

Dûma 5. The 2014-2015 Report of the Saudi–Italian–French Archaeological Project at Dûmat al-Jandal, Saudi Arabia

Guillaume Charloux, Romolo Loreto

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Dûma 5

The 2014-2015 Report of the Saudi-Italian-French Archaeological Project at Dûmat al-Jandal, Saudi Arabia

Guillaume Charloux & Romolo Loreto

With the participation of Olivier Barge, Roberto Bottiglieri, Charlène Bouchaud, Jacques Brochier, Clarissa Cafora, Anaïs Chevalier, Marianne Cotty, Rémy Crassard, Elise Devidal, Gwenaël Herviaux, Yamandú Hilbert, Thamer A. al-Malki, Andrea Marcolongo, Bruno Marcolongo, Céline Marquaire, Romain Mensan, Hervé Monchot, Olivia Munoz, Charly Poliakoff, Marinela Polosa, Ahmed A. al-Qaeed, Ayidh al-Qahtani, Dara'an al-Qahtani, Vincenzo Regine & Ariane Thomas

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الحروف الصوتية	Long vowels â, û, î
ة	a

Arabic Alphabet & Transliteration
(contemporary personal names and well-known sites excluded)

الحروف العربية و مقابلها بالاتينية

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- CISA, Centro Interdipartimentale di Servizi di Archeologia

The 2014-2015 Season

Affiliations and Partnerships

The project works under the aegis of the following institutions:

- The Saudi Commission for Tourism and Antiquities
- The French National Centre for Scientific Research (UMR 8167, *Orient et Méditerranée*)
- The University of Naples "*L'Orientale*", *Dipartimento Asia, Africa e Mediterraneo*

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- *CISA, Centro Interdipartimentale di Servizi di Archeologia*
- The National Research Council of Italy, Inst. of Applied Geology [I.R.P.I.], Padova

Participants

The project is directed by Dr. Guillaume Charloux and Dr. Romolo Loreto. The following specialists took part in the project in 2014-2015:

Saudi component

Ahmed A. Al-Qaeed (director of the al-Jawf Museum, SCTA)
Abdul M.N. Al-Marshd (vice-director of the al-Jawf Museum, SCTA)
Thamer A. Al-Malki (historian-archaeologist, SCTA)
Ayidh Abdulhadi al-Qahtani (archaeologist, SCTA)
Dara'an al-Qahtani (archaeologist, SCTA)

Italian component

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Dr Andrea Marcolongo (architect)
Prof. Bruno Marcolongo (geomorphologist)
Vincenzo Regine (student, archaeologist, University of Naples L'Orientale)
Clarissa Cafora (student, archaeologist, University of Naples L'Orientale)
Marilena Polosa (student, archaeologist – historian, University of Naples L'Orientale)

French component

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Dr Jacques Brochier (geomorphologist, Aix-Marseille Université)
Dr Guillaume Charloux (archaeologist, CNRS)
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Marianne Cotty (archaeologist, Louvre Museum, AO)
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Elise Devidal (Draftsman, freelance)
Gwenaël Herviaux (archaeologist, freelance)
Dr Yamandu H. Hilbert (prehistorian, freelance)
Céline Marquaire (student, archaeologist, Paris 1)
Romain Mensan (archaeologist, freelance)
Dr Hervé Monchot (archaeozoologist, Paris 4 Sorbonne)
Dr Olivia Munoz (anthropologist, CNRS)
Charly Poliakoff (student, university Paris 1 Sorbonne)

Activities carried out during the season

The 2014-2015 mission to Dûmat al-Jandal took place in two stages due to incompatible schedules and various administrative constraints. A first field campaign executed by the Italian component of the mission was held from September 2 to October 5, 2014. The second one, by the French component began on February 27, 2015, and ended on March 28, 2015. Some readjustments were made in 2015, modifying the lines of research and scientific cooperation put in place since 2010, notably with the beginning of studies on funerary customs:

1. Prospecting

Once again this year, prehistoric surveys (R. Crassard and Y. Hilbert) in the north-west of the oasis, but also the Nafûd, were fruitful and yielded around fifty new sites from the lower, middle and upper Paleolithic, including a number of lithic industries. Moreover, we have found, surveyed, excavated and photographed nine desert kites. These vast structures made up of dry stone walls in the desert, measure up to several hundred meters and have an uncertain dating (although prehistoric; project ANR Globalkite, resp. R. Crassard, O. Barge & J. Brochier). Furthermore, the team continued with geoarchaeological and hydrological surveys in the north of the region. It surveyed several necropoleis spotted last year, not far from ʻArʻar. Rock art surveys (entire team and C. Poliakoff) were less intense than in previous years. However, they yielded several new sites and engravings, some Nabataean graffiti, a representation of a desert kite and inscriptions from the beginning of the Islamic era, the contribution of which is being discussed by several researchers. A more specific Arabic text was sent to Prof. A. al-Ghabbân for comments and even an official announcement if necessary.

2. Historic occupation

The Italian team has opened a deep sondage in Qasr Marid, looking for the oldest archaeological features in the historical area (Sector A). Excavations have also intensified in the western sector (Sector C). Many additions have been made thanks to the opening of six test pits in 2015. In particular, we have started the geoarchaeological description of the sector (thanks to the use of mechanized means); revealed an older occupation; discovered a new section of the enclosure, and cleared an alley and canal structures linked to agriculture in the centre of the western sector.

We also continued the scientific cooperation and training of our Saudi colleagues who had full responsibility of an archaeological trench (SD19) located on the northern segment of the enclosure, under the supervision of on director of the mission (G. Charloux). On this occasion, a stone staircase leading to the top of the wall was uncovered.

Moreover, the archaeological excavations were supplemented by paleo-environmental studies: analysis of fauna and plant macro-remains, as well as the organization and drawing of the ceramics of the western and the historical sectors.

3. Funerary structures

In 2015, we began excavating a vast, and apparently very old, triangular masonry structure on the Burj, a promontory in the western sector. The study of human bones and the discovery of beads suggest the presence of a grave there.

In addition to that, to our knowledge, we started the first archaeological mechanized preventive assessment of a burial necropolis in Saudi Arabia (al-Sunamiyat, ca. 3 ha). We used technical and methodological procedures used by the preventive services in French urban digs. Unfortunately, this assessment revealed that a large part of the ancient necropolis has already been destroyed.

4. Activities of protection

Two letters (English and Arabic) were sent to SCTA officials to be transmitted to the President of the SCTA, Prince Sultan bin Salman and to Prince Fahd bin Bader, governor of Jawf Province. The request seeked to protect the ancient western enclosure of the oasis.

Based on the information provided by colleagues from the SCTA, we have learned that the Saudi state appropriated the area east of the enclosure (through a royal decree). However, the northern part of the wall (Unit 4,700 m long) is still in danger due to modern construction, which is always moving closer.

The official approaches to save the enclosure started in 2010. We involved the French and Italian ambassadors, as well as all the regional and national Saudi authorities. Many lectures have been given on this subject since 2011. Moreover, in December 2013, we delivered an official letter to Prince Sultan bin Salman by hand. The data was collected in the annual reports of the mission (*Dûma* 1–4, 2010 to 2013 reports).

5. Lectures

1. G. Charloux, Angevin R., Bouchaud C., Durand C., Monchot H., Dal-Prá P., Novik W., Thomas A. & Touber M., "New Evidence of the Nabataean Presence in the Jawf Region at the Dawn of Romanization : a Triclinium at Dûmat al-Jandal (North Saudi Arabia)". ICAANE 9, Basel, 13 June 2014.
2. G. Charloux, "Birth and Development of an Oasis in Saudi Arabia", Karnak, Touristic Centre, 22 October 2014.

3. G. Charloux, "Birth and Development of an Oasis in Saudi Arabia: Dûmat al-Jandal ", colloquium *The Oasis : Eco-systems and their value for heritage and tourism*. Sorbonne Abu Dhabi, 17 December 2014.
4. G. Charloux, "Exploration du réseau hydraulique de Dûmat al-Jandal, oasis de l'Arabie déserte ", Study day on Arabia, Nanterre, 16 May 2014.
5. G. Charloux & R. Loreto, "A Cooperative European-Saudi Archaeological Research Program at Dûmat al-Jandal ", Riyadh, 11–12 May 2014.
6. G. Charloux, "Archéologie des systèmes hydrauliques en milieu désertique : l'oasis de Dûmat al-Jandal à l'étude", Seminar "Pratiques, Théories, Terrain en archéologie" (Prof. J.-P. van Staëvel), University Paris IV, Paris, 28 March 2014.
7. G. Charloux, "Ancient Water Management in Northern Saudi Arabia : The Case of Dûmat al-Jandal Oasis" (English and Arabic), King Saud University, 12 January 2014.
8. R. Loreto & G. Charloux. "The Saudi-Italian-French Archaeological project at Dûmat al-Jandal (ancient Adummatu) : Results from 2009-2013 Seasons". ICAANE 9, Basel, 13 June 2014.
9. R. Loreto, "Città e Territorio – uomo e ambiente: dinamiche di insediamento e nascita delle oasi nel nord della Penisola Arabica", ciclo di conferenze del Dottorato di Ricerca "Vicino Oriente Antico", Napoli, 8 april 2014.
10. R. Loreto, "Tra mare e deserto. Le attività de "L'Orientale" nella Penisola Arabica". Paesaggi Sommersi, Procida, 30–31 May 2014.
11. R. Loreto, "A Europaean-Saudi joint archaeological Project: The Saudi-Italian-French archaeological project at Dûmat al-Jandal", Riyadh, King Abdul Aziz Historical Centre, European Archaeologists in Saudi Arabia, Saudi Commission for Tourism and Antiquities – European Union. 8 May 2014.

6. Publication

1. G. Charloux, M. Cotty M. & A. Thomas. 2014. Nabataean or Not? The Ancient Necropolis of Dûmat. First Stage : A Reassessment of Al-Dayel's Excavations, *Arabian Archaeology and Epigraphy* 25: 186-213. http://dx.doi.org/10.1111/aae.12044.
2. R. Loreto. 2014. Dûmat al-Jandal (antica Adummatu), Arabia Saudita. Un Centro Carovaniero nel Nord della Penisola Arabica, in B. Genito, L. Caterina eds. *Archeologia delle Vie della Seta. Percorsi Immagini e Cultura Materiale. II Ciclo di Conferenze, 6 Marzo – 22 Maggio 2013*: 105–145.

Second Season of the Prehistoric Survey around Dûmat al-Jandal

Rémy Crassard [1] & Yamandú Hilbert [2]

1. Introduction

Today, the Arabian Peninsula benefits from an intensification of research in prehistoric archaeology, which has increased these last few years exponentially. Among other discoveries, such as the earliest hunter-gatherer groups and the first Neolithic societies, this increase in research has shown the Arabian Peninsula to be a crucial geographical zone for studying human occupations and dispersals across the Quaternary. Located in northern Arabia, the area around Dûmat al-Jandal , in the al-Jawf province, is particularly decisive in analyzing the relationship between the peninsula and better-known regions such as (to the north) the southern Levant, northeast Africa and the Sinai, and (to the south) the Nafûd Desert and beyond.

Since 2013, a survey program has been documenting Paleolithic and Neolithic sites across the diverse landscapes surrounding the modern town of Dûmat al-Jandal. [3] In 2013, survey activities focused on the wider surroundings of Dûmat al-Jandal. At the end of this first season, 30 surface sites were discovered, spanning all prehistoric periods including the Lower Paleolithic, the Middle Paleolithic, the Upper Paleolithic, the Epipaleolithic, the Pre Pottery Neolithic, and most probably also the Late Neolithic/Chalcolithic period.

In March 2015, a second survey campaign was started, which concentrated on three specific areas within the so-called al-Jawf Quadrangle (**Fig. 1**). The authors conducting the prehistoric survey were accompanied by a team of researchers studying the "desert kites" phenomenon in northern Saudi Arabia (cf. Barge et al. in this report), making it possible to cover a greater range of research questions aiming at the integration of prehistoric human populations and their environment. In the Jal Ajrubah and At-Tawil regions, 49 additional prehistoric sites have been discovered, mapped and sampled in 2015. They were labelled DaJ88 to DaJ136.

1. CNRS – UMR 5133 "Archéorient", Maison de l'Orient et de la Méditerrannée.
2. CNRS – UMR 5133 "Archéorient", Maison de l'Orient et de la Méditerrannée.
3. Crassard & Hilbert 2020; Hilbert & Crassard 2020 and Hilbert et al. 2017.

These sites are almost exclusively lithic surface scatters and sometimes isolated finds. Based on techno-typological parameters, the assemblages from the located sites have been chronologically assigned to known cultural periods ranging from the Lower Paleolithic to the Pre Pottery Neolithic. While few assemblages could be assigned to the Lower Paleolithic, the majority have been attributed to the Middle Paleolithic.

The sites presented here come from three different areas sampled during the 2013 and 2015 field campaigns. Areas 1 and 2 are located north of the al-Jawf quadrangle and are situated on the Jal Ajrubah, a large horizontal plateau dissected by minor faulting and small drainages. Survey area 1 encompasses the sandstone portion of the plateau, which is characterized by a large, now dry, drainage system that cuts through the soft sandstone. The topography on top of the sandstone plateau is variable; the highest zones are composed of flat surfaces, while towards the drainage system topography becomes increasingly rough, and surfaces are composed of large sandstone blocks found on moderate to steep slopes.

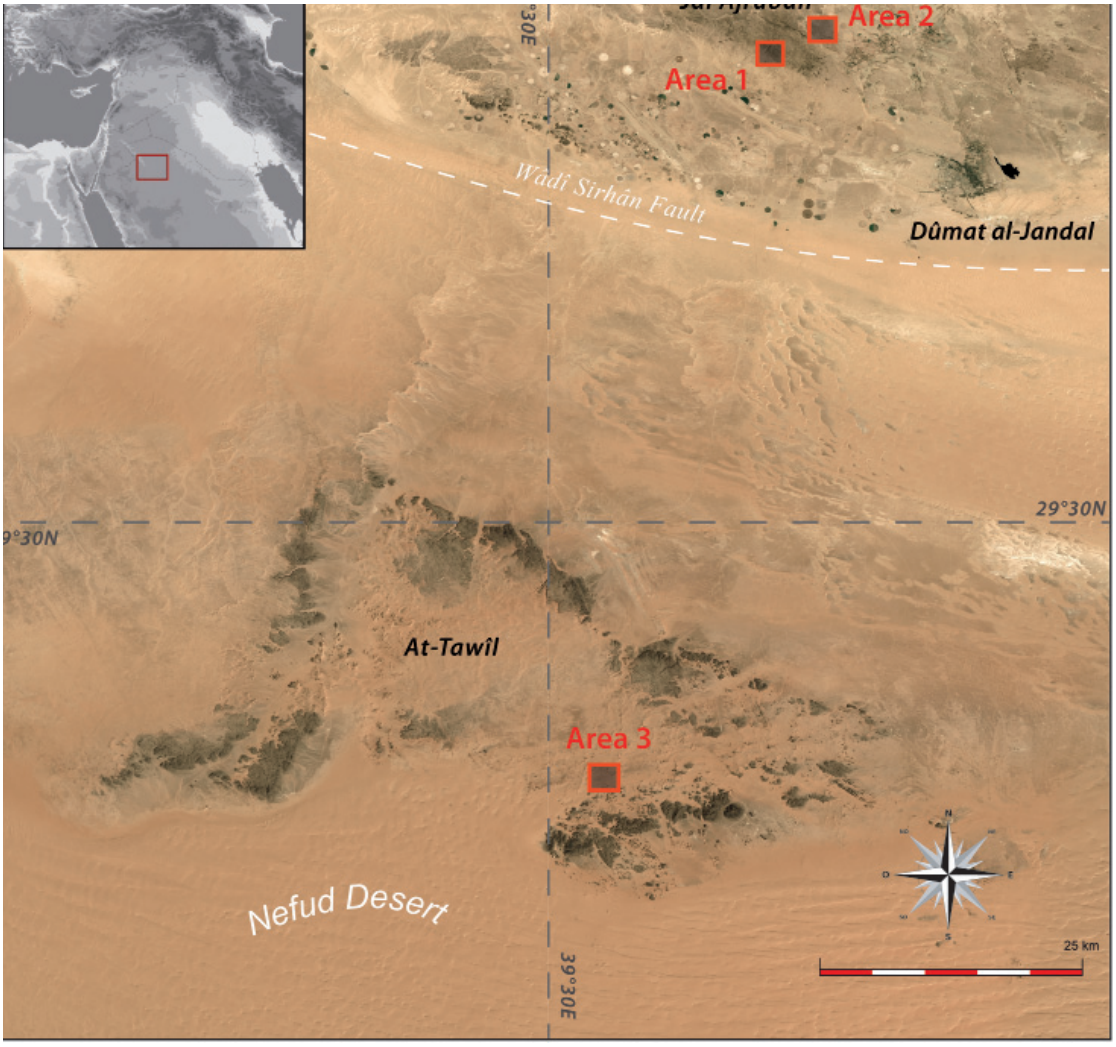


Fig. 1. Regions visited during the 2015 DAJ survey

Area 2 is located to the north of area 1 (still on the Jal Ajrubah). It is situated some 100 meters higher and shows a different lithology. In this area, beige bioclastic limestone forms the predominant portion of the exposed bedrock. Low step zones with flat surfaces characterize the topography on the limestone plateau; slopes are very steep and generally coincide either with drainage systems or faults in the area. Area 3 is located in the At-Tawîl escarpment situated within the Nafûd desert. Sandstone ridges and inselberg chains surrounded by large aeolian plains and dissected by small drainages characterize this escarpment. Survey activities in area 3 targeted the top of one sandstone ridge in the southeast of the At-Tawîl escarpment.

2. Methodes: survey and lithic analyses

Since the first campaign of the comprehensive survey, the same survey methodology and artifact analytical protocols have been applied, making it possible to find and analyze hundreds of artifacts from 79 prehistoric sites. For an outline of the methodology used throughout the survey in 2013 and 2015, see the methodology section of previous reports of analyses carried out in the Al-Kharj region.[4] In 2015, the survey process and analytical protocols were improved by the use of a handheld tablet device with uploaded survey sheets, GPS data, analysis sheets and various databases. The archaeological localities have also been described with systematic criteria. This approach gives a good homogeneity in descriptions of landscapes, topography and artifacts characteristics, among other descriptive aspects. Therein, information on each site location, disposition, archaeological period, raw material, techno-typology and general observations were recorded. Analytical protocols of the artifacts were also converted into a database that allowed an individual analysis of each collected archaeological piece including metrical attributes, techno-typology and morphology. Artifacts were then photographed and drawn to produce scientific illustrations and diacritic schemes.

3. Results: the discovery of new prehistoric sites

The 49 sites found during the 2015 survey (**Table 1**) are surface sites. The archaeological material discovered is composed of lithic industries, encompassing mostly flakes, blades, cores and few tools. They are mostly made of various types of fine-grained chert and more rarely ofsi

4. Crassard & Hilbert 2016.

silicified sandstone (**Fig. 2**). Raw material variability observed within the lithic assemblages was roughly related to general landscape specific availability and outcrop presence. That is to say that the raw material, which was most easily and readily available, was the one used by the prehistoric makers of lithic assemblages. However, some exceptions have been noted, specifically, at sites located away from fine-grained (chert) raw material sources found atop the Jal Ajrubah sites in area 1. At sites DaJ110, 120, 122 and 123, grey silicified sandstone was readily available. However, flintknappers went through the trouble of procuring chert nodules within the secondary wadi deposits of this area instead of using the slightly lower quality silicified sandstone readily available.

The lithics found around the visited areas date to various periods from the Lower Paleolithic, the Middle Paleolithic and the Pre Pottery Neolithic. In 2015, no site from the Upper Paleolithic or the Epipaleolithic period had been found. A comprehensive study of the Middle Paleolithic artifacts with detailed descriptions and interpretations has been published elsewhere.[5]



Fig. 2. Various raw materials used by Paleolithic populations in Dûmat al-Jandal area. 1. Nubian Levallois Type 1/2 core from DaJ100 made out of grey chert; 2. Nubian Levallois Type 2 core from DaJ63 made on grey and beige banded chert; 3. Levallois preferential core from DaJ126 made out of grey silicified sandstone; 4. Levallois preferential core from DaJ97 made out of dark silicified sandstone.

5. Hilbert et al. 2017.

Site	Date	Type	Period
DaJ88	01/03/2015	lithic	Holocene
DaJ89	01/03/2015	lithic	Unknown
DaJ90	01/03/2015	lithic	Middle Paleolithic
DaJ91	01/03/2015	lithic	Holocene
DaJ92	01/03/2015	lithic	Holocene
DaJ93	01/03/2015	lithic	Middle Paleolithic
DaJ94	02/03/2015	lithic	Middle Paleolithic
DaJ95	02/03/2015	lithic	Middle Paleolithic
DaJ96	02/03/2015	lithic	Unknow
DaJ97	03/03/2015	lithic	Middle Paleolithic/ Lower Paleolithic
DaJ98	03/03/2015	lithic	Middle Paleolithic
DaJ99	03/03/2015	lithic	Middle Paleolithic
DaJ100	03/03/2015	lithic	Middle Paleolithic
DaJ101	03/03/2015	lithic	Middle Paleolithic
DaJ102	03/03/2015	lithic	Holocene
DaJ103	03/03/2015	lithic	Lower Paleolithic
DaJ104	03/03/2015	lithic	Middle Paleolithic
DaJ105	04/03/2015	lithic	Middle Paleolithic
DaJ106	04/03/2015	lithic	Holocene
DaJ107	04/03/2015	lithic	Holocene
DaJ108	04/03/2015	lithic	Lower Paleolithic
DaJ109	04/03/2015	lithic	Middle Paleolithic
DaJ110	04/03/2015	lithic	Middle Paleolithic
DaJ111	05/03/2015	lithic	Middle Paleolithic
DaJ112	05/03/2015	lithic	Neolithic
DaJ113	05/03/2015	lithic	Middle Paleolithic
DaJ114	05/03/2015	lithic	Middle Paleolithic
DaJ115	05/03/2015	lithic	Middle Paleolithic
DaJ116	05/03/2015	lithic	Middle Paleolithic
DaJ117	05/03/2015	lithic	Middle Paleolithic
DaJ118	05/03/2015	lithic	Unknow structure
DaJ119	05/03/2015	lithic	Tailed Tomb
DaJ120	07/03/2015	lithic	Middle Paleolithic
DaJ121	07/03/2015	lithic	Middle Paleolithic
DaJ122	07/03/2015	lithic	Middle Paleolithic
DaJ123	07/03/2015	lithic	Middle Paleolithic
DaJ124	07/03/2015	lithic	Middle Paleolithic
DaJ125	07/03/2015	lithic	Neolithic
DaJ126	08/03/2015	lithic	Middle Paleolithic
DaJ127	08/03/2015	lithic	Middle Paleolithic
DaJ128	08/03/2015	lithic	Middle Paleolithic
DaJ129	08/03/2015	lithic	Holocene
DaJ130	08/03/2015	lithic	Middle Paleolithic
DaJ131	08/03/2015	lithic	Middle Paleolithic
DaJ132	09/03/2015	lithic	Lower Paleolithic
DaJ133	09/03/2015	lithic	Middle Paleolithic
DaJ134	09/03/2015	lithic	Lower Paleolithic
DaJ135	09/03/2015	lithic	Middle Paleolithic
DaJ136	09/03/2015	lithic	Neolithic

Table 1. List of dicovered sites during Dûmat al-Jandal 2015 surveys

Description of sites and associated lithic industry

DaJ88: is located on a deflated terrace overlooking the wadi mouth, covering a surface of 30 x 30 m. The site is a low density scatter (0–3 pieces by m^2) of very good quality chert (including grey and orange) artifacts, including two heavily patinated Middle Paleolithic flakes (collected); also some bifacial elements including one thick broken bifacial fragment. The rest of the assemblage is composed of Holocene debitage (14 pieces collected).

DaJ89: is located on a terrace overlooking the wadi. It is characterized by the presence of one isolated large discoid core, made out of a dark silicified sandstone.

DaJ90: is on top of a plateau between two wadis on a sandstone area. Isolated artifacts are mainly small in size, and made of weathered chert, including Levallois flakes, which indicate a Middle Paleolithic chronology of the scatter.

DaJ91: is on a sandstone terrace overlooking the plain. It is composed of Holocene artifacts, mainly flakes and tools made on chert. One multiple burin on a truncation made on both ends as a bladelet and a hammer stone have been found. The burin is a PPNB-like tool, similar to the specimens found at DaJ112. Three pieces in total were collected.

DaJ92: is at the mouth of the wadi, on a sediment terrace coming out towards the plain. The density of Holocene fresh artifacts is very low (less than three pieces per m^2), encompassing flakes and blades, as well as tools (scrapers) and retouched flakes, all made on very fine chert. Some blades present parallel edges. Seven pieces were collected.

DaJ93: is on an aggregational terrace located inside the wadi bed. The surface material is composed of fresh and weathered chert Middle Paleolithic elements and some pieces from undetermined period(s). The artifact density is very low; one core shows the use of Levallois preferential flaking method.

DaJ94: is on a flat plain composed of heavily weathered chert and gravel of all sizes. The plain is on the foot of a sandstone hill, in an area cut by small gullies. The surface site is eroded on a moderately flat and undulating surface, with presence of raw material on site. Made of heavily to lightly weathered chert, artifacts are dated to the Middle Paleolithic and other undetermined period(s). Artifacts are of small size. Nubian cores (preparation type 1/2), some centripetal recurrent Levallois cores, bidirectional preferential other Levallois cores have been found. Some

younger flakes were also observed on site. One possible Nubian core has been reused in younger phases, with the distal portion of core removed.

DaJ95: is located on an elevated terrace, amongst hills closer to the plateau, overlooking large circular farms located on the plain. The area is rich in geofacts, with a low density of lithic artifacts (less than three pieces per m^2). The material most probably dates to the Middle Paleolithic, but only small chert flakes have been observed, including one with a facetted platform.

DaJ96: is located on top of a secondary terrace in the vicinity of dark ferruginous silicified sandstone outcrops, overlooking the Nafûd Desert. The state of preservation of the lithic material is moderate. The site spreads over a surface of approximately 50 x 50 m. Mainly intermediate and large-sized flakes were found, with large plain butts made on the dark red and beige well silicified and ferruginous sandstone. Flakes are made directly on the outcrop, the raw material itself shows the same color variations with short grading. The flaking is made by unidirectional and unidirectional-crossed patterns of production. The chronology of the material is difficult to establish; however, the material could be related to the desert kite (Globalkites #AB550) construction nearby.

DaJ97: is a surface scatter on a slight slope on foot of a sandstone terrace, within a hilly area (**Fig. 3**). The surface is moderately preserved with a low density of silicified sandstone flakes (large butts) and Levallois recurrent and preferential cores. This indicates a Middle Paleolithic chronological attribution. Moreover, some heavily weathered hand axes with complete bifacial retouch are present, indicating a probable older age (Lower Paleolithic). Other cores show unidirectional scar patterns.

DaJ98: is an eroded surface lithic scatter located on top of a plateau overlooking two valleys. The rocky surface is composed of silicified sandstone blocks, small shattered rocks showing heavy signs of fracturing. Density of artifacts is low, with small and intermediate-sized lightly weathered chert and silicified sandstone assemblages. One small ovoid biface has been found with hard hammer-shaped scars. Cores are also present, including bidirectional flake/point production, and unidirectional Levallois. Levallois technology encompasses Nubian, as well as centripetal recurrent and preferential patterns, while flakes are often characterized by facetted platforms. Some large silicified sandstone flakes also composed the series. Some diagnostic pieces were collected.

DaJ99: is on the same plateau area as DaJ98, further towards the edge of the rise, on a slope. The site presents a low density of artifacts made on chert and silicified sandstone (small and intermediate sizes) dated to the Middle Paleolithic. Debordant flakes and Levallois flakes are made on grey chert and show an orange patination. Bidirectional-crossed Levallois preferential cores, one silicified sandstone facial core, as well as one heavily weathered hand axe made on

dark quartzite and one side-scraper on quartzite have been found.

DaJ100: is on a low depression between two geological units on top of the plateau, on a sandstone, silicified sandstone and chert terrace. The topography is characterized by a slight slope, yielding an eroded surface site with low-density lithic artifacts. There are some made of chert, usually lightly weathered, with some pieces being exfoliated ("pot-lid" fracture), the raw material is close to the site. There are some others dated to the Middle Paleolithic: Nubian cores, Levallois preferential cores, some flakes.

DaJ101: is located on top of a limestone and chert outcrop plateau overlooking the hilly area of the At-Tawil. The lithic scatter was found slightly on a slope. The surface is eroded with a low density of Middle Paleolithic artifacts, all moderately to lightly weathered and made on chert. The Levallois component is composed of preferential cores and one possible Nubian core. Bidirectional cores for flakes are also observed, and one lightly weathered blade. Some artifacts are partially buried in the sand.

DaJ102: is located within a section of a wadi cut, in alternating layers of coarse gravels and fine silts. One isolated patinated blade with a small butt made on fine chert has been found, probably dated to the Early / Middle Holocene.



Fig. 3. General view of DaJ97

DaJ103: is also (as DaJ102) an isolated artifact found in a wadi fill, in the third gravel bed (from top). It was found in a section. Ade4 hand axe (**Fig. 4**) is made of purple indetermined raw material, with an almond shape and symmetric edges. It is heavily weathered.

DaJ104: as DaJ102 and DaJ103, this site is characterized by the discovery of one isolated flake with a facetted platform, made on dark and weathered silicified sandstone, within a natural section of a wadi cut.

DaJ105: is located on the edge of the sandstone plateau overlooking the plain and inselbergs. One isolated Levallois preferential core with centripetal preparation was found semi-buried in aeolian sediments, slightly on a slope. The core is slightly patinated (white color) with some damage fractures.

DaJ106: is a 20 x 30 m surface site located on a slight rise of the plateau, overlooking a plain of sandstone slabs shatters and aeolian sediment, the artifacts being sometimes buried in the sediment between slabs. Being on a slope, this site is a probable Holocene bifacial workshop, connected to large circular structures on the top and below. A desert kite (Globalkites #AB549) was found in the vicinity of the lithic scatter. The density of finds is moderate, with an average of 4 to 10 pieces per m^2. The assemblage is mainly characterized by thin bifacial foliates, with bifacial production flakes and some rarer blades and bladelets. One cowry shell fragment has been collected.

DaJ107: is located around a limestone inselberg, some 50 meters away from the plateau, with several engraved rocks, mostly signs and animals (camel, ibex,...). A disperse lithic scatter located at the foot of the inselberg was found. The site is of low density, artifacts are fresh to lightly weathered and made on chert. Artifacts are probably Holocene and are composed of different raw materials (mostly chert), some scrapers, thin bifaces as well as thin foliate fragments, bifacial thinning flakes, and one gunflint.

DaJ108: is an eroded surface site on a wadi terrace with a low density of Lower Paleolithic artifacts: a very weathered hand axe, some bidirectional cores and blades that are less weathered, and some preparation flakes were also found.

DaJ109: is inside a wadi (at its bifurcation) on top of an aggregational terrace located at the right bank of the wadi. The topography of the site is moderately flat and close to the steep wadi side. The lithic scatter (probably Neolithic) shows a low density of artifacts, with fresh chert blades, bladelets, multiplatform cores, tools and retouched flakes. Some blades have small plain platforms and are possibly associated with the PPN period. 15 pieces have been collected.

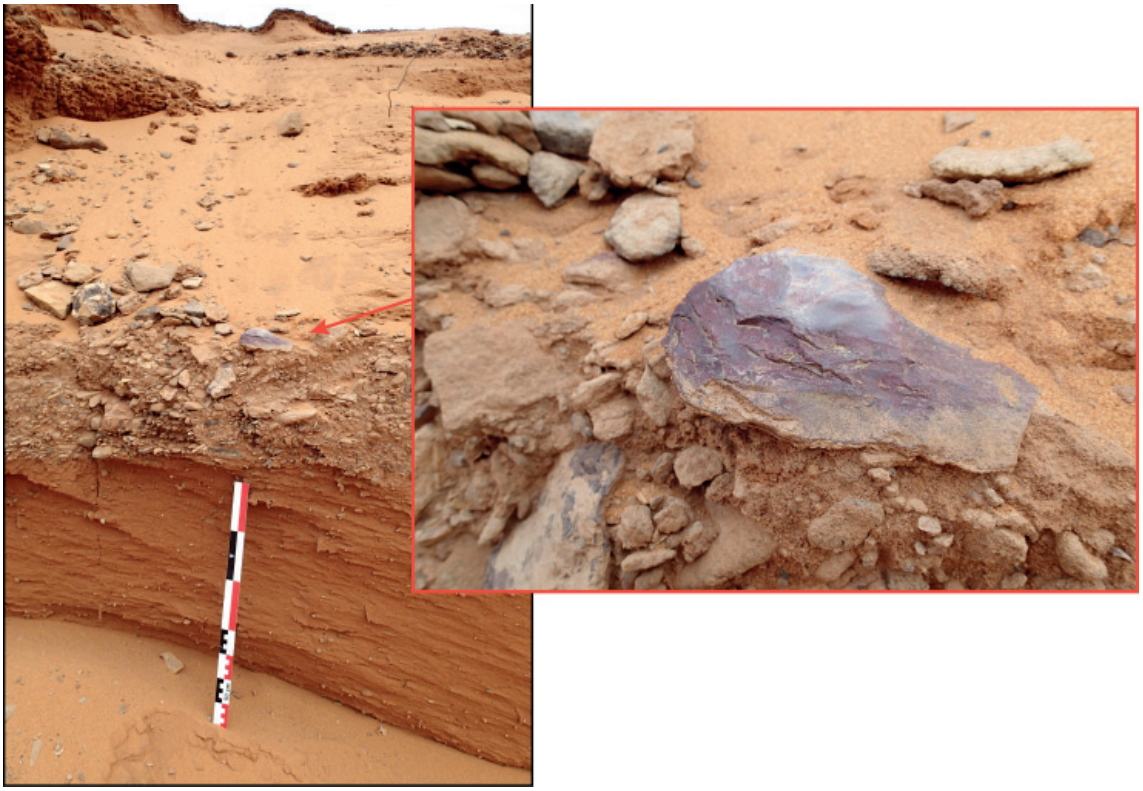


Fig. 4. General view of the section in the wadi cur at DaJ103, with a close-up on the silicified sandstone hand axe

DaJ110: is on top of the sandstone plateau of survey area 1. The site is slightly on a slope, with artifacts scattering down the plateau. The densest area is on top of the slope, in a depression (camel pit). The surface is moderately preserved, with a density from 4 to 10 pieces per m². The assemblage comprises Middle Paleolithic artifacts, with highly weathered chert (far from any raw material outcrop). Lithics encompass Levallois flakes and points, Levallois preferential cores, Nubian cores and bidirectional cores for flakes and are generally small.

DaJ111: is on a flat area on top of the plateau, on the right bank of the wadi. Some isolated chert artifacts are dated to the Middle Paleolithic: small heavy weathered and reduced Levallois cores and some flakes; one core has Nubian tendencies, very reduced and heavy weathered semi-triangular shape with a unidirectional-crossed pattern of preparation.

DaJ112: is located on the slope of a sandstone rise, on top of the plateau. It is a well preserved Pre Pottery Neolithic site with a high density of lithic artifacts (11–50 pieces per m²; (**Fig. 5**). The assemblage is in a well-preserved condition and made entirely from chert; the raw material outcrop, however, is far from the archaeological site. The technology observed on the site is characterized by blade production on bidirectional naviform cores. All the steps of the operative chain are present, including the different types of lateral and frontal crests, preparation blades

and rare predetermined blades. Burination is frequent, if not systematic, as even crested blades are turned into burins. Burins are usually made on concave truncations, and the bidirectional cores are most of the time exhausted when they became too short to produce blades and bladelets that would have been long enough. Some flakes and rare thin foliates are also present, including triangular-shaped bifacial pieces made on exfoliated flakes. This site is extremely rich in quantity and well preserved. A random collection has been made all over it for an initial test analysis.

DaJ113: is on a flat area on top of the plateau. It is an eroded surface Middle Paleolithic site of very low find density with heavily weathered chert artifacts: one Nubian core with type 2 preparation and some small flakes with facetted platforms have been collected.

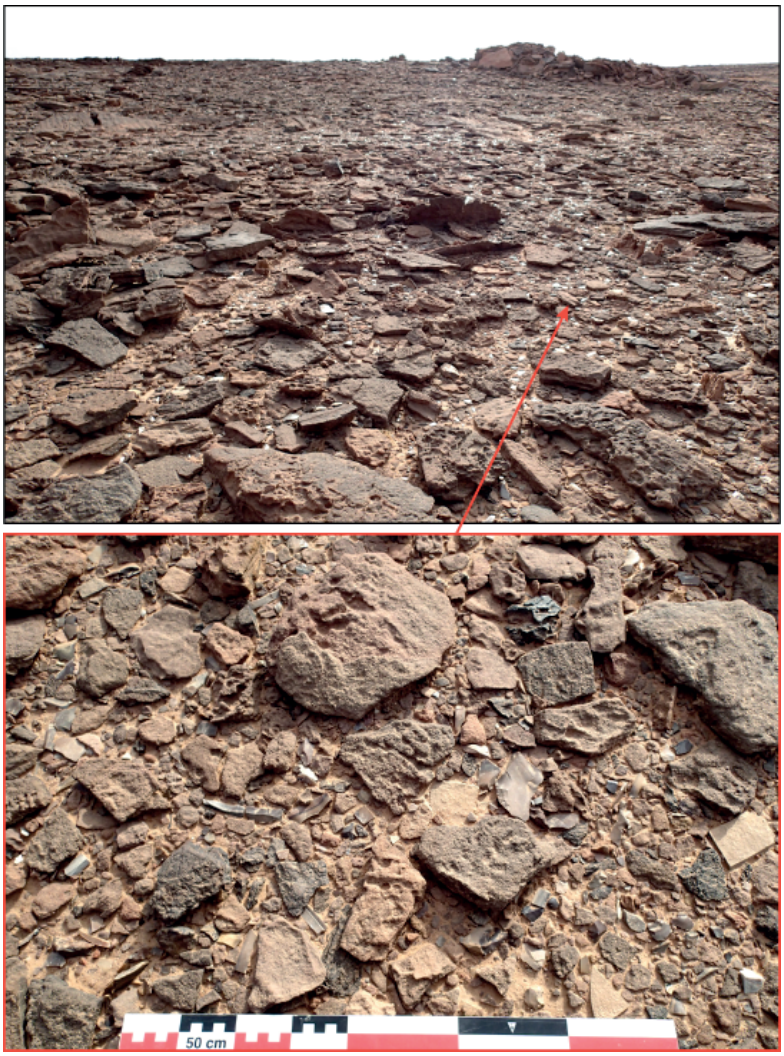


Fig. 5. General view of DaJ112's surface. Every shiny element is an archaeological lithic piece. The close-up (bottom) shows the aspect of lithic industries in situ, with examples of blades and burins.

DaJ114: is on a flat area on the highest point of the sandstone plateau. This Middle Paleolithic site is moderately preserved with a low density of artifacts. The raw material source (chert and silicified sandstone) is located on-site and is highly weathered. Artifacts encompass bladelets and Levallois flakes, as well as Levallois recurrent cores and Levallois preferential cores. One heavily weathered foliate has been found.

DaJ115: is a low-density surface site dated to the Middle Paleolithic and other(s) undetermined period(s). It is very similar to DaJ114 with worse preservation and lower density, showing flakes, Levallois flakes and preferential cores, as well as Nubian cores.

DaJ116: is on a sandstone terrace overlooking a small tributary, on a flat surface composed of sandstone blocks and desert pavement. The site is moderately preserved with an artifact density ranging from 4 to 10 pieces by m². The Middle Paleolithic artifacts are heavily weathered, mainly small chert elements were used. The assemblage is characterized by Levallois flakes and points, Levallois recurrent cores, preferential cores, Nubian cores and bidirectional cores for flakes. Technological patterns are unidirectional-crossed and bidirectional with very small Nubian cores ("mini-Nubian"?). There are small Levallois products, including some pointed pieces.

DaJ117: is on a terrace within a minor wadi. One isolated Middle Paleolithic Nubian core type 2 has been discovered. It is made on chert and is weathered and shattered.

DaJ118: is on a rise, overlooking the wadi. The surface site is partially on a slope. Artifacts are undiagnostic fresh flakes, most probably Holocene, associated with large rounded structures made of sandstone blocks.

DaJ119: is a tailed tomb on top of a rise and some undiagnostic fresh (Holocene) flakes are associated with the structure.

DaJ120: is located on the sandstone plateau in area 1. The site is moderately preserved, with low to medium artifact density (4–10 pieces per m²) over a 30 x 10 m surface. The heavily weathered chert artifacts are characterized by Levallois flakes and points, Levallois recurrent and preferential cores, as well as Nubian cores; raw material is not available on site. A selective sample of cores has been made, as well as diagnostic Levallois products. Artifacts are generally very small in size. Some brimming elements and two Nubian cores are part of the assemblage, including one less than 40 mm in length.

DaJ121: is within a gully running towards the wadi. It is characterized by one isolated bidirectional core, potentially dating to the Middle Paleolithic, made of weathered chert.

DaJ122: is on a flat area on top of the plateau. This Middle Paleolithic site is well preserved, with a good density of 11 to 50 pieces per m², over a 30 x 30 m surface. Artifacts are highly to moderately weathered and made of chert. Flat centripetal Levallois preferential and recurrent cores have been found. There are also large bidirectional core, some Débordants and Levallois flakes.

