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## FIELD RESEARCH AT TŪWĀNEH AND DA'JĀNIYA, SOUTH JORDAN: SEASON 2022

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**ABSTRACT:** This report summarises the results of field research conducted in October 2022 as part of the ArTu-DTu – The Archaeological Study of Da'jāniya & Tūwāneh, South Jordan project. The project focused on the sites of Tūwāneh and Da'jāniya, where a research team from the Jagiellonian University and AGH University of Kraków conducted excavations, geophysical surveys and analysis of looting damage. In Tūwāneh, excavations were carried out in the bath complex, documenting the architectural remains and stratigraphy associated with the site's use and abandonment. Additionally, geophysical prospection was performed in selected areas adjacent to the so-called “caravanserai”, uncovering subsurface structures potentially linked to the complex. The team also systematically recorded Arabic graffiti on the walls of the caravanserai, preserving contemporary marks of local cultural heritage. In Da'jāniya, geophysical surveys aimed to locate remnants of a vicus surrounding the Roman fort, potentially shedding light on civilian settlement patterns near military installations. The report provides insights into the stratigraphy, architectural elements and temporal analysis of looting activity at

the site, contributing valuable data on settlement dynamics and heritage conservation challenges in the region.

**KEYWORDS:** archaeological survey, cultural heritage preservation, geophysical prospection, limes arabicus, roman archaeology

## Introduction

In October 2022, following a two-year hiatus (due to the COVID-19 pandemic), work resumed on the ArTu-DTu – The Archaeological Study of Da’jāniya & Tūwāneh, South Jordan project (Pl. 1: 1). The project, which began in 2018 (Bodzek *et al.* 2019a; Bodzek *et al.* 2019b), continued in 2019 on the Nabatean-Roman-Byzantine site at Tūwāneh (ar. *توانه*)<sup>1</sup> (Bodzek *et al.* 2022) – though no fieldwork was conducted in Roman-Byzantine *castellum* in Da’jāniya (ar. *الدعجانية*)<sup>2</sup> during that year.

The 2022 survey was conducted over seven days (25<sup>th</sup>-31<sup>st</sup> October). The research team comprised archaeologists and archaeology students from the JU Institute of Archaeology: J. Bodzek (expedition director), K. Kopij, Ł. Misk, G. Sochacki, K. Bator and M. Krupa, alongside archaeologist Nikola Babucic from the University of Hamburg, as well as surveyors and doctoral candidates in surveying from the Faculty of Geo-Data Science, Geodesy and Environmental Engineering at AGH University in Kraków: P. Ćwiakała, E. Puniach and K. Strzabała. The 2022 field season at Tūwāneh expanded upon previous investigations, including the excavation of trial trenches within the bath complex and the documentation of looting pits. Furthermore, geophysical prospection was conducted in four areas adjacent to the so-called “caravanserai”. The team also documented Arabic graffiti preserved on the walls of this monumental structure.

<sup>1</sup> Also at-Tuwāna, et/at-Twāne, eth-Thuwāneh, Khirbat at-Tuwanah; MEGA-Jo Number 9824; JADIS 2101004. GPS coordinates: 30.7494, 35.7242.

<sup>2</sup> MEGA-Jo Number 5983; JADIS 2299003. GPS coordinates: 30.55209, 35.7616.

## Tūwāneh

### Trial trench TTIV (Pl. 1: 2, 2: 1-3)

The trench was established within the ancient bath complex to the northeast of Trial Trench TTIII, directly adjacent to it. The primary objective was to locate the northeastern wall of Room R.3 (Pl. 1: 2, 2: 1), which was hypothesised to serve as the northeastern boundary of the entire bathhouse.

The excavation revealed both the northeastern wall of Room R.3 and undisturbed archaeological layers associated with the occupation and abandonment phases of the baths and their immediate vicinity. The excavation followed the stratigraphic method (Harris 1989), documenting eleven distinct stratigraphic units (Table 1).

The initial phase involved removing a surface layer approximately 10 cm thick, which exposed the crown of wall W.8. The wall destruction layer was designated as context k.150. Six distinct layers were identified northeast of wall W.8 (Pl. 2: 2). The uppermost layer – k.151 – consisted predominantly of grey soil. This layer, formed through fluvial deposition, represents a combination of architectural collapse and accumulated non-anthropogenic material resulting from slope erosion processes. Below this lay k.153, which shared the same coloration as k.151 but exhibited increasing compaction with depth. During excavation, a concentration of stones was identified in the southwestern portion of this context, interpreted as backfill from the collapse of wall W.8.

