EXCAVATION AND MAGNETIC PROSPECTION IN JARASH'S SOUTHWEST DISTRICT: THE 2015 AND 2016 SEASONS OF THE LATE ANTIQUE JARASH PROJECT

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Introduction

This article accounts for the 2015 and 2016 campaigns of the Late Antique Jarash Project (henceforth LAJP). In 2015, approximately 7ha in Jarash's southwest district was surveyed using magnetic prospection, while a residential area on the district's hilltop was examined through key-hole excavations (**Fig. 1**). In 2016, finds (especially ceramics) retrieved from the excavations were recorded and analysed during a short study season.

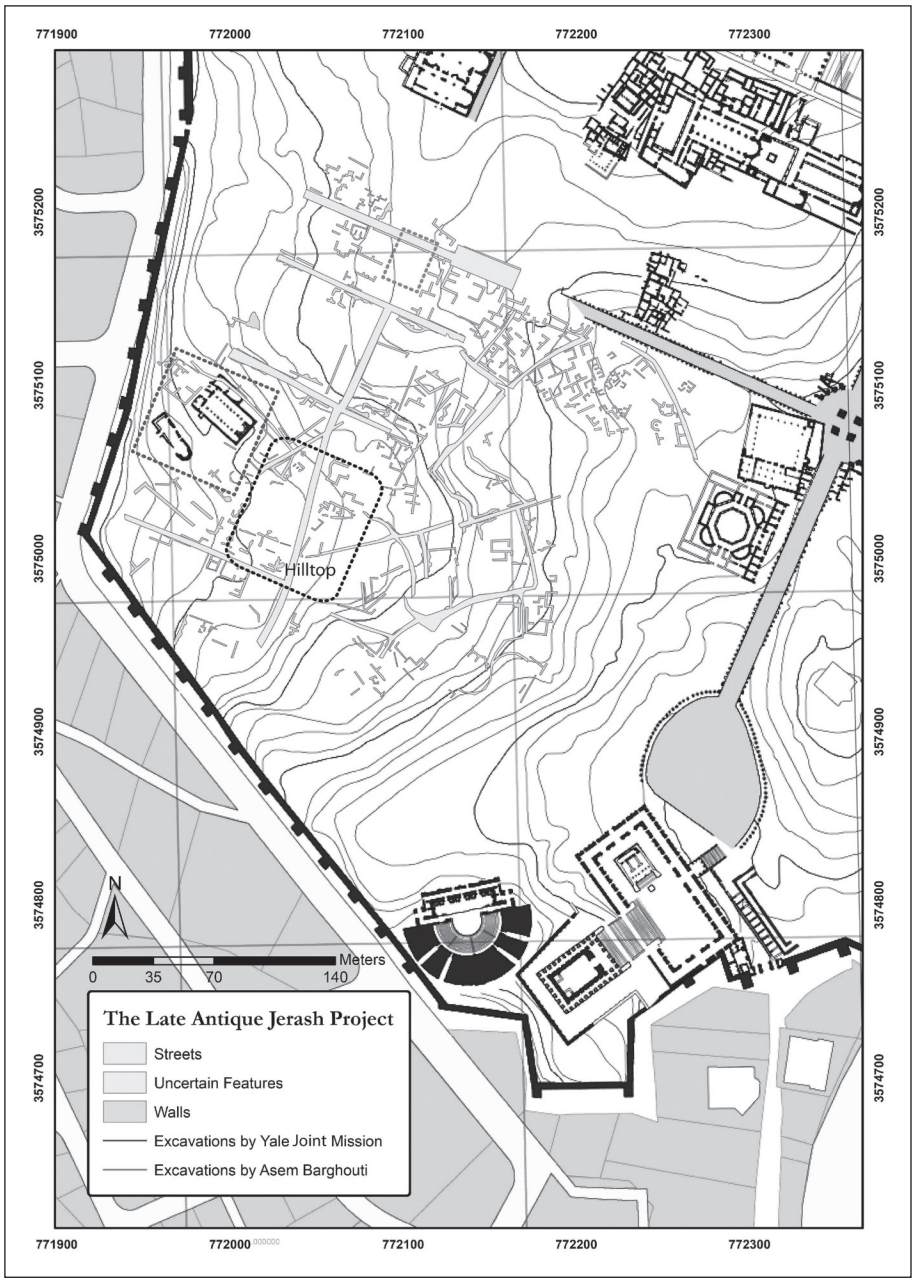
LAJP builds on a survey of architectural surface remains that was carried out in 2011 as part of the Danish-Jordanian Islamic Jarash Project (Blanke *et al.* 2015). The survey identified features associated with the residential usage and water supply in Jarash's southwest district and traced the remains of streets running parallel with and perpendicular to the South Decumanus.

LAJP commenced as an independent project in 2015 with the aim of investigating the infrastructure and daily life of a residential area over the *longue durée*, with an emphasis on the city's development in the Islamic periods. The project thereby aims to cast light on a hitherto little explored aspect of Jarash's history, as the focus of most past excavations has been on monumental remains of the Roman and Byzantine past.

Excavations conducted throughout the city since the 1980s have established an unbroken material record reaching into the Umayyad period, but major disruptions to urban life have been associated with the great earthquake of 749 (Ambraseys 2009: 230-238). Archaeological work in the city centre on the so-called Umayyad House on the South Decumanus and excavations by the Islamic Jarash Project have demonstrated that the centre was rebuilt after the 749 earthquake, with a long history afterwards (Blanke and Walmsley forthcoming; Rattenborg and Blanke 2017; Walmsley 2018). Archaeological work carried out in other parts of Jarash suggests a different occupational history, however, maintaining major patterns of disruption and abandonment after the earthquake. Published data from Jarash's northwest quarter and from the Temple of Zeus have increased our understanding of the afterlife of the city in the Middle Islamic period (twelfth to fifteenth centuries). Here, life was resumed after a long hiatus had transformed the former city into a rural settlement of fields and farmhouses (see, for example, Lichtenberger and Raja 2016; Peterson 2017; Tholbecq 1997-98).

The results from LAJP's first two seasons have vastly increased our understanding of Jarash's development over the *longue durée*. So far, our excavations have revealed that it was not only in the city centre that life continued after the 749 earthquake. On the contrary, new archaeological evidence produced by LAJP suggests that the entire southwest district was rebuilt to accommodate urban life, with religious, administrative and commercial units restored in the town centre and residential structures constructed on the terraces leading from the centre towards the city wall (Blanke 2018; see also Rattenborg and Blanke 2017).

Below follows an account of the magnetic prospection, excavation and finds studies (mainly ceramics) with an emphasis on methodology and results. The presentations are followed by a summary of how these new data affect our understanding of Jarash as a whole.



1. Map of Jarash's southwest district with emphasis on survey area and the hilltop, which has so far been the focus of the excavations carried out by LAJP. © LAJP.

Magnetic Prospection

Between 2nd and 8th November 2015, Eastern Atlas carried out a magnetic prospection in Jarash's southwest district. In 2011, the Danish-German Jarash Northwest Quarter Project contracted Eastern Atlas to survey an area to the east and northeast of the Temple of Artemis (Kalaitzoglou *et al*. 2012). Here, Eastern Atlas tested a number of geophysical methods and concluded that magnetic prospection was best suited for the topography and geological composition found in Jarash. Therefore, this method was applied exclusively to survey Jarash's southwest district.

The southwestern part of the city is characterised by a sloping landscape that inclines uphill from the Cardo and the congregational mosque in the centre of town towards the city wall. A plateau located towards the summit – generally described as the hilltop – comprise distinct architectural features that have so far been the focus of our excavations. The area southwest of the hilltop is characterised by a terraced landscape, while the highest point towards the north exhibits a hilly nature with several holes, excavation trenches and recently deposited stone heaps.

Remains of archaeological structures related

to buildings and terracing characterise the landscape throughout the southwest district; the ground is covered in stone fragments of archaeological origin. The bedrock outcrops at the steep margins of the site and has been identified as karst limestone of a type that was also used to build the area's architectural features.

In general, the site offers complex surface conditions with steep slopes, uneven ground, heaps of stone and other irregularities. These could influence the data outcome and thereby complicate interpretation of the magnetic data, especially in the heavily disturbed northeast part of the survey area. Consequently, the main challenge consisted of negotiating the many field obstacles such as slopes, piles of stones and spoil heaps. Special measures were taken regarding the magnetic survey system and the positioning of the data.

