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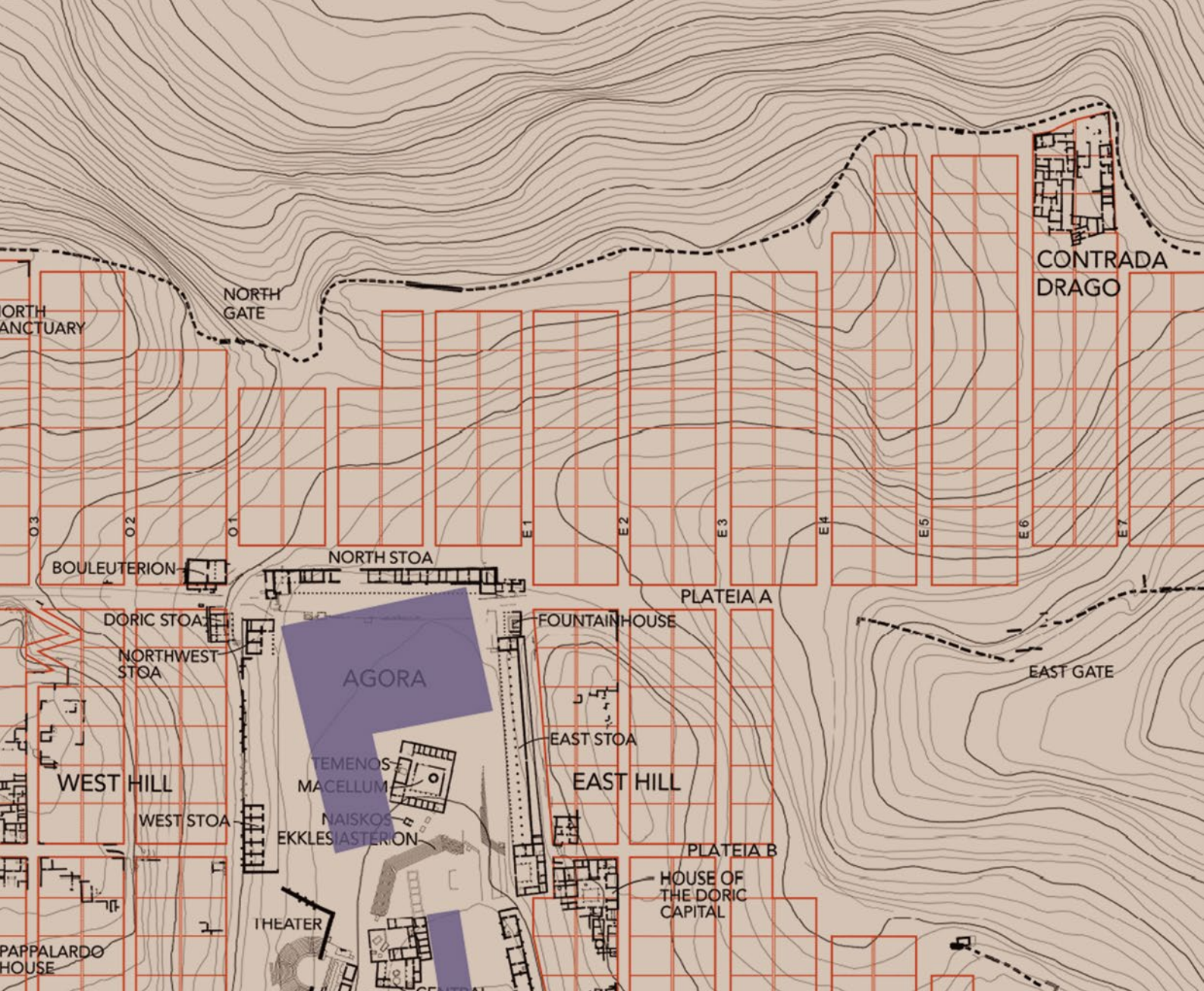
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ABSTRACT

Geophysical Survey at Morgantina

Stephen Kay – Monika Trümper – Michael Heinzelmann – Elena Pomar

Geophysical surveys were conducted at Morgantina in 1970, 2012 and 2018, with the objective of better understanding the city plan of the Archaic city on the Citadella Hill and the Classical and Hellenistic city on the Serra Orlando Ridge. This paper focuses on the results of the 2018 survey conducted over three sectors on the Serra Orlando Ridge. It demonstrates that magnetometry was successful in rapidly recording subsurface archaeological features across the site, including the presence of streets, walls and areas of habitation. The general layout of streets and insulae of the orthogonal grid plan that was established in the mid-5th century B.C. on the Serra Orlando Ridge has been confirmed and the precise course of streets has been defined in more detail than hitherto known.

KEYWORDS

Morgantina, geophysical prospecting, city plan, street grid, insulae

Geophysical Survey at Morgantina

Introduction

¹ Morgantina is located in east central Sicily, close to the modern city Aidone in the Province of Enna. Since 1955, the American Excavations have uncovered extensive areas of the Prehistoric and Archaic settlement (c. 13.6 ha) on the Cittadella Hill and of the Classical and Hellenistic city (c. 78 ha) on the adjacent Serra Orlando ridge (Fig. 1). The settlement on the Serra Orlando Ridge was established around the middle of the 5th century B.C. with an orthogonal grid plan, which has recently been reconstructed from evidence in various areas of the city. These areas included particularly the Agora and adjacent residential quarters on the east and west hill as well as a quarter at the western border of the city (Contrada Agnese)¹. The terrain of some 78 ha was subdivided by two wide east-west avenues (Plateia A 11.60 m; Plateia B 6.50–6.90 m) and narrower north-south streets (stenopoi, at least fifteen east of the Agora and fourteen to the west, 4.80–6.50 m in width)². The streets define rectangular insulae that are 38.64 m wide (120 feet, with a foot measuring 0.322 m), while the length varies according to the topography of the specific location. Insulae are subdivided by a central ambitus (3 feet wide), with each half in turn divided into standard lots of 17.71 m north-south and 18.84 m east-west (55 × 58.5 feet). The reconstructed city plan indicates that there was open space adjacent to the city wall to the west (c. 500 m east-west in extension) and to the east (c. 50 m east-west in extension).

² While the plan was laid out in the middle of the 5th century B.C., excavation has shown that most visible remains were only built in the 3rd century B.C., when the city was most likely part of the Kingdom of Hieron II of Syracuse. After the city had

¹ Bell 2006; Bell 2008; Bell 2010, 732 f.

² Stenopoi are numbered successively from the Agora to the west and to the east, respectively: e. g., Stenopos E3; Stenopos W14. Insulae are numbered according to the bordering stenopoi, with N, C or S added to indicate their position to the north of Plateia A (N), between Plateia A and Plateia B (C), and to the south of Plateia B (S): e. g., Insula W14/15S indicates the insula between the western Stenopoi 14 and 15, and south of Plateia B. Lots are numbered from north to south and west to east in each insula, with lot 1 located in the northwest corner, and lot 2 in the northeast corner.

been conquered by the Romans and given to Spanish mercenaries in 211 B.C., it was still inhabited for about 250 years, but significantly reduced in size.

³ Despite extensive research, several important questions regarding the development and layout of the city remain:

a) First, was the Classical and Hellenistic city on Serra Orlando ever densely inhabited in all of its quarters? This is suggested by the excavated quarters but has not yet been confirmed for the unexcavated parts, including the unbuilt terrain next to the eastern and western city gates.

b) Second, how was the grid plan on Serra Orlando implemented, developed, and respected? The irregular topography of the site, which stretches longitudinally over several sharp ridges, meant that a number of solutions were necessary in order to implement the regular city grid. Some excavated remains show how the grid plan was adapted to the topography, for example, in the layout of the Agora and in the Contrada Agnese quarter (Fig. 2)³. Adherence to the implemented grid was obviously not always fully enforced, as some buildings do not respect central features such as the orientation and borders of the standard lot size or the *ambitus*. The degree and importance of these practices in the entire city remains to be clarified.

c) Third, can the functional organization of the city be determined in more detail? Excavations have revealed the following picture from the city's heyday in the 3rd century B.C.: the Agora was the political and commercial center; sanctuaries have been identified in the Agora and various quarters all over and outside the city; two public baths were found in the Contrada Agnese quarter; houses excavated in four different sectors of the city (Contrada Agnese, Contrada Drago, East Hill, West Hill) differ significantly in size and decoration, and large lavish peristyle houses have only been found in the city center (Fig. 1. 2). Thus, the question arises as to whether the use and significance of unexcavated quarters confirm or modify the current picture.

⁴ In order to answer these questions and to better define the plan of the city, two geophysical surveys were carried out in March 2012 and in October 2018. The aim of this paper is to present the results of these surveys, with a focus on the results of the more recent one. Morgantina is an ideal site to test the significance and limits of geophysical prospections. After its abandonment in the early 1st century A.D., the site was only sporadically inhabited. While the northern and western part of the Serra Orlando Ridge are private property, c. 21 ha of the 78 ha are today part of the fenced archaeological park (Fig. 1). After a brief history of fieldwork from 2012 onwards, the methodology of the 2018 survey will be discussed, followed by a discussion and interpretation of results.

History of Geophysical Fieldwork at Morgantina

⁵ The first geophysical survey was conducted in 1970 to test the feasibility of the magnetometer prospection at Morgantina. It was trialed in a limited area on the steep slopes of the Cittadella and yielded several anomalies that were ultimately identified as undisturbed Iron Age tombs in subsequent excavations⁴. A second survey took place in March 2012, carried out by a team of the University of Cologne with three different techniques tested, including magnetometry, Ground-Penetrating Radar (GPR), and resistivity prospection.

³ Walthall et al. 2014, 10.

⁴ Allen 1974, 361. 367–370.

