SVENSKA INSTITUTEN I ATHEN OCH ROM
INSTITUTUM ATHENIENSE ATQUE INSTITUTUM ROMANUM REGNI SUECIAE

Opuscula

Annual of the Swedish Institutes at Athens and Rome

16
2023

STOCKHOLM

SECRETARY'S & EDITOR'S ADDRESS
Department of Archaeology and Classical Studies
Stockholm University
106 91 Stockholm, Sweden
secretary@ecsi.se | editor@ecsi.se

DISTRIBUTOR
Eddy.se AB
Box 1310
621 24 Visby, Sweden

For general information, see https://ecsi.se
For subscriptions, prices and delivery, see https://ecsi.bokorder.se
Published with the aid of a grant from The Swedish Research Council (2020-01217)
The English text was revised by Rebecca Montague, Hindon, Salisbury, UK

Opuscula is a peer reviewed journal. Contributions to *Opuscula* should be sent to the Secretary of the Editorial Committee before 1 November every year. Contributors are requested to include an abstract summarizing the main points and principal conclusions of their article. For style of references to be adopted, see https://ecsi.se. Books for review should be sent to the Secretary of the Editorial Committee.

ISSN 2000-0898
ISBN 978-91-977799-5-1

Printed by PrintBest (Viljandi, Estonia) via Italgraf Media AB (Stockholm, Sweden) 2023
Cover illustration from Robin Rönnlund in this volume, p. 123, fig. 6. Photograph by Robin Rönnlund. Courtesy of Ministry of Culture and Sports—Directorate for the Administration of the National Archive of Monuments—Department for the Administration of the Historical Archive of Antiquities and Restorations.

MARIA VAÏOPOULOU, ROBIN RÖNNLUND, FOTINI TSIOUKA, JOHAN KLANGE, DEREK PITMAN, RICH POTTER, IAN RANDALL, HARRY MANLEY, ELISABET SCHAGER, SOTIRIA DANDOU & LEWIS WEBB

The Palamas Archaeological Project

A preliminary report of the 2022 fieldwork conducted by the ongoing Greek–Swedish archaeological field programme in Palamas, region of Karditsa, Thessaly

Abstract

This paper presents the preliminary results from the 2022 fieldwork of the Palamas Archaeological Project, an ongoing Greek–Swedish collaboration in the region of Karditsa, Thessaly. Working over the course of two separate field seasons, the project team conducted aerial, architectural, fieldwalking, and geophysical surveys at a number of sites within the survey area, including at the important multi-phase fortified settlements at Metamorfosi and Vlochos. Limited excavations were also conducted at the latter site, producing new evidence for the Hellenistic and Early Byzantine phases of the ancient city, including a probable cemetery. The work continues to add to the knowledge of the archaeology of the region, highlighting the long and dynamic history of human habitation in western Thessaly.*

Keywords: aerial photography, Archaic, burials, Byzantine, city, crop-marks, earth resistance, excavation, fieldwalking, fortifications, geophysics, Hellenistic, magnetometry, *magoula*, survey, tell, Thessaly

https://doi.org/10.30549/opathrom-16-03

* The project would like to extend its gratitude to a number of persons and organizations for their support and goodwill. The Hellenic Ministry of Culture and Sports for granting the permit for the 2022 season of archaeological fieldwork in Palamas. The Swedish Institute at Athens with its director Dr Jenny Wallensten and the staff Mrs Eleni Androvic and Mrs Katerina Gabierakis for their ceaseless support of the project. The municipality of Palamas and its mayor Mr Giorgos Sakellariou and deputy mayor Mr Konstantinos Banasos for finding ways of supporting the project in the field. Messrs Aggelos and Petros Davatzikos of Markos, for—as always—saving the day through their resourcefulness and kindness. Mrs Evangeli Rita-Kogia of Metamorfosi, for facilitating the project's expansion to the summit and slopes of Kourtikiano Vouno. Schoolteachers Mr Giorgios and Mrs Eleni Sakellariou, for introducing young generations of Palamiotes to our work and thus helping to save the archaeology of the region in the long term. Finally, the project would like to especially thank its financial backers Gösta och Susi Enboms donationsfond, Herbert och Karin Jacobssons stiftelse, Helge Ax:son Johnsons stiftelse, Magnus Bergvalls stiftelse, the Society of Antiquaries of London, and Åke Wibergs stiftelse.

Introduction

The *Palamas Archaeological Project* (PAP) is an ongoing (2020–) Greek–Swedish collaboration between the Ephorate of Antiquities of Karditsa and the Swedish Institute at Athens, aiming at mapping the archaeology of the municipal unit of Palamas in the region of Karditsa, Thessaly. The project aspires to study sites of all historical periods, which in the region range from the early Neolithic up to the present day. PAP is the successor to the *Vlochos Archaeological Project* (VLAP), which was a non-invasive survey of the site at Strongilovouni hill near Vlochos, a large urban settlement of the Archaic to Early Byzantine period (*Table 1*).[1] The multi-period site at Vlochos remains a focal point for the present project, with ongoing excavation and geophysical prospection aiming at a better understanding of the function and chronology of the site. The project also aims to map and study the remains on the nearby Kourtikiano Vouno, an isolated hill *c*. 3 km west of Strongilovouni, which include fortifications contemporaneous to those at Strongilovouni. A number of Neolithic to Late Bronze Age tells or *magoules* on the plain below the hills also feature as objects of study for the project, to be surveyed using various geophysical methods of prospection.

This project employs an integrated, reflexive methodology that draws together the various work packages to continuously refine and adjust the methodology in the light of the results of each phase of fieldwork. Therefore, while the preliminary results are presented individually here (alongside brief method statements), the methodological impetus and interpretation of each field are drawn from a collective analysis of *all* aspects of the programme. This process of ongoing refinement and reflection within the fieldwork programme is central to the underlying philosophy of this project, and plays a key role in shaping fieldwork, analysis of data, and interpretation of results.

[1] Vaïopoulou *et al*. 2020.

Fig. 1. The general area of survey and locations mentioned in the text within modern Greece. A: Patoma area, Strongilovouni, Vlochos. B: The multi-phase fortified site of Kastro, Kourtikiano Vouno, Metamorfosi. C: Magoula *south-east of Ayios Dhimitrios. D: Magoula Yianiki, Ermitsi. E: Petromagoula, Metamorfosi. F: Magoula Markou 1, Markos. Map by R. Rönnlund.*

The 2022 work of PAP was divided into two seasons of fieldwork, one in the spring and one in the late summer.[2] The rationale for this division was to allow for the continuation of the geophysical prospection in the area of Patoma at Vlochos (A in *Fig. 1*) in better weather conditions than was the case in 2021, while still retaining some springtime ground moisture. The fieldwalking and architectural surveys on Kourtikiano Vouno (B in *Fig. 1*), however, required that the weeds and grasses that cover the ground be completely wilted in order to obtain better visibility. The solution was the two-part field campaign, with excavations taking place together with the fieldwalking in the late summer.

Table 1. Main building phases at the site of Vlochos.

Phase 1	Late Archaic (?)
Phase 2A/B	Late Classical and Hellenistic
Phase 3	Roman (late 3rd century AD?)
Phase 4	Early Byzantine (6th century AD)
Phase 5	8th century AD

Geophysical prospection at Patoma, Vlochos

In spring 2022, the project continued the earth resistance survey commenced in 2020 and 2021.[3] Spring was chosen as time for the survey in order to mitigate some of the moisture level issues encountered during the previous late autumn season. Six areas were targeted to give a representative cross section of the site, with four areas overlapping those surveyed during the previous season (*Figs. 2, 3*). These latter areas were resurveyed in order to assess the difference in response in the drier conditions. As with previous work on the site, the survey was carried out using a Geoscan RM85 at a resolution of 50 × 50 cm.[4] The survey used a twin-probe parallel configuration with 50 cm probe separation, giving a depth of approximately 50–75 cm (in ideal conditions). The dataset was subjected to a high-pass filter to remove geological background noise, and clipped to within a standard deviation of 2 units of the mean (Ω) in order to highlight the main range of variation.

The results of the spring survey were substantially different to those of the previous autumn season,[5] producing much more apparent contrast and structured variation. In all areas resurveyed (*Fig. 3*), more structures were visible. The level of visible detail was more comparable to that of the original 2020 pilot study area. This confirms the hypothesis that the weather and ground conditions during the survey in autumn 2021 were too wet to produce usable results, and while some structures were visible, considerably more were visible in the resurveyed areas (*cf.* Area B in *Fig. 3*).

[2] PAP is directed by Maria Vaïopoulou (Ephorate of Antiquities of Karditsa) and Robin Rönnlund (Swedish Institute at Athens). The excavations at the archaeological site of Vlochos were directed by Johan Klange and Fotini Tsiouka with participating archaeologists and students (in alphabetical order) Sara Eriksson, Stelios Ieremias, Danai Kalogerini-Samouri, Derek Pitman, Rich Potter, Elisabet Schager, and Lawrence Shaw. The survey at Kourtikiano Vouno was directed by Ian Randall, with participating archaeologists and students Dario Giuffrida, Constantina Karpeti, Robin Rönnlund, and Lewis Webb. The geophysical prospection at the site of Vlochos and the prehistoric *magoules* in the surrounding area was directed by Derek Pitman, with participating students and archaeologists Sarah Elliott, Stelios Ieremias, Harry Manley, Robin Rönnlund, Rich Potter, and Lawrence Shaw. The aerial photography survey was directed and conducted by Harry Manley and Rich Potter.

[3] Vaïopoulou *et al*. 2021, 56–59; 2022, 84–86.

[4] For details on the configuration of the survey, see Vaïopoulou *et al.* 2022, 85.

[5] Vaïopoulou *et al*. 2022, 85, fig. 1.

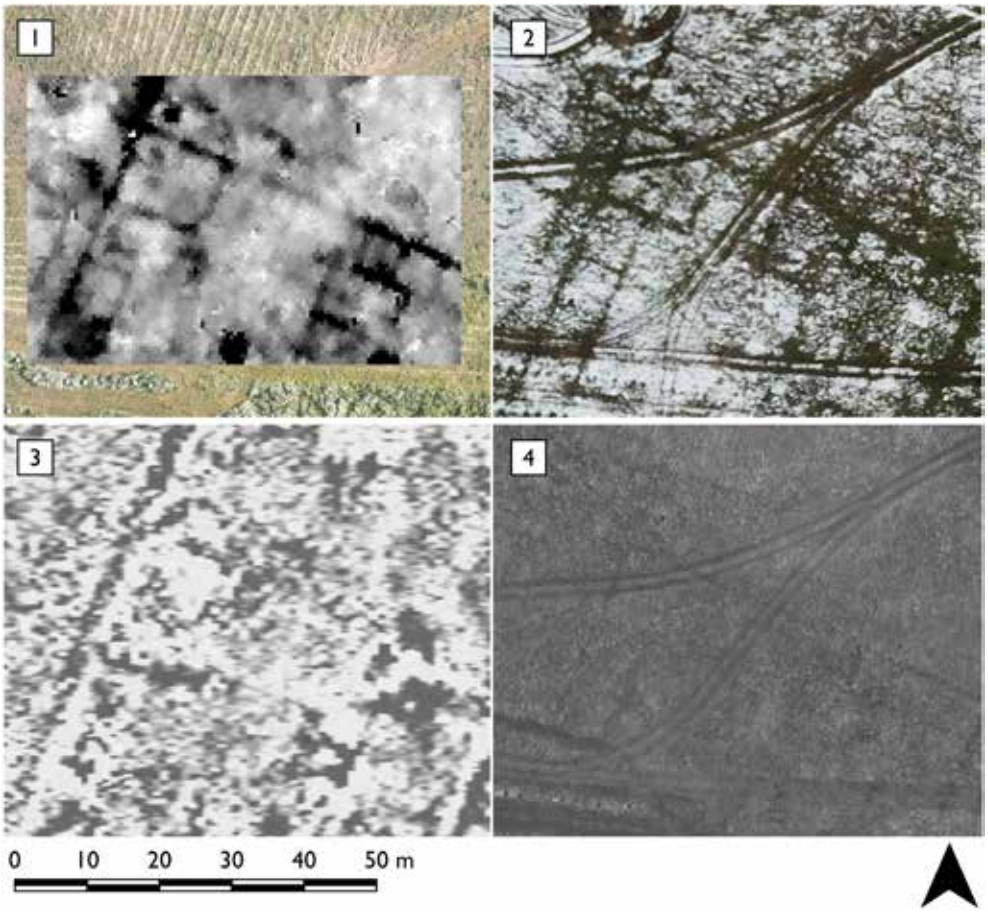
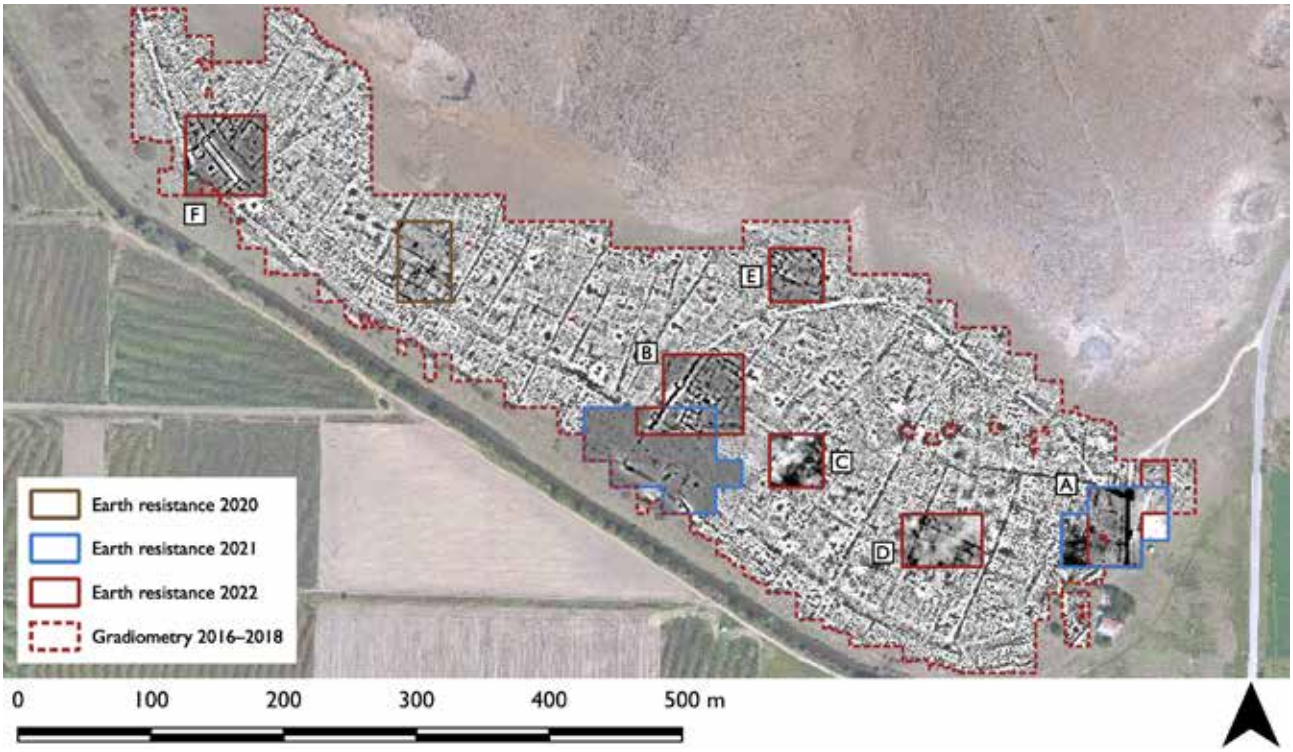


Fig. 2 (left). Area D: large courtyard building. 1: Earth resistance survey of 2022 on top of aerial photograph (black = high resistance, white = low). 2: Aerial photograph of snow marks of 2018. 3: Gradiometry of 2016–2018 (black = high nT, white = low nT). 4: NDVI aerial photograph of 2020.