Measuring Parameters

Magnetic anomalies are caused by changes in the complex magnetic properties of the soil. The amplitude of the magnetic anomalies is determined by the contrast of magnetic susceptibility between an archaeological structure and the surrounding uninfluenced soil, as well as by the volume and depth of the magnetic structure. Two types of magnetisation can be observed in magnetic measurements: induced and remanent magnetisation.

Induced magnetisation is ascribed to the effect that the elementary magnets of a matter partly align with an external field (*e.g.* the Earth's magnetic field) and will therefore enhance it. The magnetic susceptibility describes the propensity for this alignment determining the strength of the enhancement of the magnetic field. The highest magnetic susceptibility values in soils are observed in ferro- or ferrimagnetic minerals like the iron oxides magnetite and maghaemite. These minerals occur ubiquitously in the soil, forming microscopically small grains. There are several possible explanations for their origin and concentration in soils:

1) Heating: In soils with rich organic content in reducing conditions, iron oxides of low magnetisation can be transformed into magnetite and maghaemite under the influence of fire (Le Borgne 1955).
2) Microbially mediated: Microbes populating rich organic deposits can change the soil conditions sufficiently to favour the conversion of weakly magnetised iron oxides to more magnetic forms (Linford 2004).
3) Magnetotactic bacteria: These bacteria are able to produce intra-cellular crystalline magnetite which allows them to navigate in the Earth's magnetic field. These magnetite crystals remain in the soil after the death of the bacteria (Fassbinder *et al.* 1990).
4) Pedogenetic origin: The magnetic susceptibility can increase during soil formation processes in which organic material is absent (Maher and Taylor 1988).
5) Incorporation of magnetic material: Increased magnetisation of the top soil can result from anthropogenic accumulations of magnetic materials.

Besides ferro- and ferrimagnetism, there are further magnetic characteristics in materials, which show observable effects when an external magnetic field is applied. Most minerals and soils can be described as paramagnetic. In paramagnetic materials, a secondary induced magnetic field is produced, but its elementary magnets tend not to align with the external magnetic field. Therefore, the strength of the induced magnetic field is very weak, qualified by positive - but low - values of magnetic susceptibility.

Some other minerals, like calcite, which is the main component of limestone, are diamagnetic with negative values of magnetic susceptibility. Diamagnetic materials literally repel the external magnetic field and form a strong magnetic field in the opposite directions, which results in an anomaly field with negative amplitudes. Based on this effect, buried constructions made of limestone can be identified in magnetic data as assemblages of linear patterns with negative amplitudes of the measured anomaly field.

While induced magnetisation requires an external magnetic field for its development, remanent magnetisation remains in a material after its creation. The most important type of magnetic remanence is caused by the heating of a material over its specific Curie temperature. In this process the elementary magnets become mobile and align with the external Earth's magnetic

field. During the subsequent cooling, the alignment of the magnets is conserved and consequently the burnt material becomes a strong magnet. Since the average Curie temperature of soil components is around 650ºC, fireplaces, kilns, layers of burnt daub, accumulations of pottery and other burnt material can be detected by exploiting this effect (Schmidt 2009).

In addition, other types of remanent magnetisation occur in soils. For example, small grains of magnetic mineral tend to align with the external magnetic field during sedimentary processes, producing the so-called detrital or depositional remanent magnetisation (DRM). This effect can also be observed in anthropological deposits, with remanent magnetisation thus being registered in the fills of human-made pits or ditches (Fassbinder and Becker 2003).

Methodology and Data Positioning

For the magnetic investigations in Jarash's southwest district, an array of seven Förster fluxgate gradiometer probes was used (**Fig. 2**). The probes were mounted on a light, foldable frame, which was carried over the heavily undulating area. For data positioning a marker wheel as well as a Global Navigation Satellite Systems (GNSS) receiver were attached to the system. This gradiometer array is a component of the convertible LEA MAX system which usually functions as a cart, pulled by hand or pushed, but owing to the challenging surface conditions it was converted into a carried system.

2. The challenging surface conditions of Jarash's southwest district are characterised by field obstacles such as rocks, piles of stones and steep slopes. Photo shows seven Fluxgate Förster Gradiometer FEREX CON650 sensors mounted on a portable array. © LAJP.

Table 1: Technical parameters of the magnetic prospection.

Method	Magnetic prospection
System	LEA MAX (Eastern Atlas)
Sensors	Förster fluxgate gradiometer FEREX CON650
Data logger	LEA D2 with 10 channels (Eastern Atlas)
Measurement category	Vertical gradient in nT
Configuration	7 sensors, mounted on a portable array Vertical sensor separation: 0.65 m
Resolution	0.5 m profile distance / max. 0.1 m point distance
Topographic measurement	GNSS receiver (NovAtel SMART-VI), RINEX-data logging, coordinate system: WGS84 / UTMzone 36 (EPSG:32636)
Data positioning	Absolute error after post-processing: 0.2 m
Processing and filters	Eastern Atlas decoding program including offset and drift correction
Data format	ASCII, GeoTiff
Image resolution	0.2 m x 0.2 m

The Förster FEREX CON650 fluxgate gradiometer probes register the vertical gradient of the vertical component of the Earth's magnetic field with an accuracy of 0.2 nT (nanotesla). The measured gradient (*i.e.* the difference between two vertically arranged sensors in the gradiometer probe) is insensitive to the typical large fluctuations of the Earth's magnetic field and is determined only by the magnetisation of local sub-surface objects. The technical details concerning the investigation are specified in **Table 1**.

The data positioning for the magnetic survey was realised by means of a GNSS receiver (NovAtel SMART-VI) incorporating a Receiver Independent Exchange Format (RINEX) raw-data log for correction purposes. An additional post-processing step was conducted using the data from the MRAV Merav Station, which is part of the Israeli survey network. The achieved data quality was mainly of RTK floating ambiguity solution, providing a position accuracy of 0.2m. The coordinate system in use is WGS84 UTM Zone 36North.

The magnetic data shown in the maps (**Figs. 3** and **4**) reflect the archaeological situation and surface conditions of the investigation area at Jarash. Parts of the area could not be covered by magnetic measurements owing to the presence of excavation trenches, piles of rocks, steep slopes and other surface obstacles. In order to present the genuine magnetic data, Eastern Atlas did not extrapolate or interpolate data to fill the gaps. In this manner, misinterpretation can be avoided. **Table 2** sums up the main natural and anthropogenic features impacting on the magnetic data. **Fig. 3** shows the magnetic data in amplitudes of 5nT. The interpretation is presented in **Fig. 4**.

Following the data processing, the magnetic data images were thoroughly examined for anomalies that might indicate archaeological features. The general approach to the classification of magnetic anomalies is to distinguish them according to their amplitudes, polarisation and shape. In consequence, first, anomalies of unambiguously modern origin are separated and marked in blue colour. The second step consists of grading the anomalies with assumed archaeological background. In order to structure them, several classes of magnetic anomalies and corresponding causal physical structures are introduced. The specific anomaly characteristics, the related archaeological structures and the colour scheme used in the interpretation maps are defined in **Table 3**.

