surface layer, manual stratigraphic excavations were conducted during a first period of three weeks. During the full excavation period traditional and near-infrared aerial photographs were taken on a daily basis with the use of a 'Helikite', a helium balloon combined with a kite (see below).

The reasons for the excavations were partly to test the results from earlier survey interventions by the PVS team, and thus contribute to methodological progress in this line of fieldwork. In particular the intensive aerial photography monitoring, the study of archive aerial photographs, the artefact surveys, the geophysical surveys with three methods (magnetic, electric resistivity and GPR), the geomorphologic auguring and micro-topographical measurements had given clear indications for archaeological structures connected with the western gate and wall of the city in this area. Furthermore, in order to obtain more details of the layout of the entrance and defence facilities of the Roman colony, and comprehend its stratigraphic and chronologic complexity throughout the whole Roman era, it was decided that excavation work was



Fig. 8. Interpretation of the results of GPR survey near the temple in the central area of Potentia: 1. Series of parallel rectangular buildings south of the forum, 2-3. buildings adjacent to the temple area. The limits of the survey area are indicated in black.

needed. The excavation was, in fact, motivated by the desire to verify not only the location of the city gate, but also to get a clearer picture of the surrounding area, where, on the basis of aerial photographs, we could suppose a link between the western section of the city wall and a road, lined with funerary monuments, leading into the town from the west. Further main aims were to establish

the existence of architectural remains and their degree of preservation, as potential factor for the development of an archaeological park, and to create the basis for a pottery reference typology of the finds in Potentia.<sup>15</sup>

The large dimensions of the trench and the tenacious consistency of the soil, obviously not cultivated in recent years, regrettably allowed us only to investigate the surface of the first archaeological structures identified just below the removed vegetation layer. These structures were well defined and distinct.

The most recent activities consist of rectangular ditches attributable to post-medieval agricultural

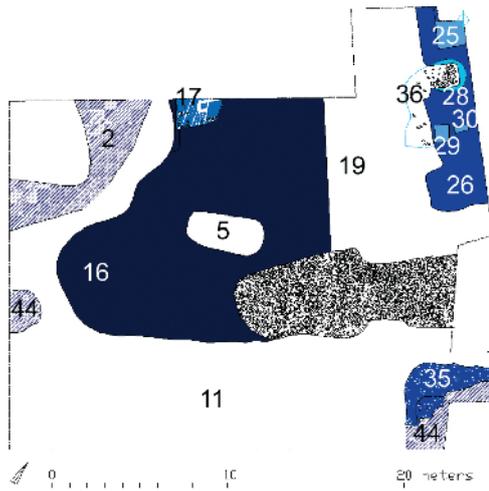


Fig. 9. Plan of the major traces excavated so far in the W-gate area.

labouring (fig. 11) and a rectangular pit located in the middle of the trench (US 5, 6). Still impossible to date are some ditch-type structures (US 2, 44) filled with apparently sterile sandy silt, but their relationship with the Roman road system described below and also partly visible on aerial photographs (fig. 2) is not wholly unlikely.

But, as is clearly visible on an aerial photograph taken shortly after the mechanical opening of the trench (fig. 10), the element occupying the most space within the excavation area, appearing almost directly under the removed top soil, is a type of platform with a hardened surface (fig. 9, US 16), which extends in the form of an inverted 'L', and apparently continues to the north of the excavated area (fig. 10, 1 and 2). On the NW edge of this platform, a conglomerate structure of violet coloured pozzolana ash, with *caementa* of stones and brick, with a maximum thickness of 15 cm (width 2.70 m; length 1.70 m) and a NW-SE orientation, could be observed.

The extension of the trench to the west, corresponding to the area of the presumed town wall, revealed in the SE corner of the trench, what appears to be the nucleus of the city wall (fig. 9, US 34/35). It consists of a yellowish conglomerate of badly worn sandstone bonded with clay. In its centre only one quasi intact worked (trapezoidal) block of sandstone remains (fig. 10, 4). The characteristics of the archaeological trace, and its irregular profile, point to heavy spoliation. A pit, now filled by a layer of sandy silt, bears witness to this activity. More or less, on the same alignment of the wall nucleus, starting from the oppo-

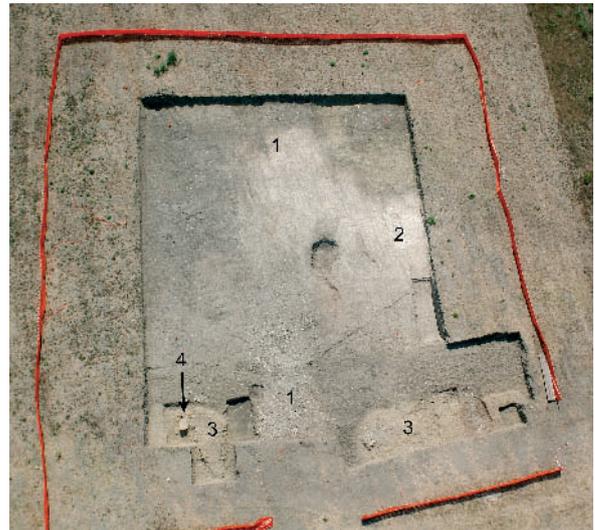


Fig. 10. The excavation area as seen from above: 1. road, 2. platform, 3. foundations of town wall and gate, 4. remaining building block in spoliated wall/gate.



Fig. 11. Top layer of the Roman road 'platform' with traces of sub-recent ploughing.

site corner of the trench, a strip, approx. 3.2 m wide, composed of a yellowish sandy layer of presumably severely worn sandstone, can also be interpreted as the remains of the town wall (fig. 9, US 26). During this first campaign the remains of the town wall were not excavated further. A clear interruption of its trace, together with a widening of the spoliation trench in this area, indicates the presence here of an entrance with gate building (fig. 10, 3). It could already be determined that the wall was cut by several traces post-dating its construction: they are recent (tree?) pits (fig. 9, US 25, 29, 30) and an oval pit (fig. 9, US 28), with a burnt edge, typical of a small kiln. The excavation of this stratigraphical unit has not



Fig. 12. Remains of the last pavement of the *decumanus maximus* just outside the W-gate.

yet been completed and we are not able to determine the exact dimensions or function of the possible kiln at this moment. However, late Roman material discovered in the unit, seems to point to possible remnants of production activity during the last phases of the town, on the remains of the town wall that by then had already been spoliated.

In the zone corresponding to the gap between US 34/35 and US 26, in line with the (via aerial photographs) presumed road that reaches the town from the west, an irregular 'cobbled' area (fig. 9, US 18 and fig. 10, 1), with a NE-SW orientation, was identified. This evidently corresponds to the ultimate phase of the Roman road, flanked by funerary monuments outside the town, and entering the colony as the *decumanus maximus*. This rudimentary phase was paved with various types of stone and a large amount of re-used Roman building material, especially roof-tiles (fig. 12). Also re-used in this irregular pavement was a fragment of a sepulchral epitaph. It is clear that the identified road phase covers the hardened platform. The cleaning of the rectangular pit in the centre of the excavation area (depth 1.10 m) and the realisation of a trench deepened near the northern border of the investigated zone, have revealed some further data. The platform US 16 consists of a very compact and hard layer (ca 35 cm thick) of gravel and sand, almost impossible to excavate manually. It covers a thin layer of burnt clay (US 20) mingled with many ceramic fragments, especially brick fragments and pieces of Roman plain ware. This material dates essentially to the 1<sup>st</sup> century BC and the 1<sup>st</sup> century AD. More precise chronological data were further rendered by the coin finds in this unit. Coins from this part of the gravel package were identified as belonging to Augustus (1 as), Caligula (1 as), Nero (1 as, 1 sestertius) and a 'fresh' piece of Titus or

Domitian (1 as), suggesting a probable date in late Flavian times for this phase of the road platform.<sup>16</sup>

The thin layer US 20 covers another compact layer of gravel and sand, no less than 45 cm thick (US 21). We hope to conduct a more extensive excavation of the above mentioned units during the next campaign, in order to determine if the two layers (US 16 and US 21) are remnants of one or more phases in road construction. These layers could be the so-called *rudus*, a layer of sand or gravel and sand combined, sometimes bonded with clay, just below the actual pavement of many well constructed Roman roads. If this is confirmed, we can presume that a road deviated from the main western road (*decumanus maximus*), continued northwards running *extra-muros* and parallel to the western town wall. It is already clear now that the Roman builders took great care to overcome the problems of extra-mural town circulation in the somewhat lower-lying and wetter immediate surroundings of their important western city gate. The possible crossroads identified here, acted at the same time as a suitable and stable open space for typical extra-mural activities, such as for loading and downloading goods.