Fig. 3 (below). Earth resistance survey (on top of gradiometry results and aerial photo-graph) of the area of Patoma, Strongilovouni, Vlochos. Letters correspond to areas referred to in the text (black = high resistance, white = low). Plot by D. Pitman.



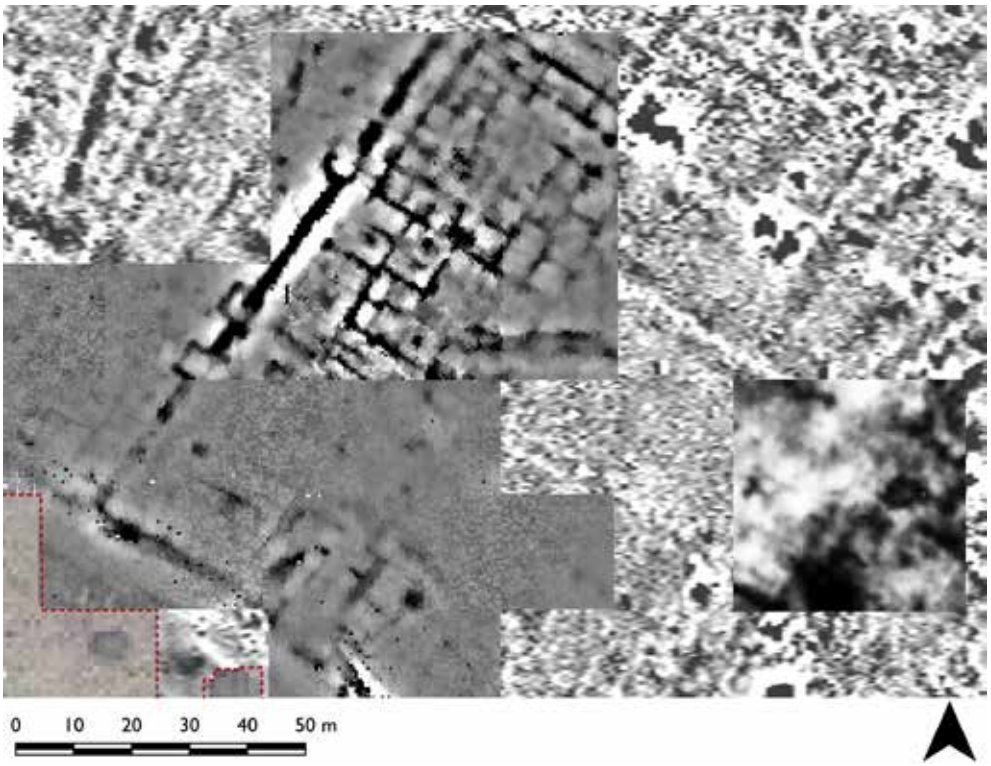


Fig. 4. Areas B and C. Detail of 2021–2022 earth resistance results, as overlaid on gradiometry results of 2016–2018 (black = high resistance, white = low). Correspond to Areas B and C in Fig. 3. *Plots by D. Pitman.*

Area A (in *Fig. 3*) showed details previously identified on the site, notably a secondary wall inside the main defensive wall and the clear intersection between the original wall and the Late Roman contraction. These features are also clearly visible in the 2022 aerial photography data (see below).

Area B (in *Figs. 3, 4*) is one of the more promising areas within the earth resistance survey. The contrast and clarity supplement the previous surveys and highlight the clear improvement in conditions between the autumn and spring seasons. The clarity of the identified foundation plan is such that two key features are visible in unprecedented detail: the double tower gate that connects the Late Roman contracted urban area to the earlier avenue-like main street (suggesting that the latter remained in use),[6] and a complex near-square structure with a central courtyard similar in plan to a Roman period *palaestra*.

Areas C, D, and E (in *Fig. 3*) display slightly less clarity than the other surveyed areas. The likely factors that contribute to this are the complexity of the stratigraphy and the possible presence of deep destruction layers. However, Area D displayed exceptional detail in the 2018 snow marks, indicating shallow and well-preserved architecture (*Fig. 2*).[7] The excavation in Area E (Trench 2) in 2022 (see below) demonstrated that there is a significant depth of stratigraphy on site with considerably more colluvium and debris than anticipated.

Area F (in *Fig. 3*) contained some of the most detailed earth resistance data yet recorded at Vlochos. The results are of great importance in areas where highly magnetic anomalies have obscured the detail of the data. It shows the stoa-like structure to the south of the avenue in clear detail, well-supplemented by the aerial and GPS survey data (*Fig. 5*). The structures in this area appear exceedingly well-preserved, and potentially represent an undisturbed, single phase (Phase 2A/B) of construction, although the data do not preclude deeper phases or subtle redevelopments.

The 2022 data clearly demonstrates the value of earth resistance at Vlochos, but notably only when the conditions are optimal. The data, when combined with the new aerial imagery and magnetometry, adds interpretable details that continue to aid the non-invasive interpretation of the site. This has now been supported by the excavations that are beginning to confirm some of the inferences drawn from the geophysical surveys.

[6] Vaïopoulou *et al*. 2020, 45.
[7] Vaïopoulou *et al*. 2022, 86.

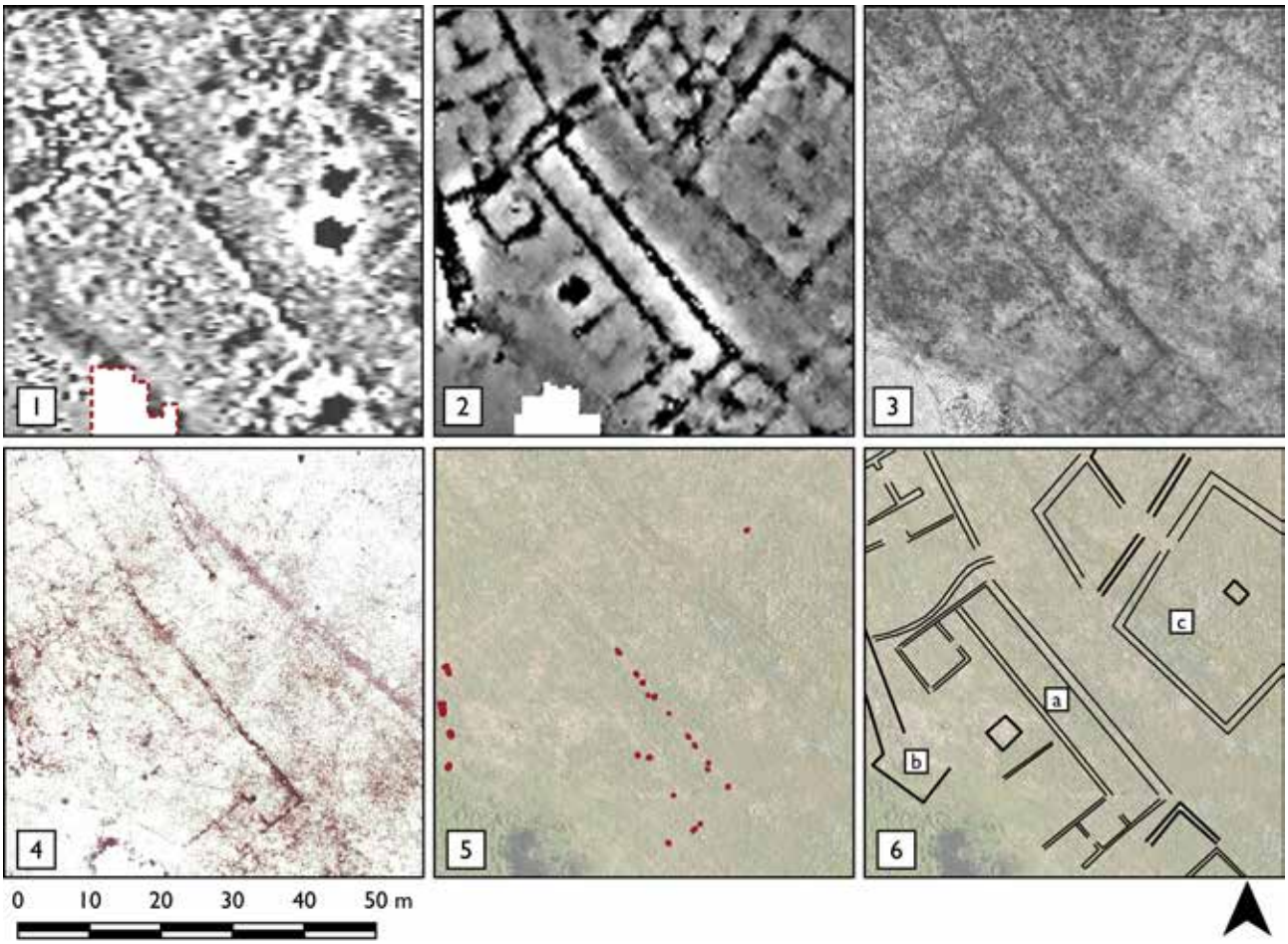


Fig. 5. Area F in the western part of the Patoma area. 1: Magnetometry plot (black = high nT, white = low nT). 2: Earth resistance plot (black = high resistance, white = low). 3: NDVI aerial photograph. 4: Processed RGB aerial imagery. 5: 2018 GNSS-GPS survey measurements of visible surface architecture. 6: Interpretation. All views show the same spatial extent. Geophysical plot by D. Pitman, NDVI plot by H. Manley; processed RGB aerial imagery by R. Potter, architectural survey by J. Klange, and interpretation by R. Rönnlund.

Aerial survey at Patoma, Vlochos

During the spring 2022 field season, and in tandem with the earth resistance investigation, the project undertook an extensive aerial survey, employing a small UAV (unmanned aerial vehicle; "drone") across the full extent of the Patoma area. The observation of snow marks in the winter of 2018[8] and the results of a small pilot project in 2021[9] indicated that a systematic approach to aerial survey for archaeological prospection would be beneficial and would complement the existing magnetometry data obtained in 2016–2018. Vegetation marks are a well-known phenomenon that can be caused by buried archaeological remains, and the observation of such marks is a key technique in identifying and defining archaeological sites.[10]

The survey was undertaken in the spring when ground conditions would best capture the contrast between healthy vegetation growing where soil moisture is unaffected by buried architecture, and areas of reduced vegetation growth where soil moisture is lower due to shallower soils. Two complementary aerial photography techniques were carried out; Red-Green-Blue (RGB) and Near infra-Red (NiR) imagery. The raw RGB imagery was processed using decorrelation stretching, and the NiR imagery was combined with the RGB to produce normalized differential vegetation indices

[8] Vaïopoulou *et al.* 2022, 86.
[9] Vaïopoulou *et al.* 2022, 88.
[10] Verhoeven 2012, 132; Wilson 2000, 41–43.

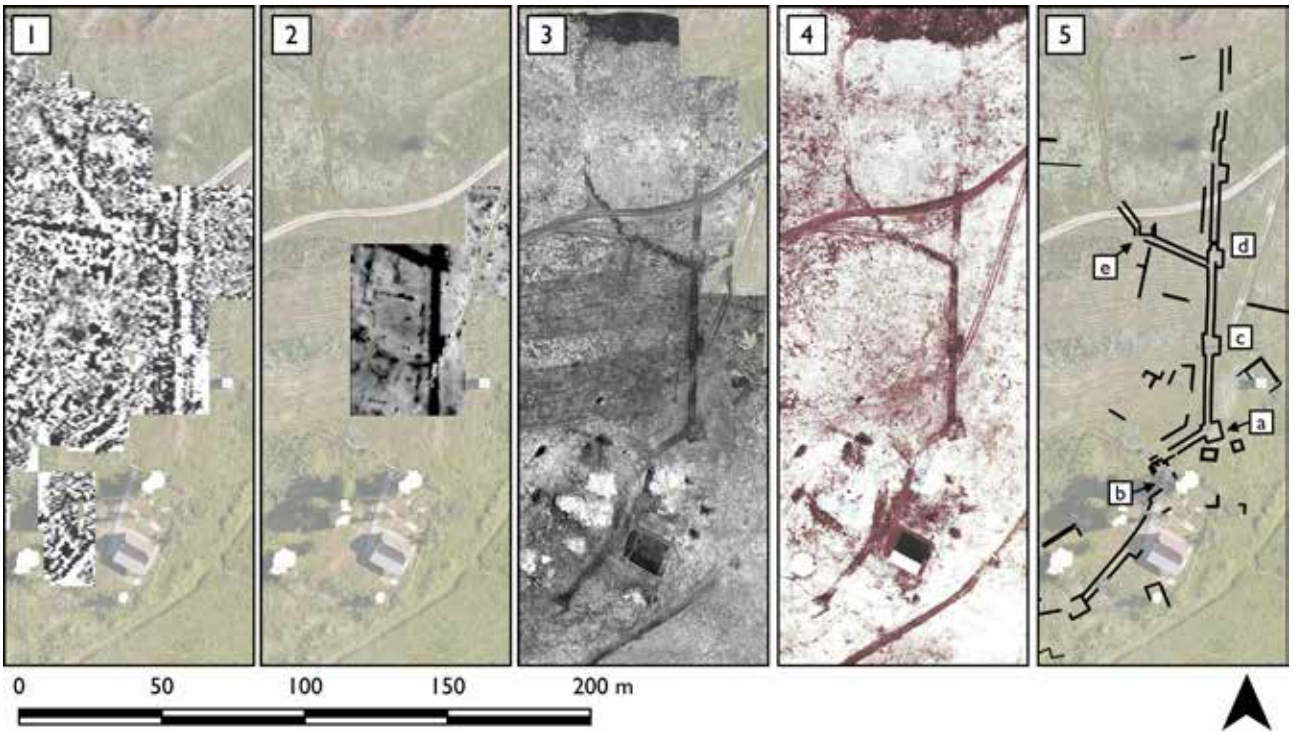


Fig. 6. Detailed view of easternmost part of the area of Patoma (including area A), Strongilovouni, Vlochos. 1: Gradiometry results of 2016–2018 superimposed on aerial photograph (black = high nT, white = low nT). 2: Earth resistance results of 2022 superimposed on aerial photograph (black = high resistance, white = low). 3: NDVI aerial photograph. 4: RGB aerial orthographic photomosaic processed using decorrelation stretch. 5: Interpretation of aerial photographs. a: Rectangular tower. b: Gateway. c: Rectangular tower with protruding back. d: Partially removed tower. e: Rectangular tower with internal chamber. All five views show the same spatial extent. Geophysical plots by D. Pitman, NDVI plot by H. Manley, photomosaic by R. Potter, and interpretation by R. Rönnlund.