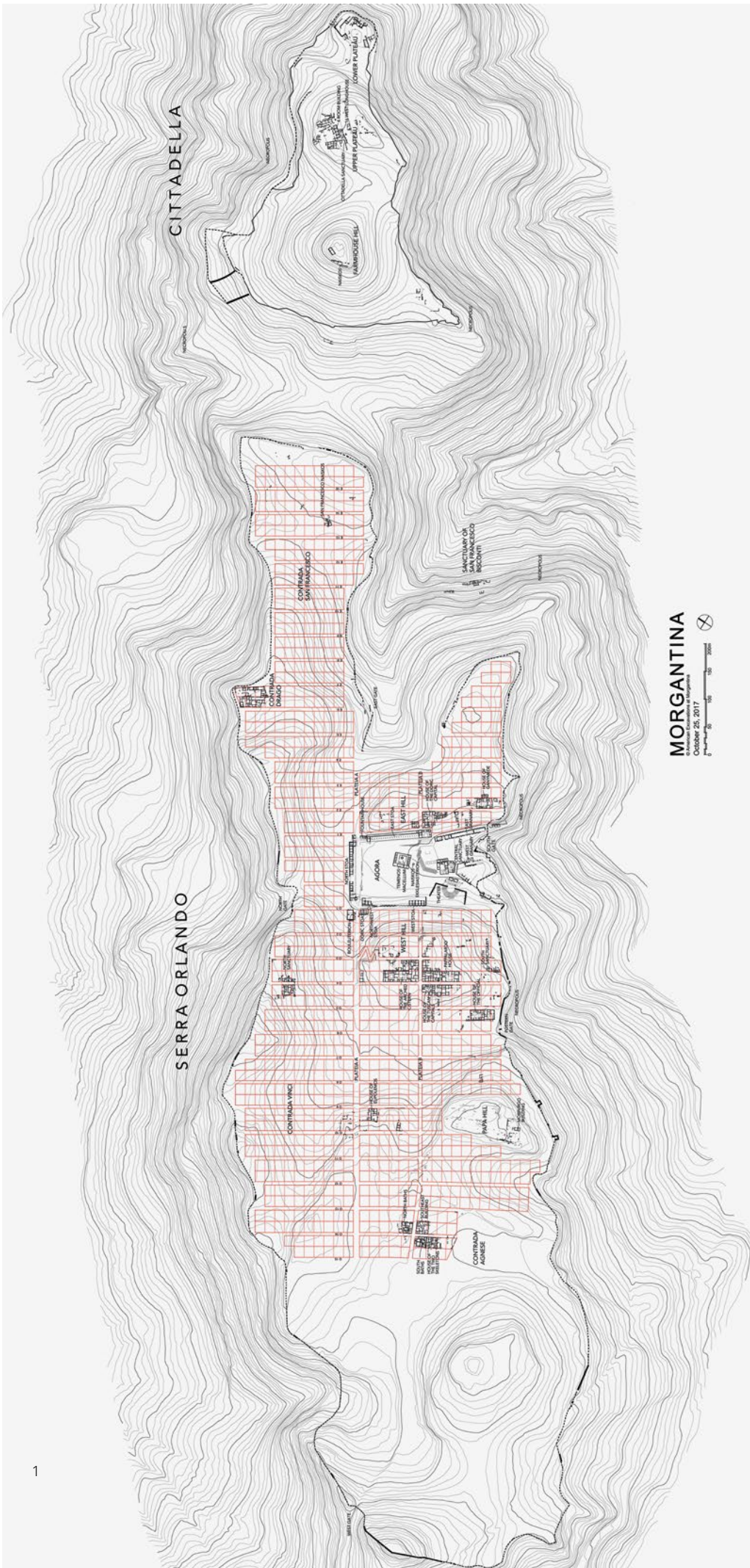
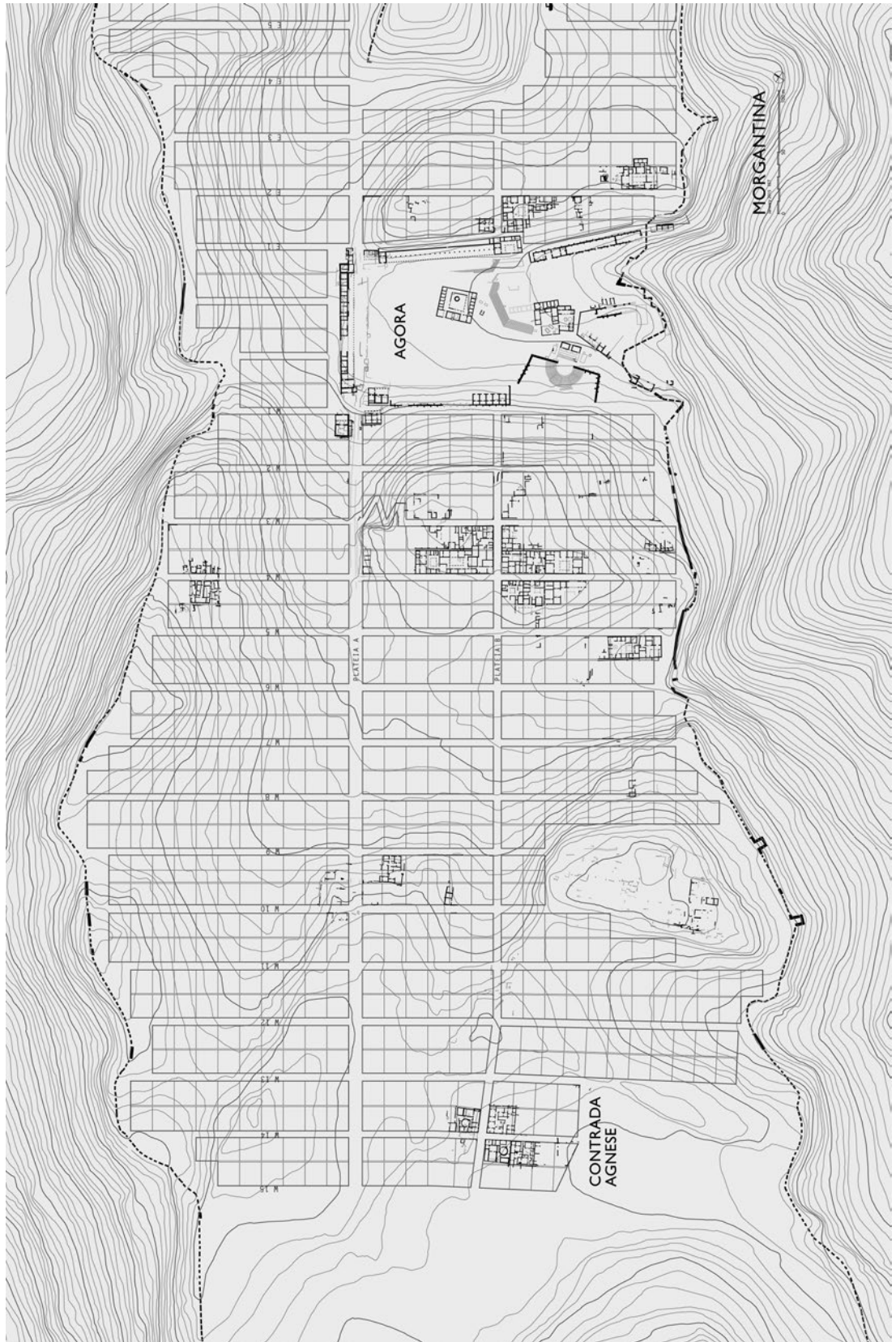


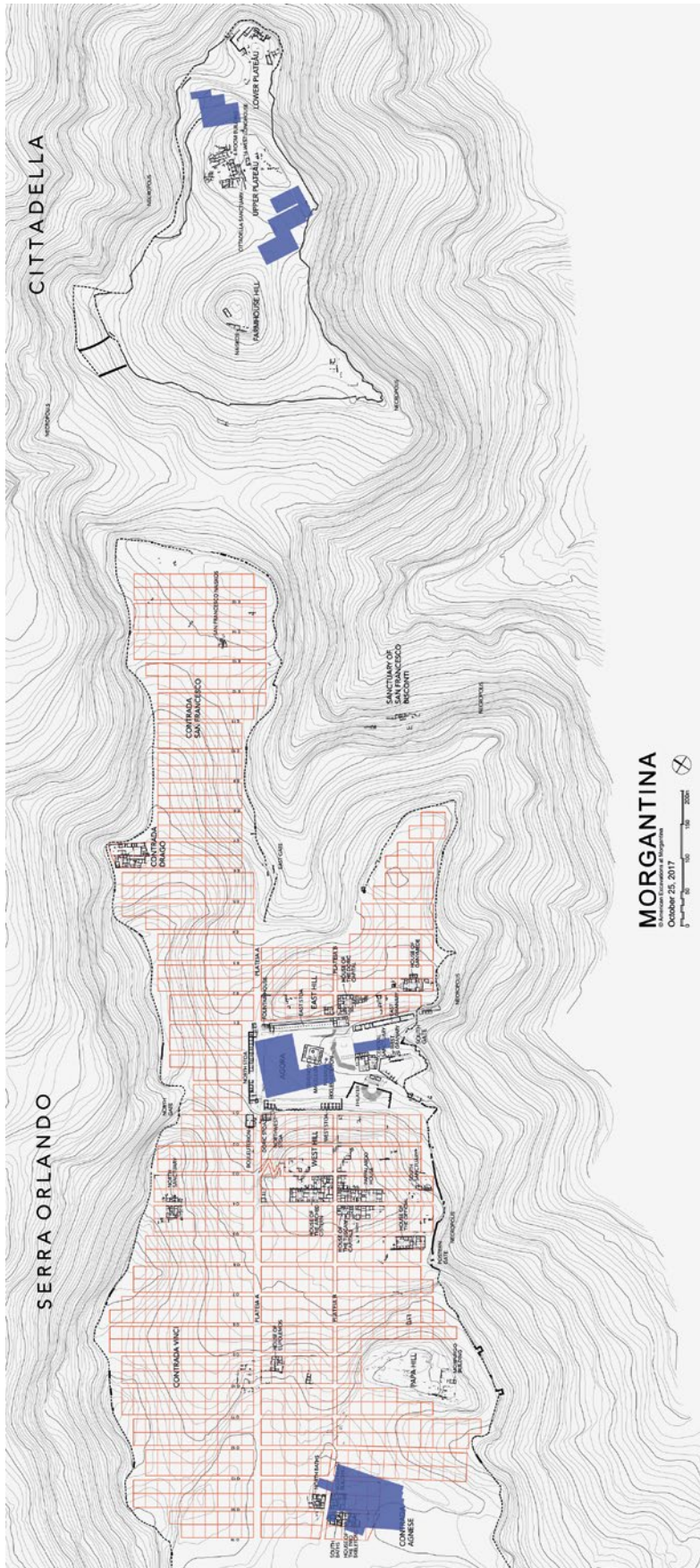
Fig. 1: Morgantina, plan of the city (scale 1 : 10 000)



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Fig. 2: Morgantina, plan of the central sector of the city (scale 1 : 5000)

6 The survey area for the magnetometry was divided into 30 m × 30 m grids, and prospection was undertaken with a Geometrics G-858 caesium magnetometers, mounted on a specially constructed cart. The four caesium sensors were placed parallel at a set distance of 0.50 m to each other (1.50 m distance between the two exterior sensors, plus 0.25 m at each end), thus allowing the survey grid to be subdivided into traverses of 2 m in width. The setup allowed 10 readings per meter in the



3

Fig. 3: Morgantina, plan of the city with the location of the 2012 geophysics (scale 1 : 10 000)

direction of movement and four readings every 2 m in a lateral direction. The raw data was processed and filtered using Magmap2000 software, and were visualized in Surfer V.8.