#### *Trial excavation of an amphora workshop in Potenza Picena (PM)*

As part of the investigations of the impact of the Roman colonial town on its territory, the PVS-team started a small trial excavation on the site of an amphora workshop, located at some 1.5 km south of the city, close to the coastline. This site of Casa Valentini, in the municipality of Potenza Picena, was probably already identified as an amphora production centre by G. Annibaldi in 1951 and a year later by inspector Athos of the Soprintendenza.<sup>17</sup> In 1969 or even before, due to the extraction of gravel, the site was partly destroyed. When Liliana Mercado visited the spot in that year, the top soil of the preserved part was already removed by the engines. The site was further cleared and most of the archaeological material was recovered from the heaps of the already removed top layers (Mercado 1979). In the south of the uncovered part, trial trenches were dug of which only one revealed archaeological traces, belonging to a small cemetery of the Flavian period and/or the first quarter of the 2<sup>nd</sup> century AD. A plan of the structures was drawn and the whole complex interpreted as a rural exploitation. After some years the site seemed forgotten and apparently there was confusion with two plots. Indeed, for unknown reasons Mercado published the



Fig. 13. Aerial view of the amphora workshop site in Potenza Picena during the trial excavation in 2007. A major part of the site is fully destroyed by gravel exploitation and is since long transformed in a lake.

site as situated at Casa Marconi (km 333 on the SS Adriatica) instead of Casa Valentini, and did not interpret, or at least discuss it, as an amphora production site. In 2002 the site was noticed again during the surveys of Ghent University and immediately interpreted again as an amphora production site. In the hope to get some more information about the workshop and to confront this with other production sites recognized during the PVS-surveys in the lower Potenza valley a small excavation was started.<sup>18</sup> The main objectives of this dig were: the definitive identification of the site as a workshop and the identification of the different types of amphorae produced here, the determination of the stratigraphic context and chronology of the site, the determination of the nature of the structures or at least what is left of them and a good sampling of material for petrographic and chemical analysis. As the excavation on this site needs at least a second field campaign, we will not present the results with much detail. It suffices to summarize here the main observations so far, in the three major zones of investigation: the northern profile near the waterfront (where the mechanical destruction of the site ended; *fig. 13*), our trench 1 with the remains of Building 1 in the eastern part of the site (*fig. 14*) and trench 2 with the younger Building 2 (*fig. 15*) and the later 'pressing stone', covering or cutting older levels of kiln debris and amphora wasters, and a wall of sandstone and tiles.

Thanks to our new fieldwork the site is now definitely to be identified as an amphora production site. Four amphora types were produced here: a



Fig. 14. Trench 1 in Potenza Picena: general view of walls belonging to Building 1.



Fig. 15. Trench 2 in Potenza Picena: general view of the excavation of Building 2.

transition of the Greco-Italic to the Lamboglia types, Lamboglia 2, Dressel 6A and Dressel 6B. Stamps on different types give also some information about the producers of these amphorae (*fig. 17*). The stratigraphy and the structures of the site are closely investigated and better understood, even if some problems remain to be solved. A valuable chronological framework for the site can also be presented. On the base of the relative chronology (stratigraphy and mode of wall constructions) and the typo-chronology of the amphorae and some other ceramics found here, we have tried tentatively to present a first evaluation of the different occupations of the amphora production site of Casa Valentini (*table 2*).

There is no indication of production of other ceramics, such as tiles, common ware or lamps, only amphorae of the above mentioned types were

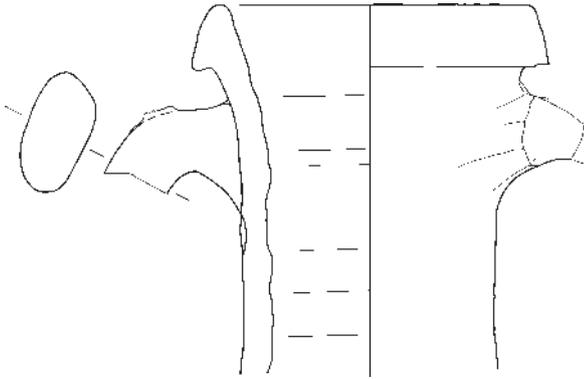


Fig. 16. Upper part of transition Greco-Italic/Lamboglia 2 amphora found during the digs.



Fig. 17. Stamps on Lamboglia 2 amphorae of *Onesim(us)*.

produced. The production of the transition of the Greco-Italic to the Lamboglia types is ascertained by some fragments, especially a well preserved upper part (fig. 16). Charcoal fragments were found in the neck and immediately around the find spot. The production of Lamboglia 2 types is ascer-

tained by many amphora fragments, kiln debris and different sorts of wasters (some of amphorae). The production of two phases of Dressel 6A and 6B is ascertained by many amphora fragments, maybe by some kiln debris and most probably by one kiln structure (Building 2), but this has to be investigated further. Animal bones, different kinds of eating vessels and pottery for food preparation, lamps and a glass fragment prove that the people involved in the amphora production lived at least partially on the site, even if some of the finds could belong to the later rural phase.

It is not clear in the descriptions or from the ground-plan published by Mercando to which building phases the different constructions belong. It could be that most of them visible on the plan were built in the last phase of the amphora production as Building 2 certainly does. It looks as if they are established around a central courtyard. There is a good chance that Building 2 was a kiln of the last production phase (phase 4). The recent excavation revealed also with certainty an older building phase, but not enough remains to have any idea of its structural organization. The function of Building 1 may have been the working place of potters. It is not clear if the building was re-used in the later production phases. The continued study of this site and of the results of the surveys around *Potentia* has to fit in a larger framework of research on the production, export and consumption of Middle Adriatic amphorae.

INTEGRATED GEO-ARCHAEOLOGICAL SURVEYS IN AND AROUND THE MUNICIPIUM OF *TREA*

The Roman town of *Trea* lies in the middle valley of the Potenza, some 30 km from the Adriatic shore, on a dominant plateau, one km northwest of present day Treia. Like *Potentia* the former urban site is now mostly agrarian land, except for the presence of the important abbey SS. Crocifisso. The

Phases	Chronology	Production	Stamps	Structures
Phase 1	125/100-75 BC	transition Gr.-It./Lamb. 2		construction 1: only amphorae recognized, no structures or structural elements; US20, 21
Phase 2	75-50/25 BC	Lamboglia 2	<i>Onesim(us)</i>	construction 2: kiln debris and wasters; Building 1; 'pit' in N Profile (post-hole? ditch? pit?); wall 50 in Trench 2; US22
Phase 3	50/25-1 BC	Dressel 6A, Dressel 6B	? <i>L Lae</i> ( )	construction 3: amphorae recognized; presumed kiln debris; maybe second phase Building 1; US23
Phase 4	1-25/50 AD	Dressel 6A, Dressel 6B		construction 4: Building 2, probably a kiln; US23,24
Phase 5	25/50-125 AD	rural estate		construction 5: 'pressing-stone'; amphora wall basin; reuse buildings; necropolis; specific archaeological layer not found

Table 2. Evaluation of the different occupations of the amphora production site of Casa Valentini.

only remaining visible ruins are a small section of the city walls connected to the partly preserved western gate. According to the *Itinerarium Antonini* the Roman city was located on the *Via Flaminia per Picenum Anconam*, a diverticulum from the main Rome-Rimini road, leading via *Septempeda*, *Trea* and *Auximum* towards Ancona, and its excellent position in a fertile section of the Potenza valley also explains its development into a small but flourishing centre for the area. Possibly grown out of a pre-Roman settlement (see below) *Trea* became a Roman *municipium* shortly after 49 BC<sup>19</sup> and knew some continuity into the early Middle Ages, when the much decimated remaining habitation was restructured in connection with an old 'pieve', to be located at the site of the SS. Crocefisso.

