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SERENA SABATINI*, KRISTIAN GÖRANSSON*, ANNA GUSTAVSSON*,
STEPHEN KAY**, ELENA POMAR**, IRENE SELSVOLD*, LEWIS WEBB***

HISTORY AND ARCHAEOLOGY AT VULCI: OLD EVIDENCE AND NEW DATA FROM A GEOPHYSICAL INVESTIGATION IN THE URBAN AREA♦

Molteplici studi hanno contribuito a creare nel corso degli anni una notevole, anche se dispersa, quantità di dati sul complesso processo di urbanizzazione che ha caratterizzato l'Etruria meridionale dalla fine dell'età del bronzo fino al periodo tardoantico.

Il presente lavoro intende rivisitare and espandere la conoscenza del vibrante sviluppo storico dell'Italia centro-occidentale presentando vecchi e nuovi dati da uno dei suoi centri chiave, il sito di Vulci (VT). L'articolo si divide in tre parti. Nella prima ci si propone di presentare il progetto di ricerca Understanding Urban Identities (UII) gestito dall'Università di Göteborg. La seconda parte propone una rapida panoramica dello sviluppo storico di Vulci, mentre nella terza ed ultima parte dell'articolo si presentano i risultati della prima campagna di prospezioni geofisiche condotte nell'area urbana dell'antica Vulci in collaborazione con la British School di Roma.

I risultati delle prospezioni geofisiche dimostrano che l'area urbana investigata era probabilmente occupata da strutture di tipo domestico e produttivo. I segnali raccolti escludono la presenza di strutture monumentali e suggeriscono si tratti di un'area adatta allo studio dello sviluppo diacronico del sito. Dal punto di vista metodologico, il risultato delle prospezioni conferma quello di precedenti indagini nell'area urbana di Vulci e dimostra come nella stessa il Ground Penetrating Radar sia lo strumento più adatto allo studio non invasivo del sito.

INTRODUCTION

This paper aims at presenting the Understanding Urban Identities (UII) project¹ and the successful results of a geophysical survey on the eastern part of the ancient urban area of Vulci between the so-called Acropolis and the East Gate. In doing so, it also aims at revisiting our

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1) See: <https://www.gu.se/forskning/understanding-urban-identities-uu-1-from-the-bronze-age-to-the-roman-time-the-case-of-vulci-in-the-context-of-southern-etruria> (last accessed 29 October 2021).

knowledge about the impressive historical development of the site of Vulci (*fig. 1*) from its origins during the Bronze Age until Late Antiquity.

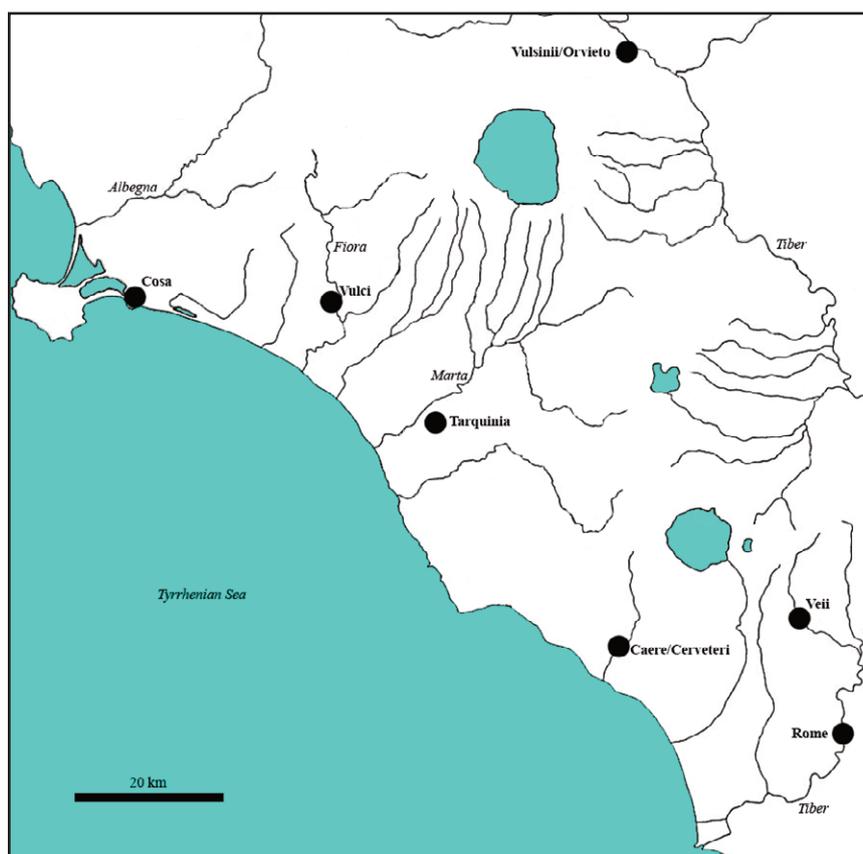


1. MAP OF CENTRAL ITALY WITH THE LOCATION OF VULCI (VITERBO PROVINCE)

1.1. THE UNDERSTANDING URBAN IDENTITIES PROJECT

Building on a long tradition of studies by Swedish scholars on Southern Etruria (see below), in the past three years, a research group at the University of Gothenburg has initiated the UUI project, whose main aim is to investigate broadly the urban development in central western Italy over the *longue durée* from the Bronze Age until Late Antiquity. Using an interdisciplinary approach, the project aims to anchor the examination of the general historical processes with the archaeological record from the site of Vulci. Due to the richness and the complexity of its historical trajectory, Vulci is expected to provide invaluable evidence as to continuity and transformation in Southern Etruria settlement configuration over time.

Southern Etruria is the name commonly given to the territory that includes roughly the northern part of modern *Latium* and the very south of Tuscany, between the Fiora River to the north and the Tiber to the south (*fig. 2*). At the beginning of the Iron Age in this area (ca. second



2. MAP OF SOUTHERN ETRURIA WITH THE MAIN SITES AND RIVERS NAMED IN THE PAPER

half of the tenth century BCE)², a remarkable – and widely debated as to its forms and characteristics – urbanization process dramatically transformed the earlier settlement patterns³. The well-defined configuration with a dense network of Final Bronze Age settlements occupying local hilltops⁴, abruptly cease to characterize the landscape at the dawn of the Early Iron Age. At the same time, and as a likely consequence of social, cultural, economic and political transformations, still to be fully understood, the sizeable elevated plateaux scattered around the region clearly attract local populations into much larger settlements⁵. Although debated, it is today widely accepted that the sites where the Early Iron Age so-called proto-urban centres flourished were already occupied at least during the preceding Final Bronze Age, supporting the idea that this urbanization process should be seen as part of a path towards social complexity with roots back in the Bronze Age⁶. This urbanisation process is not exclusive of southern Etruria

2) While a relative consensus exists as to the absolute chronology of the Bronze Age and the Early Iron Age I periods (e.g. CARDARELLI 2018, p. 360), the absolute chronology of the periods that follow (Early Iron Age II, Orientalizing and Archaic periods) is debated (e.g. GUIDI 2006; RIVA 2010, pp. 2-3), we therefore largely refer to the traditional relative chronology throughout with occasional references to absolute dates.

3) PACCIARELLI 2001; PACCIARELLI 2010; PACCIARELLI 2016; PACCIARELLI 2017; VANZETTI 2004; BONGHI JOVINO 2005; RASMUSSEN 2005; RIVA 2010; RIVA 2021; FULMINANTE, STODDART 2013; CARDARELLI 2015; CARDARELLI 2018, pp. 373-376; MARINO 2015; STODDART 2017; PRIGNANO *et al.* 2019.

4) The Italian Final Bronze Age is generally divided into three sub-phases: Final Bronze Age 1-2 (ca 1150-1025 BCE) and Final Bronze Age 3 (ca 1025-950/925 BCE), see e.g. PACCIARELLI 2016, p. 168; PACCIARELLI 2017, p. 563; CARDARELLI 2018, p. 360.

5) DI GENNARO 1986; IAIA 1999; PERONI 2000; PERONI 2004; SCHIAPPELLI 2008; BARBARO 2010; PACCIARELLI 2010; PACCIARELLI 2016, pp. 180-191; CARDARELLI 2018, pp. 373-376.

6) GUIDI 2006; BARBARO 2010; CARDARELLI 2015; CARDARELLI 2018; PACCIARELLI 2016.

and occurs in the neighbouring *Latium Vetus* south of the Tiber as well, albeit at a somewhat different pace and with characteristics fostering a different political balance and the rise of the dominant centre of Rome⁷.

During the successive orientalisising and archaic periods or between approximately the end of the eighth and the sixth century BCE, the Early Iron Age proto-urban settlements of Southern Etruria systematically developed into the well-known Etruscan cities of significant political importance⁸. Indeed, one could say that a period of apparent stability and demographic expansion began in the whole region during the Iron Age, despite intense social, political, economic and administrative developments⁹. By contrast, in *Latium Vetus* the proto-urban phase does not seem to have been characterized by the same kind of “stability”, likely due to the early and exponential urban growth of Rome¹⁰. The two areas continued to have deep bonds and contacts¹¹, but irreparably clashed in the Republican period, when the political independence of the Etruscan world ceased¹².

Despite accurate studies of specific areas and periods and important contributions such as those for example on the debate about monumentalisation in Etruscan and Early Roman architecture¹³, we still lack a full understanding of the characteristics and organization of the proto-urban settlements and of the processes that led to the subsequent blossoming of the Etruscan cities. Indeed, there is a clear need to understand better the political and particularly the economic foundations that allowed later so-called city-states such as Vulci to emerge. Additionally, the investigation of such processes shall provide a solid background for a better understanding of later historical developments, which still lack satisfactory explanations, such as the apparent wealth of sites like Vulci in the Roman and late antique periods when literary sources and historical documentation in particular would suggest instead a dwindling situation (see below).

[S.S.]