DaJ123: is a moderately preserved Middle Paleolithic site with a good artifacts density ranging from 11 to 50 pieces per m². The surface of the site is estimated to 100 x 40 m area. The assemblage is similar to that found at DaJ122, with some large Levallois preferential flakes and many centripetal recurrent Levallois cores. Artifacts are made of chert and different types of silicified sandstone. No Nubian cores have been found.

DaJ124: is on a flat surface on the side of a gully in a wadi tributary. The eroded surface site presents only a low artifact density, mainly isolated cores and flakes down the wadi, all made of weathered chert and silicified sandstone. One isolated hand axe has been found.

DaJ125: is on top of low rise, on top of the plateau, just above DaJ112. It is a very well preserved surface PPN site with burin production on blades (**Figs. 6 and 7**). The technology is identical with DaJ112, with a naviform bidirectional blade production. This site is even denser and better preserved. Only a very small collection of a few pieces has been carried out, in order to keep the site undisturbed.

DaJ126: is located on a flat area of sandstone the plateau in area 1. The site shows a moderately preserved surface and a low artifact density. The Middle Paleolithic assemblage is made of weathered chert and silicified sandstone, with Levallois preferential cores (on silicified sandstone) and preferential flakes (on chert). One Levallois centripetal recurrent core is on chert.

DaJ127: is close to DaJ126 on the same topography. The surface of the site is around 20 x 30 m in total area. It shows a low density of weathered chert and silicified sandstone Middle Paleolithic artifacts. Moreover, we noted the presence of Levallois preferential cores.

DaJ128: is on a large flat area, on top of the plateau. This Middle Paleolithic site is moderately preserved over a 100 x 60 m surface. The artifact density goes from 4 to 10 pieces per m². There are mostly Levallois flakes and Levallois preferential cores on highly to lightly weathered chert.

DaJ129: is located on top of a rise overlooking a wadi tributary in area 1 of the Jal Ajrubah. It is a 20 x 30 m surface site with a density of 4–10 pieces per m², most probably dating to the Holocene period. The lightly weathered chert assemblage is composed of flakes, multiplatform cores, and thin bifacial pieces.

DaJ130: is located on a low depression on top of the plateau. Silicified sandstone cobbles and sandstone shatters have been noted around the site. The eroded surface of this Middle Paleolithic site is estimated to be approximately 100 x 80 m in size and shows a very low density of artifacts. The majority of artifacts are weathered silicified sandstone flakes, Levallois recurrent cores and pre-forms.

DaJ131: is an isolated Nubian Levallois core found within the wadi bed. The piece is made of weathered chert.

DaJ132: is on top of a plateau, overlooking valley and farms; it is slightly on a slope, with small gully cuts scatter. This site is probably from the Lower Paleolithic and may encompass some Middle Paleolithic traits. Over a 30 x 40 m surface, a few heavily weathered large flakes and hand axes are mixed with crude Levallois preferential cores, all made of silicified sandstone. The site was possibly used as a quarry site, or as a hand axe production site.

DaJ133: is on a terrace on top of the plateau. This 30 x 50 m Middle Paleolithic surface site seems moderately preserved with a density of 4 to 10 pieces per m². The highly weathered chert assemblage is made of Levallois flakes, Levallois recurrent and preferential cores. The Levallois products are rather large, while the few cores are small and much reduced.

DaJ134: has the same topography as DaJ135 with chert Nubian-like core reworked and one hand axe of silicified sandstone.

DaJ135: is on the lower sandstone terrace, below the limestone plateau. The 60 x 30 m eroded surface of the site presents only low-density artifacts in heavily weathered chert. There are Levallois flakes and points, Levallois recurrent and preferential cores and Nubian cores, including one small Nubian and some Nubian-like pre-forms.

DaJ136: is on a terrace over the wadi. One isolated tanged Neolithic point on blade has been found above the aeolian sediment covering of a "Bronze Age" tomb. It is in chert and presents a fine pressure retouch.

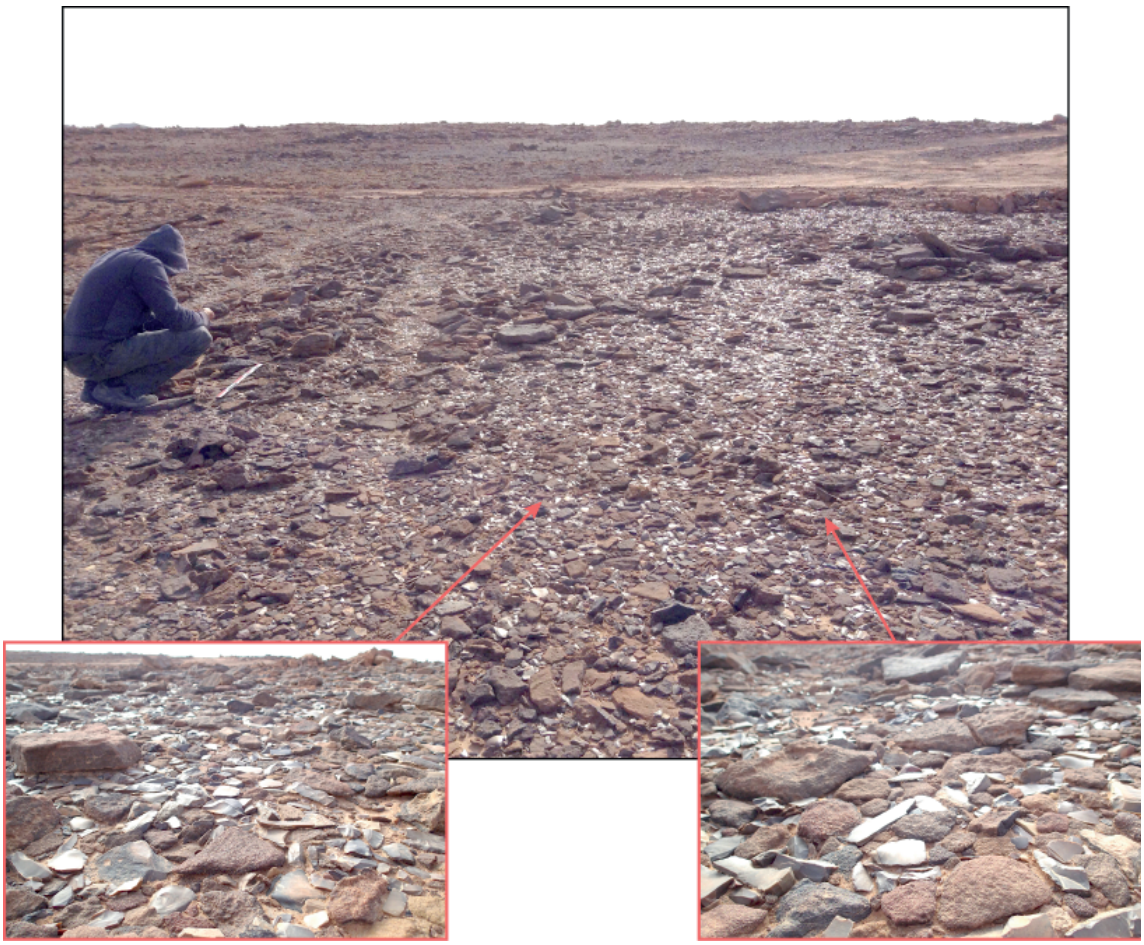


Fig. 6. General view of DaJ125's surface and close-up oblique views of the lithic richness at the site



Fig. 7. Another general view of DaJ125. The close-up view shows three naviform cores, as well as some blades, burins and flakes

4. Perspectives

The surroundings of Dûmat al-Jandal in the al-Jawf Quadrangle are a particularly promising territory for future research of the Paleolithic and Neolithic occupation of the Arabian Peninsula.[6] The discoveries from the 2013 and 2015 field seasons have a direct impact on our current knowledge of Arabian archaeology, and will definitely be of great impact to general and specific research questions once additional analyses have been completed. Further work on several aspects are planned, as each period of prehistory has a specific interest:

- First settlings by hominids during the Lower Paleolithic
- Origins and dispersals of the first modern humans and/or Neanderthals during the Middle Paleolithic,
- Definition and comparisons of the undescribed (until the present moment) Upper Paleolithic, and the little known Epipaleolithic [7] and Pre-Pottery Neolithic [8] from nor thern Arabia.

Given that the area has been poorly explored and considering its rich prehistoric heritage, this region of northern Arabia displays a particularly high potential for addressing these different research topics.

Regarding the latest periods of prehistory, two interesting localities were found in 2015: DaJ112 and DaJ125, where Pre Pottery Neolithic assemblages have been identified. They are characterized by the presence of bidirectional naviform core technology, a hallmark of the PPN period in the Levant. Bidirectional naviform core technology is used to serially produce elongated blanks (mostly blades and bladelets) to serve for shaping different types of tools. Core maintenance and initial reduction start with the preparation of a crested edge and two opposite platforms. At the sites, cores, crested blades and retouched blades have been found, as well as bifacial triangular tools. Most of the tools are blades are burins. It is difficult to estimate the number of artifacts on the site, but estimations could go up to several thousand pieces. The state of preservation is very good for a surface site, but no stratigraphy has been identified; nevertheless, circular structures have been observed, albeit almost invisible as they are extremely eroded.

In general, a strong link with the Near Eastern archaeological record may be established based on the technological affinities visible on the lithic evidence. This is true for most of the studied and observed periods, but problematic for the Middle Paleolithic, as Nubian Levallois technology is found (which was previously unknown from northern Arabia and the Near East). This will need to be discussed in detail after the completion of further field studies, not only at al-Jawf but also in various other regions of the Arabian Peninsula.

6. See also Bottiglieri in this volume.
7. Hilbert et al. 2014.
8. Crassard et al. 2013.

Geomorphological survey in Dûmat al-Jandal area Sep. 6th – 22nd 2014

Romolo Loreto [1] & Bruno Marcolongo [2]

Introduction

Since 2011 the project focuses on the study of landscape evolution, paleo-environment and climate changes between the Neolithic and Bronze Age in order to understand the processes that were behind the naissance of the oasis economy. Neolithic sites were discovered in northern Nafûd,[3] at Asfân (hunter-gatherers communities living along paleo-lakes and paleo-wadis) and along the northern Wadi al-Sirhân, in the Harrat al-Harra,[4] where villages and desert kites were detected. This represents a further step towards defining the large multi-faceted spread of human occupation in northern Arabia, linked to the humid Holocene phases at the Arabian Peninsula.

Approaching the Bronze Age and the intensification of the desertification process, we see how the human settlements pattern changed. The local economy is now based on wells exploitation and seasonal water from the wadis: sites such as Rajajîl, Qulban Bânî Murra, Rasîf [5] and Shaqîq testify to this change. Human settlements based on well exploitation survived until the Iron Age when historical sites (Dûmat al-Jandal, Tayma, Dedan, Qurayat) come to be part of a regional system characterized by trade routes, which linked north Arabian cities with the Ancient Near East and South Arabia.

The 2014 activities of the Italian team focused on both the prehistory of the region and the historical Dûmat al-Jandal. In the prehistorical context they comprised of a:

1) geomorphological study of the paleoenvironment around Dûmat al-Jandal;

2) geoarchaeological study of Asfân Neolithic;

3) emergence of the ancient caravan routes and emergency of Iron Age oasis.

1. University of Naples "L'Orientale".
2. National Research Concil of Italy, Inst. of Applied Geology (I.R.P.I.), Padova.
3. Loreto 2013.
4. Loreto & Marcolongo 2018.
5. Gebel 2013.

The fourth geomorphological campaign in Dûmat al-Jandal and surrounding areas, performed in September 2014 as part of the field activities of the Joint Saudi-Italian-French Archeological Mission, has been essentially devoted to the following main objectives:

- Deepening of the environmental analysis of the Asfân prehistoric sites, discovered during the first geo-archaeological survey in 2011;
- Extension of geoarchaeology reconnaissance to the Ash Shaqîq area, about 60 km to the south of Dûmat al-Jandal, just at the limit of the northern edge of Nafûd;
- Realization of a GIS concerning all the geoarchaeological data gathered since the beginning of the project.

Deepening the environmental analysis of Asfân area

The Asfân area has shown very interesting features from the beginning of the geoarchaeological survey. Tens of Neolithic sites, which have provided abundant lithic material, are lying at the edges of paleo-lake silty-clayey sediments, which appear on the satellite high-resolution images as darker patches, clearly recognizable from the lighter aeolian deposits (sand fields and dunes) (**Fig. 1**)



Fig. 1. Survey of Asfân area

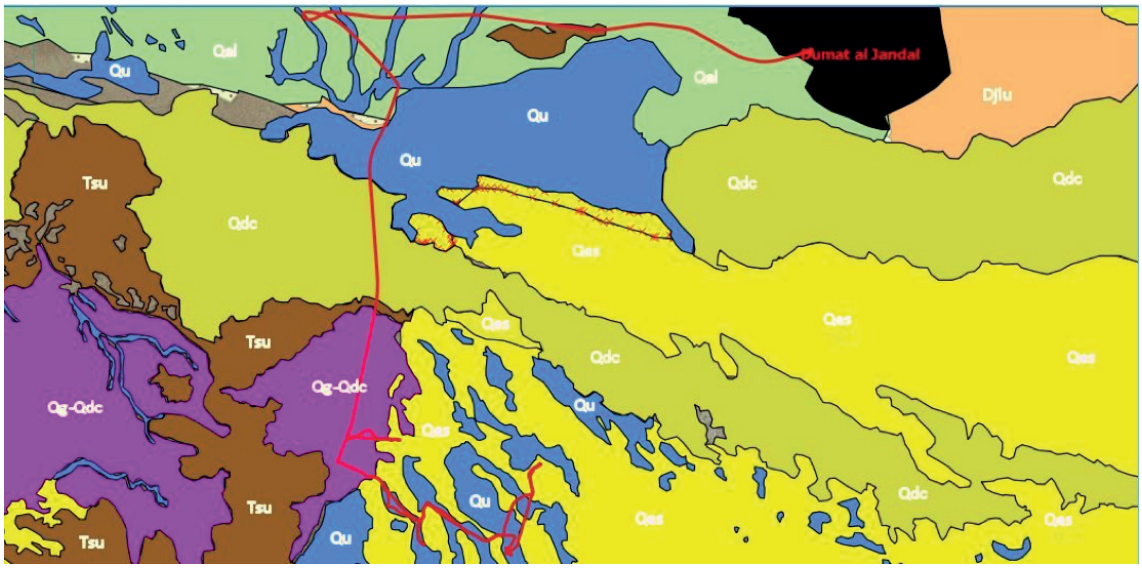


Fig. 2. Geological simplified map (Asfân survey track 2014 in red)

A geological map has been produced based on previous works [6] (**Fig. 2**) and a direct survey, to understand the close relationship between ancient settlement patterns and environmental and physical parameters.

LEGEND

SEDIMENTARY ROCKS

Quaternary

- Q_{al} Sirhan valley floor undifferentia ted Young Alluvium
- Q_{u} Alluvium
- Q_{S} Silt & Clay
- Q_{SB} *Sabkah* deposits
- Q_{ES} Aeolian sand
- Q_{G} Gravel and duricrust
- Q_{G2} Regolith gravel
- Q_{DC} Calcareous and gypsiferous duricrust

---------- Unconformity----------

Tertiary

- T_{SU} *Sirhân* Formation MIOCENE UNDIFFERENTIATED
  (multi-colored sandstone and shale
  with interbeds of sandy limestone)
  ---------- Unconformity----------
- T_{TMS} *Mira* Formation-Sib member EOCENE-PALEOCENE

(interbedded silicified limestone and chert with thin phosphorite beds)

- T_{TMM} *Mira* Formation-Mindassah member EOCENE-PALEOCENE (bioclastic limestone with Nummulitic beds)

---------- Unconformity----------

- T_{TJK} *Jalamid* Formation-Kuwaykabah member PALEOCENE-MÂSTRICHTIAN

6. Meissner et al. 1989.

(sandy limestone with interbeds of shale,

chert lenses and nodules)

- T_{TJT} *Jalamid* Formation-Thaniyat Phosphorite member PALEOCENE-MÂSTRICHTIAN (phosphorite, sandy limestone, shale and chert)

Cretaceous

- K_{AZ} *Aruma* Formation-Zallum member

(multi-colored sandstone and shale)

- K_{AH} *Aruma* Formation-Hudayb member

(limestone and dolomite, algal and fossiliferous)

---------- Unconformity----------

- K_{WU} *Wasia* Formation-Upper member

(friable sandstone and claystone)

---------- Disconformity----------

- K_{WL} *Wasia* Formation-Lower member

(sandstone, silty shale and mudstone)

---------- Unconformity----------

Devonian

- D_A *Al Jubah* Formation (sandstone interbedded with silty and sandy shale. Devonian index fossil Prototaxites)
- D_{JLU} *Jawf* Formation-Upper & Lower members combined (Upper member: limestone, gypsiferous shale and sandstone. Lower member: shale and gypsiferous siltstone, with interbeds of sandstone and marls and reef mounds)
- D_T *Tawil* Formation (ferruginous sandstone with quartz pebbles)

VOLCANIC ROCKS

- βBasalt TERTIARY-QUATERNARY

The whole area falls entirely within the so-called al-Jawf Quadrangle [7](**Fig. 3a**).

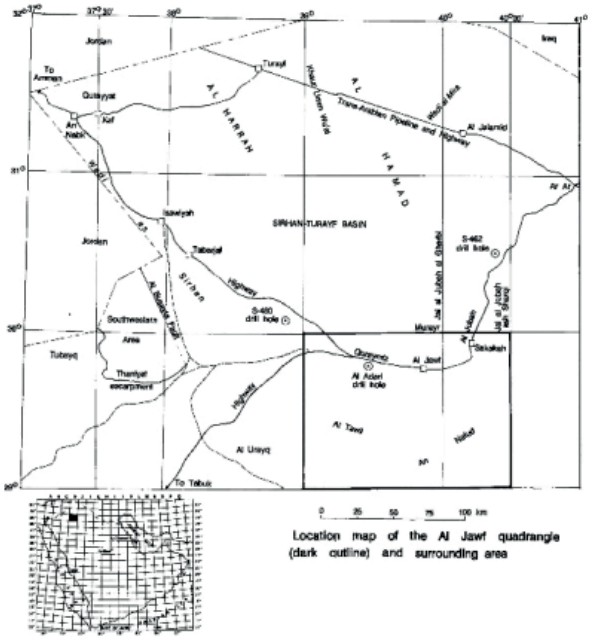


Fig. 3a. al-Jawf Quadrangle (after Meissner et al. 1989). The quadrangle lies between lat. 29° 00' and 30° 00'N, long. 39° 00' and 40° 30' E

7. Meissner et al. 1989.

As a general overview of the tectonics and lithology of the studied area, we can quote the already mentioned "File Report 89" of the U.S. Geological Survey, which says:

"al-Jawf quadrangle contains the south-eastern rim of the Sirhan-Turayf basin and includes the Al Jayb, Quraymiz and Rumman escarpments, along which phosphatic rocks are exposed. Rocks of the southern rim occupy the north-western part of the quadrangle. Exposures located south-east of the rim are of folded and faulted Devonian rocks, that contain the type localities of Tawil and Jawf Formations. The type locality of the Tawil Formation is at At Tawil, a mountainous area located in the south-central part of the quadrangle. The type locality of the Jawf Formation is in the vicinity of the town of Dawmatal-Jandal, a highly faulted area in the north-central part of the quadrangle. Between At Tawil and Dawmat al-Jandal is a broad, flat area (Al Ajaiz) that it is mostly covered by Miocene Pliocene rocks and Quaternary deposits, and occupying the central part of the map area. The Al Ajaiz area also contains a few outcrops of Devonian rocks north of At Tawil".

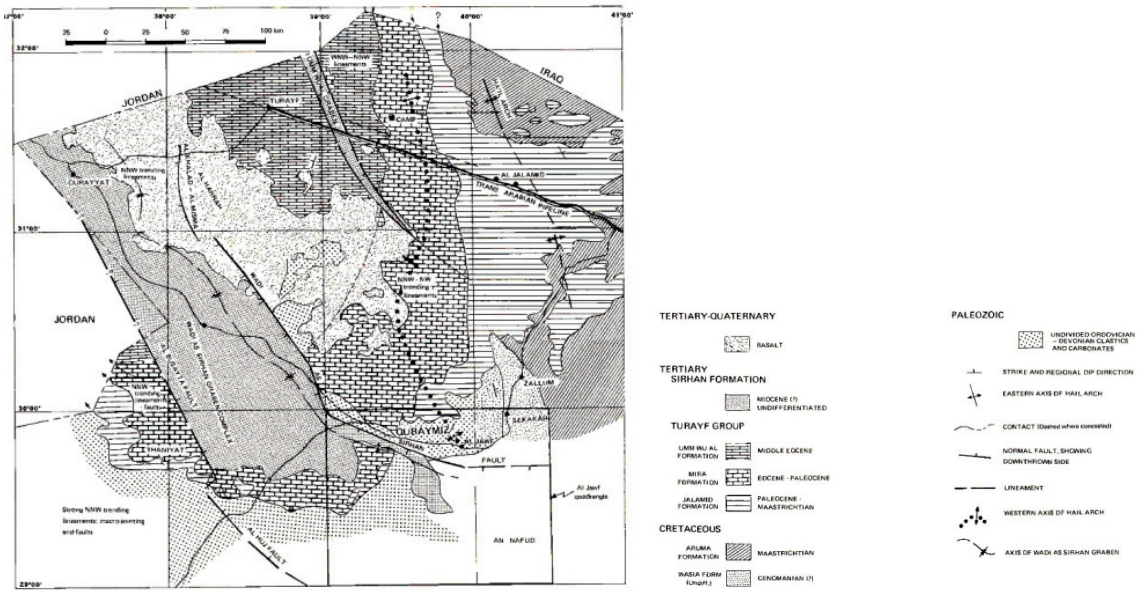


Fig. 3b & 3c. Regional geological setting of al-Jawf area inserted in the Sirhân-Turayf basin of north-western Saudi Arabia (after Meissner et al. 1989)

The local geological setting of al-Jawf quadrangle includes part of the Sirhân-Turayf basin of north western Saudi Arabia, a complex sedimentary basin extending north and west into Iraq and Jordan (**Fig. 3b and 3c**). The age of sedimentary rocks ranges from Cambrian to Recent Quaternary. The north-western part of the al-Jawf quadrangle includes the south-east edge of the basin, where Upper Cretaceous and Lower Tertiary rocks dip regionally northwestward toward the basin axis occupied by the Wadi al-Sirhân graben. The Wadi al-Sirhân fault has controlled the regional hydrography and groundwater circulation model, thus representing the main geological feature capable of affecting the settlement pattern.

Attention has been given to the Quaternary deposits (fluvial, lacustrine, aeolian, eluvium and colluvium) in the area of Asfân, where an extended paleo-lake, fed by the (paleo-)Wadi al-Sirhân, existed till the end of Pleistocene-beginning of Holocene. The humid conditions lasted for a longer period during the middle Holocene, and the whole area attracted and sustained a we ll spread Neolithic occupation. Of particular significance in this context are the groundwater flow directions and the possible storage area. Two ancient wells, lined with stones, 10–15 m in depth, have been localized in a depressed, low area (silty-clayey lacustrine sediments) between sand dunes. To this day, they witness the presence, of groundwater resources stored and exploited by nomads, as inferred by the predictive model elaborated four years ago when the paleo-lake was first identified on satellite images and then by ground survey (**Figs. 5a-b; 6a-b and 7a-b**).



Fig. 4a

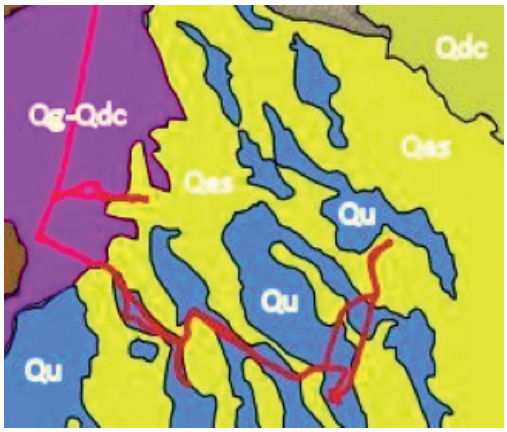


Fig. 4b

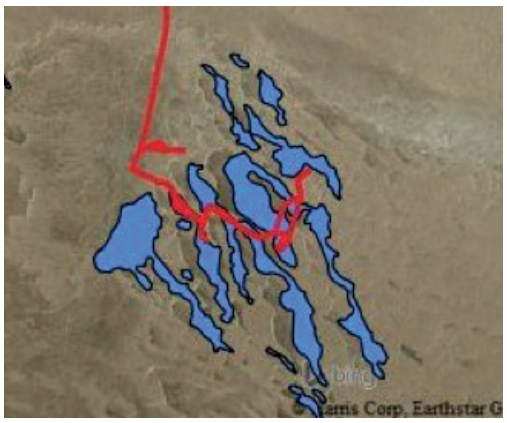


Fig. 4c

Fig. 4a, 4b & 4c. Track to the wells from Asfân. Wells are on the floor of a depressed inter-dune patch of paleo-lake silty-clayey sediments (light blue colour)



Fig. 5a. Detailed survey around wells at the rim of sand field



Fig. 5b. Detailed survey around wells at the rim of sand field

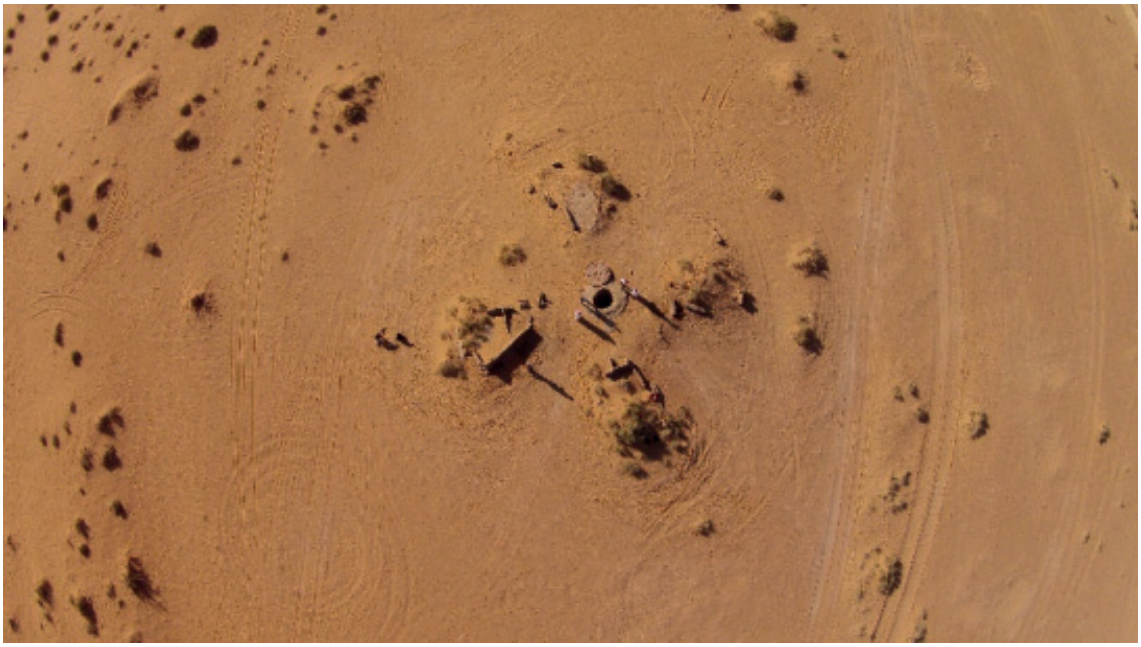


Fig. 6a. Vertical view of Well 2 from "drone"



Fig. 6b. Oblique view of Well 2 from "drone"



Fig. 7a. Vertical view of Well 1 from "drone"



Fig. 7b. Oblique view of Well 1 from "drone"

Moreover, to improve the picture of Asfân as an area rich in Neolithic sites, along the track leading to the wells we found many other places with lithic tools, like those reported in the figure below (**Fig. 8**).

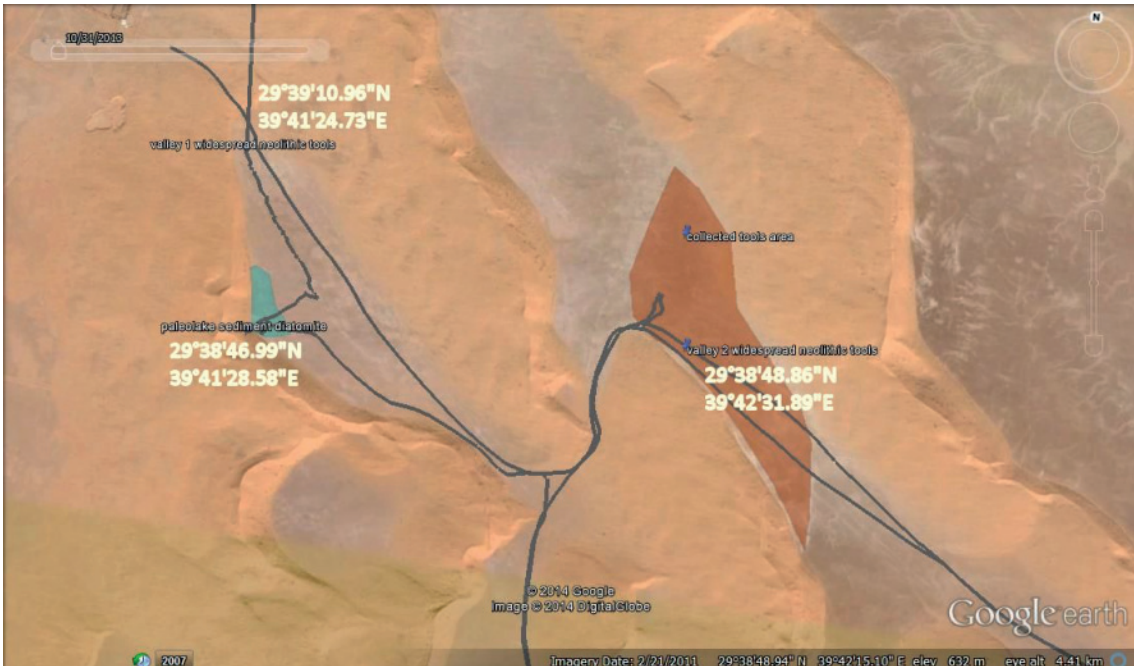


Fig. 8. Along the track to the well, we discovered lithic tools in the outcrops of paleo-lake sediments at the rim of sand fields/dunes

The peculiar localization of these "ateliers de débitage" along the edges of these paleo-lake patches confirms the univocal relation between landforms/geomorphological setting and the ancient settlement model, as it was inferred at the very beginning of our geoarchaeological survey (first campaign in 2011) from the interpretation of high-resolution satellite images.

From the prehistory to the Iron Age: North Arabian oases and the emergence of ancient caravan routes

Starting from the Neolithic sites identified in the Asfân vicinity, south and south-east to the sites discovered in 2011 (Asfân 1–5) (**Fig. 2**),[8] it has been decided to open two small excavation trenches. The aim was to collect in stratum samples for further analyses specifically related to Neolithic sites (diatomite and clay samples related to the ancient paleo-lakes identified in the

8. Loreto 2013; Aurino & Loreto 2016.

area). The 2014 survey confirms what has already been seen in 2011: the Asfân area revealed a huge sequence of Neolithic sites with a wide and deep occupation by hunter-gatherers spread around a series of paleo-lakes.

The most striking collected lithic materials from the 2014 survey show are similar to the PPNB Amuq Levantine tradition, suggesting a northern Nafûd passageway from the Levant to south-eastern Arabia.[9]

For the transition from the Bronze Age to the Iron Age, there is a need to define the relationships between the ancient Adummatu and the Ancient Near East, as well as the whole Arabian Peninsula. A study of the ancient caravan routes is currently in progress, which relies rather on the archaeological evidence and artifacts than textual sources. It is linked to the progress of the North Arabian oases and looks into the identification of wells (possible caravan stations), ancient rivers (possible routes with season availability of water) and rock graffiti. From previous observations of the better documented western routes during the Nabataean period, it seems that one of the main research topics is the definition of the interrelation between al-Jawf and ancient Mesopotamia during the 1st millennium BCE. This was a time of the royal Assyrian annals, which document the warfare and commercial contacts between these two areas.

The analysis starts with the definition of Bronze Age sites, their location along the as-Sirhân valley and their subsistence economy. The first Bronze Age sites, i.e. necropoleis, were discovered in 2013 along the paleo-wadis in the Tamriyat area, 120 km northeast of Dûmat al-Jandal along the routes to Ancient Mesopotamia.[10] After the analyses by H. Gebel, who looked at sites from the 5th Millennium BCE between Jordan (Qulban Bânî Murra) and al-Jawf (Rasîf),[11] it appears that the first community living around wells and developing embryonic oases already appeared at that time. Bronze Age oases wells seem to be still in use during the Iron Age.

One example is the wells site of Asfân, discovered in 2011 (**Figs. 5a-b; 6a-b and 7a-b**). Thus, the 2014 season focused on the detailed study of the Asfân wells.

From an architectural perspective, the wells are very similar to the already known Chalcolithic-Bronze Age sites (Rasîf, Shaqîq, etc.). After a detailed survey conducted around the Asfân wells, various prehistoric and historical materials (Bronze Age lithics, pottery from Nabataean to Islamic periods, bronze, glass, etc.) were put in the focus.

Considering the architecture, Asfân could have been a possible Bronze Age site, whose wells (which took water from the underground aquifer fed during the Holocene humid phase) were still used during the historical period as a trade station around the ancient Adummatu.

9. Charpentier & Crassard 2013, fig. 2.6; Inizan 1988. Particular thanks go to Marie-Louise Inizan for the preliminary analysis
10. Loreto & Marcolongo 2018.
11. Gebel 2013.

Geoarcheological survey of Shaqîq area

During the same survey campaign, we decided to extend field observations to otherareas south of Dûmat al-Jandal, showing interesting geomorphological features and a high probability of the presence of archaeological evidence (**Fig.9**). Shaqîq lies in a depression area of Quaternary alluvium (Q_u- unconsolidated silt, sand and gravel), surrounded by outcrops of Al Jubah Formation of Devonian age (D_a- sandstone interbedded with silty and sandy shale, with minor interbeds of siltstone. It contains Devonian index fossil Prototaxites) (**Fig. 10**).

Close to Shaqîqmarkazi (29°17'58.68"N, 39°54'58.88"E) there is a series of interesting ancient wells, exploiting the phreatic aquifer contained in the loose silty sediments of the paleo-



Fig. 9. Survey of Shaqîq area

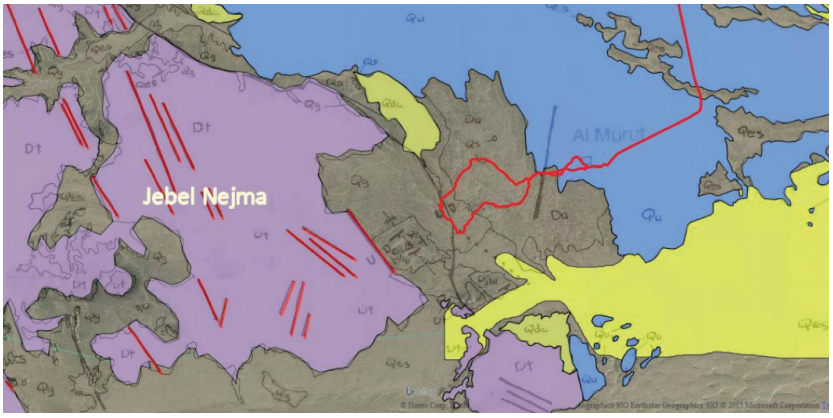


Fig. 10. Simplified geological map (Shaqîq survey track 2014 in red). For a Legend, please refer to Legend of Fig. 2 and relative the Geological setting

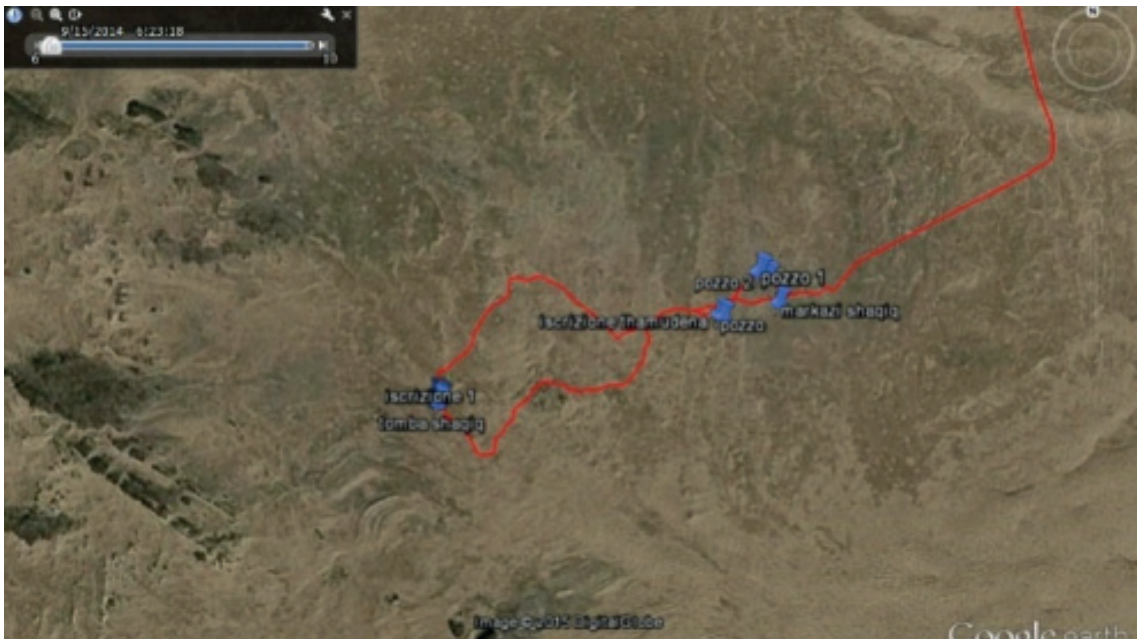


Fig. 11. Track to the wells and tombs from Shaqîqmarkazi. Wells are on loose silty sediment of the paleo-lake rim

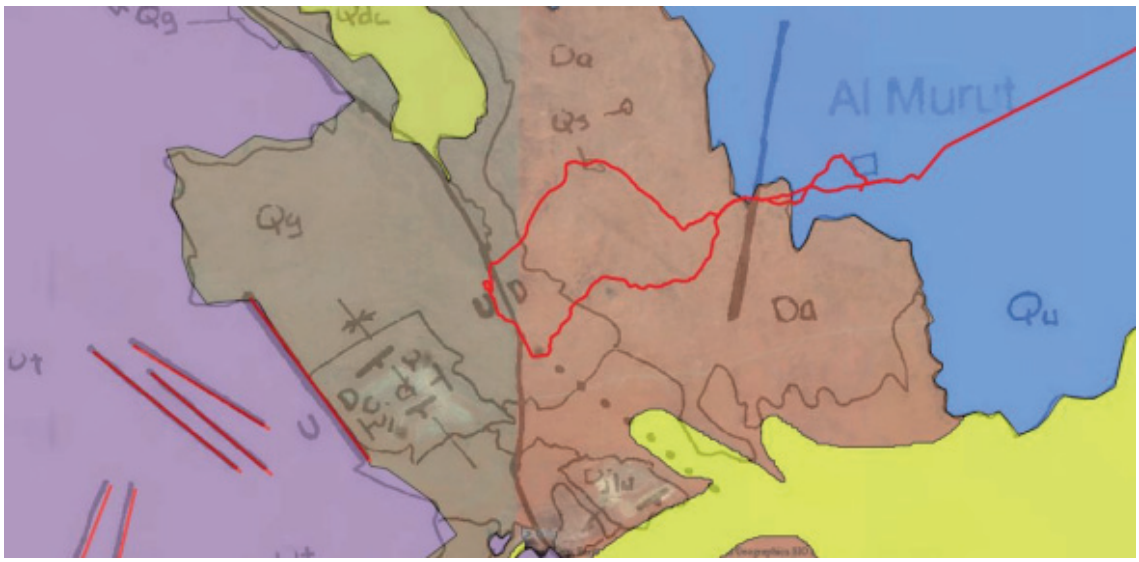


Fig. 12. Track to the wells and tombs from Shaqîqmarkazi. Tombs are localized at the eastern foothills of the isolated Jebel Nejma - Tawil Formation(D_T) -

lake rim (**Figs. 11, 12 and 13**).

Their number and density show how local people were increasingly forced to sustain productive activity and life itself with groundwater resources instead of surface ones. As the climate started to become more arid and environmental conditions shifted towards dry steppe and sandy desert, this was a necessity.

Most of them are completely filled with aeolian sand, and only a few still maintain an open connection with the phreatic table (**Figs 14 to 23**).