Notwithstanding the fact that *Trea* received good scientific attention these last 30 years, information about the precise location, extent and urban organization of the Roman city remained long very limited and partly hypothetical (Vermeulen 2004). Intensive aerial photography surveys, followed up by surface artefact prospections by the PVS-team since 2003 have dramatically changed this situation and we now have good information on the exact location of the town area and wall, the organisation of the forum and the location of a number of streets and *insulae* in the intra-mural area.<sup>20</sup> The purpose of the intensive 2007 campaign in this area was threefold: first we wanted to deepen knowledge of the intra-mural town structures and confirm and refine the remote sensing data obtained so far, in order to understand the internal urbanisation of this small city. Secondly we wanted to check the hypothesis that this town grew out of a pre-Roman core and thirdly we needed a better understanding of the suburban developments around *Trea* and of the impact of the gradual urbanisation on landscape use by the Romans.<sup>21</sup>

#### *Geophysical prospections on the intra-mural area of Treia (BM)*<sup>22</sup>

The geophysical research strategy was prepared corresponding to the exceptionally evident crop marks on aerial photography from April 2003 (Vermeulen et al. 2005), followed by archaeological survey together with research design adaptation deduced from several geophysical explorations in similar natural environments on pedosequences of gravel and sand (Mušič 1999). The basic geology on the city site of *Trea* consists of quaternary (Pleistocene) alluvial fan deposits creating a terrace of the first order, composed mainly of poorly sorted sandy-gravel sediments deposited in the foothills

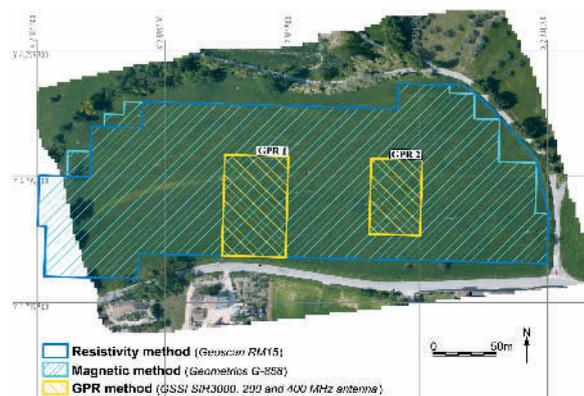


Fig. 18. *Trea* survey 2007: geophysical methods used and their respective survey areas.

of the Apennine mountains.<sup>23</sup> The geological surroundings consist of Tertiary, mainly clastic sedimentary rocks, some of which are plausible source areas for the sandstone and limestone building materials used on the site of *Trea* (see below). Brief on-site surface inspection of stone materials revealed sandstone as prevailing building material, with more limited numbers of limestone fragments.

Ultra shallow high resolution geophysics is designed for revealing small and shallow buried targets and is especially sensitive for high frequency lateral and vertical changes in the physical properties beneath the soil, which are normally the result of intensive ploughing, consecutive destruction of shallow buried architectural remains as well as natural variations in top soil structure and texture. All of these parameters contribute to soil homogeneity and anisotropy (Carr 1982). Geophysical prospection is actually a ground based remote sensing method and therefore significantly influenced by the top soil conditions. There is no unified processing flow for reducing background noise and contrary enhancing 'signal to noise ratio'. The most creative research design makes use of a multi-method approach (fig. 18) with application of several independent geophysical techniques (Mušič et al. 2007). The geophysical prospections at *Trea* incorporated, therefore, the application of the resistivity method with Twinpole array (Geoscan RM15), the magnetic method with caesium magnetometer (Geometrics G-858), measurements of the apparent magnetic susceptibility of soil and stone construction fragments (Kappameter KT-5) and the Ground Penetrating Radar method using 200 and 400 MHz antennas (GSSI SIR3000). A profile separation of 0.5 m was used for the magnetic and the GPR methods, while resistivity measurements were

taken at a distance of 1 m between profiles. Separation between measuring points along the profiles for magnetic survey was 0.15 m, for resistivity readings 1 m and for GPR traces 0.04 m. The geophysical field campaign was organized in September 2007 when conditions for productive acquisition for all of the used geophysical techniques were favourable. As the archaeological results derived from our multi-method approach are very important, and the influence of the strategy crucial, we will first elaborate shortly on the distinct methods applied here, before discussing some of the results.

The geoelectric resistivity method (*fig. 19*)

The geoelectrical mapping with twinpole array (Geoscan RM15) assures the high lateral resolution and therefore suitability for the detection of high resistivity vertical structures also in the subsurface medium with low signal to noise ratio. The good lateral resolution and therefore capability of discerning vertical structures is a consequence of integrating resistivity values over a broad depth range (Appel et al. 1997). On the other side, its potential for differentiating features and boundaries at different depth is relatively weak. Anyhow, the quality of geophysical prospection results is normally not significantly reduced with this deficiency because the Ground Probing Radar method (GPR) is more effective in resolving stratigraphical sequences at shallow depths than any resistivity configuration. Advantage of the twinpole array is also the relatively high depth of investigation compared with the spacing of the mobile electrodes, which assures appropriate sensitivity to the depth of approx. 1.5 m for a mobile probe separation of only 0.5 m. In an environment with optimal humidity of the soil, this resistivity method clearly shows lateral changes in resistivity caused by shallow buried archaeological architectural remains to the depth of 1.5 m, which in this particular case can be considered as an optimal effective depth of investigation. From the high quality aerial photography of the Ghent team, it can be assumed, that the top part of architectural remains appears shallow below the present day surface, which is then 'level zero' for geoelectrical remote sensing.

Although the weather conditions were generally favourable for geophysical prospection, the background resistivity was not entirely homogeneous due to the varying moisture content in the soil during the measurements conducted on different days. A few raining days affected measure-



*Fig. 19. Results of the resistivity survey on Trea represented in grey scales with histogram manipulation.*

ments to a lesser extent. Results show that the soil moisture content, and hence the depth range and the contrast in the results were not significantly influenced by these circumstances (*fig. 19*). Impact of variable moisture content on resistance readings was successfully reduced by applying adequate data processing flow using Geoplot 3.0 software (Geoscan Research): e.g. edge matching, power function and histogram manipulation. Geoelectrical mapping was executed with a spacing of 0.5 m on a regular grid of 1 m covering in total an area of 46.140 m<sup>2</sup>. The measured resistance values were interpolated using a bi-cubic spline-smoothing algorithm (Davis 1973) on a regular grid of 0.5 m.

The results from geoelectric mapping are presented as the electrical resistance ( $R$ ,  $\Omega$ ) and not as resistivity ( $\rho$ ,  $\Omega\text{m}$ ). This is because at archaeological sites, where the research substratum is heterogeneous, only a qualitative analysis of the results, based on the relative differences between the measured resistance values are important. The general impression based on resistivity data can be expressed also for estimation of the preservation level of the architectural remains (Mušič et al. 2007). It is evident, that modern intensive agricultural land use significantly blurs the resistivity response of some structures due to intensive ploughing and consecutive significant wall destruction, associated with ruination material close to the surface. Nevertheless, results are clear enough to enable reliable interpretation, especially in combination with the magnetic method.

The magnetic method (*fig. 20*)

Measurements of the magnetic susceptibility of soil, limestone and sandstone fragments revealed significant differences between the susceptibility of building materials and the surrounding soil

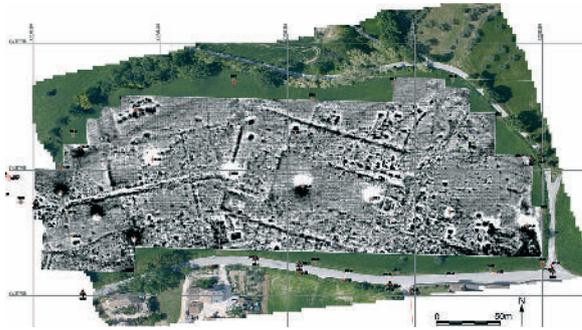


Fig. 20. Results of magnetic survey. Dynamic range of represented values of magnetic field density:  $-4$  nT/m,  $+4$ nT/m.

and much lesser distinction between building material itself. Besides sandstone and limestone fragments, also bricks and tiles with much stronger susceptibility caused by thermoremanent magnetization can be frequently encountered among the surface material collection (table 3).

The magnetic method was used for revealing remains with an induced type of magnetization generated by building materials made of stone blocks on one side and objects with strong thermoremanent magnetization, which is characteristic for architectural elements made of bricks, kilns, hearths and destruction layers with ceramic tiles on the other side. Other geophysical methods do not reliably recognize these types of remains.