Fig. 4: Morgantina, plan of Contrada Agnese with magnetometry results (scale 1 : 1500)

4

7 The Ground-Penetrating Radar (GPR) survey used a GSSI SIR 3000 with a 400 MHz antenna, resulting in a maximum depth of penetration of approximately 3 m. Data were collected in parallel zig-zag traverses every 0.25 m width within a 30 m × 30 m grid. The data was processed with Radan software, combining the separate vertical sections with a three-dimensional image that registers features in light colour on a dark ground.

8 The resistivity prospection was conducted using a Geoscan Research RM15 combined with an MPX15 Multiplexing unit again within a 30 m × 30 m grid, with a sample interval of four readings per square meter. A twin-probe set-up was employed, with the four probes set at a distance of 0.50 m apart that generally allowed penetration of the current to about 1 m in depth. Data were collected in a zig-zag formation. The resulting raw data were processed in Geoplot 3.0, registering high resistance features as dark anomalies against a lighter background.

9 Data was collected in three areas: Contrada Agnese, at the western limit of the ancient city; the Agora; and the Cittadella (Fig. 3). The purpose of this survey was to guide and supplement ongoing and planned excavations in all three areas:

- a) Survey on the Cittadella was most challenging, as the site has been significantly affected by reforestation efforts, the implementation of agricultural terraces, paths made by pasturing animals and the activities of hunters, foragers, and illegal excavators. The results will be included in the upcoming publication of the Cittadella⁵.
- b) In the sector of the Agora, resistivity and magnetometry both provided positive results. These included anomalies that were cautiously identified as a large, rectangular structure (c. 16 m × 6 m) with tripartite internal room division, located south of the Macellum and monumental staircase. A team under the direction of Alexander

5 Carla Antonaccio is responsible for the area of the Cittadella.



5

Fig. 5: Morgantina, plan of Contrada Agnese with resistivity results (scale 1 : 1500)

Walthall excavated a trench of 4 m × 2 m at the site of the hypothesized structure in 2013⁶. Excavation to a depth of 2.67 m did not yield any trace of a building, however, suggesting that »the survey's interpretation suffered from inaccuracies, possibly due to interference caused by the proximity of a modern drain«⁷. The forthcoming publication of the Agora will discuss the results of the excavation in more detail⁸.

c) The area of Contrada Agnese was investigated with both the techniques of magnetometry (Fig. 4) and resistivity (Fig. 5). The datasets revealed deviations to the orthogonal plan and densely occupied city blocks, particularly in Insula W13/14S. In 2013, Walthall and his team tested the validity of the geophysical survey, opening two trenches at points where the survey had identified deviations of Stenopos W13. In both trenches, excavations revealed »standing architecture that closely matched the interpretations of the geophysical survey«⁹.

10 The survey was undertaken prior to two major excavation projects (Fig. 6) at Contrada Agnese: first, the complete excavation of the partially known South Baths and adjacent House of the Two Skeletons (former West Sanctuary of Demeter and Kore) under direction of Sandra Lucore and Monika Trümper, which was conducted between 2013 and 2016¹⁰; second, the excavation of the Southeast Building under direction of Alexander Walthall from 2014 to 2018¹¹. Whilst the geophysical surveys had not revealed clear plans in the lots that were later explored, excavations confirmed the general pic-

6 Walthall et al. 2014, 2 f.

7 Walthall et al. 2014, 2.

8 Malcolm Bell is responsible for the area of the Agora.

9 Walthall et al. 2014, 9–12, citation p. 11.

10 Lucore 2015; Trümper 2015; Trümper 2018; Trümper 2019; reports on <<https://www.morgantina.org>>; <<https://www.geschkult.fu-berlin.de/e/klassarch/forschung/projekte/morgantina/index.html>>.

11 Benton et al. 2015; Walthall et al. 2014; Walthall et al. 2016; Walthall et al. 2018.

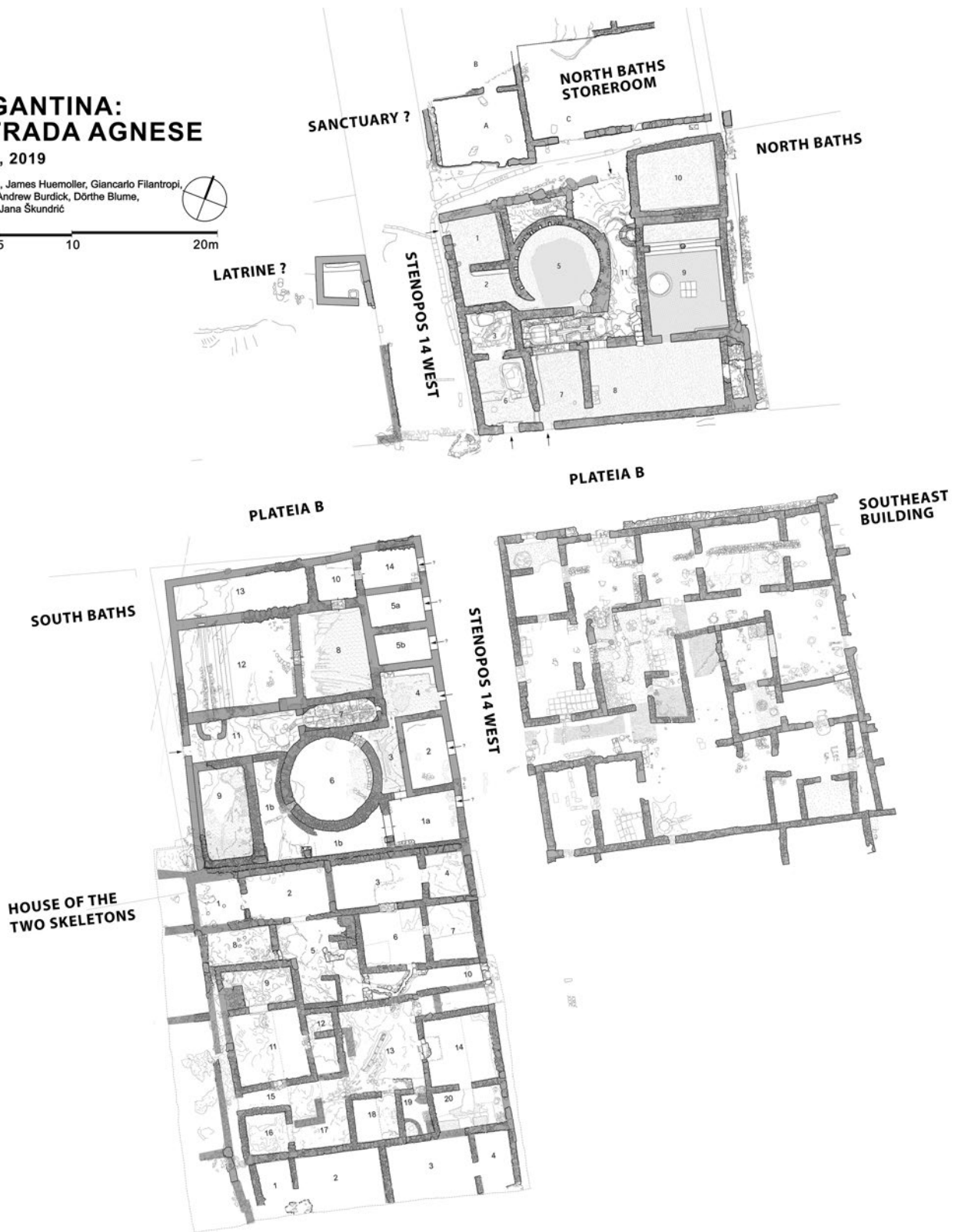
MORGANTINA: CONTRADA AGNESE

August 3, 2019

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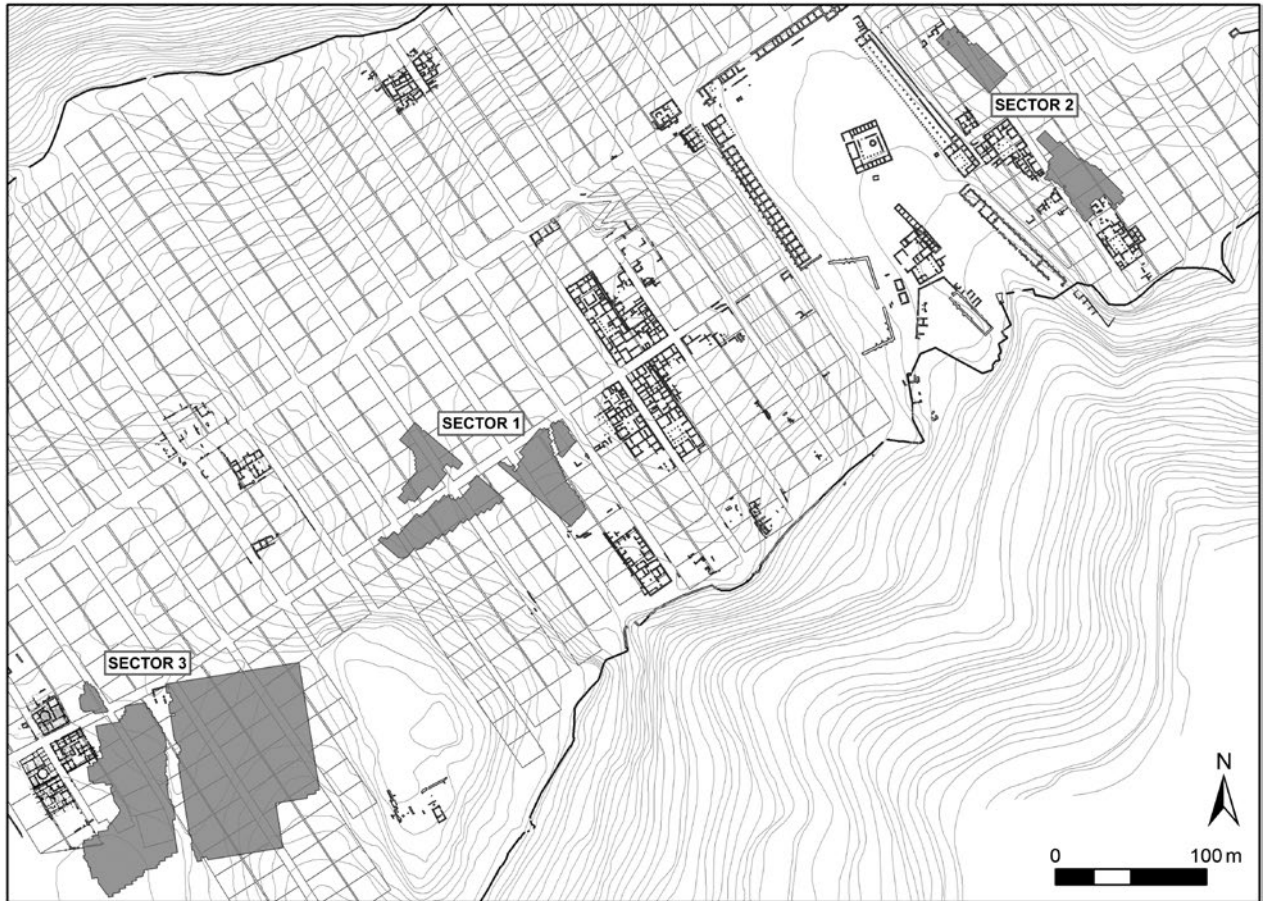


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Fig. 6: Morgantina, plan of Contrada Agnese following recent excavations (scale 1 : 400)

ture of densely built lots with several walls that belonged to different phases and were located at different stratigraphic depths. No remarkable house types such as peristyle houses could be identified in the survey results, and excavations (of four entire lots and of several partial lots) so far confirmed that such houses were not built in the Contrada Agnese quarter.