Fig. 13. A group of wells close to Shaqîqmarkazi



Fig. 14. Well 1, completely filled by sand, as seen from the satellite



Fig. 15. Well 1, completely filled by sand, as seen on the ground



Fig. 16. A well with a Thamudic inscription, completely filled by sand, as seen from the satellite



Fig. 17. A well with a Thamudic inscription, completely filled by sand, as seen on the ground



Fig. 18. Well 8, some hundred meters north of Shaqîqmarkazi, still open and protected



Fig. 19. Well 8, some hundred meters north of Shaqîqmarkazi, still open and protected



Fig. 20. Well 5, some hundred meters north-east of Shaqîqmarkazi, still open and protected



Fig. 21. Well 5, some hundred meters north-east of Shaqîqmarkazi, still open and protected



Fig. 22. Large slabs of the At Tawil Formation (DT) (ferruginous sandstones) employed for "margelle" (well-curb)



Fig. 23. Large slabs of the At Tawil Formation (DT) (ferruginous sandstones) employed for "margelle" (well-curb)

Further to the west of Shaqîqmarkazi, near the eastern foothills of the isolated Jebel Nejma (mainly composed by ferruginous sandstone with quartz pebbles of Tawil Formation(DT)) we encountered several tombs, partially destroyed (**Figs.24 and 25**).



Fig. 24. Approaching Jebel Nejma (Tawil Formation DT), west of Shaqîqmarkazi



Fig. 25. Approaching Jebel Nejma (Tawil Formation DT), west of Shaqîqmarkazi

They are mainly lying on the eluvium surface of the At Tawil Formation in the vicinity of Jebel Nejma, which is an easy source of the large slabs employed for their construction (Figs. **26,27 and 28**).



Fig. 26. Walking on the eluvium surface of the At Tawil Formation in the vicinity of Jebel Nejma.



Fig. 27. Tombs, partially destroyed, close to foothills of the sandstone dissected relief of Jebel Nejma



Fig. 28. Tombs, partially destroyed, close to foothills of the sandstone dissected relief of Jebel Nejma

Again, this peculiar location underlines the strong influence of environmental parameters on the choice of the site by man for performing various activities.

For our future research, it will be crucial to interpret the remote-sensing data and execute a contextual geomorphological survey. Both are irreplaceable methodological tools for our research questions and will guide our work in this desert area.

In the next few years, we intend to focus and develop the study of the entire Jebel Nejma as a well-defined geomorphological unit and conspicuous, isolated landform, fully surrounded by Quaternary loose alluvium and sand.

The desert kites around Dûmat al-Jandal, Saudi Arabia

Olivier Barge [1], Jacques Élie Brochier [2] & Rémy Crassard [3]

Context and methodology

Desert kites (also simply called kites) are mega stone structures made of long walls or stone alignments that converge into an enclosure flanked by several closed rooms, called cells. Their function is still enigmatic, although a trapping purpose is regularly accepted. They have been recorded at a spectacular rate in the last few years, growing both in their number and area of diffusion. New regions have been discovered and surveyed in the recent past. In the mid-1990s, the estimated number of kites was a few hundred. More recently, this body of evidence has been estimated at more than 5,000 of these structures (see www.globalkites.fr for a regularly updated interactive distribution map.[4] While some discoveries were made through fieldwork and surveying, the majority result from research derived from high-resolution satellite imagery. An approach, which has been largely favored by easy on-line access (Google Earth, Bing Maps). This enlarged body of material re-launched scholars' interest in these constructions, whose age and function remain fundamental questions without any satisfying answers. Today, it seems that kites and their distribution represent a phenomenon the magnitude of which was quite underestimated, from the Arabian Peninsula to the Levant, the Caucasus and the Aralo-Caspian region.

The al-Jawf region in northern Saudi Arabia has thus far experienced sporadic archaeological investigation. A new operation, part of the Dûmat al-Jandal project, was carried out in March 2015. It consisted of identifying and surveying the desert kites structures known in the region thanks to high-resolution satellite imagery. A total of nine structures have been visited (**Table 1**).

1. CNRS, UMR 5133 Archéorient, Maison de l'Orient et de la Méditerranée.
2. Aix-Marseille Université (AMU), CNRS UMR 7269 LAMPEA, Maison Méditerranéenne des Sciences de l'Homme.
3. CNRS, UMR 5133 Archéorient, Maison de l'Orient et de la Méditerranée.
4. Crassard et al. 2014.

Three areas have been explored around Dûmat al-Jandal. Two are located some 20 and 40 km to the west of the actual city, while a third one lies some 70 km to the south, at the northern edge of the Nafûd Desert (**Fig. 1**).

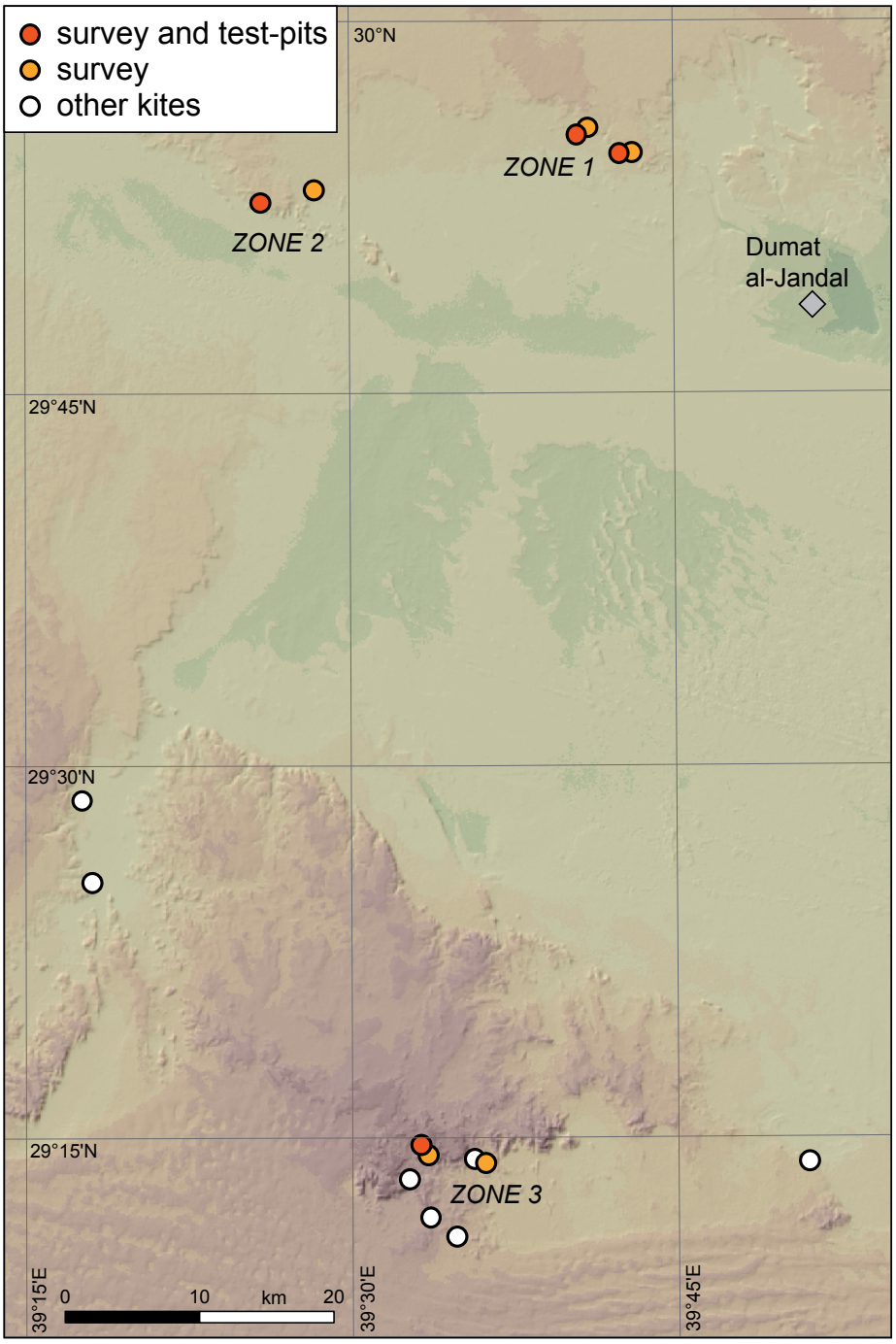


Fig. 1. General map of the three zones with desert kites around Dûmat al-Jandal

The kites present the particularity to have several "cells" at their periphery; they look like small rounded and closed stone structures. Some of these cells have been examined by excavating a test pit of about one square meter each. No artifacts have been found in them, but a whole range of geoarchaeological analyses are possible thanks to the study of sediment compositions. A geoarchaeological analysis, conducted after a stratigraphic study of the profiles (generally cells profiles) is essentially laboratory work. Two kinds of samples have been systematically collected: small dust samples and large soil samples. The first ones, analyzed under the microscope for mineral, anthropogenic and/or biogenic components, allow us to construct regional correlations between profiles (hence between kites). The second ones, water-washed at the base camp on a 0.5 mm mesh and sorted under a binocular microscope at the laboratory for biogenic material, allow us to retrieve datable radiocarbon elements. In this context, it may be charcoals, charred seeds, avian eggshell fragments, carbonated seeds, etc. This work is now in progress. In addition to that, a series of samples have been extracted for dating these structures with "Optically Stimulated Luminescence" (OSL) in specialized laboratories in Europe.

The kites all across their very wide distribution in the world are studied through a complex Geographic Information System (GIS) that allows performing a wide range of geostatistics. Subsequently, the structures are analyzed at three different scales: global, regional, and individual. For the research on an individual kite, an accurate plan is performed by Differential GPS (DGPS), that provides a degree of precision of the measurements that is impossible to obtain with the satellite imagery only. Besides, pictures are taken from the sky with a camera system fixed on a kite. The camera is operated by remote control and/or through a video signal on a screen from the ground. Combining DGPS mapping and multi-angle photography allows producing photogrammetric models that are particularly useful for understanding the construction. Eventually, this sheds light on the function of such mega-structures, which are so difficult to understand from the ground.

Globalkites Kite #	DAJ site number
AB135	DAJ137
AB136	DAJ138
AB547	DAJ139
AB549	DAJ140
AB550	DAJ141
AB557	DAJ150
AB558	DAJ151
AB559	DAJ152
AB621	DAJ153

Table 1. Desert kites in the Dûmat al-Jandal region

Desert kites in the Dûmat al-Jandal area: zone 1

The first studied area is situated west of the Jebel al-Himdi and the al-Wadi graben area. Using satellite imagery remote sensing, the team identified four mega-structures at the edge of a sandstone plateau (kites AB135 and AB136 to the east; kites AB547 and AB549 to the west).

The eastern couple: AB135 and AB136

AB135 and AB136 are very close to each other, having their opening and the funnel entrances in parallel (**Fig. 2**). These kites were already observed in 2014 by the "Prehistory" team.[5]

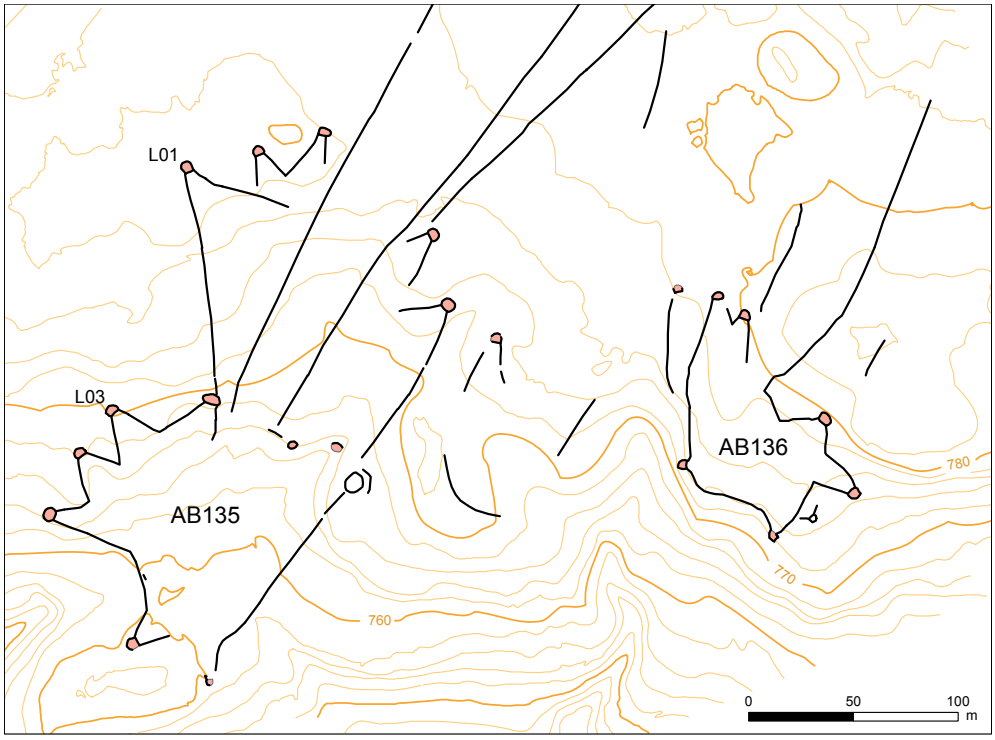


Fig. 2. DGPS Mapping of AB135 and AB136

5. Hilbert & Crassard forthcoming

Desert kite AB135

This kite is a huge star-shaped example of a type rather representative of the region. Its actual state of preservation is very bad, as many parts of the structure have been bulldozed by previous geophysical surveys for oil and gas exploration (**Fig. 4**). The kite has also been partially reused by later prehistoric populations, who built tombs and circular structures with the kite's stones. This whole context renders an accurate interpretation of the exact initial structure difficult. Nevertheless, field observations, as well as aerial pictures, allow a better understanding of the original shape of AB135.

A small test pit was excavated in a first cell (AB135-L01) revealing a very shallow deposit with just little potential for sediment sampling in an indurated and carbonated sediment. Subsequently, a small structure, interpreted as a tomb, was then excavated as it leaned against the cell wall. This tomb-like structure was then potentially younger than the cell. The tomb-like structure, excavated in its half along the width, was completely devoid of any artifacts. Only the construction technique could be observed: facing walls in the funerary chamber with four to five courses from one side and with orthostats from the other. The filling of this small structure is particularly soft with collapsed stones, indicating a post-looting filling. Few samples of bird eggshells were collected for dating, but with low potential.

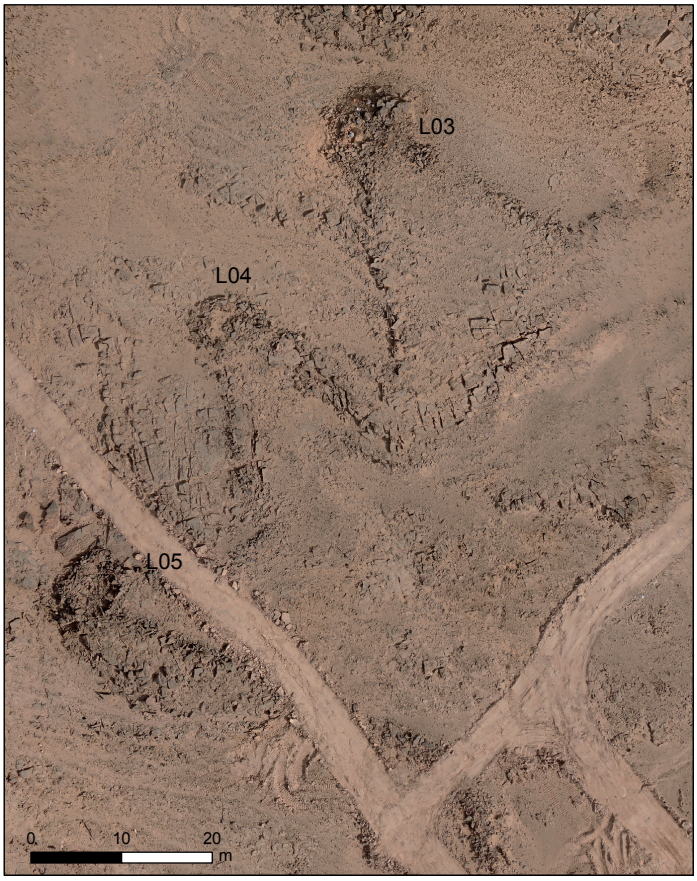


Fig. 3. Kite AB135, aerial view of cells L03 (test-pit), L04 and L05



Fig. 4. Kite AB135, aerial view of the entrance

Another test pit was carried out in a second cell (AB135-L03 - **Fig. 3**). This structure was special in that it uses the natural relief for the construction of its peripheral wall. No artifacts were found, but several sedimentological and OSL sampling were taken.

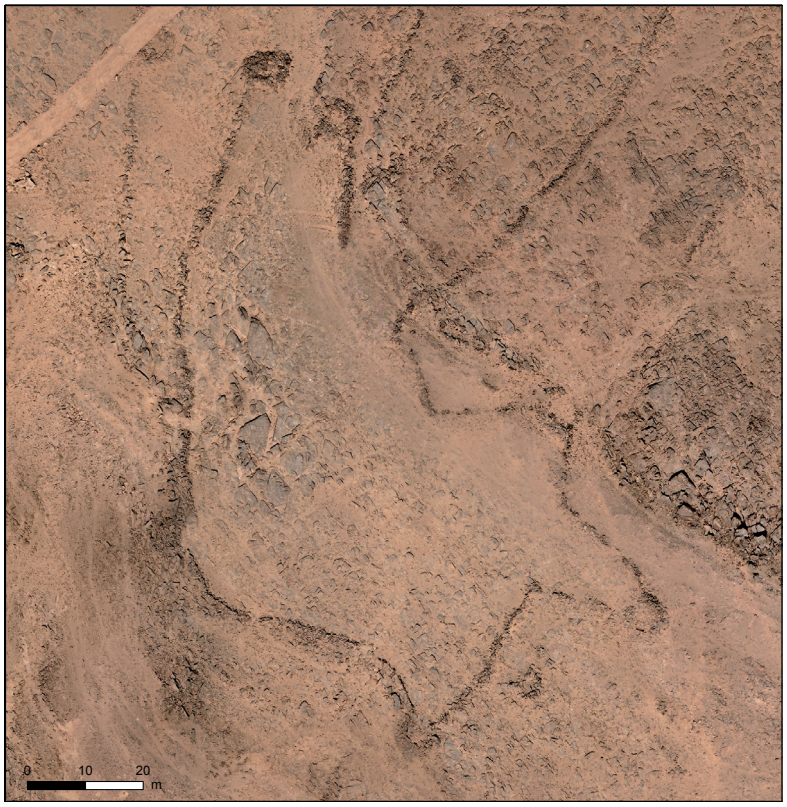


Fig. 5. Kite AB136, aerial view of the enclosure

Desert kite AB136

Being less disturbed and destroyed than its neighbor AB135, this AB136 kite had the rather better potential for excavation (**Fig.5, 6 and 7**). Unfortunately, field observations concluded that no cell had enough sediments and that the general topographic context was not favorable for good conservation. While no excavation was realized, a DGPS mapping of the kite was made. The relationship with the neighboring AB135 kite still remains to be defined.



Fig. 6. Kite AB136, the right side of the enclosure

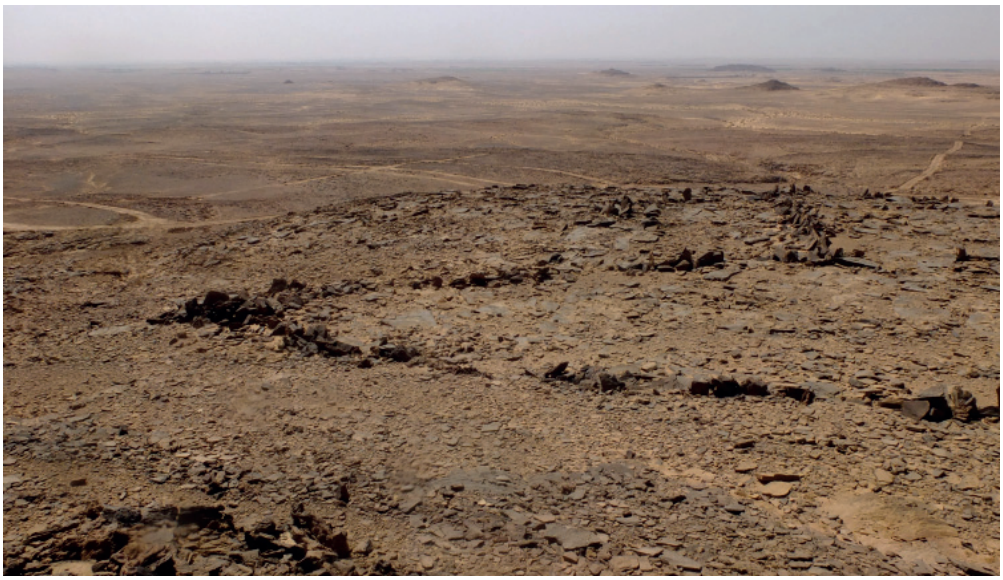


Fig. 7. Kite AB136, a cell built at a slope break

The western couple: AB547 and AB549

AB547 and AB549 seem to function together, and they are located about 3 km to the west of the first couple of kites (**Fig. 8**).

Desert kite AB547

After attentive observation of the different sectors of this AB547 kite, no cell had been considered as suitable for excavation. All were either related to a slope, or showed very little accumulation of sediments, thus jeopardizing a secure context for geoarchaeological analyses or OSL sampling. An accurate DGPS mapping of the kite has been made, showing its direct relation with the neighboring AB549 kite. Field observations seem to indicate that both kites were functioning simultaneously.

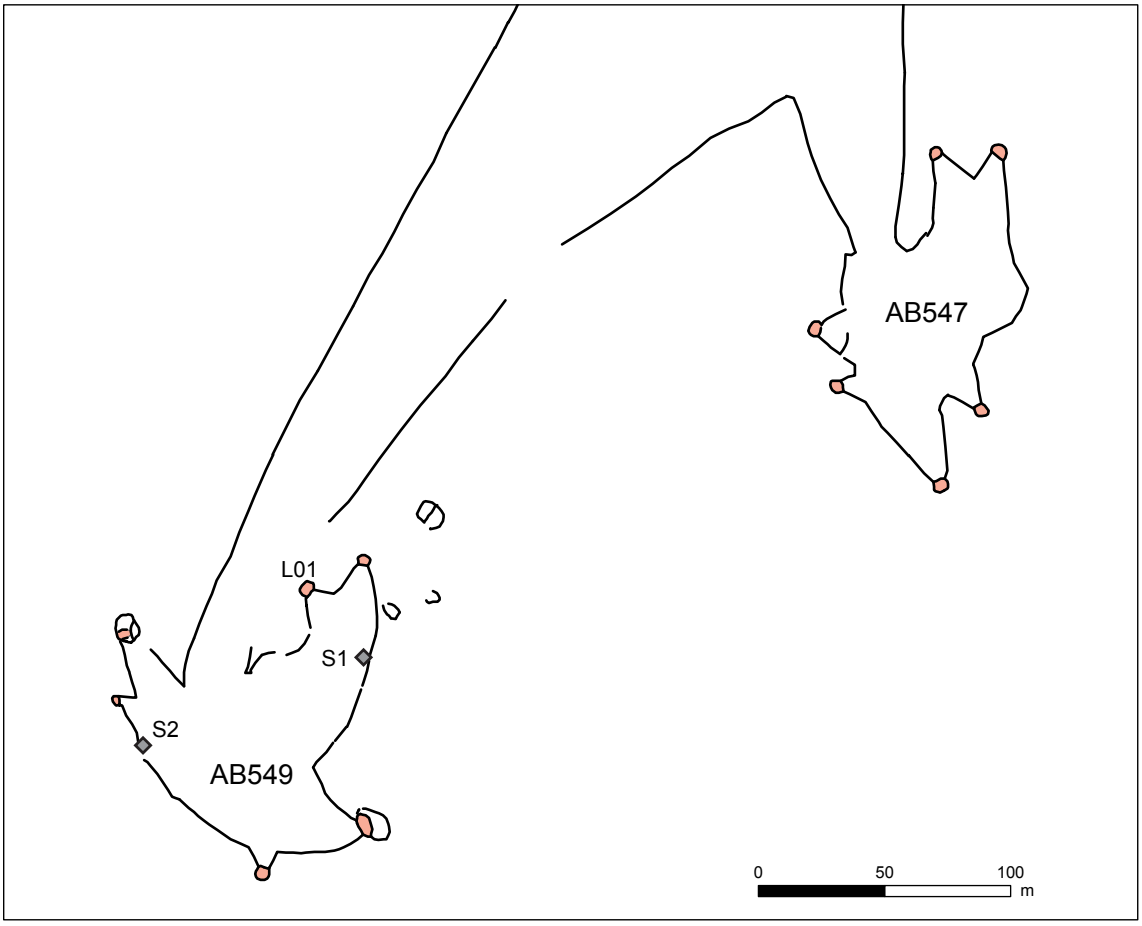


Fig. 8. DGPS Mapping of AB547 and AB549

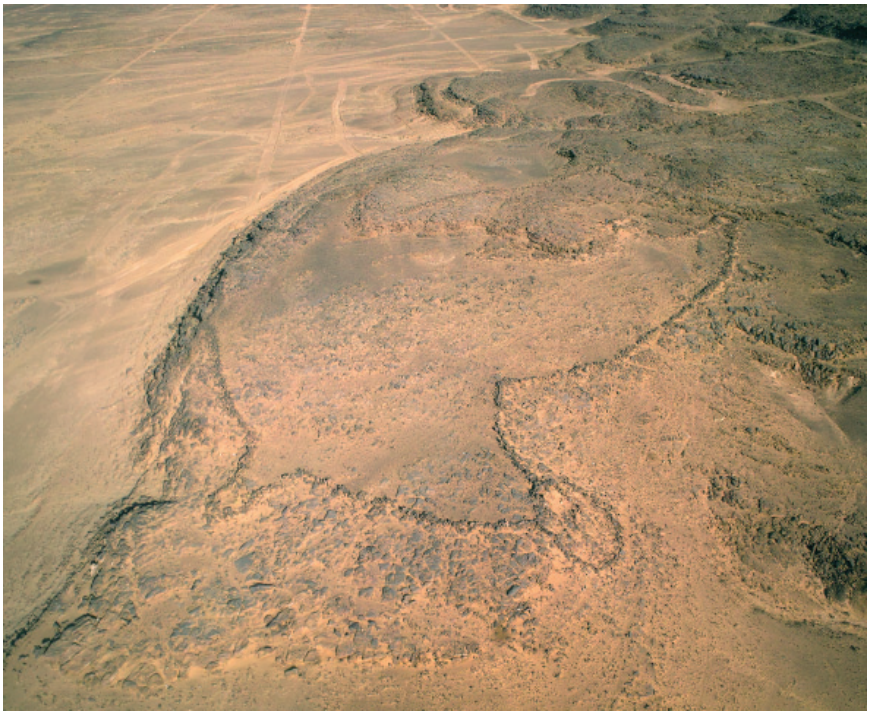


Fig. 9. Kite AB549, an oblique aerial view of the enclosure

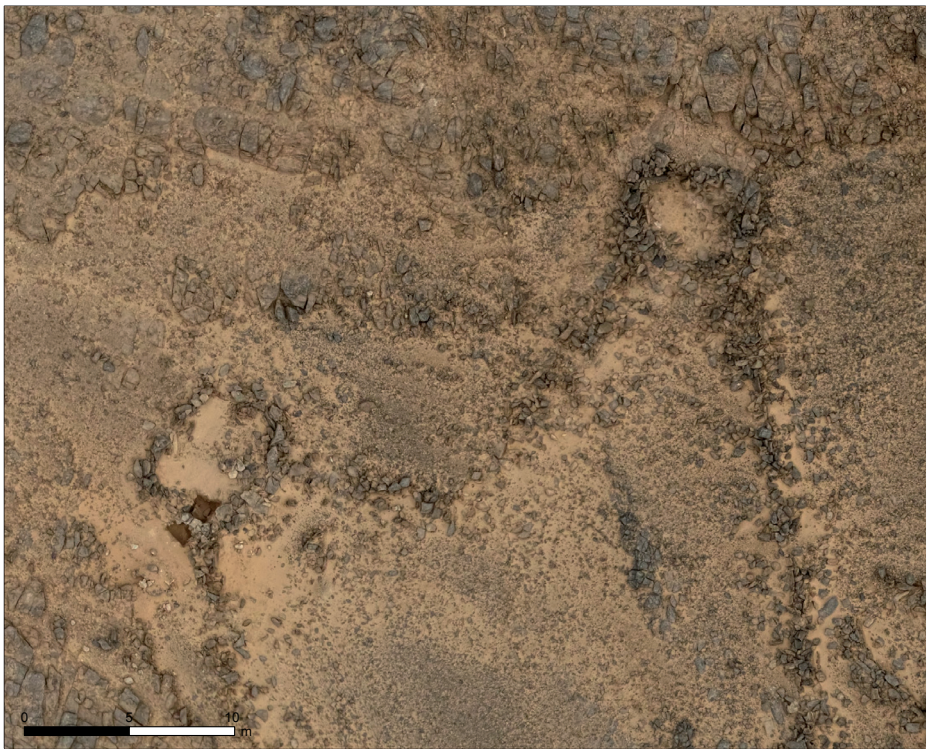


Fig. 10. Kite AB549, aerial view of cells L01 (test-pit) and L02

Desert kite AB549

The excavation potential at AB549 appeared more promising. Several cells were sufficiently filled with sediment and in good shape for running small test-pits. Around the kite, several rounded structures were found. At least one very large tower tomb (or what looks like one) overlooks the whole area. Other large circular structures are at the same level as the kite, some reusing the kite enclosure's stones at one spot (**Fig. 9**).

At this kite, one cell has been excavated (AB549-L01 - **Fig. 10**). We wanted to understand the construction technique of the cell's wall better, and thus analyzed the course number, the facing technique (simple or double) and examined the corbelled construction. It seems that a type of double facing technique was used, as vertical stones were positioned conjointly. This is not typical for the classic double facing technique, which uses fillings of small rocks between stone courses. Thus, it was concluded that the technique of construction is mainly based on vertical slabs alignments. Sometimes flat horizontal 4–5 courses walls are erected, and few larger slabs are positioned over the top of this wall as a corbelled construction. No artifacts were found, but a good number of sediment samples have been collected, as well as two OSL samples.

Some other two small structures (AB549-S1 and AB549-S2) have been excavated in order to obtain a relative chronological hint, as they were reusing the kite enclosure's walls. These small quadrangular piles of stones were completely empty and built directly on the sandstone bedrock. They are interpreted as "boxes" or "storage facilities", even as traps for small animals. A calcite crust sample at the base of AB549-S1 has been collected and another one at the base of a vertical slab of the kite enclosure. These are potentially interesting samples for radiocarbon measurements and U-Th dating.

Presence of lithic industries on surface

Located in the nearest vicinity of each couple of kites (especially near AB135 and AB549), were high-density lithic scatters. Artifacts are predominantly thin leaf-shaped bifacial foliates, knives, endscrapers, circular scrapers, tanged and barbed arrowheads, burins on truncation and retouched blanks. These finds are usually heavily fragmented and only lightly patinated. Their state of preservation and typological and technological characteristics indicate a rough dating from the end of the Neolithic period to the Chalcolithic. Nevertheless, their direct proximity to the kites does not indicate a synchronous occupation by the stone-tool makers and the kite users.

Desert kites in the Dûmat al-Jandal area: zone 2

The second area of study is further west from ZONE 1, with the presence of kites AB621 and AB550. The first one is a limestone/sandstone context, while the second one, just 4 km away to the west, is in a sandstone/quartzite zone.

Desert kite AB621

As for previous examples of AB547 and AB136, this AB621 kite did not have enough potential for excavation or even for a small test pit. The DGPS mapping of the kite from the field observation was necessary as the satellite imagery of this zone is not that accurate (**Figs. 11 and 12**). Only one antenna (driving stone line) of the kite has been observed, any other antenna being not visible, or maybe replaced by the surrounding natural relief.

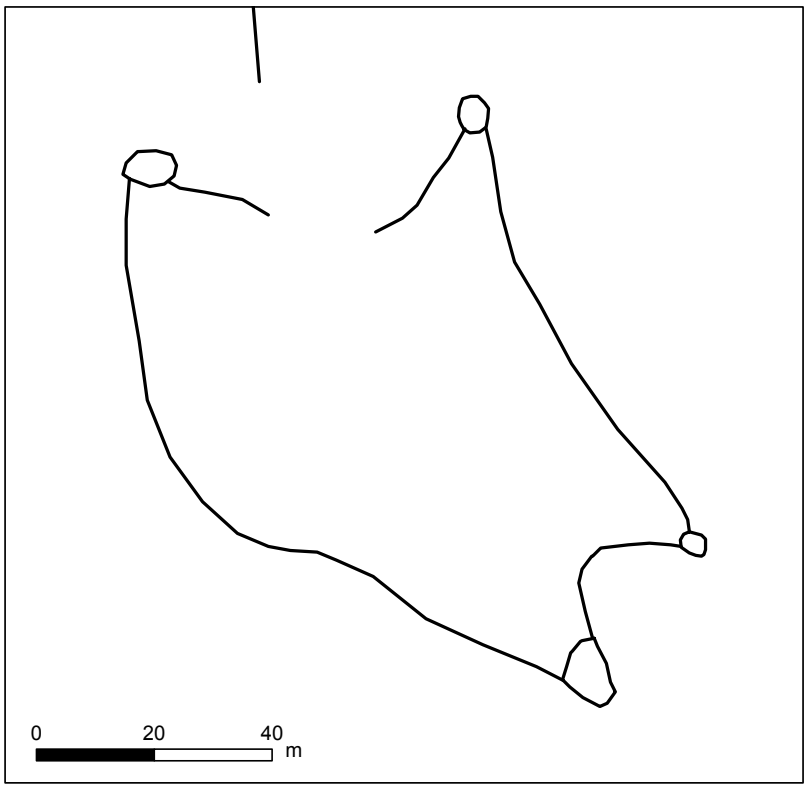


Fig. 11. DGPS Mapping of AB621



Fig. 12. Kite AB621, general view of a cell

Desert kite AB550

Located in a rather different environment than previous kites observed around Dûmat al-Jandal, AB550 is mainly made of dark quartzite and sandstone blocks. The general shape of the enclosure is peculiar for its straight lines and sharp angles (**Figs. 13 and 14**). The impressive cliff to its southwest part is also deliberately used as part of the trapping system. As observed elsewhere, several later structures are reusing the kite's walls. One tomb at the southern part of the kite is particularly striking for its large dimensions and good preservation. However, it has been looted in ancient times. Other enigmatic stone alignments in the northern part of the kite, close to the entrance, are present without any comparative structure known from the region or farther from it. One cell has been excavated with a small test-pit (AB550-L01 - **Figs. 15 and 16**). No artifacts were recovered, but interesting samples were exported for geoarchaeological analyses.

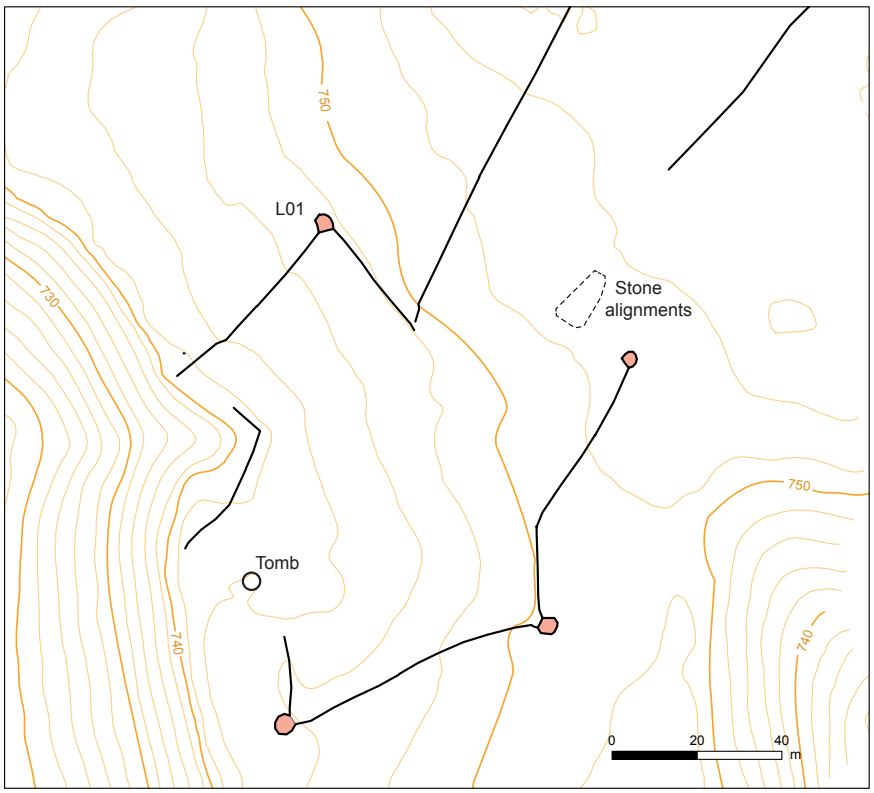


Fig. 13. DGPS Mapping of AB550

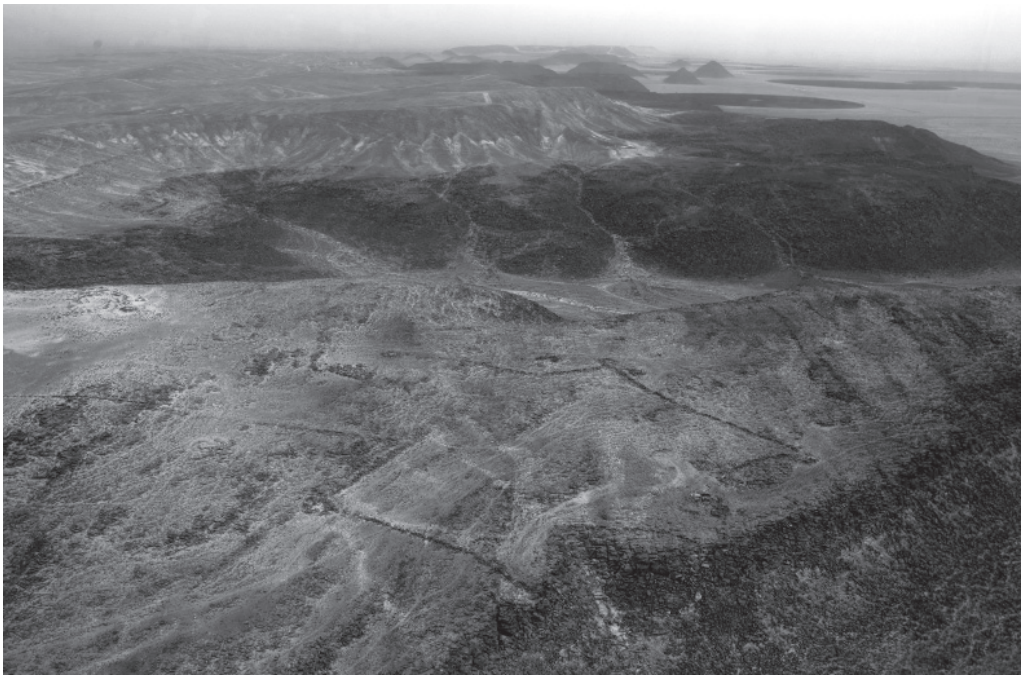


Fig. 14. Kite AB550, an oblique aerial view of the enclosure

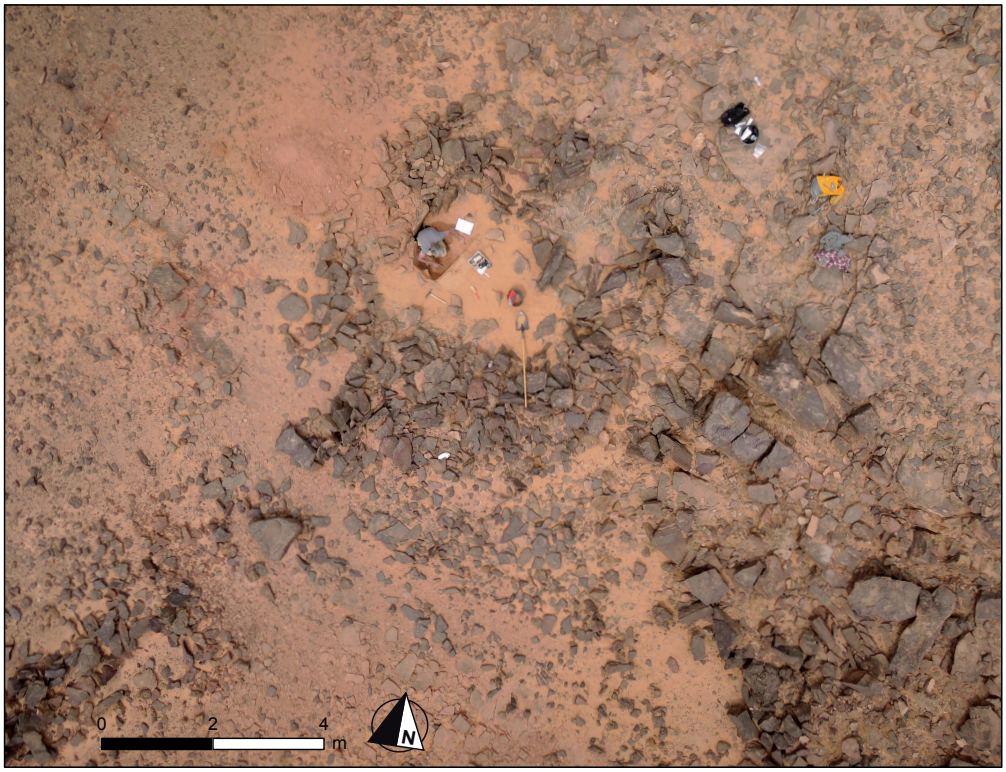


Fig. 15. Kite AB550, aerial view of cell L01 (test-pit)



Fig. 16. Kite AB549, cell L01

Desert kite in the northern Nafûd Area

South to Dûmat al-Jandal lies a region with a dozen different kites. The team excavated one, and the other three were observed on the field (**Fig. 17**). The kites are all located on sandstone fringes at the northern border of the Nafûd Desert. Among these, three kites were observed in the field, kites AB556 and AB557 (built close to one another) and kite AB559, located 5 km to the east of the latter. The kites AB556 and AB557 are built on the upper part of the relief occupied by their antennas. The enclosure is arranged slightly below it so that the entrance is at the break of slope. The antennas are quite large, and here we can observe an entanglement: kite AB556 might be posterior insofar as its antennas intersect those of AB557. The two enclosures are relatively small, half a hectare each and have similar star shapes. Their mode of construction, made by aligning erect slabs, is identical (**Fig. 18**). They have four cells each.



