

## SCANNING AND VISUALIZATION OF ROMAN ADRIATIC TOWNSCAPES

### 1. FOUR ABANDONED ROMAN TOWNS IN AN ADRIATIC VALLEY

In the past two decades we have seen a revolution in the Mediterranean area in how classical archaeologists approach ancient urban sites, with survey techniques such as geophysics and remote sensing being used increasingly often to generate a full or partial plan of a town site, prior to excavation or just as a way of addressing broad questions about early urbanism. At the same time cultural heritage management authorities have also benefited from this approach, with urban surveys, based on an always wider array of non-invasive technologies, providing them with a very effective tool for gauging the degree of archaeological survival on major urban sites in their care and choosing appropriate conservation strategies. During recent years always greater numbers of archaeologists have begun to reveal the advantages of intensively integrating whole suites of different non-destructive techniques on urban sites (JOHNSON, MILLETT 2012; VERMEULEN *et al.* 2012), instead of only applying one method of geophysical prospection, often geomagnetic survey (CAMPANA, PIRO 2009). When integrating different non-invasive techniques and especially choosing those that are most appropriate for the nature of the town or landscape conditions in question, great efficiency can be attained and a real leap in urban studies is possible (CORSI, SLAPSAK, VERMEULEN 2013).

One of the archaeological landscape survey projects in Italy, which almost since the onset in 2000 integrated urban surveys in its strategy, is the Potenza Valley Survey or PVS (VERMEULEN *et al.* 2017). This long term project by the Department of Archaeology at Ghent University, directed by the author, studied for more than 15 years urban and rural occupation patterns in the ca. 400 km<sup>2</sup> large valley of the river Potenza, from prehistoric times into the Middle Ages, with a special focus on the period of early urbanization and so-called Romanization of the area (ca. 300 BC-500 AD). Apart from objectives connected with wider themes such as Italian settlement history and Roman colonialism, this predominantly geo-archaeological research also aimed at developing interdisciplinary geo-archaeological survey methods, such as different kinds of remote sensing. A particular focus of the intensive archaeological fieldwork was achieving a series of intra-site prospections carried out on a few large protohistoric (mostly Iron Age) centres in the valley, as well as on the four Roman towns situated at relative short distance from one another in the Potenza corridor. From W to E these Roman cities are: Septempeda (San Severino Marche), Trea (Treia), Ricina (Villa Potenza) and Potentia (Porto

Recanati). All of these sites came into being as urban centres in the course of the Late Republic, even if some clearly had a pre-Roman settlement predecessor. Only one of them seems to be the result of a fully planned town foundation (Potentia, 184 BC), while all of them display a very good integration in the fast developing Roman road network in this part of ancient Picenum since the 3<sup>rd</sup> century BC. As they all are for most part totally abandoned since at least the early Middle Ages, the sites have reasonable to excellent potential for non-destructive surface survey and because of the small scale of excavation work previous to our investigation of the area, much could be learned from an integrated prospection approach. That this would lead to an unexpected wealth of insights into the urban character and development of small cities in this part of Italy was unexpected, even for true believers of the power of landscape archaeology.

## 2. NON-INVASIVE URBAN SURVEYS

The ancient cities of central Adriatic Italy discussed here belong to the category of small to medium sized (12 to 22 ha *intra muros*), complex and diachronic sites, which until recently were almost solely approached with very limited punctual archaeological excavations and some traditional topographic work, mostly using existing vertical aerial images (VERMEULEN 2017). This earlier attention was typically centred on a few monumental or visible intra-mural structures, or on presumed defensive elements. As these abandoned town sites are today mostly devoid of modern habitation and are essentially reduced to agricultural land, they are suited for new investigations of the non-invasive kind. They are ideal for being “scanned” with survey techniques to quite rapidly generate detailed plans including their main intra-mural components (public buildings, city walls, housing quarters, open spaces, etc.) and the vital elements of their suburban landscapes (roads, cemeteries, extra-mural housing, etc.). As the sites are not covered with impenetrable vegetation and show almost no archaeologically significant relief features or archaeological structures at the surface, archaeologically driven high resolution Light Detection and Ranging (LiDAR), was not a necessary research option, even if recent availability of such data allows now to include this layer of evidence in the efforts of interpretational mapping (with the production of really revealing Digital Elevation Model’s) and topographic analysis. Starting from the evident use of easily available remote sensing data, such as excellent vertical aerial photographs of the second half of the 20<sup>th</sup> century, “passive” desktop mapping was recently enhanced by the high resolution aerial views and satellite images (e.g. QuickBird, IKONOS, WorldView) from websites such as Google maps or Bing maps. But much more detailed remote sensing could be obtained by active aerial photography intensively applied by the