Beneath these deposits lay a compacted, hard light brown soil layer (k.154), interpreted as the original occupation surface contemporary with the bathhouse's use. This was underlain by k.156, comprising firm light brown soil with a high sand content. The compacted nature of this deposit suggests it may represent the surface of a street or pathway external to the bathhouse. The layer's character altered notably adjacent to the northeastern face of wall W.8, where a higher concentration of stones was documented. K.157 was subsequently identified in this area.

At this point, excavation was restricted to a 75 cm-wide trench immediately adjacent to the northeastern face of wall W.8. Further exploration (k.157 and k.159) revealed a deposit of mostly unworked stones within a grey sand matrix. The stones were irregularly shaped, ranging in size from approximately 10 x 10 cm to 25 x 25 cm. This layer was interpreted as foundation trench fill for

wall W.8, although this interpretation remains provisional due to the limited excavation area. Excavation terminated at 125 cm below the surface (Pl. 2: 2-3).

**Table 1:** List of Trial Trench TTIV contexts explored in 2022

k.150	<b>DESCRIPTION</b>	A layer of the destruction of the wall W.8.
	<b>INTERPRETATION</b>	A layer of the destruction of the wall W.8.
	<b>DATING</b>	Late antique-Islamic?
k.151	<b>DESCRIPTION</b>	Grey soil to the N of the wall W.8.
	<b>INTERPRETATION</b>	Fluvial accumulation. A layer of bath destruction mixed with a non-anthropogenic layer associated with processes of slope erosion.
	<b>DATING</b>	Late antique/Islamic-20 <sup>th</sup> /21 <sup>st</sup> century.
k.152	<b>DESCRIPTION</b>	Grey soil with white mortar, small stones particularly visible in the E part of the context. In the bottom part of the context, more stones. Exploration in the western part of the context revealed larger stones.
	<b>INTERPRETATION</b>	Fluvial accumulation. A layer of bath destruction mixed with a non-anthropogenic layer associated with processes of slope erosion.
	<b>DATING</b>	Late antique/Islamic-20 <sup>th</sup> /21 <sup>st</sup> century.
k.153	<b>DESCRIPTION</b>	Grey soil to the N of the wall W.8. In colour, the context is identical to that of k.151, but the layer became harder as the exploration progressed. The exploration revealed a cluster of stones in the south-western part of the context.
	<b>INTERPRETATION</b>	Backfill resulting from the destruction of the wall W.8.
	<b>DATING</b>	Late antique/Islamic-modern?
k.154	<b>DESCRIPTION</b>	Light brown soil, very compact and hard.
	<b>INTERPRETATION</b>	Original utility level when the bathhouse was in operation? Perhaps identical with k.156.
	<b>DATING</b>	Late antique?

k.155	<b>DESCRIPTION</b>	Light brown soil, very loose, consisting mainly of gravel and sand. Shortly after exploration began, fragments of the hypocaustic pillars began to appear. Remnants of plaster were noted on the south façade of the wall W.8 in the bottom part of the context.
	<b>INTERPRETATION</b>	Level of destruction of the floor of the room.
	<b>DATING</b>	Late antique-Islamic?
k.156	<b>DESCRIPTION</b>	Light brown soil, rather hard, consisting mainly of sand. Just at the N face of the wall W.8, the layer was much lower in thickness and there were also stones in it.
	<b>INTERPRETATION</b>	The layer of compacted soil suggests that this may be the utility level of the street or walkway outside the bathhouse – perhaps identical, with k.154.
	<b>DATING</b>	Late antique-Islamic?
k.157	<b>DESCRIPTION</b>	Layer of stones with grey sand, rather unworked, size between about 10 x 10 cm to 25 x 25 cm, irregular shape.
	<b>INTERPRETATION</b>	Given that only the area adjacent to the wall was explored with a smaller trench approximately 75 cm wide from the face of the wall, it is unclear whether this layer is the remains of the foundation for the bathhouse wall or whether a similar in-kind layer is also to be found under k.156 in the remainder of the trench.
	<b>DATING</b>	Late Roman?
k.158	<b>DESCRIPTION</b>	A layer of loose light brownish-yellow sand between the remains of the hypocaustic system.
	<b>INTERPRETATION</b>	Level of destruction of the floor of bathhouse Room R.3.
	<b>DATING</b>	Late antique-Islamic?