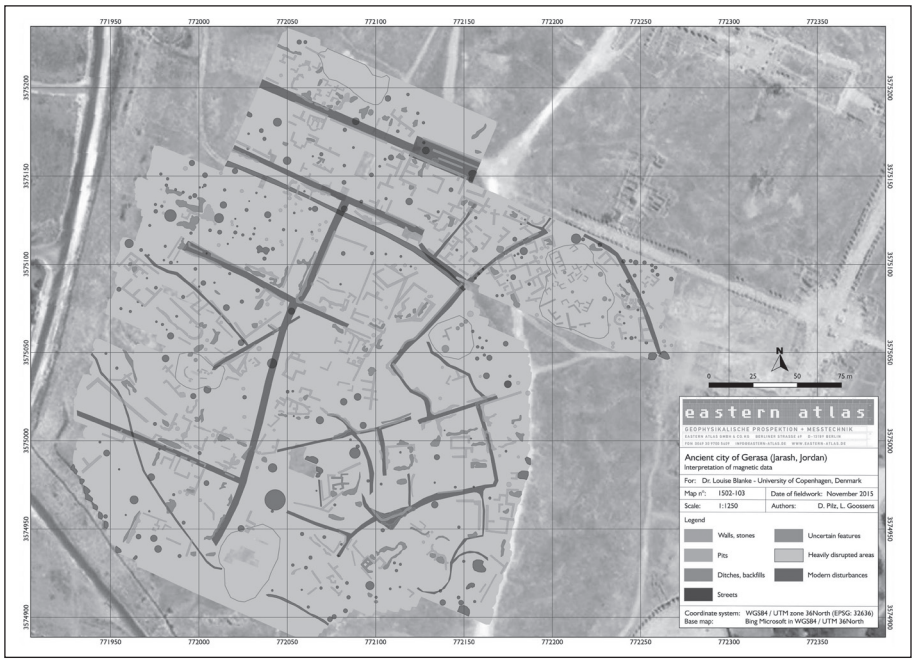
Interpretation

In general, the magnetic data show numerous anomalies caused by modern interference. Dipole anomalies of high amplitudes occur frequently throughout the whole investigated area. Their origin is to be found in deposits of

3. Magnetic prospection of Jarash's southwest district. © LAJP.

Table 2: Measuring conditions and key figures of the magnetic prospection.

Site	**Ancient city of Gerasa**
Historical context	Occupation from Hellenistic Period to 8th century AD
Terrain	Heavily undulated with steep slopes, partly terraced, excessive amount of stone fragments on the surface (partly piled), huge obstacles
Geology	Karstified limestone
Soil	Very thin or no soil layer
Surface	Variable (from rough to very rough)
Visible archaeological structures	Stones, walls, terraces, remains of collapsed buildings, ruins
Vegetation	Mostly dry grassland, few bushes
Land use	Archaeological park
Weather	15-30°C, sunny, dry, partly foggy, partly rainy
Sources of disturbance	Deposits of restored archaeological blocks and other excavated material, excavation trenches, heavily disrupted areas, scrap metal, wirefences
Investigated area	approx. 7 ha (=70,000 m²)



4. Interpretation of magnetic data from prospection of Jarash's southwest district. © LAJP.

construction waste, scrap metal and large iron poles, possibly resulting from past excavations or other archaeological activity. Furthermore, the data are affected by partly open excavation sections (such as Asem Barghouti's excavations on and near the South Decumanus, and the Yale Joint Mission's excavation of the Mortuary Church and church of Sts Peter and Paul), modern roads and disrupted areas of stone piles and spoil heaps. A long, linear anomaly recognised in the data in the southern and southwestern part of the area reflects a cable, which is also visible at the surface. The most dominant modern features in the data are marked in blue colour, while heavily disrupted areas are outlined in light blue colour.

Apart from the modern disturbances, the data reveal a very complex archaeological landscape, manifested through different phases of construction, destruction and rebuilding. Features of archaeological origin were subjected to a further categorisation. A distinction was made between streets, walls and stones, pits, ditches and backfills, and - finally - uncertain features.

The magnetic markers of roads are characterised by slightly positive anomalies and are depicted in dark grey on the interpretation map (**Fig. 4**). The South Decumanus is recognised in the data in the northernmost end of the investigated area. Interestingly, a widening of this street is identified extending from Barghouti's excavation towards the east. About fifty meters south of the Decumanus, another linear positive anomaly is identified as a street, clearly running parallel to the Decumanus. The same applies for another road about sixty meters further to the south. Another hundred meters further to the south, a third parallel road is visible as a linear positive anomaly. One of the known primary access routes in Late Antiquity, a street that runs from the triple church of Sts Cosmas and Damian, St Paul and St George, intersects with the South Decumanus and extends towards the south, can be recognised. It seems to be aligned with the Roman-period grid system, although it stands out on account of its slightly irregular course to the south of the surveyed area. Branching off from this street, smaller linear positive anomalies in the data are identified as irregular alleys, for example the north and south alleys running along the two excavated churches (*i.e.* the Mortuary Church and Church of Sts Peter and Paul). The street layout in the area southeast of the Decumanus seems to be more complex. Here, the data show different, irregular positive anomalies that have been interpreted as streets. They deviate markedly from the Roman orthogonal street grid and seem in comparison to be orientated almost diagonally (see Blanke 2018 for a discussion of the dating of these street systems).

The remains of building structures can be recognised by negative anomalies, indicated in dark yellow at **Fig. 4**. Generally irregular in

Table 3: Colour scheme of the magnetic-data interpretation.

Colour	Magnetic anomaly type	Amplitudes	Type of magnetisation	Related structures
	Distinct linear negative anomalies of moderate amplitudes	-1... -10 nT	Induced, diamagnetism	Walls, foundations, stone settings, stones
	Distinct circular and oval positive anomalies	+5... +15 nT	Predominantly remanent	Fillings of pits and post holes, burial chambers, fillings possibly containing pottery fragments, metal objects and burnt material, scattered construction debris enriched with burnt daub and pottery fragments
	Mainly linear, partly irregularly shaped positive anomalies	+5... +10 nT	Induced and remanent	Organically enriched fillings of ditches and backfills of construction debris
	Slightly positive anomalies in stripes of several meters wide	+2 ... +10nT	Induced and remanent	Pavement remains of streets and paths, occupational layer with organically enriched material
	Mainly distinct linear negative anomalies of moderate amplitudes	-1... -10 nT	Induced, diamagnetism	Uncertain, dubious features located in heavily disrupted areas, possibly remains of walls or stone settings, possibly modern features caused by rearranged or relocated archaeological fragments of limestone
	Various, not clearly defined	-	Unclear	Heavily disrupted areas with difficult topography due to the geomorphological conditions and/or areas with piled rock fragments (mainly of archaeological origin)
	- Clearly defined dipole anomalies - Weak dipole anomalies - Slightly positive anomalies	> ±50 nT ±5... ±25 nT +3... +5 nT	Induced Induced Unclear	- Modern disturbances: by iron poles, fences, scrap metal or other ferromagnetic sources - Cable, small or deeper ferromagnetic sources - Modern path

form and orientation, they differ in dimensions and cover the space alongside the linear positive anomalies (streets). The foundations of the two churches are recognisable in the data, as are some larger structures south of the Decumanus. Jarash's prolonged and complex building history is demonstrated in the data, as the structures seem to alter their orientation in alignment with the streets. About one hundred meters south of the widening of the Decumanus, a group of linear negative anomalies - interpreted as walls - show an overlap, possibly indicating different building phases. Noteworthy is the impression that, to the southeast of the Decumanus, the architecture occurs more densely. The magnetic image shows a fragmented area, with features that form smaller units orientated to the smaller alleys. However, the tangle of linear negative anomalies cannot provide conclusive answers on the architectural characteristics, owing to the complex circumstances and elaborate chronology of the site.

Throughout the area, circular strong positive anomalies of varied size are visible in the magnetic data. These represent pits and are depicted in orange in **Fig. 4**. Fills of pits and post holes

may contain ceramic fragments, metal objects, burnt material or scattered construction debris that are causing the anomalies.

Some strong linear positive anomalies are interpreted as backfilled ditches. These often occur alongside linear negative anomalies (streets) and are indicated in brown on the interpretative map. Groups of these linear positive anomalies almost show the negative print of building structures, reflecting ditches now filled with organic material - where the foundations were once situated.

A few areas are disrupted to such an extent that unambiguous interpretation is impossible owing to spoil heaps or stone fragments. These areas are visualised in light blue, while the single features are depicted in dark pink. In the immediate proximity of the mosque, spoil heaps from past excavations had accumulated and were arranged. This heavily disrupted area is reflected in the magnetic data and hinders an unambiguous interpretation. The recognised single features marked in dark pink could either be of archaeological origin or represent the magnetic markers of stone heaps.