11 The promising results obtained at Contrada Agnese encouraged further geophysical prospecting at Morgantina in other unexplored sectors in order to answer the



7

above-mentioned questions. The survey conducted in 2018 was based upon 2012 results, in the choice of methods and survey sectors.

Methodology of 2018 Survey

12 In 2018, a new survey was undertaken by the British School at Rome drawing upon the results of the previous work (Fig. 4. 5). Since these earlier surveys indicated that magnetometry provided among the clearest results across the site, the new survey was conducted with the same technique, using a fluxgate gradiometer. The survey covered an area of 2.14 ha and was divided across three separate parts of the site, referred to below as Sector 1, Sector 2, and Sector 3 (Fig. 7):

- a) Sector 1 is situated in the valley between the West Hill and Papa Hill (Fig. 8. 9), north-west of the House of the Official and west of the House of the Tuscan Capitals. It extends northward and southward of the Plateia B, for a total area of 0.4 ha. Plateia B is now used as modern path for visitors, leading to some disturbance in the magnetometry. Furthermore, the sector is divided by a modern track and fence running NW-SE. While the terrain to the east of this track is flat (Fig. 8), located at



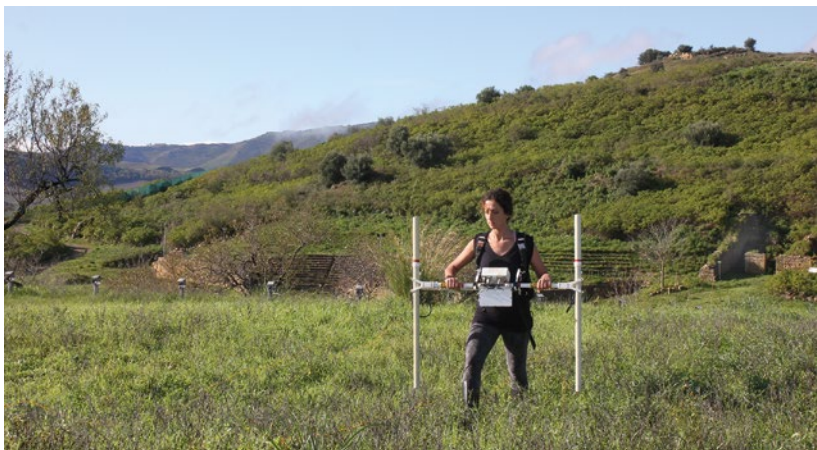
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Fig. 7: Morgantina, location of 2018 geophysical survey sectors (scale 1 : 5000)

Fig. 8: Morgantina, Sector 1, facing west with Papa Hill in the background



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10



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Fig. 9: Morgantina, Sector 1, facing east with West Hill in the background

Fig. 10: Morgantina, magnetometry survey of Sector 2, facing west

Fig. 11: Morgantina, magnetometry survey of Sector 3, southern part facing west

the bottom of the valley, the terrain to the west has a downward gradient from west to east (Fig. 9).

b) Sector 2 is located on the ridge east of the Agora and north of the House of Ganymede, covering a total area of 0.2 ha (Fig. 10). A modern track runs N-S along the ridge, and the sector between the House of the Ganymede and the House of the Doric Capital is crossed by a number of paths.

c) Sector 3 at Contrada Agnese was the largest sector surveyed, extending 1.54 ha. Contrada Agnese includes to the west the second largest valley on the Serra Orlando Ridge and to the east a steep but low (1–4 m high) ridge of limestone bedrock, the Agnese Ridge. The western part comprises an open sector that is fenced within the archaeological park (Fig. 11, 12). The terrain of this sector slopes north to south, first steeply and with major outcroppings of bedrock, and then more gradually. The zone is bordered by the paved access road to the north and a modern dirt road to the west. The Agnese Ridge to the east extends to the ancient city wall, sloping steeply north to south. It is bordered by a modern path to the north and Papa Hill to the east and lies within the archaeological park (Fig. 13). The geophysical survey sector extended south from the North Baths in the western part and over large parts of the Agnese Ridge in the eastern part. To facilitate reference below, the western part is referred to as Contrada Agnese and the eastern as Agnese Ridge. The survey area surrounds the excavations at Contrada Agnese and data collection was conducted as close as possible to the edge of the open trenches.

Immediately to the south of the open trenches, a large spoil heap restricted survey (Fig. 12) whilst the metal roof covering the North Baths limited access to some sectors close to the excavations. This survey sector slightly overlaps with that of 2012, which was important to verify and compare results, but the 2018 survey extended significantly further to the east, on top of the Agnese Ridge, which was extensively cleared for this purpose¹².

¹³ The geophysical prospection was preceded by a topographical survey to establish the survey grids. The aim was to provide a framework with which to correctly position the sector to be investigated within the American Excavations at Morgantina

¹² Clearance had not been possible on top of the ridge in 2012.

(AEM) recording system. Regular grids of 30 m × 30 m were set out using a Leica TCR307 Total Station and subsequently recorded by GPS. The individual lengths of the acquired traverses within the grids are irregular as the data was collected according to the topography of the site and readings could not be collected where there were obstacles. Likewise, no data could be collected where there were large stones emerging from the ground surface or where there were deep trenches¹³. The grids were oriented approximately north-south and the acquisition lines were oriented east-west in order to intersect obliquely the potential buried targets.

¹⁴ The survey was carried out using a fluxgate gradiometer Bartington Grad 601. Data was collected every 0.25 m (sample interval) in parallel zig-zag traverses at a regular distance of 0.5 m. The raw data was processed using the software Geoplot 3.0.

Preliminary Observations

¹⁵ The geophysical survey at Morgantina was successful in mapping a range of subsurface features. The magnetic response was much clearer in Sectors 1 and 3, most probably due to a more substantial overburden of soil on the underlying bedrock. Several factors have led to the data that has been recorded by the survey:

- a) The local bedrock at Serra Orlando is formed by a weak magnetic limestone rock. During the survey, several outcrops were observed, in particular in Sector 2 and on the western edge of the Agnese Ridge in Sector 3. Comparing the magnetic response to satellite imagery, it is possible to assess the effect of the local bedrock. In the sectors where the outcropping rock is visible in the satellite image, the geophysics response is a weak negative anomaly (Fig. 14). The excavations at Morgantina have shown that many of the buildings were constructed of locally quarried rock, therefore the medium-weak negative linear anomalies of the data probably represent a response to buried walls.
- b) A further type of material that is commonly present on archaeological sites of this period is terracotta. When compared to the local rock it has a very different magnetic signal. Terracotta generally produces high positive values in magnetic readings, related to the thermoremanent magnetization caused by its firing¹⁴. Therefore, some of the positive anomalies may indicate structures or undisturbed occupation layers, especially when they have a regular shape and are related to other features.



12



13

Fig. 12: Morgantina, geophysical survey of Sector 3, facing south

Fig. 13: Morgantina, Sector 3, Agnese Ridge, facing northeast. The underlying bedrock can be seen in the foreground

¹³ Particularly in Sector 3, on top of the Agnese Ridge, which has never been excavated by archaeologists, but has partially been disturbed by illegal excavations in the past; see below. In the interpretation of the results, the areas of no data are indicated by white irregular polygons.

¹⁴ Aspinall et al. 2008, 22. 151.



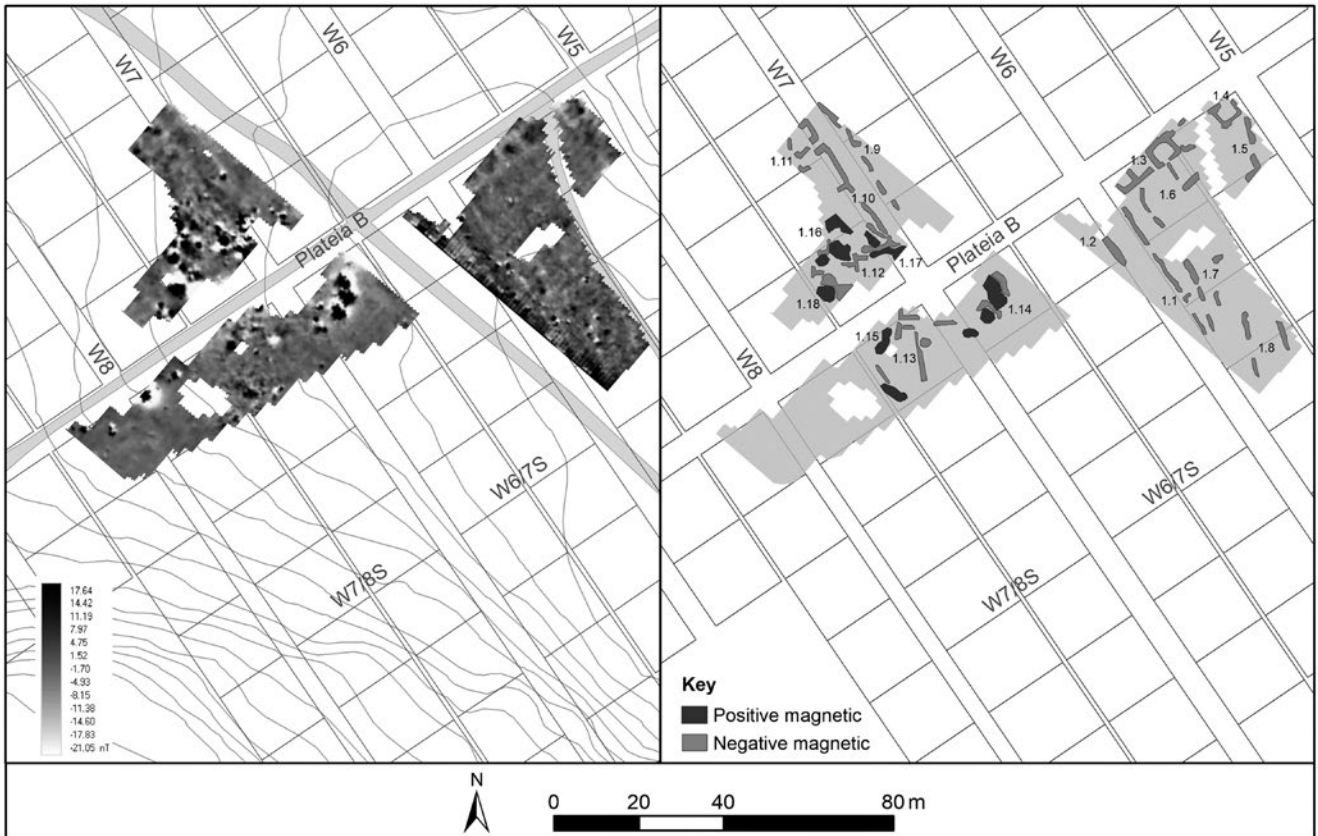
Fig. 14: Morgantina, Sector 3, comparison of the geophysics results with a satellite image. The outcrops of the limestone rock can be seen in the satellite image as well as scattered trenches (in black) (scale 1 : 1500)