k.159	<b>DESCRIPTION</b>	Layer of stones with grey sand, rather unworked, size between about 10 x 10 cm to 25 x 25 cm, irregular shape similar or identical to k.157.
	<b>INTERPRETATION</b>	Given that only the area adjacent to the wall was explored with a smaller trench approximately 75 cm wide from the face of the wall, it is unclear whether this layer is the remains of the foundation for the bathhouse wall or whether a similar in-kind layer is also to be found under k.156 in the remainder of the trench.
	<b>DATING</b>	Late antique-Islamic?
k.160	<b>DESCRIPTION</b>	Cut of foundation trench.
	<b>INTERPRETATION</b>	Cut of foundation trench.
	<b>DATING</b>	Roman (Late Roman?).

Four stratigraphic layers were excavated southwest of wall W.8 (within Room R.3) (Pl. 2: 3). The uppermost layer (k.152) consisted of grey soil mixed with white mortar. Small stones were particularly concentrated in the eastern section of the context, with a higher density observed in its lower portion. The western part of the layer revealed larger stones. This context was interpreted as a fluvial accumulation – a layer of bath destruction debris mixed with non-anthropogenic deposits associated with slope erosion processes.

The subsequent layer (k.155) comprised very loose, light brown sand mixed with pebbles and cobbles. During the initial stages of excavation, fragments of hypocaustic *pilae* emerged. Plaster remnants were observed on the southern façade of wall W.8 in the bottom portion of the layer. This layer was interpreted as the destruction level of the *suspensura* of Room R.3's floor.

Beneath this lay a layer (k.158) of loose light brownish-yellow sand interspersed between the remains of the hypocaust system. The hypocaust remains themselves were designated FL.3, consisting of *pilae* remains and fragments of broken floor plates. Upon completion of the excavation, the trial trench was backfilled.

Wall W.8, approximately 120 cm thick, was constructed of stone blocks bonded with white mortar (Pl. 2: 2). The wall exhibited a characteristic three-part construction: two faces composed of well-dressed large stone blocks with an intermediate core of smaller stones and mortar. The masonry components displayed varying degrees of finishing, with regularly hewn stones of

diverse dimensions. The five largest blocks measured 50 × 50 × 30 cm and 30 × 30 × 35 cm, while approximately 12 smaller blocks measured about 20-25 × 10 cm. These smaller blocks were roughly hewn and squared, showing irregular finishing.

Plaster remnants were preserved on the southwestern façade of wall W.8 within the lower portion of context k.155. The wall has been interpreted as the northeastern boundary wall of both Room R.3 and the bathhouse complex.

Table 2: List of Trial Trench TTIV structures explored in 2022

W.8	DESCRIPTION	A stone wall in the S part of the trench. Masonry approx. 120 cm thick. Stones of various sizes. Five large ones measuring 50 x 50 x 30 cm, 30 x 30 x 35 cm, a dozen smaller ones about 20-25 x 10 cm. Roughly hewn, squared, not very regular. Stones bonded with white mortar. The faces of the wall made are of larger stone blocks and the space between them is filled with smaller ones.
	INTERPRETATION	NE wall of the bathhouse.
	DATING	Roman (Late Roman?).
FL.3	DESCRIPTION	Remains of <i>pilae</i> of the hypocaustic system, fragments of broken floorboards.
	INTERPRETATION	Remains of floor suspension of the hypocaustic system in Room R.3.
	DATING	Roman (Late Roman?).

During the excavation, various archaeological materials were recovered, including ceramic vessel fragments (n=128<sup>3</sup>) (see Table 3) construction and building materials (CBM), glass fragments (n=4), faunal remains (n=19) and a single piece of worked flint (n=1).

Table 3: Quantitative information on pottery fragments recorded in Trial Trench TTIV

Context	Pottery	Glass	Bones	Flints
150	32	0	3	0
151	7	1	0	0

<sup>3</sup> Only diagnostic sherds were included in the count.