Measurements of the variations in the total Earth's magnetic field density in a (pseudo)gradient mode (nT/m) are used much more frequently in magnetic prospecting for archaeological targets, than measurements such as of the total magnetic field using only one sensor (nT). The gradient mode is strictly speaking a high-pass filter; it amplifies the weak magnetic anomalies of small structures at shallow depths (signal) and eliminates long-wave anomalies that are a result of the geological background (noise). The resolution in measuring the total field density of magnetometer Geometrics G-858 that was used in our research is 0.1 nT/m, with an acquisition speed of 0.2 s. The distance between the magnetic profiles measured 0.5 m, and readings of the magnetic field density were taken at 15 cm intervals in the direction of the profiles. For a more reliable interpretation using the magnetic method, theoretical 2D archaeological models were applied (e.g.: Eppelbaum et al. 2001, Mušič 1999, Mušič et al. 2007). These are generated on the basis of the on-site measured values of the (pseudo gradient) magnetic field density and on comparison with the calculated

Soil (mean values)		
Topsoil/Surface	Soil profile/Bottom	Soil profile/Top
$0.68 \times 10^{-3} \text{SI}$	$0.37 \times 10^{-3} \text{SI}$	$0.57 \times 10^{-3} \text{SI}$
Building material (mean values)		
Sandstone	Limestone	Bricks
$0.08 \times 10^{-3} \text{SI}$	$0.03 \times 10^{-3} \text{SI}$	$3.23 \times 10^{-3} \text{SI}$

Table 3. Apparent magnetic susceptibility values measured by Kappameter KT-5 on soil and surface building material fragments.

magnetic anomalies for the presumed archaeological model. The model variables comprise: the form of the presumed archaeological remains, their dimensions, depth and magnetic susceptibility values of building material fragments measured in the field (see table 3).

The natural environment is described by the thickness of top soil and its susceptibility, besides the presumed basic geology parameters, which in pseudo gradient operational mode do not significantly affect results. Local Earth's magnetic field intensity, declination and inclination were derived from The International Geomagnetic Reference Field (IGRF; [http://www.iugg.org/IAGA/iaga\\_pages/pubs\\_prods/igrf.htm/](http://www.iugg.org/IAGA/iaga_pages/pubs_prods/igrf.htm/)). The same geometry of anticipated archaeological features, top soil and basic geology was used to illustrate the differences in the shape and magnitude of magnetic anomalies generated by different material. Consequences of similar sandstone and limestone susceptibility are the similar shape, polarity and magnitude of the calculated magnetic anomalies. Calculated magnetic anomaly generated by the same shape of the object, but with magnetic susceptibility typical for bricks, is significantly different.

The Ground Penetrating Radar method (fig. 21)

GPR sounding was used to determine the depth and height of preservation and the mutual spatial relationship of the architectural elements in two areas where results from geo-electric mapping and magnetometry deemed it advantageous to check. This was a quite ambitious plan for first year testing of GPR possibilities in such archaeological and natural contexts. However, the GPR method is the only technique among the geophysical methods within the *Trea* survey project, used for geophysical sounding. In favourable circumstances it enables a 3D visualization as well as analyses of the measurement results in a 3D environment. Areas 1 and 2 (fig. 18) were surveyed with a 400 MHz antenna and the Area 1 also with

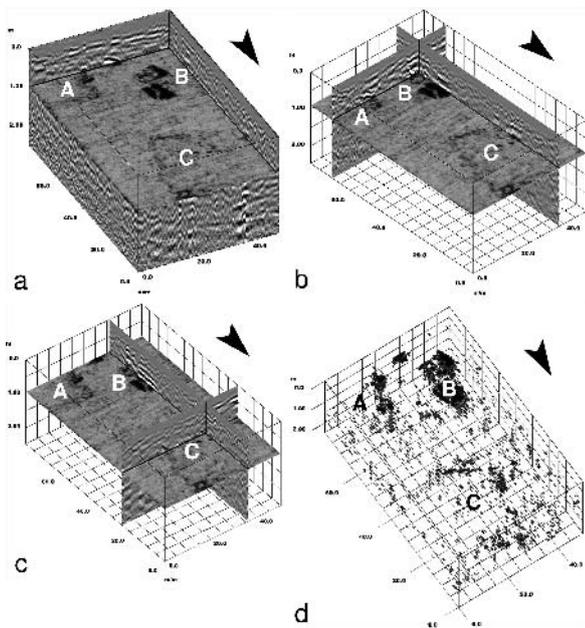


Fig. 21. 3D visualization of GPR echoes at Area 1 in Trea. Archaeologically significant anomalies indicated.

a 200 Mhz antenna. Much better results were obtained by the 200 MHz antenna on Area 1. GPR echoes in general correspond to resistivity and magnetic anomalies. The aim of GPR survey in Area 1 was to ascertain the assumption of a superposition of the eastern and the western parts of the town organisation (see below). On the time slices are discernible faintly visible lines of different orientation on a greater depth, but it does not fully prove our expectations. Moreover, from 3D GPR visualization it can be deduced, that architectural remains appear more or less at the same depth.

#### Multi-method approach capabilities and archaeological implications

Selection of the most suitable method is dictated exclusively by an evaluation of the 'signal to noise ratio'; and for a reliable method, this needs to be large enough so that the difference between the two data sets demonstrates enough contrast to secure successful prospecting. It is often difficult to define the 'signal to noise ratio' for each of the various methods; so archaeological prospecting has adopted a multi-method approach for the development of efficient research strategies (Mušič et al. 2007). Sometimes it is effective if results of resistivity and magnetometry, for instance are overlain and observed under gradual image trans-

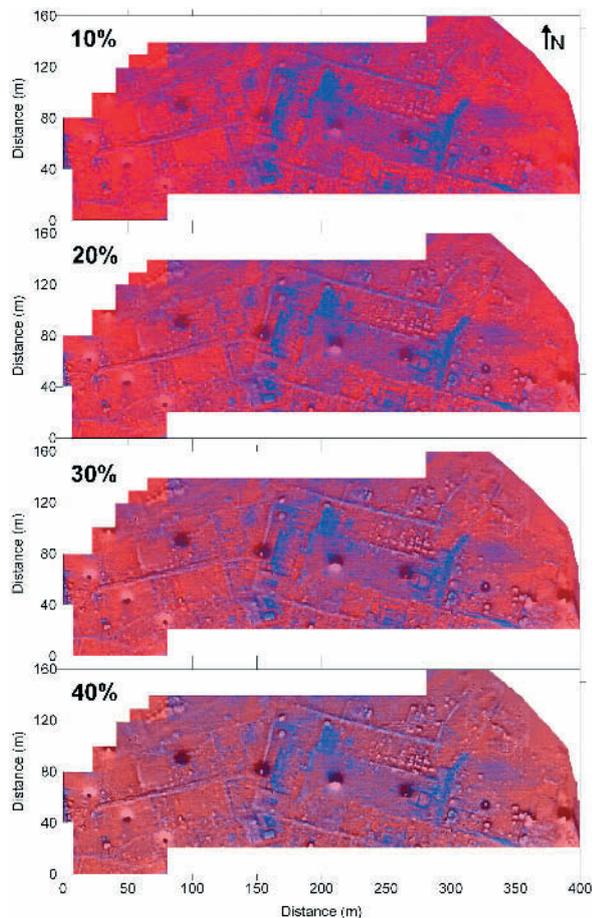


Fig. 22. Combined results of resistivity and magnetic survey in Trea. Overlaid images with gradual resistivity transparency (in %).

parencies (fig. 22). It shows spatial correlation between different data sets and makes more reliable interpretation possible.

In this way it is possible to visualize magnetic and resistivity anomalies in a manner that architectural elements and the urban organisation are much easier discernible. Some of these structures clearly confirm the excellent aerial photographs and earlier interpretations by Frank Vermeulen,<sup>24</sup> but often interesting details are now better visible. The most evident features of relevance to the urbanization of Trea, as revealed in our interpretative mapping (figs. 23, 24) are the following:

- the public open space or forum square, rectangular in shape and with its central part presumably (still) paved with stone slabs;
- a 'capitoline' temple on its eastern short side, with its still discernable stairway and internal subdivisions;



Fig. 23. Interpretation of geophysical results of the Trea survey, presented on the topographic map and a rectified oblique aerial photograph.