1.2. SWEDISH ARCHAEOLOGY IN SOUTHERN ETRURIA

As mentioned, Swedish pre- and protohistoric research and excavation projects in Italy have had a significant focus on Southern Etruria. Those works represent from an archaeological historical perspective a solid background for the UUI project. The Italic past sparked an interest among Scandinavian scholars already in the nineteenth century, at the time mainly directed towards linguistic studies on the Etruscan and other pre-Roman languages. Among the early references is Carl Olof Thulin’s study on Etruscan religion and Olof August Danielsson’s studies from the 1880s to the 1920s on Italic and Etruscan inscriptions¹⁴. A number of Swedish archaeologists were involved in research on Early Italy, starting with Oscar Montelius’s large publication of the Bronze Age, Iron Age, and Etruscan cultures. He was followed by Gösta

7) SMITH 2005; PACCIARELLI 2010, pp. 87-93 and 120-128; PACCIARELLI 2016, pp. 177-180; ALESSANDRI 2013; FULMINANTE, STODDART 2013; NAGLAK, TERRENATO 2019.

8) BARTOLONI 2000; RIVA 2016; RIVA 2021; CERCHIAI 2017.

9) PACCIARELLI 2001; PACCIARELLI 2016; BONGHI JOVINO 2005; RIVA 2010; RIVA 2021.

10) BIETTI SESTIERI 1992; BETTELLI 1997; FULMINANTE, STODDART, 2013; for a more articulated vision see also ALESSANDRI 2013.

11) BETTELLI 1997; IZZET 2007, pp. 226-231.

12) BRADLEY 2007; IZZET 2007, p. 124; LEIGHTON 2013; CECCARELLI 2016.

13) DAMIANI, PACCIARELLI 2007; BARTOLONI 2009; BONGHI JOVINO 2010; THOMAS, MEYER 2012; POTTS 2015.

14) DANIELSSON 1884; DANIELSSON 1928; THULIN 1968.

Säflund's work on the Bronze Age, Einar Gjerstad's extensive publications on early Rome, and Pär Göran Gierow's study on the Iron Age in *Latium*; Åke Åkerström's studies on Etruscan tombs, and Arvid Andrén's dissertation on Etruscan temple terracottas are examples of notable works on Etruscan material from the interwar period¹⁵.

The lively tradition of Etruscan and prehistoric studies by Swedish scholars was consolidated with the foundation of the Swedish Institute of Classical Studies in Rome in 1926¹⁶. Since then, the most consistent body of scholarly research has had a major focus on Southern Etruria, and further developed in the post-World War II period with fieldwork activities. Several Swedish archaeological excavations were conducted in the area from the 1950s onwards, with the San Giovenale field campaigns 1956-65, the excavations at Luni sul Mignone in 1960-63, and at Acquarossa in 1966-75, 1978 and 1991. Notably, the excavations at San Giovenale and Acquarossa were strongly supported by the Swedish King Gustaf VI Adolf, who actively participated in the fieldworks in Italy¹⁷.

The material from the Swedish investigations in Southern Etruria has been widely presented¹⁸. It resulted in a vast number of published monographs, doctoral dissertations, and journal articles, which would be too extensive to list. The UUI project at Vulci builds on this previous Swedish scholarship and aims, among other things (see above), to shed new light on some of the many research questions that have emerged from earlier studies.

[A.G.]

2. VULCI

2.1. A BRIEF HISTORY OF EXCAVATIONS AT VULCI

As well known, the site of Vulci was first correctly identified by Annus of Viterbo (*Joannes Annus Viterbensis*) in the fifteenth century¹⁹. The first known excavations at the site were undertaken by Filippo Prada between 1776 and 1778²⁰. His excavations took place on the so-called "Pian de' Voci", the local name of the site that obviously conserved a trace of the original ancient name of the city. Excavations in the area of "Ponte della Badia", north-east of the ancient site, were soon after conducted by Cardinal Pallotta in 1783²¹. Then followed a turbulent period in the history of the Papal States, with the French occupation in 1798, which apparently prevented further investigations in the area.

15) MONTELIUS 1895-1910; SÄFLUND 1939; GJERSTAD 1953-1973; GIEROW 1961; GIEROW 1962; GIEROW 1966; ÅKERSTRÖM 1934; ANDRÉN 1940.

16) GREN 1960, p. 247.

17) WETTER *et al.* 1972.

18) For an overview see NYLANDER 1986; *Forma Urbis* 2017. Additionally, the results from San Giovenale are published in the San Giovenale-series from the 1960s onwards. The latest published volume includes a complete bibliography of the area, covering the years 1877-2011 (BELLERBA, ALROTH 2013, pp. 155-159). The excavations at Luni have been published in the series "Luni sul Mignone results of excavations conducted by the Swedish Institute of Classical Studies at Rome and the Soprintendenza alle Antichità dell'Etruria Meridionale" (*Acta Instituti Romani Regni Sueciae*, Series in 4°, 27) between 1969 and 1975. Likewise, the excavation at Acquarossa are published in the series "Acquarossa: Results of Excavations Conducted by the Swedish Institute of Classical Studies at Rome and the Soprintendenza alle antichità dell'Etruria meridionale" (*Acta Instituti Romani Regni Sueciae*, Series in 4°, 38) since 1981. Doctoral dissertations linked to those projects include: ÖSTENBERG 1975; SCHEFFER 1982; RYSTEDT 1983; STRANDBERG OLOFSSON 1984; WIKANDER 1988; BENGTSSON 2001; BACKE-FORSBERG 2005; TOBIN 2015. Finally, many field reports and articles have been published in *Opuscula Romana. Annual of the Swedish Institute in Rome* (from 2008 under the joint periodical *Opuscula. Annual of the Swedish Institutes at Athens and Rome*).

19) TAMBURINI 2000, p. 20.

20) BURANELLI 1991, pp. 5-6; TAMBURINI 2000, pp. 20-21.

21) MORETTI SGUBINI 2012, p. 1084.

After the restoration of the Italian territories of the Papal States, Vincenzo Campanari began excavating the tombs of Vulci, first with the Candelori brothers in 1825, and from 1828 with a personal papal permit. At the same time, the Papal States issued permits to excavate to three other persons, including the Prince of Canino, Lucien Bonaparte. This resulted in four excavations going on at the same time in various parts of the ancient city's necropoleis, yielding an amazing quantity of exceptional material, which quickly found its way to «the Museums of Europe, from Paris to St. Petersburg», as Dennis describes it²². Indeed, the richness of the tombs of Vulci was extraordinary and Lucien Bonaparte alone organized several major sales in which he sold thousands of vases²³. The Campanari family house in Tuscania became a place where collectors would visit to view objects, not least the many locally found sarcophagi exhibited in the garden. In 1837, the Museo Gregoriano Etrusco was opened by Pope Gregory XVI to house the increasing number of Etruscan finds coming from the territory controlled by the Papal States, with Vulci being one of the most important sites²⁴.

It would be impossible to list here the complete history of early excavations at Vulci - for this the reader is referred to other publications²⁵. Suffice to say that interest mounted in the second half of the nineteenth century with new extensive explorations of the necropolis²⁶. In 1889 French archaeologist Stéphane Gsell, with a concession from Prince Giulio Torlonia, excavated over a hundred tombs on Torlonia's land on behalf of the École française de Rome, possibly the first foreign excavations in the recently unified Kingdom of Italy²⁷.

It is only after World War II that the first large fieldwork investigations in the urban area of Vulci finally take place under the direction of Renato Bartoccini in 1956-58, which among other things uncovered parts of the city walls, Roman roads and the Great Temple. For over a century, the finds from the tombs had overshadowed any interest in the city itself. Following Bartoccini's example, excavations were carried out in the urban area of Vulci in the 1960s under the direction of Mario Moretti and intensively from the 1970s to the early 2000s by Anna Maria Moretti Sgubini of the Italian Soprintendenza²⁸. Today, the archaeological park is the permanent object of rescue excavations and investigations conducted by the staff of the Vulci archaeological park and the Soprintendenza²⁹.

The UUI project is part of a more recent set of fieldwork activities conducted by Italian and foreign academic institutions, among others, the Vulci 3000 archaeological project which focuses in particular on the transition between the Etruscan and the Roman city of Vulci and combines non-invasive prospecting and development of digital documentation methods with stratigraphic excavations by the Western Forum³⁰.

[K.G.]

22) DENNIS 1848, p. 411.

23) MACKINTOSH TURFA 2013, p. 1140.

24) BURANELLI 2000.

25) See for example the useful summaries in FALCONI AMORELLI 1983, pp. 11-17 and MORETTI SGUBINI 2012.

26) MORETTI SGUBINI 2012, pp. 1093-1095.

27) TAMBURINI 2000, pp. 24-25; WHITLING 2018, p. 57. For the following years, it is important to be considered among others the significant work of Raniero Mengarelli (CONTI 2018) or the investigations on important local monumental graves such as the Cuccumella (e.g. MORETTI SGUBINI 2015).

28) MORETTI SGUBINI 1979; MORETTI SGUBINI 1993; MORETTI SGUBINI 1997; MORETTI SGUBINI 2001; MORETTI SGUBINI 2002; MORETTI SGUBINI 2005; MORETTI SGUBINI 2006; MORETTI SGUBINI 2008; MORETTI SGUBINI 2012; MORETTI SGUBINI 2017; MORETTI SGUBINI *et al.* 2005; MORETTI SGUBINI, RICCIARDI 2006; ARANCIO *et al.* 2008.