Fig. 17. Map of kites AB557 and AB558



Fig. 18. Kite AB557, general view of the enclosure wall

Desert kite AB557

This kite features an enclosure that is off-centered to the direction of the antennas; The latter converges towards the entrance and forms an elbow at right angles just before the latter. The four cells of this kite exploit the local topography: they are constructed at a break of slope in order to create the level difference between the floor of the cell and that of the enclosure (which is observed everywhere). The wall, which delimits the cell and is initially of notable height, is built in the slope below the enclosure (**Figs. 19 and 20**).



Fig. 19. Kite AB557, cell built below the enclosure



Fig. 20. Kite AB557, the enclosure wall

Desert kite AB558

The construction of the four cells also exploits the local topography, but in a way different from that of its neighbor AB557 (**Fig. 21**). The location chosen here is the summit of small mounds: the cells have been hollowed out in the substratum - on the plane part formed by the top of said mounds. As a result, there is an inverse slope rupture and a difference in level between the cell floor and the floor of the enclosure. This difference is also accentuated by the development of a "ramp" at the cell entrance (**Fig. 22**), made of superimposed slabs that are laid flat. The cell L01, in the proximal position, was the subject of a survey: a set of sedimentological samples was taken to study its composition. It will be compared with the other sequences obtained in the various surveys carried out in 2015.



Fig. 21: Kite AB558, **the** enclosure



Fig. 22. Kite AB558, the cell with an inclined plane entrance.

Desert kite AB559

The kite AB559 appears to be atypical in more than one way (Fig. 23, 24 and 25):

- The antennas are very short, and they frame a small narrow canyon with a slope to wards the entrance that is very steep.

- The enclosure occupies an area with a complex and tormented topography; The enclosure is delimited by walls which, in two places, give way to small vertical cliffs of a few meters height.

- The entry is split (unless the kite has been altered over time). In this case, it is impos sible to say whether the enclosure was later enlarged by adding a second entrance opposite the antennas or, on the contrary, if it was deliberately cut off.

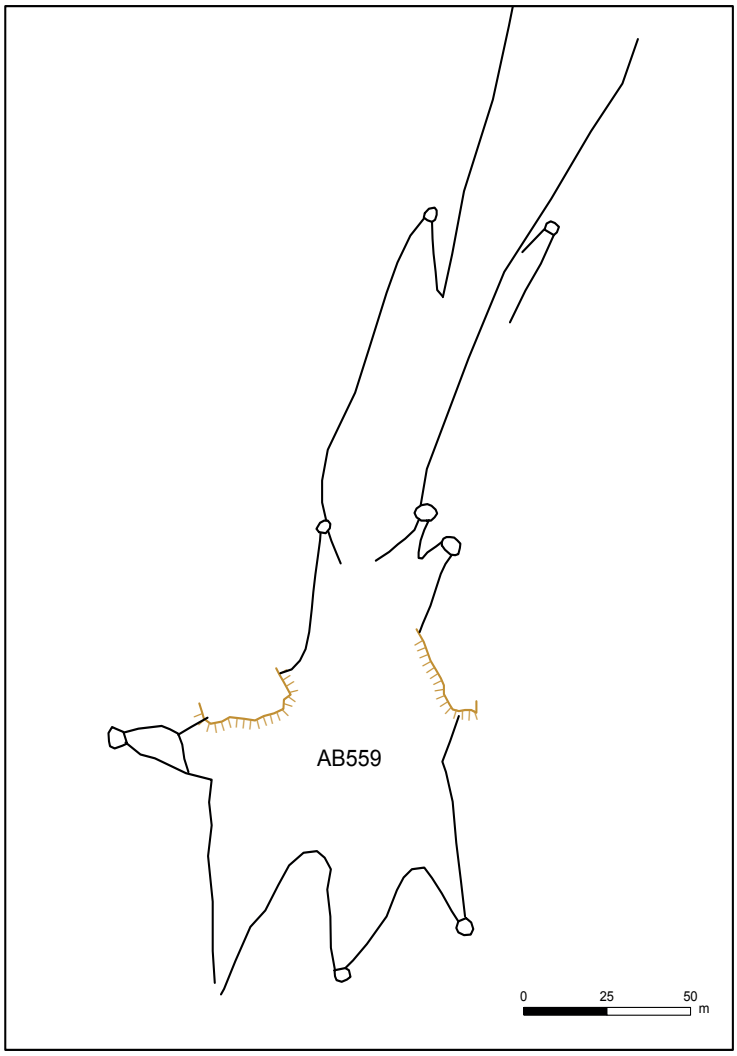


Fig. 23. DGPS Mapping of AB559



Fig. 24. Kite AB559, blocked pointed cell / “pointe barée” type.



Fig. 25. Kite AB559, entrance

Outlook and Conclusions

The al-Jawf region displays a very interesting mixture of landscapes and archaeological sites. The archaeological occupation of this area, ranging from the Lower Paleolithic to the present, may be linked to environmentally favorable conditions.

The kites explored during our 2015 fieldwork are situated in the rarefaction zone to the south of the major Syro-Jordanian concentration. Our preliminary results show that they share several characteristics with kites from this "classic" zone. None of the specific morphological characters observed in the southern isolated Khaybar area has been observed. Nevertheless, the diffusion to the south of this hunting technique cannot be discussed without more robust chronological data.

For the first time in Arabia, fieldwork and test pits in cell fillings will hopefully provide the expected and necessary chronological data. Unfortunately, the sedimentary facies, derived from Devonian sandstone and quartzite, probably do not favor the discovery of datable biogenic radiocarbon material. Nevertheless, the fast sand filling of the cells soon after their last utilization will be major source material for an Optical Stimulated Luminescence analysis.

Acknowledgements

Fieldwork in 2015 has been feasible thanks to the generous support of the Saudi-Italian-French team at Dûmat al-Jandal directed by G. Charloux and R. Loreto, and a grant from the French National Research Agency (Globalkites, grant No. ANR–12-JSH3-0004-01).

Dry Stone Structures in Dûmat al-Jandal and Surrounding Area: Results of 2015 survey

Anaïs Chevalier [1]

Several tens of thousands of protohistoric tombs punctuate the reliefs of the Arabian Peninsula. These funerary monuments represent a diversified architectural typology, which can take the form of simple tumuli, tombs "with external orthostats and tiered crowns", "tombs-walls" or "cuneiform" tombs. Due to their position on the top of the reliefs, these structures are well visible in the landscape. However, initiatives to locate, classify and date these monuments have remained scarce.[2] These tombs are the main archaeological remains of the protohistoric periods of this region of Arabia (with kites and some rock engravings). Subsequently, their study not only allows us to examine the protohistoric funerary practices of the peninsula but also provides key elements of the protohistoric western and central Arabic societies. Our research surveys were designed to systematically record all dry stone archaeological structures that punctuate the reliefs of the region, protohistoric tombs being amongst them. This systematic recording of the archaeological data made it possible, firstly, to re-contextualize the monuments in their immediate archaeological environment and, secondly, to study the organization and spatial distribution of funerary structures.

Surveying inside the oasis

The promontory of Rijm al-Burj

As of 1st March 2015, an exhaustive survey was carried out on the entire promontory of the Rijm al-Burg (western sector). This survey, which was also intended to complement the archaeological examination of the promontory, recorded 19 structures in total. This included five protohistoric funerary structures (L2201, L2202, L2204, L2206 and L2207) and some miscella-

1. Student, Paris 1 Panthéon-Sorbonne.
2. See also the results of the studies carried out by the Italian component of the project in Dumât al-Jandal.

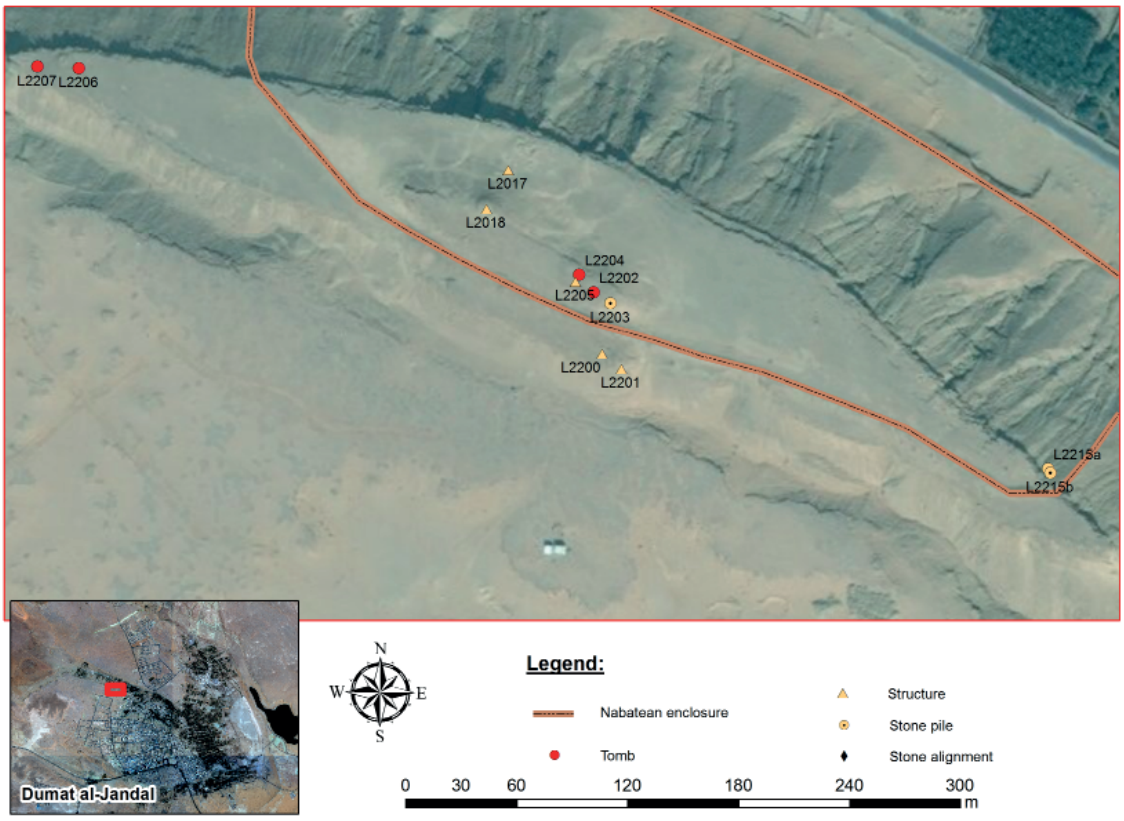


Fig. 1. Map of Rijm al-Burg and the registered structures. (ArcGis 10)

neous structures (e.g., a built shelter (L2205) and piles of stones (L2203, L2215a and L2215b)[3] (**Fig 1**). All these funerary vestiges showed signs of looting. To the south-east of the L2200 structure, a few blocks of imposing stones, arranged in a circle open towards the south (in which some bones have been found) have been interpreted as a funerary structure called L2201.

L2202 is a collapsed dry stone structure located on the highest plateau of the promontory. A few foundations of the north and south facings can still be seen through the rubble. The presence of these facings presupposes a 3.5 m wide quadrangular monument constructed of dry stone masonry. This type of structure could correspond with a protohistoric tomb. However, during a first survey in 2011, the team suggested the presence of a tower.[4] Only an excavation might decide this interpretation.

L2204 is a circular tumulus located west of L2202, which has looting holes at its top. Bone fragments and some sherds have also been observed on the surface of this structure.

L2206 is an imposing tomb of 7 m in diameter, which has undergone significant looting. The looters entered the structure through a central hole (3.50 m in diameter), in which many human bones were observed and collected (**Fig. 2**). Some of these bone remains will be used for bio-apatite dating to obtain chronological data and understand the use of this grave better.

3. Note of the editor : "These author's assumptions have been reassessed and partly modified in future works" (notably Munoz et al. 2020).
4. Corresponds to structure L2027 (Charloux et al. 2014a: 183–226).



Fig. 2. Photograph of the tomb L2206. (DJ2015a0191)

Finally, L2207 is a funerary structure that was completely disrupted by thorough looting; Only a few blocks of stones, scattered rubble, thrown outwards in a circle, as well as some bony fragments,allow us to grasp the funerary character of this structure.

The south/south-western plateaux of Dûmat al-Jandal [5]

A series of surveys were carried out on 15th, 17th, 19th and 20th March 2015 on the south-west plateau, located south of the Rijm al-Burg promontory (**Figs. 3 and 4**). The planned surveys in this area focused mainly on the edge of the plateau. The interior of this massif has not been covered in its entirety and has only been the subject of a half-day prospection.

However, as this plateau was hardly marked with relief, the location of funerary structures was relatively easy to find. The systematic recording gives us a complete picture of the distribution of funerary structures on this relief. 140 archaeological remains were recorded, including 61 graves and 57 piles of stones. Funerary structures were generally tumuli constructed of flat and angular stones (**Fig. 5**). Very disturbed by looting, it was found that some funerary chambers of these tombs were excavated in the rock (**Fig. 6**). The large looting of the tumulus 1226 allowed us to observe a funerary chamber 2 m long, 1.20 m wide and 90 cm deep.

5. In the surveys described below, the discovered stuctures were recorded according to a system different from that of the loci of sector C, since they bear the GPS point number. In total, 203 additional dry stone structures were recorded during this stage, including 86 protohistoric tombs.

Structure Types \ Dates	8 March 2015	15 March 2015	16 March 2015	17 March 2015	19 March 2015	23 March 2015	Total
Tombs	15	6	10	20	30	5	86
Stone piles	12	16	2	2	8	12	52
Other structures	10	13	9	16	6	11	65
Total	37	35	21	38	44	28	203

Fig. 3. Summary table of the structures recorded in the various survey areas.
(A. Chevalier)

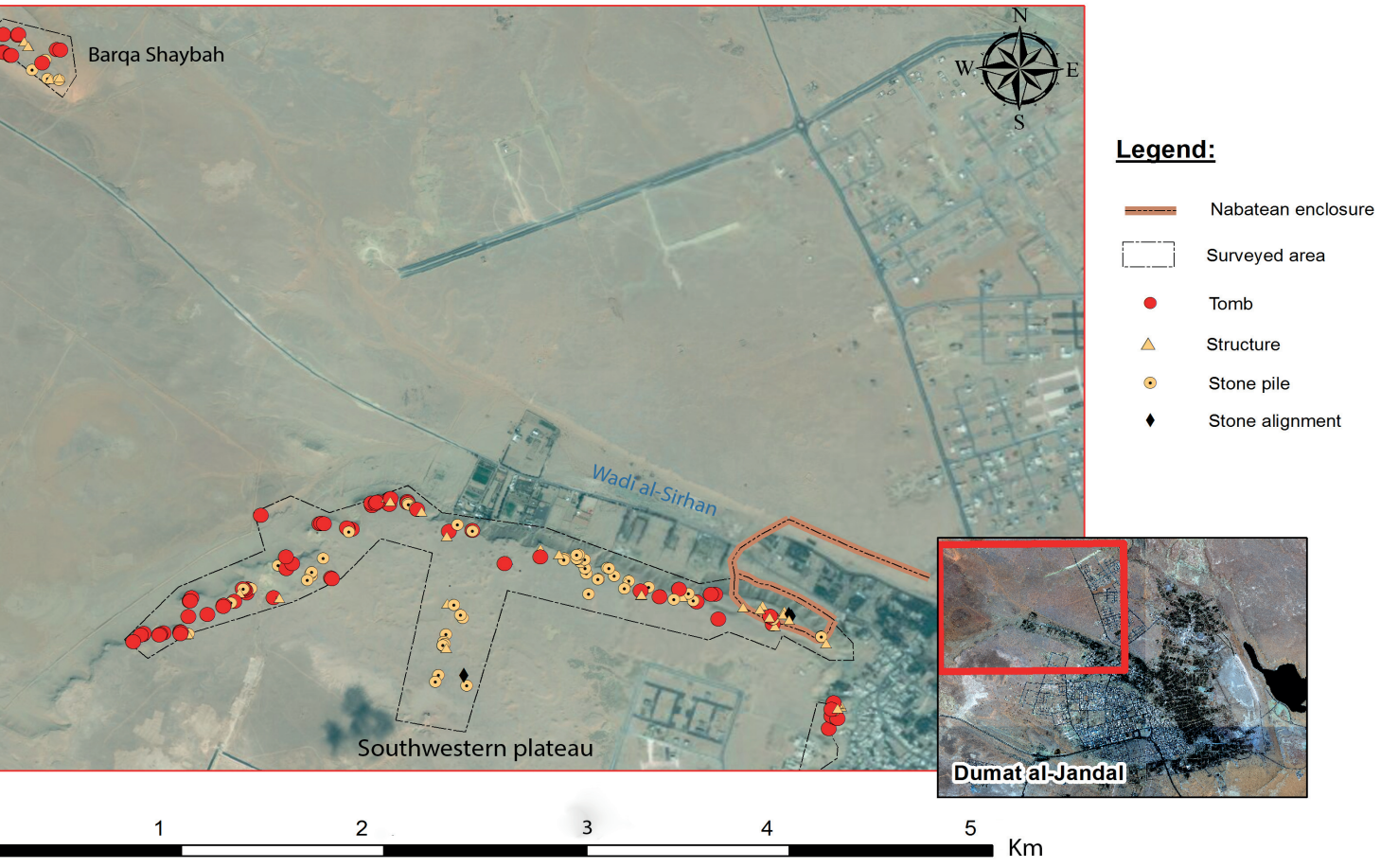


Fig. 4. Situation map of the surveyed structures on the south-west plateau and the promontory of Barqa Shaybah.
(Fond de carte: ArcGis 10)



Fig. 5. Photograph of Tomb 1228 on the south-west plateau of Dûmat al-Jandal, which is the most recurrent type of tombs observed on this plateau. (DJ2015a1442)

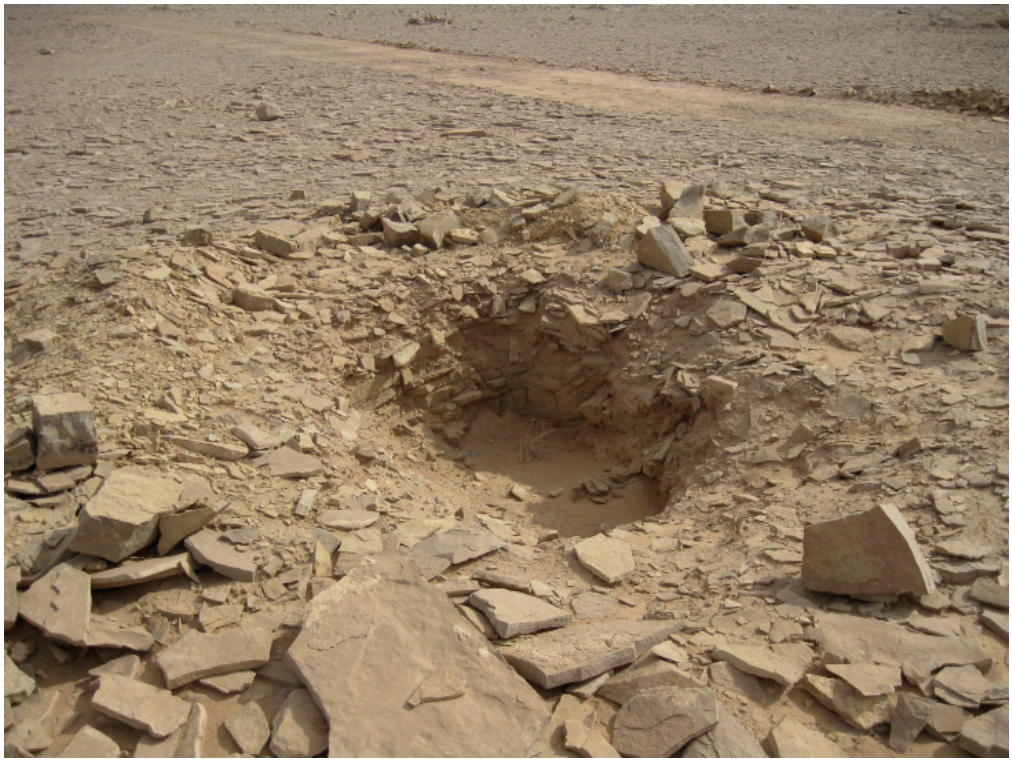


Fig. 6. Case of Tomb 1226, located on the south-west plateau of Dûmat al-Jandal, where looting allows us to find that the funerary chamber is excavated in the rock. (DJ2015a1440)

In some cases, cist tombs or funerary chambers built in orthostats were also noted (**Fig. 7**) such as structure 1205, which had large slabs (110 x 10 x 70 cm) to cover a quadrangular funerary chamber. Despite the destructive plundering of almost all of the funerary monuments on this plateau, it was possible to collect bone remains from the disturbed funerary chambers to provide bio-apatite data. Thus, human remains were taken from four of the funerary structures on this plateau; namely tombs 1090, 1091, 1086 (one of the rare cuneiform tombs recorded during the survey) and tomb 1087. This last tomb is a 5 m diameter tumulus. It contained the remains of at least two individuals, based on a rapid inventory of the bones recovered. During these surveys, no funerary structure was found in the interior of the plateau. The latter comprised only of piles of stones, which could not be fully recorded. All 61 funerary monuments were divided into more or less strong concentrations, located exclusively on the edges of this plateau, thus dominating the wadi.



Fig. 7. Example of a cist tomb (the tomb 1205) that can be found on the plateau south-west of Dûmat al-Jandal (DJ2015a1421)

Surveying outside the oasis

The promontory of Barqa Shaybah

The survey of this zone located to the west of Dûmat al-Jandal was completed on 16th March on the promontory of Barqa Shaybah. This latter area is located at the western outlet of the oasis. We have had the opportunity to identify there 21 structures, including 10 graves. The funerary structures listed are all of the "simple tumulus" type, made of rubble (**Fig. 8**). These circular tumuli are on average about 4 m in diameter. The smallest are 2.2 m in diameter (tombs 1461 and 1187) and the largest 6.40 m (tomb 1190). These tombs did not appear to be too disturbed by looting, which can be explained by the fact that the promontory of Barqa Shaybah lies isolated from the urban area. Moreover, the occurence of structures other than funerary monuments is relatively low; only four piles of stones, two undetermined structures and five enclosures (located on the north side of the promontory) were recorded.



Fig. 8. Photograph of the tomb 1183, a typical example of the tumuli encountered on the promontory of Barqa Shaybah (DJ2015a1389)

The plateau of Az-Zilliyat

On 8th March 2015, a day of the survey was organized on the large outcrop located about 20 km north-west of Dûmat al-Jandal, called Jabal Az-Zilliyat. This visit made it possible to identify 34 archaeological structures, located near two kites. Among these structures, 13 graves, 14 piles of stones and seven different and/or indeterminate structures were identified (**Fig. 9**). The tombs take mainly the form of tumuli of varied sizes, ranging from 1.80 m (tomb 1469) to 9 m in diameter (tomb 1464). In the latter tomb, which had a 3 m diameter looting hole, a right patella was recovered and salvaged. However, the tumulus is not the only architectural form found on this plateau; some quadrangular tombs of dry stone masonry were also identified (e.g., tombs 1470 and 1471), as well as tombs with mixed architecture (mixing orthostats and masonry of dry stones, e.g., tombs 1472 and 1474). These structures are distributed mainly on the south face of the relief, dominating the valley. Furthermore, some tombs are still distributed within the interior of the massif, isolated (Tomb 1472; **Fig. 10**) or concentrated along wadis. A flint arrowhead, a priori dated from the PPNB, was discovered on the surface of the plundered tomb 1474 (**Fig. 11**).

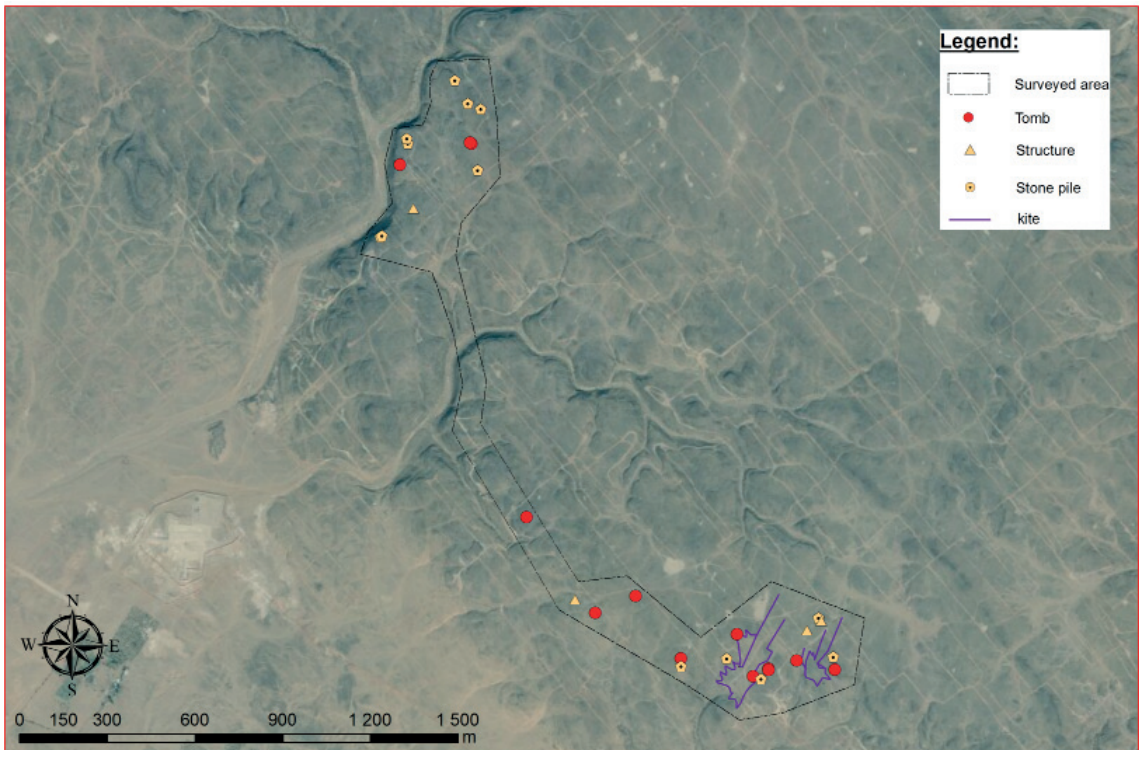


Fig. 9. Situation map of the surveyed structures on the Az-Zilliyat plateau. (Fond de carte: ArcGis 10)



Fig. 10. Photograph of the tomb 1472: located in the interior of the massif, very isolated from other structures, it shows a mixed architecture. (DJ2015a0292)



Fig. 11. Photograph of the tomb 1474. (DJ2015a0295)

Conclusion and discussion

At present, it seems that the oasis of Dûmat al-Jandal does not have any real necropolis with a high density of protohistoric funerary structures, as can be observed in other regions such as Al-Kharj.[6]

On the contrary - these surveys have shown us a very loose and scattered network of funerary structures that seem to be organized more according to the local topography than in relation to each other. The tombs are scattered along the plateau's borders or on reliefs, resulting in relatively high concentrations on small isolated mounts (e.g., the Barqa Shaybah promontory). On the south-west plateau of Dûmat al-Jandal, the tombs concentrate exclusively on the edges of the plateau providing very good visibility from and onto the oasis below. In contrast, the funerary structures of the Jabal Az-Zilliyat are distributed along the edge of the plateau and the wadis that incise it, but also inside. The structures in this rock massif are not very well visible, even from the top of the plateau due to the rugged terrain. Thus, these concentrations of funerary monuments on the reliefs do not necessarily suggest a particular quest for visibility in the landscape.

Furthermore, as far as the funerary monuments on the south-west plateau of Dûmat al-Jandal are concerned, their location at the level of the rupture line of the plateau [7] was probably practical for obtaining raw material for construction. We found that the modules of stones disintegrated by erosion in these places are the same as those used in the architecture. One could even assume that these structures are located on the edge of the plateau precisely in order to benefit from the natural disintegration of the stone and thus save energy in construction. For example, the excavated burial chambers highlight this extra energy expenditure by the immediate reuse of raw material extracted from the bedrock in the construction itself. Subsequently, it would be interesting to observe during future fieldwork, whether these tombs with excavated chambers are actually located preferentially in the interior of the rocky massifs where the plateau has a lower erosion rate. At the same time, the tombs on the interior of the plateau of Jabal Az-Zilliyat are on a much more uneven relief, which allows access to blocks of stones naturally cut across the massif. Thus, it is possible that the situation of theses funerary structures is, at least in part, conditioned by the access to the available raw materials.

While a great variability of architectural forms can be observed throughout the peninsula, it is found that the funerary structures of the Dûmat al-Jandal region mostly take the form of simple tumuli. However, other architectural forms are present, such as cuneiform tombs and dry stone masonry or mixed architecture structures, but these monuments are very limited compared to the tumuli. The tumuli are constructed by stacking locally found sandstone or limestone blocks on the funerary chamber. This is an interesting regional feature, which should be explored further in future excavation and survey programs. The bone samples that could have been taken despite the significant looting of these structures should be able to provide answers concerning

6. Schiettecatte et al. 2012; Chevalier 2015.
7. Where the rock starts disintegrating in stone blocks, right before the slope towards the wadi.

the periods of use of these structures and may even deliver typo-chronological information, which could perhaps explain these architectural observations and their spatial distribution.

Furthermore, during these surveys, three to four types of tumuli have been identified. There are piles of uncut stones loosely distributed on top of each other, forming a tumulus without any particular organization. Flat stones could also be stacked on top of each other into a pile. These stones could sometimes be laid aside, placed on top of each other, creating a small pyramid structure. It was also possible to observe small rectangular, circular or hexagonal constructions, built in dry stone masonry, devoid of any internal structure (**Fig. 12**). At this moment, it is difficult to date such structures and establish their function. Whether of some symbolic value or as a marker of the territory, these stones are in any case strongly present on the plateaus close to the funerary structures studied, and until now remain poorly understood. Similarly, the proximity of these protohistoric funerary structures to the "kites" in the Dûmat al Jandal region is, for the moment, difficult to interpret and would require further study.



Fig. 12. Photographs of the different types of stone piles encountered in the Dûmat al-Jandal region.

Archaeological and Epigraphic Survey

Guillaume Charloux [1] & all Saudi-French members

In 2015, archaeological and epigraphic surveys focused mainly on rock art (except kites and prehistoric sites and remains, see previous reports). Two new sites, located northwest of Sakâkâ, were recorded during a weekend journey, while others were identified during the survey with the Prehistorians (**Fig. 1**, see also Poliakoff in this volume).

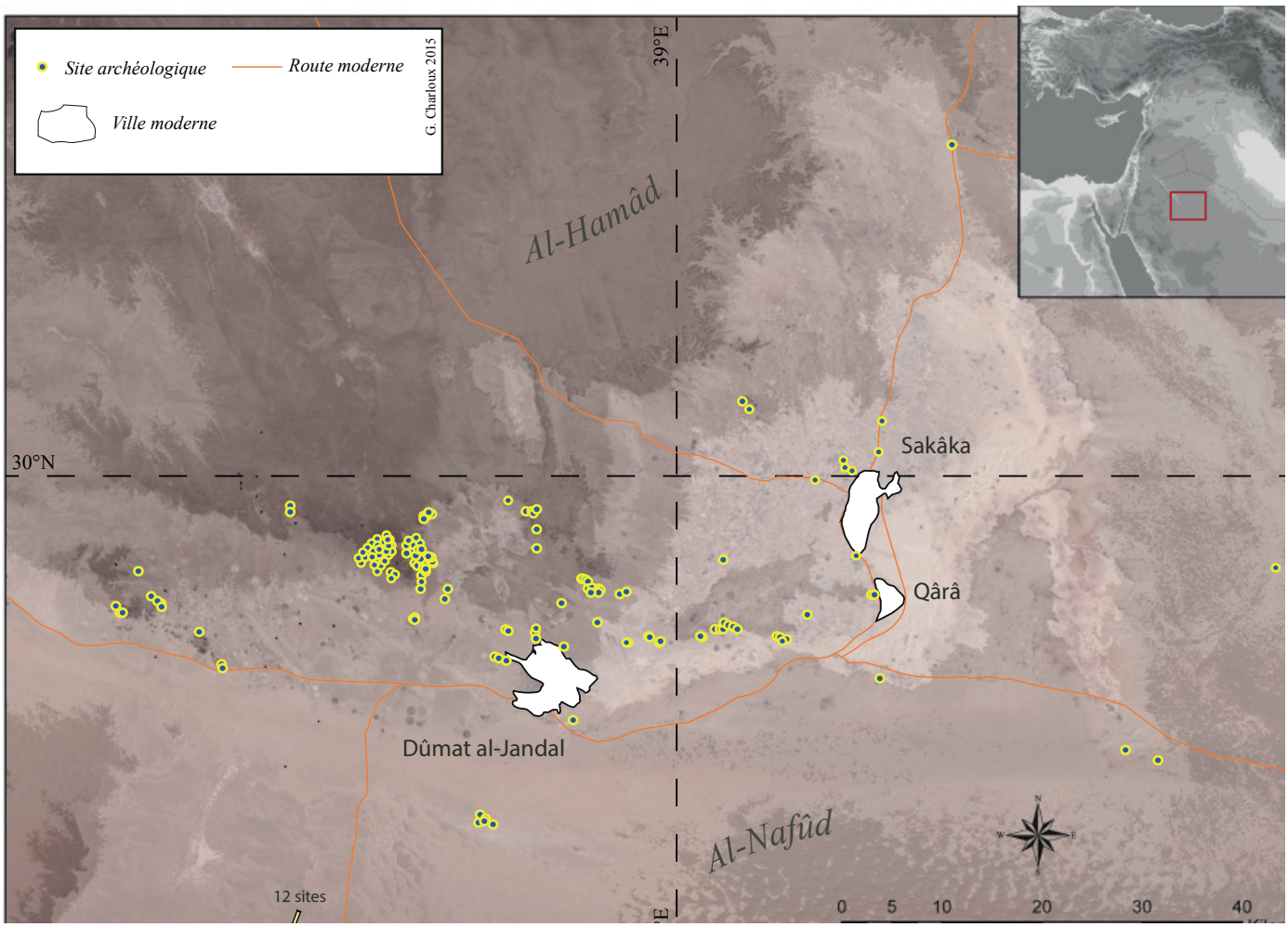


Fig. 1. Map of the sites surveyed in 2015

1. CNRS, UMR 8167, Orient & Méditerranée.

Site 144

Site 144 (**Fig. 2**) is located along a road on the western outskirts of Sakâkâ, in a residential area in dense urban development. It is represented in the form of two eroded orange-yellow sandstone rocks covered with a dark grey patina, bringing out the engravings. Flat faces are ideal for large representations. Scattered blocks of small and medium dimensions dot the immediate surroundings. Some are also covered with engravings. These are of two types: animal representations, for some from the Prehistoric period, and Ancient North Arabian and Arabic inscriptions of the first centuries A.H. There are also some modern graffiti. Petroglyphs are recorded in the project database.



Fig. 2. Site 144 (Picture DJ2015a1727)

Site 143

Site 143 (**Fig. 3**), not far to the south of the previous site, consists of a small sandstone mushroom-shaped monticule with a flat top and a patinated surface. It is located a few hundred meters from the previous site. The summit is entirely covered with dozens of animal and human representations and symbols, probably prehistoric. Among the representation, it possibly comprises the representation of a desert kite.



Fig. 3. Site 143 (Picture DJ2015a1734B)

Definition of a Prehistoric and Paleo-environmental GIS

Roberto Bottiglieri [1]

Introduction

Based on the amount of data collected from 2009 to the present, concerning both the prehistoric archaeological evidence and the paleo-environmental characteristics, it now becomes necessary to have a reference system that allows the integration of anthropic and natural data.

The 2014 campaign saw the launch of a GIS focused on the mapping of the evidence related to the Neolithic phases of the al-Jawf(Neolithic of Nefûd and Neolithic of Harrat) covering both anthropic aspects (architectural structures and material culture) and the paleo-environment (paleo-lakes and wadis) in order to define a land-use pattern during the Holocene.[2] The main goal is to integrate all data concerning the Neolithic phase with the new evidence of the Bronze Age brought to light by the Saudi-Italian-French archaeological project and the German archaeological mission, directed by H. Gebel. Furthermore, the aim is to underline the landscape variations and the different adaptation strategies used by humans during the most humid phases of the Holocene, through the desertification and the birth of the oases.

Survey Methodology

Geographic Information Systems (GIS) are used in various fields and disciplines to summarize and analyze spatial patterns, with the aim to understand how geographic and non-geographic entities interact with each other in space and time.[3]

The GIS data are digital objects that represent real-world entities. They are defined by their geometrical properties (spatial position), their attributes (characteristics associated with each object), and their topology (definition of how the various entities are linked one another in space). In other words, the data provide means to position them in space so they can be over-

1. Student, archaeologist, University of Naples *L'Orientale*.
2. Note of the editors G.C.: "Another GIS tool was developped on Qgis by the French component of the SIF project in Dûmat al-Jandal, focusing on archaeology and epigraphy". All data (locations of sites and pictures) were sent to the SCTH authorities in 2018. R.L.: "At the time this report is published, the GIS [Italian component] includes more than 15000 pre- and protohistoric architectonic evidence".
3. Rogers & Staub 2013: 1.

laid, calculated, manipulated, visualized and analyzed with other data layers that use the same coordinate system. Each entity in the real world is represented by a data layer with geometrical and topological properties and associated with a set of attributes, in the form of a chart, that defines the characteristics of such entities.

The GIS facilitates the analysis of spatial connections, presented in data sets based on the topological properties.

Study areas

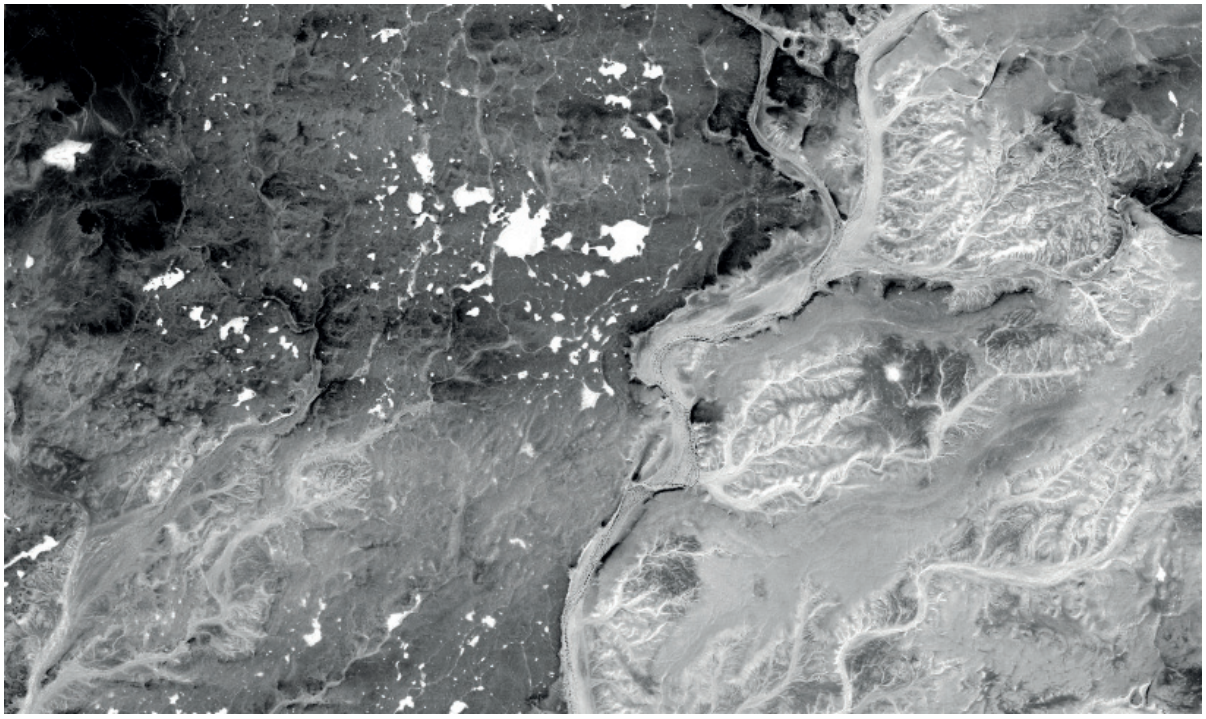


Fig. 1. Study area: Harrat al-Harra

What are the areas to be investigated: Harrat al-Harra and Nafûd(Asfan). As an example of the adopted working methodology, we present here a sample of 10x16 km from Harrat al-Harra in the north of Wadi al-Sirhan (**Fig. 1**).