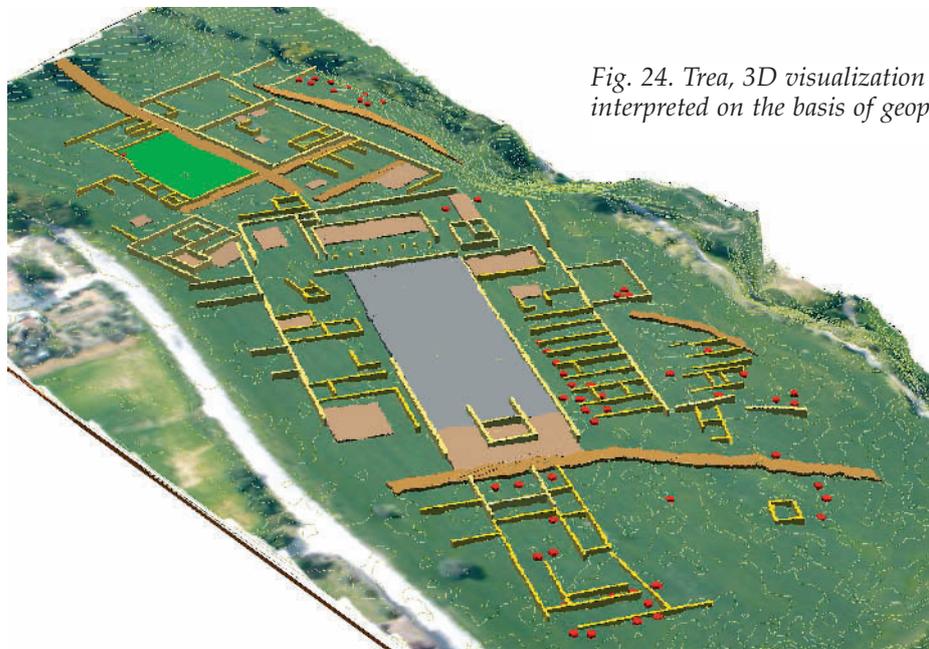


Fig. 24. Trea, 3D visualization of architectural remains interpreted on the basis of geophysical exploration.

- a large probably public building (*basilica?*) with the bases of a colonnade on the short western side of the forum, and also well visible now two other (public?) buildings on either side;
- another public (?) building (market or *macellum?*) at the southern side of the forum;
- the forum is further flanked by a series of oblong buildings (*tabernae*) along its northern and partly also southern sides, preceded by a portico;
- several communicating streets were also identified, displaying a complex and probably partly diachronic street organisation;
- many building structures (e.g. houses and shops) outside the forum area, often oriented in strict relationship with the streets;
- a number of strong magnetic anomalies with slight magnetic field polarity deviation is clearly distinguishable on the magnetograms; these anomalies are characteristic of archaeological remains with a thermoremanent type of magnetization (TRM) which is the attribute of bricks, tiles, forges, kilns, furnaces, etc. Some clusters probably indicate the presence of workshops, with activities that might have required high temperatures of firing.

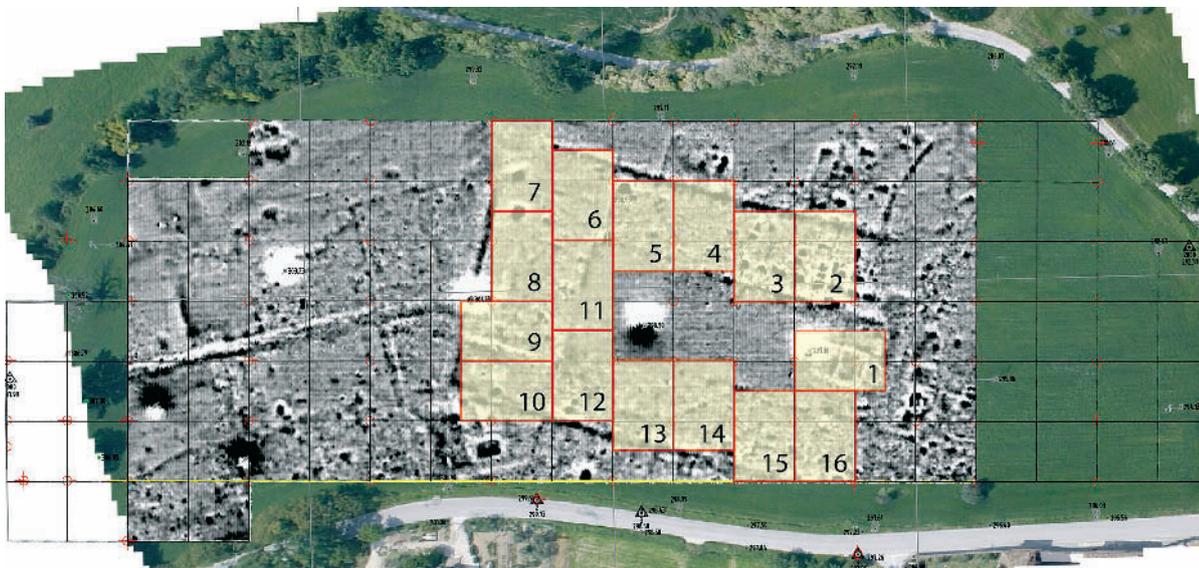
A more intensive integration of the geophysical results with the rectified imagery from oblique aerial photography monitoring of the site is awaited before more definite and detailed interpretations of the significant archaeological data are possible. They will also be integrated with results from artefact surveys on the site. It is however clear now

that remote sensing operations can seriously contribute to the understanding of the urbanisation scheme of this city site.

*Artefact surveys and geo-archaeological observations in and around Trea (FV, SD, MDD, PDP)*

During the last ten days of September 2007 an intra-site artefact survey was carried out by the PVS team on the former urban area of *Trea*. The area chosen for the intensive survey was the zone of the forum of the Roman town, an area of some 140 x 90 m if we include the surrounding public buildings. The precise location of the forum has been known since the aerial photography flights over the town in 2003 and was confirmed by the geophysical survey (see above). By concentrating this artefact survey especially on the ancient built-up area around the forum square (*fig. 25*) we wished to further characterize the type of structures, their function and their chronology. The survey area was not ploughed but as vegetation had been mowed quite short before our fieldwork visibility for artefact recovery was reasonably good. The area was subdivided into sixteen regular units (30 x 20 m), using the grids set out by the team of Ljubljana. Every unit was walked by a group of seven people (a mix of archaeologists and students) during 30 minutes. Samples of datable ceramics and other diagnostic artefacts (building materials, glass,...) were collected in a systematic way.

We synthesize here the most important conclusions of this work. They are of special relevance to



*Fig. 25. Location of the artefact survey units in the forum area of Trea.*



Fig. 26. Decorated fragment of a small column found during the intra-site survey on Trea.

the ulterior interpretation of the excellent remote sensing data in this crucial part of the Roman town, as the terrain of the forum is quite flat and horizontal movement of artefacts and building materials ploughed to the surface should be quite limited. In this way, and with the remotely sensed data in hand, we are able to link some of the surface observations to the actual situation of the archaeological structures *in situ*.

In the zone of the 'capitoline' temple we found large pieces of mortar, which could belong to a podium nucleus built of *opus caementicium*. Fragments of very big roof tiles, a few white marble *crustae* and a fairly large amount of *tesserae* were also detected, indicating the importance of the building and its high quality. The most remarkable finds were a fragment of a small marble column (fig. 26) and a piece of a marble slab with remains of an inscription.

The grids over the *tabernae* on the northern forum side produced many fragments of worked limestone and sandstone, probably the main building materials here, together with the roof tiles. In several units, especially near the edge with the forum square, we collected fragments of pie-wedge shaped bricks, which could indicate that the portico in front of the *tabernae* had brick columns. A good amount of brick floor tiles seems indicative of the predominant floor type in the shops. Fairly large numbers of marble *crustae* and *tesserae* prove also a certain quality of these centrally placed shops, while a concentration of fragmentary *tubuli* near the central shops of the north side might indicate rooms with *hypocaustum*. Many fragments of *dolia* demonstrate food storage, while pieces of over-fired brick and burned sandstone, together with metal slag, seem to confirm the proposition from magnetic survey that several remnants of furnaces are to be located here (see above).

The grids over the probable *basilica* and the buildings on either side of it displayed an especially rich assemblage of building materials. Although limestone, sandstone and mortars prevail, the finds comprise also huge numbers of marble *crustae* in different colours, many *tesserae*, pieces of hexagonal floor tiles in brick and some fragments of painted stucco. Several small fragments of *tubuli* are possibly indicative of a heating system, especially in the building south of the probable *basilica*.

Finally in the area of the buildings (mostly *tabernae*) south of the forum square a quite similar situation was observed as around the northern shops. However in the most eastern zone here, where we located a possible *macellum*, special finds include many *crustae*, *tesserae*, some stucco and a (leg) fragment of a high quality marble statuette. The pottery is also quite diversified here. In general, however, pottery finds over the whole forum area are enough similar, including a wide range of fine wares (mostly thin walled ware, *terra sigillata* and African red slip ware) and coarser categories (*dolia*, amphorae, cooking ware...), spread over the broad chronological range of the city's main occupation phases (1<sup>st</sup> century BC-5<sup>th</sup> century A.D). Most pottery is Imperial and only very few late Republican wares were picked up. The presence of protohistoric (Piceni) pottery in several grids is however of particular importance for the origin of grouped settlement on the site.