The Magnetic Prospection in Summary

The results of the magnetic prospection campaign in Jarash's southwest district allow us to draw the following conclusions:

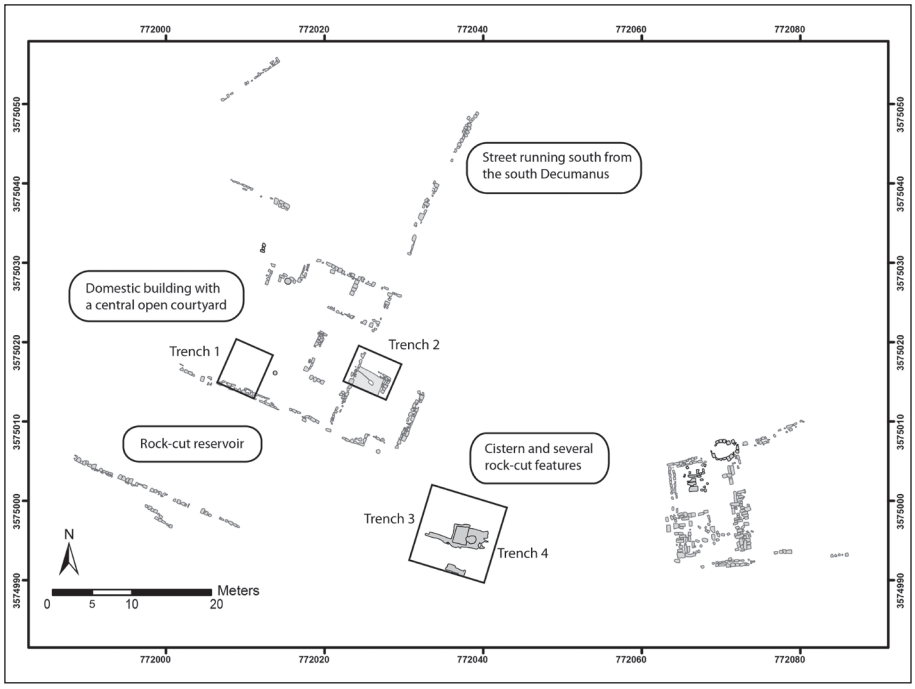
- Despite challenges presented by the surface conditions, complex landscape and severe field obstacles, the magnetic data offer important new insights into the archaeological remains of Jarash's southwest district and provide good evidence for a large number of hitherto unknown archaeological features.
- Interferences to the data caused by modern streets, metal objects and spoil heaps somewhat complicate the archaeological interpretation of the data.
- The data show the remains of an orthogonal street plan, which includes the South Decumanus as well as the remains of an irregular, more complex, almost circularly orientated street plan in the eastern part of the surveyed area. A widening of the South Decumanus is identified, and the perpendicular street dating from Late Antiquity continues to the southwest in the data. Smaller alleys on both the east and west sides of this street were identified.
- Many buildings were detected on the strength of the magnetic data. In some areas, an overlap of architectural features is visible, possibly resulting from different building phases. The structures seem to be more fragmentary southeast of the Decumanus, but the overlay of archaeologically relevant anomalies with magnetic anomalies caused by spoil heaps and stone piles precludes a deeper insight into the character and function of these constructions.
- Several positive anomalies are interpreted as pits and fills of archaeological origin, mostly found in association with streets and architectural features.
- The complexity of the site is clearly visible in the magnetic data. Further investigation can only be encouraged in order to better understand the intricate history of the site and enable the interpretation of possible archaeological structures by placing them in a broader context on a substantial horizontal scale.

Excavations in Jarash's Southwest District

The remaining part of this article summarises the results of four excavation trenches located on the hilltop in Jarash's southwest district (**Fig. 5**). Trenches 1 and 2 examine two rooms within a large residential building, while Trenches 3 and 4 examine a cistern and series of orthogonal cuts made into an outcrop of bedrock located southeast of the residential building. The ceramic assemblage retrieved from each trench is discussed at the end. The surface remains of the residential building as well as the bedrock cuts were recorded in detail as part of the 2011 survey (Blanke *et al*. 2015). These two areas were selected for further investigation in accordance with LAJP's research aim of examining Jarash's residential history over the *longue durée*. This goal entails an examination of the amenities of daily life, such as the construction and maintenance of the water supply, the organisation and development of streets and alleys, and the disposal of rubbish.

A Residential Building on the Southwest Hilltop (Trenches 1 and 2)

The residential building (examined in 2011 as Area D [see Blanke *et al.* 2015: 232]) covers some 20×25m and is located on the north-south street, which can be traced from the triple



5. Detail of hilltop in southwest district showing location of Trenches 1-4. © LAJP.

church complex to the north of the Decumanus. Prior to excavation, three rooms were identified along the eastern end of the building. A fourth room was identified along the north wall, while the presence of internal walls at the south end of the complex implies further rooms here. The collapsed building material slopes towards a depression in the western part of the building, which could have resulted from a relative absence of structural collapse indicating the possible location of an open courtyard. A pear-shaped cistern cut into bedrock is located at the northern extent of the courtyard. In 2015, two trenches were excavated in order to examine a room within the building (Trench 1) and a room encroaching onto the north-south street from the building (Trench 2).

Trench 1: A Storage Room in a Residential Household

Trench 1 is located at the southern end of the residential unit and covers the western part of a room as well as a small part of the building's courtyard (**Fig. 5**). Prior to excavation, sections of the room's outer walls were visible on the surface. The aim of the 2015 season was to establish a chronological sequence for the building's occupation and abandonment, in addition to identifying the usage of this part of the building. Consequently, the excavation (5×6m) focused on the junction of what has been identified as the building's main courtyard and an adjacent room opening onto it. Owing to time constraints, the excavation concentrated on the room, which was excavated to the level of bedrock. An outline of its main phases follows below.

Results and Stratigraphy

The excavation revealed that, similar to other structures in Jarash, the walls were built directly on the bedrock (see, *e.g.* Gawlikowski 1986: 110). Smaller cuts were made into the bedrock to facilitate the construction of walls and piers, while a deeper cut was made along the northern part of the room to accommodate the insertion of two large ceramic storage units. Three walls were identified within the trench: a southern (east-west) wall that constitutes the south limit of the building; a western (north-south) wall that separates the courtyard from the room; and, finally, a northern (east-west) wall (**Fig. 6**). A doorway with two steps provided access between the courtyard and room. The southern and western walls were constructed from courses of large squared stones with levelling between each course consisting of stone rubble and reused architectural fragments. The stones' appearance suggests that they were re-used from a nearby derelict building: their edges are smooth (rather than angular) and they vary considerably in size.

6. Trench 1 after excavation. View towards the north. Note north-south wall separating room from courtyard with centrally placed opening for door and remains of ceramic emplacements in northern part of the room. © LAJP.

Of similar material and construction technique are two pillars that stand on the eastern edge of the trench. Several arch stones found in the collapse suggest that the pillars supported an arch spanning the room from north to south. A building block in the northern pier included a rope hole, which could have been used to either suspend a pot or to tether an animal. Given the general use of the room for storage (see below), the former option seems more probable.

It is worth noting that the construction technique of the northern wall differs markedly from that of the room's other architectural features. The lower courses consist of smooth, medium-sized stones set in a thick earthy mortar. The construction technique comes across as less solid than that applied to other walls, which has led to the conclusion that the wall served as a partition rather than a load-bearing construction. Furthermore, the wall does not display any architectural link with the northern pillar and may have belonged to a second construction phase, either replacing an existing wall or creating a new division of space within this part of the building.

No dateable material can be associated with the construction of the main structure or the partition wall. In comparison with other structures excavated at Jarash, the construction technique applied to the southern and western walls is similar to that of the so-called Umayyad House located on the South Decumanus (Gawlikowski 1986: 124), as well as that of shops excavated on the North Decumanus (Watson 1986: 365). Based on the ceramic assemblage, these structures were dated by their excavators to the late sixth or early seventh centuries.

The main architectural elements related to the occupational usage of the building are two ceramic storage vessels set directly on the bedrock, embedded within a stamped yellow clay floor (**Fig. 7**). Only the lower parts of the ceramic installations are preserved *in situ*, as the vessels were crushed when the building collapsed. These two pithoi-style vessels were set directly onto the bedrock within a circle of stones, which served to stabilise and support them. The stone circles as well as the lower parts of the vessels were then covered in a compacted yellow clay mixed with lime that also served as the floor of the room. No residue was recovered from within the vessels, but comparative examples from Caesarea Maritima suggest a likely association with food storage, for example, olive curing before consumption - in which olives are soaked in brine to remove the bitterness from their taste (Ramsey and Holum 2015: 667).