PVS team over a long period of more than 15 years of flying over the valley. The contribution of a systematic reconnaissance of these large sites lies not so much in their initial finding, but more in their full comprehension as an urban landscape, including a first appreciation of their total size, their planned layout, their relation to the human induced landscape elements, their suburban areas, etc. A recurrent phenomenon in the aerial survey hereby is the almost continuous discovery of new features thanks to prolonged flying at different moments of the year, under ever changing conditions of ground visibility. The specificity of Roman townscapes with their good architectural understanding, and often the homogeneity of the application of certain architectural models and plans, is of course a great help. The very proof of this is that for all four towns exceptional discoveries could be done concerning the location and characterisation of their city walls, towers and gates, most parts of the internal and immediate external street systems, and the detailed mapping of forum plazas, with their surrounding monumental architecture of basilicas, temples, *tabernae*, and the occasional *curia* or *domus*. Even more spectacular is the discovery of another set of large and crucial buildings of the towns, such as baths, theatres, amphitheatres, *macella*, extra-mural sanctuaries, etc., while about the more difficult housing sectors these aerial surveys also allowed important acquisitions. A crucial part of the flying strategy, whether from classic two seater planes or with the help of different types of drones, both allowing for tests with multi-spectral imaging (e.g. Near InfraRed and UltraViolet photography), is that once a potential architectural structure or important new feature was spotted, there was a regular follow up of the specific area during different seasons and in different weather conditions. Important also is the idea that the town area could be controlled several times a year, which makes it possible to organize a real follow up and even a monitoring of the vulnerability and erosion activity affecting these urban sites, which are crucial elements for not only the better comprehension of the many archaeological structures present in the soil, but also for their conservation and management.

The aerial surveys were in all four urban cases followed or paralleled by intensive field observations and activities. A main contributing strategy here was the extensive use of geophysical prospections (Fig. 1). Hereby a multi-method research strategy was conceptualized from 2004 onwards in collaboration with several external partners (BSR, University of Ljubljana, Eastern atlas). The incorporation of different geophysical technologies into the survey program was specifically aimed at producing multiple spatial data layers of certain subsurface features of the Roman urban sites – that could be integrated with the results from the aerial surveys and from other, more traditional field methods applied on all four sites, namely gridded artefact surveys, augerings and micro-topographical field measurements. To this end, the chosen approach comprised the use of three complementary and often