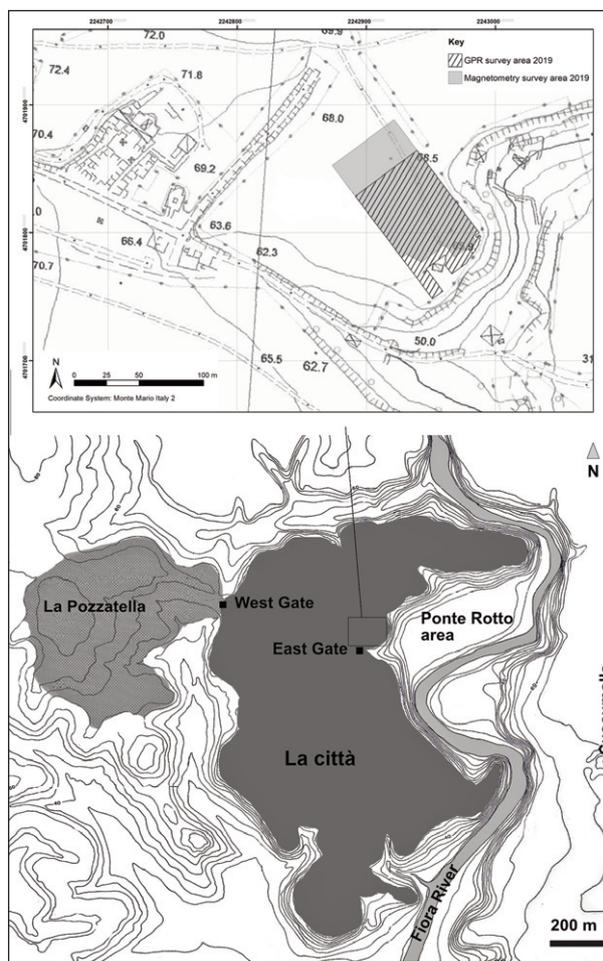
29) DELLA FINA *et al.* 2012; CASI 2013; CASI 2014; CASI 2016; CAROSI, CASI 2017.

30) McCUSKER, FORTE 2017; FORTE *et al.* 2020.

2.2. BRONZE AND IRON AGE VULCI

Significant evidence suggests that the plateau at Vulci was occupied during at least the last part of the Final Bronze Age³¹. Although clear and precisely recorded in recent times, data about this early occupation phases at Vulci are still limited. The most conspicuous hints at a well-organised Proto-Villanovan presence on the plateau come from the surrounding necropolis where Final Bronze Age graves appear distributed in roughly the same way as those of the later Early Iron Age³².

The possibility that the Bronze Age occupation could have covered, according to a density that is not yet possible to establish, more or less the whole plateau emerges in particular from both systematic and non- systematic field surveys conducted or accurately reviewed by Marco Pacciarelli³³. The same investigations also suggest that not only the classical perimeter of “La Città” was part of the early occupation, but also the adjacent area of “La Pozzatella” (*fig. 3*), which was probably an integral part of the site at least until the Hellenistic period³⁴. Further evidence of an early settlement dating back to the Final Bronze Age has been recovered thanks to modern stratigraphic excavations in the area of the West Gate³⁵. During those investigations, traces of a structure dated to the end of the Bronze Age/beginning of the Early Iron Age emerged at the bottom of the sequence. More finds dated to the protohistoric phases of the settlement seem to have been discovered during a survey followed by another excavation in the so-called Area I along the eastern slopes of the plateau³⁶, and approximately below the area where the UII project aims to focus its fieldwork activities (*fig. 3*). The challenge for future studies is to acquire a deeper understanding of the occupation and use of the plateau right before and during the proto-urban phenomenon of Southern Etruria and therefore contribute to the debate on the issue with new datasets from within the settlement area. We believe that a more accurate knowledge of the early phases of the later Etruscan town will considerably contribute not only to an increased



3. THE URBAN AREA OF VULCI WITH THE LOCATION OF THE UII 2019 GEOPHYSICAL SURVEYS

31) PACCIARELLI 2001, pp. 136-165; PACCIARELLI 2017; MORETTI SGUBINI 2006; BARBARO 2010, pp. 123-125; NEGRONI CATACCHIO 2013.

32) PACCIARELLI 2001, pp. 137-139; PACCIARELLI 2017; BARBARO 2010, p. 123.

33) PACCIARELLI 2001, pp. 138-140.

34) BONGHI JOVINO 2005.

35) MORETTI SGUBINI 2006.

36) MORETTI SGUBINI *et al.* 2005, pp. 263-265.

understanding of the local proto-urban phenomenon, but also to a better understanding of later political, economic and historical developments at Vulci in particular, and in Southern Etruria in general.

[S.S.]

2.3. ETRUSCAN VULCI

Etruscan Vulci must have been a vital, well-populated and opulent centre³⁷. Its large cemeteries and the wealth of material recovered from the graves being one of the most consistent proofs of that.

Archaeological evidence from the surrounding territory suggests that - in line with what is also happening around other centres of Southern Etruria - if during the earlier Iron Age Vulci had likely become the only settlement between the Fiora and Albegna rivers³⁸, by the second half of the eighth century BCE a consistent number of relatively minor open sites populate again its fertile region. The rise of such sites has been interpreted as an indication that the now fully flourished orientalisating period is a time of political transformations; the administration has now likely consolidated and manage the territory and its resources according to new political-economic choices³⁹. It also suggests demographic growth, which shall continue well into the later archaic period when the number of rural settlements seem to increase exponentially. During the subsequent centuries some larger centres gain importance and the territory dominated by Vulci appear not only intensively populated and exploited, but also the theatre of continuous exchanges between the rural and the urban areas thanks among other things, to what must have been a developed road network⁴⁰.

Our knowledge of the topography, structure, and urban organization of Vulci is limited⁴¹. Probably during the second half of the eighth century BCE, at about the same time as we see the abovementioned reorganization of the territory managed by the town⁴², at strategic points around the edge of the plateau defensive embankments with a palisade were raised⁴³. Clearly, around 500 BCE the main temple was erected. The temple was built on an impressive podium providing a glimpse of the local wealth at the time⁴⁴. An imposing wall enclosing the whole town and still visible today was built at the end of the fourth century BCE. The wall was then restored, expanded, and reinforced in various ways during the third century BCE⁴⁵. Of most interest for future research is the fact that the wall excludes the “Pozzatella” area, which was possibly an integral part of the site before that. However, sub-urban areas in this period might have assumed a more specific productive vocation, which would continue into the Roman time⁴⁶.

Despite the limited information available about the organization of the Etruscan urban milieu, other overall evidence suggests that Vulci was not only a wealthy centre, but was also widely renowned for its artistic and craft productions. Vulci seems to be the place of origin for a number of different types of craft productions over time. Countless studies have been carried

37) NEPPI MODONA 1977; MORETTI SGUBINI 1993; MORETTI SGUBINI 2001; MORETTI SGUBINI 2005; MORETTI SGUBINI 2012; TAMBURINI 2000; BIANCHI 2016.

38) NEGRONI CATAACCHIO 2013, p. 129.

39) BONGHI JOVINO 2005, p. 47.

40) RENDELI 1993; STEINGRÄBER 2000; BONGHI JOVINO 2005, pp. 52-53; IZZET 2007, pp. 193-207; PRIGNANO *et al.* 2019.

41) MORETTI SGUBINI 1993; MORETTI SGUBINI 1997; MORETTI SGUBINI 2005; MORETTI SGUBINI 2012; cf. also POCOBELLI 2004.

42) BONGHI JOVINO 2005, p. 47.

43) MORETTI SGUBINI 2012, p. 67; MARINO 2015.

44) MORETTI SGUBINI 1997; MORETTI SGUBINI, RICCIARDI 2006; EDLUND-BERRY 2015.

45) MORETTI SGUBINI 2002, p. 138; MORETTI SGUBINI 2017.

46) CAROSI *et al.* 2017; MORETTI SGUBINI 2017, p. 68.

out on Etruscan productions and their ability to meet the requirements of both demanding local customers and a vast market in the Mediterranean and in continental Europe north of the Alps as well⁴⁷. The wealth sumptuously displayed in Vulci's Etruscan graves strongly suggests that local productions, which included ceramics, jewellery, sculpture, mirrors and metalworking must have had a significant economic role⁴⁸.

Despite being a vital and wealthy actor throughout the first millennium BCE, Vulci does not seem to have a major place in the preserved ancient written sources (see below). This is probably an unfortunate consequence of the lack of surviving indigenous Etruscan historiography. We hope that future investigations at the site will help to shed light on this apparent historical contrast.

[S.S.]

2.4. VULCI IN THE TEXTUAL SOURCES

While there is a wealth of Etruscan, Ancient Greek, and Latin inscriptions from Vulci and its surrounds⁴⁹, Etruscan, Ancient Greek, and Latin textual sources directly mentioning the city or the people of Vulci are scarce, but not non-existent⁵⁰. The latter are in focus here. Although scarce, these sources still provide rich information about, and perspectives on, the notability, persistence, and impact of the city and its people in the Mediterranean from the fifth century BCE to the sixth century CE, as we will see.

To our knowledge, the earliest sources directly attesting Vulci are three Etruscan inscriptions from the fifth century BCE. They include an inscription on an Attic red-figure *kylix*, one on an Attic red-figure *rhyton* cup, and one on an Etruscan *oinochoe*: «*fuflun(s)l paxies velclθi*»⁵¹, «*fuflunsul paxies velclθi*»⁵², and «*mi arnthial tetnies ουθιθι velclθi*»⁵³. In all three inscriptions, the name of the city of Vulci, *velclθi*, contains a stem *velc-* along with a genitive suffix (-*l*) and locative postposition (-*θi*), suggesting that an Etruscan name for Vulci was probably built on the stem **Velc-*⁵⁴. The first two inscriptions may offer evidence for a local cult of the deity *Fufluns Paxie* (sc. *Dionysus Bacchios*) at Vulci⁵⁵.

Polybius refers to «*Ὀλκιον· πόλις Τυρρηνίας*»⁵⁶ in a fragment from the sixth book of his *Historiae*⁵⁷ retained in an entry in the epitome of Stephanus of Byzantium's *Ethnica*⁵⁸; if the fragment is authentic, a Greek name for Vulci in the second century BCE was *Ὀλκιον*. The text also provides further evidence for the people of Vulci in the same entry: «*τὸ ἐθνικὸν Ὀλκιῆται καὶ Ὀλκιεῖς*»⁵⁹, indicating that two Greek demonyms for these people were *Ὀλκιῆται* and *Ὀλκιεῖς*.