14

c) A building constructed with both the materials mentioned above (rock and terracotta) can result in magnetic data with an irregular pattern of high and low readings, with a consequent difficulty in determining its origin. Moreover, the presence, in the same context, of materials with strong magnetic response together with archaeological features made of poor magnetic materials can have the effect of masking the weaker features such as beaten earth surfaces.

16 Despite the minimal difference between the background value and those of the principal targets (i. e. structures made of local stone), the survey was successful in recording a range of significant archaeological features.

17 The results are illustrated in a series of grayscale plots, which show a range of different anomalies, including geological, modern, and archaeological. The magnetic features can be classified as follows: strong magnetic anomalies; areas of high magnetic response; low linear anomalies. Of these, strong magnetic anomalies generally



15

indicate subsurface ferromagnetic material, which is usually the product of modern rubbish (e. g. pieces of metal). For this reason, these anomalies are not archaeologically interpreted in the accompanying figures. The numbers of the features to which the text refers, visible in the figures, group the anomalies according to similar geometry and alignment.

Fig. 15: Morgantina, results and interpretation of Sector 1 (scale 1 : 1750)

Results and Interpretation

18 The following section describes the results of the magnetometry survey in each sector and provides an interpretation of some of these features.

Sector 1

Results

19 The survey of Sector 1 (Fig. 7, between the West Hill and Papa Hill) traced a series of anomalies, which relate to archaeological buried features (Fig. 15). In the eastern half of the survey sector, although the contrast between distinguishable features and background value is very weak, it is possible to recognize several alignments of negative linear anomalies. A number of weak negative linear features (such as 1.1 and 1.2 in the eastern area, Fig. 15) precisely align with the proposed city grid and similarly in the eastern area, close to a metal fence, a weak negative feature was recorded on a parallel alignment (1.2, Fig. 15). On the eastern side of the survey sector, along the southern edge of Plateia B, are a series of anomalies that form several squared units measuring approximately 5.50–6 m on each side (1.3 and 1.4, Fig. 15).

20 The western half of Sector 1 was affected by general magnetic disturbance, which was likely to have been caused by modern activity (for example 1.14, Fig. 15). However, the survey recorded a number of features of potential archaeological interest,

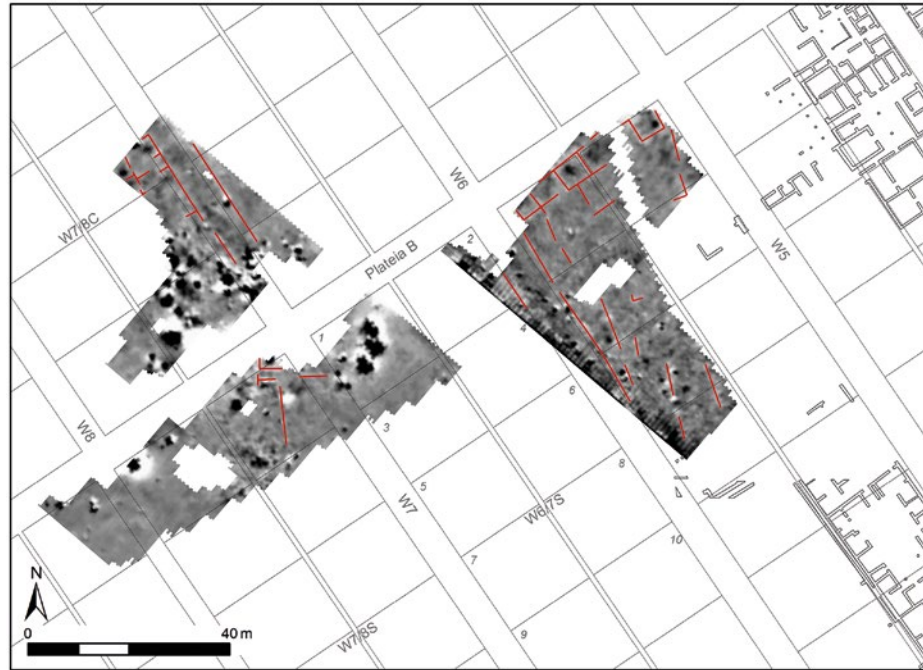


Fig. 16: Morgantina, Sector 1, schematic interpretation of the geophysics results (scale 1 : 1500)

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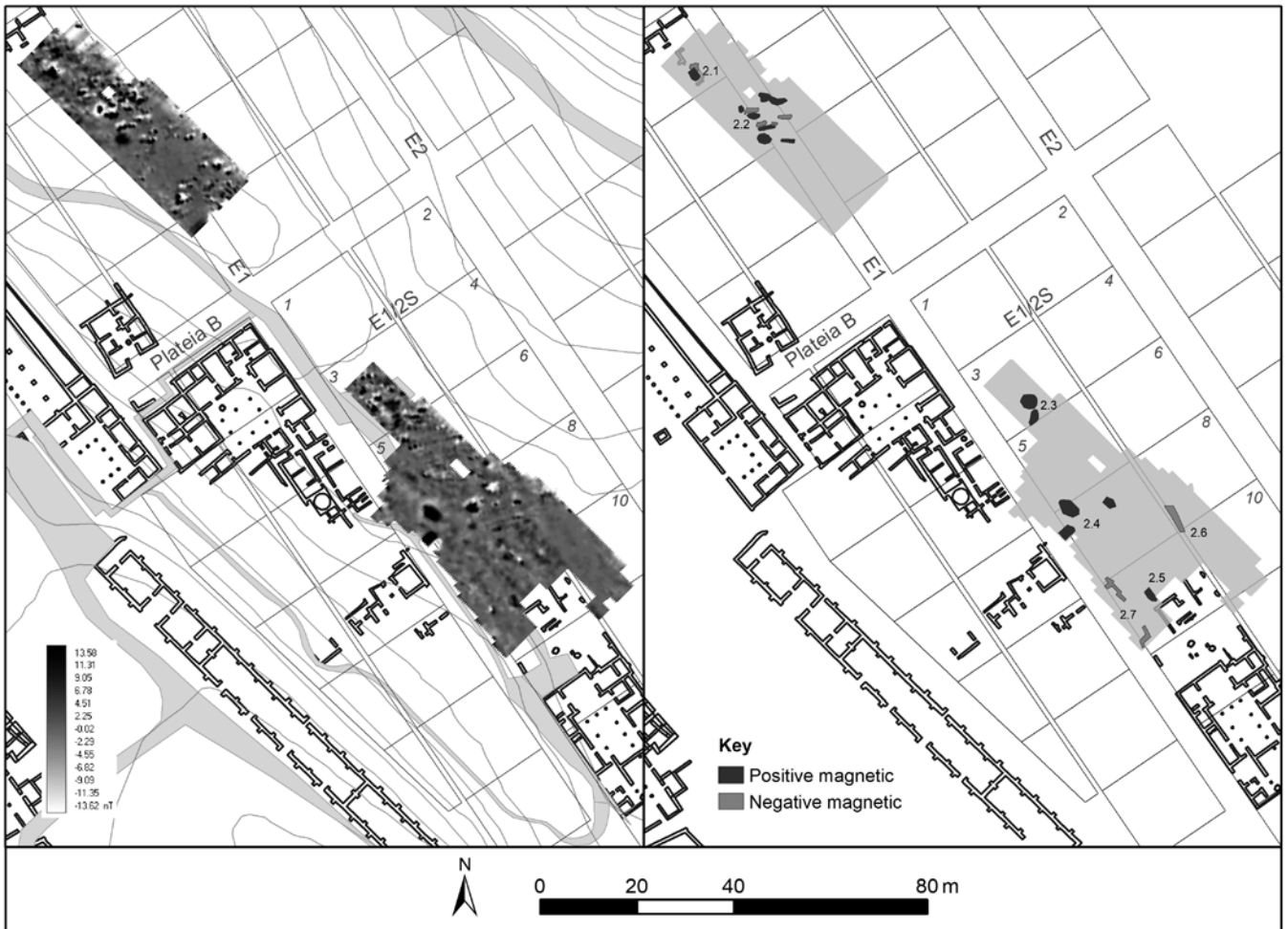
the most prominent of which include weak negative anomalies (1.9 and 1.10, Fig. 15) in two parallel lines NW-SE at a distance of approximately 6.50 m.

Interpretation

21 Several of the magnetic anomalies recorded by the survey (1.1, 1.2, 1.9 and 1.10, Fig. 15) appear to indicate the edges of two NW-SE stenopoi: Stenopos W6 on the southern side of Plateia B and Stenopos W7 on the northern side. The lines confirm the reconstruction proposed on the plan (Fig. 3), although two features (1.9 and 1.10, Fig. 15) appear 1.50 m further east.