Context	Pottery	Glass	Bones	Flints
152	32	1	0	0
153	28	1	8	0
154	4	0	0	0
155	9	1	0	0
156	6	0	6	1
157	1	0	0	0
158	3	0	2	0
159	6	0	0	0

### Recording of robbery pits

During the 2022 field season, a second research objective focused on systematically documenting looting pits across the site using RTK GNSS technology for spatial mapping and recording. Each pit was photographically documented, resulting in a total of 634 recorded features (Pl. 3). Since 2018, a cumulative total of 723 looting pits has been recorded. The field measurements, combined with orthomosaic imagery generated by the project and archival satellite imagery, provided the foundation for a temporal analysis of looting activities at the site between 2013 and 2022 (Kopij *et al.* 2024).

The survey identified concentrations of construction and building materials (CBM) characteristic of Roman bath architecture in the site’s central sector. The presence of associated architectural remains suggests the possible existence of a second bathhouse complex, provisionally designated as the “Upper Baths” (Pl. 4: 1-2). The recorded architectural material comprises 237 brick fragments, 82 *tubuli* fragments (including 47 diagnostic specimens), 10 *pilae* fragments and 30 floor tiles (both complete examples and fragments).

Ceramic material was collected from 20 illicit excavation pits and their associated waste piles in the southern and western sectors of the site. The assemblage comprises 130 pottery sherds (Table 4).



**Table 4:** Quantitative information on pottery fragments recorded in looting pits

LP ID	Quantity
LP.19/051	41
LP.19/052	29
LP.19/053	14
LP.19/060	6
LP.19/058	7
LP.19/075	4
LP.19/068	24
LP.19/057	22
LP.19/059	11
LP.19/069	28
LP.19/055	13
LP.22/099	57
LP.19/165	25
LP.19/164	15
LP.19/168	8
LP.19/150	8
LP.19/171	6
LP.19/166	7
LP.19/151	15
LP.19/169	71

### Registration of graffiti on the walls of the “caravanserai”

The next research objective of the 2022 field season focused on documenting modern Arabic graffiti preserved on the walls of the so-called “caravanserai”.

A total of 101 inscriptions were recorded. Each inscription was photographically documented and spatially referenced to enable precise positioning within the architectural framework of the structure (cf. Pl. 5: 1). A more detailed examination of the graffiti will be presented in a separate text.

## Geophysics

The fourth research objective of the 2022 field seasons involved conducting geophysical prospection in the eastern sector of the site, encompassing areas adjacent to and southwest of the so-called “caravanserai”. Magnetic mapping was chosen as the method to identify possible building remains on the uppermost level of the eastern settlement mound. This area is particularly interesting because ancient settlement structures have been built over by medieval and, in some cases, modern structures. Additionally, graves in the northern part of the area have been identified but were systematically destroyed by looting pits. A 5-channel fluxgate gradiometer system from Sensys, equipped with an odometer for distance correction, was used. The survey was implemented across four discrete zones, covering a total area of 7,150 square metres.

The weather conditions were good – dry and sunny with a steady wind. In total, four individual areas, A-D, were surveyed (Pl. 5: 2, 6: 1). Since we only had one day to conduct the survey, we focused on areas that covered as much of the terrace as possible and were accessible for walking. The area had many small- to medium-sized surface disturbances (debris and trash), which made surveying challenging.

The northernmost grid, Area A (35 x 21 m), is located in an area that may represent a necropolis, with several metre-long holes marking looting pits. The magnetic map shows unusually strong anomalies (+/- 200 to +/- 750 nT), which are typically attributed to modern disturbances (pipes, concrete). However, as there is no documented evidence of modern constructions of this type, the signatures may be associated with other strongly magnetised materials. The shape and orientation of the linear signatures along the visible surface architecture in the northwest could indicate potential massive wall remains. The northern architectural element is over 20 metres long and turns at a right angle south-eastward, extending beyond the measurement field. The southern feature resembles a rectangular foundation with side lengths of about 13 x 13 m. Archaeological investigation is recommended to determine the material causing these strong deflections.

Area B (50 x 51 m) was situated within a platform most probably associated with a nomadic encampment. The area contained scattered fist-sized rocks,

some accumulated in piles, isolated modern debris and sparse vegetation. The geophysical survey proved challenging due to continuous jolting and axis misalignment of the sensor carrier, which manifested as slight line drifts in the magnetic map. The investigation yielded minimal findings; apart from two exceptionally strong dipole anomalies ( $\pm 700$  and  $\pm 1,000$  nT), indicating the presence of substantial metallic objects, the area was largely featureless.