47) E.g. AIGNER-FORESTI 1992; GRAN-AYMERICH, MACINTOSH TURFA 2013; IZZET 2007, pp. 211-235; NASO 2017, in particular vol. 2.

48) E.g. FISCHER-GRAF 1980; MORETTI SGUBINI 1993; MORETTI SGUBINI 2008; RIIS 1998; BRUNI 2000; COLIVICCHI 2000; MARTELLI, GILOTTA 2000; AMBROSINI 2002; WERNER 2005; MORETTI SGUBINI, RICCIARDI 2006; BELELLI 2009; NASO 2012; AMBROSINI 2013; DE PUMA 2013; SMALL 2016.

49) E.g., *ET*, Vc 1.1-AV 0.30; *IGASM* III App. I, 5-17; *CIL* XI, 2925-2950; *AE* 1975, pp. 378-391. Cf. BIANCHI 2016, pp. 213-214.

50) HUS 1971, pp. 20-22, 159-169; MORETTI SGUBINI 2012, p. 1082; BIANCHI 2016, pp. 1, 137, 140, 158, 169-170.

51) «of *Fufluns Paxie*, of/at Vulci»: *ET*, Vc 4.1 with HUS 1971, p. 21; BIANCHI 2016, p. 50; MIANO 2020, pp. 115-117.

52) «of *Fufluns Paxie*, of/at Vulci»: *ET*, Vc 4.2 with HUS 1971, p. 21; BIANCHI 2016, p. 50; MIANO 2020, pp. 115-117.

53) «I, of *Arnth Tetnie*, in the grave, of/at Vulci»: VAN HEEMS 2006.

54) HUS 1971, p. 21; VAN HEEMS 2006, pp. 51-52; MIANO 2020, pp. 117-118.

55) BIANCHI 2016, p. 50; MIANO 2020, pp. 115-120.

56) «*Olkion*, a city of *Tyrrhenia* [Etruria]»: Plb. 6 fr. 11.12W *apud* St.Byz. s.v. *Ὀλκιον* with BILLERBECK 2014, pp. 430-431.

57) Ca. 118 BCE: WALBANK 1957, pp. 1, 292-297.

58) Ca. sixth century CE: BILLERBECK 2006, p. 3.

59) «The demonym [is] *Olkietai* and *Olkieis*»: Plb. 6 fr. 11.12W *apud* St.Byz. s.v. *Ὀλκιον* with BILLERBECK 2014, pp. 430-431.

An entry on the *Fasti Triumphales*⁶⁰ attests to the consul *Tiberius Coruncanius*' triumph «[de *Vulsiniensibus et Vulcentib(us)*»⁶¹ in 280 BCE, providing evidence for a Roman victory over Vulci in that year, as well as a Latin demonym for the people of Vulci, namely *Vulcientes* (and one for the people of *Vulsinii, Vulsinienses*).

A probably Claudian (first century CE) marble relief found in *Caere* depicts, *inter alia*, a dressed, veiled woman seated on a throne on a raised base; in her outstretched right hand she holds an object difficult to interpret (perhaps a Victory or *picus*). On the same relief, on the raised base beneath the woman's throne, is a Latin inscription with the word *Vulcentani*, suggesting that the woman was a personification of the people of Vulci or a tutelary deity of Vulci⁶². The inscription on this relief provides another Latin demonym for the people of Vulci, *Vulcentani*.

In a discussion of the geography and cities of Italy in the third book of his *Naturalis Historia*⁶³, Pliny the Elder mentions «*Cosa Volcentium a populo Romano deducta*» and «*Volcentani cognomine Etrusci*»⁶⁴. These two passages attest to the foundation of the *colonia* of Cosa in the coastal territory of Vulci in 273 BCE⁶⁵, as well as to two additional Latin demonyms for the people of Vulci, namely *Volcientes* and *Volcentani*. Furthermore, the second passage probably distinguishes between the people of Vulci in Etruria and the people of *Volceii* in Lucania⁶⁶.

Ptolemy mentions *Ούόλκοι* in his list of cities in the «*Τούσκων μεσόγειοι*»⁶⁷ in the *Geographia*⁶⁸ providing another Greek name for the city, namely *Ούόλκοι*.

In *Festus*' epitome⁶⁹ of *Verrius Flaccus*' *De verborum significatu*, in an aetiology for the *Tuscus Vicus*, *Festus* mentions «[... ..]entes fratres *Caeles et Vibenn[a ...] Tarquinium Romam secum max[... ..]rint*», which has been restored by Lindsay to «*aut quod Volci>entes fratres Caeles et Vibenn<a, quos dicunt regem> Tarquinium Romam secum max...<colue>rint*»⁷⁰. Here *Festus* and his sources (e.g., *Verrius Flaccus* and *Varro*) may be referring to two Etruscan brothers (*Caeles* and *Vibenna*) or perhaps the famous Etruscan leader *Caeles Vibenna*, mentioned by *Varro*, *Claudius*, and *Tacitus* in their aetiologies for the Caelian Hill (all three) and the *Tuscus Vicus* (*Varro* and *Tacitus*)⁷¹, and whose Etruscan name, *Caile Vipina*, famously identifies a male figure being freed by a *Macstrna* on the “night attack” fresco (ca fourth century BCE) in the François Tomb in Vulci⁷². If Lindsay's conjecture is correct, *Festus* provides additional evidence

60) Ca. 19-11 BCE: DEGRASSI 1947, p. 20.

61) «Over the *Vulsinienses* and *Vulcientes*»: *CIL* I², pp. 46, 172 with DEGRASSI 1947, pp. 72-73, 545. On the triumph see BROUGHTON 1951, pp. 190-191; HUS 1971, p. 21; RICH 2014, p. 248; BIANCHI 2016, pp.137-138.

62) HUS 1971, p. 22; LIVERANI 1989; GRUMMOND 2006, pp. 203-204, esp. fig. IX.2 (Victory); MORETTI SGUBINI 2012, p. 1082 (*picus*).

63) 77 CE: BALDWIN 1995.

64) «Cosa of the *Volcientes*, founded by the people of Rome» and «The *Volcentani* with the additional name *Etrusci*»: *Plin. nat.* 3.51-52 with KÖNIG, WINKLER 2002, p. 239.

65) Cosa: *Liv. perioch.* 14; *Str.* 5.2.8; *Vell.* 1.14.7 (foundation date of 273 BCE) with BIANCHI 2016, p. 143.

66) HUS 1971, p. 21; KÖNIG, WINKLER 2002, p. 239; BIANCHI 2016, p. 94 n. 202. *Volceii* in Lucania: *Liv.* 27.15.2.

67) «*Ouolkoi*» and «Area of the Tusci in the interior [of Italy]»: *Ptol. Geog.* 3.1.49 (wider context 3.1.47-49) with STÜCKELBERGER, GRASSHOFF 2006, pp. 272-273.

68) Ca. 150 CE: STÜCKELBERGER, GRASSHOFF 2006, p. 11.

69) Ca. second century CE: GLINISTER *et al.* 2007, p. 1.

70) «Or because the *Volcientes* brothers *Caeles* and *Vibenna*, whom they say king Tarquin [...] lived with him at Rome»: *Fest.* 486L with LINDSAY 1913, pp. 486-487; BIANCHI 2016, pp. 64-65; NEEL 2017, pp. 17-20. Cf. restoration in LETTA 2013, p. 95.

71) *VARRO ling.* 5.46; *CIL* XIII 1668 (*Tabula Lugdunensis*); *TAC. ann.* 4.65 with BIANCHI 2016, pp. 62-66; MALLOCH 2018. Cf. also D.H. 2.36.2; PAUL. *FEST.* 38L.

72) CORNELL 1995, pp. 133-138; ROSS HOLLOWAY 1995; RATHJE 2014; NEEL 2017.

for the Latin demonym *Volcientes* and, perhaps, attests to a famous figure of Vulci, *Caeles Vibenna*, who provided the eponym for the Caelian Hill⁷³.

In his aetiology for the *Capitolium* (Capitoline Hill) in the sixth book of his *Adversus Nationes*⁷⁴, *Arnobius* asks «*regnatoris populi Capitolium qui est hominum qui ignoret Oli esse sepulcrum Vulcentani*» and, after citing *Sammonicus*, *Granius*, *Valerius Antias*, and *Fabius* (Pictor?), claims «*nec erubuit civitas maxima et numinum cunctorum cultrix, cum vocabulum templo daret, ex Oli capite Capitolium quam ex nomino Iovio nuncupare*»⁷⁵. Whoever this *Olus* (Latin variant of *Aulus*) was, he cannot be securely identified with *Aulus Vibenna*, the famous brother of *Caeles Vibenna*, and whose Etruscan name *Aule Vipina* also identifies another male figure on the “night attack” fresco in the François Tomb⁷⁶. *Arnobius* and his sources evince the Latin demonym *Vulcentanus/Vulcentani* and another famous figure of Vulci, an *Olus*, who provided the eponym for the Capitoline Hill⁷⁷.

Perhaps the latest extant ancient textual source mentioning Vulci and its people is a Latin honorific inscription for *Caesar Flavius Valerius Severus* from 305 CE⁷⁸, dedicated by «*ord[o] et populus Vulcentium*»⁷⁹. This inscription attests to the public activities of the entire community of Vulci – as encompassed by the formal expression *ordo et populus*⁸⁰ – in the early fourth century CE, as well as to another Latin demonym, *Vulcentes*.

In summary, textual sources attest to an Etruscan name of the city built on the stem **Velc-*, Greek names for the city, *Ὀλκίον* and *Ὀνόλκοι*, Greek demonyms, *Ὀλκιῆται* and *Ὀλκιεῖς*, Latin demonyms *Vulcientes*, *Vulcentanus/i*, *Volcientes*, *Volcentani*, and *Vulcentes*, and perhaps two famous figures of Vulci, *Caeles Vibenna* and *Olus*. As far as the UUI project is concerned, the textual sources, although scarce, indicate, *inter alia*, that Vulci was well known in the wider Mediterranean world, that life at the site continued long after the Roman conquest of 280 BCE, and that persons from Vulci were deeply integrated into Roman aetiologies for Rome itself. As investigation of the site continues, more illuminating inscriptions may emerge.