22 The geophysics results show the presence of at least one building (1.3–1.6, Fig. 15) with the anomalies probably corresponding to walls or foundations constructed from stone. The visible segments include a row of squared rooms aligned to Plateia B, which defines the northern limit of the Insula W5/6S. When comparing the schematic interpretation (Fig. 16) of the results with excavated houses¹⁵, it seems that the buildings display similar characteristics, although several features do not respect the ambitus of this insula. It is difficult to determine whether the rooms belonged to simple courtyard houses, each covering one lot, or to one larger elaborate house or two such houses with two or more courtyards, similar to nearby houses on the West Hill: House of the Official (Insula W5/6S, 2–3 lots in N-S direction), House of the Arched Cistern (Insula W3/4C, 3.5 lots in N-S direction), and House of the Tuscan Capitals (Insula W4/5S, 4.5–5 lots in N-S and E-W direction). At Morgantina, average-sized and large houses alike occupied parts of the ambitus or even the entire ambitus: for example, the House of the Official and the House of the Tuscan Capitals on the West Hill; the House of Ganymede and the House of the Doric Capital on the East Hill; and the House of the Two Skeletons and the Southeast Building in Contrada Agnese.

15 Here the rooms are c. 3.70 m NW-SE, 3–4 per lot; cf. the corresponding N-S extension of rooms at the northern/northwestern border of the following houses: House of the Arched Cistern, rooms 23–25: 2.63 m; Tsakirgis 1984, 256 n. 121. House of the Official, rooms 21–24: 2.90–3.10 m; Tsakirgis 1984, 297 n. 519; 298 n. 521–524. House of the Tuscan Capitals, rooms 30–34: 3.70–4.80 m; Tsakirgis 1984, 287 f. n. 424–428.; House of the Two Skeletons, rooms 1–4: 3 m. Southeast Building, 5 rooms: 4.50 m.



17

23 A feature in the western part of the survey (1.11, Fig. 15) indicates the location of a square room adjacent to the stenopos, which is possibly part of a larger structure. The geophysical survey also suggests the presence of a possible second alignment of archaeological structures oriented N-S (1.5, 1.8 and 1.13, Fig. 15) that appear to extend into Plateia B and Stenopos W7. The excavated houses to the south and east on the West Hill do not include walls with a similar alignment, even though they were inhabited until at least the late 1st century B.C. and saw significant remodeling. Therefore, this potential differing alignment will only become apparent through excavation.

24 A further structure has probably been recorded in the central part of the western extent of the survey. The strong anomalies in the south-eastern lot of Insula W7/8C (1.12, 1.16-1.18, Fig. 15) may relate to a structure that has been significantly disturbed. Finally, the survey covered the area where the ambitus of Insulae W5/6S, W6/7S, W7/8S and W7/8C as well as Stenopos W8 should be located, but securely identifiable evidence has yet to be found.

Sector 2

Results

25 In comparison to the other areas surveyed, Sector 2 (Fig. 7) had a relatively poor magnetic response (Fig. 17). The data is characterized by a general background noise with few identifiable features. The processed data has a series of high magnetic peaks with the clearest features at the northern extent of the survey (2.2, Fig. 17) and to the north of the House of Ganymede (2.5, Fig. 17) at the southern limit of the survey. A few weak anomalies at the edges of the survey align with the city grid.

Fig. 17: Morgantina, results and interpretation of Sector 2 (scale 1 : 1500)

Interpretation

26 The survey of Sector 2 recorded few features that appear to be of archaeological significance, probably a result of the similarity between the material of the structures and the emerging underlying bedrock. Indeed, some features may also be cut into the bedrock and, therefore, have a similar magnetic value to the background. However, it is feasible that a few of the detected anomalies (2.5–2.7, Fig. 17) represent features associated to the block divisions within the city. They are aligned with walls excavated in the lot (9 of Insula E1/2S)¹⁶, whilst it is difficult to determinate whether one of these (2.6, Fig. 17) was set on top of the ambitus or bordered it on the western or eastern side (the latter is suggested in Fig. 17). Finally, one anomaly (2.1, Fig. 17) is recorded in a lot that has been partially excavated. The walls footings exposed here were cut into the bedrock and oriented like the street grid¹⁷.

Sector 3

Results

27 The gradiometry survey of Contrada Agnese and the Agnese Ridge (Fig. 7) was the largest of the three sectors investigated (1.54 ha) and provided the clearest results. The survey recorded positive anomalies across the study sector, although it should be noted that some of these may be the result of modern activity and disturbance such as dumped soil or other artificial changes, whilst some are likely to be archaeological¹⁸. In the eastern area of the survey, on top of the Agnese Ridge, a significant number of deep trenches were noted scattered across the area, probably the result of previous illegal excavations as no known documented archaeological excavation has been conducted in this area.

28 A number of magnetic anomalies with a regular geometry were recorded at Contrada Agnese that aligned with the known excavated Insula WS13/14S (3.2–3.5 and 3.7, Fig. 18). As there is extensive archaeological evidence at Contrada Agnese for the use of terracotta elements in various parts of the buildings¹⁹ and given the positive nature of the signal, it is probable that these features are related to subsurface structures. A few areas of strong magnetic anomalies are also visible in the data, however, as these features are located next to the excavation trenches and in areas where spoil heaps were created (several were moved prior to the survey), the disturbance of the ground has meant that it is difficult to give an interpretation to all of these features. For example, in the southwest of the survey a double-dipole anomaly (3.14, Fig. 18) correlates with an area where the 1971 excavation²⁰ was backfilled prior to the survey.

29 The most significant features in the central area of the survey at Contrada Agnese are a series of linear anomalies (grouped under 3.15, Fig. 18), which are all aligned on a northwest-southeast orientation. The magnetic response of these features, although weaker than those previously mentioned, are clearly distinguishable from the background with medium-weak negative values, suggesting that they are related to low-magnetic material.

30 The geophysical survey of the Agnese Ridge allowed the investigation of a large open area within the archaeological park and, although it was pockmarked by a number of irregular deep trenches, a clear pattern of features has emerged. Among

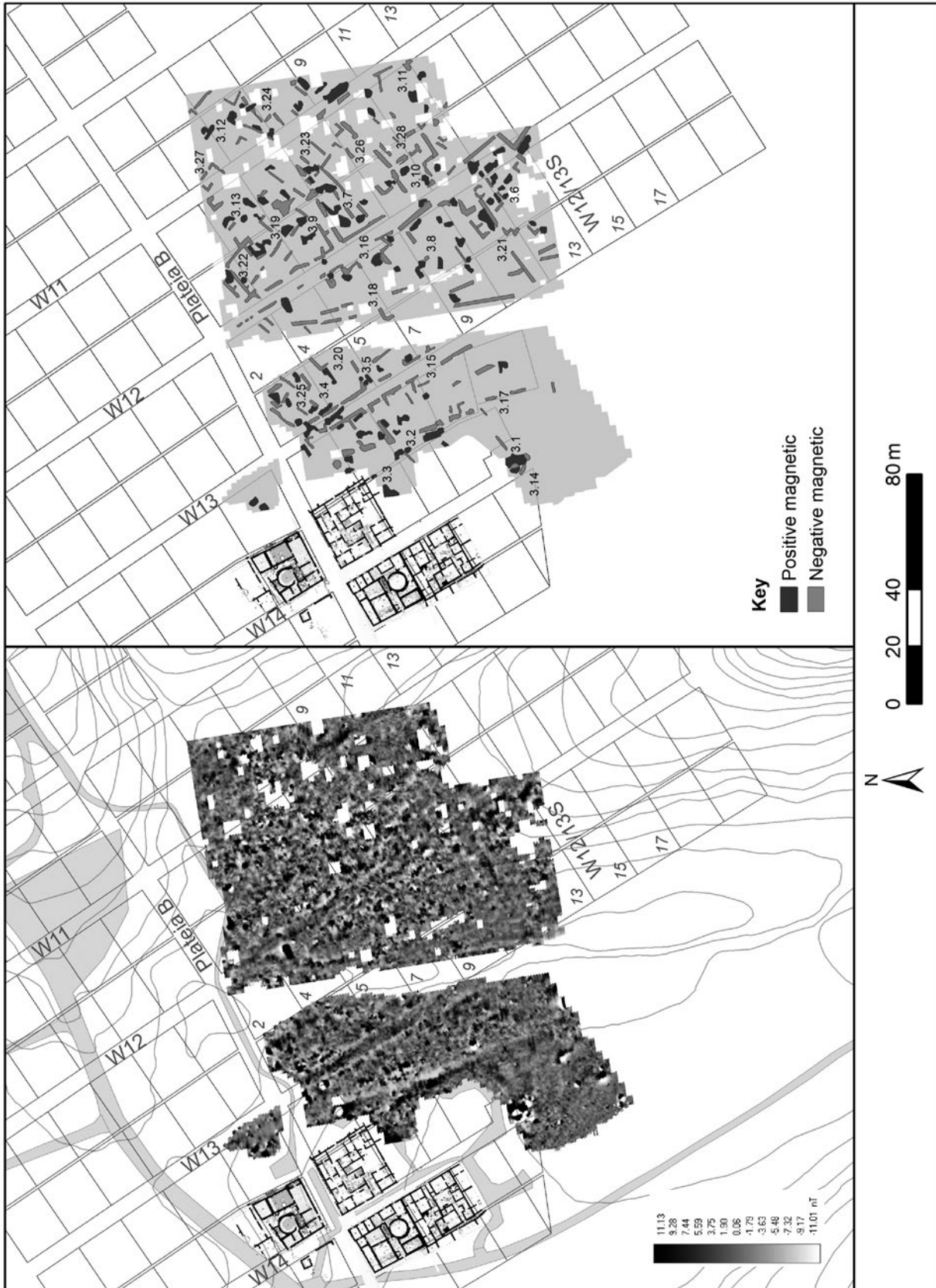
16 Tsakirgis 1984, 90 f. pls. 13, 14; 77 a: trench 65. The House of Ganymede covers the entire lot 13, and parts of lots 11, 14, and 15 of this insula.

17 Tsakirgis 1984, 85 pls. 10, 11: trenches 29 and 29A.

18 Aspinall et al. 2008, 149.

19 Terracotta elements were particularly found in the walls, vaults, furnace, and drainage system of the North Baths; the furnace of the South Baths; and the walls, thresholds, floors, and other architectural features such as columns, podia, and drainage pipes of the Southeast Building; Lucore 2013, 160–172; Lucore 2015; Trümper 2015; Walthall et al. 2014, 11; Walthall et al. 2016, 4, 11, 14 f. 17; Walthall et al. 2018, 4, 14, 17–19. Furthermore, thick layers of terracotta roof tiles (tile falls) were found in all of the buildings in Contrada Agnese.