(NDVI)—an approach that highlights variation in vegetated areas based on their growth condition.

DECORRELATION STRETCHED RGB IMAGERY

Decorrelation stretching using DStretch,[11] a plugin for the image manipulation software ImageJ,[12] was employed to process the raw RGB imagery produced by the survey. Decorrelation stretching is an image analysis technique that enhances different hues in RGB imagery and makes it possible to see colour variations that are not visible with the naked eye.[13] From this, a filtered image is generated from the orthographic photomosaic of the archaeological site, allowing for the extrapolation of further, previously unknown archaeological features.

NORMALIZED DIFFERENCE VEGETATION INDICES (NDVI)

Normalized Difference Vegetation Indices, created from combining both RGB and NiR imagery, can be used as a proxy for the presence of buried archaeology. The combined RGB/NiR imagery is processed in such a way that the resultant new image highlights extremely subtle variation in vegetation health (or plant stress) which can be indicative of differing soil conditions.[14] Its use in archaeological prospection is based upon the principle that buried archaeology will affect the underlying soil conditions and thus will affect plant growth and health.[15]

The application of this method was evaluated at Vlochos in 2021[16] and, based on some encouraging results, a wider survey was undertaken in the 2022 spring season. Weekly flights were undertaken to reflect the changing moisture conditions across the Patoma area. Each flight captured 687 overlapping

[11] https://www.dstretch.com/ (accessed 26 September 2022).
[12] https://imagej.nih.gov/ij/ (accessed 26 September 2022).
[13] Schulz Paulsson *et al.* 2019.
[14] Bennett *et al.* 2013, 221; Hill *et al.* 2020, 17.
[15] Moriarty *et al.* 2019, 33–46.
[16] Vaïopoulou *et al.* 2022, 86–89.

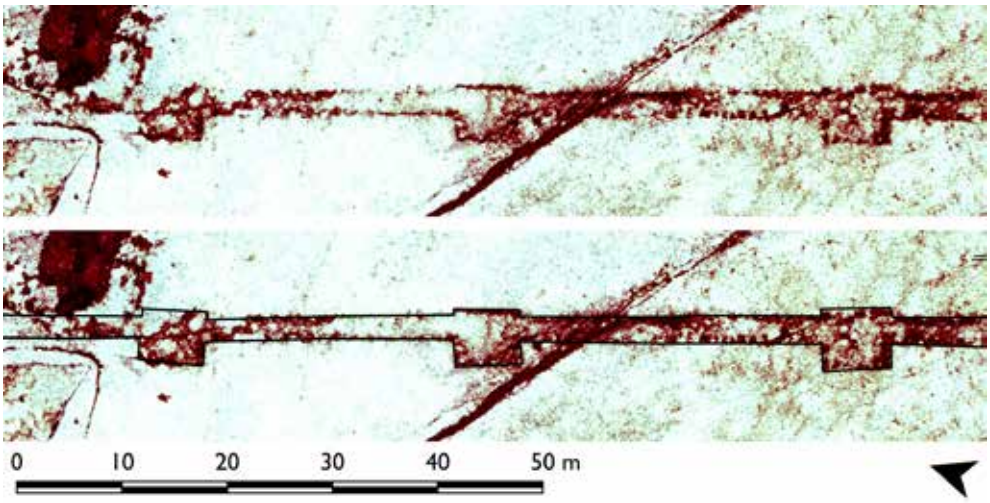


Fig. 7. Top: detail of processed RGB aerial photomosaic of the western Patoma area with towers in the city walls. Bottom: same view as above, with interpretative lines. Plot by R. Potter and R. Rönnlund.

RGB and NiR images from *c.* 50 m above ground level. The individual images were processed to create two orthographic photomosaics (one RGB and one NiR) that were then combined and analysed for NDVI.

AERIAL SURVEY RESULTS

Processed RGB and NDVI data indicated the presence of buried remains. Employing these methods,[17] it was possible to obtain a relatively sharp image of a sizeable portion of the below-ground archaeology, including some areas that had previously been unsuitable for geophysical survey due to the amount of magnetic ferrous waste on the ground and the steepness of the terrain. Two areas were especially clear from the results, including the area of the **Peirasia gate** at the eastern end of the Patoma area (*Fig. 6*).[18] The existence of this gate had been known from the fragmentary view produced by the magnetometry results of 2016–2018 (*Fig. 6*, 1) as well as from the snow marks of the winter of 2018, and the 2021 and 2022 earth resistance surveys (*Fig. 6*, 2).[19] However, the newly processed NDVI and RGB aerial photographs allowed the layout of the buried remains of the gate to be discerned in significantly more detail (*Fig. 6*, 3 & 4).

The results show that the gate was located in the northern part of the modern church yard, and that it is of an overlap type,[20] with a large rectangular tower on its north exterior (*Fig. 6*, 5, a), and what appears to be a small court within the two gateways of the passage between the parallel walls (*Fig. 6*, 5, b).[21] The foundations of a narrow wall, perhaps marking the inner side of a street running along the city wall, can be discerned immediately inside the corner tower. Future earth resistance work is planned in the area to further discern the details of this gate. It is now also clear that the towers in the fortification wall north of the gate protruded from the inside of the wall trace, something which had previously not been noticed (*Fig. 6*, 5, c & d):[22] this same building technique could also be discerned in other towers in the lower fortifications in the western Patoma area (*Fig. 7*). Further to the north-west of the towers (3 and 4), and north of the gate, in a section of the Phase 3 fortifications, a rectangular tower with an internal chamber can clearly be seen in the processed image (*Fig. 6*, 5, e). This had previously been interpreted as a possible gate,[23] a theory that now can be refuted.

In the western part of the Patoma area, the outlines of a stoa-like building could be identified in the processed RGB imagery (*Fig. 5*, 3 & 4). This is the same structure that was seen in the earth resistance survey and identified on the ground during the GPS survey (see above; *Fig. 5,* 2, 5, and 6, a). Furthermore, one of the towers in the fortification wall (*Fig. 5*, 6, b) can also be identified, although the processed RGB data lacks clarity in this area. Across the avenue or large street from the stoa-like building, the large rectangular structure (*Fig. 5*, 6, c) can only be partially seen, indicating that it is possibly buried at a deeper level where the soil conditions have less influence on the growth of the surface vegetation.

Indications of buried remains were also noted on the lower western slopes of the hill, just north-west of the area of the

[17] A more in-depth presentation and discussion of the decorrelation stretching as employed by the project can be found in Potter *et al.* 2023.
[18] Vaïopoulou *et al.* 2020, 44.
[19] Vaïopoulou *et al.* 2022, 86–88.
[20] This corresponds to the Type II in Winter's typology, Winter 1971, 222.
[21] Similar to the examples in Lawrence 1979, 333.
[22] This arrangement is quite rare in ancient Greek fortifications, where curtain walls are generally continuous with the backside of towers. Lawrence 1979, 380.
[23] Vaïopoulou *et al.* 2020, 46.

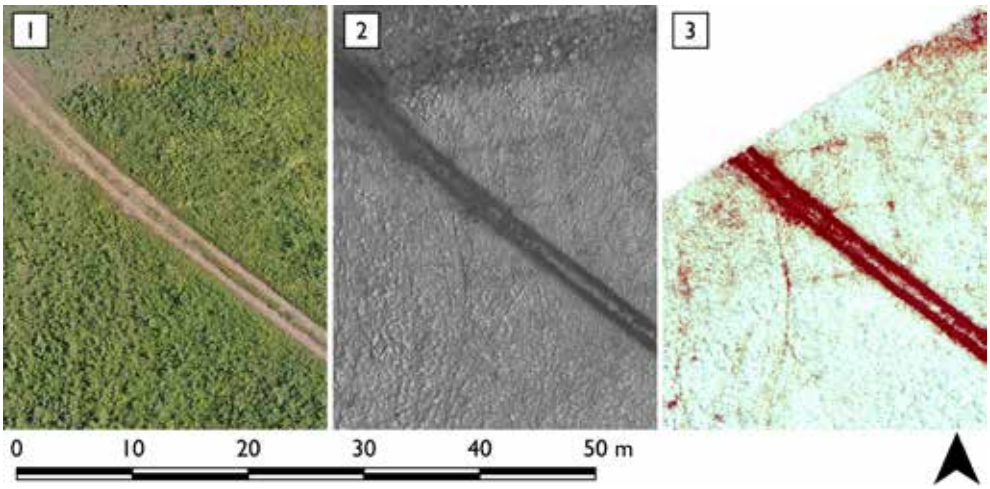


Fig. 8. Comparison between unprocessed RGB imagery (1), and NDVI aerial photograph (2), and processed RGB aerial photograph (3) in an area to the north-west of the main city walls of Phase 2A/B, showing a square feature with possible internal divisions. The area has yet not been subjected to magnetometry survey. Aerial photographs by H. Manley and R. Potter.

ancient city in the Patoma area. This area had previously not been surveyed, as abandoned modern pens here had left magnetic rubbish on the ground surface that disrupted the results of any gradiometry. Lines and rectangles probably representing buildings and walls can be seen in the processed RGB imagery and NDVI data (*Fig. 8*), and supplementary geophysical surveys in the area employing earth resistance are consequently planned for future seasons.

It is clear that by applying both decorrelation stretching and NDVI to RGB and NiR aerial photography mapping it is possible to identify a range of buried archaeological features at Vlochos. The rapid nature of this approach has advantages and, in instances where structures are visible, they are typically clear. That said, the approach is highly condition-dependent and as such, needs to be embedded in a wider survey package.

Excavations at Patoma, Vlochos

As part of the 2022 campaign, targeted excavations were conducted at two locations within the Patoma area (*Fig. 9*).[24] The first was a continuation of Trench 1 from the preceding year,[25] situated in the western half of the Classical-Hellenistic city of Phase 2A/B. The aim of the excavation was to reach foundation levels for a building (**Building 1**) that had been uncovered during the previous year, as well as to investigate indications of a second building at a lower level than the first.

The second location is on the lower slopes of the central colluvial fan of the Strongilovouni hill, north of the Late Roman town (Phase 3) in the eastern half of the Patoma area. Here, a 12.5 × 2 m trench (Trench 2) was laid out to cut across an anomaly observed in the geophysical surveys (*Fig. 10*). The gradiometric plot indicates a large square platform with a rectangular-shaped highly magnetic anomaly at its northern side.[26] The electromagnetic survey conducted in 2021 using a CMD mini explorer unit across the anomaly revealed a series of terrace features running perpendicular to the slope in line with the high magnetic reading.[27] Finally, the earth resistance survey conducted in the area (see above) revealed further indications of structures with the same alignment as the results of the other geophysical surveys (*Fig. 10*).

Due to the limited three-week time frame of the excavation campaign, bad weather conditions, and the unexpected discovery of burials in Trench 2, neither of the targeted excavations reached the lowest archaeological strata during the 2022 season.

TRENCH 1

The 2022 excavations of Trench 1 were conducted within the Eastern room of **Building 1** and in the area outside this building. The previous excavation campaign had shown **Building 1** to be a small rectangular structure with two rooms conveniently referred to as the "Western room" and the "Eastern room". Excavations in 2021 had indicated that **Building 1** had been constructed in the 6th century AD, and originally con-

[24] The excavations were conducted using an adapted single-context methodology. Archaeological strata were divided into contexts representing the physical remains of single events, such as the construction phase of a wall, a destruction layer, a cut for a pit, etc. Each context was recorded separately but in relation to each other according to their stratigraphic relationships. Groups of contexts were further created in order to define archaeological features such as a phase of use of a building or a destruction event. Finally, these groups were linked to the general chronological periodization scheme of the site.

[25] Vaïopoulou *et al*. 2022, 78–84.

[26] Vaïopoulou *et al.* 2020, 61.

[27] Vaïopoulou *et al.* 2021, 59.

Fig. 9. Locations of trenches within the area of Patoma, Strongilovouni, Vlochos. Plan by R. Rönnlund.

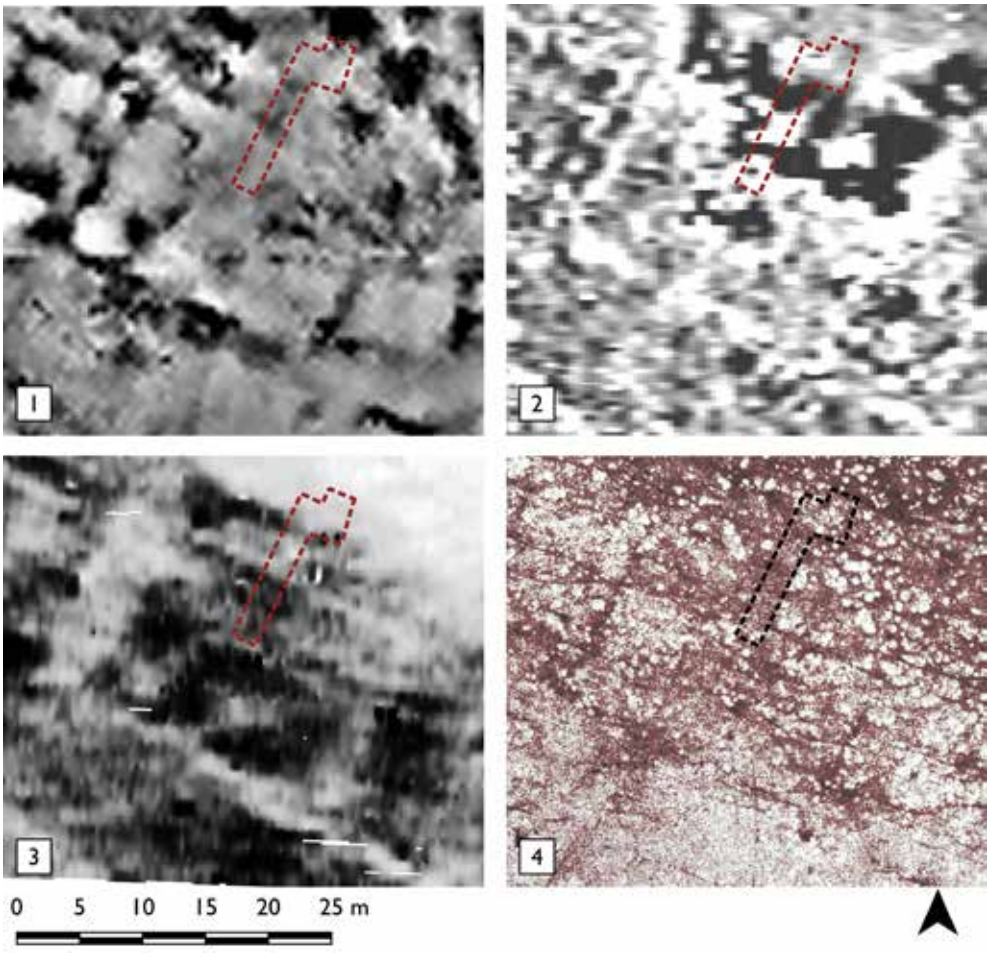


Fig. 10. Results of 2018–2022 geophysical and aerial photography surveys in the area surrounding Trench 2 (marked in red and black). 1: Earth resistance (black = high resistance, white = low). 2: Gradiometry (black = high nT, white = low nT). 3: Electro-magnetism. 4: Processed RGB aerial photography. Plots and aerial photography by D. Pitman and R. Potter.