[L.W.]

2.5. ROMAN VULCI

Vulci was defeated by the Romans (likely led by the consul *Tiberius Coruncanius*, see above) during the expansion campaign of 284-280 BCE⁸¹. It has been argued that Vulci as other Etruscan cities was forced to enter a bilateral treaty with Rome that rendered it a *civitas foederata* without political and military independence in foreign affairs⁸². Vulci seems to have been

73) HUS 1971, p. 22; BIANCHI 2016, pp. 62-66.

74) Ca. 303 CE: SIMMONS 1995, pp. 92-93.

75) «Who is there among men who does not know that the *Capitolium* of the ruling people is the tomb of *Olus Vulcentani*?» and «nor did the greatest community, worshipper of all divinities, blush, when giving name to the temple, to call it the *Capitolium* after the head of *Olus*, rather than the name of *Jupiter*»: ARNOB. *nat.* 6.7 with CORNELL 2013, p. 103; BIANCHI 2016, pp. 62-66; NEEL 2017, pp. 20-24. Cf. on *Olus* and the *Capitolium*: SERV. *Aen.* 8.345; Mart. Cap. 3.22-3; MOMMSEN 1892, 1.144 (*Chronica Urbis Romae*) with BIANCHI 2016, pp. 62-66; NEEL 2017, pp. 20-26.

76) CORNELL 1995, pp. 135-138; NEEL 2017, p. 10. Identification difficulties: NEEL 2017, pp. 20-26.

77) Cf. HUS 1971, pp. 21-22; BIANCHI 2016, pp. 62-66.

78) Dated by his title Caesar: *PLRE* Severus 30.

79) «The order and people of the *Vulcentes*»: *CIL* XI 2928 with MORETTI SGUBINI 2012, p. 1083.

80) Sc. the decurions and the rest of the community: VEYNE 1961; DAWSON 2019.

81) HARRIS 1971, pp. 79-82; BIANCHI 2018, p. 770 and 778.

82) BIANCHI 2016, pp. 137-144; BIANCHI 2018, p. 770. See even details in HARRIS 1971, pp. 85-98; and recently TERRENATO 2019, particularly pp. 144-150. Among the ancient sources see Zonar. 8.7.

particularly harshly treated by the Romans after the defeat. The city walls appear to have been partially destroyed, alongside strongholds near the city⁸³. Eduardo Bianchi recently argued that the destruction of the site's defences was a consequence of Vulci being a major player in the recent Etruscan wars, and that these harsh measures ensured that they would not reclaim their power⁸⁴.

After the Romans took control over the city and its territory, the construction of the major Roman roads *Via Clodia* and *Via Aurelia*, while making the territories of Vulci easily accessible from Rome, both seem to bypass the settlement itself and to be apparently independent of earlier Etruscan road networks⁸⁵. After their construction, Vulci was accessed via a side road from the *Via Aurelia*⁸⁶, while a new Latin colony, Cosa, was founded on the Tyrrhenian coast north of Vulci in 273 BCE, situated directly on the *Via Aurelia*. Cosa controlled the fertile lands of Vulci in and around the Fiora river valley, and ultimately removed focus further from Vulci⁸⁷. Previous scholarship suggests that the bypassing of Vulci by the new major roads and the growing status of Cosa explains how Vulci dwindled in importance in the Roman Republican period⁸⁸. Yet, these factors should not be taken as an indication of disappearance, nor the meagre mentions of Vulci in the written sources (see above) as an indication that the city disappeared after it was conquered by the Romans⁸⁹. Andrea Carandini has suggested that the early and efficient integration of Vulci and its territories into the Roman system conceals the continued importance and influence of Vulci behind Roman names, which appear in local burial inscriptions, such as the *Publius Serveilius* inscription dated to the fourth quarter of the second century BCE⁹⁰. Judging from the increasing number of Latin inscriptions in the necropolis of Vulci, the Roman presence significantly influenced the local citizens⁹¹.

The people of Vulci probably became Roman citizens and the site a Roman *municipium* following the passage of the *lex Iulia de civitate* of 90 BCE and *lex Plautia Papiria de civitate* of 89 BCE, along with other Etruscan, Umbrian, and Latin communities; indeed, revolts in Etruria and Umbria may have prompted the passage of the former law⁹². The people of Vulci were enrolled in the *tribus Sabatina* likely in or soon after 86 BC⁹³. Bianchi argues that this event marked the removal of the last vestiges of Vulci's political autonomy⁹⁴. On the other hand, the presence of monuments and buildings dated to imperial times as much as archaeological evidence for craft production suggest that the liveliness of the site continued well after the Roman conquest⁹⁵.

The relationship between Etruscan and Roman Vulci remains to be understood. However, the existing archaeological evidence, e.g. monumental constructions such as the temple, fortifications, and the bridges over the Fiora River, demonstrate a substantial continuity between these periods, and that the Roman topography did not obliterate existing structures.

83) MORETTI SGUBINI 2005, p. 462; BIANCHI 2018, p. 771 and n. 33.

84) BIANCHI 2016, pp. 139-144.

85) DE ROSSI 1968; IZZET 2007, pp. 193-207; PRIGNANO *et al.* 2019.

86) The issue is debated, see the incisive observations by DE ROSSI 1968.

87) E.g. BIANCHI 2018, pp. 770-771 and p. 776.

88) BIANCHI 2016; BIANCHI 2018.

89) See also WITCHER 2006.

90) CARANDINI 1985, p. 63. *Publius Serveilius* inscription: *CIL* XI 2945; HUS 1971, p. 162; BIANCHI 2016, pp. 162-167. On the *gens Servilia*: TREGGIARI 2019, pp. 24-25.

91) CARANDINI 1985, p. 58.

92) App. *BC* 1.49-50; BIANCHI 2016, pp. 169-170. On the *lex Iulia* see BISPHAM 2008, pp. 162-172; DART 2014, pp. 171-188.

93) *CIL* I2 3344 = XI 2930; DART 2014, pp. 143-146 and p. 187.

94) BIANCHI 2016, p. 169.

95) CAROSI *et al.* 2017.

The Ponte Rotto and Osteria necropolis have yielded extensive material datable to the Roman period⁹⁶, supporting the claim of a well populated town. After the ostentatious and monumental tombs of the Etruscan period, the Roman period tombs were smaller and more modest. Those which have been explored are generally simply furnished hypogea with a single chamber, or with a central corridor with flanking open burial cells. They date to the third and second century BCE. The change in burial customs towards the more “simplistic” has been interpreted as expression of decline⁹⁷. However, other factors might also have influenced the development of local funerary rituals.

Of particular interest is the presence of a *mithraeum* built between the Cryptoporticus house and one of the earlier houses in the third century CE⁹⁸. *Mithraea* are the temples of the initiation cult of Mithras. The cult was established in Italy in the late first century CE, and was popular amongst soldiers and the non-elite social strata. The temples of Mithras were generally situated in locations hidden from view and as in Vulci often in direct relation to residential quarters. Mithraism along with other so-called mystery cults retained their popularity into the late antique period, and the discrete locations could have made it possible to maintain religious activity after the Christianization⁹⁹. A recent discovery at Tarquinia suggests that Mithraism might have been relatively popular in the region¹⁰⁰. Moretti Sgubini argues quite convincingly that the *mithraeum* at Vulci most likely was subject to religious violence in Late Antiquity¹⁰¹. The mithraic cult image, the tauroctony, was toppled, and particular destructive attention was aimed at the figures of Mithras himself, leaving other animal images undisturbed. The *mithraeum* of Vulci has recently been identified by David Walsh as one of very few plausible cases of religious violence towards Mithraic cult spaces¹⁰². A nearby late antique/early medieval Christian chapel was constructed from Roman *spolia* and attests to Christian presence in the urban area. It demonstrates together with the religious manipulation of the *mithraeum* the likelihood that Vulci was still a lively community in Late Antiquity and that it took an active part in the religious transformation in the area¹⁰³.

[I.S.]

3. THE GEOPHYSICAL SURVEY AT VULCI 2019

3.1. THE UII FIELDWORK AREA

As discussed in the introduction, using a multidisciplinary approach, the UII project intends to contribute to a renewed understanding of the history of Southern Etruria from the Bronze Age to Late Antiquity. One of the purposes of the project is to anchor investigations of broader historical processes in archaeological fieldwork at the site of Vulci in order to bring new knowledge about the settlement's configurations over time. Such an approach shall provide - among other things - much needed information about the economic fundamentals that catalysed the local urbanization phenomenon and its further development. The area chosen for the

96) CARANDINI 1985, pp. 61-64.

97) CARANDINI 1985, p. 64

98) MORETTI SGUBINI 1979; MORETTI SGUBINI *et al.* 1998.

99) CLAUS 2001; WALSH 2018.

100) SCAPATICCI 2018.

101) MORETTI SGUBINI 1979, pp. 268-270.

102) WALSH 2018, p. 97. It is interesting that a similar fate apparently happened also to the Tarquinian *mithraeum* (SCAPATICCI 2018).

103) Cf. SELSVOLD 2019.

archaeological fieldwork is located to the east of the “*Domus del Criptoportico*” and south of the so-called “Acropolis”, on an open plateau 150 m north of the Eastern Gate overlooking the River Fiora and the “Ponte Rotto” area (*fig. 3*). No modern archaeological investigations have been conducted in the area. As mentioned, recent excavations along the slopes immediately below and overlooking the Fiora River and the “Ponte Rotto” (named *Area I* by the excavators) returned material that could be dated to different phases of the settlement including proto-historic ones¹⁰⁴. Notably the area lacks visible monumental structures of Roman and later periods and it is presumably a particularly suitable zone to pursue investigations, which seek to reach the earlier occupation phases of the site. A geophysical survey was performed in summer 2019, the results of which are presented in the following section.