Geo-referencing Methodology

For each analysis, it is essential to know the data coordinate system that identifies the study area (region of interest) to ensure that all data levels are converted to the selected coordinate system.[4]

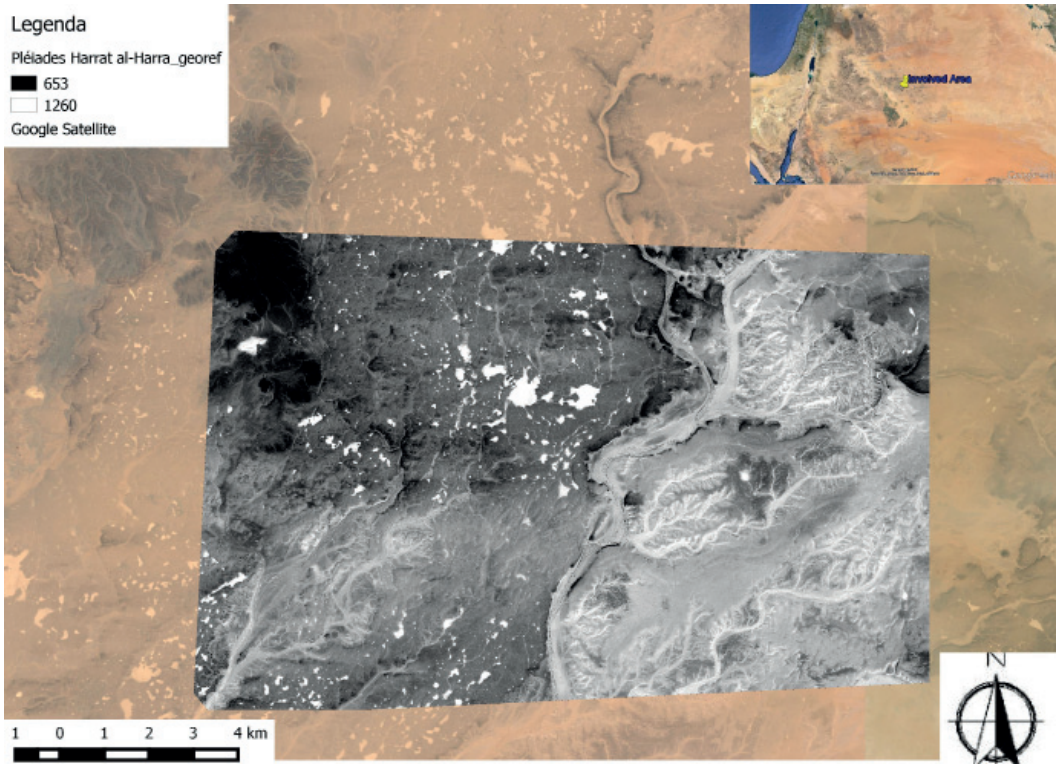


Fig. 2. 10x16 km dallo Harrat al-Harra (Nord wadi al-Sirhan)

In this case, as the area concerned is Harrat al-Harra in the north of the Wadi al-Sirhan (Saudi Arabia **Fig. 2**), the chosen coordinate system is called WGS 84 / UTM zone 37N, UTM projection (Universal Transverse Mercator / Mercator transversal projection). In fact, this latter projection is suitable for geodetic purposes, allowing a very precise and detailed detection. The Time Zones are cut by 8-degree bands marked with uppercase letters; in this case, Saudi Arabia falls into the N-band.

The software used for geo-referencing is Quantum GIS (QGIS version 2.4.0-Chugiak), which includes the main QGIS Desktop program, the QGIS Browser for data management, and a variety of optional plugins that offer specific features.[5] Using QGIS Desktop, the OpenLayers plugin application that has Google Satellite is downloaded directly into the program, allowing

4. Rogers & Staub 2013: 9- 10
5. Rogers & Staub 2013: 28

Google Earth to be in QGIS, to improve its geo-referencing (**Fig. 3**).

We created the Archaeological Map program to define better the evidence related to the Neolithic phases of Jawf (Neolithic Nefûd and Neolithic of Harrat), which encompass both the anthropic aspects (architectural structures, material culture) as well as the paleo-environment (paleo-lakes, paleo-wadis). Subsequently, we included a geo-referenced image of the affected area with a high resolution to define a model of the environment exploitation during the Holocene.

Currently, within the project, six shapefiles have been created. Vector Layers that represent discrete space features in the shapes of dots, lines, and polygons. They represent static and immutable entities that do not contain spatial or temporal information.[6] Five of these are related to anthropic aspects:

- ***Structure single:*** single housing, with a distance of no less than 20–25 meters from another residential building (**Fig. 4**)
- ***Compound:*** multiple housing structures (**Fig. 5**)
- ***Kite:*** Kite (**Fig. 6**)
- ***Tomb:*** tombs (**Fig. 7**)
- ***Undefined object:*** unclear structures (**Fig. 8**)
- One on geomorphological evidence:
- ***River:*** The Waterways (**Fig. 9**)

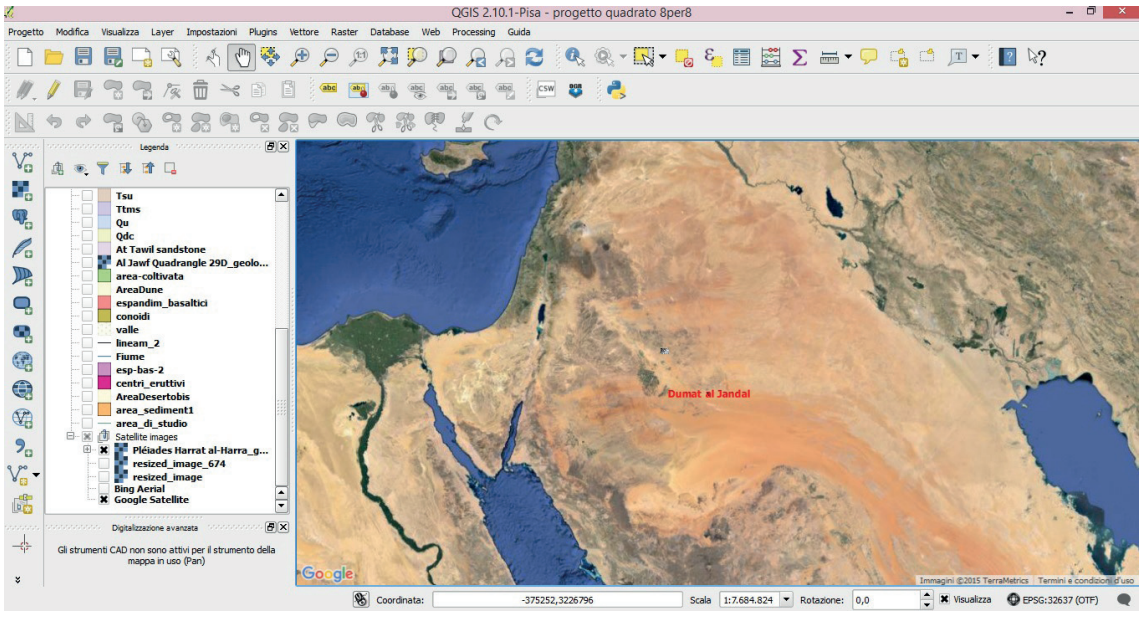


Fig. 3. Image Google Earth in Qgis sample's

6. Rogers & Staub 2013: 5–6

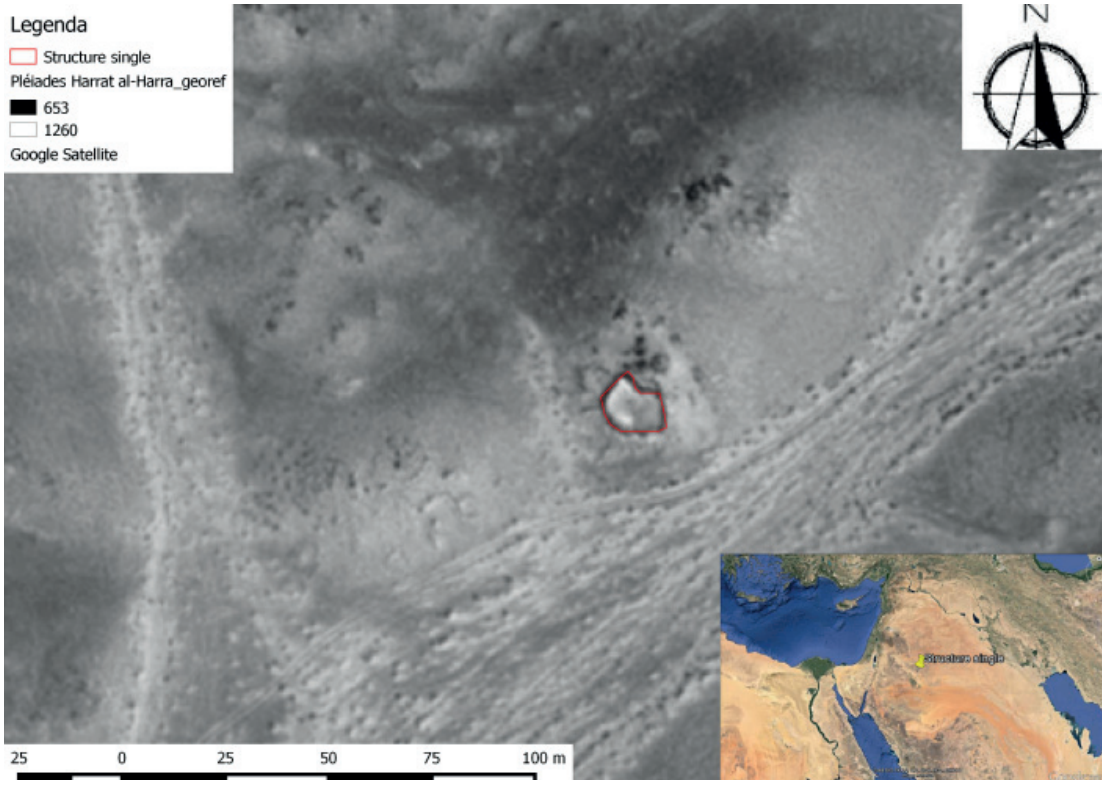


Fig. 4. Structure single example

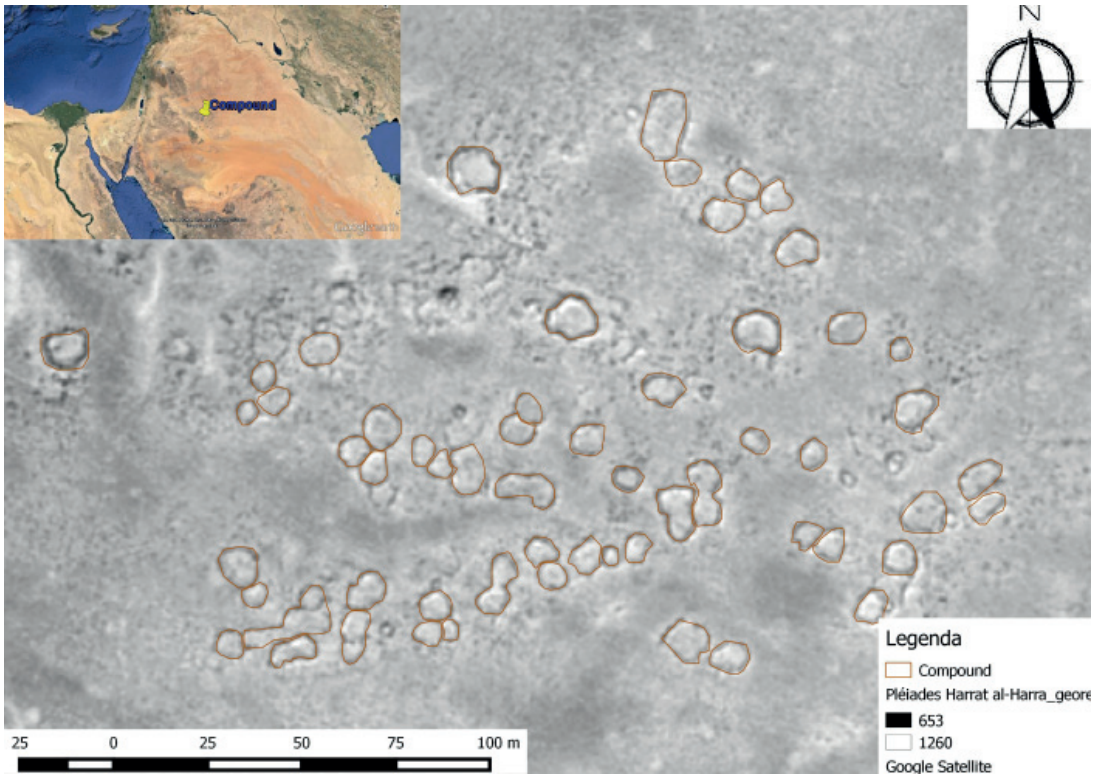


Fig. 5. Compound example

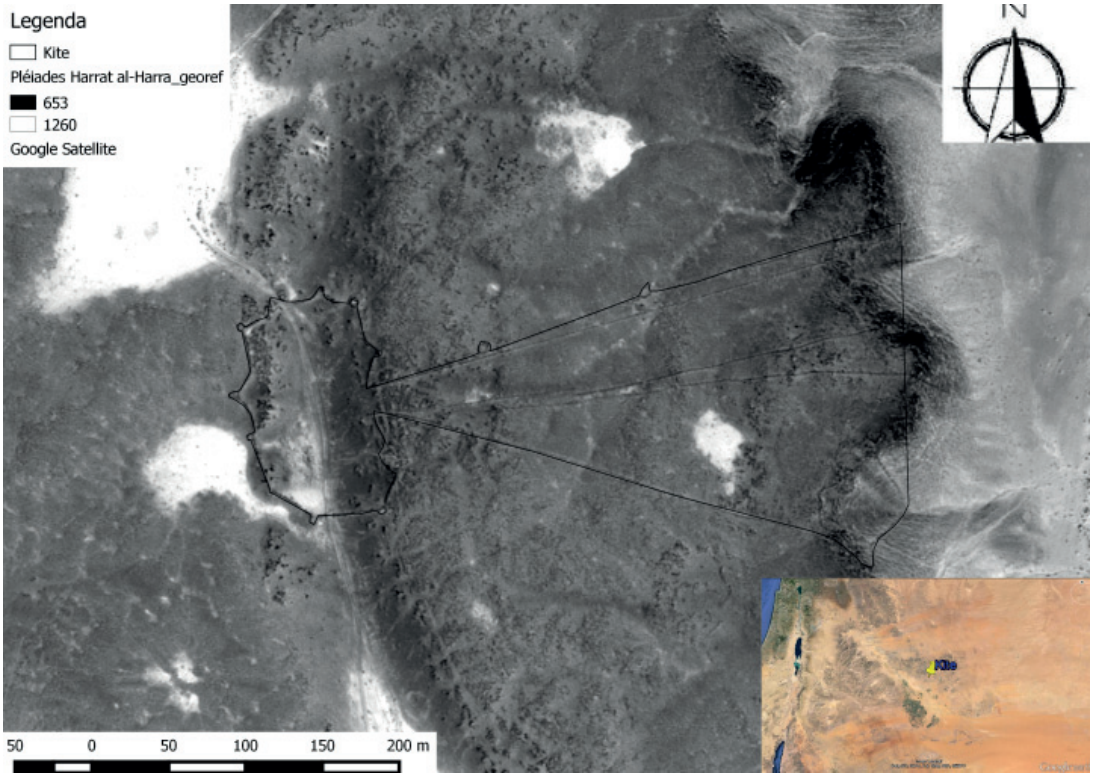


Fig. 6. Kite example

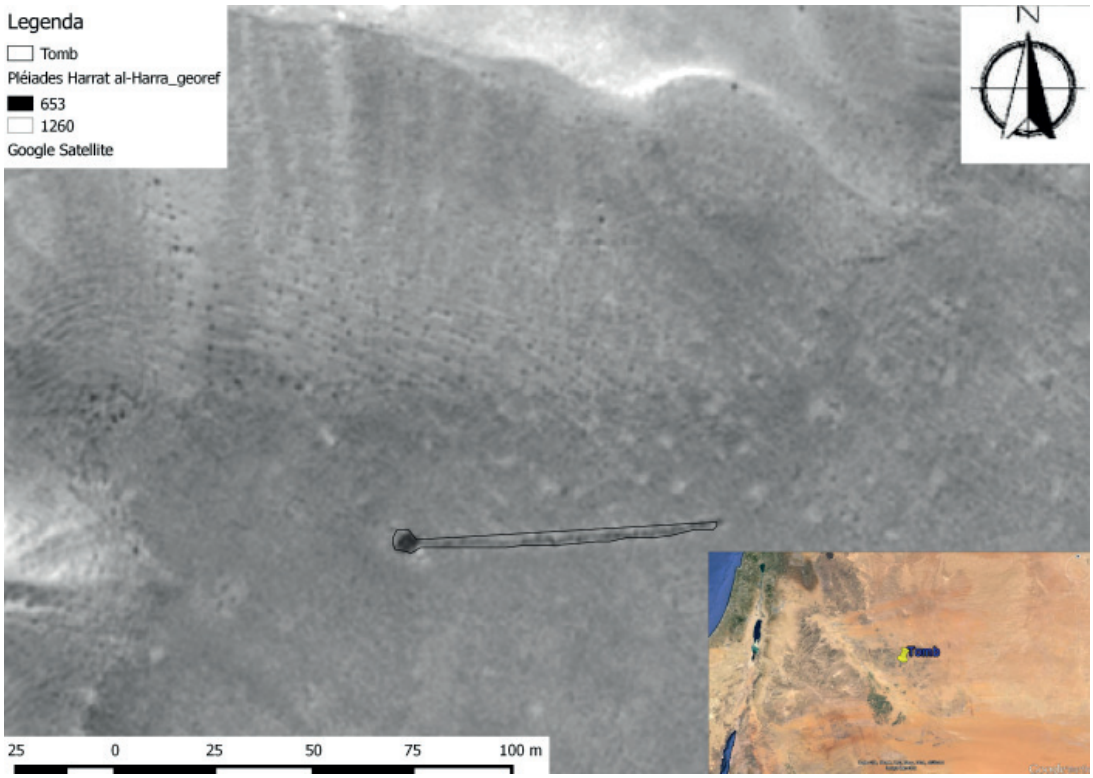


Fig. 7. Tomb example

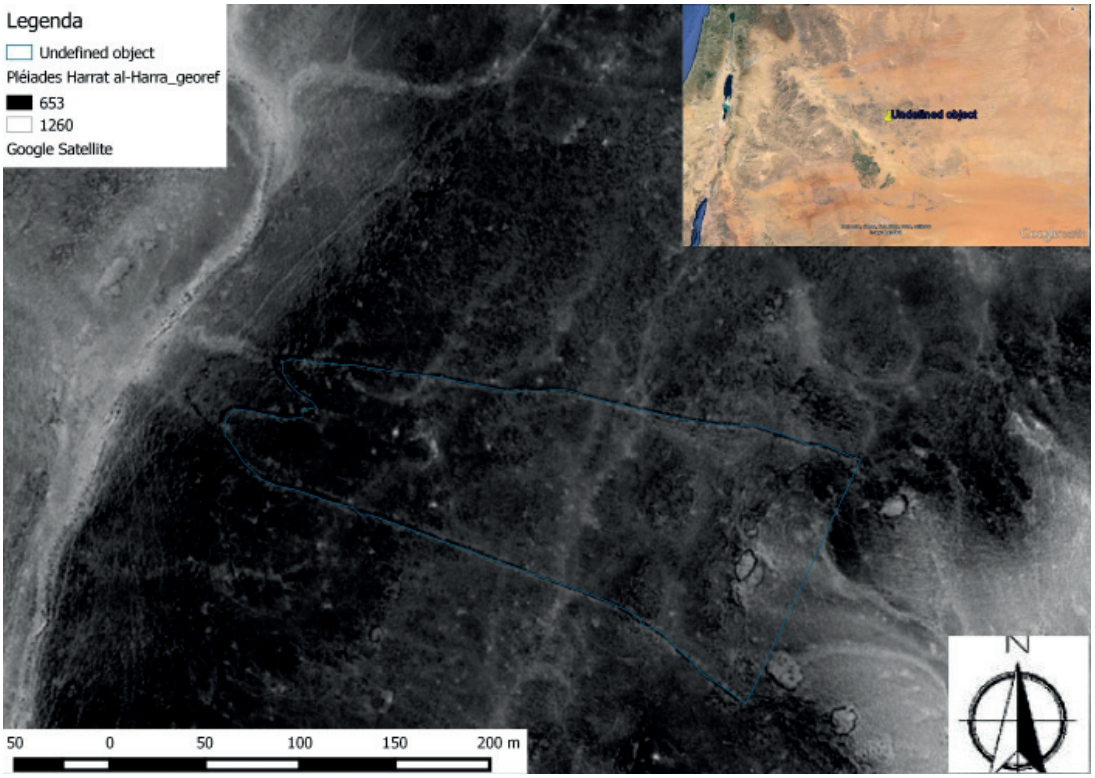


Fig. 8. Undefined object example

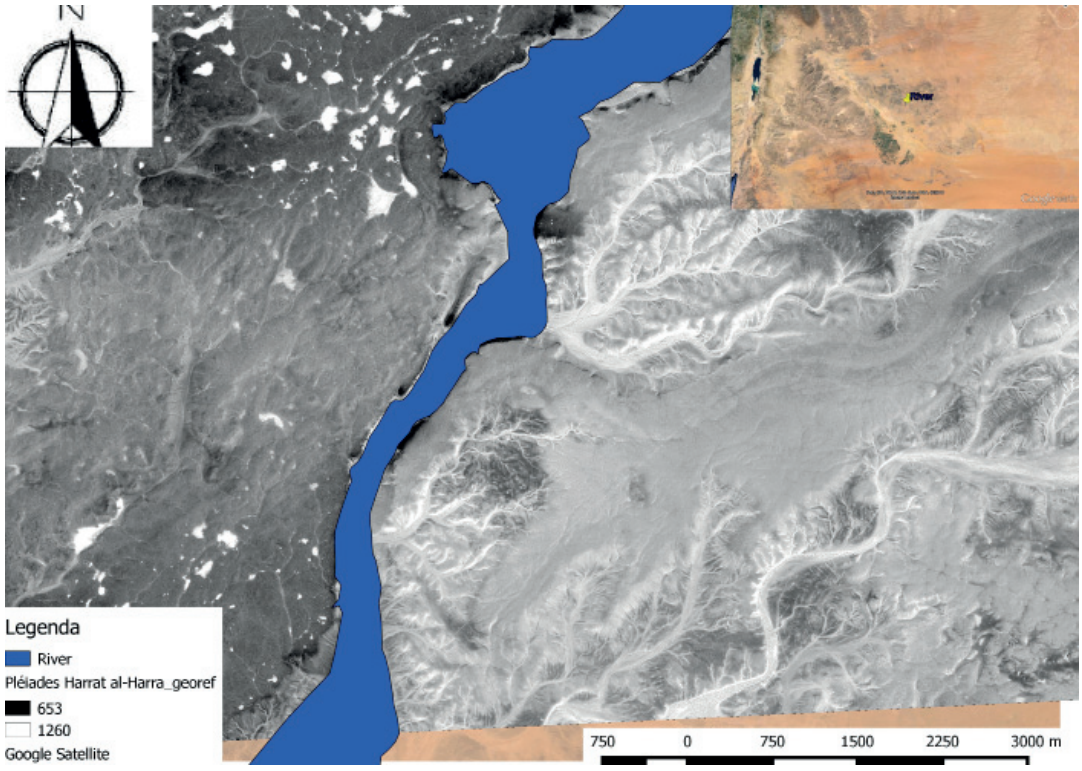


Fig. 9. River example

Database

Starting from the data contained within the project, a QGIS Database was created for each shapefile, which has several fields with the English denomination, listed below:

Structure Single (**Fig. 10**):

Number: acronym

Diameter: diameter

Surface: surface

Share: share

Distance R: distance from the nearest river

Distance C: distance from the nearest compound

Distance K: the distance from the nearest kite

Period: dating

Compound (**Fig. 11**):

Number: acronym

Max diameter: unit with a maximum diameter

Min diameter: unit with a minimum diameter

Tot S: total area

Units: number of units present

DC largest: distance from the larger compound

DC equivalent: distance from the equivalent compound

DC small: distance from the smaller compound

500 m: *how many satellite structures are within 500 meters radius*

1 Km: how many satellite structures are within 1 km radius

1.5 Km: how many satellite structures are within 1.5 km radius

Dist R: distance from the nearest river

Dist L: distance to the nearest lake

Dist K: distance from the nearest kite

Kite (**Fig. 12**):

Period: dating

Tot Length: total length

Tot Width: total width

Tot S: total area

Head L: head length

Head W: width from head

Head S: head surface

Tail L max: maximum tail length

Tail L min: minimum tail length

Tail W max: maximum tail width

Tail W min: minimum width from the tail

Tail S: tail surface

Head Num R: number of head chambers

Kite type: kite type

Dist Lake: distance to the nearest lake

Dist River: distance to the nearest river

Dist C: distance from the nearest compound

Dist K: distance from the nearest kite

1 Km SS: number of single structures within 1 km

1 Km C: number of compounds within 1 km radius

2 Km SS: *number of single structures within 2 km*

2 Km C: number of compounds within 2 km radius

2.5 Km SS: *number of single structures within 2.5 km radius.*

2.5 Km C: number of compounds within 2.5 km radius.

S or M: Single or Multiple Kite

Tomb (**Fig. 13**):

Number: acronym

Diameter: diameter

Type: type of tomb

Period: dating

Dist River: distance to the nearest river

Dist SS: distance to the nearest single structure

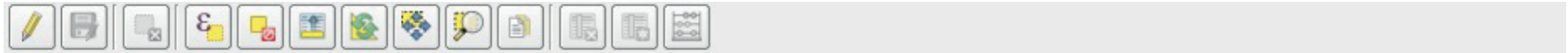
Dist C: distance from the nearest compound

Dist K: distance from the nearest kite

Databases are partially complete or simply set because the mapping of anthropic and geomorphic evidence is still ongoing.

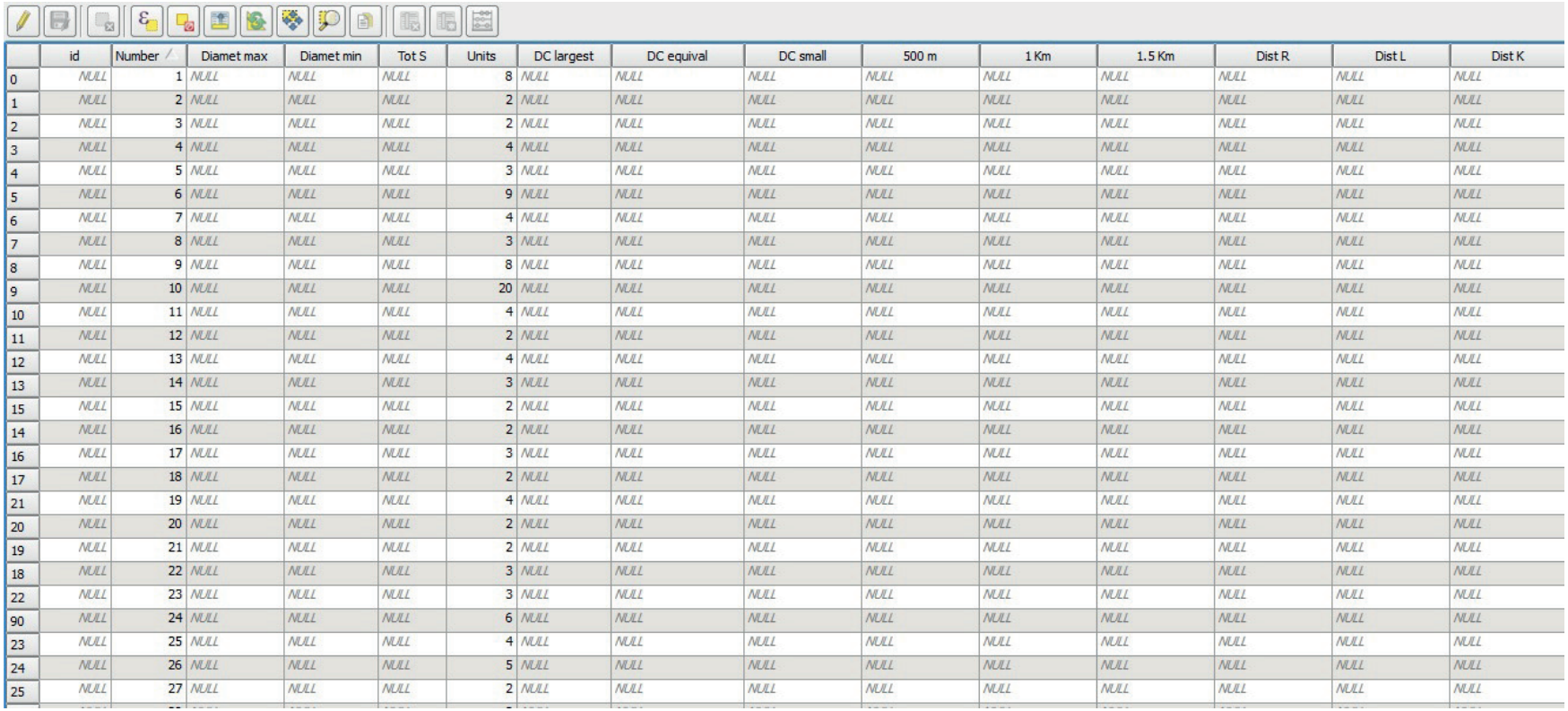
Associated software

Google Earth
QGIS 2.10.1
Query examples
http://books.openedition.org/ifpo/1321



	id	Number	Diameter	Surface	Share	Distance R	Distance C	Distance K	Period
2	NULL	001	12 m	132 m x m	678 m	NULL	0513 m NE	2,148 Km SO	NULL
1	NULL	002	16,500 m	105 m x m	681 m	NULL	0465 m SO	2,062 Km SO	NULL
0	NULL	003	23,500 m	275 m x m	678 m	NULL	0387 m SO	2,040 Km SO	NULL
62	NULL	004	15 m	162,500 m x m	676 m	NULL	0386 m SO	2,047 Km SO	NULL
63	NULL	005	13,500 m	114 m x m	682 m	NULL	0120,500 m S	1,676 Km S/SE	NULL
68	NULL	006	10,500 m	071 m x m	681 m	NULL	0217 m SO	1,610 KmS/ SE	NULL
67	NULL	007	09 m	058,500 m x m	669 m	NULL	0208 m SE	5,580 Km SE	NULL
66	NULL	008	09 m	042 m x m	670 m	NULL	0028 m N/NE	1,562 Km SO	NULL
65	NULL	009	11,500 m	065,500 m x m	670 m	NULL	0240 m SO	1,270 Km SO	NULL
64	NULL	010	12,500 m	075 m x m	676 m	NULL	0414,500 m NE	2,165 Km E/SE	NULL
69	NULL	011	18,500 m	132 m x m	675 m	NULL	0421 m N/NE	2,098 Km E/SE	NULL
70	NULL	012	12 m	087,500 m x m	668 m	NULL	0152 m NO	5,250 E/SE	NULL
71	NULL	013	16 m	212 m x m	666 m	NULL	0364 m NO	5,044 Km E/SE	NULL
72	NULL	014	20 m	178 m x m	668 m	NULL	0527 m SE	1,907 Km E	NULL
73	NULL	015	12,500 m	077 m x m	667 m	NULL	0391 m S	2,276 Km E	NULL
74	NULL	016	12,500 m	089,500 m x m	661 m	NULL	0207,500 m S/SE	3,683 Km E	NULL
75	NULL	017	08,500 m	041 m x m	658 m	NULL	0175 m SE	3,841 km E	NULL
76	NULL	018	09 m	54,500 m x m	671 m	NULL	0109 m S/SE	992 Km NO	NULL
77	NULL	019	14 m	101 m x m	663 m	NULL	0437 m SE	566,634 m NO	NULL
78	NULL	020	10,500 m	63,500 m x m	679 m	NULL	0737,500 m N/NE	301,160 m N	NULL
80	NULL	021	17 m	133,500 m x m	662 m	NULL	0057 m NE	3,000 Km NE	NULL
79	NULL	022	09,500 m	60 m x m	661 m	NULL	0173,500 m SE	3,018 Km E/NE	NULL
83	NULL	023	14 m	108 m x m	655 m	NULL	0196 m SO	4,834 Km E/NE	NULL
82	NULL	024	16 m	102,500 m x m	655 m	NULL	0026 m SO	5,428 Km E/NE	NULL
81	NULL	025	20 m	182 m x m	659 m	NULL	1000 m SE	5,326 Km E/NE	NULL

Fig. 10. Database Structure single



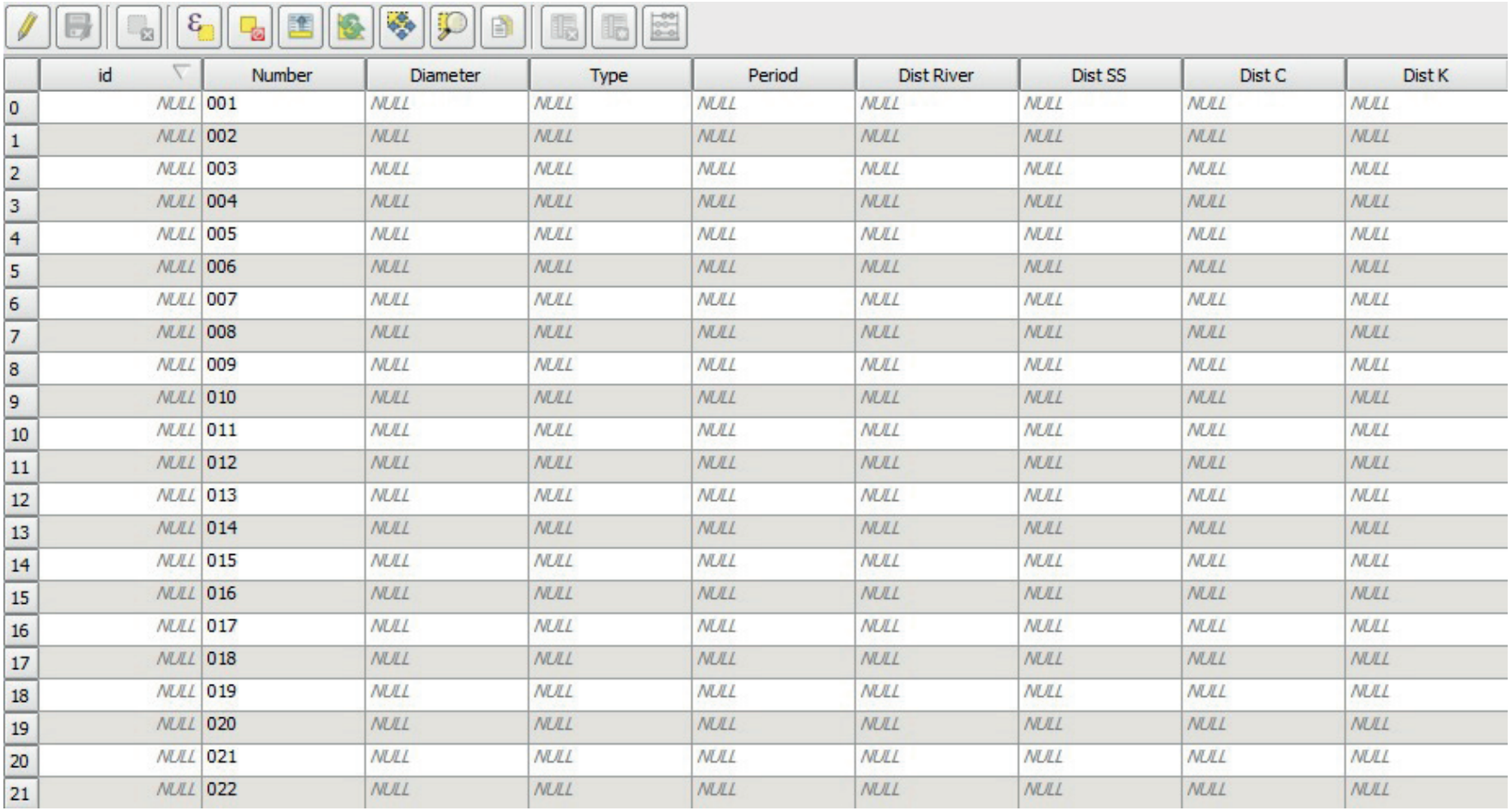
	id	Number	Diamet max	Diamet min	Tot S	Units	DC largest	DC equival	DC small	500 m	1 Km	1.5 Km	Dist R	Dist L	Dist K
0	NULL	1	NULL	NULL	NULL	8	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
1	NULL	2	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
2	NULL	3	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
3	NULL	4	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
4	NULL	5	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
5	NULL	6	NULL	NULL	NULL	9	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
6	NULL	7	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
7	NULL	8	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
8	NULL	9	NULL	NULL	NULL	8	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
9	NULL	10	NULL	NULL	NULL	20	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
10	NULL	11	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
11	NULL	12	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
12	NULL	13	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
13	NULL	14	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
15	NULL	15	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
14	NULL	16	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
16	NULL	17	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
17	NULL	18	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
21	NULL	19	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
20	NULL	20	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
19	NULL	21	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
18	NULL	22	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
22	NULL	23	NULL	NULL	NULL	3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
90	NULL	24	NULL	NULL	NULL	6	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
23	NULL	25	NULL	NULL	NULL	4	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
24	NULL	26	NULL	NULL	NULL	5	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
25	NULL	27	NULL	NULL	NULL	2	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Fig. 11. Database Compound



	id	Period	Tot Length	Tot Width	Tot S	Head L	Head W	Head S	Tail L max	Tail L min	Tail W max	Tail W min	Tail S	Head Num R	Kite type	Dist Lake	Dist River	Dist C	Dist K	1 Km SS	1 Km C	2 Km SS	2 Km C
0	NULL	NULL	450 m	221,600 m	5,188 ...	101,50...	158 m	1,093 ha	364 m	338 m	219 m	15,500 m	4,032 ha	11	NULL	NULL	NULL	247.500 m	2.075 Km S	1	2	11	11
1	NULL	NULL	235 m	146 m	1,736 ...	93 m	130.5...	8.412,5...	183 m	115 m	145 m	18,500 m	9.086,10...	9	NULL	NULL	NULL	212 m SE	2,075 Km N	2	5	8	14
2	NULL	NULL	1,012 Km	619 m	14,51...	157,50...	163 m	1,689 ha	921,500 m	550 m	617,500 m	21,500 m	13,174 ha	14	NULL	NULL	NULL	389 m O	1,189 Km S	5	1	16	15
3	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
4	NULL	NULL	783 m	780 m	4,451 ...	84 m	158 m	8.780,2...	936,500 m	234 m	958 m	22,500 m	3,670 ha	8	NULL	NULL	NULL	387 m E	1,211 Km S	5	1	16	15

Fig. 12. Database Kite



	id	Number	Diameter	Type	Period	Dist River	Dist SS	Dist C	Dist K
0	NULL	001	NULL	NULL	NULL	NULL	NULL	NULL	NULL
1	NULL	002	NULL	NULL	NULL	NULL	NULL	NULL	NULL
2	NULL	003	NULL	NULL	NULL	NULL	NULL	NULL	NULL
3	NULL	004	NULL	NULL	NULL	NULL	NULL	NULL	NULL
4	NULL	005	NULL	NULL	NULL	NULL	NULL	NULL	NULL
5	NULL	006	NULL	NULL	NULL	NULL	NULL	NULL	NULL
6	NULL	007	NULL	NULL	NULL	NULL	NULL	NULL	NULL
7	NULL	008	NULL	NULL	NULL	NULL	NULL	NULL	NULL
8	NULL	009	NULL	NULL	NULL	NULL	NULL	NULL	NULL
9	NULL	010	NULL	NULL	NULL	NULL	NULL	NULL	NULL
10	NULL	011	NULL	NULL	NULL	NULL	NULL	NULL	NULL
11	NULL	012	NULL	NULL	NULL	NULL	NULL	NULL	NULL
12	NULL	013	NULL	NULL	NULL	NULL	NULL	NULL	NULL
13	NULL	014	NULL	NULL	NULL	NULL	NULL	NULL	NULL
14	NULL	015	NULL	NULL	NULL	NULL	NULL	NULL	NULL
15	NULL	016	NULL	NULL	NULL	NULL	NULL	NULL	NULL
16	NULL	017	NULL	NULL	NULL	NULL	NULL	NULL	NULL
17	NULL	018	NULL	NULL	NULL	NULL	NULL	NULL	NULL
18	NULL	019	NULL	NULL	NULL	NULL	NULL	NULL	NULL
19	NULL	020	NULL	NULL	NULL	NULL	NULL	NULL	NULL
20	NULL	021	NULL	NULL	NULL	NULL	NULL	NULL	NULL
21	NULL	022	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Fig. 13. Database Tomb

2015 Rock Art Survey in the Dûmat al-Jandal Area

Charly Poliakoff [1]

In March 2015, rock art surveys were carried out in parallel with the documentation of desert kites (cf. Barge et al. in this report) within the Globalkites project (Dir. Rémy Crassard). The first objective was to determine the relationship between these structures and the surrounding petroglyphs. The second objective was to discover and document the oldest petroglyphs and inscriptions. Thus, systematic surveys were carried out in the target areas around the desert kites visited.