Table 2. Stratigraphic groups of Trench 1.

Group no.	Description of group	Vlochos phase	Contexts (no.) belonging to group	Chronological span of finds from contexts in group
1	Topsoil affected by modern activities	Modern land use	1001	Classical/Hellenistic, Late Roman, Modern
2	Topsoil reflecting Medieval and Early Modern land use	Post-Antique land use	1002	Classical/Hellenistic, Late Roman, Late Byzantine, Early Modern
3	Disuse and backfill of **Building 1**	Phase 5	1003–1006, 1009–1010, 1014	Classical/Hellenistic, Roman, Late Roman, Early Byzantine
4	Last use of **Building 1**	Phase 5	1007, 1016	Classical/Hellenistic, Early Byzantine (8th century AD)
5	Construction of Western room of **Building 1** including floor levels and hardened outside surfaces	Phase 5	1008, 1011–1013, 1017–1020, 1030	Classical/Hellenistic, Roman, Late Roman
6	Ground level or levelling deposit on top of which Western room in **Building 1** was constructed	Phase 4	1015, 1021	Classical/Hellenistic, Roman, Late Roman, Early Byzantine
7	Destruction level of **Building 1**	Phase 4	1025, 1027	Classical/Hellenistic, Roman, Late Roman (first half of 6th century AD)
8	Use of structures connected to Eastern room of **Building 1**	Phase 4	1028, 1032	
9	Construction of Eastern room of **Building 1** including postholes on the outside the building	Phase 4	1023–1024, 1026, 1031, 1033	Classical/Hellenistic, Early Byzantine (?)
10	Backfill (?) of stones from robbed-out wall	Phase 3 or Phase 4 (?)	1022	-
11	Destruction of **Building 2**	Phase 2A/B	1034–1036, 1038	Geometric, Classical/Hellenistic
12	Last use of **Building 2**	Phase 2A/B	1037	Classical/Hellenistic
13	Construction of **Building 2**	Phase 2A/B	1029, 1039–1042	-

sisted only of the Eastern room, and that the Western room was an 8th-century extension. Stratigraphic locks were established for the construction and abandonment of the Western room but not for the original construction of the building. The excavation of 2021 had also revealed possible indications of an even earlier building in the form of a stone protruding through the lowest excavated archaeological strata.[28]

The continued excavation of Trench 1 in 2022 (*Figs. 11, 12*) revealed that the stratigraphic sequence could be extended back to the Hellenistic period (Phase 2B), with the discovery of a second building (**Building 2**) set underneath **Building 1**. The excavations further provided a stratigraphic lock for the original construction of **Building 1**. However, the excavation of 2022 did not reach the bottom of the archaeological strata. Consequently, the stratigraphic evidence can only provide a date for the end of use of **Building 1** (including all its phases), and not for its original construction. Similarly, only the last use of **Building 2** can be so far be discerned stratigraphically (*Table 2*).

Beginning with the youngest archaeological strata excavated in 2022, a group of destruction layers were investigated that indicated that the Eastern room of **Building 1** was abandoned in the 6th century AD (*Table 2*, Group 7). This is evidence for a hiatus in use between the abandonment of **Building 1** in Phase 4 and the reuse of the same building in Phase 5, with a reconfiguration of the floor of the Eastern room and the construction of the Western room (*Table 2*, Group 5). However, little evidence was found relating to the last use of **Building 1** in Phase 4, as the reconfiguration taking place in Phase 5 must have included the removal of any floor surfaces before a new raised floor surface was added to the room. There is, however, scant evidence for the use of **Building 1** during Phase 4 in the fills of two 0.2-m-wide postholes that aligned with the south-western wall of the building (*Table 2*, Group 8). Both postholes were positioned 0.2 m outside the southern wall of the Eastern room of **Building 1**, with one located south-west of the corner of the Eastern room and the second located south-west of the corner of the doorway of the same room (*Fig. 11*). The function of the postholes is uncertain, but they are set on the same stratigraphic level as the original construction of **Building 1** and could possibly have served for posts supporting a roof extending out from the walls of the building. Apart

[28] Vaïopoulou *et al*. 2022, 82.

Fig. 11. View of Trench 1 and ***Building 1*** *towards north-east. Posthole visible in front surface. Photograph by R. Potter.*

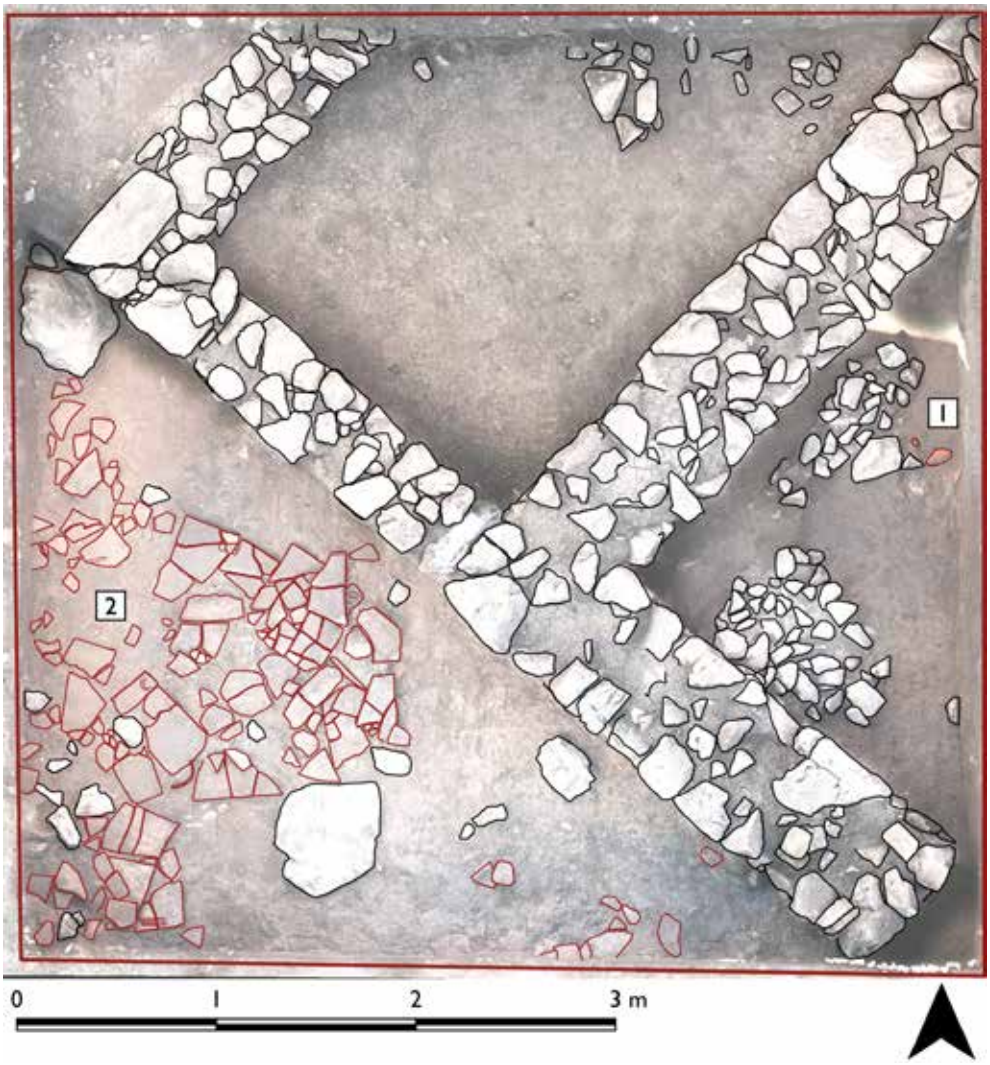


Fig. 12. Orthographic photo-mosaic with superimposed drawing of Trench 1, Patoma, Strongilovouni, Vlochos. Black lines indicate stonework, red lines tile fragments. Photo-mosaic by R. Potter, drawing by R. Rönnlund.

*Fig. 13. Drone photograph of floor or courtyard surface area outside **Building 1** in Trench 1. North is to the bottom of the image. Photograph by R. Potter.*

from the postholes, the construction of **Building 1** (*Table 2*, Group 9) must have begun with the excavation of a foundation trench covering the area that later would constitute the outline of the building. After this, the walls would have been constructed, and finally a levelling deposit added to the inside of the building to create the floor level. Below the construction level of **Building 1**, a linear feature consisting of small stones was noted, interpreted as the remains of a robbed-out wall (*Table 2*, Group 10; *Fig. 12*, no. 1). The general alignment of the feature suggests that it formed part of **Building 2** but as the excavation was concluded before reaching any underlying surface, this issue could not be resolved.

A group of demolition layers was discovered on a stratigraphically lower level than the foundations of **Building 1**, belonging to **Building 2** (*Table 2*, Group 11). The most notable of these was an undisturbed collapsed roof with near-complete tiles situated at the bottom of the demolition deposits (*Fig. 12*, no. 2). The finds in the demolition deposits differed from the layers above in that none dated to the period after the 2nd century BC, and that most of the finds were from the Hellenistic period, including West Slope ware and vases with imitations of architectural elements.[29] However, there were four peculiar metal finds associated with the collapsed roof, which due to their chronology create something of a conundrum. These consist of an iron javelin head, two bronze figurines depicting dog- or fox-like animals, and a bronze figurine of a bird standing on a seal stamp. The latter has several parallels from the wider area of Thessaly, and should probably be dated to the Geometric period.[30] One of the bronze dogs/foxes has a very close parallel in an undated find kept in Volos (interpreted by Hagen Biesantz as a "fox with prey"),[31] but cannot be dated with any certainty. The close association between the collapsed roof and the metal finds makes it highly likely that these were in use at the time of the destruction of **Building 2**.

The closed context provided by the collapsed roof is of interest as it not only creates a stratigraphic lock for the last use of **Building 2**, but also gives typological evidence for the local development of roof tiles during the Hellenistic period. The tiles, one of which was stamped "H[P]A",[32] belong to a type with finger-mark decorations which is often held to be Roman in date, but the exclusively Hellenistic finds in the associated contexts makes it possible that these types of tiles developed

[29] Karapanou & Katakouta 2000, 159, 161.

[30] Biesantz 1965, 109, nos. L71–73, pls. 53–54.

[31] Biesantz 1965, no. L82, pl. 56. Volos Archaeological Museum, inv. no. 743.

[32] Possibly from the same or similar stamp as the one found on a tile on the ground surface in the southern slope of the hill in 2017, Vaïopoulou *et al*. 2020, 66 (AMK 17723). Tiles with similar stamps have been found in Hellenistic contexts at nearby Ermitsi, see Hatziangelakis 1993, 244, and Agnandero, see Theogianni 2011, 605.