To approach the interesting question whether Roman Trea was preceded by an earlier form of grouped settlement we initiated the systematic sampling of surface materials on the ploughed fields to the west and south-west of the Roman town area (fig. 27). Parts of this extra-mural territory were already surveyed by Umberto Moscatelli (Università di Macerata) in the 1980s. His findings were published in the *Forma Italiae* series (Moscatelli 1988). Our aim was to re-visit the sites located by Moscatelli and survey also some surrounding ploughed fields in order to get a clearer picture of the chronology and extent of possible sites in the area. Although Moscatelli located the Roman sites which he found on a map, he did not point out the total area surveyed so it was possible that we would be surveying fields already surveyed by him, but where according to his findings no Roman material was present. We revisited a total of three sites, and of these only one Roman site (UM 89) could be confirmed by our team. The other two sites, both situated on the bottom of the steep slope to the SW of Trea, revealed absolutely no Roman pottery or building material, while Moscatelli mentions the location of a Roman nec-





Fig. 28. Fragments of terracotta pipes and calcareous sediment from the Trea aqueduct.

to the west of *Trea* running parallel to the main road (S.P.N.169). During the fieldwork we were able to confirm and specify his findings. At a distance of 1100 m from the western wall of *Trea*, in a field to the north of the road several large fragments of terracotta hydraulic pipes were discovered (07-WS/268). Also in fields further west, near Villa Trionfetti we were able to find such pieces. All new archaeological data, as well as some geomorphological observations, suggest that we can now locate the aqueduct very precisely. It follows a straight line just north of the S.P.N.169 road. At its lower end it entered the Roman town near the presumed West gate. At its upper part it connects the town with a water-rich spring area just east of the present-day San Lorenzo sanctuary. Near the water spring Roman pipe fillings, consisting of calcinated layers of sediment, were discovered, together with more terracotta pipe fragments with a diameter of circa 30 cm (fig. 24).

Another valuable observation in this area west of *Trea*, is the location at some four kilometres from the Roman town, of large outcrops of marly limestone, with exactly the same consistency as the blocks of limestone used to built the town wall and gates. It is very likely that this easily reachable hilly area, largely belonging to the Mesozoic carbonate, procured the raw materials for building important parts of the town infrastructure.

A final observation connected with this geo-archaeological survey of the edges and immediate hinterland of *Trea*, concerns a re-evaluation of the position of the town wall. This is made possible by the presence of huge concentrations of compact marly limestone blocks ploughed up in fields north-east of the town. Instead of the rounded north-east corner proposed in earlier publications

(Vermeulen/Verhoeven 2004), we now have good reasons to believe that part of the slope downwards in north-eastern direction was also taken in by the walled town, enlarging the town's intra-mural surface to some 12 ha. In accordance also with evidence from the geophysical survey (see above), and with the presence here of a large building block lying in a field nearby, we can now suggest the presence of a gate in the NE corner of the site, probably leading out in the direction of Ancona. A new and detailed plan of the topography of ancient *Trea* will be presented shortly, incorporating all existing geo-archaeological data.

#### NEW APPROACHES TO THE TOPOGRAPHY AND OCCUPATION HISTORY OF THE AREA OF SEPTEMPEDA

Roman *Septempeda* is located in the middle Potenza valley, on a river terrace bordering the stream, at some 40 km inland from the coastline. The urban site is now mostly used as farmland as the population of the ancient city moved during the early Middle Ages to the nearby hilltop site and now modern town of San Severino Marche. The Roman site is located in an area of important *Piceni* settlements and cemeteries, in the shadow of the Monte Pitino, an imposing hilltop site dominating the whole middle valley (fig. 32). The urbanisation of *Septempeda* probably originates from a function as *statio* along the *diverticulum* of the Via Flaminia, on the crossroads with the inland Via Salaria, connecting Ascoli with Jesi. Several archaeological discoveries during the 20<sup>th</sup> century show that the walls of the town encompass the higher, hilly area north of the Roman valley road, acting as *decumanus maximus* of the small town, and the lower area slightly sloping towards the river Potenza (Landolfi 2003). This almost pentagonal town must have measured some 15 ha *intra muros*. Parts of the 1<sup>st</sup> century BC walls in *opus quadratum* and two gates were excavated. Along the central *decumanus maximus* were found several rooms of two imperial *domus* and large thermal installations. There was for a long time no indication about the location of the forum, temples, other public buildings, houses and the street system, as there are no remains visible above ground today. This changed dramatically since remote sensing operations by the PVS-team started here in 2005. Although aerial photography flights over the town area in that year showed distinct crop marks of some parts of the city streets and delivered us a well distinguishable plan of a large, yet unknown *domus* (Vermeulen 2006), more intensive monitoring from the air and especially more fieldwork seemed necessary. Apart



Fig. 29. Aerial view from the south of the rectangular enclosure with portico (sanctuary ?), just outside the city wall of Septempeda. On the far left we see a broad crop mark of the newly discovered road leading to Tolentinum.

from new surveys on the Roman town site itself we also decided to enlarge our vision to the surrounding territory, especially in order to understand the origins of this city and its crucial role in the 'Romanisation' of the Picene heartland.

#### *Septempeda revisited (FV, GV, MDD, PDP)*

Especially astonishing were the results of new flying over *Septempeda*. This small town had given us only little satisfaction in previous aerial surveys. Successful flights in April, July and especially September 2007 now gave away a mass of new topographic information, enabling us to prepare in the near future a very detailed map of the main elements of the whole city grid of streets, some further precision on the already partially studied defensive system and on important parts of the town buildings.

Especially thrilling is the discovery of many well preserved floors of Roman city houses and of a series of important structures in the south-eastern part of town. In the latter we could discover a new gate (fig. 30), with inner corridor and bastion, connected to a clearly visible road leading out of town in the direction of *Tolentinum*. Immediately next to it, just outside of the well visible trace of the 2 m wide city wall, we discovered in a field of clover, a remarkable complex (fig. 29). It consists of a rectangular structure of min. 55 m wide and more than 70 m long, bordered by a thin enclosure wall. On its SW side, three parallel walls suggest the presence of a portico, while in the NE part we clearly distinguish a rectangular (building?) structure of some 35 by 15 m. The orientation and fea-



Fig. 30. Comparative oblique views from the south of the newly discovered SE-gate in the city wall of *Septempeda*. Upper: traditional digital take from a plane; under: infrared digital take from the 'helikite'.

tures of the whole complex, neatly positioned parallel with the city wall, point no doubt at a Roman date. The identification as an important extra mural sanctuary with open courtyard seems possible, but only further fieldwork can elucidate this.

In the month of April part of the remote sensing activities were also dedicated to testing a new instrument. To deal with cloudy conditions (or other particular situations in which the shutter speed becomes too long for conventional aerial photography) and allow the PVS researchers to take very detailed imagery of specific locations (both in the visible as the near-infrared range), a stable, easily maintainable and remotely controllable construction was created. The device consists of seven different parts, the first - and maybe most important piece - being a Helikite. This unique design, patented by Allsopp Helikites Ltd., combines a helium balloon with a kite. This enables the Helikite to take off in windless weather conditions, whereas the kite components lift this lighter-than-air construction up in the air, while additionally stabilising it.<sup>25</sup> For obvious reasons, this type of photography was inaugurated HAP or Helikite Aerial Photography. As it was tested and applied in several weather conditions, it can be stated that HAP truly enables excellent low altitude aerial photography and is capable of delivering imagery with a very small ground sampling distance, hence yielding so-called high spatial resolution imagery. Moreover, its low cost allows for a higher tempo-



Fig. 31. View of Monte Pitino from the east.

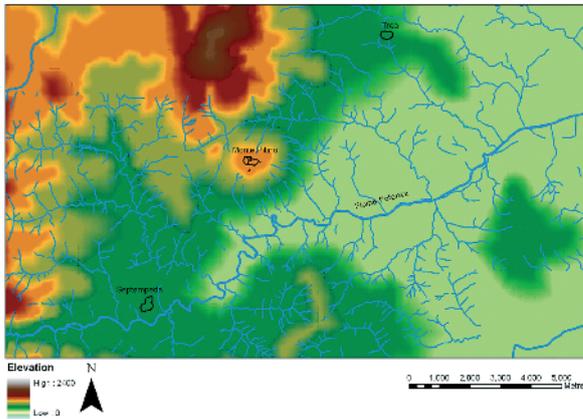


Fig. 32. Location of Monte Pitino related to the Roman towns of Trea and Septempeda, and to the River system.

ral resolution, as the platform can provide imagery from a certain archaeological interesting area at short intervals. Besides detailed near-infrared imaging, HAP permits to take low altitude colour photographs, used for mapping the on-going excavations as well as reconnaissance purposes.