Methods of study

Sampling strategy

During surveys in a new sector, the total number of the researched entities is never known in advance. The main objective is, therefore, to obtain an exhaustive representative sample of this "population". Thus, like the archaeological surveys, rock art surveys are based on a quantitative and spatial approach. Two methods, which determine the speed and detail of the recording, were used. The first seeks to diagnose the rock potential of localities. It consists of taking a single GPS point for each large set of discovered petroglyphs. These engravings are then recorded using photographic techniques. A second, more demanding and intensive method can nonetheless be put into practice. It determines in advance the surface to be surveyed based on the constraints of the rock matrix to raise the petroglyphs systematically. In this case, the spatial distribution of rock art engravings at a site is taken into account and recorded by GPS.

These introductory remarks on the sampling method require some definitions. From the general to the particular, the first observed entity is the site. While the definition of an archaeological site may be problematic, the definition of a rock art site has been resolved by spatial and topographical considerations. A rock art site corresponds to a coherent whole of engravings, which are distributed on a remarkable relief in a more or less dense way. Each site then receives an identifier of three letters inspired by the local toponym followed by two digits. The detailed spatial distribution of petroglyphs within these sites is based on a GPS positioning paradigm cal-

1. Université Paris 1 Panthéon-Sorbonne.

led the "rock art point" (RP). This last notion is inspired by the so-called "epigraphic point" from work carried out on the *Archaeological and Epigraphic Atlas of Petra* [2]. In a study specifically focused on petroglyphs, the RP corresponds to a certain rock surface on which engraved elements are found and recorded by a single GPS point. This RP may correspond to a panel several meters long, as well as all the faces of a block of modest dimensions. Thus, this notion makes it possible to restore the rock "population" in space with a precision level according to the object of study.

Iconographic and statistical analysis

The systematic and comprehensive methodology applied at the Jabal al-Zillîyât found a representative sample of sites. In addition to the field observations, the photographic documents were studied in such a way as to individualize each iconographic quantum.[3] that composed the scenes. This has allowed us to bypass the biases of identification and regrouping of information constituting the rock scenes. Thus, these indivisible elements have been grouped into several broad categories, some of them defined by IFRAO.[4] "Anthropomorphic" includes all representations interpreted as a whole, referring to the human figure. "Imprint" refers to the particular parts of the human or animal anatomy on which a representation is based. "Zoomorphic" refers to all the figures that may belong to what a human relates to the animal kingdom. Likewise, "Phytomorphic" is used for what humans relate to the vegetable world. The category "Object" represents elements produced by a human being. "Abstraction" refers to patterns that are not interpretable in terms of a figurative repertoire but have their own meaning. In the study that follows, it is mainly tribal markers: the so-called "wusum" (singular "wasm"). "Unidentified element" includes all elements that are unintelligible or too degraded to be interpreted. In addition, each of these broad categories includes subcategories. For example, in the systematic study of Jabal al-Zillîyât, the zoomorphs were broken down into animal families for mammals, class and order respectively for birds and reptiles represented (Aves, Bovidae, Camelidae, Canidae, Equidae, Felidae, Squamata). Finally, the subcategory "Unidentified animal" was added when the identification of the animal was impossible.

2. Nehmé 2012: 161.
3. An iconographic quantum is a collection of engraved motifs, joined or not, identified naturally by human cognition as an object, an animal or a character.
4. International Federation of Rock Art Organisations, see http://www.ifrao.com/ifrao-glossary/. Bednarik 2003.

Discovery of new rock art sites

This year (2015), many rock art sites were discovered in the al-Jawf province. First of all in the locality of Dûmat al-Jandal but also on the side of Sakâkâ in the north-west, and the fringes of the Nafûd towards the south. These sites have been identified and positioned on a map with the desert kites already located in the region by the Globalkite project.[5] (**Fig. 1**)

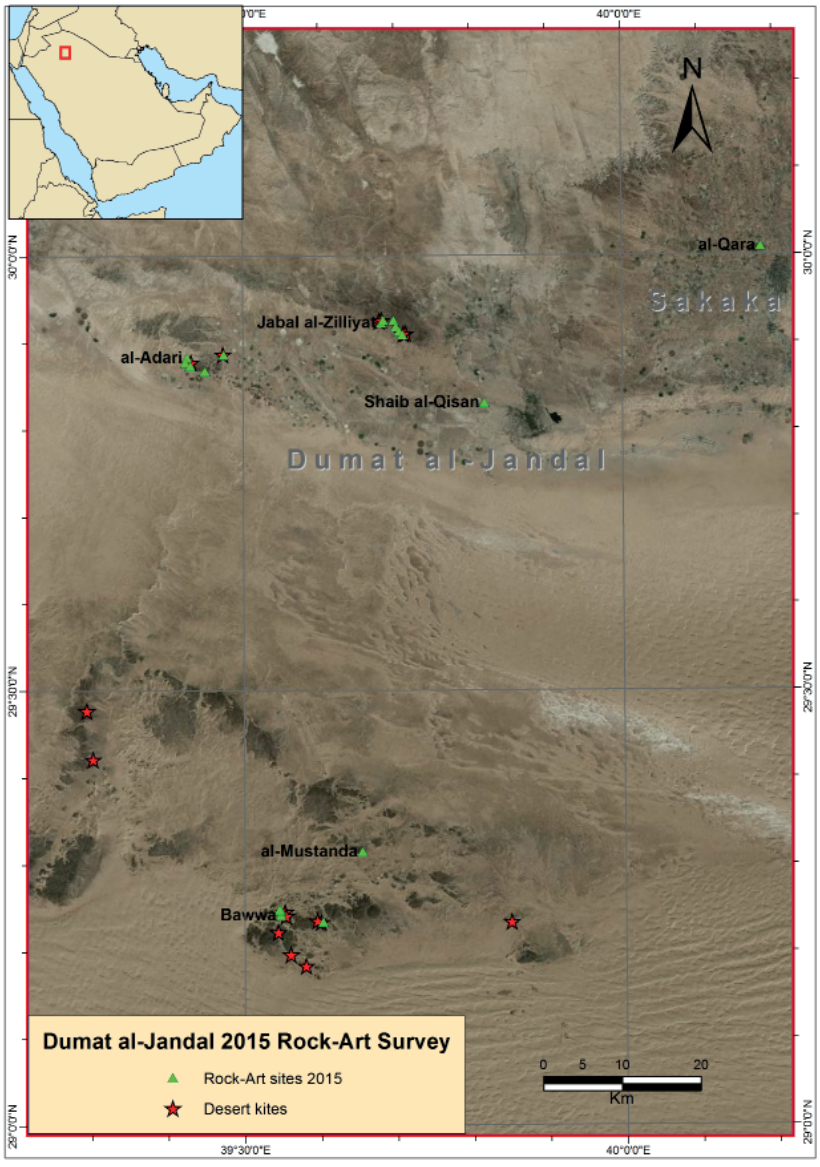


Fig. **1.** General map of the rock art sites surveyed during the 2015 Dûmat al-Jandal campaign with nearby desert kites.

5. For the Globalkites project map see http://opengeo.mom.fr:8080/geoexplorer/viewer/#maps/2.

al-Adâri' (ADR) الأضارء

On the locality of al-Adâri', five sites have been listed not far from two desert kites. The lower layers of these massifs are composed of a favorable sandstone, while in the upper layers it is possible to find limestone and its derivatives. The rock art sites in the area have a majority of wusum (tribal markers) and very few figurative engravings. Particularly remarkable, a small rocky surface displays several aligned wusum, which have been engraved by the same person (**Fig. 2**). This might point to the existence of an extended repertoire of tribal markers, not to be confused with Thamudic letters. Moreover, two other elements attract closer attention. First of all, an engraver has tried to represent the ears of an oryx, which is rather rare, as generally speaking petroglyphs place little emphasis on this part of animal anatomy (**Fig. 3**). However, according to its patina and the associated wasm, this engraving cannot be prehistoric. Finally, another block presents two anthropomorphic figures with a dark patina, one of which is more than one meter high (**Fig. 4**). The smallest has antennas on its head, while the larger one has claws or well-individualized fingers. Apart from these strange details, this mode of schematic representation is also found further south in the Najd. According to the patina and tight picketing, these engravings were probably made before the Islamic period. Finally, several Arabic inscriptions dating from the end of the 20th century have been found.

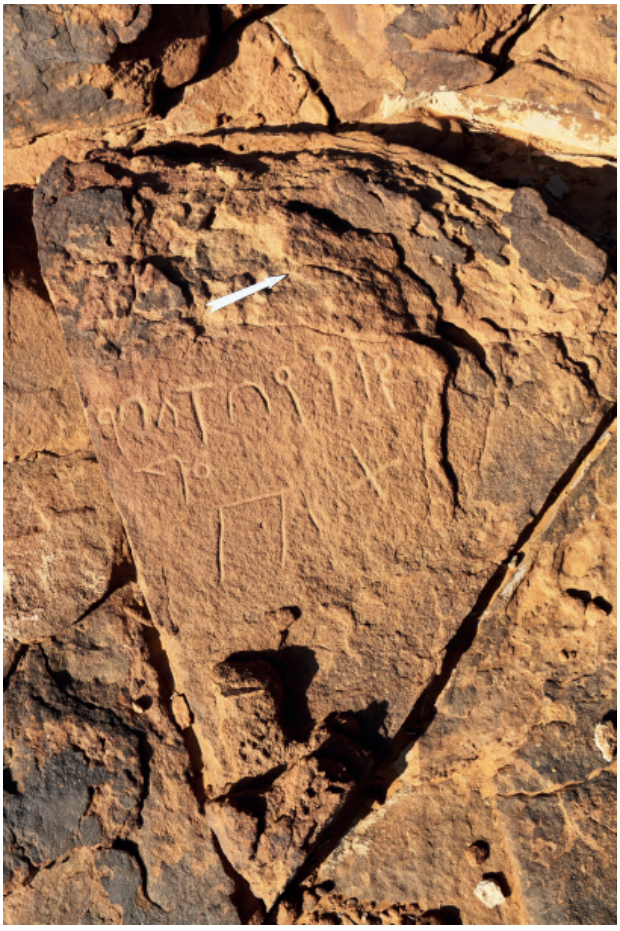


Fig. **2.** Alignment of the wusum at al-Adâri' (the north arrow measures 12 cm) (DJ2015a0019B)

104



Fig. 3. Hippotragus (oryx) with ears represented at al-Adâri '(DJ2015a0016B)



Fig. 4. Schematic characters with dark patina at al-Adâri '

al-Mustanda (MST) المصتندة

The site of al-Mustanda is located at the foot of an orange sandstone massif with dark patches and partially eroded. Most of the figures are poorly preserved schematic dromedaries as well as some wusum. These rather recent engravings were probably made by people who kept the herds in the area. Nevertheless, a small slab presents a recent scene of a caprine hunt (**Fig. 5**). Two characters with firearms aim at the bovids on the left side of the board. With the typical position of aiming at the knee, the use of modern weapons gives us an approximate dating to the second half of the 2nd millennium of the Christian era. It should be noted that one of the caprines on the left is older and that it was probably replicated by the engraver who realized the characters.



Fig. **5.** Hunters with guns aiming at a caprine at al-Mustanda (DJ2015a0027B)

Bawwa (BWA) بوة

At the locality of Bawwa, near the dunes of the Nafûd, many desert kites have been located. These sandstone massifs appear very close to the road margins, and the team drove only one vehicle during the day of surveying. This distance from frequented roads results in infrequent engravings. Some anthropomorphic figures with weapons are associated with these representations. A small surface on a rock with an inattentive patina shows a character who hunts a caprine with a bow (**Fig. 6**). This engraving, which presents coarse picketing on a rock of such poor quality, questions the engraver's skill level. Finally, a few engravings of camels that are poorly realized, with very clear patinas also document the presence of breeders in this region in recent times.

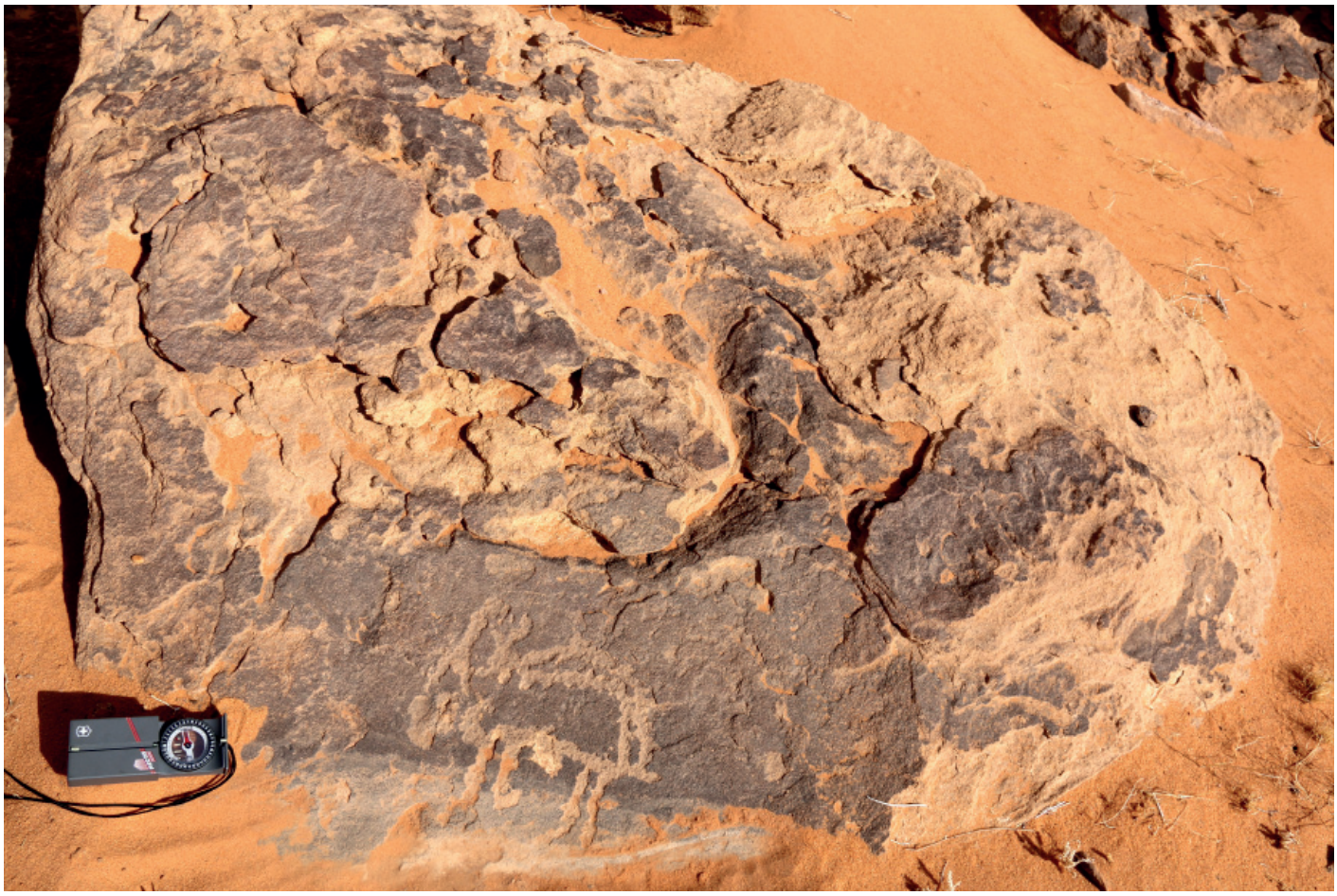


Fig. **6.** Hunter with a bow pursuing a caprine at Bawwa (the compass case serving as a scale, measures 12 cm) (DJ2015a0030B)

Sha‘ib al-Qîsân (QSN) شعيب القيسان

Sha‘ib al-Qîsân is a small outcrop located a few kilometers to the west of the sector C of Duma. The rocky station lies 500 meters from a water source Bi’r al-Jidîlîyah (بئر الجديلية), which makes it an ideal sheltered place close to a water point. This sector has delivered recent Arabic inscriptions with dates, mostly from the end of the 20th century to the beginning of the 21st century (**Fig. 7**). There is no representation on this site.



Fig. **7.** Recent Arabic inscriptions at Sha‘ib al-Qîsân

al-Qar‘â’ (QRA) القرعاء

One of the last sites discovered this year is located north-west of Sakâkâ, in the locality of al-Qar‘â’ (site 144). The dwellings literally encircle the large blocks that make up this rock art site. In general, these petroglyphs are only slightly degraded but still heavily threatened by the urban sprawl. The patinas of the rocks are mixed, from partial desquamation to a relatively uniform surface. Two elements have attracted the attention of the surveying team and will require new interventions for documentation and preservation. First of all, Arabic inscriptions from the first

centuries AH were discovered, but more surprising is the nature of the surrounding petroglyphs. A slab contains numerous engravings with several overlays. This provides some clues for a relative chronology.

Thus, the earliest of these petroglyphs could be a bovid represented in a bi-angular perspective, a well-known form dating back to prehistoric times (**Fig. 8**). Other animals have been represented on the rocks around, such as caprines or hippotraginae, on occasion, some carnivores and felids are represented as well (**Fig. 9**). Most of these scenes seem to describe wild animal herds and specific hunting practices using hunting aids. It is difficult to go further into the details of interpretation without a systematic study. Nevertheless, it is possible to affirm that this rock art site was frequented from the Neolithic to modern times, making it a prime study area for our understanding of rock art in the al-Jawf region.



Fig. 8. A slab that includes many superimpositions, as well as the old bovines at al-Qar'â' (DJ2015a1086B)



Fig. 9. A scene showing a felid attacking a caprine at al-Qar'â ' (DJ2015a1079B)

Surveys in Jabal al-Zillîyât (ZLT) جبل الظليات

Contextualization and general results

Intensive surveys between four desert kites in the locality of Jabal al-Ẓillîyât (ZLT) revealed six rock art sites (**Fig. 10**). These reliefs, composed of sandstone, are a superb material for any engraving activity. The first site, ZLT01, is located on a rocky island about a hundred meters south of two desert kites. Some small structures with lithic tools were found a few meters to the north-east of these reliefs (cf. Crassard et al. in this report). ZLT02 corresponds to a partially disintegrated wall with some modern engravings and wusum. ZLT03 is located in the great wadi in the middle of the study area. In addition to containing the overwhelming majority of the corpus, it hosts some structures, including an under-rock shelter. ZLT04 corresponds to the adjacent wadi with some interesting inscriptions and engravings. Finally, the marginal sites ZLT05 and ZLT06 are composed of a few small block engravings in the plateau desolation. Despite the almost complete absence of petroglyphs, lithic residues have also been found to the south of these last stations.

To this day, 389 Rock art Points (RPs) have been identified in the area on which 1824 iconographic elements and 330 inscriptions have been revealed (**Fig. 11**). The biggest contributor to the iconography and engraving catalogue is ZLT03, where engraving concentrations are the highest. The RPs containing petroglyphs and inscriptions are very numerous. They seem to concentrate mainly in the middle of the wadi of ZLT03 and ZLT04 and the outcrop ZLT02 (**Fig. 12**).

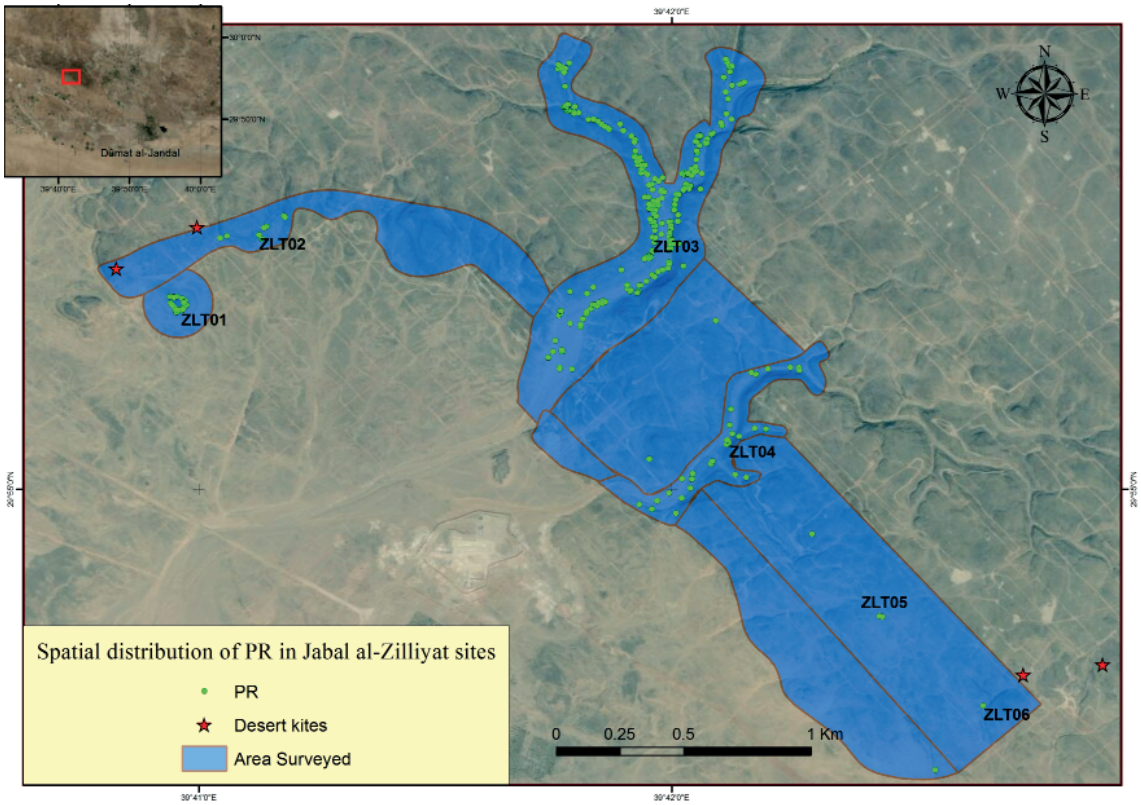


Fig. 10. Spatial distribution of RPs at Jabal al-Zillîyât

Fig. **11.** The Rock art Point with the number of iconographic quantum and inscription per site

	RP	Iconography	Inscription
ZLT01	31	102	8
ZLT02	9	13	5
ZLT03	309	1439	293
ZLT04	35	253	23
ZLT05	3	8	0
ZLT06	2	9	1
Total	**389**	**1824**	**330**

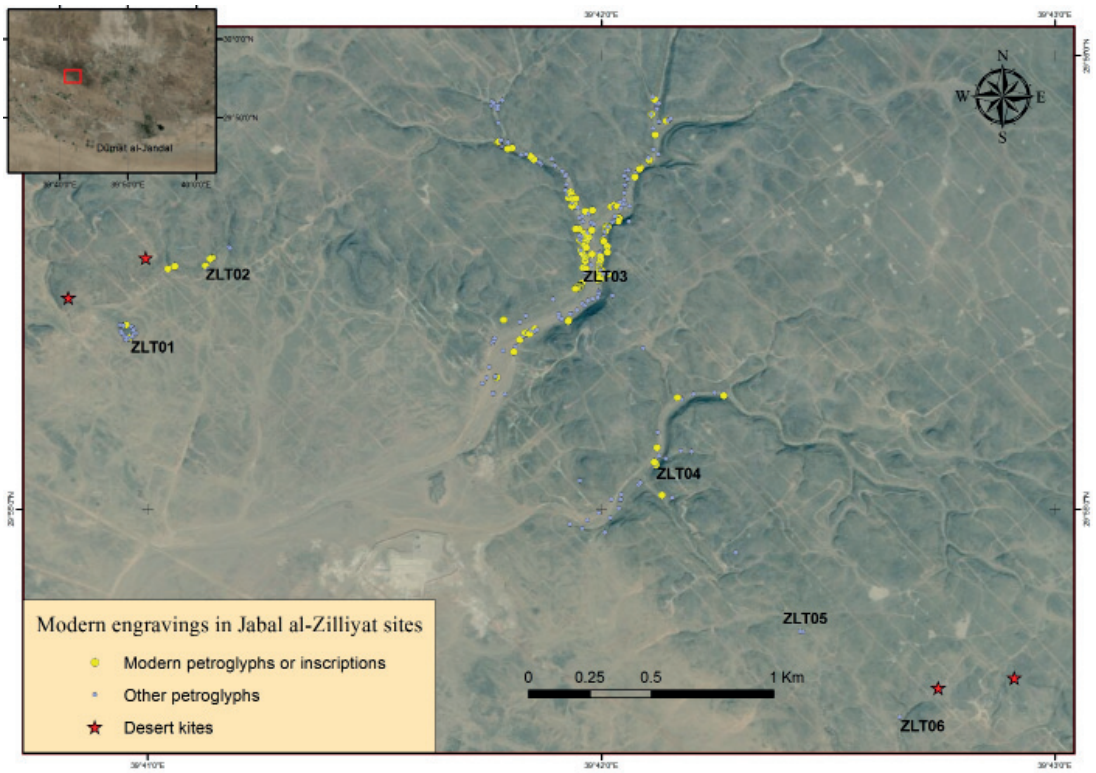


Fig. 12. Distribution of recent engravings and inscriptions at the Jabal al- Zillîyât sites

The total surveyed rock art "population" is unevenly broken down (**Fig. 13**). The largest number of individuals falls into the abstraction category (44.68%), which accounts for almost all wusum (tribal markers). The zoomorphs come second (25.93%). These are for the vast majority of dromedaries and caprines, followed by other species like the large bovines and the hippotraginae. The rarely represented animals are ostriches, felids, canids, snakes and lizards. Equines, which are exclusively mounted, are also few. Anthropomorphic figures are rare in the assemblage (5.43%) and must be associated with wild animals, equines and objects to make sense. The objects recorded may be representations of weapons, equipment or structures. In addition to that, infrequent prints are, for the most part, human hands with sometimes a few feet. Finally, what is absent from this collection is the phytomorph.

	Anthropomorph	Print	Zoomorph	Phytomorph	Object	Abstraction	Und. Element	Total
ZLT01	10	2	33	0	13	7	37	102
ZLT02	2	1	3	0	1	4	2	13
ZLT03	75	32	373	1	44	664	250	1439
ZLT04	12	12	56	0	10	137	26	253
ZLT05	0	4	0	0	0	3	1	8
ZLT06	0	0	8	0	0	0	1	9
Total	**99**	**51**	**473**	**1**	**68**	**815**	**317**	**1824**
%	5.43	2.80	25.93	0.05	3.73	44.68	17.38	

Fig. 13. Distribution of the main categories of figural depictions by site

The inscriptions

The earliest inscriptions were found at ZLT01, ZLT03 and ZLT04. Most of the time, these are proper names in Thamudic writing (**Fig. 14**). These series of characters have the particularity of being arranged in a horizontal or vertical direction. All inscriptions in Thamudic writing found this year are currently the subject of a specialized study. Finally, besides the overwhelming majority of recent cursive Arabic script, some Nabatean inscriptions have been located on ZLT03. They will also be the subject of a specialized study.



Fig. 14. Vertical Thamudic inscriptions at ZLT01 (DJ2015a0053B)

The animal world and hunting

The oldest engravings of the area were found on the side of ZLT03. These are several bovine figures with a bi-angular perspective. Most of the time, they are engraved on slabs, which distinguishes them from other animal figures depicted indiscriminately on horizontal or vertical walls. A slab covered with petroglyphs highlights this phenomenon of the oldest engravings (**Fig. 5**). On this surface, four bovinae with a body seen in profile, and a pair of horns seen from above, possess a patina as dark as the rock. These engravings were, moreover, ignored by the engravers of the later periods. These animals are probably bovines of the Neolithic. They could be buffalos or aurochs, which flourished in Arabia during the most favorable climatic conditions towards 8000 BP.[6] These wild animals have surely not escaped the sphere of human hunting practices.



Fig. 15. Neolithic bovines, probably aurochs or buffaloes at ZLT03 (Poliakoff)

Other later figures are engraved indistinctly on horizontal or vertical surfaces. These are caprine or hippotraginae. On the rock station ZLT01, it seems that these are the oldest representations, whereas at ZLT03 they seem younger than the neolithic bovines. The overwhelming majority of caprines represented is modern. However, in some representations, the patina of these animals seems relatively old (**Fig. 16**). They are probably ibices, recognizable by their two horns wound backwards. This scene is particularly sophisticated, as it uses the relief of the rock

6. Garrard & Harvey 1981

to represent the situation. The two hunters with their bows upwards are placed on the vertical face of the slab, while the caprines are represented on the horizontal surface of the latter. One of the ibexes on the right faces a smaller animal. In this context, it is probably a domestic canid used for hunting. It is difficult to ascertain what the cupulas around the animals are supposed to depict. One interpretation might lean towards traps, but this is unverifiable in this case. Nevertheless, on a slab of ZLT03, two representations of a desert kite were found (**Fig. 17**).

The first one on the left stands out well from the rock's surface, while the second on the right is very eroded. These are the first engravings representing megastructures of this type in the Dûma region. These structures could be related to the hunting of specific animals, as has been shown in Armenia.[7] This point could be confirmed in the study area, as an old engraving of a bovid was found near the slab, probably a hippotraginus (**Fig. 18**). Even if the figure and its execution push the interpretation towards an ancient date, it does not meet the same representation criteria as the neolithic bovines shown above. Moreover, a little further in the main wadi, many animals, mostly caprines, have been found on a group of rocks (**Fig. 19**). This assemblage of animal engravings with an old patina, not far from the representation of a desert kite, is quite troubling.



Fig. 16. Caprine hunting scene using the two faces of the rock at ZLT01 (DJ2015a0047B)

7. Chahoud et al. 2015



Fig. 17. Two representations of a desert kite at ZLT03. The first is visible on the left, and the second is strongly eroded on the right (DJ2015a0897B)



Fig. 18. Detail of a hippotragus (Oryx) near the desert kite engravings at ZLT03 (the animal representation is 18 cm long) (Personal Photo, in the database: DJ2015a0898B)

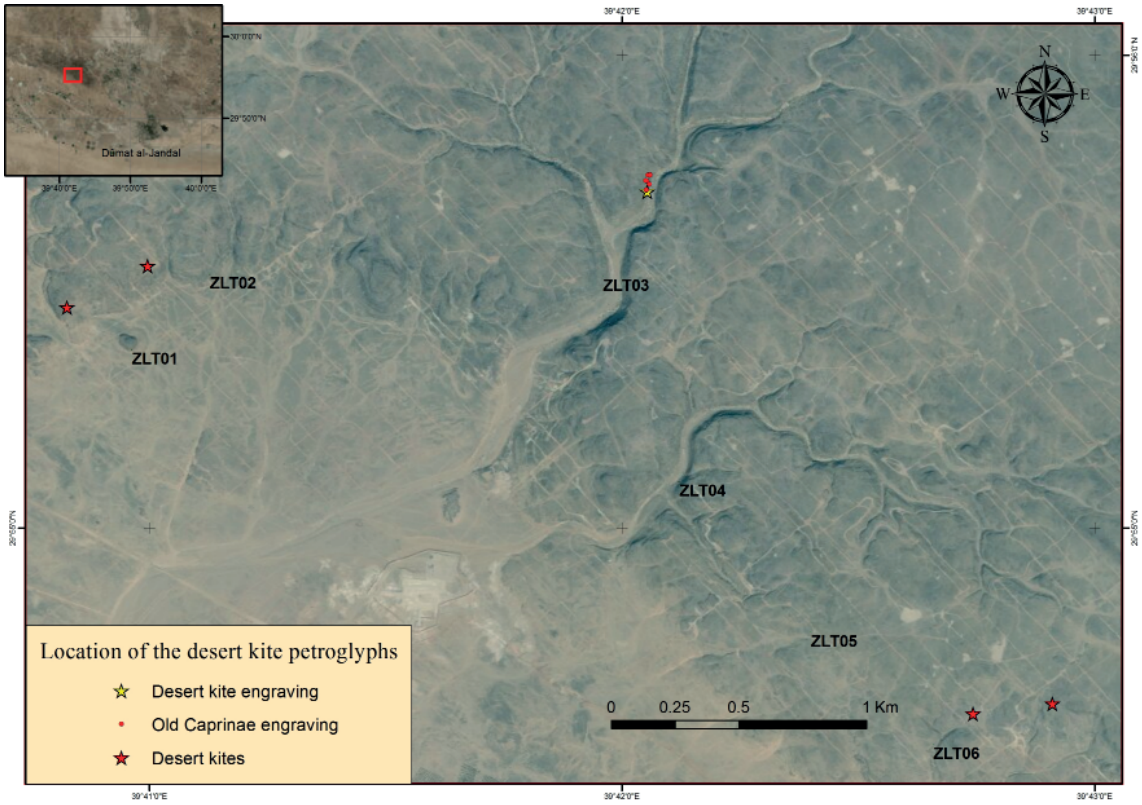


Fig. 19. Location of desert kite engravings and ancient goat engravings at Jabal al-Zillîyât sites



Fig. 20. A felid hunted by a mounted archer at ZLT03. A character appears in a bad situation in the animal's mouth (DJ2015a0881B)

More rarely, hunting scenes invoke other animals such as felidae. A rock highlights this theme at the entrance to the big wadi of ZLT03 (**Fig. 20**). A character, probably riding a horse, aims his bow in the direction of a wounded lion. Between the two figures, an anthropomorphic figure seems to be in a bad situation in front of the gaping mouth of the animal. The representation of this type of hunting is quite rare. It describes hunting practices that were at the beginning of historical periods only practiced by kings and princes. Nevertheless, considering the progressive accessibility of the mounts and the improvement of riding techniques, a date from the Islamic period for this representation is quite conceivable. The mounted archer could thus refer to the practices of the Mamluk elite.[8] Finally, the representations of ostriches, lizards and snakes are exceptional and always engraved with little care.

Domestic dromedaries

In addition to these hunting practices, camelids are indirectly attested in the Jabal al-Zilliyât rock art assemblage. Most dromedaries are schematic with a clear patina. They were probably engraved between the Islamic era and the 20th century. Therefore, they cannot be hunted animals. Indeed, today's optimistic consensus of the scientific community agrees on the domestication of the dromedary in the Middle East in the middle of the 3rd millennium BC.[9] Some of these representations of camelids on the Jabal al-Ẓillîyât are mounted by a rider, but they are often quite recent engravings. Nevertheless, some figures seem older, including a large camelid on a wall of ZLT03 (**Fig. 21**). This representation, which measures 1 m in height by 1.2 m in width, has a patina difference that contrasts with the recent Arabic inscription from below. In addition, the characteristic of the downward-pointing tail (which opposes recent representations with the tail pointing upwards) reinforces the interpretation of a wild camelid. Unfortunately, we lack information to date more precisely this engraving. It might as well have been made in the Bronze Age or on the eve of the Islamic era.

Anthropomorphs and weapons

Most anthropomorphic figures are represented schematically with two lower limbs, two upper limbs, and sometimes the sketch of a head. The execution of these figures lacks the care that directs the interpretation towards engravings and gives very little information on the societies of the time. A few other characters are depicted as "praying" with their legs and arms apart, but it is difficult to say more when they are found isolated, without any particular context. On the other hand, certain anthropomorphs are engraved with more attention, thus making the details intelligible. Most of the time, these characters are equipped with weapons and engaged in hun-

8. Nicolle 2011
9. Kennedy 2010

ting or other confrontational actions. In the hunting scenes, they are often equipped with a bow, sometimes even mounted on horseback (Supra). Nevertheless, the most frequent representations of armed characters are relatively recent. It is often a recurring scene of a man carrying a firearm that opposes a rider armed with a spear or a sword. Such a representation was found on the side of ZLT03 (**Fig. 22**). It depicts a character who fires a shot at a rider with a strange motif. The points that pass around the rider represent the trajectory of the shot. The horse's motif is composed of two triangles opposite the apex on which the lower limbs, the neck and the tail have been drawn. The spear that the rider holds and the use of a firearm place the engraving between the 16th and 20th century. Indeed, as the introduction of firearms to Arabia happened relatively late, the battle of Sabilla (1929) in the Najd would have been represented with swords and spears as in pre-Islamic times.[10]



Fig. 21. Large dromedary with a very dark patina at ZLT03

10. Elgood 1995: 89



Fig. 22. A scene of confrontation between a rifleman and a rider armed with a lance at ZLT01 (DJ2015a0041B)

The wasm, an indicator of attendance?

At the Jabal al-Zillîyât sites, an impressive amount of wusum was recorded. Even though most are recent, some may go back to pre-Islamic times. According to Majeed Khan's thesis, the wusum would be engraved since prehistory.[11] This hypothesis has not yet been confirmed at the Jabal al-Zillîyât sites. On the other hand, the spatial distribution of "Abstraction" elements, the overwhelming majority of which is composed of wasm, allows for a definition of preferential resting stations (**Fig. 23**). RPs with wusum are distributed fairly homogeneously on outcrops and within the wadi. However, their concentration by RP varies significantly in some places. Indeed, the majority is found on large blocks when the main wadi meets another tributary.

11. Khan 2000

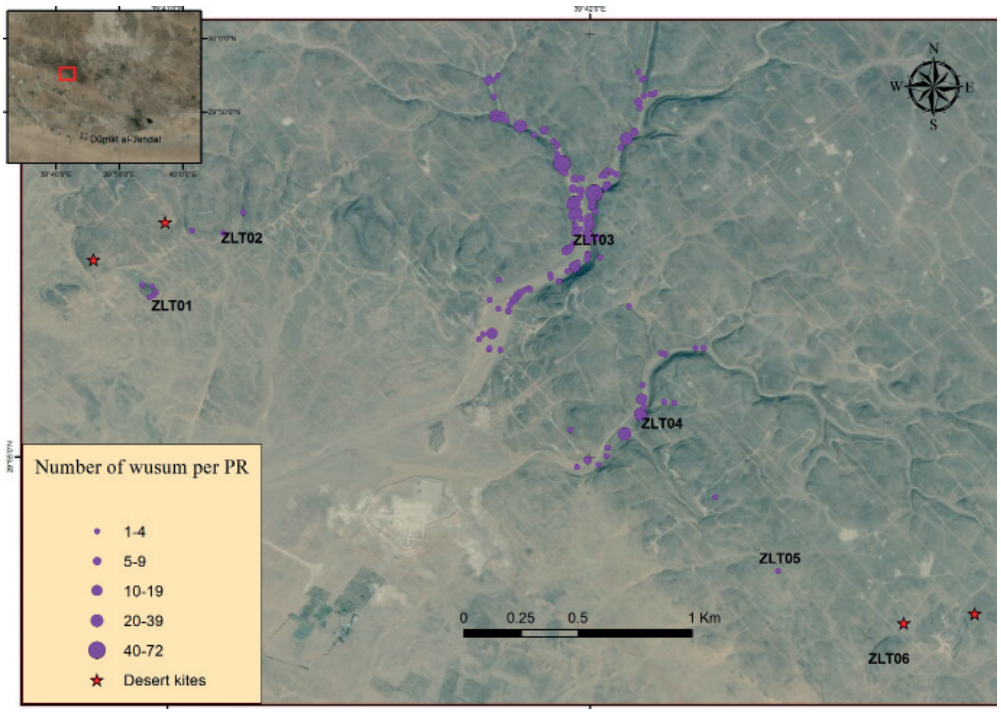


Fig. 23. The distribution and frequency of wusum by RPs at the Jabal al-Zilliyât sites

Conclusion

In al-Jawf region, surveys around Dûmat al-Jandal revealed a rock art potential whose in-depth study is fundamental. Some sites require sustained attention in the upcoming campaigns, including the Jabal al-Zillîyât and the locality of al-Qar'â'. These rock art sites contain testimonies from the Neolithic period, historical inscriptions and all the way to present-day engravings. The most prestigious representations in ancient times revolved around the wild animal world and ritual hunting. A little later, when environmental conditions no longer allowed large bovine animals to survive, hunting practices were oriented towards new birds of prey with the occasional use of hunting weapon. The most common animals in the representations become hippotraginae or wild caprines, better adapted to life in an arid environment. It could be at this point that the desert kites of the region, of which several rock art representations have been found on the side of Jabal al-Zillîyât, could intervene in hunting practices. The hunting techniques evolved little by little, and the bow was gradually replaced by the firearm in the second half of the 2nd millennium AD. This evolution of weapons is also perceptible in the emergence of the theme of confrontation, where modernity and traditions compete. These traditions are also attested by the indirect representations of pastoral practices with the dromedary. Finally, the study of the spatial distribution of wusum, combined with the most recent engravings, could open up new areas of research in order to specify the routes taken by the populations and the preferential resting stations.

Excavation in the Historical Area, Sector A

Romolo Loreto, Vincenzo Regine, Marinela Polosa,
Clarissa Cafora & Roberto Bottiglieri

Introduction (R. Loreto)

In 2014, activities in the historical area (the so-called Sector A) were carried out between 9th – 28th September, in the presence of the authors: Andrea Marcolongo (architect), Thâmer al-Malkî (SCTA), Darhan al-Qahtani (SCTA) and Ahmad al-Gayed (SCTA). The archaeological excavation focused on two different topics: First, the enlargement of Trench 1 towards the east, including the eastern terrace, which dominates the lower Nabataean, Roman, Byzantine and Early Islamic structures (**Fig. 1**). Second, on a first test probe inside the castle of Mârid, the supposed ancient acropolis (**Fig. 2**).[1]



Fig. 1. The east enlargement of Trench 1 done in 2014

1. al-Dayel & al-Shadukhi 1986.



Fig. 2. Trench 7. Excavation test probe in the north-eastern part of the Mârid Castle courtyard

In detail, the excavated areas involved five new trenches named in the succession of Trench 1 (excavated since 2009) and Trench 2 (excavated in 2011) (**Figs. 3–4**). Trenches 3–6 were opened above the eastern terrace; Trench 7 was opened inside the castle of Mârid.