[S.S.]

3.2. GEOPHYSICAL PROSPECTION AT VULCI

The application of geophysical prospection for the non-invasive investigation of archaeological sites provides a rapid form of assessment of the near subsurface. The technique has been extensively applied at the major Etruscan and Roman centres in South Etruria including Tarquinia, *Veii*, *Pyrgi*, and Cerveteri¹⁰⁵. The Roman Town Projects¹⁰⁶, which focused on the Tiber valley, primarily investigated Classical sites using magnetometry and extensively mapped several Roman cities including *Falerii Novi*, Otricoli, and Capena¹⁰⁷. Further south, other Latin centres and Roman colonies have also been extensively explored using geophysics including *Gabii*, *Interamna Lirenas* and *Aquinum*¹⁰⁸.

Several geophysical surveys have been recently undertaken at Vulci due to its suitability for prospection¹⁰⁹. In the area of the Great Temple and to the south of the “*Domus del Criptoportico*” an extensive magnetometry survey has been undertaken by the Vulci 3000 project (see above). The results mapped numerous magnetic targets although the survey was also affected by the underlying geology¹¹⁰. A subsequent GPR survey by the project of the same area as well as to the North of the “Tempio Grande” has recorded the subsurface features in much greater detail¹¹¹. In 2020, an extensive magnetometry survey was also undertaken of the northern part of the plateau by the *Cityscape e sviluppo urbano dell’antica Vulci* project of the University of Freiburg and University of Mainz¹¹². In 2016 a combined magnetometry and GPR survey in the extra-urban area of “Ponte Rotto” was undertaken in order to assess the area of the river port of Vulci. An initial magnetometry survey identified several features 50 m to the north of the bridge¹¹³. However, targeted GPR failed to locate similar anomalies and subsequent test trenches showed only for the area to have a deep alluvial sediment, a result of the flooding of the River Fiora¹¹⁴.

104) MORETTI SGUBINI *et al.* 2005.

105) For Tarquinia cf. BAGNASCO GIANNI *et al.* 2018, for Veii cf. PIRO 2015; CAMPANA 2019, for Pyrgi cf. ORLANDO *et al.* 2019 and for Cerveteri cf. NARDI 2003; WALLNER *et al.* 2019.

106) See KEAY *et al.* 2004 *et al.* for an overview.

107) For *Falerii Novi* cf. KEAY *et al.* 2000, for Otricoli cf. HAY *et al.* 2013, and for Capena cf. KEAY *et al.* 2006.

108) For *Gabii* cf. KAY 2013, for *Interamna Lirenas* cf. BELLINI *et al.* 2018, and for *Aquinum* cf. PIRO *et al.* 2011.

109) In 2020 the UUI project undertook a second campaign of GPR geophysical survey expanding the study area to the north and west (see KAY *et al.* 2021; SABATINI *et al.* 2021).

110) McCUSKER, FORTE 2017, p. 98.

111) FORTE *et al.* 2020.

112) <https://vulcityscape.hypotheses.org/101> (last accessed 29 October 2021).

113) LOCKYEAR *et al.* 2018.

114) HAY 2016.

3.2.1. GEOPHYSICAL METHODS

Geophysical techniques permit the investigation of the subsoil through the measurement of its physical properties, which reveal areas of contrast, often called anomalies¹¹⁵. These indicate the presence of subsurface materials that differ from the general composition of the ground, recorded by an average value. In some circumstances, anomalies can originate from features of archaeological interest¹¹⁶.

The survey at Vulci used two geophysics techniques, GPR and magnetometry, both of which are commonly employed for archaeological prospection. The aim of applying two techniques was to maximize the potential for identifying archaeological remains, as each technique is responsive to different physical properties. The earlier magnetometry survey in the area south of the Great Temple had shown the effect of the underlying geology, therefore whilst the technique was tested in this eastern area, GPR was also used to help correlate the results.

The magnetometry survey at Vulci was carried out using a Bartington Grad601 fluxgate gradiometer. This instrument is equipped with two opposed magnetic sensors, which register the small variations of the magnetic field of the soil¹¹⁷. It allows the identification of anomalies caused by subsurface features whose magnetic values differ from the surrounding context, depending on the consistence and composition of the material¹¹⁸. Magnetometry is particularly suitable for locating archaeological features such as brick structures, kilns and other construction materials, which have a magnetic contrast with the local soil matrix¹¹⁹.

GPR has been successfully used at a number of Etruscan and Roman sites in Southern Etruria to detect a variety of different types of features (see above). Above all, the technique is particularly useful for mapping walls and foundations¹²⁰. GPR survey is an electromagnetic technique, where a high frequency radar wave is emitted into the ground: measurements are obtained by recording the time (calibrated in nano-second: ns) elapsed between the transmission and reception of the signal¹²¹. Buried features or subsurfaces with contrasting physical properties are represented in data sets as reflections or hyperboles¹²². There are two main advantages of utilising this technique: through velocity analysis it is possible to estimate depth measurements of identified features and data sets can be displayed both vertically (radargrams) and horizontally (time-slices)¹²³.

[S.K., E.P.]

3.3. GEOPHYSICAL SURVEY PARAMETERS

The overlapping geophysical surveys extend across an area (*fig. 3*) of 120 m by 60 m with the aim of identifying sub-surface features associated to the different occupation phases of the site. The geophysical prospection was preceded by a topographical survey in order to establish a regular grid and geographically locate the survey. The magnetometry survey collected the data every 0.25 m (sample interval) in parallel zig-zag traverses at a regular distance of 0.5 m. The

115) BOSCHI 2009, p. 298.

116) GAFFNEY, GATER 2003, p. 55.

117) SALA *et al.* 2012, p. 139.

118) CLARK 1990, pp. 65–66; ASPINALL *et al.* 2008, p. 27.

119) MEYER 2013, p. 188 and table 10.3.

120) GAFFNEY, GATER 2003, p. 48.

121) CLARK 1990, p. 118; CONYERS, GOODMAN 1997, p. 23; GAFFNEY, GATER 2003, p. 48; CONYERS 2004, p. 25.

122) CLARK 1990, p. 118.

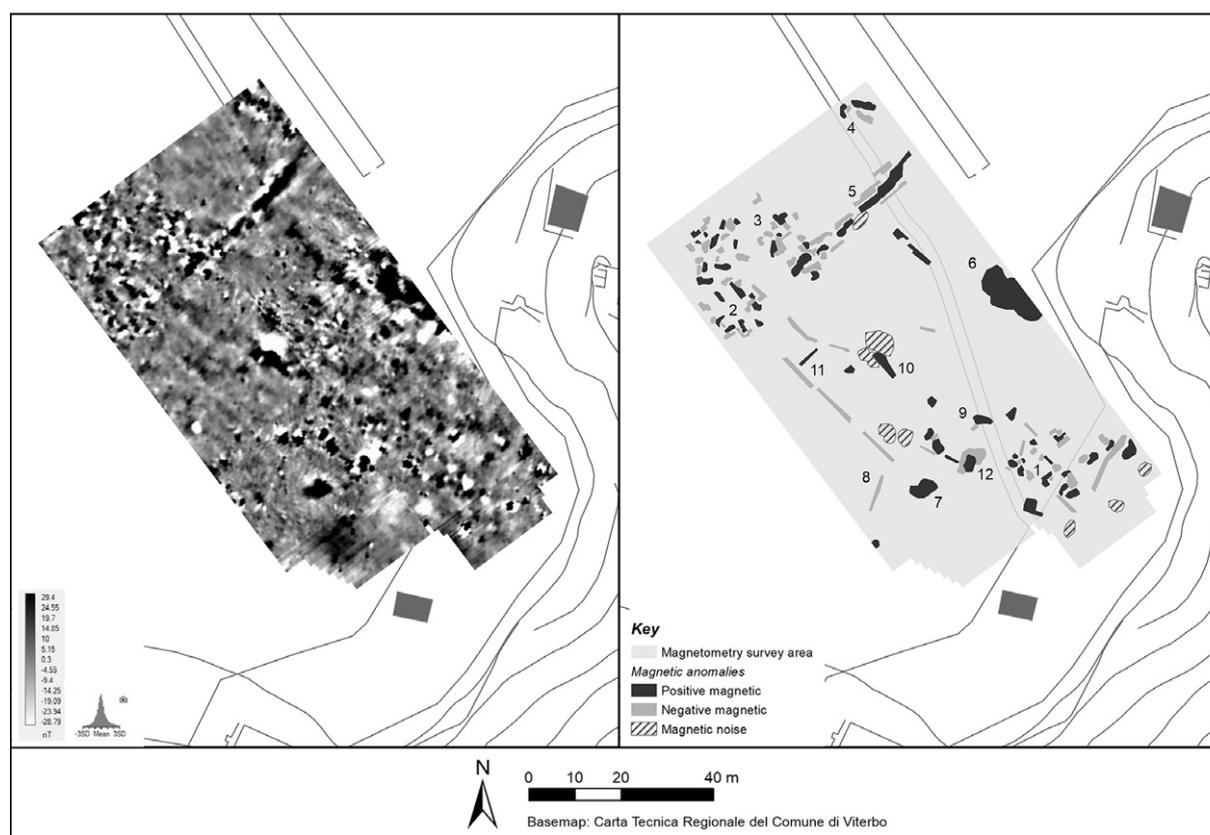
123) GAFFNEY, GATER 2003, p. 48.

GPR survey, which utilised a single channel GSSI 400MHz antenna mounted on a cart, collected data at a regular parallel traverse interval of 0.25 m.