The building collapsed in a single violent event – most likely an earthquake – which sealed the occupational deposits below a thick layer of wall and roof collapse. It is clear from the material assemblage retrieved from the room that it was still in use at the time of the earthquake. Finds associated with the use of the building comprised a rich assemblage of ceramic sherds from which 22 vessels could be reconstructed. Most of these vessels are associated with storage of foodstuffs; it has therefore been possible to identify the use of this part of the building (see section on ceramics below). Several thick, square iron nails were found directly on the floor or in the collapse immediately above the floor.

7. Remains of two ceramic pithoi embedded into the construction of the floor. © LAJP.

This type of nail is often associated with carpentry and may have been used in the construction of the building's roof. Other finds associated with the use of the building include coins (which were cleaned by a conservator in 2017 and will be included in a separate report on that season), an iron knife and a small bronze cup.

Following the collapse of the building, the area was abandoned and remained untouched until our excavations were initiated in 2015. While adjoining areas saw secondary usage in field systems, it is likely that the amount of rubble here was thought too extensive for this to be viable.

Trench 2: Encroachment onto the Thoroughfare

Excavations in Trench 2 commenced to investigate the Late Antique encroachment of buildings onto the thoroughfare that runs perpendicular to the South Decumanus, as well as the construction, maintenance and use of those structures. Based on the surface remains examined during the 2011 survey, there were clear outlines of a building extension from the main residential structures onto the street (Blanke *et al.* 2015: 231-233). A 5×5m trench was placed over the northeastern corner of this extension from the face of the street wall eastwards (see **Fig. 5**).

Results and Stratigraphy

The three walls that were uncovered in the excavation unit incorporate two identifiable phases of construction. The western (north-south) wall (defined here as Wall 1) is the façade of the building that lined the street running south from the South Decumanus. This street was identified during the 2011 survey and confirmed by geophysical examination. Wall 1 marks the earliest phase of construction in Trench 2. The excavation revealed that the residential building was accessed from the street through a narrow doorway that was blocked during the second architectural phase (**Fig. 8**).

A one-metre extension of the excavation unit to the west was made to fully expose the top of Wall 1, which is 82cm thick. Walls 2 and 3 form the second phase of the construction in Trench 2 and were later additions encroaching onto the street. Wall 2 runs east-west and abuts

8. Trench 2 showing Wall 1 with blocked doorway. View towards the west. © LAJP.

Wall 1 at a length of 3.6 metres (**Fig. 9**). A doorway is situated approximately in the middle of this wall. It is unclear whether this door had street access or led to another room. However, comparing the layout here with that found in Barghouti's excavation some 150 metres further north suggests an unbroken line of rooms encroaching from the buildings onto the street (Barghouti 1982). Wall 3 runs parallel to Wall

9. Overview of Trench 2 upon completed excavations. Note continuation of room towards the south. © LAJP.

1 and is bonded to Wall 2. It stretches across 2.5m within the excavation unit but continues south beyond the limit of the excavation. The 2011 survey recorded a total length of *ca* 8m. The section at the southern limit of Trench 2 features two pillars incorporating reused architectural elements from Roman-period buildings as a part of their construction. Similar to Trench 1, the pillars would have supported a transverse arch spanning the room from east to west. No doorway was found in Wall 3 that would have led onto the street, but one is likely present south of the excavated area, as the room continues in that direction.

The construction of Walls 2 and 3 is consistent with the technique documented in Trench 1 (see above) and the area defined as GO of the Islamic Jarash Project located immediately west of the congregational mosque in the centre of Jarash (Blanke *et al.* 2015; Rattenborg and Blanke 2017; Walmsley *et al.* 2008: 113-118). Additionally, the construction is consistent with other sites that experienced street encroachment in the *ajnad* of Ḥimṣ and al-Urdunn, such as Palmyra and Scythopolis (al-As'ad and Stępniowski 1989: 206-210; Tsafrir 2009: 77-79 [see also Jacobs 2009]).

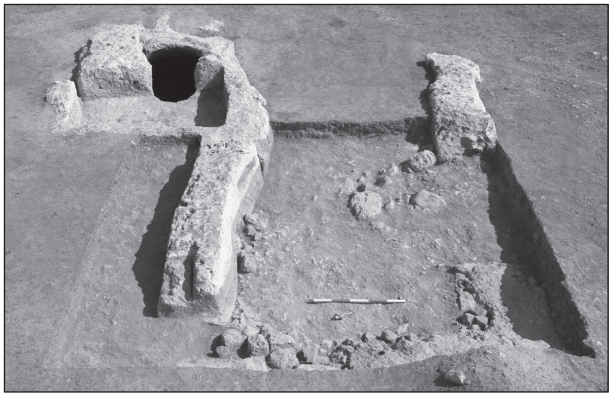
The main construction materials are large reused limestone blocks intermixed with small packing stones and *terra rossa*. The walls were built directly onto bedrock, which had been cut to accommodate the construction. As seen in Trench 1 (see above), Trenches 3 and 4 (see below), and the rock-cut reservoir in survey Area C of the LAJP 2011 season, cut bedrock was an integral part of construction for the southwestern hilltop (Blanke forthcoming; Blanke *et al.* 2015: 233-235).

The areas within and outside the structure in question both had significant amounts of wall collapse consisting of small to large limestone blocks and architectural elements, mainly door jambs and a single column drum. Surprisingly, very few ceramics and only few objects were found here compared to the other excavation units, of which Trench 3 and 4 yielded a particularly large number of ceramic sherds. This would suggest either that the area was abandoned before the structure collapsed, or alternatively that the room featured a type of usage which did not require a large number of objects. The stratigraphic sequence within the room is quite simple, with distinct differences between silty topsoil and wall collapse comprising stone tumble mixed with hard clay and *terra rossa*.

The finds from the room comprised ceramic sherds, as well as an abundance of partially and fully preserved iron nails. The combination of carpenter's nails found within the lower layers of collapse, mixed with the same type of yellow clay that was used for flooring in Trench 1, suggests that both here and in Trench 1 the roof was constructed of timber beams that spanned the stone arches and were then packed with clay. This would have created a flat roof, which would probably have required some maintenance involving relaying and hardening of the clay. A single bronze coin was found near the surface layer. After fully excavating Trench 2 and revealing the bedrock, no *in-situ* finds were recovered from the surface, which may suggest that the room was abandoned before the walls collapsed. Surprisingly, the floor of the room is cut bedrock. Divots and holes formed by natural erosion had been filled with small packing stones and sealed with stamped clay in order to create an even surface.

This partial section of the structure offers clues as to how the inhabitants of Jarash expanded their residential buildings onto the city's thoroughfares. The dating of the buildings' first two phases is unclear, but the ceramic evidence suggests that the extension was completed towards the end of the sixth or seventh century and saw some form of usage into the Abbasid period.

Evidence found here pertaining to street encroachment may fit Hugh Kennedy's 'From Polis to Madina' model (Kennedy 1985 [see also



10. Trench 3 during first stage of excavation showing cistern and bedrock cuts that were visible on the surface. View towards the east. © LAJP.

Foote 2000]). Depending on the exact function of this room, it is intriguing that a large extension was made onto a thoroughfare where there would have been major foot traffic between the domestic quarter and the major triple-church complex north of the South Decumanus. This would parallel the extensions made in the Jarash *suq* on to the Cardo near the Umayyad mosque (Walmsley *et al.* 2008: 118-121).

A Cistern, a Quarry, a House and a Rubbish Dump (Trenches 3 and 4)

Trenches 3 and 4 are located southeast of the residential building and street that were explored in Trenches 1 and 2 (see **Fig. 5**). Trench 3 takes up 5×5m while Trench 4 measures 10×5m. The trenches were laid out to examine a series of bedrock cuts surrounding a pear-shaped cistern. Several of these cuts were visible on the surface and had been examined in detail as a part of LAJP's survey in 2011 (Blanke *et al.* 2015). Given the location of the cuts and cistern immediately east of the area's main reservoir, it was believed that the cuts would be associated with the water supply leading downhill from the reservoir into the town centre. Excavation commenced to address the relationship between the cistern and the cuts, to examine whether these features were a part of the main water-supply system in southwest Jarash, and to evaluate the chronology and abandonment of this system. The two trenches are located immediately adjacent to each other and are therefore be dealt with below as one unit.