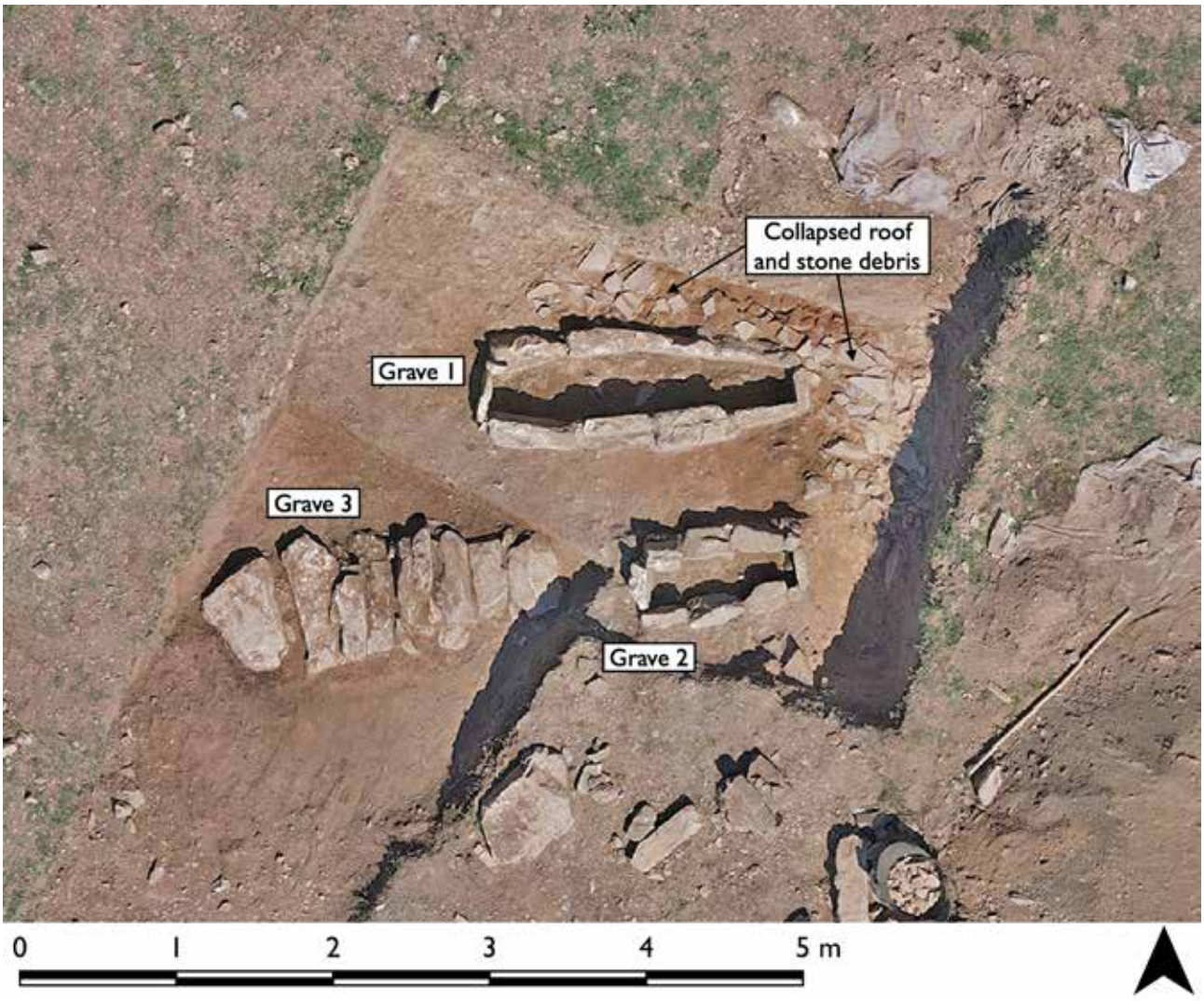


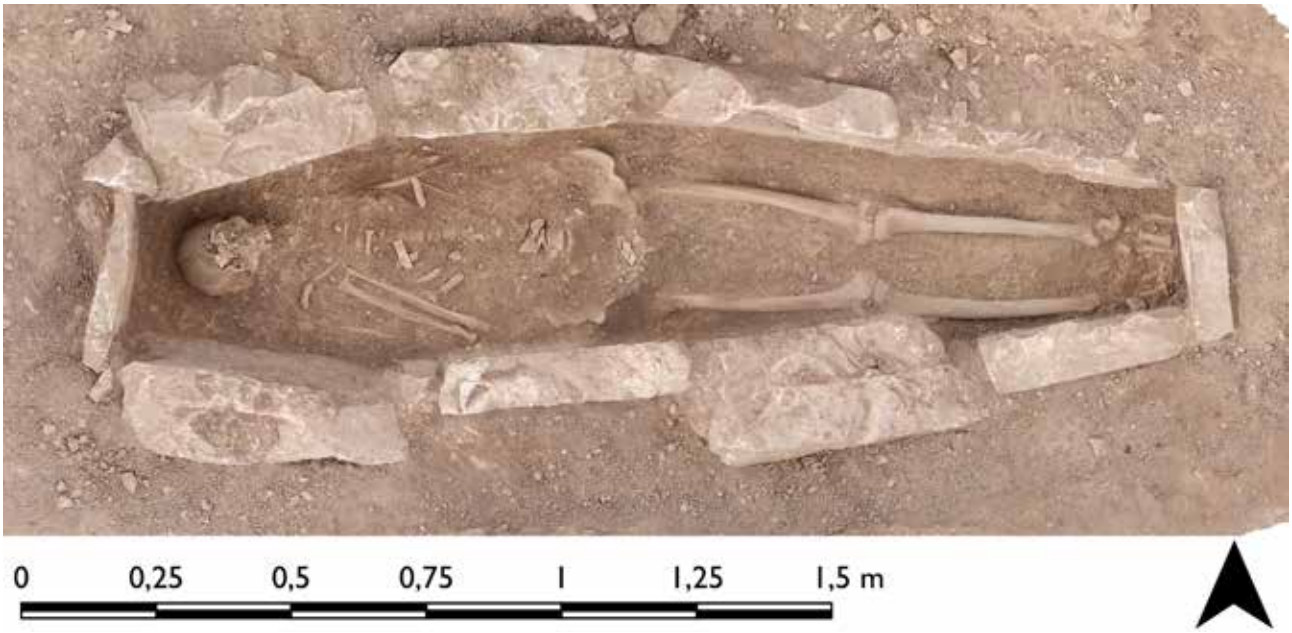
Fig. 14. Aerial photomosaic of northern end of Trench 2 after the excavation of ***Graves 1*** *and* ***2****, with* ***Grave 3*** *still unexcavated. Aerial photomosaic by R. Potter.*

earlier than commonly assumed. The final levels reached during the excavation relate to the last use of **Building 2** prior to its destruction, and some features belonging to the construction of the building (*Table 2*, Groups 12–13). These features included a well-executed pebble floor surface with a slightly elevated rectangular foundation (pillar or column base?), as well as a line of protruding stones likely marking the extent of an exterior wall (*Fig. 13*).

TRENCH 2

Trench 2 (*Fig. 14*) was originally planned to run downslope in a north-east–south-west alignment, but due to the discovery of the western half of a cist tomb (**Grave 1**) in the northern part of the trench, excavations of the southern two-thirds of the trench were abandoned at the level just below the turf. The trench was instead expanded at the northern end to the south-east in order to access the rest of the burial. Two additional graves (**2** and **3**) were found in the expanded area of the trench.

The stratigraphic sequence within Trench 2 can be divided into three phases of use that likely range from the Hellenistic to the Early Byzantine period (*Table 3*). Due to the depth of the colluvial deposits at the location, and due to the allocation of resources to excavate the graves, the excavation did not reach the bottom of the archaeological strata. In addition to this, the stratigraphic resolution was further impeded by the deep colluvial deposits that covered the different levels of archaeological remains. A stratigraphic lock could, however, be established at the bottom of the excavated trench, indicating



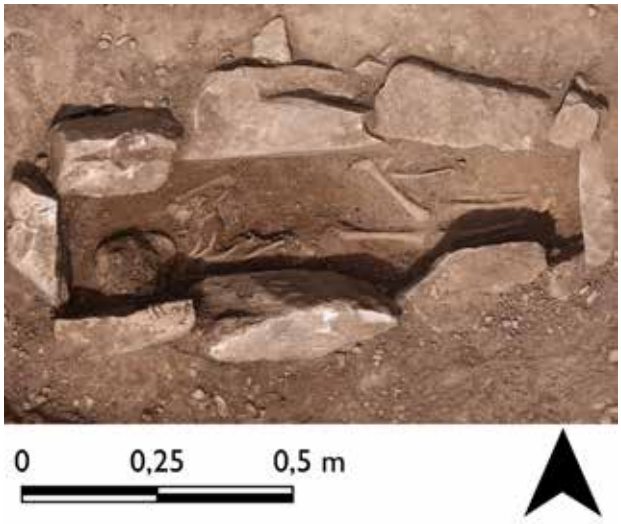


Fig. 15 (above). Rectified, orthographic photomosaic of ***Grave 1****. Photomosaic by R. Potter.*

Fig. 16 (left). Rectified, orthographic photomosaic of ***Grave 2****. Photomosaic by R. Potter.*

Fig. 17 (below). Rectified, orthographic photomosaic of ***Grave 3****. Photomosaic by R. Potter.*

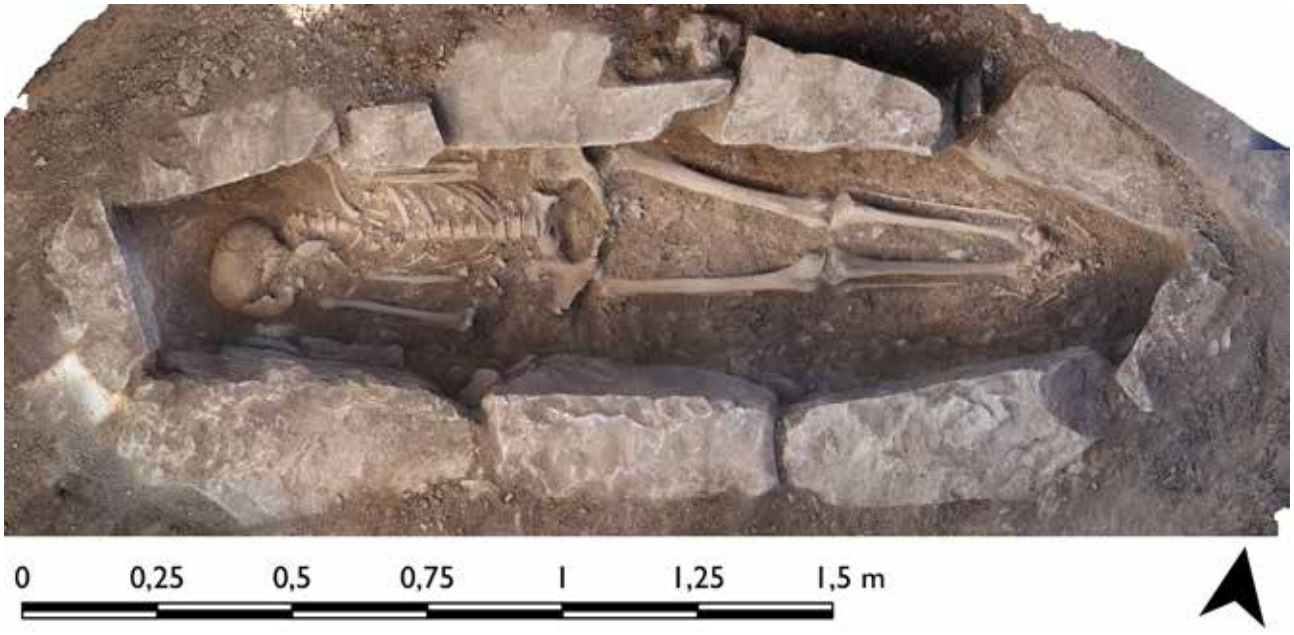


Table 3. Stratigraphic groups in Trench 2.

Group no.	Description of group	Vlochos phase	Contexts (no.) belonging to group	Chronological span of finds from contexts in group
1	Topsoil and post-Medieval colluvial deposits	Post-Medieval	2001, 2002	Archaic, Classical/Hellenistic, Late Roman, Early Byzantine
2	**Grave 1**	Phase 5 (?)	2004–2009	Classical/Hellenistic, Late Roman
3	**Grave 2**	Phase 5 (?)	2013–2018	Classical/Hellenistic, Late Roman
4	**Grave 3**	Phase 5 (?)	2011, 2022–2026	Classical/Hellenistic, Late Roman
5	Late Roman to Early Byzantine colluvial deposits	Phase 4; Phase 5	2003, 2012, 2019, 2021	Classical/Hellenistic, Late Roman
6	Destruction level	Phase 2A/B (?)	2010, 2020	Classical/Hellenistic (?)

a destruction event during the Classical-Hellenistic period (Phase 2A/B).

Starting with the youngest archaeological strata, the first level of archaeological significance consisted of accumulated colluvial deposits containing finds from the Archaic period to the 8th century AD (*Table 3*, Group 1). The latest of the diagnostic finds consisting of single sherds of the "Slavic" ware type.[33] Three cist graves (**Graves 1–3**) were discovered stratigraphically below the upper colluvial deposits, containing relatively well-preserved skeletal remains (*Table 3*, Groups 2–4). The cists were approximately east–west oriented, rectangular or slightly trapezoidal in shape, and were built using stone slabs that had been placed along the sides of cuts made into colluvial deposits of what must have been a slope at the time. The bodies of the deceased were placed inside the cists in a supine and extended position, with their heads to the west. No depositions of pottery or any other accompanying grave goods were found, and it appears that the deceased had been placed on the bottom of the grave without stone or tile pillows under their heads; neither were there any visible traces of wooden coffins or biers under the dead, nor coffin nails around the skeletons. The close arrangement of the extremities of the dead could indicate that the bodies were shrouded when placed in the graves. The combined evidence from the burials makes it likely that they are Christian, and that they date to the Byzantine period.[34] The skeletons are presently under osteological analysis, with further results to be presented in a later publication.

Grave 1 (*Fig. 15*) was slightly trapezoidal in shape, with outer dimensions of 2.11 × 0.8 m. The buried individual was approximately 1.84 m tall, with folded arms and hands placed on the chest. The legs were lying parallel and the feet were up against the foot-end stone.

Grave 2 (*Fig. 16*) was rectangular in shape, with outer dimensions of 1.13 × 0.54 m. The western half of the grave had been heavily damaged at some point before the current excavation, and it had been opened during this previous event. This has caused the skeletal remains to be considerably disturbed, especially at the left side where part of the arm and most of the pelvis were missing. The buried individual was a child, approximately 0.88 m tall. The position of the arms could not be determined due to the disturbance of the skeletal remains.

Grave 3 (*Fig. 17*) was rectangular in shape with outer dimensions of 2.2 × 0.9 m. The body was most likely of an adult, approximately 1.64 m tall. The arms were folded, and hands placed on the chest.

The stratigraphic position of the graves set between accumulated colluvial deposits and without any apparent internal relationships makes it impossible to discern the relative chronology between the burials. **Grave 3**, however, was buried deeper than the other two graves, which were dug down to roughly the same height above sea level, but this could rather be attributed to the positioning of the graves on a slope than due to their relative date. Accumulated colluvial deposits and erosion debris (*Table 3*, Group 5) were found on a stratigraphically lower level than the burials, but providing no firm stratigraphic locks. However, the finds in the layers above and below the graves could be used to provide a rough date for the burials, to be compared with the date indicated by the burial type and customs. The finds in the deposits above the graves range in date from the Archaic to the 8th century AD, whilst the deposits below the graves have yielded pottery dating from the Classical-Hellenistic period and the Late Roman period. If the finds and stratigraphy are combined with the burial customs of the graves, an Early Byzantine date seems fairly plausible.

The stratigraphically lowest excavated deposits consisted of the remains of a destruction event, as discernible in the northernmost part of the trench. The layers consisted of a collapsed tiled roof set on top of stone debris (*Table 3*, Group 6). The roof tiles were horizontally deposited in the northernmost part of the trench, whilst the stone debris was positioned to the south of the tiles in a sloping manner towards south. This could indicate the presence of a terrace under the roof tiles, which also was indicated by the electromagnetic survey

[33] On finds of similar pottery from the site, see Vaïopoulou *et al.* 2022, 84.
[34] Poulou-Papadimitriou *et al.* 2012, 377–379, 388, 407, 416.

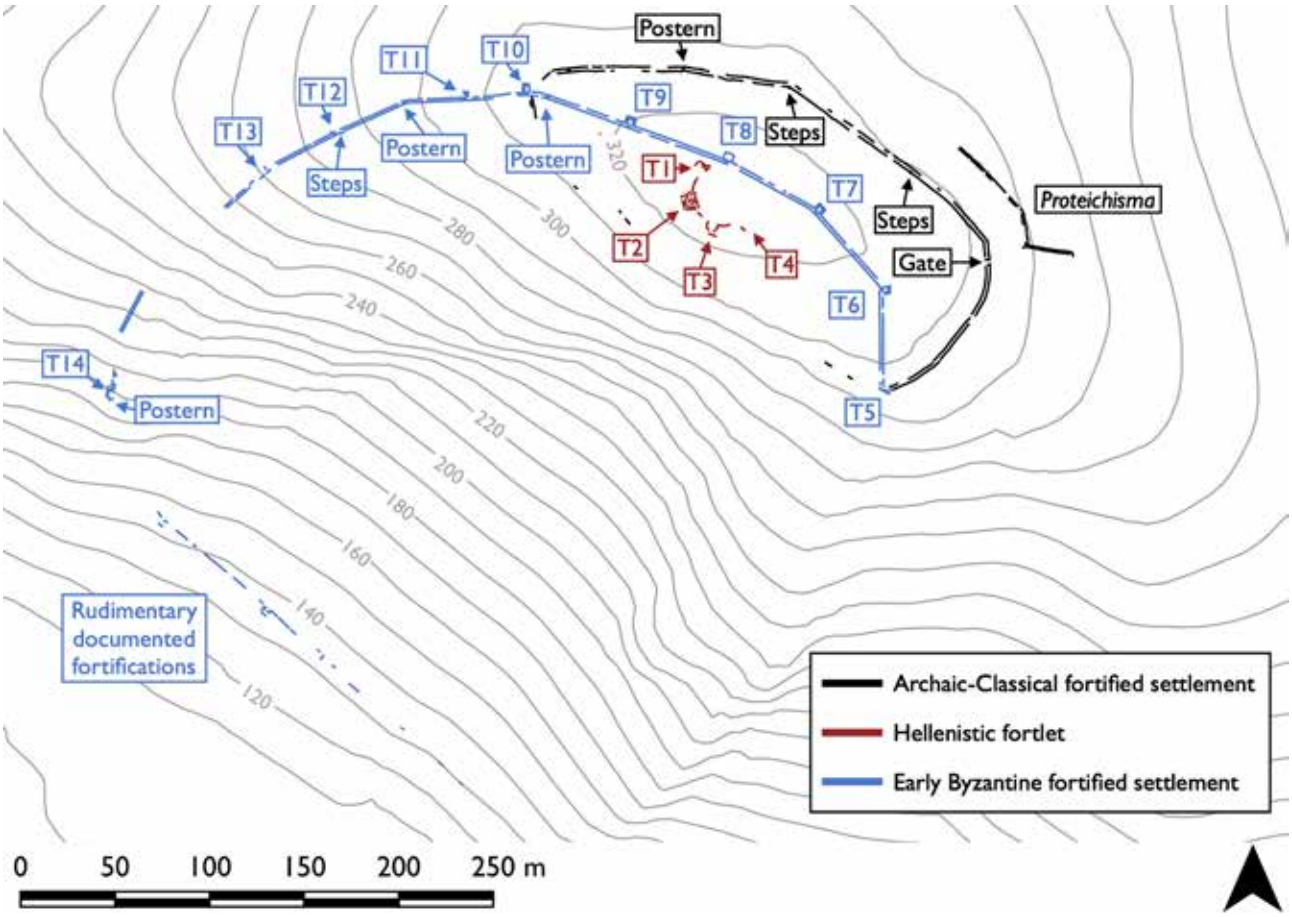


Fig. 18. Results of 2021–2022 architectural surveys, Kourtikiano Vouno. T = tower. Plan by R. Rönnlund.