Areas C ( $1,800 \text{ m}^2$ ) and D ( $26 \times 80 \text{ m}$ ), situated at the southern end of the terrace, partially overlap. Area C exhibits strong, large-scale magnetic anomalies. Several of these anomalies are attributable to shallow metallic objects, identifiable as distinct dipole anomalies ( $\pm 800$  to  $\pm 1,500$  nT). Two larger anomalies display characteristics consistent with potential (lime) kilns, based on their circular morphology, dimensions (approximately 6.5 m in diameter) and magnetic signatures ( $\pm 150$  to  $\pm 400$  nT).

The primary feature in Area D contrasts markedly with anomalies observed elsewhere, both in its morphology and magnetic signature. While numerous small dipole anomalies are dispersed throughout the area, a prominent feature with negative magnetisation ( $-75$  to  $-270$  nT) is particularly noteworthy. This feature presents a semi-circular ground plan with a linear edge extending approximately 25 metres. The negative magnetic susceptibility may be attributed to substantial foundations constructed of limestone or sandstone, materials commonly employed in local architectural practices.

The comprehensive interpretation of these areas presents significant challenges due to current site conditions, including extensive debris accumulation, modern anthropogenic disturbances and surface refuse. The complex stratigraphic sequence and architectural development of the site further complicate the analysis. Nevertheless, several substantial structures are discernible in the magnetic data, indicating potentially significant archaeological features. These identified features exhibit considerable variation in their morphology, dimensions and magnetic signatures (Pl. 6: 1).

## **Da'jāniya**

The 2022 geophysical survey was conducted over two days (26<sup>th</sup>-27<sup>th</sup> October). The project team comprised archaeologists and archaeology students from the Jagiellonian University Institute of Archaeology (Ł. Miszk and M. Krupa), an archaeologist from the University of Hamburg (N. Babucic) and surveyors from

the AGH University of Kraków's Faculty of Geo-Data Science, Geodesy and Environmental Engineering (P. Ćwiakała and K. Strzabala).

The primary research objective of the 2022 field season was to investigate the hypothesised existence of a *vicus* – civilian settlement structures surrounding the fort. To evaluate this hypothesis, geophysical prospection was conducted in the fort's immediate vicinity. The fort at Da'janiya represents one of the largest Roman military installations established during the reorganisation of the Empire's eastern frontier under Emperor Diocletian. Its strategic position adjacent to a water source suggests the probable development of extramural settlement. To date, only two such structural foundations have been documented (Brünnow and von Domaszewski 1905, 13; Godwin 2006, 276-277; Rucker 2007, 13-16). Current understanding of Roman military installations suggests the likelihood of additional structures in this area.

The archaeological remains surrounding the fort face ongoing threats from agricultural expansion, temporary Bedouin encampments established adjacent to the ancient structures and associated earthmoving activities, as observed during the 2019 and 2022 field seasons.

## Methods

The magnetic mapping was chosen as the method to detect potential remnants of structures in the vicinity of the camp. Opting for the magnetic approach facilitates swift and comprehensive surveying of expansive areas through measurements.

## Results

Geophysical prospection was implemented in the immediate vicinity of the fort, encompassing an area of approximately 2.9 hectares (Pl. 6: 2). Survey coverage was constrained in the northern and southeastern sectors by the presence of contemporary Bedouin encampments. Consequently, the investigation was conducted across two discrete zones, measuring approximately 0.65 and 2.25 hectares, respectively.

The acquired documentation will inform the selection of areas for future archaeological investigation, ranging from targeted trial trenches to extensive open-area excavations at the site and its immediate environs. This research strategy aims to address key questions concerning the fortress's chronological

sequence and the identification of military units stationed at the installation. A detailed presentation of the survey results and their interpretation will be published in a separate study.