3.3.1. GEOPHYSICAL SURVEY RESULTS

I) MAGNETOMETRY

The magnetometry survey recorded a series of features, however, similar to results elsewhere at Vulci, the recorded magnetic field appeared affected by the geology (*fig. 4*). The data indicates several features of potential archaeological interest as well as some magnetic noise originating from subsurface metallic material or rubbish¹²⁴. The most significant features are grouped in the south-eastern and north-western parts of the survey area (*fig. 4*: 1, 2, and 4). These are composed by concentrations of small positive and negative magnetic anomalies. The features are also located in the same area as those recorded by the GPR survey (*fig. 5*: 1.1, 1.2 and 5.4) and are likely to originate from the same target. Therefore, although the plotted geometry of the magnetic features does not immediately suggest the presence of structures, comparison with the GPR results strongly supports this interpretation. Moreover, since the features to the northwest (*fig. 4*: 2 and 4) are very similar to the clear anomalies to the southeast (*fig. 4*: 1) it seems reasonable to suggest a similar interpretation for all these features.



4. RESULTS AND INTERPRETATION OF THE MAGNETOMETRY SURVEY AT VULCI

124) The recognition of modern metal material in magnetic data is given by extremely high combined to extremely low values, which represent ferromagnetic dipoles.

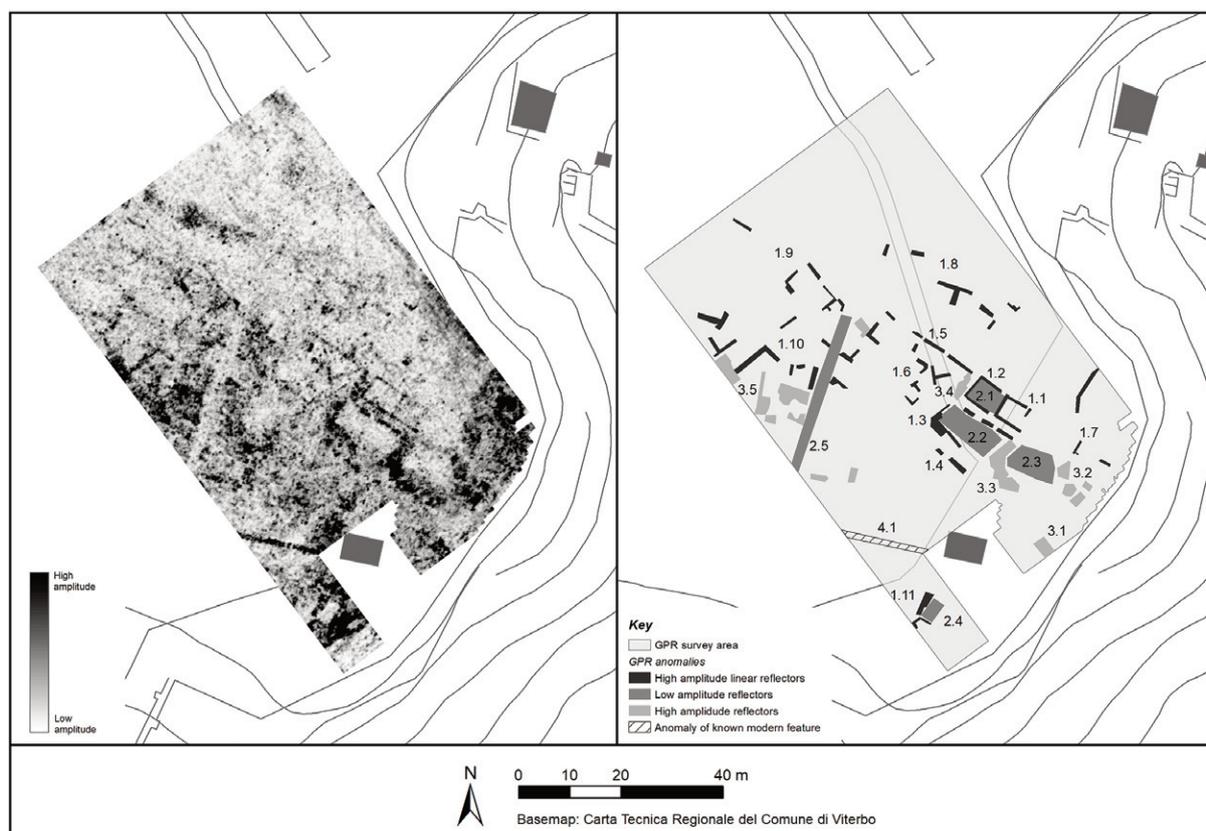
A prominent linear feature (*fig. 4: 5*) crosses the survey area in a northeast-southwest direction. It includes a central and quite homogeneous sequence of high magnetic readings, flanked on both sides by lower magnetic readings. The feature's maximum width is approximately 5 m and is 37 m in length. The dimensions and the orientation, following the same alignment as some previously noted features, as well as the magnetic values suggest that the feature is of potential archaeological interest.

The linear features (*fig. 4: 8, 9, 10 and 11*) to the south of the survey area also respect a northwest-southeast and northeast-southwest alignment, which was also observed in the GPR survey. Finally, a significant feature was recorded in the central southern area (*fig. 4: 12*) whose characteristic shape and strong positive magnetic value (around 240 nT in the raw data) indicate the possible presence of a hearth or kiln.

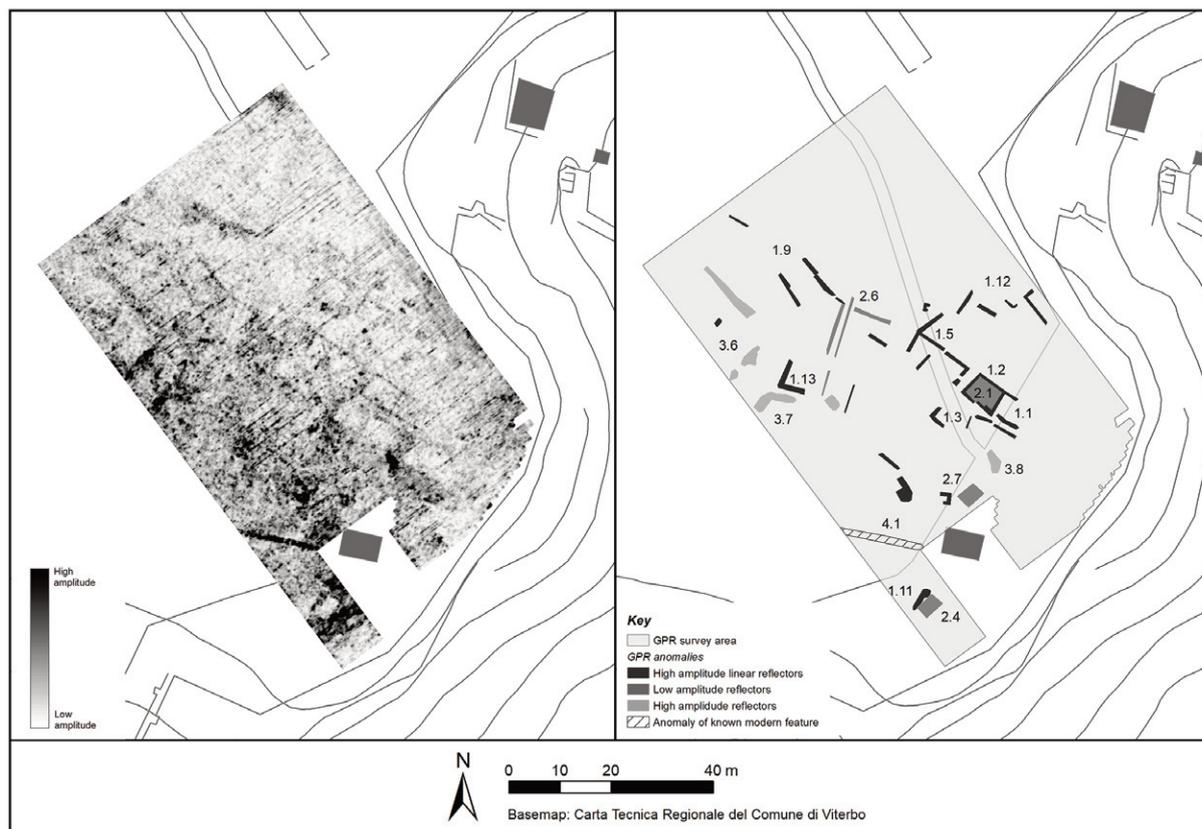
II) GROUND-PENETRATING RADAR

The GPR survey responded with much more clarity than the magnetometry, and the results indicate a range of anomalies related both to high and low amplitude reflectors. The most prominent features were recorded at shallow depth, between ca. 0.15 and 0.65 m, whereas the deeper slices were more affected by the variations of the local topography.

The clearest features were recorded at approximately 0.18 m to 0.47 m below ground level (*fig. 5*), however several of these features were also recorded at a greater depth, between 0.38 and 0.67 m (*fig. 6*). These are clusters of linear and other regular anomalies generated by high



5. RESULTS AND INTERPRETATION OF THE GPR SURVEY AT VULCI. ESTIMATED DEPTH CM 18-47



6. RESULTS AND INTERPRETATION OF THE GPR SURVEY AT VULCI. ESTIMATED DEPTH CM 38-67

amplitude reflectors, which occupy the central part of the survey area (*figs. 5 and 6: 1.1, 1.2, 1.3, 1.4, 1.5 and 1.6*). The arrangement of these features appears to be very regular and follows two main axes of alignment, northwest-southeast and northeast-southwest. Two anomalies (*figs. 5 and 6: 1.2 and 1.3*) form right angles resulting in rectangular spaces marked by low amplitude reflections (*figs. 5 and 6: 2.1 and 2.2*). Given the geometric organization and the linearity of the feature it is possible to relate these features with the presence of archaeological buried structures.