(*Fig. 10*, 3). The finds including the roof tiles indicate a Classical-Hellenistic date for the destruction deposits, which likely would make the remains part of a building which had been set on top of a platform with a terrace wall at its back.

Architectural survey on Kourtikiano Vouno, Metamorfosi

The multi-period fortifications on the top of Kourtikiano Vouno, a large isolated limestone hill at Metamorfosi, were initially surveyed in 2021, resulting in the first published plan of the ancient remains.[35] The aim of the 2022 architectural survey was to complete the recording of the Early Byzantine fortifications, and especially the wall that extends from the hilltop down the western slope of the hill. Continuing with the same methodology, the fortifications were recorded digitally with a GNSS-NRTK unit, with descriptions and photographs collected in parallel, with each tower, curtain wall, postern, etc. designated as separate contexts of the survey. The resulting plan of the remains (*Fig. 18*) highlights the complexity of the site, as well as its different functions of use.

An isolated stretch of wall had been observed immediately east of and outside the gate in the earliest phase of the fortifications on the hilltop (black in *Fig. 18*). The feature represents in all probability a *proteichisma* or outer breastwork; a secondary wall which served as a point of defence in front of the gate. It consists of a thin (*c.* 1.1 m wide) double-faced wall, built in the same polygonal and pseudo-trapezoidal masonry as the main Archaic-Classical fortification above it on the slope. The wall follows for 65 m the general outline of the main fortification at a distance of *c.* 20 m, then makes a sharp turn east–south-eastwards down the hill-slope, ending abruptly after 23 m. In the sharp angle created by the walls is a small semicircular feature, *c.* 2.2 m in diameter, of unknown function.

[35] Vaïopoulou *et al.* 2022, 96–99.

Fig. 19. Isolated section of Early Byzantine wall, south-western slope. View towards north. Photograph by R. Rönnlund.

The survey resumed the documentation of the Early Byzantine wall (*Fig. 18* in blue), which had been paused in 2021 just west of **Tower 10**. The work showed that the fortifications of this phase continue further westwards down the increasingly steep slope, with three fragmentary preserved towers (**Towers 11–13**) before ending abruptly at the top of a precipice. **Tower 11** and **Tower 12** are sufficiently preserved to show that they were hollow, with an internal rectangular chamber, similar to **Towers 5–10** documented in 2021. The section of the fortified enceinte also contains a postern 30 m west of **Tower 11**, as well as a small protrusion on the inside of the wall, representing a set of steps leading up to the top of the wall.[36] The whole extent of this sector of the fortifications, from **Tower 10** westwards, is 173 m long, and all curtain walls are uniformly *c*. 1.5 m wide. All features are constructed in stones of varying sizes, some lightly tooled, all fixed with considerable amounts of white mortar and gravel.

The wall trace continues further down the slope to the south-west at a distance of 60 m horizontally but nearly 50 m vertically. Here, a 23-m-long stretch of wall is built across a small, steep plateau in the slope. The wall is here 1.3 m wide (*Fig. 19*), and abuts the vertical cliff in the north-east, but ends abruptly above yet another precipice in the south-west.

Further to the south, 20 m horizontally and 15 m vertically from the aforementioned stretch of wall, is another segment of the fortifications. A curtain wall, preserved for 9 m, adjoins a rectangular tower (**Tower 14**), both constructed on a steep, small plateau in the slope. The wall is 1.3 m wide, and poorly preserved. **Tower 14** is also poorly preserved, but enough remains to indicate that this too was hollow, with a rectangular inner chamber accessed from within the fortified area. Just south of the tower are clear indications of a passageway or a postern, which leads to some rock-cut steps in the cliff. The slope below this point is extremely steep and rocky, with no further observable sections of the fortifications.

The large colluvial fan in the slopes below the fortified hilltop (*Fig. 20*), known locally as Aspropetra, contains substantial amounts of pottery and tile, but also fragmentary remains of building foundations and dislocated blocks.[37] During the 2022 survey, the area was rudimentarily searched for traces of fortifications, as such had been observed in passing during the 2021 season. A 213-m-long completely straight line of what is evidently the outer face of a fortification wall could be traced in the slope here, containing at least three towers (*Fig. 18*). The wall has a north-west–south-east alignment and cuts across the colluvial fan, with an approximate vertical drop of 20 m. No continuation of the wall was noted at its south-eastern end, but the ground at the location is somewhat overgrown and covered in erosion debris, and the team consequently decided to only measure the outline of the fortification, with a more detailed survey to be conducted in future campaigns. Terraces and probable building foundations were

[36] Similar sets of steps have been noted in the contemporaneous Early Byzantine fortifications (Phase 4) at Strongilovouni, Vlochos, see Vaïopoulou *et al*. 2020, 50.

[37] Dandos 1999, 209.

Fig. 20. The Aspropetra area as seen from the hill-slope looking towards the south-east. Photograph by R. Rönnlund.

observed immediately within the fortification wall, as well as Late Roman or Early Byzantine pottery, indicating that the Early Byzantine fortifications served to protect a settlement or town on the hill-slope, similar to those at Vlochos,[38] Farsala,[39] and elsewhere.

Systematic surface survey on Kourtikiano Vouno, Metamorfosi

In parallel with the 2022 architectural survey on Kourtikiano Vouno, a fieldwalking survey of ceramic surface material was conducted during the three-week field season. The fortified area of the hilltop, bounded on the gradual slope to the north and east by the Archaic-Classical walls, and to the south and west by steep, largely impassable terrain, was laid out in a grid of 10 × 10 m squares using the above-mentioned GNSS-NRTK unit, encompassing some 28,200 m^2. A single team of three fieldwalkers, spaced 2.5 m apart, moved across each grid unit from west to east, collecting all sherds and tile fragments observed, as well as any other extraneous archaeological surface finds.[40] With collection taking place within a 5-m-wide transect for each walker, total coverage was achieved with overlapping observations. Diagnostic ceramic material was kept and brought to the ephorate storeroom for further analysis, while non-diagnostic ceramic finds were recorded and left within their grid square.

The terrain of the hilltop is characterized by bare bedrock, moderate to large boulders interspersed with patches of grass, large bushes, and the occasional olive and Christ's-thorn trees (*Paliurus spina-christi*). Grass is kept low due to regular visits by caprids, although surface visibility significantly decreases as one moves between the wall traces of the Early Byzantine and Archaic-Classical fortifications, with heavier concentrations of grass, bushes, and trees located on the gradual slope extending from the summit to the north. Just under half of the fortified area of the hilltop was surveyed in 2022 (*Fig. 21*), with the remaining portion of the gridded area scheduled to be completed in coming seasons.

Already, the quantity and character of material observed thus far on the hilltop allows for a number of inferences to be drawn concerning the nature of settlement on Kourtikiano Vouno across multiple periods. In contrast to the quite sparse scatters observed on Strongilovouni hill,[41] Kourtikiano Vouno displayed large quantities of ceramic material, with some grid units producing over 500 fragments alone (*Fig. 21*, A combined with B). While diagnostic sherds ranged from the Archaic to Late Roman periods, the vast majority appeared to be concentrated in the Classical-Hellenistic, including a large amount of black glaze pottery. Hellenistic amphora sherds were also heav-

[38] Vaïopoulou *et al*. 2020, 47–52.
[39] Katakouta & Toufexis 1994, pl. 1, 194.
[40] Fossey 1986, 43–63; Gregory & Kardulas 1990, 470–472; Fachard *et al*. 2020, 482–489.
[41] Vaïopoulou *et al*. 2020, 77–103.

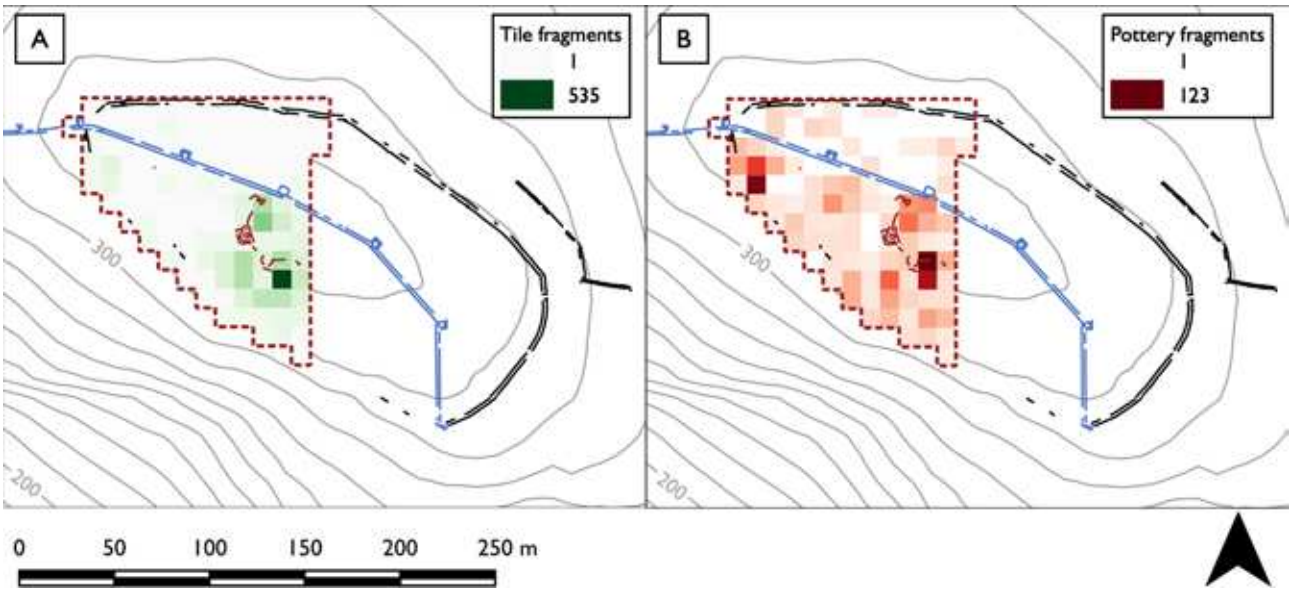


Fig. 21 Distribution of finds from the fieldwalking survey on Kourtikiano Vouno. Dashed red line indicates area surveyed in 2022. Colour legend for architectural features as in Fig. 18. *Plans by R. Rönnlund.*

ily represented. At least four kinds of tile were in evidence, some with slipped surface treatment, the largest concentration occurring just south of the *hexapyrgion* (the circular Hellenistic fortification dominating the summit).[42] Signs of industrial activity of various kinds were also found on the hilltop, including slag, a spindle whorl, and several pottery wasters. There was also some presence of chipped stone artefacts.

Due to bioturbation across the hilltop, likely caused by caprids and wild boar, and the almost certain migration of material downslope due to erosion and water action, the taphonomy on Kourtikiano Vouno is far from clear. However, with no evidence of modern dumping, it can safely be stated that material is unlikely to have moved *up* the hill, and the large quantity of tile, amphorae, and fine ware points to a significant settlement. The ephemeral traces of industrial activity also indicate either a variegated settlement during the Classical-Hellenistic period, or the shifting nature of hilltop occupation over the *longue durée*. The planned completion of the Kourtikiano hilltop survey in 2023 will no doubt augment this picture, not least with a detailed distribution map of both non-diagnostic and diagnostic ceramic material for the entire surveyed area.

Geophysical prospection of *magoules*

In addition to the geophysical surveys at the site of Vlochos, the 2022 fieldwork also included a pilot programme of magnetometry survey on nearby prehistoric tells or *magoules* (sing. *magoula*).[43] These sites are typically identifiable as circular or near-circular mounds that protrude from the overall surface of the surrounding plain. Excavated examples and surface finds typically date such structures to the Neolithic and Bronze Age,[44] which is also the case with the surveyed *magoules*. While many of the known mounds are topographically discernible, some are identifiable only as soil or crop-marks through aerial photography. There are also examples where the topographic footprint and the extent of the site—as visible in aerial photographs—are different. One of the aims of this pilot was to assess the relationship between subsurface features and the mound structure. The survey therefore included an approach that combined a topographic study with geophysical survey, using aerial photography-based photogrammetry (structure-from-motion or SFM) and magnetometry. Systematic surface surveys are planned for these locations in future field seasons.

Magnetometry was conducted using a Bartington 601-2 fluxgate gradiometer with a twin-probe setup. Probes were separated by 1 m. Points were recorded every 25 cm along 1 m

[42] Vaïopoulou *et al*. 2022, 97–98.

[43] Magoula Markou 1 was surveyed as part of the 2021 field campaign, but is presented here.

[44] Hamilakis *et al*. 2017, 81–96.

transects in 20 m grids using a zig-zag pattern of collection. The data were de-striped, de-spiked, and clipped to *c*. 2 standard deviation of the mean (nT) and interpolated (by increasing the x to match the y). The sites are distributed throughout the study area, comprising the *magoules* at Ayios Dhimitrios, Yianiki, Petromagoula, and Markos (*Fig. 1*, C–F).

In terms of recognizable features, each survey contained a similar range of responses, including low-magnetism linear features that can be indicative of walls, foundations, or terrace edges; rectangular or sub-rectangular magnetic anomalies that typically range between 4 m and 8 m in length which can be indicative of pits or clay house structures (as have been noted in comparable sites)[45]; and magnetic linear features that are typically interpreted as ditches. In other comparable examples, these types of features have been shown to relate to the function and organization of the prehistoric tell/*magoula* sites, notably, including a combination of clay houses (sometimes burnt), enclosure ditches, and walls.[46] These interpretations will be discussed in more detail in future publications but are summarized below.