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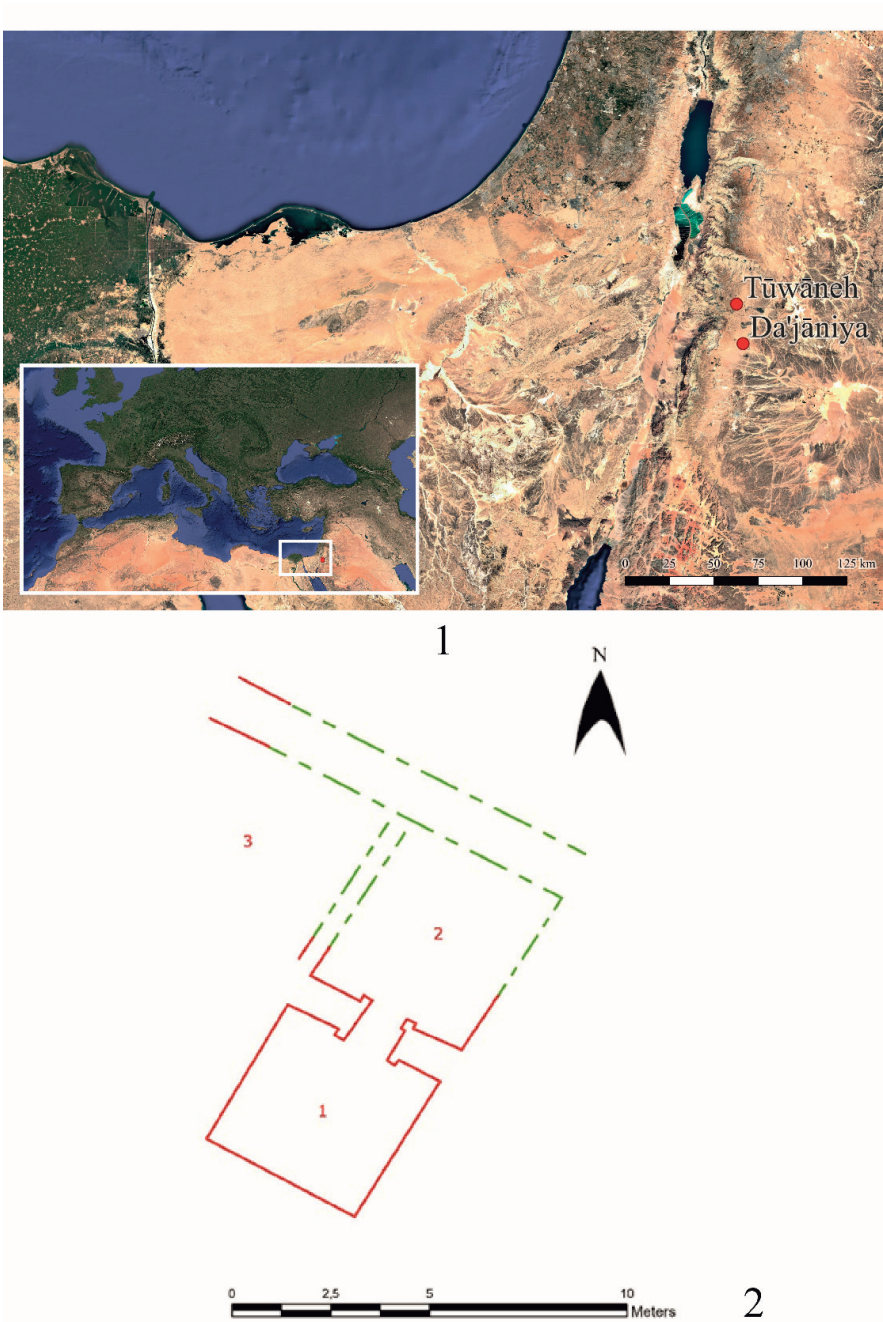
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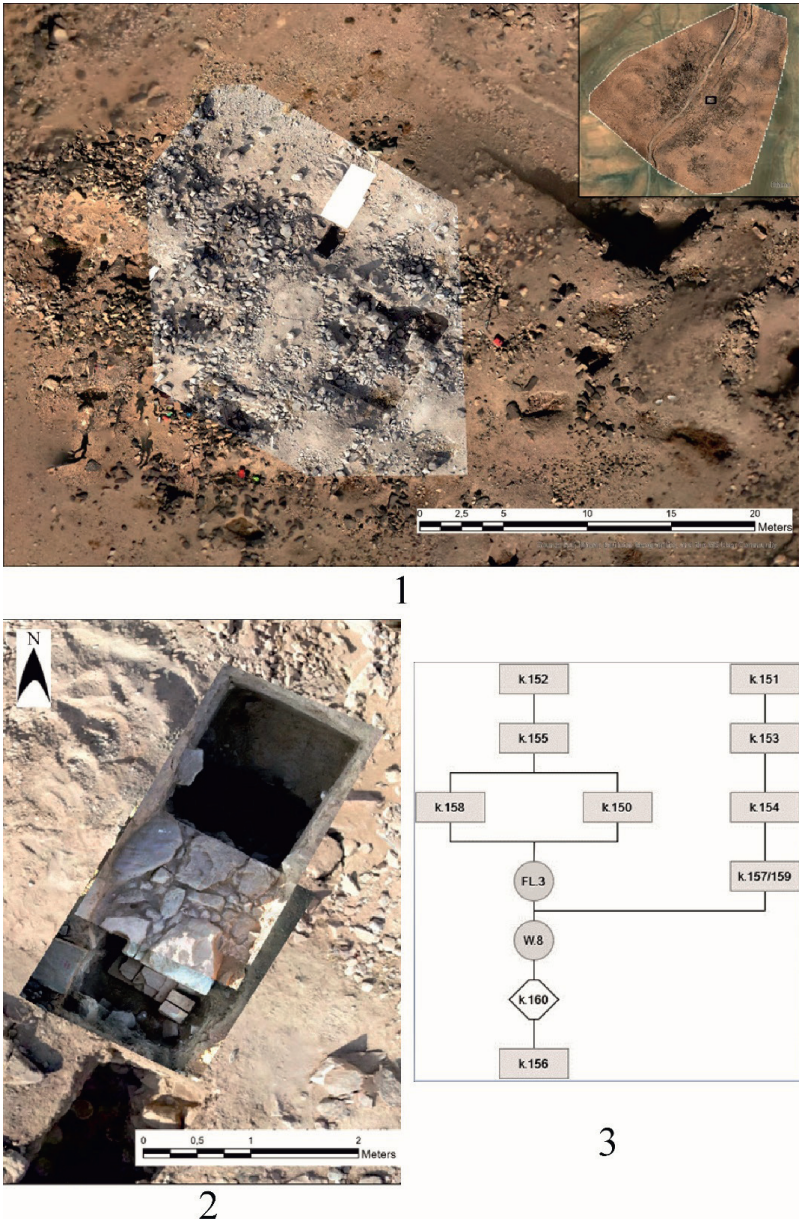
PLATE 1