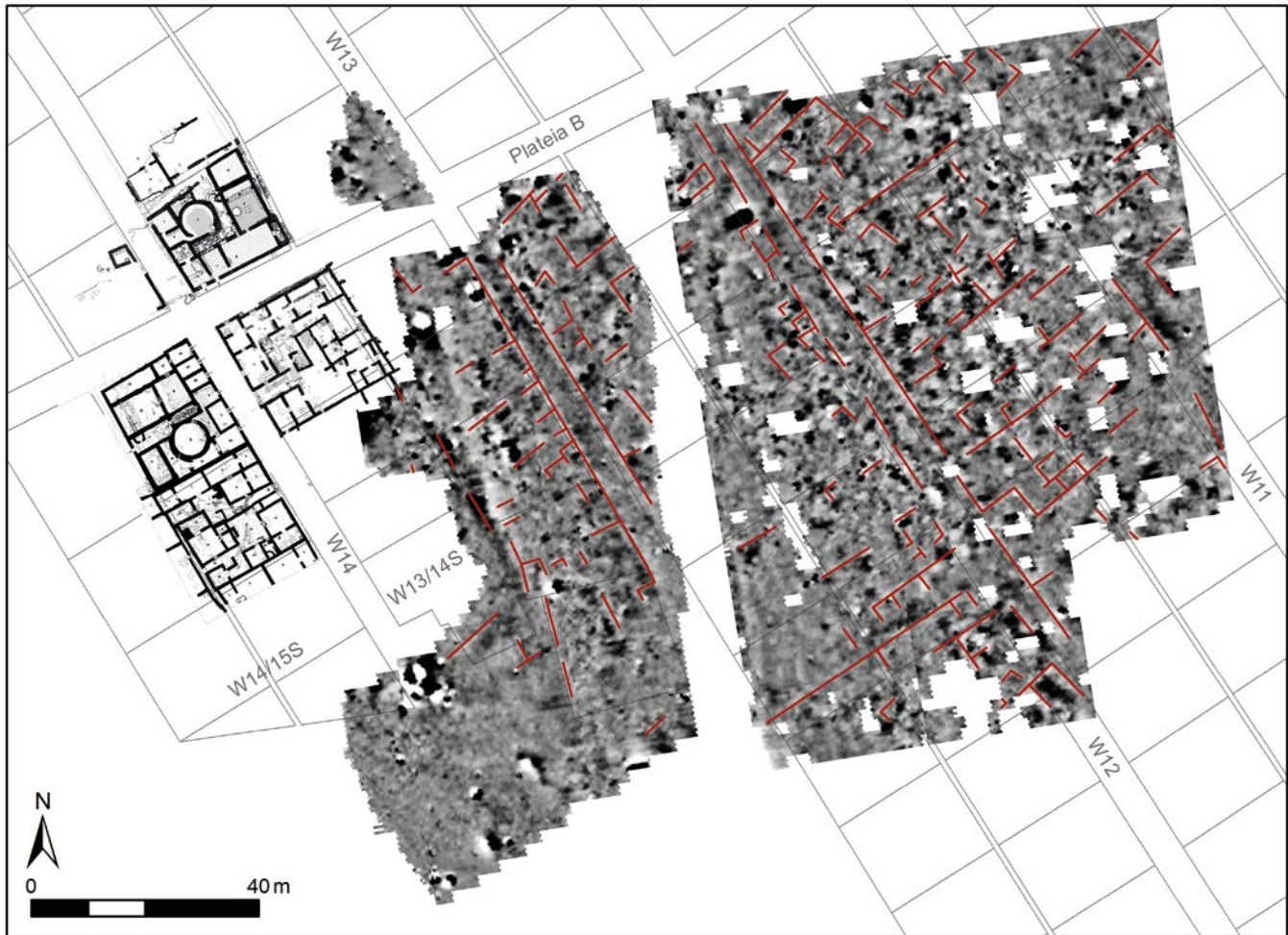
20 Allen 1974, 373 fig. 11: trench 12, which revealed a strangely obliquely running south façade of Insula W14/15S.



18

the most prominent are a series of regular linear anomalies (grouped in 3.16 and 3.19, Fig. 18), whose dimension change in length but vary in width only between 0.70 and 1.30 m. A further series appear to insect these features at a right angle (3.21, 3.22 and 3.26, Fig. 18), whilst others are oriented on a more acute northwest-southeast alignment (3.22 and 3.23 Fig. 18). The regularity of the arrangement as well as their positions

Fig. 18: Morgantina, results and interpretation of Sector 3 (scale 1 : 2000)



19

Fig. 19: Morgantina, Sector 3, schematic interpretation together with the gradiometry results in relation to the city plan. The red lines indicate possible walls; grey sectors: positive magnetic anomalies of possible archaeological interest (scale 1 : 1250)

forming right angles suggest that the mentioned linear features have an anthropic origin. Furthermore, their alignment with the city plan and their accordance with the reconstructed division in lots encourage the interpretation of these anomalies as generated by buried features of archaeological interest.

Interpretation

31 The majority of the linear anomalies, in particular the negative anomalies, appear organized along the main axis of the orthogonal plan (for example 3.15 and 3.16, Fig. 18) and trace Stenopos W13 and Stenopos W12 respectively (Fig. 19). Interestingly, the anomaly on the higher area of Agnese Ridge (3.16, Fig. 18) appears slightly further east compared to the reconstructed city plan (approximately 1.50 m). Although less clear in the data, some features (3.23, Fig. 18) possibly indicate Stenopos W11, which is also approximately 1.50 m to the east of the reconstructed city plan. Most of the linear features probably indicate walls or their foundations, built of worked blocks and set alongside the roads, serving both as retaining walls for the stenopoi and as the boundary of the buildings inside the blocks. The actual stenopoi are identified in the data by the areas enclosed between the linear features. The magnetic response is similar to the background value as the road probably consisted of a beaten earth surface, formed of several layers of packed earth, and, therefore, similar to the background value²¹.

32 Whereas many linear features trace the proposed partition into lots or fall within these feature limits, indicating internal divisions, in several sectors there are

21 No stone pavement was found in any of the excavated streets in Contrada Agnese: Plateia B, Stenopos W14 to the north and south of the Plateia; parts of Stenopos W13 to the south of Plateia B.

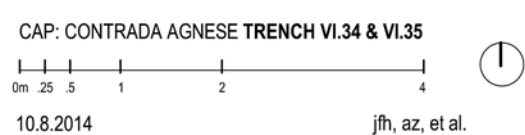
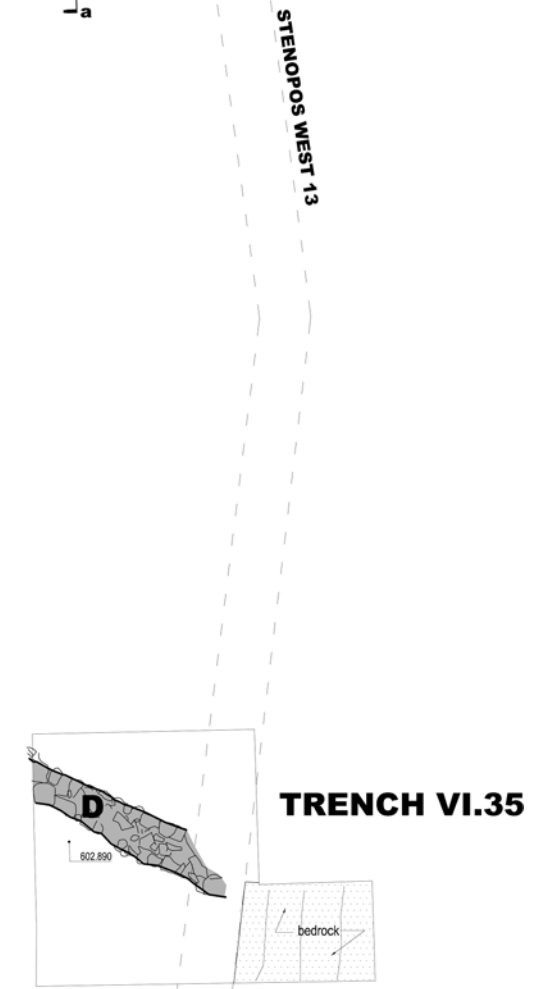
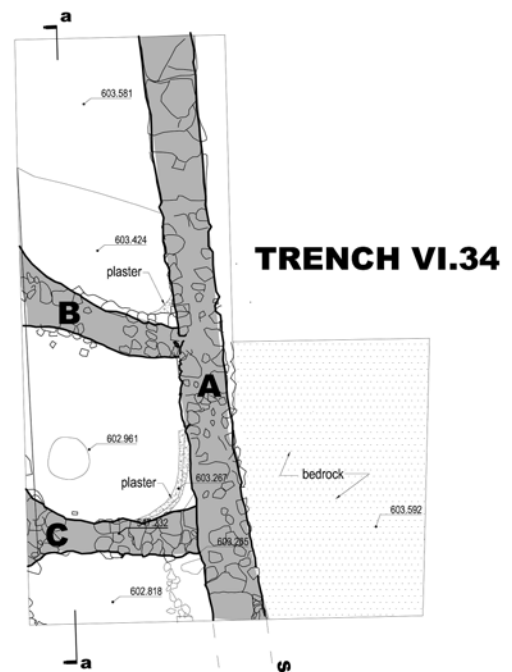


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some irregularities. In particular, one anomaly (3.17, Fig. 18) indicates a slight deviation southward in the orientation of the southern part of Insula W13/14S. The same deviation was documented in the geophysical survey of 2012 (Fig. 4. 5) and was subsequently confirmed following excavation in 2013 (trenches VI.34 and VI.35; Fig. 20. 21²²). In these trenches, the irregularity appeared in the divergence of Wall A, flanking Stenopos W13 (Fig. 20. 21), whose line is traced by the southernmost segment of the magnetic anomaly.

33 The 2018 survey correlated with the results of the 2012 geophysical investigations where the two survey sectors overlapped. Furthermore, it has added further information to the 2013 excavations to the west, particularly the deviation of walls in Insula in W13/14S, following the course of the ridge. The anomalies recorded by the new survey suggest that the structures continued further south (e. g. 3.17, Fig. 18), beyond lot 8, to include possibly at least one further lot with the modified orientation. Interestingly, neither survey detected clear traces of structures to the south of Insula W14/15S. A trench dug in 1971 and re-excavated in 2005 had revealed the southeast corner of Insula W14/15S with a south wall (next to 3.14, Fig. 18), which is not perpendicular to the east wall of this insula, but instead turns sharply northwest²³. Remarkably, no obvious topographical features that would necessitate this deviation are visible today. In 1971, Allen discovered some built remains and finds in a test trench that was located around 70 to 80 m to the south of Insula W14/15S²⁴. Since this area is now located outside the fenced area of the archaeological park, the question of the southern extension of the city at this point will have to await future investigations.