AYIOS DHIMITRIOS

Soil marks visible on satellite and aerial photographs (*Fig. 22*, A) had indicated the existence of a large *magoula* just south of the road from Ayios Dhimitrios to Petrino,[47] some 1.5 km south-east of the former village (*Fig. 1*, C). There are to our knowledge no previous published references to this *magoula*, which until the mid-20th century was located at the northern edge of a large area of marshland, but at present is found in a completely drained agricultural landscape. On the other side of the former marsh, at the spring of Paparma, Jean-Claude Decourt noted a Neolithic settlement on a small *magoula*.[48] The spring has dried out and the water trough (*vrisi*) has been demolished in connection with the extensive quarrying activities conducted on the hillside above it, and the team was not able to locate the Neolithic settlement from Decourt's descriptions.[49]

Aerial photographs show that the *magoula* under study is *c*. 150 × 130 m in size, and not completely circular. The gradiometric image (*Fig. 22*, B) shows a geophysical cross-section through the magoula measuring 180 × 40 m running north-east–south-west across the centre of the soil mark. The plot shows clear features including a linear ditch-like feature and four defined rectangular features that are similar in dimensions to possible clay-built house structures identified at other similar sites.[50] Preliminary spot-dating of surface material, including pottery and fragmentary figurines, suggests habitation in the Neolithic and Late Bronze Age. Future survey will investigate this in more detail.

MAGOULA YIANIKI

Magoula Yianiki is situated just north of the Karditsa–Larisa highway (*Fig. 1*, D),[51] approximately 1.3 km north of the village of Ermitsi. It is the largest *magoula* of the four, some *c*. 220 × 250 m in size. The site was until the early 20th century the location of the small village of Yianiki, possibly mentioned in Ottoman tax records from the mid-15th century.[52] RAF and Luftwaffe aerial photographs of the 1940s (*Fig. 23*, A) show indications of houses in the south-western sector of the *magoula*, as well as a possible ditch surrounding it. These features are less visible in modern aerial photography, yet the site is still topographically visible albeit truncated by ploughing in the south-east.

The gradiometric image (*Fig. 23*, B) shows two distinct areas of activity. The area to the south-west is relatively quiet with the exception of a significant amount of small, ferrous peaks, suggestive of a mixture of disturbance and deposition of recent (Ottoman period?) material culture. In contrast, the north-east half of the plot appears more structured with a series of rectangular and near-rectangular features. The surface material is overwhelmingly Early Modern, with typical Ottoman-period brown-glazed pottery dominating the ceramics. Some pottery and lithic tools, however, indicate probable habitation in the Neolithic period.

PETROMAGOULA

Some 500 m north of Kourtikiano Vouno (see above), situated at the borders of the former marshlands of Derbinia, is the low rocky ridge of Petromagoula. The ridge is *c*. 900 m long, extending from north-west to south-west, with rocky ground and low shrubs covering most of the area. Neolithic pottery and some undated tombs have been noted here previously.[53] Just east of the southernmost point of the ridge is

[45] Hamilakis *et al*. 2017; Sarris *et al*. 2017, 27–48.
[46] Borić *et al*. 2018, 336–346.
[47] Co-ordinates (GGRS87): 339293, 4374312.
[48] Decourt 1990, 101.
[49] The mound described by Decourt at the Paparma location consists mainly of gravel and debris from the construction of the old dirt track, as placed on the top of a rocky outcrop. That the mound does not constitute a *magoula* is further indicated by the bedrock being visible in the top surface. Apart from some modern tile, we did not note any ceramic material on the mound nor in its vicinity despite the surrounding fields being recently ploughed.
[50] Sarris *et al*. 2017, 27–48.
[51] Co-ordinates (GGRS87): 337047, 4366507.
[52] If it is to be identified with the *Yenice yurt* ("new small settlement"), see Kayapınar & Spanos 2016, 280. There is also the possibility that the name renders the Turkish *yeni köy* ("new village").
[53] Nikolaou & Firfiris 1999, 63.

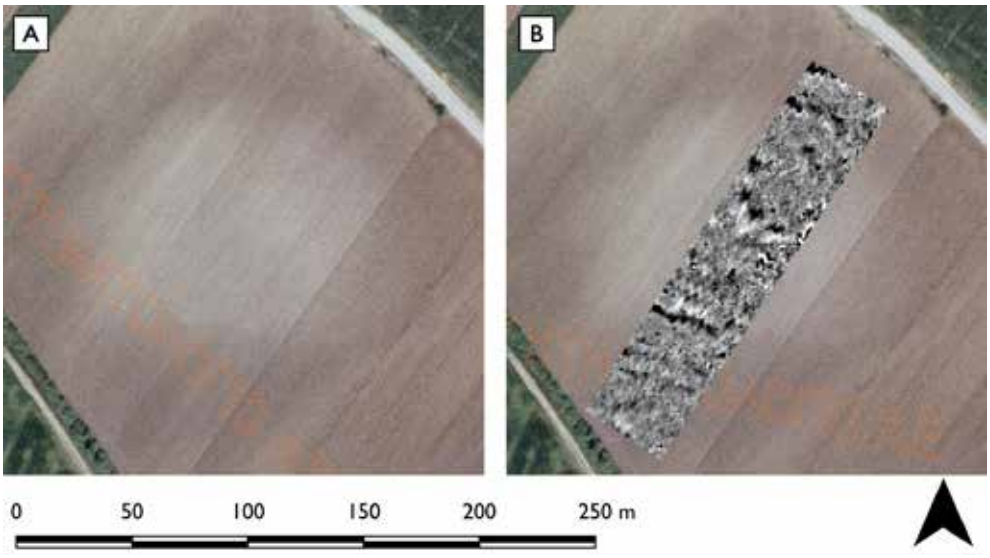


Fig. 22. Magoula *at Ayios Dhimitrios. A: Aerial image of soil mark. B: gradiometric plot. Plot by D. Pitman (black = high nT, white = low nT). Aerial photographs courtesy of Ktimatologio AS.*

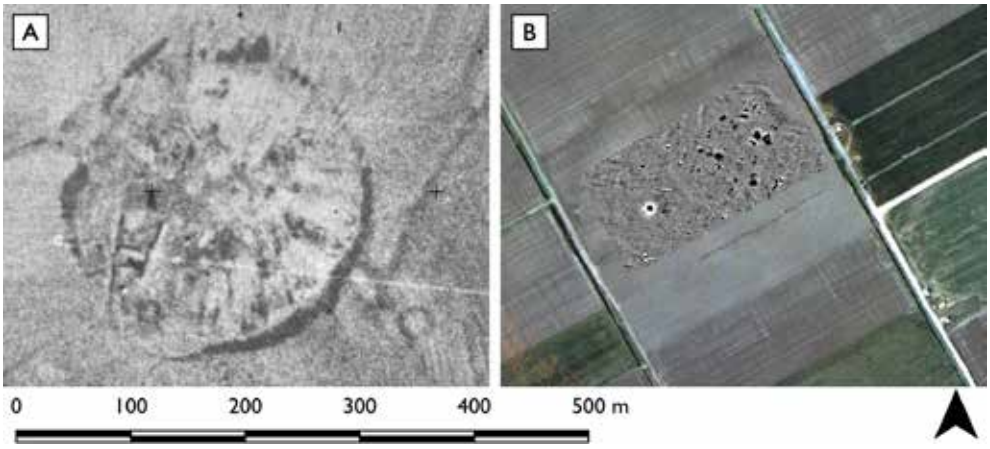


Fig. 23. Magoula Yianiki. A: Luftwaffe aerial photograph, c. *1943. B: Gradiometric survey (black = high nT, white = low nT) on present-day aerial photograph. Both views show the same spatial extent. Geophysical plot by D. Pitman. Aerial photographs courtesy of Ktimatologio AS.*

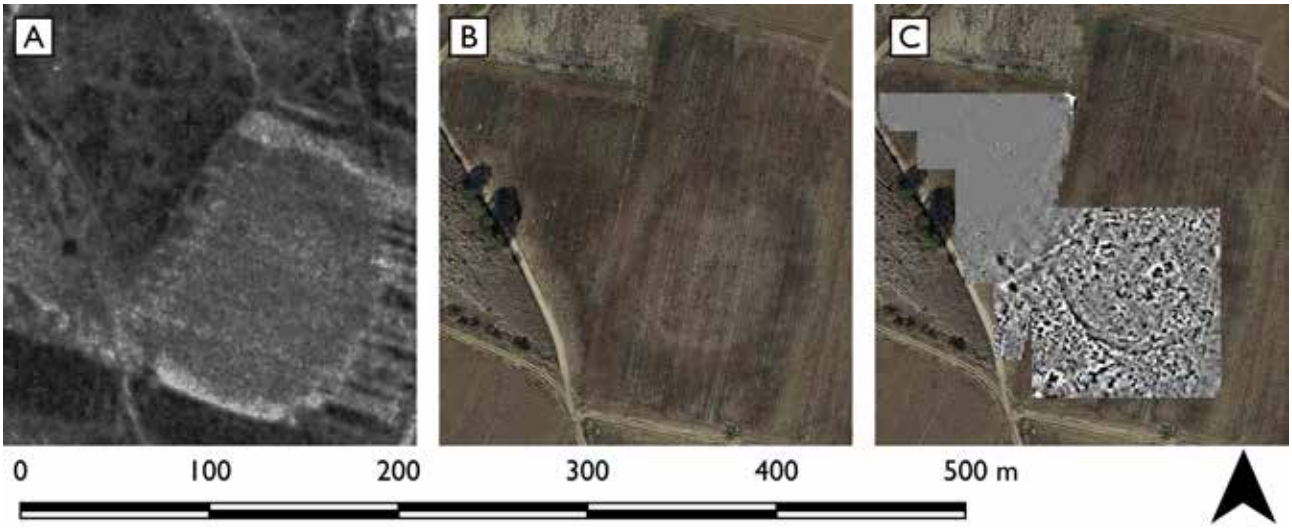


Fig. 24. Petromagoula. A: RAF aerial photograph, c. *1943, crop-mark. Courtesy of the British School at Athens. B: Present-day aerial photograph, soil mark. C: Gradiometric plot (black = high nT, white = low nT) on present-day aerial photograph. Geophysical plot by D. Pitman.*

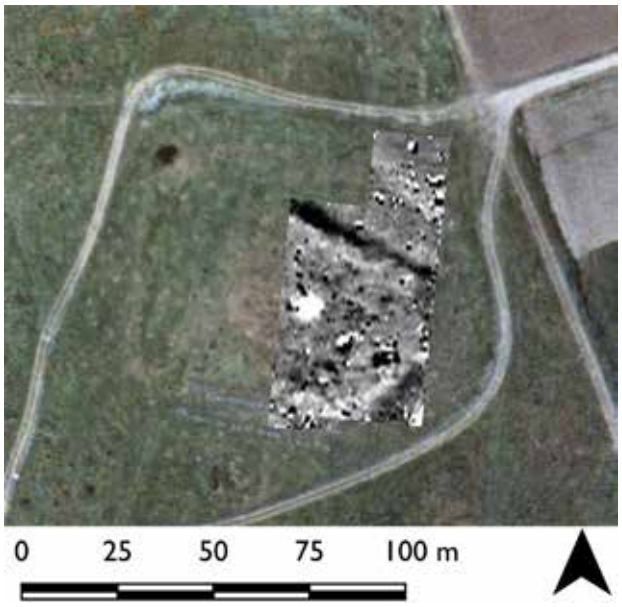


Fig. 25. Magoula Markou 1. Gradiometric plot (black = high nT, white = low nT) on top of aerial photograph. Plot by D. Pitman. Aerial photograph courtesy of Ktimatologio AS.

a low *magoula* (*Fig. 1*, E),[54] *c.* 120 m in diameter, barely visible from the ground but presenting a strong crop- and soil mark in aerial photographs (*Fig. 24*, A and B respectively). Notably, the extent of the site, as seen in the RAF 1940's aerial photograph (*Fig. 24*, A), is larger than the feature visible in the present-day aerial photographs (*Fig. 24*, B). This suggests that the extent of the mound was perhaps better preserved in the 1940s and was less affected by agriculture. It is clear that the site has been extensively ploughed since, and the soil mark visible in present-day aerial photographs perhaps represents an internal division.

The latter hypothesis is supported by gradiometry (*Fig. 24*, C), which shows a clear curvilinear feature that shares some alignment with the crop-mark. The gradiometry results also contains a significant number of discrete anomalies. Both rectangular, house-like structures and possible pits are visible. It is notable that these are largely restricted to the east of the surveyed area, with a clear north-east–south-west boundary delimitating the area of heightened activity. However, the structures are not impacted by the curvilinear feature, thus supporting its interpretation as an internal boundary. In terms of use, the site has a much denser scale of visible activity than the other sites surveyed. This includes the house structures, but there are also low magnetic linear structures that may indicate the presence of later foundations (see interpretation below). There are two such structures at the centre of the mound with a larger cluster to the south of the linear feature.

MAGOULA MARKOU 1

Magoula Markou 1[55] is situated at the right bank of the former course of the Onochonos/Sofadhitis river, which since the mid-20th century has its main course in a man-made canal further to the east. It is of considerably smaller size than the larger Magoula Markou 2, which is found within the adjoining village of Markos, and which has produced pottery of mainly Late Bronze Age date.

The most visible feature in the gradiometry plot (*Fig. 25*) is a linear feature that runs across the mound in a broadly north-west–south-east alignment. This is likely unrelated to the mound due to its scale and orientation. Another modern feature is the rectangular area of low magnetism on the centre of the mound which is the remains of modern activity. Overall, the data includes a fair amount of magnetic disturbance, yet there are some features that may be indicative of occupation. As with the other *magoules* surveyed, there are features that could be interpreted as house structures, although they are less clear than in the other examples. There is no surface material discernible at the *magoula* itself, but the fields immediately to the east and north of the mound contain abundant Classical-Hellenistic pottery.

The preliminary interpretative plots for each of the surveyed *magoules* reveal several features observed at similar sites (*Fig. 26*). Features have been classified broadly as it is intended to show the spatial patterning of activity, rather than explicitly mapping specific feature classes. However, it is clear from the plots that the activities visible in the gradiometric data contain some similarities in overall response, but variation in intensity and distribution. Magoula Yaniki, Ayios Dhimitrios, and Magoula Markou 1 all have structures that could be indicative of occupation, but they are fairly sparse and randomly distributed (although there are hints of a circular layout at Ayios Dhimitrios). In contrast, Petromagoula has significant and convincing evidence for the dense distribution of house-like structures with some spatial patterning around a road/terrace feature. There is clear differentiation between the mound and surrounding area in terms of intensity of activity.

While preliminary, it is worth noting that the absence of identifiable structures is not necessarily indicative of an absence of structures. Houses made from clay and mud-brick may be invisible to gradiometry unless they are heavily used

[54] Co-ordinates (GGRS87): 331545, 4377420.

[55] Co-ordinates (GGRS87): 331826, 4366244.