Pl. 1: 1 – Regional map showing site locations (Author: Kamila Niziołek)

Pl. 1: 2 – Schematic plan of the bathhouse remains at Tūwāneh (Author: Kamil Kopij)

**PLATE 2**



**Pl. 2: 1** – Location of Trial Trench TTIV (highlighted in white) within the site context (Author: Kamil Kopij)

**Pl. 2: 2** – Orthophoto of Trial Trench TTIV following excavation (Authors: Edyta Puniach, Kamil Kopij)

**Pl. 2: 3** – Harris Matrix stratigraphic diagram of Trial Trench TTIV (Author: Kamil Kopij)



PLATE 3



1

Pl. 3 – Distribution map of documented looting pits at Tūwāneh  
(Authors: Paweł Ćwiąkała, Edyta Puniach, Kamil Kopij)



## PLATE 4



1



2

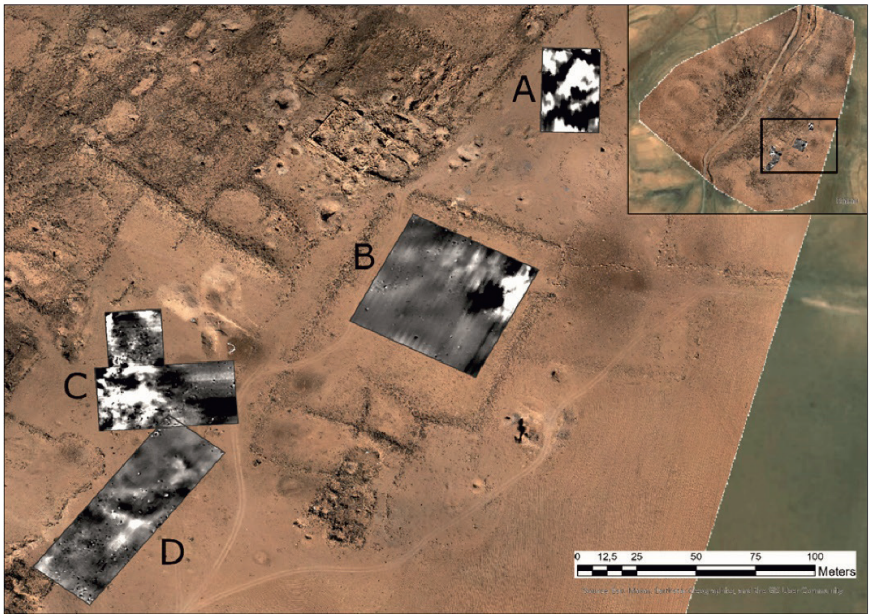
Pl. 4: 1 – Spatial context of the ‘Upper Baths’ within Tüwāneh (Author: Kamil Kopij)