Making use of the Helikite aerial pictures were taken over the full surface of the four Roman towns in the valley, and also over an important Iron Age settlement (Montarice) which had procured complex crop marks in the past.<sup>26</sup> Although the new technology needs to be further tested, comparing results with the imagery obtained from more traditional flights clearly demonstrates the added value of this new approach. This can be well illustrated with an example from *Septempeda*, where pictures taken of the area of the newly found SE gate of the city, were compared (fig. 30). Although the period and conditions of the two takes, one with normal digital camera from a low flying aircraft and one with an infrared camera mounted on the helikite, where quasi identical, comparison shows that the latter visualises the structures of city wall and gate complex with much more detail.

Finally, several field days were spent for terrain observations on and near *Septempeda*. These comprised not only the necessary checks of the crop mark evidence, but we started also a geo-archaeological campaign of locating the natural resources of great interest for the Roman town, especially for the provisioning of building materials and water. Connected with the former, we were able to locate the most evident source area for water, in fact situated immediately north of the central part of the town, no doubt originally linked with the thermal installations by way of an aqueduct. The discovery, immediately west of the urban area, of a site where sandstone was quarried in Antiquity to build the town wall, is equally worth mentioning.

#### The Monte Pitino Survey (MS)

Related with the work on *Septempeda*, a small and extensive survey was carried out in September on the top and slopes of the hill of Monte Pitino (fig. 31). The survey was designed to explore the extent of human occupation and activity in this place in the protohistoric period and the possibility of continuity into the Roman Republican period when two towns were constructed at the nearby sites of *Trea* and *Septempeda* (fig. 32). A human presence is known on this site from the Mesolithic period and the area is particularly famous for two excavated protohistoric cemeteries that produced rich chariot burials. Excavations on the summit have also produced evidence of structures and ceramics from the protohistoric and Republican periods, but these are poorly recorded (Lollini 1958). Although there is no evidence for the Imperial period on the top of the hill, several Roman sites were located nearby in the survey of Moscatelli (Moscatelli 1988). The summit was also the location for a 13<sup>th</sup> century castle, which is likely to have had associated medieval sites.

Although the survey is only the start of more intensive work here and the vegetation cover, mostly ranging from dense brambles and woodland to thick grasses, clearly hinders such activities, some results could already be obtained (figs. 33, 34). The new fieldwork has been successful in establishing that during the later Iron Age period, perhaps 5<sup>th</sup> to 4<sup>th</sup> centuries, there was some form of settlement over the terraces and plateau that surrounds the summit of Monte Pitino and a model of the terraces can be proposed (fig. 34). Medieval material is overlying the earlier phases, so it is difficult to estimate the density or type of habitation. However, the strong presence of tiles in the visible material along with the assemblages that parallel

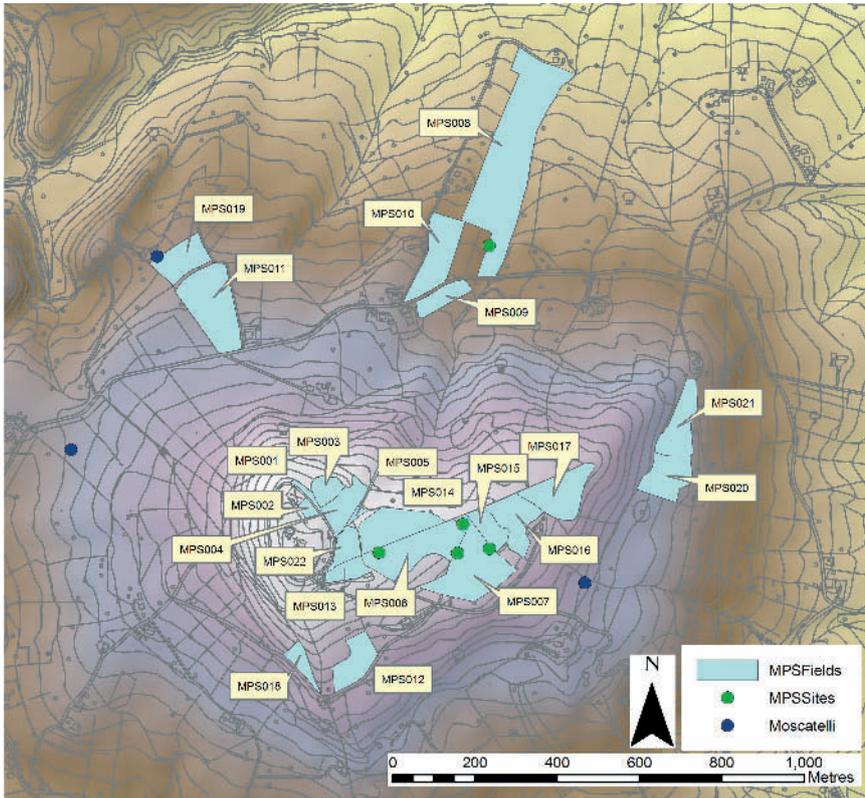
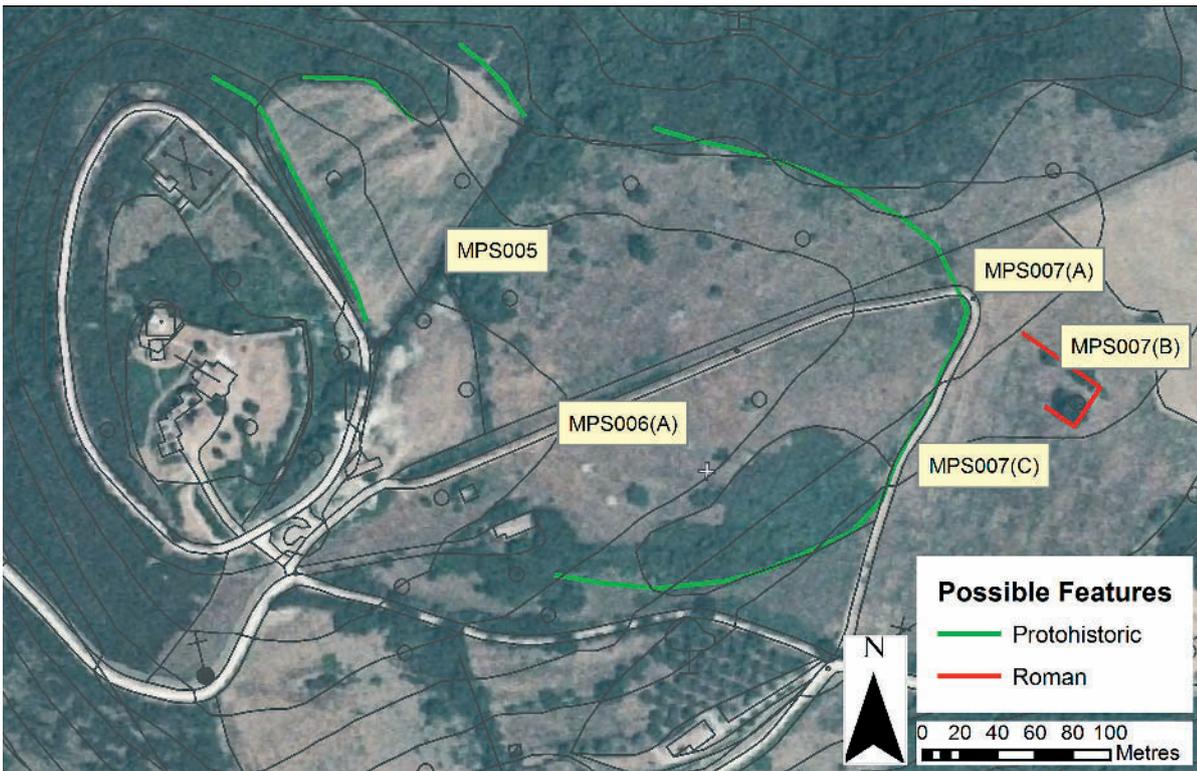


Fig. 33. Survey results on the Monte Pitino on a combined DEM-aerial photo mosaic.