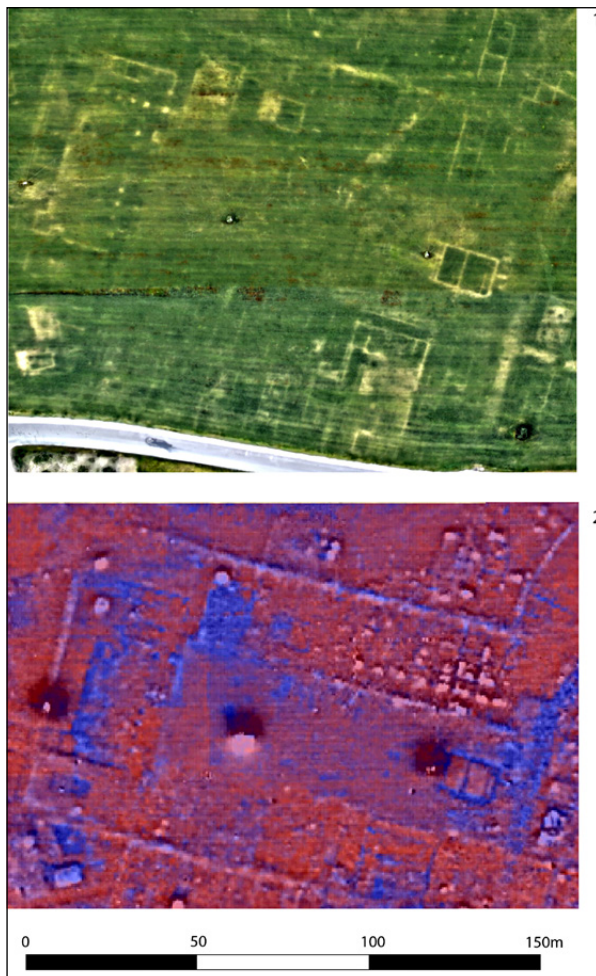


Fig. 1 – Aerial photograph with clear cropmarks of the buried remains of the Roman forum of Trea and (below) fused imagery of geomagnetic and earth resistance surveys on that same area. Elaboration: F. Vermeulen, B. Music and G. Verhoeven.

proven to be very efficient geophysical methods for archaeological contexts: magnetometry, earth resistance and Ground Penetrating Radar (GPR). Experience learned here that in general only the two first named techniques really worked well, while GPR often produced no results at all, or needed a very time-consuming high density effort for obtaining some useful imagery. This was not due to the instruments or know how of the prospectors, but is very

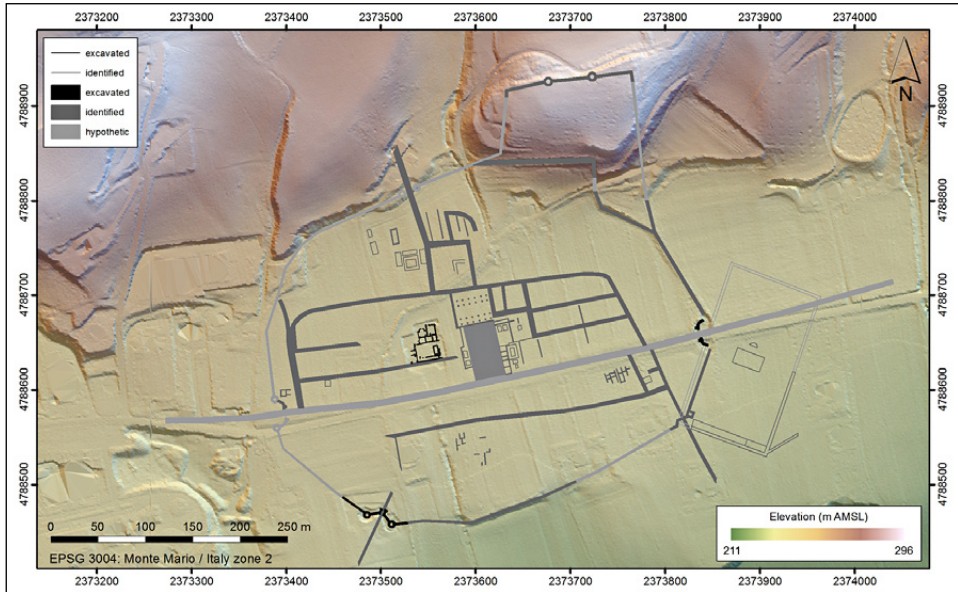


Fig. 2 – Interpretative mapping of geophysical and aerial survey evidence combined with some excavated data, presented on a background of LiDAR imagery of the Roman town site of Septempeda. Elaboration: F. Vermeulen, D. Taelman and F. Carboni.

much linked with the less suitable clayish soils in the valley. In general however, the application of intensive, full to almost full coverage geophysics on all four urban sites allowed for remarkable results, bringing much more detail and certainty into the mapping effort than was possible when based only on remote sensing data. Especially when fusing the raw resistivity imagery with magnetic data from the three sites where both techniques were applied on a certain scale (Trea, Potentia and Septempeda) the deciphering of many buried structures of the intra-mural parts of the towns centre reached levels of detail unseen before in much non-excavation fieldwork in Italy (Fig. 2). Integration with the aerial data, and eventually also with legacy data from older ill located sources, such as some earlier not well located 19<sup>th</sup> century excavations on the town site of Trea, reveal now also an understanding of functions and even chronologies of the individual structures and certain components of the town centre during its long life.