Trenches 3 and 4: Objectives and Pre-Excavation Conditions

The area immediately surrounding the cistern comprises several features that were visible on the surface prior to the excavation of Trenches 3 and 4. These are, a rectangular basin located immediately west of and draining into the cistern; an east-west bedrock outcrop in the northern part of Trench 3 that was formed by long straight cuts - with a rectangular and curved groove on its south face; and a small section of another east-west rock-cut feature located in the southern part of Trench 3 (**Fig. 10**) (Blanke *et al.* 2015: 233-235). The surface conditions mainly comprised an evenly distributed silty soil across the two trenches. Unlike the residential unit explored in Trenches 1 and 2, which was covered in debris and collapsed building material, Trenches 3 and 4 featured an even surface resulting from agricultural activities, as well as recent usage as a football field.

Results and Stratigraphy

Excavation of the bedrock cuts revealed five main phases of use. The first phase comprised the initial use of the area for water collection. Several features are associated with this phase. Most important is the pear-shaped, rock-cut cistern, which is described in detail in LAJP's report on the 2011 survey season (Blanke *et al.* 2015: 233-235). Associated with this cistern are at least two sedimentation tanks that may have served as part of an overflow system in which water was collected in the westernmost tank. From here, water flowed through an overflow channel east into another tank and then into the cistern. It is not clear how water was collected, but comparative material from sites in Jarash's hinterland - as well as in northern Jordan more generally - suggests that rain water was often collected on prepared bedrock surfaces and then directed into cisterns for storage and further use (see, for example, Arce 2014; Baker and Kennedy 2009, 2011).

During the second phase, the water system was partially abandoned, although the cistern and easternmost tank remained in use. Instead, quarrying became the predominant use of this part of the site. This is evident from a series of stepped cut marks on the south, north and west sides of the cistern (**Fig. 11**). It is possible that some quarrying also took place prior its use for

11. Post-excavation overview of Trenches 3 and 4. View towards the west. Note stepped quarry cuts north and south of the cistern as well as doorjamb and rope hole in bottom-left side of photo. © LAJP.

water storage, but this cannot be confirmed from the archaeological remains. In the area's third phase, it was used for domestic purposes, which included a thorough remodelling of the bedrock south and southwest of the cistern. Here, the bedrock was transformed through a series of modifications that created a rectangular room which saw domestic usage as either a stable or modest living quarter. Within the room, modifications included postholes that were cut into the floor, which, combined with deep ledges at the tops of the walls, suggest that it was roofed by a wooden construction (**Fig. 12**). In the eastern part of the room, the bedrock was cut to accommodate a door. A threshold and pivot hole were cut into the floor, while the vertical face of the bedrock was cut to form a level surface. Finally, rope holes were cut into both the exterior and interior of the room, allowing for ceramic vessels to be suspended or to act as tethering points for animals.

It is not possible to date the use of this domestic phase, but its abandonment can be dated from an extensive ceramic deposit which was dumped into the bedrock cuts. During the fourth phase, Trenches 3 and 4 were used as a rubbish dump. These distinct deposits of mainly ceramic material were dumped into the former domestic structure from the fifth to the seventh century. The composition of the ceramic assemblage is described below. Other finds from the rubbish deposit include bones, glass and discarded building material, such as *tegula* (roof tiles), brick fragments and a single fragment of a *pilae* (circular tile from a hypocaust system). The final (fifth) phase saw the area transformed for agricultural purposes. This development entailed moving large quantities of soil to the location (*ca* 0.7m). The soil was then spread across the area to create an even surface. Ceramic sherds dating to the Mamluk period (mid-thirteenth to early sixteenth centuries) were found embedded within the deposits and suggest a *terminus post quem* for the use of this part of the site for agricultural purposes.

12. Detail of room in Trench 3 after completed excavation. View towards the north. Note vertical bedrock, roof-supporting postholes in floor and ledge in upper part of image, as well as two rope holes designed as tethering points or for the suspension of pots. © LAJP.

Preliminary Study of the Ceramic Assemblage from Trenches 1-4

The analysis of the ceramic assemblage was initiated in 2015 and carried out alongside the excavation of the four trenches. The study was completed in 2016. 16,535 sherds were retrieved from the excavation of Trenches 1-4, of which 1,852 were identified as diagnostic (Pappalardo forthcoming). Below follows, first, an outline of the applied methodology and, second, an overview of the ceramic forms retrieved from each trench, accompanied by a brief discussion of what this material means for our understanding of the dating and use of each area.

Methodology

The first stage of pottery processing was the setting-up of a recording system, which entailed creating an Excel spreadsheet for preliminary classification of ceramic sherds. Sherds from the same trench and locus were grouped according to ware, fabric, colour and - if possible - shape. At this stage, the different wares were identified based on their function (*e.g.* table, storage or cooking wares). From here, several categories of sub-ware were identified based on fabric (*e.g.* orange-red ware, light grey ware *etc.*), technical aspects (*e.g.* handmade, wheelmade) and shape (bowls, amphorae, lamps *etc.*) (see **Table 4**). Following this initial identification, all diagnostic sherds were marked with a unique identifier comprising trench, locus and a progressive number in order to identify the specimen in drawings and photos. Furthermore, all diagnostic sherds were photographed, drawn and recorded in detail in a designated FileMaker Pro database.

Trench 1

2,515 sherds were retrieved from the excavation of Trench 1. This assemblage can be

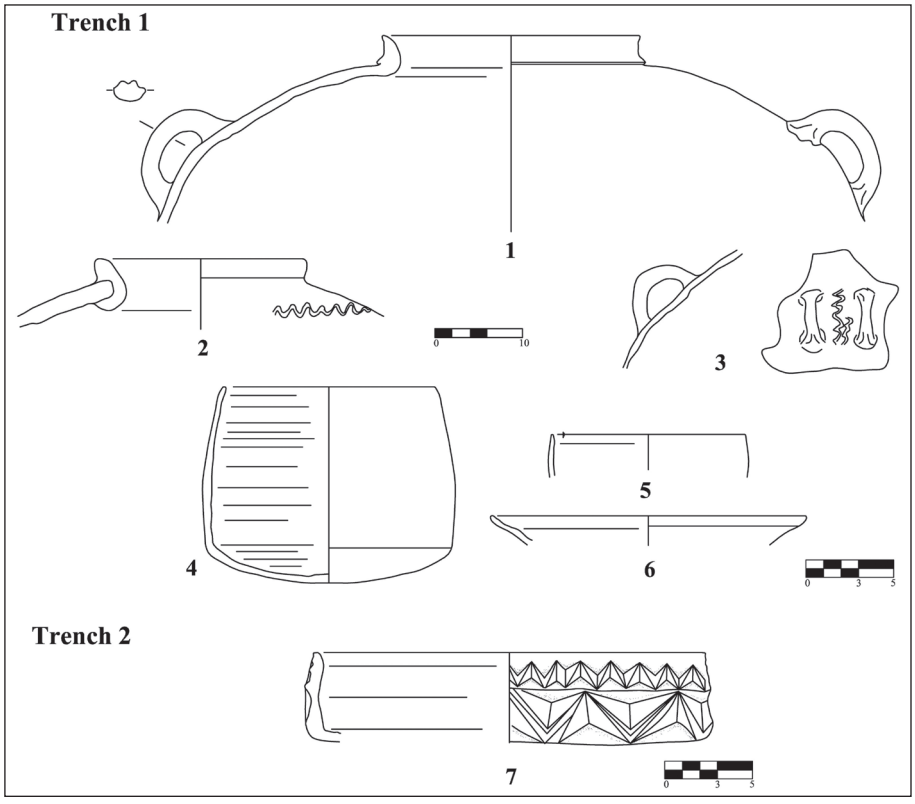
Table 4: Wares and subwares identified according to their functional aspects, then according to fabric and technical aspects.