34 The survey results indicate that some east-west walls (branching from 3.15, Fig. 18) follow the general grid



21

Fig. 20: Morgantina, Contrada Agnese, Trenches VI.34–VI.35, 2013, facing north

Fig. 21: Morgantina, Contrada Agnese, Trenches VI.34–VI.35, 2013, deviation of the Stenopos W13 in the excavated trenches (scale 1 : 75)

22 Walthall et al. 2014, 9 f.

23 Allen 1971, 50; Allen 1974, 373 fig. 11; Sharp 2005, 59.

24 Allen 1974, 373 fig. 11; the trench is not discussed in the text, but only briefly in Allen 1971, 6–39.

pattern, and one is located roughly at the border between lots 4 and 6. However, the data do not permit the boundaries and plans of houses to be reconstructed in further detail. Interestingly, lots 1, 3, and partially the cut lot 5 of Insula W12/13S were built alongside the edge of the ridge. This would indicate a dense inhabitation of the area, which is at odds with the seemingly unexplored sector to the south of Insula W14/15S.

35 The prospection results are particularly significant for the eastern part of the survey sector, on top of the Agnese Ridge, which was hitherto unknown. The location of the two Stenopoi W11 and W12 can be confirmed, although their course suggests a slight modification to the reconstructed city plan, both in position and orientation. Oriented slightly further to the west, these stenopoi seem to follow more closely the angle of streets confirmed further east, in the West Hill sector.

36 The results of the survey indicate that Insula W12/13S probably did not negotiate between the two different orientation systems (Contrada Agnese and West Hill), as indicated on the reconstructed plan (Fig. 2). Insula WS12/13S was built across the survey area of Agnese Ridge; therefore, a minimum of 7–8 lots in a north-south direction, indicating that the sector on top of the ridge may have been more densely inhabited than the western part of Contrada Agnese. Similarly to Insula W13/14S, several east-west oriented walls are visible, but no ambitus and no clearly identifiable house plans can be determined.

37 A comparison of some alignments of the city grid recorded by the geophysical survey in the sector of Agnese Ridge supports the interpretation of a slight change in orientation of the plan, as seen in Figure 3, but not thus far confirmed by excavations. The negotiation of the grid around the Papa Hill appears to have required a slight adjustment in orientation, which was previously hypothesized on features based further to the west at Contrada Agnese. The survey results at the west foot of the hill provide evidence for this adaptation of the orientation to the natural topography of the site as the grid extends westward, over the Serra Orlando ridge.

Conclusion

38 The 2018 geophysical survey at Morgantina was successful in tracing further evidence of archaeological features across the site, including the presence of walls, streets, and areas of habitation. The data confirms that the overall orthogonal plan can be applied to unexcavated sectors of the city with some adaptations to the orientation caused by the topography of the ridge, providing a clear indication of where structures are preserved. The survey around Contrada Agnese and the Agnese Ridge (Sector 3) yielded the clearest results, confirming the earlier work in 2012. Returning to the questions that were posed of the survey in the introduction, the geophysical data provided additional detail in order to answer some of these questions.

39 The survey confirmed the existence of houses for all the insulae surveyed in Sector 1, which are located on Plateia B and relatively close to the city center. Similarly, the eastern part of Sector 3, on top of the Agnese Ridge, suggests dense habitation across the entire survey sector. The data suggests that the area south of Insula W14/15S at Contrada Agnese may have been unbuilt. However, this hypothesis will require further investigation.

40 Survey in Sectors 1 and 3 confirmed that the orthogonal grid plan was generally respected for the construction of buildings and roads in these sectors of the city. In particular, this can be observed in the orientation of the structures and the alignment of the stenopoi. In both sectors, the reconstructed grid plan requires minimal modification, with stenopoi being located slightly further east than thus far assumed. Results of the survey over Agnese Ridge in Sector 3 also suggest that the grid was rigidly implemented

in this sector and that only the grid in the Contrada Agnese sector deviated from the predominant orientation, probably for topographic reasons. Remarkably, not a single ambitus could be securely identified in the 2012 and 2018 surveys, although they are clearly visible in several parts of the excavated quarters, especially on the West Hill, bordered by long parallel running walls. One reason for this may be that the small dimensions of the ambitus may not have been recorded by the survey, conducted at a resolution of 0.25 m by 0.50 m. However, the lack (or disrespect) of ambitus was confirmed by excavation in Contrada Agnese: the ambitus between the House of the Two Skeletons and its western neighbour was partially overbuilt from the beginning; the ambitus to the east of the North Baths was also partially occupied by the baths; and no ambitus was found at all between the Southeast Building and its eastern neighbour.

41 Whilst the mapping of the street grid is the most obvious result of the geophysical surveys, the subdivision of lots cannot be securely determined. Investigation of Contrada Agnese showed that all four excavated buildings were largely fitted into the lot system, but none of them fits exactly; for example, the House of the Two Skeletons exceeds the southern border of the standard lot and partially the western ambitus, and the Southeast Building exceeds both the southern and eastern borders of the standard lot.

42 The size and individual plans of the houses and insulae are difficult to determine from the data; therefore, the function of some of these buildings remains unclear. In the absence of recognizable features (e. g. stoa, row of rooms/shops, peristyle courtyard), it is difficult to identify specific (commercial, sacred or other) functions.

43 The two seasons of survey at Morgantina, in 2012 and 2018, have demonstrated the suitability of geophysics, and in particular of gradiometry, to record the general pattern of occupation at the site. The potential future extension of the survey to the south and west of Contrada Agnese, beyond the archaeological park, would assist in mapping the extent of habitation at the site.

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References

- Allen 1971** H. L. Allen, Morgantina 1971 (Unpublished Dig Log of the Excavations in Contrada Agnese)
- Allen 1974** H. L. Allen, Excavations at Morgantina (Serra Orlando), 1970–1972: Preliminary Report XI, *AJA* 78, 1974, 361–383
- Aspinall et al. 2008** A. Aspinall – C. Gaffney – A. Schmidt, *Magnetometry for Archaeologists* (Lanham 2008)
- Bell 2006** M. Bell, Rapporti urbanistici fra Camarina e Morgantina, in: P. Pelagatti – G. Di Stefano – L. de Lachenal (eds.), *Camarina. 2600 anni dopo la fondazione. Nuovi studi sulla città e sul territorio. Atti del convegno internazionale Ragusa 7 dicembre 2002, 7–9 aprile 2003* (Ragusa 2006) 253–258
- Bell 2008** M. Bell, Hiera oikopeda, in: C. A. Di Stefano (ed.), *Demetra, la divinità, i santuari, il culto, la leggenda. Atti del congresso internazionale Enna 1–4 luglio 2004* (Pisa 2008) 155–159
- Bell 2010** M. Bell, Serra Orlando, in: G. Nenci – G. Vallet (eds.), *Bibliografia topografica della colonizzazione Greca in Italia e nelle isole Tirreniche* (Pisa 2010) 724–751
- Benton et al. 2015** J. Benton – R. Gorham – J. F. Hue-moeller – L. A. Lieberman – D. Massey – A. Smalling – R. Souza – A. Truetzel – A. Walthall, Recenti scavi a Morgantina. Il progetto Contrada Agnese (2013–2014), in: G. Bruno (ed.), *Atti del Convegno nazionale di geoarcheologia. La geoarcheologia come chiave di lettura per uno sviluppo sostenibile del territorio Aidone (EN) 4–5 luglio 2014* (Alatri 2015) 19–24
- Lucore 2013** S. K. Lucore, Bathing in Hieronian Sicily, in: S. K. Lucore – M. Trümper (eds.), *Greek Baths and Bathing Culture. New Discoveries and Approaches*, *BABESCH Suppl.* 23 (Leuven 2013) 151–179
- Lucore 2015** S. K. Lucore, Le terme sud di Morgantina: impianti idrico e di riscaldamento, in: L. Maniscalco (ed.), *Morgantina Duemilaquindici. La ricerca archeologica a sessant'anni dall'avvio degli scavi* (Palermo 2015) 92–101
- Lucore – Trümper 2012** S. K. Lucore – M. Trümper, Morgantina Geophysical Survey 2012, in: *Newsletter of the Friends of Morgantina* (December 2012) 1–4
- Sharp 2005** H. Sharp, Morgantina 2005 (Unpublished Field Notebook of the Excavations in Contrada Agnese)
- Trümper 2015** M. Trümper, South Baths at Morgantina: Assessment of the Heating System in the Context of Graeco-Roman Public Baths, in: L. Maniscalco, (ed.), *Morgantina Duemilaquindici. La ricerca archeologica a sessant'anni dall'avvio degli scavi* (Palermo 2015) 102–114
- Trümper 2018** M. Trümper, Morgantina under Roman Rule. Recent Research in the Contrada Agnese Quarter, in: O. Belvedere – J. Bergemann (eds.), *Römisches Sizilien: Stadt und Land zwischen Monumentalisierung und Ökonomie, Krise und Entwicklung* (Palermo 2018) 369–386
- Trümper 2019** M. Trümper, Crisis and Decline in Morgantina under Roman Rule: A Reassessment, in: S. R. Amicone – E. Perego – R. Scopacasa (eds.), *Collapse or Survival? Micro-Dynamics of Crisis, Change and Socio-Political Endurance in the Late Prehistoric and Early Roman Central Mediterranean* (Oxford 2019) 97–138
- Tsakirgis 1984** B. Tsakirgis, *The Domestic Architecture of Morgantina in the Hellenistic and Roman Periods* (Diss. Princeton University 1984)
- Walthall et al. 2014** A. Walthall – R. Souza – J. Benton, Preliminary Report on the 2013 Field Season of the American Excavations at Morgantina: Contrada Agnese Project (CAP), *Fastionline* 2014, 1–14 <<http://www.fastionline.org/docs/FOLDER-it-2014-322.pdf>>
- Walthall et al. 2016** A. Walthall – R. Souza – J. Benton, Preliminary Report on the 2014 Field Season of the American Excavations at Morgantina: Contrada Agnese Project (CAP), *Fastionline* 2016, 1–23 <<http://www.fastionline.org/docs/FOLDER-it-2016-364.pdf>>
- Walthall et al. 2018** A. Walthall – R. Souza – J. Benton, Preliminary Report on the 2015 Field Season of the American Excavations at Morgantina: Contrada Agnese Project (CAP), *Fastionline* 2018, 1–23 <<http://www.fastionline.org/docs/FOLDER-it-2018-408.pdf>>

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