### 3. TOWARDS VIRTUALLY RECREATING A ROMAN LANDSCAPE

Via the production, in collaboration with the Austrian company 7Reasons, of a series of 3D visualisations, an animated film and interactive



Fig. 3 – Visualization of the early Imperial phase of the Roman town of Potentia and its hinterland near the central Adriatic coast. Elaboration: M. Klein and F. Vermeulen.

realtime applications, the glorious past of these large and complex urban sites is currently coming alive again. The advanced ways of non-invasive data acquisition, processing and architectural analysis, combined with a limited number of old and recent stratigraphic excavations on smaller parts of these town sites, and with intensive geo-archaeological studies of the whole valley environment, allow today to produce a quite elaborate virtual presentation of the Roman Potenza valley in its early Imperial heyday (Fig. 3). In this step towards understanding the full material aspect of the Roman towns and modelling their topographic complexity, three-dimensional graphics have been employed as a means of further exploring data and their interpretation, and for translating the main acquisitions in an understandable way to a broader audience. The created models allowed for major multidimensional understanding of the archaeological evidence encountered in the field, but are considered neither definitive statements of fact, nor wholly imagined products of Virtual Archaeology. Viewing the data from integrated surveys in this way gives the archaeologist the opportunity to engage with hypotheses in a virtual physical environment. It represents a shift from past research with a significant impact on how the material culture relating to such cityscapes is documented and understood. No more extrapolations based on too little information about one or two plots excavated in a full city, but visualisations based on intensive, total site surveys, integrated with all possible evidence from excavations,

geo-approaches, legacy finds from this site and comparative research on other sites. However, even if the obtained Virtual Reality reconstructions of the four Roman towns during their widest Early Imperial expansion (1<sup>st</sup>-2<sup>nd</sup> centuries AD) are the result of much interactive work and discussion among team specialists of different fields, using a wide array of local, regional and supra-regional data, we must be aware that the reconstructions are tentative and experimental. Much of the data remains non-stratigraphic in nature and some of the interpretations cannot disentangle the complexity of many centuries of settlement development. The reconstruction of ancient cityscapes is a challenging research activity implying the management of a high level of uncertainty, especially regarding the ecological context and the factors “time” and “evolution”.

Better than any other approach to mapping and visualisation it reveals that the integrated study and interpretation of mostly buried town structures needs to be undertaken at different levels, i.e. at different scales, ranges of precision and with variety in the depiction of interpreted detail. In the particular case of these four Adriatic cities we chose to broadly visualise the suburban environments according to the data obtained from the systematic prospections and some punctual paleo-ecological investigations (e.g. pollen analysis). Zooming into the urban centres, the high resolution data from certain geophysical and aerial photography operations allows providing quite realistic representations of the public areas and buildings in the cities, while higher detail and more daring visualizations are proposed when also good or at least some local excavated information can enhance the non-invasive data. As with any archaeological investigation the end product of such an interpretative effort can never be final and must keep the flexibility with which any proposed plan or representation resulting from archaeological research can be changed in the future.

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## ABSTRACT

Since 2000 a team from Ghent University has achieved intensive non-invasive intra-site prospections on four abandoned Roman towns in central Adriatic Italy (Marche Region): the coastal colony of Potentia and the inland municipia of Ricina, Trea and Septempeda. These urban surveys include total coverage geophysical prospections (such as GPR, geomagnetic and earth resistance approaches), low altitude aerial photography (including NIR photography with drone and helikite), geomorphological augerings, surface artifact collection, and micro-topographical field measurements. A GIS-based integration of all survey data, maps and re-studied legacy data has procured a formidable database for the computer-aided digital 3D mapping and interpretation of these complex ancient sites. The methodological acquisitions and archaeological results not only contribute to the understanding of Roman urbanization in this part of Italy, but also support and innovate the use of integrated approaches to geospatial mapping and analysis of ancient urban environments. Based on earlier experiences with 3D visualizations of the abandoned Roman town of Ammaia in Lusitania, as part of the EC funded Project “Radiography of the Past” (<http://www2.radiopast.eu/>), the project in Adriatic Italy moves now towards presenting the new data in digital formats that allow specialists from archaeology and cultural heritage management, as well as the wider public to immerse into the visual world of Roman Late Republican and Imperial townscapes of a whole valley and its coastal environment.