Ware	'Subware'
Table, storage and food-processing wares (common wares)	**O-RW**: Orange-red ware; wheel-made (local fabric); Munsell 2.5 YR 7/6; 6/6; 5/6. Inclusions: tiny-small, few, lime; tiny, very few, grits.
	LGW: Light-grey ware; wheel-made (local fabric); Munsell: 5YR 6/1; 5/1. Inclusions: tiny-small, few, lime; tiny, very few, grits.
	LBW: Light-brown ware; wheel-made (local fabric); Munsell: 7.5 YR 7/6–5/6. Inclusions: tiny, very few-few, grits.
	NLF: Not local fabric (in this case, the colour, the inclusions, and the technical aspect should be specified).
	LBH: Light-brown ware; handmade (local fabric); Munsell: 7.5YR 6/6. Inclusions: tiny, very few, grits; tiny, very few, voids.
	LGH: Light-grey ware; handmade (local fabric); Munsell: 5YR 6/1; 5/1. Inclusions: tiny, very few, grits; tiny, very few, voids.
Cooking ware	**O-RWC**: Orange-red ware; sometimes tempered with quartz (cooking local fabric); Munsell: 2.5 YR 7/6; 6/6; 5/6.
Table wares (fine wares)	**Jerash Red Slip**: Munsell: 2.5 YR 6/8 (Uscatescu 2001)
	Jerash Bowls: Munsell: 2.5 YR 6/8 (Watson 1989)
	African Red Slip
	Eastern Sigillata
	Other types of fine ware
Transport wares (amphorae)	**O-RW**: Orange-red ware; wheel-made (local fabric); Munsell: 2.5 YR 7/6; 6/6; 5/6. Inclusions: tiny-small, few, lime; tiny, very few, grits.
	LGW: Light-grey ware; wheel-made (local fabric); Munsell: 5YR 6/1; 5/1. Inclusions: tiny-small, few, lime; tiny, very few, grits.
	LBW: Light-brown ware; wheel-made (local fabric); Munsell: 7.5 YR 7/6–5/6. Inclusions: tiny, very few-few, grits.
	NLF: Not local fabric (the colour, the inclusions, and the technical aspect should be specified).
Storage ware (coarse ware)	**LBH**: Light-brown ware; handmade (local fabric); Munsell: 7.5YR 6/6.Inclusions: rich in small,–medium and large–lime inclusions; Sometimes with vegetal, and chamottes inclusions. Dark-grey/grey core.

roughly divided between two contexts: a deposit associated with the use of the room that was sealed by the collapsed roof and walls (960 sherds), and sherds found within the collapse and upper layers that were not directly linked to the building's occupational phase (1,555 sherds). Of these contexts, the sherds found within the sealed deposit proved to be the most informative and will be the focus of the following paragraphs.

The 960 sherds retrieved from the sealed deposit mainly comprised 22 highly fragmented, but almost complete, vessels with only few sherds from other ceramic vessels. Most were large handmade pithos-style storage vessels (**Fig. 13**:1-3). They are characterised by large globular bodies with elbow-shaped handles and inward folded rims. The fabric is mainly red-orange with a grey core and lime inclusions, and a light orange slip on the exterior surface. Other types are the multi-handle pithoi, some of which show incised combed decoration on the body or on the edge of the rim. Several other types of storage jar were retrieved from the context (see Pappalardo forthcoming for a full overview of the assemblage). Comparanda from Jarash and other sites in northern Jordan suggest that the large storage pithoi were produced into the seventh or early eight century, but continued in use well into the later eighth or ninth centuries (for Jarash, see Lichtenberger *et al.* 2013: 40; Uscatescu 1996: fig. 97; for al-Ḥumaymah, see Amr and Schick 2001: fig. 6-7; for Umm ar-Raṣāṣ, see Alliata 1991: fig.17.1; for Tall Ḥisbān, see Gerber 2014: fig. 6; for Capernaum, see Loffreda 2008: Type ANF 27, 151, DG 103:1-12; DF 829).

The most noteworthy vessel from the sealed deposit is a black polished bowl, which (albeit fragmented) is almost completely preserved (**Figs. 13**:4**, 14**). The bowl has a straight rim and body with a curved base. The shape is comparable to ceramic vessels retrieved from excavations in Pella (Walmsley 1995: fig. 5, n. 10-11), Mahesh (Whitcomb 1989: fig. 4:a-e), Jerusalem (Magness 1993: FBW form 1D [4] – FBW form 1E [2-4]) and Capernaum (Loffreda 2008: PIAT 72, DG 262 n. 5, 8) where it has been dated to the late eighth or ninth centuries, which provides a *terminus post quem* for the collapse of the building. The black fabric with a polished surface is a distinctive trait of these bowls, which led Jodi Magness to suggest that they are imitations of the more valuable stone or metal bowls (Magness 1994: 200). Sherds from two further vessels made from the



13. Pottery form Trench 1: 1-3: Pithoi; 4-6: Black polished bowls. Pottery from Trench 2: Cutware bowl. © LAJP.

14. Black polished bowl found in the sealed occupational deposit in Trench 1. © LAJP.

same black fabric with a polished surface were retrieved from the sealed deposit (**Fig. 13**:5-6).

Trench 2

The excavation of Trench 2 revealed by far the lowest quantity of sherds, comprising a total of 498 with only 67 diagnostic specimens. Unfortunately, the diagnostic sherds are highly fragmented, but it has been possible to identify several handmade basins. Among the notable ceramic finds is an almost complete profile of a shallow bowl with a vertical body, flat base and distinct triangular carved design commonly known as Cutware or Kerbschnitt (**Fig. 13**:7), which is typical of the late eighth or ninth centuries (Bessard 2013: fig. 14; Walmsley *et al.* 2008: 133-134; Uscatescu 1996: fig. 108, n. 754-755; Gawlikowski 1995: fig. 9-10). The bowl testifies that some activity took place here into the early Abbasid period.

Trenches 3 and 4

The ceramic assemblage from Trenches 3 and 4 comprised an impressive 13,522 sherds, of which 1,570 are diagnostic. By far the most informative context was associated with the area's fourth phase when it was used for rubbish disposal (see section on Trenches 3 and 4 above). Concentrated in the westernmost part of the trench were 1,004 sherds with 230 diagnostic specimens, many of which were preserved to almost complete forms. The deposit yielded 66 almost identical juglets with a flared rim, cylindrical neck, globular body, flat or disc shaped base and with a vertical handle running from the neck to the shoulder (**Fig. 15**:1-3). The juglets vary in height from 9 to 11.5cm, with a diameter of 2.5 to 3.5cm. The fabric is almost fine with scattered small, lime inclusions and the occasional inclusion of grit. The colour is not homogenous, but varies from shades of brown, red and grey (Munsell chart 7.5 YR 4/4, 5YR 5/8, 5YR 5/2), which probably results from the firing process. Parallels for this type of juglet were found in contexts excavated in Jarash's northwest quarter (Lichtenberger *et al.* 2013: 32, n. 76), in the Macellum (Uscatescu 1996: Group XXIV-XXVI, fig. 78, n. 440), in the intermediate terrace of the Artemis Sanctuary and in the Propylaea Church (Parapetti 1986: 183, fig. 9.5; Sepio and Baldoni 2010: fig. 10, n. 5). These comparative examples suggest a fifth- or sixth-century date of production.

Thirty-nine specimens of a type of large basin were also retrieved from this context. The basin has an ovoid-shaped rim, an almost vertical body and ranges in diameter from 40 to 50cm (**Fig. 15**:4). The colour is light brown to greyish (Munsell chart 5YR 6/3). Comparative material from Jarash and Pella suggests that this type of basin was produced from the sixth century into the early seventh century (Uscatescu 1996: Group XLII, fig. 99, n. 668-671; Smith *et al.* 1992: Pl 110, n. 12).