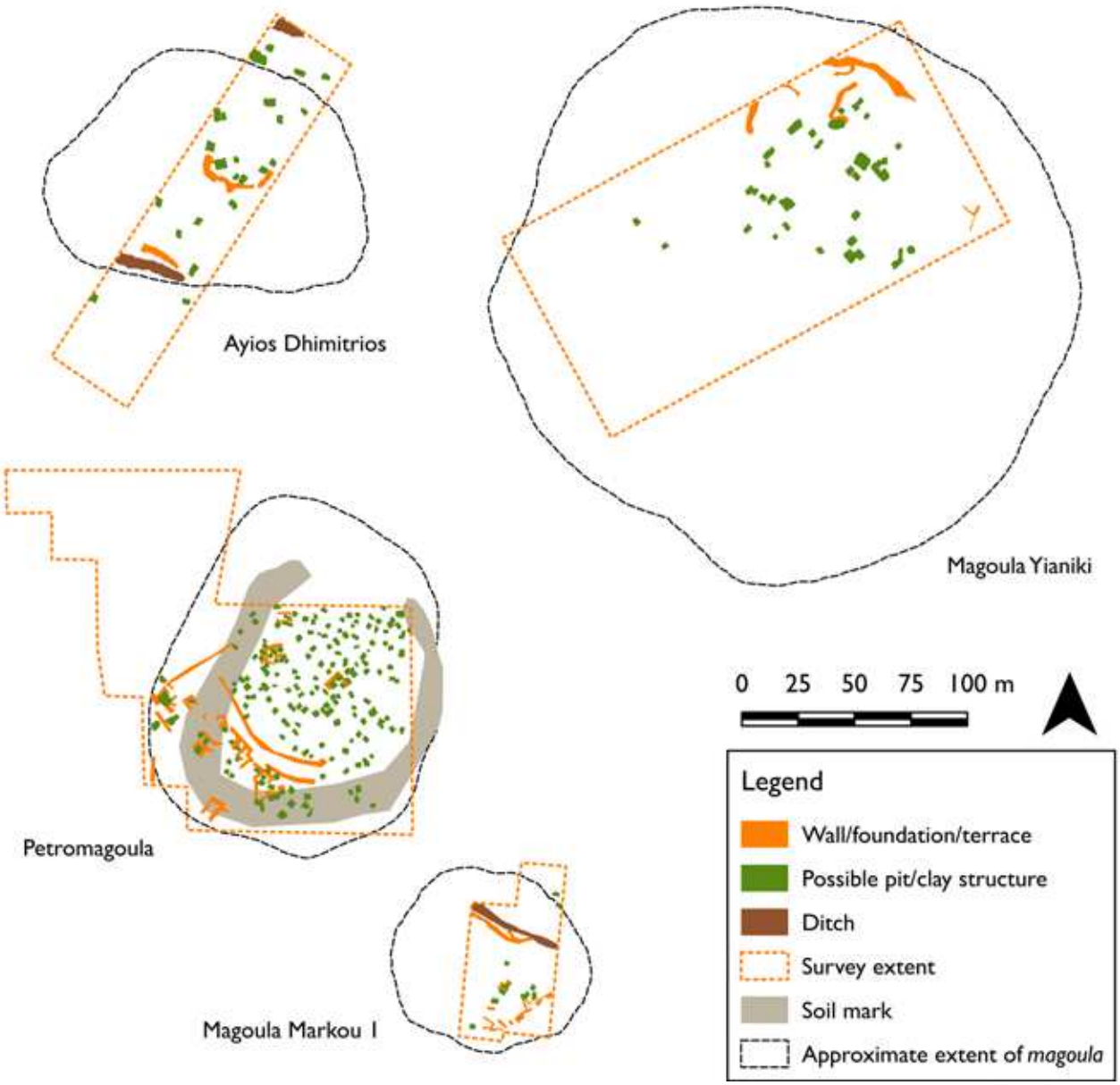


Fig. 26. Comparative interpretation of the four magoules *showing the distribution of key anomaly types within the survey areas, overlain on an estimated extent drawn from historic aerial photography. Interpretations by D. Pitman.*

and/or have been exposed to heat. The variation between Petromagoula and the other surveyed sites could be related to variation in the mode of occupation and post-occupation use, rather than variations in settlement density.

Concluding remarks

The 2022 season of PAP proved very productive, and the substantial wealth of archaeological results cannot be covered in complete detail in this present report.[56] The chronological, spatial and typological extent of settlement activity at the surveyed and excavated sites continue to grow, adding burials to the categories of remains examined by the project. The hitherto little-known Early Byzantine settlement at Kourtiki-

[56] After the completion of the ongoing project, the team aims to publish the results from Palamas as an edited volume in the series *Acta Instituti Atheniensis Regni Sueciae*.

ano Vouno has proven to have been far more substantial than previously assumed, being revealed as one of the larger fortified settlements in the region. The ceramic material on top of the same hill, however, caused surprise in being mainly much older than the fortified settlement phase of the Early Byzantine period, and the sheer number of sherds contrasts starkly with the near-sterile hilltop of neighbouring Strongilovouni. The geophysical prospection at the *magoules* began to reveal a situation similar to that previously noted in eastern Thessaly, but much work remains to be done before a more complete picture of these sites can be acquired.

In the seasons to come, the project aims at continuing the excavations in the Patoma area at Vlochos, as well as widening the ground resistivity survey in the area, aiming for a complete coverage of the ancient urban settlement. Geophysical prospection will be resumed at the *magoules* of the area, to include further sites not surveyed during previous seasons. The surveys atop the Kourtikiano hill will also continue, with the aim of a complete fieldwalking survey of all the intramural spaces on the hilltop and its slopes. The multi-method and multi-site work of PAP continues to showcase both the productivity of the methods employed, as well as the richness of the archaeology of Western Thessaly.

MARIA VAÏOPOULOU
Ephorate of Antiquities
of Karditsa
Loukianou 1
431 00 Karditsa, Greece
mvaiopoulou@culture.gr

ROBIN RÖNNLUND
Wenner-Gren fellow
Department of History, Archaeology, and Social Anthropology
University of Thessaly, Greece

Swedish Institute at Athens
Mitseon 9
117 42 Athens, Greece
robin.ronnlund@sia.gr

FOTINI TSIOUKA, Ephorate of Antiquities of Karditsa, Greece
JOHAN KLANGE, Halland Museum of Cultural History, Sweden
DEREK PITMAN, Bournemouth University, United Kingdom
RICH POTTER, University of Gothenburg, Sweden
IAN RANDALL, University of British Columbia, Canada
HARRY MANLEY, Bournemouth University, United Kingdom
ELISABET SCHAGER, National History Museums of Sweden
SOTIRIA DANDOU. Independent scholar, Greece
LEWIS WEBB, University of Oxford, United Kingdom
& University of Gothenburg, Sweden

Bibliography

Bennett, R., K. Welham, R.A. Hill & A. Ford 2013. 'Airborne spectral imagery for archaeological prospection in grassland environments. An evaluation of performance', *Antiquity* 87:335, 220–236. https://doi.org/10.1017/S0003598X00048730

Biesantz, H. 1965. *Die thessalischen Grabreliefs. Studien zur nordgriechischen Kunst*, Mainz am Rhein.

Borić, D., B. Hanks, D. Šljivar, M. Kočić, J. Bulatović, S. Griffiths, R. Doonan & D. Jacanović 2018. 'Enclosing the Neolithic world. A Vinča culture enclosed and fortified settlement in the Balkans', *CurrAnthr* 59, 336–346. https://doi.org/10.1086/697534

Dandos, Ch.E. 1999. 'Η αρχαία πόλις το Λιμναίον', in *Πρακτικά Α' ιστορικού συνεδρίου Παλαμά, 23 Ιουλίου 1994* vol. 1, ed. L. Detziortzio, Palamas & Trikala, 195–216.

Decourt, J.-C. 1990. *La vallée de l'Énipeus en Thessalie. Études de topographie et de géographie antique* (BCH Suppl., 21), Paris.

Fachard, S., S. Murray, A. Knodell & K. Papangeli 2020. 'The fortress of Eleutherai. New insights from survey, architecture, and epigraphy', *Hesperia* 89, 475–549. https://doi.org/10.2972/hesperia.89.3.0475

Fossey, J. 1986. 'Répartition de la céramique en surface du site', in *Khóstia 1983. Rapport préliminaire sur la seconde campagne de fouilles canadiennes à Khóstia en Béotie, Gréce centrale*, eds. J. Fossey & J. Morin, Amsterdam, 43–63.

Gregory, T. & P. Kardulas 1990. 'Geophysical and surface surveys in the Byzantine fortress at Isthmia 1985–1986', *Hesperia* 59, 467–511. https://doi.org/10.2307/148299

Hamilakis, Y., N. Kyparissa-Apostolika, T. Loughlin, T. Carter, J. Cole, G. Facorellis, S. Katsarou, A. Kaznesi, A. Pentedeka, V. Tsamis & N. Zorzin 2017. 'Koutroulou Magoula in Fthiotida, Central Greece. A Middle Neolithic tell site in context', in *Communities, landscapes, and interaction in Neolithic Greece*, eds. A. Sarris, E. Kalogiropoulou, T. Kalaycı & L. Karimali, Ann Arbor, Michigan, 81–96. https://doi.org/10.2307/j.ctvw049k3.12

Hatziangelakis, L. 1993 (pr. 1998). 'Ανασκαφικές εργασίες. Νομός Καρδίτσας. Ερμήτσι', *ADelt* 48 *Chron*. B'1, 244–245.

Hill, A.C., E.J. Laugier & J. Casana 2020. 'Archaeological remote sensing using multi-temporal, drone-acquired thermal and Near Infrared (NIR) imagery. A case study at the Enfield Shaker Village, New Hampshire', *Remote Sensing* 12:4, 690, 21 pp. https://doi.org/10.3390/rs12040690

Karapanou, S. & S. Katakouta 2000. 'Ταφικά αγγεία με επιθέτους πλαστικούς κίονες από τη Βορειοδυτική Θεσσαλία', in *Ελληνιστική κεραμική από τη Θεσσαλία*, ed. E. Kypraiou, Volos, 157–167.

Katakouta, S. & G. Toufexis 1994. 'Τα τείχη της Φαρσάλου', in *Θεσσαλία. Δεκαπέντε χρόνια αρχαιολογικής έρευνας, 1975–1990, αποτελέσματα και προοπτικές. Πρακτικά διεθνούς συνεδρίου, Λυών 17–22 Απριλίου 1990*, eds. J.-C. Decourt, B. Helly & K. Gallis, Athens, 189–200.

Kayapınar, L. & K. Spanos 2016. 'Οι οικισμοί της Καρδίτσας στο Οθωμανικό απογραφικό κατάστιχο 105 (1521)', *Thessaliko Imerologio* 70, 273–306.

Lawrence, A.W. 1979. *Greek aims in fortification*, Oxford.

Moriarty, C., D.C. Cowley, T. Wade & C.J. Nichol 2019. 'Deploying multispectral remote sensing for multitemporal analysis of archaeological crop stress at Ravenshall, Fife, Scotland', *Archaeological Prospection* 26:1, 33–46. https://doi.org/10.1002/arp.1721

Nikolaou, E. & A. Firfiris 1999. 'Από τους Νεολιθικούς οικισμούς της δυτικής Θεσσαλικής πεδιάδας', in *Πρακτικά Α' ιστορικού συνεδρίου Παλαμά, 23 Ιουλίου 1994* vol. 1, ed. L. Detziortzio, Palamas & Trikala, 53–105.

Potter, R., D. Pitman, H. Manley & R. Rönnlund 2023. 'Cost-effective, rapid decorrelation stretching and responsive UAS mapping as a method of detecting archaeological sites and features', *Heritage Science* 11:89, 12 pp. https://doi.org/10.1186/s40494-023-00931-6

Poulou-Papadimitriou, N., E. Tzavella & J. Ott 2012. 'Burial practices in Byzantine Greece. Archaeological evidence and methodological problems for its interpretation', in *Rome, Constantinople and newly-converted Europe. Archaeological and historical evidence* vol. 1, eds. L. Salamon, M. Wołoszyn, A. Musin & P. Špehar, Kraków, Leipzig, Rzeszlów & Warsaw, 377–428.

Sarris, A., T. Kalaycı, F.-X. Simon, J. Donati, C. Cuenca-García, M. Manataki, G. Cantoro, I. Moffat, E. Kalogiropoulou, G. Karampatsou, K. Armstrong, N. Argyriou, S. Dederix, C. Manzetti, N. Nikas, K. Vouzaxakis, V. Rondiri, P. Arachoviti, K. Almatzi, D. Efstathiou & E. Stamelou 2017. 'Opening a new frontier in the Neolithic settlement patterns of eastern Thessaly, Greece', in *Communities, landscapes, and interaction in Neolithic Greece*, eds. A. Sarris, E. Kalogiropoulou, T. Kalaycı & L. Karimali, Ann Arbor, Michigan, 27–48. https://doi.org/10.2307/j.ctvw049k3.9

Schulz Paulsson, B., C. Isendahl & F. Frykman Markurth 2019. 'Elk heads at sea. Maritime hunters and long-distance boat journeys in Late Stone Age Fennoscandia', *OJA* 38, 398–419. https://doi.org/10.1111/ojoa.12180

Theogianni, L. 2011 (pr. 2016). 'Έργο «Κατασκευή αυτοκινητοδρόμου Κεντρικής Ελλάδας Ε 65»', *ADelt* 66 *Chron*. B'1, 600–605.

Vaïopoulou, M., H. Whittaker, R. Rönnlund, F. Tsiouka, J. Klange, D. Pitman, R. Potter, L. Shaw, J. Hagan, E. Siljedahl, M. Forssén, S. Chandrasekaran, S. Dandou, V. Forsblom Ljungdahl, A. Pavilonytė, H. Scott-Pratt, E. Schager & H. Manley 2020. 'The 2016–2018 Greek–Swedish archaeological project at Thessalian Vlochos, Greece', *OpAthRom* 13, 7–72. https://doi.org/10.30549/opathrom-13-02

Vaïopoulou, M., R. Rönnlund, F. Tsiouka, D. Pitman, R. Potter, S. Dandou & J. Klange 2021. 'Some preliminary notes on the limited 2020 campaign of the Palamas Archaeological Project (PAP)', *OpAthRom* 14, 55–63. https://doi.org/10.30549/opathrom-14-04

Vaïopoulou, M., R. Rönnlund, F. Tsiouka, J. Klange, D. Pitman, S. Dandou, R. Potter, L. Shaw, L. Webb, S. Ieremias, I. Randall & H. Manley 2022. 'Roman and Early Byzantine evidence from the area of Palamas. A preliminary report of the ongoing Greek–Swedish archaeological work in the region of Karditsa, Thessaly', *OpAthRom* 15, 77–103. https://doi.org/10.30549/opathrom-15-02

Verhoeven, G.J. 2012. 'Near-Infrared aerial crop mark archaeology. From its historical use to current digital implementations', *Journal of Archaeological Method and Theory* 19, 132–160. https://doi.org/10.1007/s10816-011-9104-5

Wilson, D.R. 2000. *Air photo interpretation for archaeologists*, Stroud.

Winter, F.E. 1971. *Greek fortifications* (Phoenix Supplementary Volume, 9), Toronto & Buffalo.