Other linear features which follow the same northwest-southeast and northeast-southwest alignment are scattered across the area (*fig. 5: 1.7, 1.8, 1.9 and 1.10*). Some of these reflections, located to the north and east, have a weaker signal (such as *fig. 5: 1.8*) or are less clear (*fig. 5: 1.7*) when compared to those previously mentioned. A very strong and distinct feature was recorded in the southern corner of the survey area (*figs. 5 and 6: 1.11*). This is formed by a strong linear anomaly of high amplitude, oriented northeast-southwest, topographically associated to a rectangular low amplitude reflection. These anomalies are probably reflections of structural remains of an archaeological nature.

Another area of low amplitude reflection extends in a northeast-southwest direction (*fig. 5: 2.5*), ca 2.3 m wide and 32 m in length. Despite the weakness of this feature, its regular orientation and shape are significant and suggest a feature of possible archaeological interest. A final target indicated by a strong high amplitude reflector, oriented almost east-west was recorded in the south-western part of the survey area (*figs. 5 and 6: 4.1*). This feature is the metal railway line preserved under the surface built for the nineteenth century excavations.

The deeper time-slice (*fig. 6*), at an estimated depth of between 0.38 and 0.67 m below the modern ground level, recorded several features that correspond with those discussed above. Despite the minimum difference between the two depth slices levels (with a 15% of overlap), it appears that the anomalies already have a weaker signal at a depth of approximately 0.47–0.67 m. High amplitude reflectors were recorded in the data (*fig. 6*: 1.12, 1.13, 3.6, 3.7, 3.8) across the survey area. Several of these anomalies indicate the same features present at a higher level (*fig. 5*), although at an increased depth these are slightly attenuated and less clear. Other features (*fig. 6*: 1.12 and 1.13) are only present at a greater depth and have no direct correspondence with the features previously discussed, however they may be associated with the same overall feature.

[S.K., E.P.]

3.4. DISCUSSION OF THE GEOPHYSICAL PROSPECTION RESULTS

The geophysical prospection undertaken at the eastern extent of the plateau at Vulci, above the East Gate, recorded a range of subsurface archaeological features. The data collected by the two methods show a correspondence between the anomalies recorded by the two techniques. In particular, the most prominent GPR features (*fig. 5*: 1.1, 1.2 and 2.1) were recorded by the magnetometry survey as a group of positive and negative magnetic readings (*fig. 4*: 1). As described above, the geometry of magnetometry features can be less distinct than GPR (in particular due to a lower resolution), however it is clear that the anomalies are generated by the same buried features.

The proposed interpretation of the geophysical anomalies is supported by an analysis of aerial photographs of Vulci taken in 1975 and 1997¹²⁵. Through a comparison of the geophysical prospection with the interpretation proposed by Pocobelli, a clear correspondence between the features is apparent (*fig. 7*). A range of features identified by the GPR survey (*fig. 5*: 1.4, 1.10, 1.11, 2.3 and 2.4) correlate with the cropmarks identified by Pocobelli¹²⁶, with a concentration at the eastern extent of the survey. More generally, a series of other features identified by Pocobelli appear to follow the layout of the later Roman town. A major northwest-southeast road, with a series of perpendicular secondary roads and buildings aligned according to the two axes was identified. These features correlate with the anomalies identified by the magnetometry prospection (*fig. 4*: 1, 5 and 7) and presumably relate to the same urban organization. Similarly, an elongated GPR feature (*fig. 5*: 2.5) may be interpreted as a trace of a road, aligned perpendicularly to the major road traced by Pocobelli¹²⁷.

The two different prospection techniques used at Vulci had a partial correspondence, although not all features were recorded by both instruments. The difference lies in the fact that the two techniques are responsive to different materials and where one is very sensitive, the other may provide no results. Several features (*figs. 4 and 5*: 1 = 1.1, 1.2 and 2.1; 9 = 1.5; 10 = 1.9) may be structures which include material responsive to both measurements, which could for example be walls constructed from fired material. On the contrary, it is possible that other subsurface structures recorded by the GPR but not detected by the magnetometer lack sufficient magnetic contrast with the background values (e.g. *fig. 5*: 1.3, 1.4, 1.5) as the possibly reflectors are walls or foundations constructed of stone.

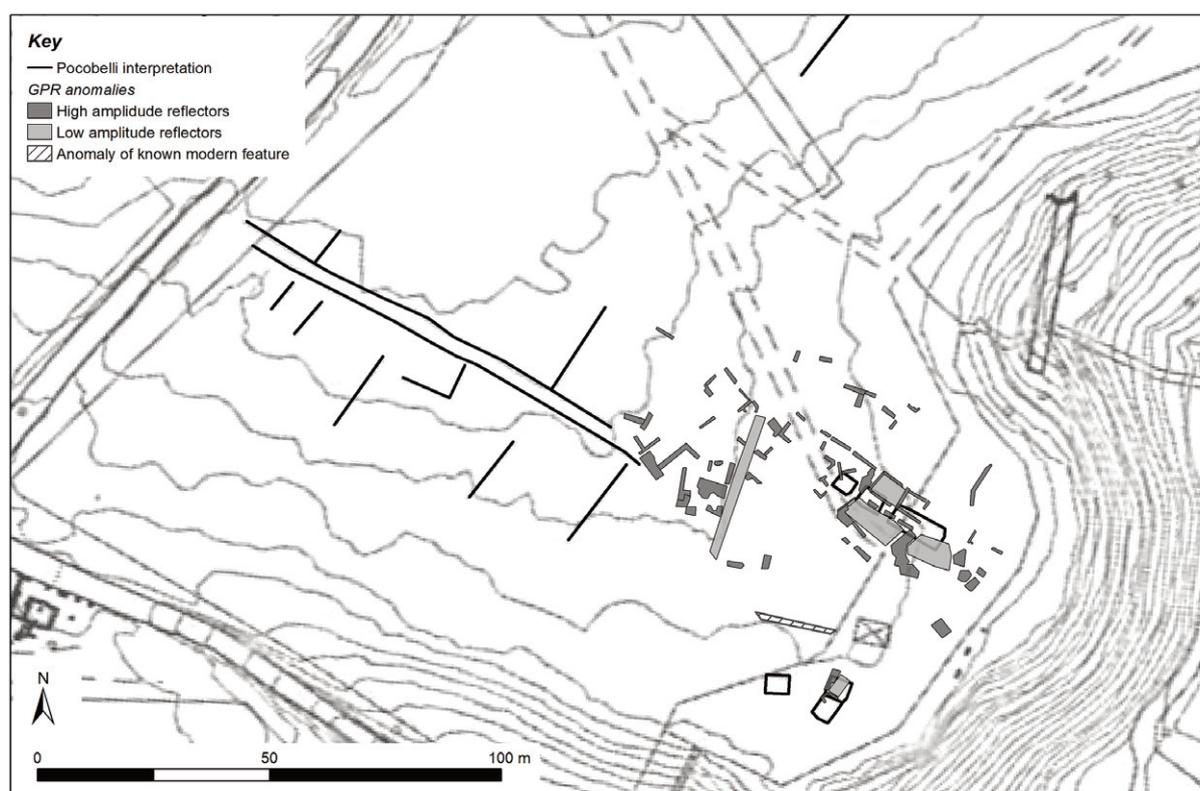
125) POCOBELLI 2004.

126) POCOBELLI 2004, p. 133 and *fig. 7*.

127) POCOBELLI 2004, p. 134 and *fig. 8*.

The combined geophysical surveys undertaken to the north of the eastern gate at Vulci covered an area of 0.7 hectares and recorded a range of archaeological anomalies that relate to the urbanisation of the plateau. Whilst the magnetometry prospection provided an approximate indication of concentrations of material, the GPR survey provided a clearer indication of the nature of the subsurface features. Furthermore, the GPR interpretation is supported by the previous work of Pocobelli. Whilst similar Etruscan sites such as *Veii* and *Tarquinia* have been extensively mapped through magnetometry, at the site of Vulci it appears that GPR is a more suitable prospection technique. The earlier work conducted to the south of the Great Temple by the Vulci 3000 project together with this new survey indicate that much of the 126 hectares of the walled ancient city of Vulci may be mapped through GPR.

[S.K., E.P.]



7. COMPARISON OF THE GPR RESULTS WITH AN AERIAL PHOTOGRAPH INTERPRETATION (POCOBELLI 2004)

4. CONCLUDING WORDS

The site of Vulci has been the subject of a multifarious attention since the eighteenth century, and yet we still lack a full understanding of the characteristics and organization of the first proto-urban settlement and of the processes that led to the subsequent blossoming of the Etruscan centre. The investigation of such processes shall provide a solid background for a better understanding of the later historical trajectory of the site, which still lack satisfactory explanations. The UUI project aims to contribute to the understanding of the long-term historical development at Vulci. The prospections presented in the third part of this paper represent a first step and were carried out with the twofold purpose to investigate through non-invasive techniques the characteristics of the urban occupation of the plateau, and to find appropriate areas for future archaeological excavations.

The results of the UUI geophysical prospections show that the ancient urban area stretched in all likelihood into the surveyed area. The characteristics of the acquired signals suggest that several archaeological structures are to be found under the modern surface. The relatively low depth of the strongest signals and the linear shapes of some of the detected features suggest the possible presence of domestic and productive areas of possible Roman period. The outcome of the survey also suggest that no monumental structures were built there during the Roman and late antique periods, since massive walls or platforms would probably give different signals. Further surveys and archaeological investigations will no doubt shed light on the function/nature of this segment of the urban area. The results also demonstrated that the most successful prospection methodology on the Vulci plateau is the GPR. Overall, the results of our prospections seem to indicate a topographical situation, which might be favourable to the investigation of the diachronic development of the site from its origin back in the Bronze Age until Late Antiquity. In a multidisciplinary perspective, we believe there is a high potential to gain new knowledge about Vulci and its place in the early history of Southern Etruria and central Italy.

[S.S.]

*University of Gothenburg
serena.sabatini@archaeology.gu.se
kristian.goransson@gu.se
anna.gustavsson@gu.se
irene.selsvold@gu.se

**British School at Rome
s.kay@bsrome.it
e.pomar@bsrome.it

***University of Gothenburg and University of Oxford
lewis.webb@gu.se

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