The enlargement of the extensive Trench 1 excavation area towards east derived from both the necessity to shed light on the ancient urban area and define a specific archaeological area. Subsequently, this area will be turned into an open-air museum. Here, archaeological activities will run side by side with restoration, conservation and valorization endeavours due to the state of preservation of the structures (**Fig. 5**). Because of this effort, an eastern enlargement of Trench 1 is quite logical, in order to explore the high-positioned ground full of archaeological potential linked to the main excavation trench.

Excavation to the east obviously came in contact with the previous al-Dayel dig, which took place in the southern half of the terrace (**Fig. 6**). The 2014 excavation cleaned the al-Dayel trench and involved built and organic structures related to sepulchral and agricultural contexts.

On the other hand, the decision to proceed with a test probe inside the Castle of Mârid was based on the necessity to confirm an archaeological stratigraphy under the Byzantine-Early Islamic structures and start a systematic analysis of the ancient acropolis, after the al-Mu'ayqil excavation.[2]

2. al-Mu'ayqil 1994: 81–84.



Fig. 3. Dûmat al-Jandal historical area (2009-2014)

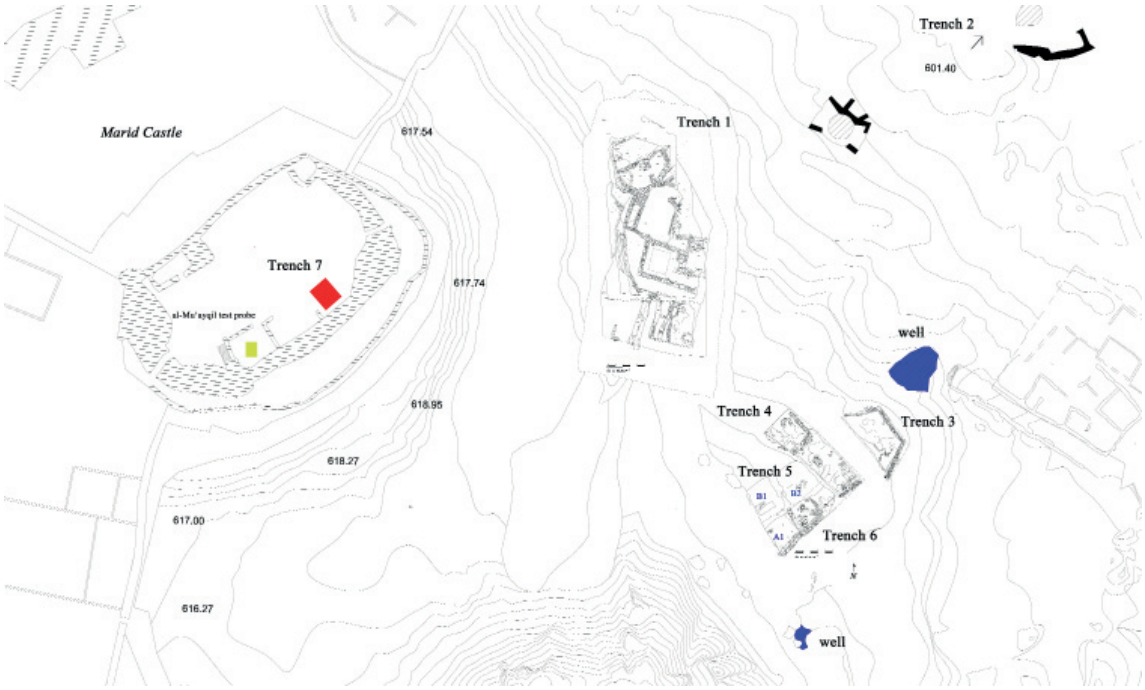


Fig. 4. Sector A, 2009-2014 excavations. Trench 1, at the foot of the acropolis and Trenches 3–6 above the terrace on the southern slope of Wadi al-Sirhân



Fig. 5. The terrace above which Trenches 3–6 were opened, as seen from the north-west

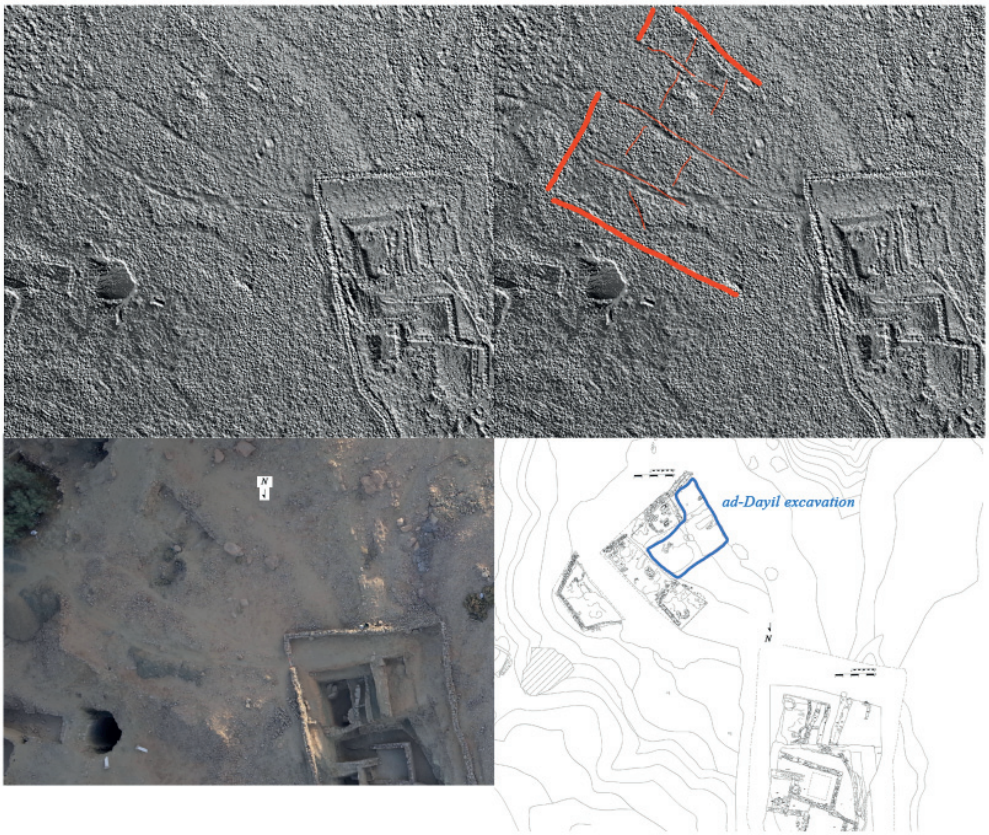


Fig. 6. Enhanced aerial picture of the 2014 excavation area

The east enlargement of Trench 1

Excavation in Sector A is on-going and encompasses a remarkably extensive excavation area. This includes a study of the eastern terrace, which dominates the lower part of the ancient site (**Fig. 7**). The excavation provided various information regarding the urbanization of the Nabataean and early Islamic Dumah.

Along the southern slope of Wadi al-Sirhân, east of the Mârid Castle and on the top of the urban area excavated until now there is a natural terrace (**Fig. 8**). According to the masonry dated to the Nabataean era, two wells are located at the south-eastern and north-eastern limits (**Fig. 4**). Between the wells and Trench 1, an orthogonal wall system has been identified (**Figs. 6–7**). It was partially excavated by al-Dayel in 1985. The excavation of al-Dayel involved the most recent levels, with poor and recent sepulchral areas. On a deeper level, after the sepulchral layer, a square orthogonal arrangement of the terrace was detected, with rooms dedicated to storage and food processing (**Figs. 6–7**).



Fig. 7. 2014 excavation area as seen from the south.



Fig. 8. View of the terrace dominating the residential area

The dating of this arrangement can be proposed based on the mudbricks used in the outer structure of the wall. This type of mudbrick is similar to the mudbrick wall of the Nabataean terrace (M 68), south of Building A in Trench 1.[3] Moreover, these mudbricks are different and harder than the mudbricks used for Islamic houses. A very large number of millstones and grindstones has been collected. These have many parallels in the impressive number of such functional tools collected in the Islamic levels of re-occupation of the Nabataean Building A in Trench 1 (re-employed in the wall construction), suggesting a daily use of food processing tools. A wider urbanization study can be conducted now, mostly devoted to understanding the oasis economy and its exploitation.

al-Dayel excavation

The al-Dayel excavation took place on the eastern part of the terrace, with the creation of three excavation trenches (A1, B1 and B2) at the south-eastern limit of the orthogonal complex (**Fig. 4**). Al-Dayel recognized a series of orthogonal stone walls built just above the rocky flank of the slope with a mortar pavement, with at least one passageway (in A1 and B1) and a semi-circular functional element (in B2). Due to the regular structure of the wall arrangement, as well as the presence of at least two supposed "doors", al-Dayel interpreted this arrangement as the

3. Loreto 2018b.

foundation of a house or a more general building (**Fig. 9**). In his report, the material culture collected is listed as follows: “a number of pottery sherds of different size and shapes were found, in addition to one coin”. Followed by: “according to the preliminary study of the finds in these trenches, this residential area can be dated to the Nabataean period”.

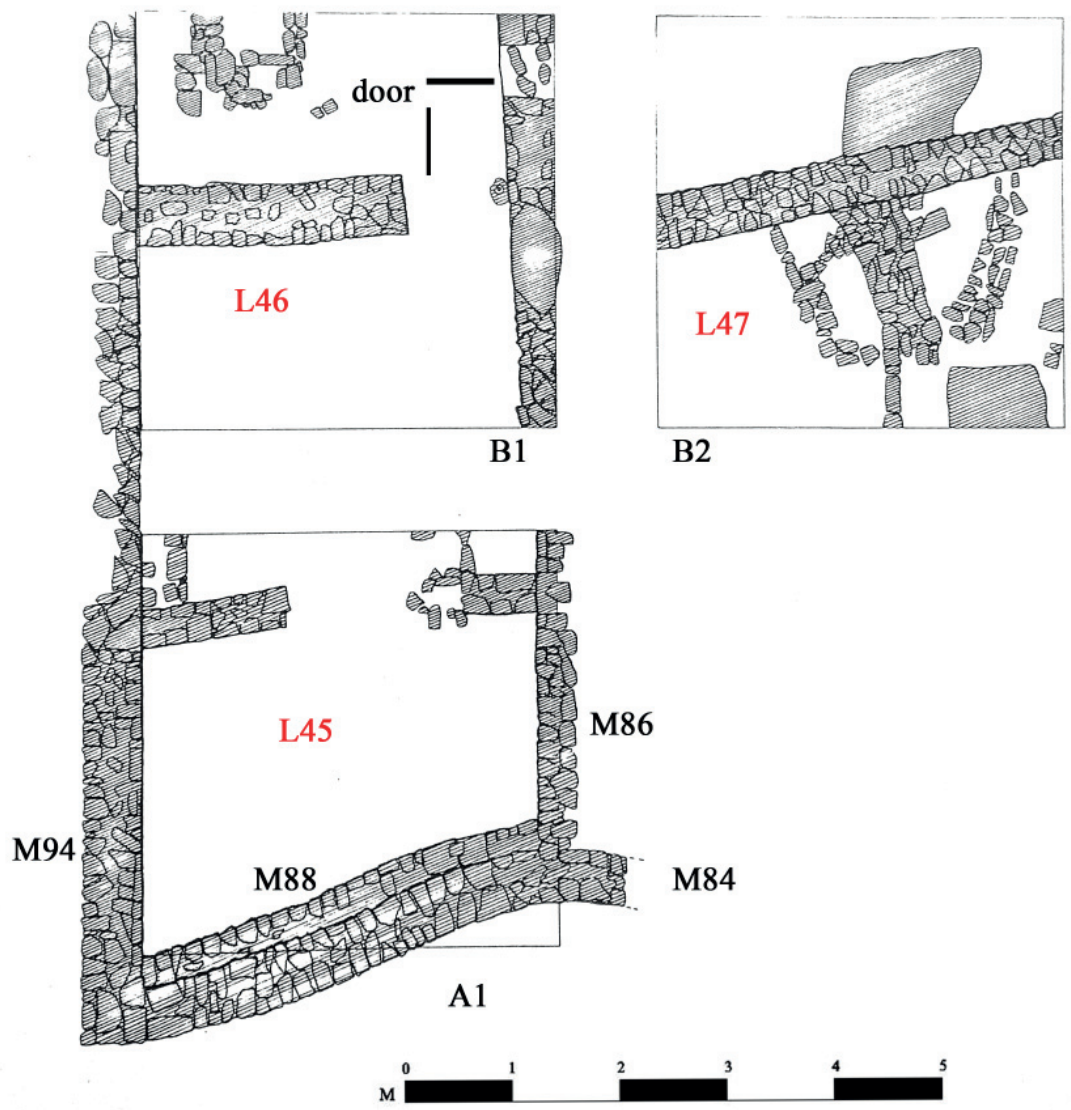


Fig. 9. Plan of the al-Dayel excavation (al-Dayel & al-Shadukhi 1986: pl. 77)

Trench 3 (R. Bottiglieri)

The trench at the beginning of the excavation

The first trench to be delimited was Trench 3, defined at the northeast edge of the terrace (**Fig. 10**). This first trench was necessary to accommodate the north wall enclosure of the terrace (M 77) as soon as possible, as this was in a bad static condition. The area (L 30) was covered with a level of aeolian sand which partially infused the perimeter walls of the terrace (M 76, 77 and 78), covering the first example of a simple funerary structure. Based on its ceramics and particularly superficial position, this feature seems to be recent (M 79) (**Fig. 11**).



Fig. 10. Trench 3 within the structures excavated in 2014

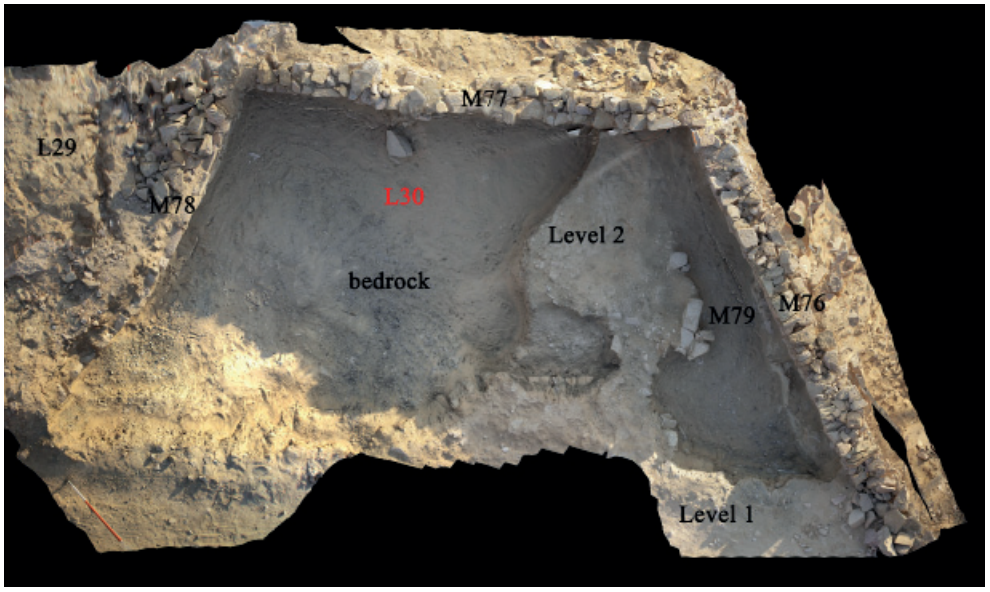


Fig. 11. Trench 3. Ortho-rectified aerial view

Defining spaces

The only structure identified is M 79, which looks like a low wall that delimits a funerary depot. M 79 is embedded in a compact ground level (level 2) set above the rock bank and is not preserved in the western half of the trench (**Figs 12–13**). It is possible that other burials of this kind were built in this section of the terrace.

Wall structures

The wall structures are made of stone walls in the double curtain that runs along the east and north edges of the terrace. After comparing the building techniques studied in Trench 1 and considering the scarce amount of ceramics from the excavation, it appears clear that these are walls built in the Islamic era. During this time, the nearby well beneath the north of the terrace was in use, as they isolated a space not destined for water supply. The walls simply follow the terrace trail to delimit a perimeter that, apparently, was meant as a burial area.

Stratigraphy

The stratigraphy is very limited as there are only two archaeological levels: Level 1, aeolian sand; Level 2, compact earth on rock.



Fig. 12. Trench 3, view from the west

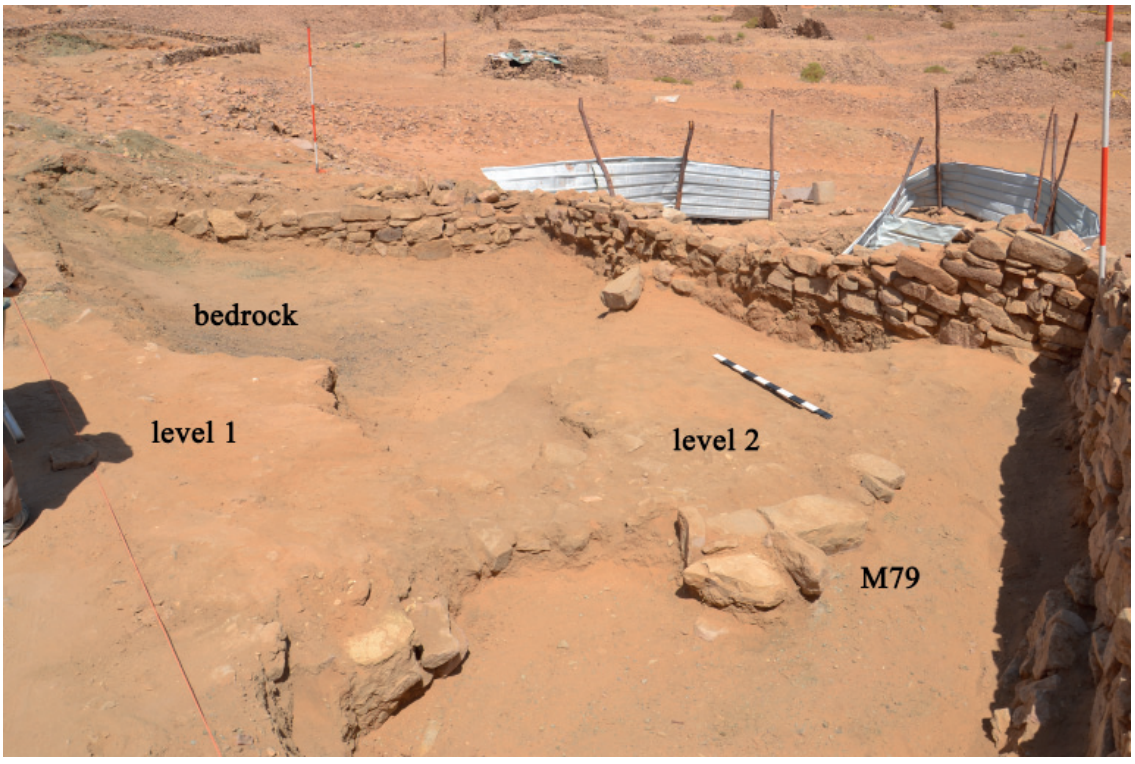


Fig. 13. Trench 3, view from the east

Trench 4 (C. Cafora)

The trench at the beginning of the excavation

Trench 4 was the first excavation area to be delimited (**Fig. 14**). The aim was to investigate an area of the terrace, where two orthogonal walls (M 80 and M 81) were visible. At a first general evaluation, they appear to be related to the structures excavated by al-Dayel and still partially visible on the surface. Subsequently, the boundaries of the trench (5 x 6 m), follow the course of these two wall alignments: one runs from north to south (M 81), and the other east to west (M 80). Before the excavation, the area had a surface covered by a modest amount of tiny stones (**Figs. 15–16**). Compared to the rest of the terrace, there were no signs of illegal excavations or excavations conducted by al-Dayel.

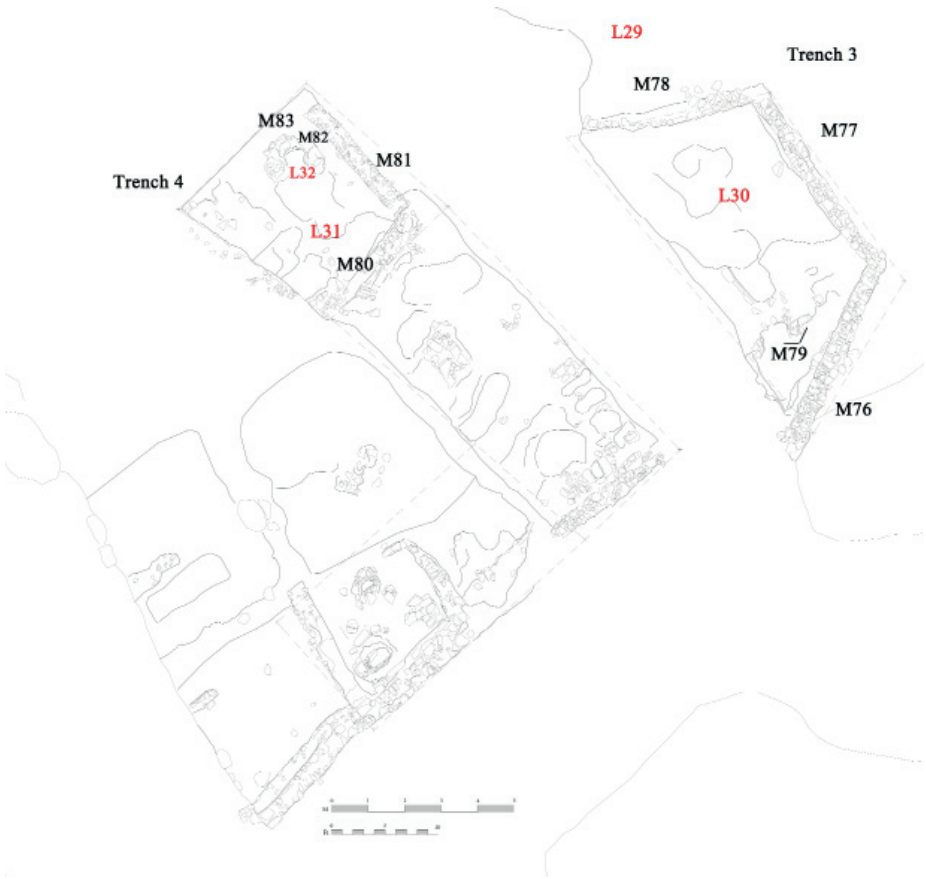


Fig. 14. Sector A, a detail of the 2014 excavation along the terrace. Highlights of Trench 4



Fig. 15. General view of the terrace before the excavation. In red, Trench 4. View from the south



Fig. 16. Trench 4 at the beginning of the excavation. South view

Defining spaces

After delimiting the area, the surface level (Level 1), consisting of aeolian sand and stones, was cleaned and removed. The walls, which previously showed only their ridges, have been brought to light. It was seen that (along the north side) M 80 and M 81 act as a perimeter to a square space called L 3, also delimited by M 83, a brick wall still partially preserved.

The newly highlighted level (Level 2) is composed of grey sand and crushed stone. Cleaning has made it possible to identify a new locus (L 32) near the northern limit of M 81 (**Figs. 17–18**).

L 32 appears as an oval pit-tomb delimited by a very coarse masonry (m 82). The associated level (Level 3) is composed of earth mixed with charcoal. Given the number of bones found there together with the ashes, the environment was interpreted as a burial area (**Figs. 19–21**). Beyond this first example of a funerary feature with limited proportions and devoid of any architectural element. A second one arose, apparently simply composed by oval pits.

One is near the northern M 81 boundary, between M 81 and M 82, and the other is found at the corner between M 80 and M 81. One cannot speak of funerary structures in both cases, but rather a simple deposition in the ground. The body would be arranged in a shallow pit - superficially excavated in the soil and enclosed by pre-existing structures. Bone remains confirm the hypothesis.

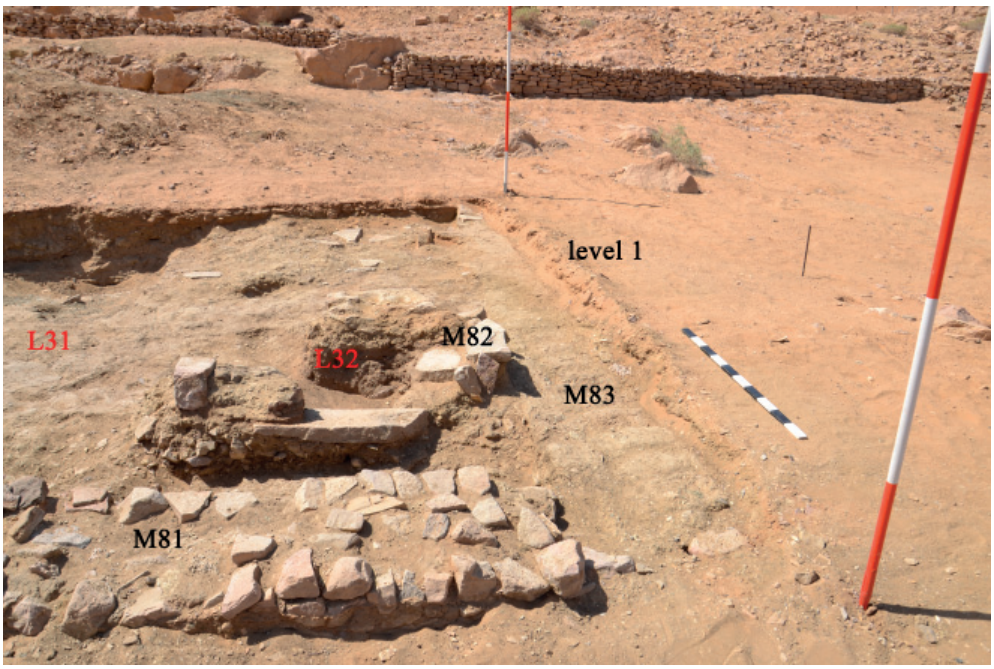


Fig. 17. Trench 4. Detail of M 83 in mudbricks. North view



Fig. 18. Trench 4. Mudbricks of M 83

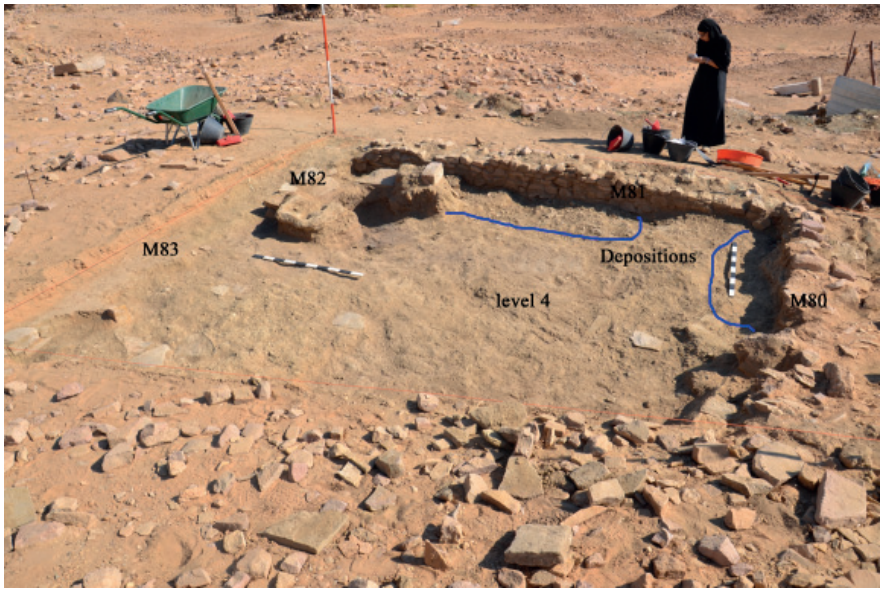


Fig. 19. Trench 4. General view of the identified burial spaces. View from the south-east

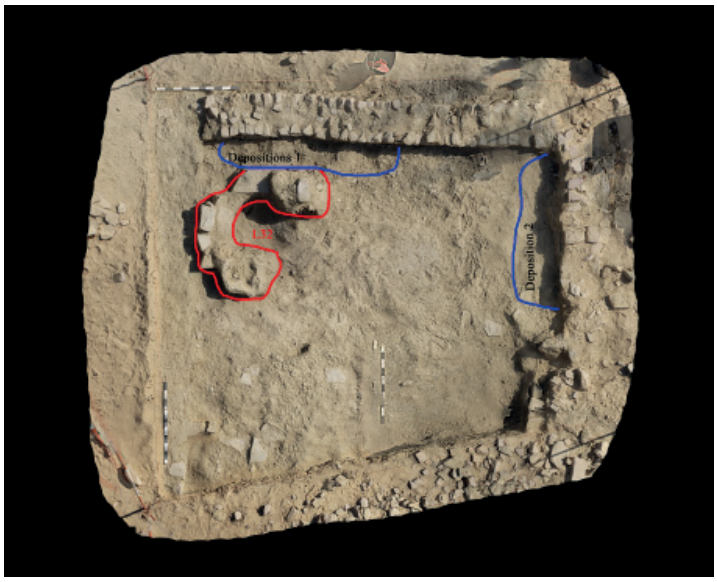


Fig. 20. Trench 4. Ortho-rectified aerial picture



Fig. 21. Trench 4. Detail of L 32. The pit was interpreted as a tomb with a burial chamber. South-west view.

Following the removal of Level 2, a rammed earth plan was brought to light (Level 4), and it covers the entire L 31. As documented in the south-west corner of the trench, this plan lies directly on the rock.

Stratigraphy

In this Trench, four levels were recognized (**Fig. 22**). Level 1 is the top layer composed of aeolian sand and stones of various sizes. This level of sand is also present in Trench 3. Level 2 covers the entire trench and consists of grey earth combined with small stones. Level 3 is only visible in the L 32 environment and is made of ash. Level 4 is the last level found before reaching bedrock. This is a flattened ground plan that covers L 31 fully. On level 4 lie all the identified walls (M 80, M 81, M 83).

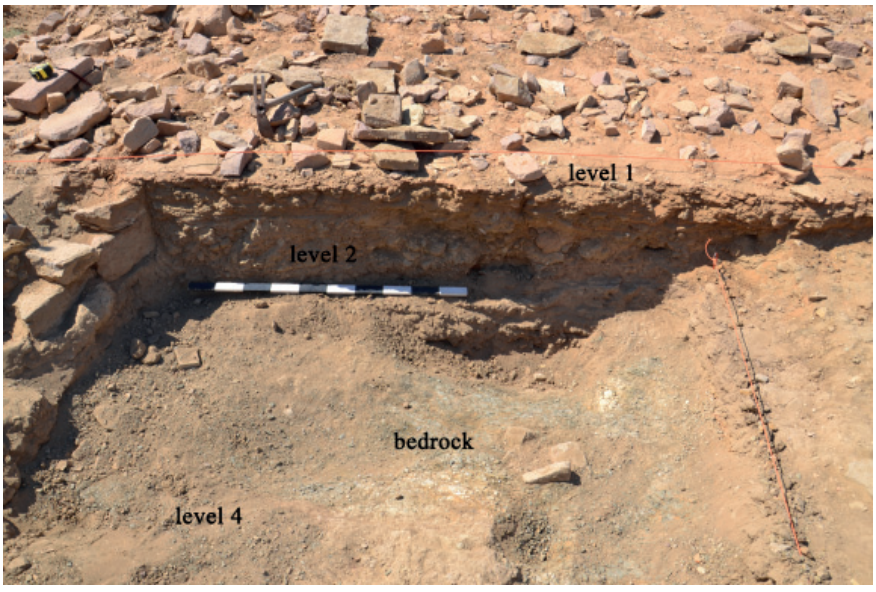


Fig. 22. Trench 4, southern section

Wall structures

There are four wall structures in the excavation area: M 80, M 81, M 82 and M 83.

M 81 (4.95 x 0.50 m) and M 80 (2.88 x 0.60 m) are preserved at a height of about 0.30 m. They both lie on Level 4 and intersect orthogonally. The corner formed by the two walls is not preserved. Both are very similar to the trench walls visible along the rest of the terrace: not only because they are quadrangular-orthogonal to each other but also due to the construction techniques used. In both cases, this was a double curtain wall made of medium-sized stones that do not have obvious traces of craftsmanship.

The second wall structure, M 82, is part of the tomb L 32. The wall, made up of arched stones, acts as a perimeter for the small pit.

The last wall structure highlighted is M 83: a mudbrick wall, whose two rows appear on the surface. M 83, at least in the single row, does not intersect with M 81.

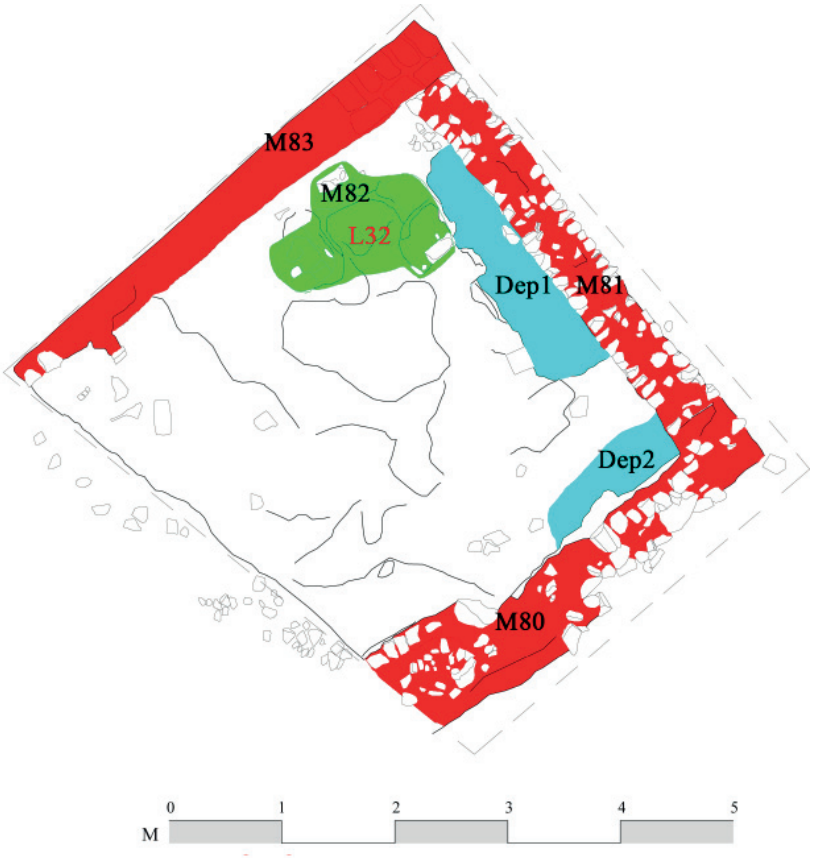


Fig. 23. Trench 4. Highlighted in red are the most ancient elements (M 80, M 81 and M 83); in green, the burial chamber L 32 (intermediate); in blue, the two burials (later)

At this preliminary stage of the terrace analysis east of Trench 1, we can define a first interpretive framework. M 80, M 81 and M 83 appear to be part of a system of orthogonal walls that define a series of square areas placed along the south side of the Dûmat al-Jandal oasis. According to what has been highlighted, this is a series of structures partly in stone and partly in brick and raw earth, a sort of adobe.

The only evidence that emerged at this time suggests that it is a small necropolis, related to the later Islamic phase of the site. This interpretation is based on the collected ceramics, which present at least two phases: an older one, found in the burial chamber, and a more recent one, documented in the two burials with no architectural elements (**Fig. 23**).

Environments

Tomb 1 (L 32)

The L 32 environment was interpreted as a tomb, given the presence of ash and human bones. The pit has modest dimensions (about 0.40 m). To the north, the grave borders with an arched wall consisting of a single row of stones.

In addition to bone fragments, a fragment of a vitreous paste bracelet of the Islamic tradition was found (D.J.14.A.O/10).

Burial 1

Near the northern corner of the M 81 wall, human bones were found. In this case, we cannot talk about a tomb as there are no traces of structures that delimit the burial area. The body appears to lie directly on the ground (precisely on Level 2) near the perimeter wall. Fragments of bronze and plaques and ornaments were associated to the deposition.

Burial 2

This is the second case of burial not accompanied by any grave structure, found in the corner between M 80 and M 81. No objects were associated with the bones.

Trench 5 (M. Polosa)

The trench at the beginning of excavation

After completing the excavation of Trench 4, it was decided to expand the investigation area by moving eastward. Such a choice was determined by the presence of masonry structures (M 80 and M 84), which hinted at the existence of circular environments bound to structures, as highlighted by al-Dayel, who suggested a single, orthogonal construction complex, located along the terrace. This new sector, the size of 9 x 5 m, was named Trench 5 (**Fig. 24**).



Fig. 24. Map of the excavation. Trench 5 is highlighted



Fig. 25. Overview of Trench 5 before the excavation. View from the south

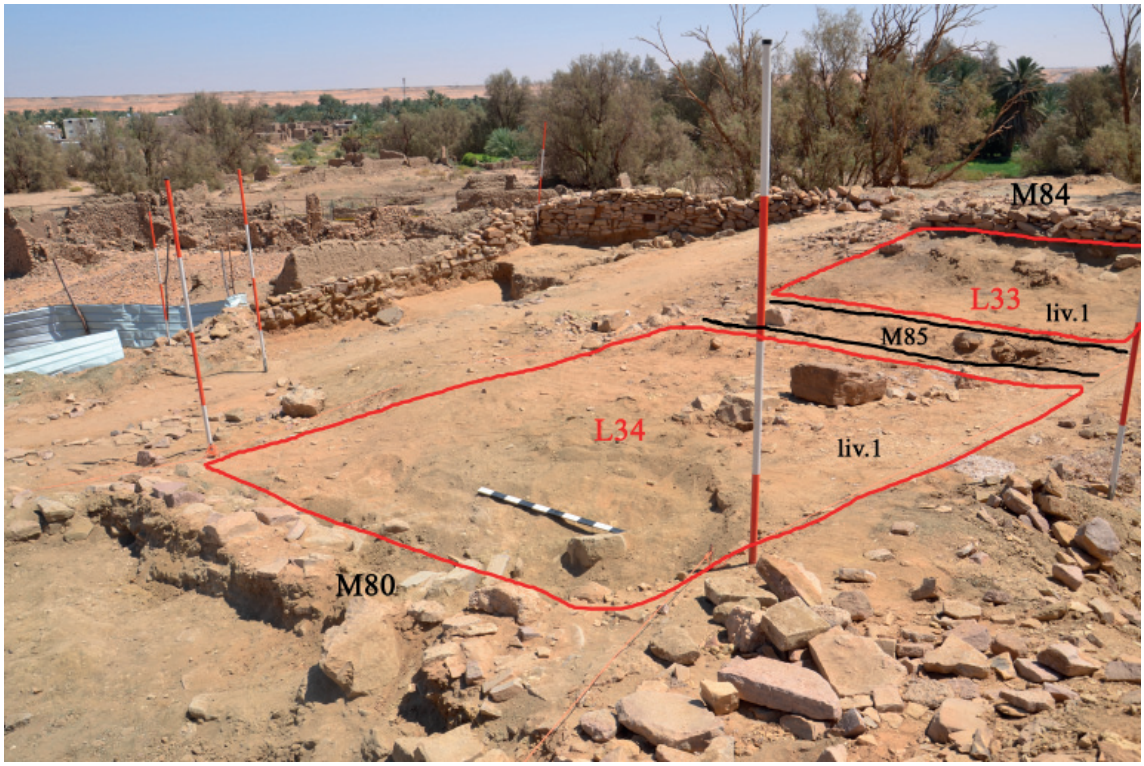


Fig. 26. Trench 5 at the beginning of the excavation. View from the west

The trench is covered by a surface layer of mixed aeolian sand deposits and stones of various sizes, called Level 1, in fact, the continuation of which is seen in Trench 4 (**Fig. 25**). After the removal of Level 1, the crests of the exposed wall structures (M 80 and M 84) (**Fig. 26**) were cleaned, and the other evidence present in the trench was brought to light, in particular walls and different types of burial.