Fig. 34. Possible walls and terraces identified through survey on the Monte Pitino drawn on an aerial photograph. The medieval castle site is well visible on the left.



the sites found through systematic field walking in the Potenza Valley Survey (Boullart 2005) suggest a nucleated settlement rather than merely a place of refuge. There is no evidence of any public or monumental buildings, but their presence should not be ruled out. The system of terrace walls is striking, even today, and perhaps has some similarities with the ramparts found on the summit of Monte Primo, an important protohistoric centre in the upper valley. There also appear to be a high quantity of *dolia* sherds across all the protohistoric areas within the terrace walls that must indicate a high degree of storage activity and perhaps some control of agricultural activity, but further study and comparison to other assemblages is needed to support this hypothesis. The presence of a few fragments of *vernice nera* is indicative of the integration of the site into wider networks and the nature of the preservation, largely from clearance activity, is likely to have biased the recovery of material against this finer material. Clearly it can be understood from this survey that there was a nucleation of settlement on top of Monte Pitino over perhaps as much as 10 ha, an area only slightly smaller than the Roman towns of *Trea* and *Septempeda*, although it is not possible to assess the density of habitation.

The concentrations discovered in fields MPS008 and MPS012 (fig. 33) as well as sites known from the survey of Moscatelli and excavation also show that any settlement on Monte Pitino was not isolated, but part of a range of different sites. However, more detailed survey of the surrounding fields and the hilltop itself is required to understand the nature of this integration: whether rural settlement was clustered around the hilltop and how much the hilltop site was linked into local social and economic networks.

The presence of a Republican activity on top of the hill is confirmed by the material recovered from MPS007(B) (fig. 33), this is a much smaller site than the protohistoric activity and its spatial separation is striking. The structures that must have existed were impressive judging by the quality of the *tegulae*, but interpretation of the function of this site is not possible from the type of survey carried out. Further analysis of the diagnostic sherds of *dolia* and amphora will hopefully allow better dating of this site, even so, there does not seem any material that is Augustan or later in date. Interestingly, no Republican material was recovered from within the system of terraces and it seems unlikely that this is due to preservation if the protohistoric material is so visible. This strongly suggests a link with the establishment of towns

at *Trea* and *Septempeda* and the current phase of the Potenza Valley Survey will surely lead to better understanding of this change in settlement system.

#### NOTES

- <sup>1</sup> This research team of the Potenza Valley Survey project, under the direction of Frank Vermeulen (Department of Archaeology), is further called PVS-team.
- <sup>2</sup> For reports on this first phase of fieldwork see: *BABesch* 76, 77, 78 and 80.
- <sup>3</sup> This second phase, programmed to last until 2011, was made possible thanks to substantial financial backing by the Belgian Science Policy - Interuniversity Attraction Poles (IAP), Phase VI, project 'The Transition from Republic to Empire: The Impact of "Romanization" on Cities and Countryside in Italy and the Provinces (2<sup>nd</sup>/1<sup>st</sup> century BC-2<sup>nd</sup>/3<sup>rd</sup> century AD)', by the Fund for Scientific Research - Flanders and by Ghent University.
- <sup>4</sup> They were made possible thanks to the excellent support by the *Soprintendenza per i Beni Archeologici delle Marche*, institution which since the start of the Potenza Valley Survey project has always given full backing. We wish to express our deep gratitude to Soprintendente Dr. Giuliano De Marinis and to the inspectors and responsible personnel of the concerned areas Dr. Edvige Percossi, Dr. Maria Cecilia Profumo, Dr. Mara Silvestrini, Dr. Maurizio Landolfi and arch. Ripari.
- <sup>5</sup> Many thanks go to all persons involved in the preparation and execution of these geophysical and topographic investigations; apart from the co-authors of this report we especially thank Prof. Bozidar Slapšak and his collaborators and students from the University of Ljubljana.
- <sup>6</sup> Vermeulen/Verhoeven 2004 and 2006; Vermeulen 2006.
- <sup>7</sup> For a recent synthesis see: Percossi Serenelli 2001.
- <sup>8</sup> Vermeulen/Boullart 2001; Vermeulen/Monsieur/Boullart 2002; Vermeulen et al. 2003; Vermeulen 2004; Vermeulen/Verhoeven 2004; Vermeulen/Verhoeven/Semey 2005; Vermeulen 2006.
- <sup>9</sup> To accomplish this topographical operation a Leica TCR 1105 total station was used on site and data were processed with Star\*net V6.0 (Starplus software). This resulted in three closed polygons and 21 base points, with a high planimetric accuracy level. In order to obtain satisfactory altimetric data, a differential levelling was carried out for the base points with a Topcon DT30 level. In order to record slight surface irregularities, the point density is of high importance for the surveyor. Considering the size of the area and the rather plane surface, a 3D measurement was taken along a 5 m rectangular grid by using the total station. Eventually the obtained point cloud, which contains more than 8000 points, was processed with the DTM component of Geopus and presented as a triangulated irregular network (TIN).
- <sup>10</sup> Special thanks go to Prof. Andrew Wallace-Hadrill and Prof. Simon Keay (BSR) for their support, and to Dr Michael Walsh for the great collaboration in the field.
- <sup>11</sup> For the results of the earlier prospections on other sectors of the town area, see: Vermeulen/Hay/Verhoeven 2006.
- <sup>12</sup> The magnetometer survey was undertaken using the Bartington Grad601-2 Dual Array Twin Fluxgate Gradiometer (fig. 13). Readings were taken at 0.5 m intervals along traverses every 1 m. The readings were recorded by the on board Grad-01Data Logger. The Bartington Grad601-2 in some circumstances is able to detect buried features up to a depth of 3 m.

- <sup>13</sup> For a discussion of this hypothesis, and references, see: Vermeulen/Hay/Verhoeven 2006 and Vermeulen et al. 2006, 230.
- <sup>14</sup> Our special thanks go to the municipality of Porto Recanati for their great help with logistics and to all students, archaeologists and collaborators of Ghent University who participated in the dig.
- <sup>15</sup> The methodology and first results of this ceramological work, building further on the doctoral dissertation of H. Verreyke, will be presented elsewhere.
- <sup>16</sup> We thank Dr. Johan Van Heesch for identifying the coins.
- <sup>17</sup> Annibaldi 1953 and archive of the Soprintendenza per I beni archeologici delle Marche.
- <sup>18</sup> We warmly thank the Soprintendenza, and especially Dott.ssa Maria Cecilia Profumo for scientific advice and permits and the municipalities of Potenza Picena and Porto Recanati for permission and logistic support. Except for the author, the following persons took part in the excavations: Prof. Jeroen Poblome (KULeuven) and the members of the PVS team: Christine Braet, Lieven Verdonck, Sophie Dralans, Devi Taelman, Dimitri Van Limbergen, Tina Bruyninckx, Eline Van Heymbeek, Liselot Lapon and Jeroen Verhegge.
- <sup>19</sup> Paci 1999. For a synthesis on sources and general archaeological background see especially Moscatelli 1988.
- <sup>20</sup> For a recent synthesis of this work see: Vermeulen/Verhoeven 2004, Vermeulen 2004 and Vermeulen 2006, where also earlier work on *Trea* is summarized.
- <sup>21</sup> This new fieldwork campaign was facilitated thanks to important topographic work done during a field campaign in 2005 in collaboration with Prof. R. Goossens, Prof. A. De Wulf and Mr. D. Van Damme of the Department of Geography of Ghent University. The methodological elaboration of a digital elevation model based on oblique aerial photography and ground control will be published elsewhere. We also thank the Municipality of Treia and the owner and user of the main archaeological area of the ancient town for permissions and support.
- <sup>22</sup> This research by the Department of Archaeology of the University of Ljubljana (Slovenia) was prepared by Božidar Slapšak and Darja Grosman in association with Frank Vermeulen. Collaboration in the field was obtained from archaeologist Jurij Soklič and students Matjaž Mori, Tonka Šoba, Iztok Vrenčur and Luka Rožič.
- <sup>23</sup> Source: Geological map of Italy at scale 1:100.000.
- <sup>24</sup> We refer to Vermeulen/Verhoeven 2004 for a more substantial description of the main structures visible on aerial photography.
- <sup>25</sup> The Helikite used is a 7 m<sup>3</sup> model, enabling a lift of around 3.5 kg in windless conditions, increasing to even 10 kg in 25 km/h wind. Furthermore, the system consist of a Dyneema tether with a large breaking strain of 270 kg, a dampened suspension for self-levelling and securing the camera-supporting cradle, a sturdy cradle made from carbon, aluminium and three small servo motors, a video live link (Pro X2) which instantaneously shows on a small TFT monitor the scene as seen by the D50, a big game fishing reel and accompanying sea-fishing rod to manage the tractive forces and allow the Helikite's 'pilot' to freely walk around and finally a 35 Mhz remote control to wirelessly control the camera shutter and enable the steering of the camera by operating the servo motors on the cradle.
- <sup>26</sup> We thank archaeologists Dimitri Van Limbergen and Devi Taelman for their precious help in the field.

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