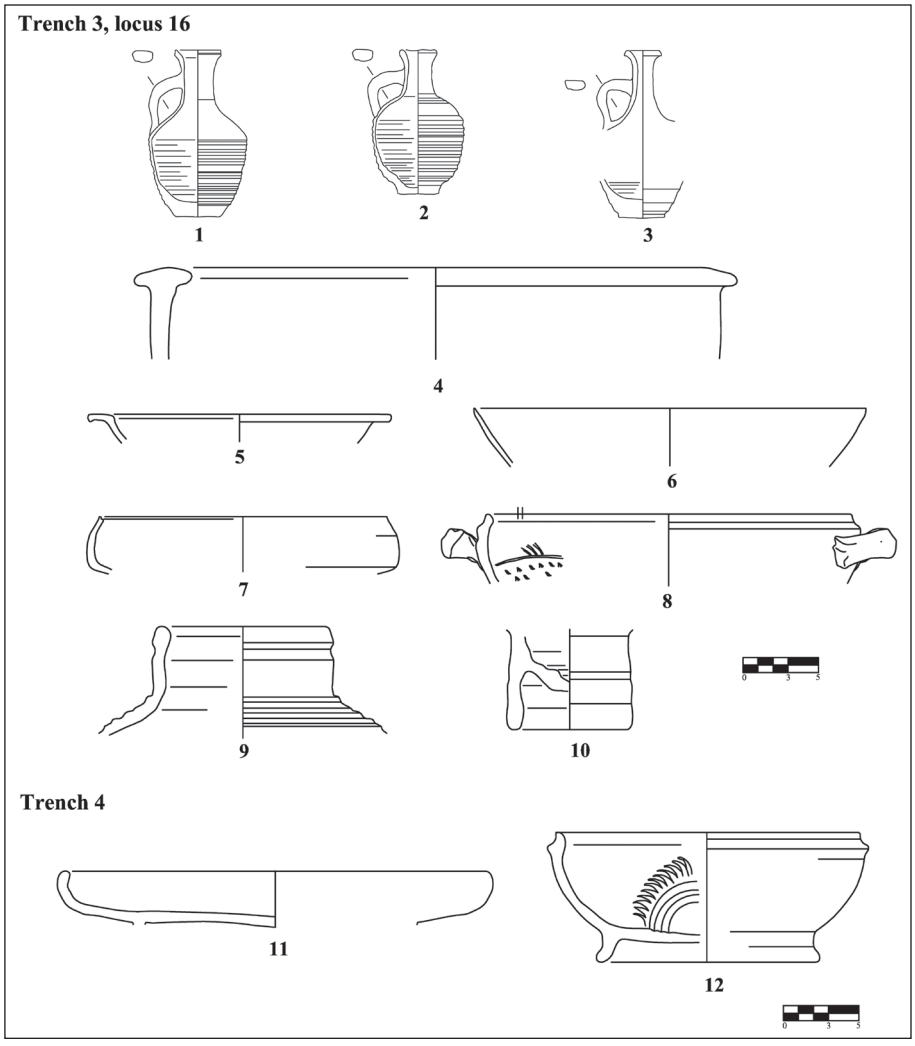
The homogeneity of this assemblage is important, suggesting perhaps that the rubbish deposit represents discard from a local shopkeeper. Given the completeness of the vessels and lack of ceramic wasters, there is no indication that the material derives from a production site. A number of other specimens found within the rubbish deposit suggest that vessels belonging to a domestic assemblage were also discarded here. The fine-ware assemblage included eight sherds of African Red Slip Ware A and C (Hayes 3 and Hayes 50A [see Bonifay 2004: 156, type 2]; Hayes 1972: 69), as well as three sherds of the locally produced Jarash Red Slip Ware, one of which is the local version of Hayes 50 (**Fig. 15**:5-6) (Uscatescu 2001: form 2).

The common-ware assemblage comprised at least 20 bowls, four of which are of the same shape with a carinated body and bifid rim (**Fig. 15**:7). These bowls probably belong to the Roman tradition, as they are mainly attested in the late Roman contexts. The type is comparable in shape to bowls found in the Macellum area and on the intermediate terrace of the

Artemis Sanctuary (Uscatescu 1996: fig. 38, 18-21; Fontana 1986: fig. 9, n. 4). The carinated-bowl type is attested at Pella where it has been dated to the third or fourth centuries (Smith *et al.* 1992: pl. 108, n. 12). Among the cooking ware, the most noteworthy vessel is a casserole with a cut rim and horizontal handle with an incised decoration representing a stylised fish (**Fig. 15**:8). The decoration is fragmentary but was identified on the basis of comparisons with vessels found in Capernaum (Loffreda 2008: 169, DG 155.1.b, 2). Finally, ten body sherds and five handles from imported amphorae were found. These comprise the Late Roman 5/6 amphora with cylindrical neck and rounded rim. (**Fig. 15**:9). Parallels for this type of amphora are found at the Propylaea Church (Sepio and Baldoni 2010: fig. 2, n. 13) and at the Macellum (Uscatescu 1996: fig. 94, n. 611, Group XXX-VII). The bottom of a Kapitän 2 amphora was also retrieved from this context (**Fig. 15**:10) (Sciallano and Sibella 1994: 99).

Overall, the ceramic material retrieved from this part of the rubbish deposit ranges in date from the fifth to sixth century, but it is important to underline the presence of vessels that can be dated to the fourth century, comprising *ca* 10% of the total assemblage.

Importantly, the eastern part of Trenches 3 and 4 reveal a similar rubbish deposit, although here the date range is somewhat later than its western counterpart. The ceramic sherds, which mainly date to the sixth and seventh centuries, comprise a similar composition of material deriving in part from a shopkeeper's assemblage and in part from a residential context (see Pappalardo forthcoming for a full overview of the assemblage). This eastern section of the rubbish dump contained, for example, 74 specimens of the so-called Jarash bowl, two of which were almost complete (**Fig. 15**:11-12) (Uscatescu 1995: type 32A and 19D).



15. Pottery from Trench 3, locus 16 (rubbish deposit): 1-3: Juglets; 4: Handmade basin; 5: African Red Slip Ware (Hayes 3); 6: Jarash Red Slip Ware (imitation of Hayes 50); 7: bowl with bifid rim; 8: Casserole with incised decoration; 9: Not local fabric amphora, late Roman 5/6 type; 10: Not local amphora, Kapitän 2 type. Pottery from Trench 4: 11-12: Badly fired Jarash Bowls. © LAJP.

Concluding Remarks

LAJP's seasons in 2015 and 2016 have significantly increased our understanding of urban development in Jarash's southwest district. In summary, the most important discoveries concern the street system and continuous residential use of the area well beyond the mid-eighth century earthquake. The geophysical examination revealed two street systems. One (located in the western part, towards the city wall) followed the Roman grid system while the other (located in the eastern part, towards the congregational mosque and city centre) followed a different, (by comparison) almost diagonal orientation. Archaeological investigations in the city centre by the Islamic Jarash Project between 2002 and 2010 uncovered a bathhouse that occupied the southwest corner of the intersection of the Cardo and South Decumanus from the fourth to the late seventh or early eighth century (previously described in publications as the Central Bathhouse [see, for example, Blanke 2015, 2016, forthcoming]). Here, excavations revealed that the Central Bathhouse was built to accommodate two converging alignments. The northern part of the bathhouse was orientated to the grid defined by the Roman street system (*i.e.* the Cardo and South Decumanus), while the bathhouse proper was aligned *ca* 30 degrees off this grid to follow the diagonal streets. This suggests that an earlier street system already existed west of the bathhouse prior to its construction. Thereby, the diagonal streets pre-date the remodelling of the city in the Roman period and the introduction of the orthogonal street system (discussed further in Blanke forthcoming). Residential buildings located to the west of the mosque that were rebuilt after the mid-eighth century earthquake also align with this grid, confirming its longevity (Rattenborg and Blanke 2017).

The excavations on the hilltop have established that urban life continued here well into the Abbasid period. This discovery is important as it demonstrates how not only the city centre was rebuilt after the earthquake, but also that residential life was resumed in large parts of Jarash's southwest district. The excavation of a storeroom in a domestic house in Trench 1 provides some information on the organisation of daily life within a residential setting, while also emphasising the continuing occupational history well beyond the mid-eighth century. Further examinations are required to establish the date and circumstances under which this part of Jarash was finally abandoned.

Examination of the bedrock cuts in Trenches 3 and 4 brought further evidence for the longevity and complexity of this part of the city, revealing that the hilltop in Jarash's southwest district was first used for the purposes of quarrying and water collection. Only at a later date were streets and buildings constructed here to incorporate the area into the city's urban fabric. The rubbish deposits are important as they suggest both residential and commercial usage, with the latter being represented in the ceramic assemblage, much of which seemingly derives from a shopkeeper's discarded collection.

LAJP's 2017 season saw further exploration of Jarash's water supply, street systems and residential areas. The results of the 2017 season will be reported separately in the coming issue of the ADAJ.

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