Pl. 4: 2 – Architectural remains of the ‘Upper Baths’ at Tüwāneh (Author: Kaja Bator)

PLATE 5



1



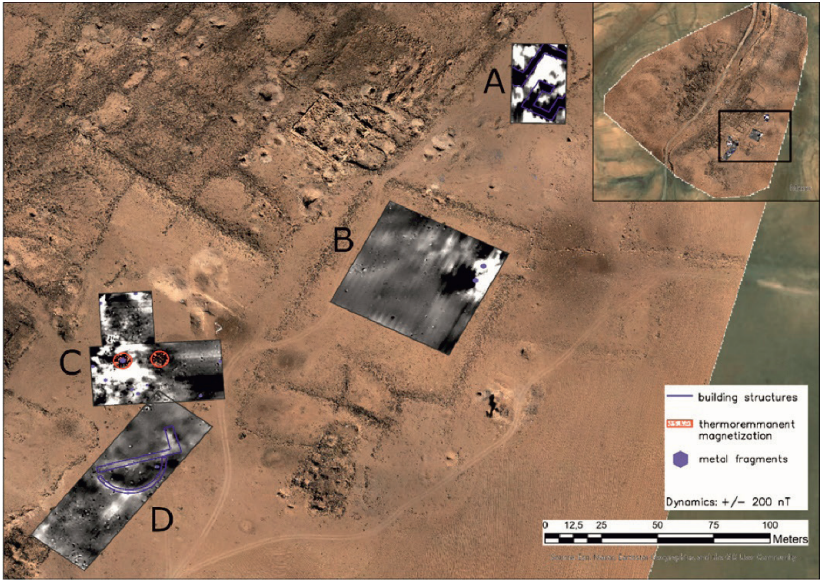
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Pl. 5: 1 – Arabic graffiti documented on the caravanserai walls at Tūwāneh (Author: Grzegorz Sochacki)

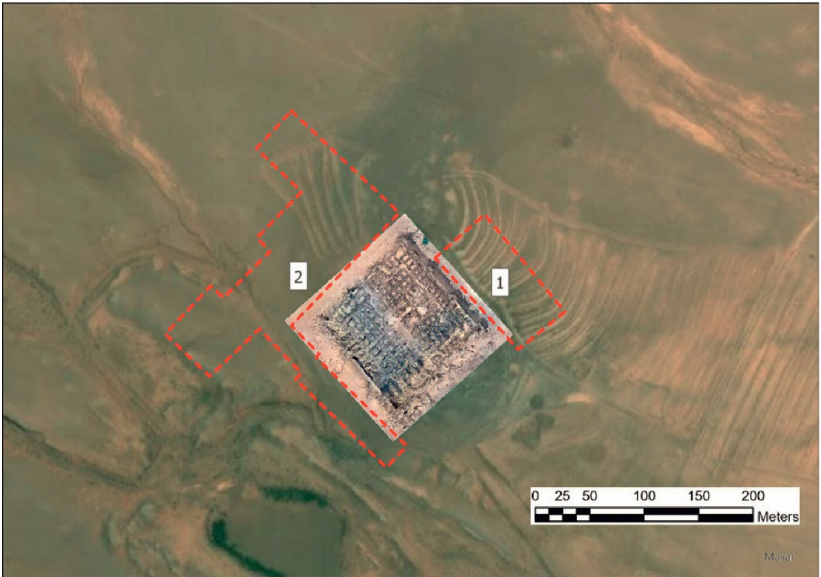
Pl. 5: 2 – Geophysical survey results from Tūwāneh (Author: Nikola Babucic)



PLATE 6



1



2

Pl. 6: 1 – Interpretative plan of geophysical survey results from Tüwāneh (Author: Nikola Babucic)  
Pl. 6: 2 – Coverage map of geophysical survey at Da'jāniya (Author: Kamil Kopij)