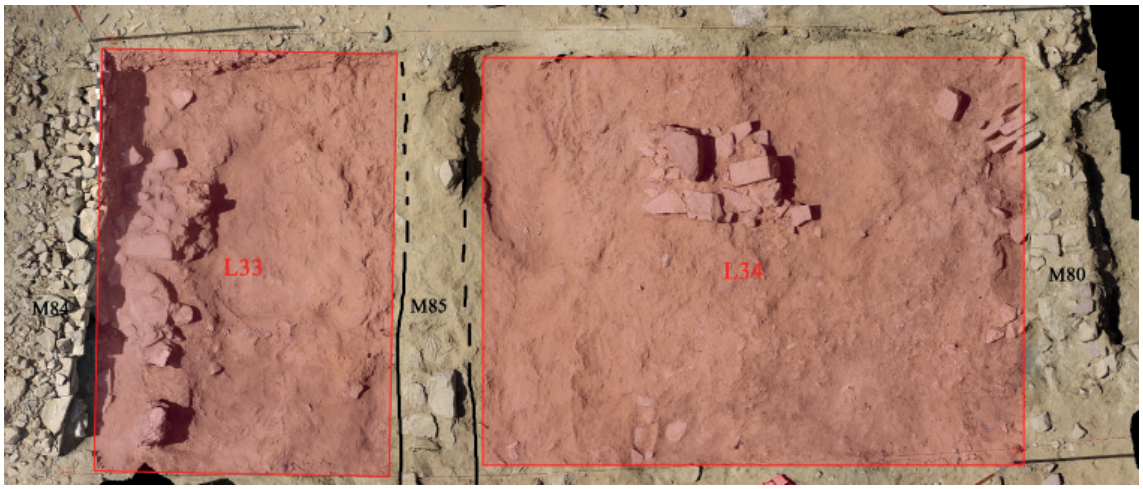


Fig. 27. Ortho-restitution of Trench 5. M 80, M 84, M 85 and the two loci L33 and L34

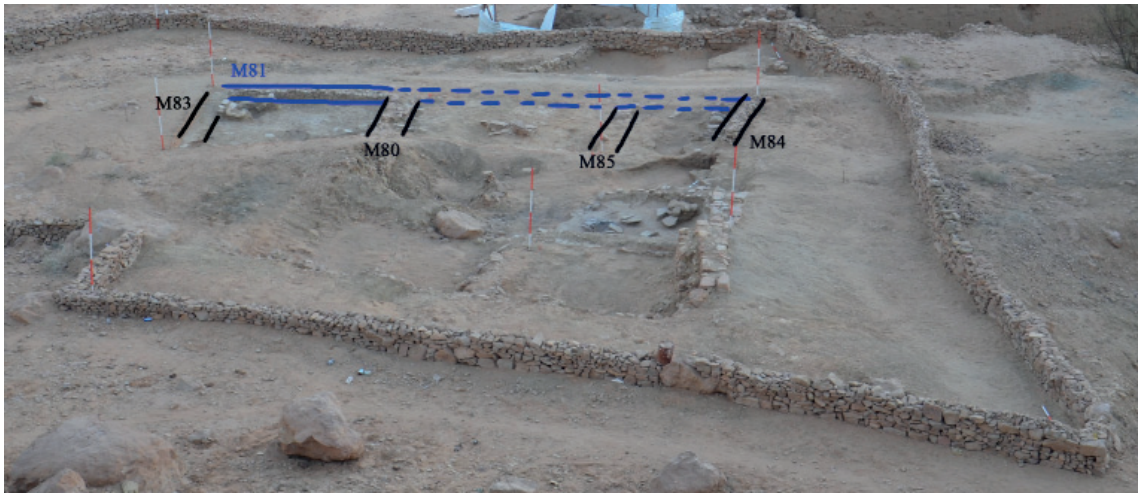


Fig. 28. Overview of the excavation. M 81, M 80, M 85 and M 84. View from the south

Defining spaces

The trench comprises two squares, bordered by three leaning walls going from the north to the south: M 80 (2.88 x 0.60 m) to the west, M 85 (2.70 x 0.50 m) and M 84 (3.20 x 0.55 m) along the eastern end of the trench. M 85 divides the trench into two loci: L 34 and L 33 (**Fig. 27**).

M 80, M 81, M 84 and M 85 appear to have been built following an orthogonal pattern, and they seem to form a casematte-like pattern, whose traces are visible from the dig of al-Dayel (**Fig. 28**).

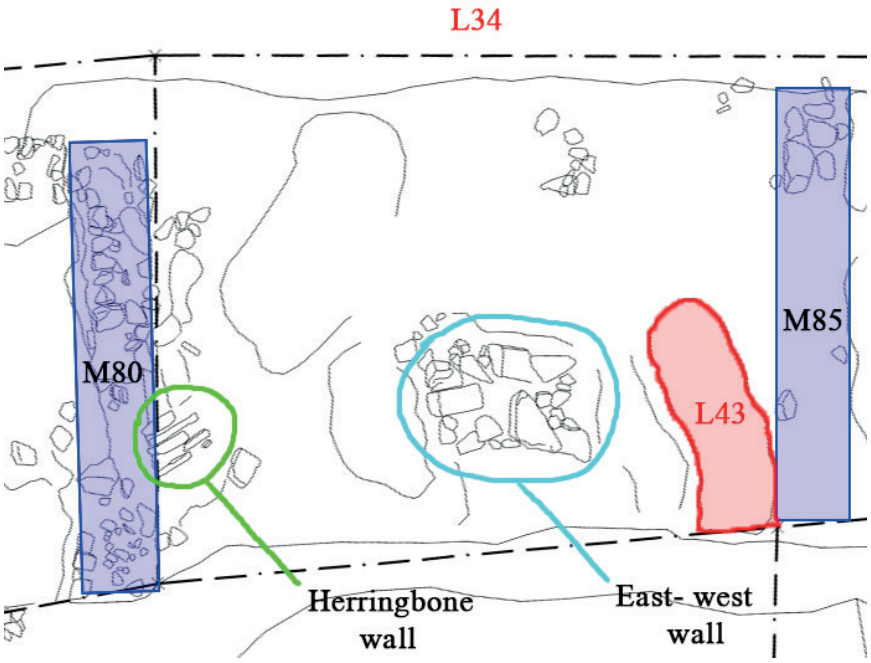


Fig. 29. Detail of Trench 5. L 34 and the elements within it.

L34

L 34 (4.85 x 3.80 m), between M 80 and M 85, shows a burial pit L 43 (2 x 0,65 m) (**Fig. 29**). Other elements worth noticing are a set of blocks, lying sideways (0.43 x 0.51 m), inserted within Level 4, by the south-western limit of M 80, that appears to form a wall with a herringbone disposition and an alignment of stones (1.47 x 0.80 m). This could represent another wall going unlike the others from the east to the west.

L33

L 33 (3.30 x 3.80 m) contains several burials: L 35, L 36, L 37 and L 38 (**Fig. 30**). Two types of burials are distinguished: L 36 and L 38 are simple burial pits, dug in Level 4; L 37 and L 35 are small chambers defined by variable blocks that act as walls. L 36, measuring 0.95 x 0.27 m, is near the northern limit of M 85. At the same time, L 38 that features a larger pit (2.28 x 1.37 m)

shows an elliptical pattern with traces of combustion, also partially visible on the surface of the bones found in it. L 37 (0.68 x 0.32 m) and L 35 (0.25 x 0.45 m) are close to M 84 but differ in the expertise used in the construction of the burial chamber walls. (**Fig. 30**): L 35 is defined by three regular blocks (a, b, c) that constitute the walls of the chamber, where the back wall (b) leans against M 84; L 37 is defined by two lateral blocks (a, b) and by M 84 that acts as a back wall.

Thus, the discovery of several burials in the various trenches to this date has helped to define three types (**Fig. 31**): chambers (L32 in Trench 4, and L35 with L37 in Trench 5); pits (L36, L38 in L33, and L43 in L34); burials (space between M80 and M82, the corner between M80 and M81 in Trench 4). The chamber tombs on Level 4 appear to be incineration tombs and chronologically older; the pits and the casual burials on Level 4, on the contrary, look like graves from more recent times.

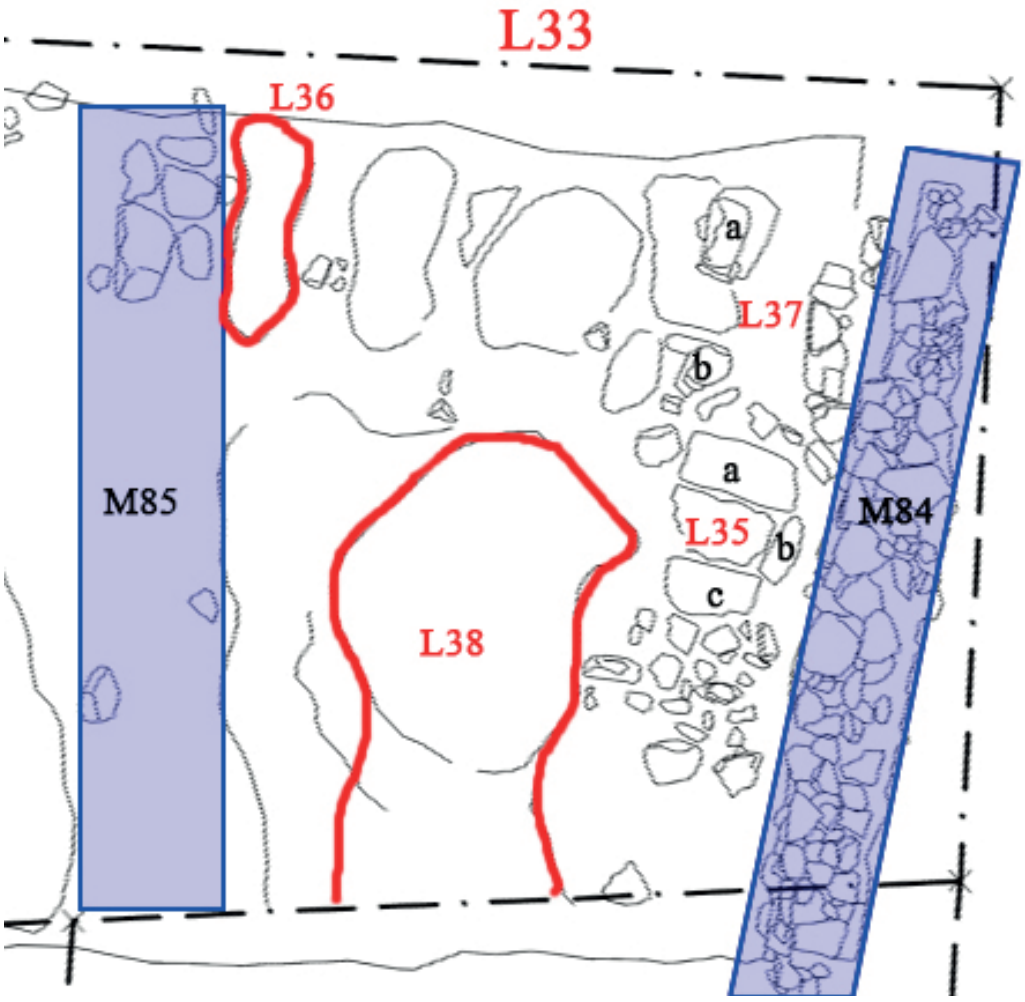


Fig. 30. Detail of the Trench 5 map. In highlight, L 33 and the elements within it (L35 - L36 - L37 and L38)

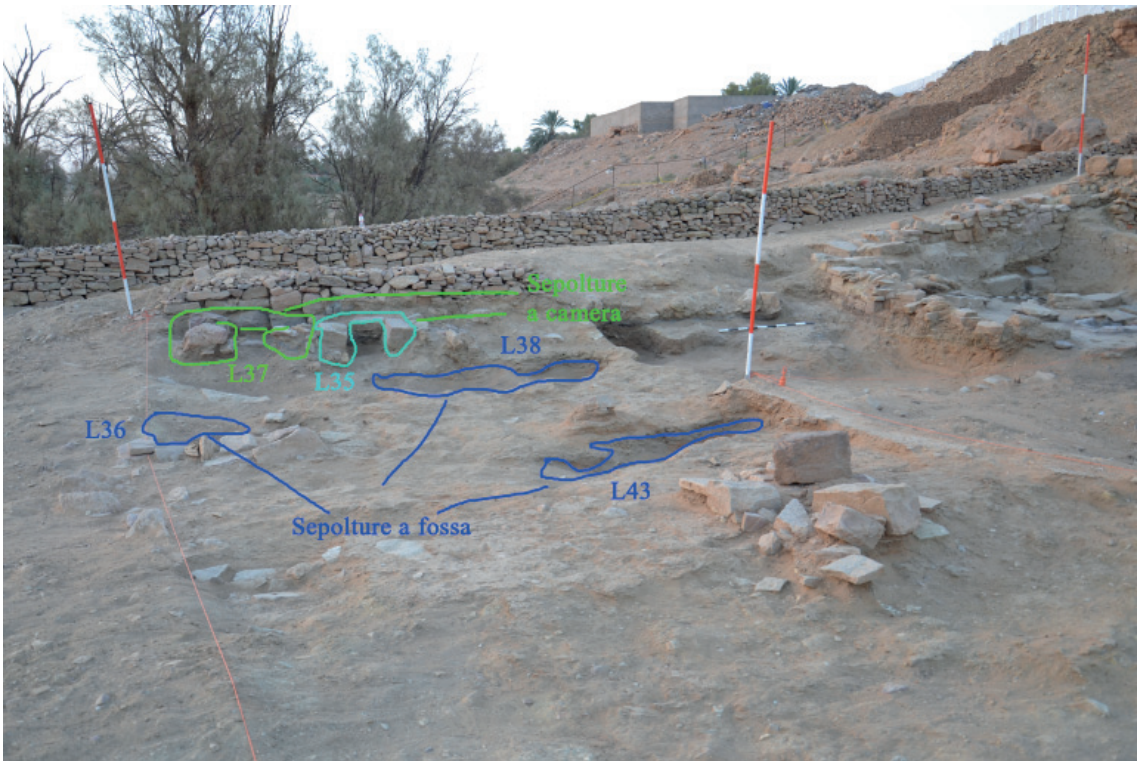


Fig. 31. Detail of the burial type present in Trench 5. View from the west

Stratigraphy

After removing Level 1, a surface level that shows aeolian deposit mixed with stones of various sizes, Level 4 - a plane surface of compact earth, that constitutes the living area and the burial site that covers the rock. (**Fig. 32**). Unlike Trench 4, neither a mudbrick wall was found, nor a level which contained one (or traces of it), as was the case in Level 2 in Trench 4 (finally, Level 3 is relative to Tomb 1 in Trench 4). Therefore, it can be assumed that in Trench 5 there were no walls and structures in mudbricks or that, having been previously excavated, they were completely destroyed by underground excavations that left no trace. Level 4, on the other hand, is found in the previous trench (Trench 4, **Fig. 22**) also in the L 40 environment of Trench 6 (**Fig. 33**).

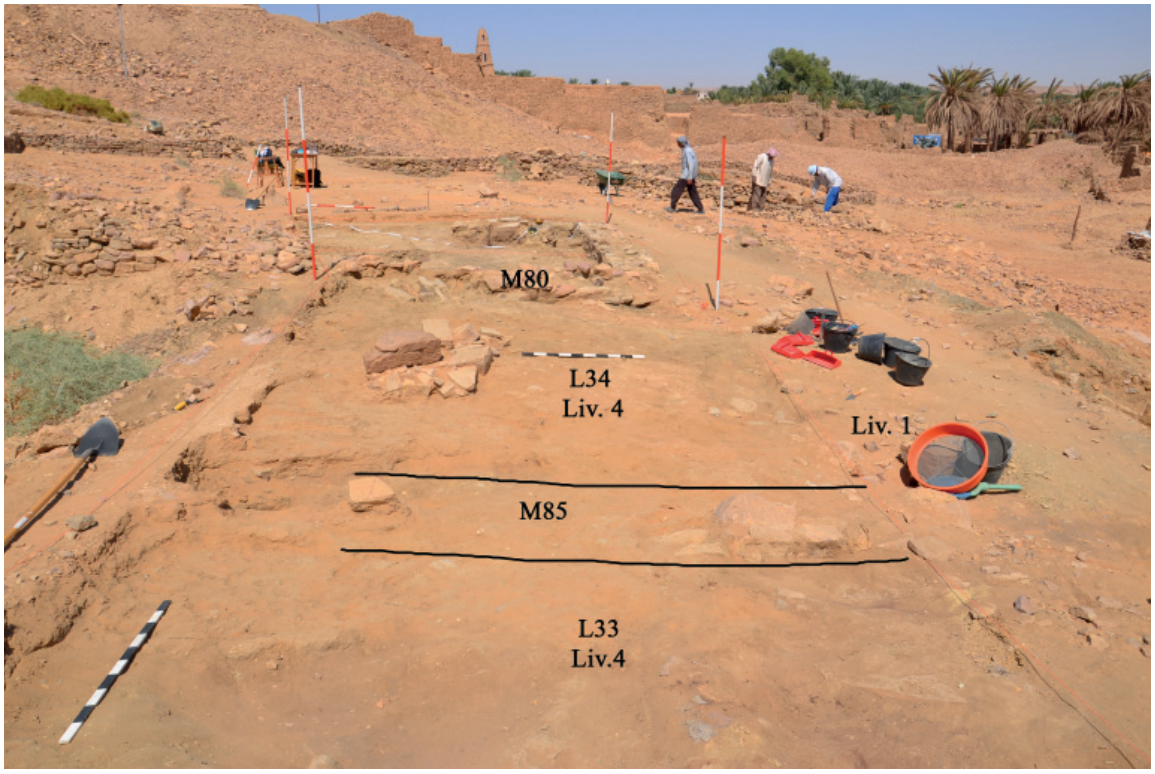


Fig. 32. Overview of Trench 5 during the excavation. The two Levels 1 and 4 are highlighted. View from the east

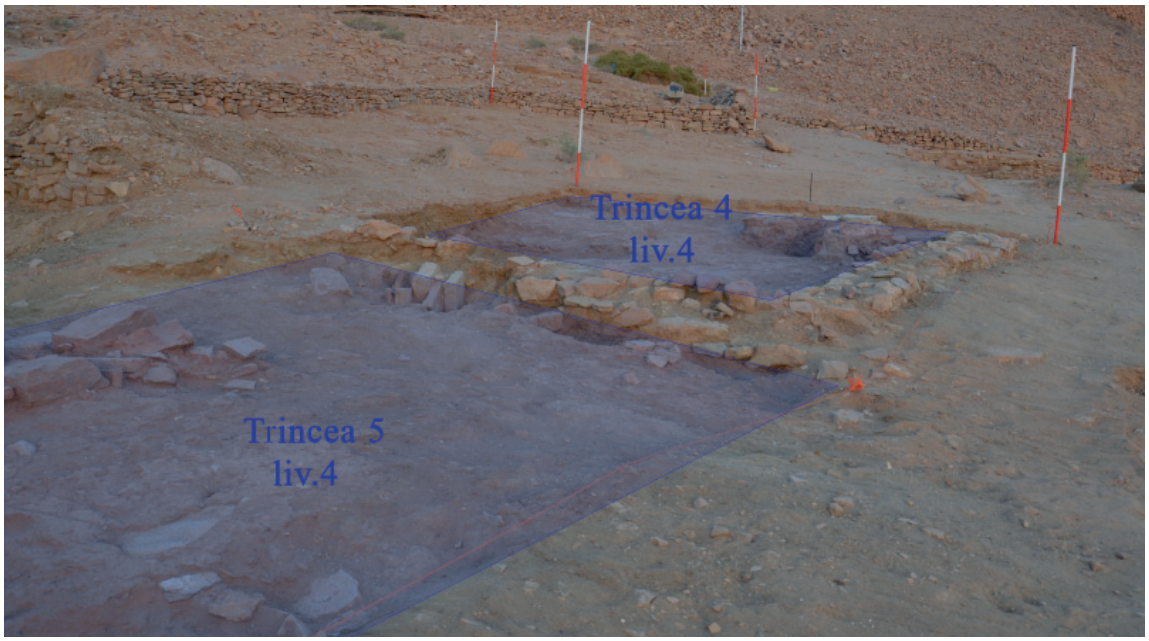


Fig. 33. Detail of Trench 4 and the environment L 40 in Trench 6. In highlight, Level 4. View from the west

Wall structures

Trench 5 has five masonry structures, three of which are well-defined (M 80, M 85 and M 84), two unclear elements, herringbone blocks and blocks with an east-west orientation (**Fig. 34**).

M80 (2.88 x 0.60 m) rests on Level 4 and runs from north to south along the western boundary of the trench. It consists of a double curtain with two rows of blocks of stones combined with a mortar and compact earth (**Fig. 35**).

M84, also placed on Level 4, east of Trench 5 (3.20 x 0.55 m), appears to have a slightly irregular north to south orientation (**Fig. 36**). Even in this case, it is possible to note that the wall has a structure consisting of two rows of blocks.

M85 (2.70 x 0.50 m) is placed at approximately three-quarters of the entire section, and it is only preserved at the north and south end (**Fig. 37**). It has a north to south orientation and divides the trench into two large environments, called L 34 and L 33 (**Fig. 32**). It also stands on Level 4 and has a structure consisting of two rows of blocks.

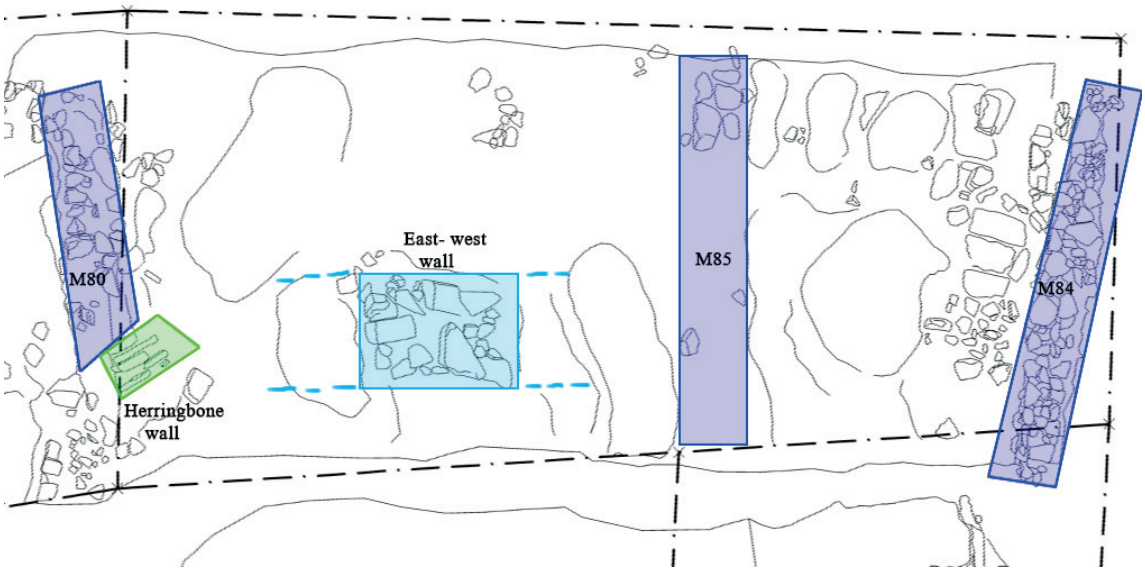


Fig. 34. Detail of thplan of Trench 5. In highlight, the orthogonal walls with north to south orientation (M 80, M 85 e M 84); herringbone wall and with an east-west orientation

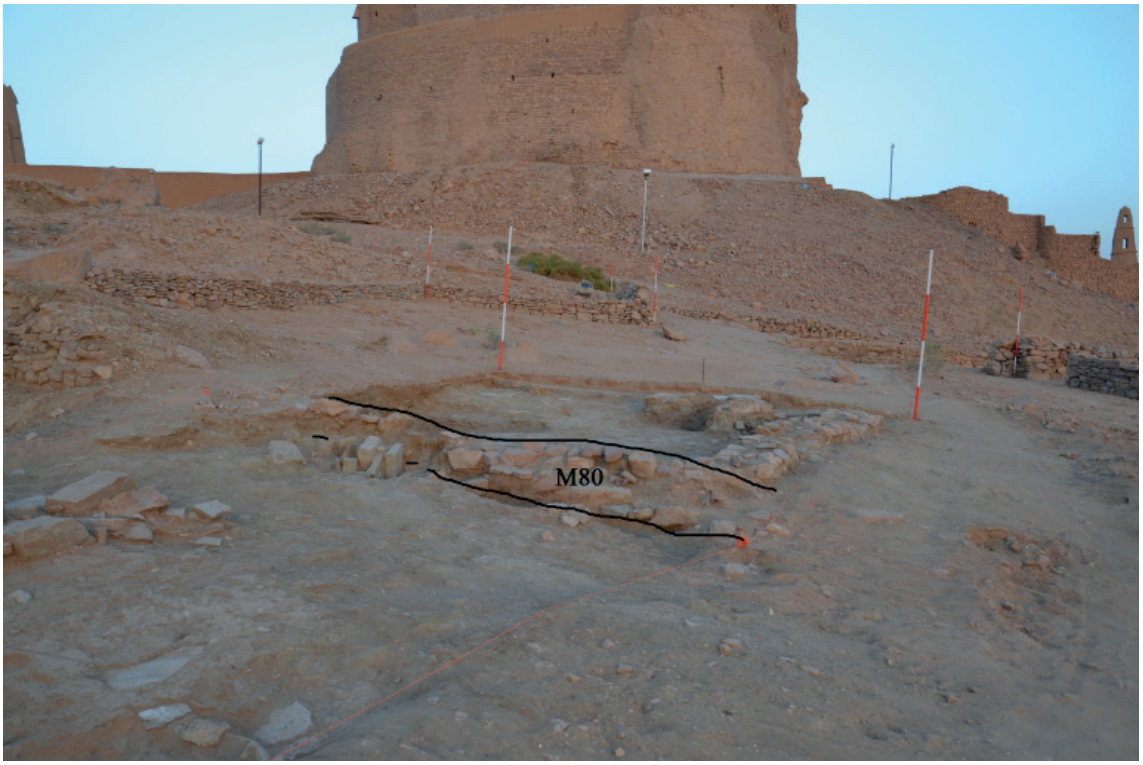


Fig. 35 Overview of Trenches 4 and 5. In highlight, M 80. View from the north-east



Fig. 36. Detail of M 84. View from the north

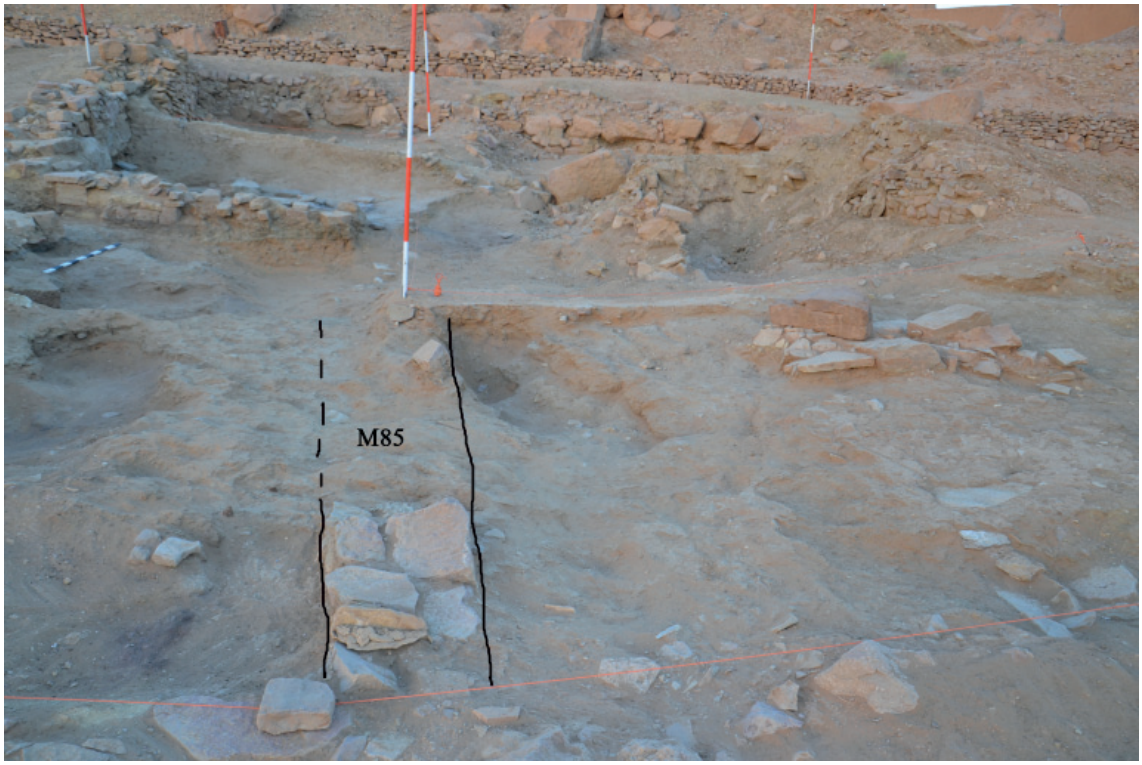


Fig. 37. Detail of M 85. View from the north

The first of the two not well-identified wall structures is a set of stone slabs (0.43 x 0.51 m) placed sideways by the south-western limit of M 80. It represents a herringbone wall, with a slightly irregular east-west orientation (**Figs 34, 38**). The fact that it lies on M80 and cuts it suggests that it is more recent than the latter. The second wall structure is also in L 34 and measures 1.30 x 0.80 m (**Figs. 34, 38**). It seems to have an east-west orientation, different from the other walls. It may be assumed that it constituted a further orthogonal wall parallel to M 81.

Environments

With regard to the environments, two main ones were identified and are both divided by M 85: L 34 to the west and L 33 to the east (**Fig. 27**). L 34, which measures 4.85 x 3.80 m, represents the largest environment and is located between M 80 and M 85. Inside, there is a burial pit named L 43 (**Fig. 38**).



Fig. 38. Detail of L 34. Ortho-restitution of the partition walls and the burial pit L 43

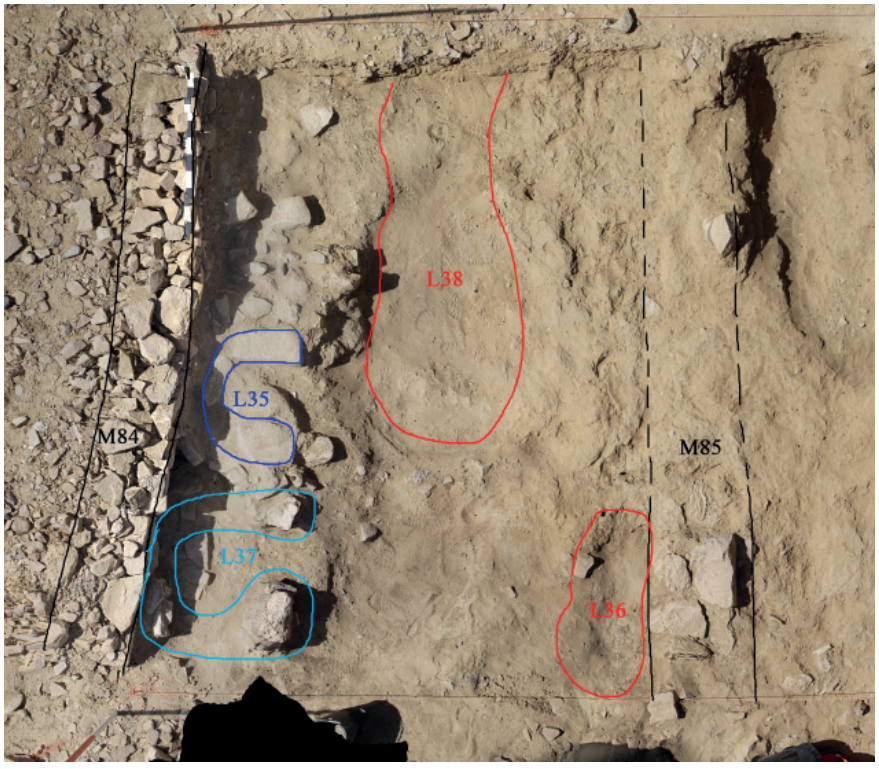


Fig. 39. Detail of L33. Ortho-restitution of the burials during the excavation phase

L33

L33 (3.30 x 3.80m) is located in the east section of Trench 5 and between M 85 and M 84. It shows a very interesting situation characterized by several burials that allowed us to define a basic typology. As mentioned, there are burial pits (L 36 and L 38) and burial chambers (L 35 and L 37) (**Figs 24, 39**).

Tomb 1

Tomb 1, in L37, measures 0.95 x 1 x 0.80m (burial chamber 0.90 x 0.32m). It leans on M 84 and is excavated in Level 4. It is characterized by irregular blocks of variable dimensions that delimit the north and south sides; the east side lines up with M 84. Other blocks of various sizes, compacted to the Level 4, pave the deposition. Along the inner walls of the room, there are visible traces of burns (**Figs. 31, 40**), which reflect the amount of ashes removed during the excavation. No bones or objects were found: the bad preservation state of the walls also shows how the burial has been violated/reused.

Tomb 2

Tomb 2, L 35, measures 0.50 x 0.30 x 0.40 m (burial chamber 0.45 x 0.25 m). It is characterized by three large blocks of stones that delimit the perimeter (**Figs. 31, 39, 41**). Like L 37, it leans on M 84 and is placed on Level 4, which constitutes the bottom.

Burial pit 1

The first burial pit, L43, measures 2 x 0.65m and is located in L34, close to M85. The fairly regular shape suggests that it is an artificial pit, dug in Level 4 (**Fig. 38**). No archaeological material was found inside.

Burial pit 2

L 36 (0.95 x 0.27m) represents the second burial pit. It is close to M 85 in the L 33 environment and is also excavated in Level 4. Even in this case, the shape is fairly regular and contains ashes (**Fig. 39**). No material was found inside.

Burial pit 3

The third burial pit, named L 38, measures 2.28 x 1.37m. It is located in L 33 and as the previous pits, was excavated in Level 4. It has a fairly smooth elliptical shape and included ashes with visible burn traces on some bones found in it (**Fig. 39**).

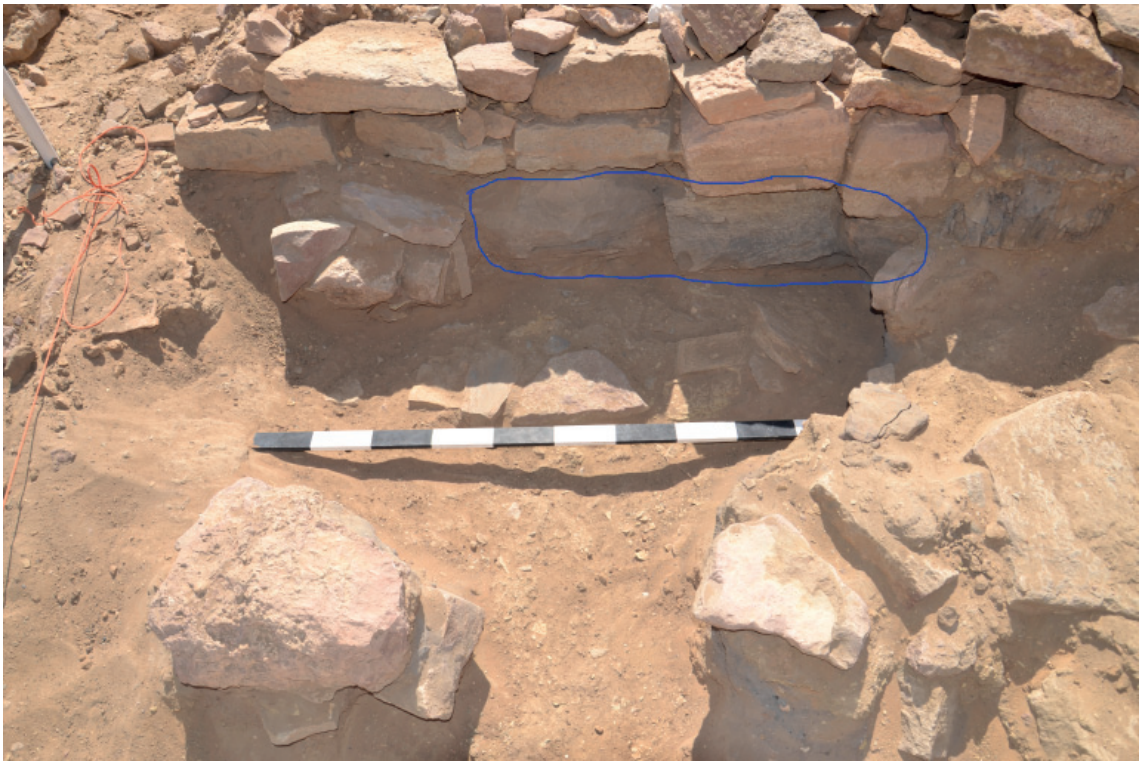


Fig. 40. Detail of burn traces in L37. View from the west.



Fig. 41. Detail of L35 after the excavation. View from the west

Trenches 4 and 5, chronological phases and structural relationship

At this point of the analysis, based on what has been seen in Trenches 4 and 5, a preliminary chronological order can be established: the oldest stage is the implementation of Level 4 on the rocky layer; later, the orthogonal walls M 80, M 81, M 83, M 84, M 85 are constructed; what follows is the construction of the tombs at L 32, L 35 and L 37; successive or contemporary to the burial chambers are the tombs L 36, L 38 and 43; finally, random burials (space between M 80 and M 82 and corner between M 80 and M 81 in Trench 4), on which M 83 collapses (Level 2) and the final aeolian deposits are set.

Trench 6 (V. Regine)

The trench at the beginning of the excavation

The decision to dig a fourth trench (Trench 6) south of Trench 5, was made with the aim of investigating an area of the terrace apparently not excavated by al-Dayel or plundered by illegal excavations (L 45, L 46 and L 47 respectively south, south-west and west of Trench 6 are already excavated). Moreover, we wanted to create a homogeneous and usable surface of the terrace between the containment walls M 77, north, M 76, to the east, and M 84 to the south (**Figs. 42–44**). The area was delimited from the south-eastern limit of Trench 5, for a total area of 3 x 7.30 m. Also, M84 is the east boundary of the excavation area and the orthogonal wall complex. M 94 represents the southern limit of the area built on the terrace, while there are no visible structures east of M 84 and M 76.



Fig. 42. General map of the excavation area (Sector A). In yellow: Trench 6 (L45, 46, 47, al-Dayel excavation)

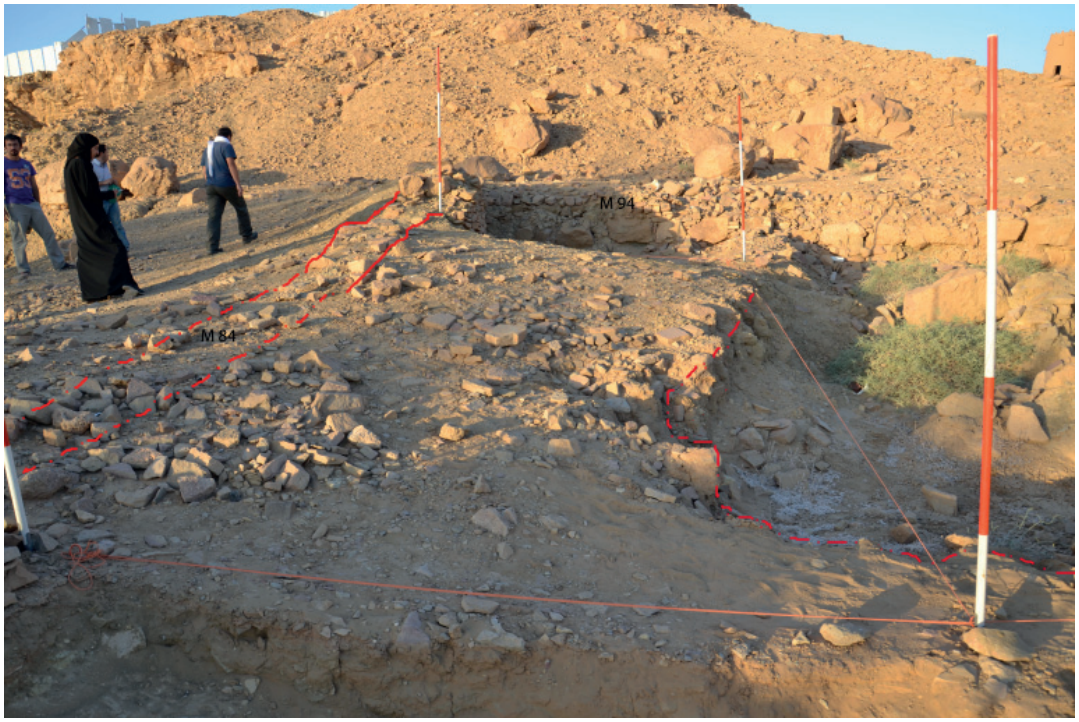


Fig. 43. Overview of the excavation area with Trenches 4, 5, 6 (Sect. A) from south/south-east



Fig. 44. Detail of Trench 6, from south/south-east. Visible surface level (Level 1) largely made up of grey earth and stones. The eastern limit of the trench is defined by M 84, the western limit appears damaged by the excavations of al-Dayel conducted in the adjacent L 47

Defining spaces

A few inches deep emerged the ridge of a brick wall (M 86) that crosses M 84, delimiting the southern perimeter of the trench for a length of approx. 4 m. M 86 rests on rows of small irregular blocks visible by the base of the outer surface and partly by the inner surface, completely covered with țin (**Figs. 45–47**). Simultaneously with the Level 1 removal, it was decided to even the section along the west perimeter of the trench, damaged by atmospheric phenomena following the al-Dayel excavations, exposing a portion of the floor at a depth of 0.70 m made of compact earth covered in țin (Level 4, also visible in Trench 3–5, **fig. 46**). As in the case of M 86, this circumstance immediately led us to the assumption that there is a relationship between these two elements. Besides, it was found that M 86 and Level 4 continue for a short stretch in the adjacent L 47, outside the east trench boundary, where al-Dayel excavations damage them. During the removal of Level 1, near the middle of the Trench 6, a block wall (M87) emerged, parallel to M 86 and perpendicular to M 84, the detection of which allowed two distinct environments to be defined in the same Trench: L 39 and L 40 respectively south and north of M 87. Level 1 covers both environments, however, after the complete removal of the level in question, different levels have emerged in their respective environments: Level 2 in L 39, consisting largely in mudbricks and stones (**Fig. 47**) and Level 7 in L 40, a deposit of aeolian sand (**Fig. 56**).



Fig. 45. M 86 exterior surface from the south. The mudbrick rise rests on a row of irregular blocks.

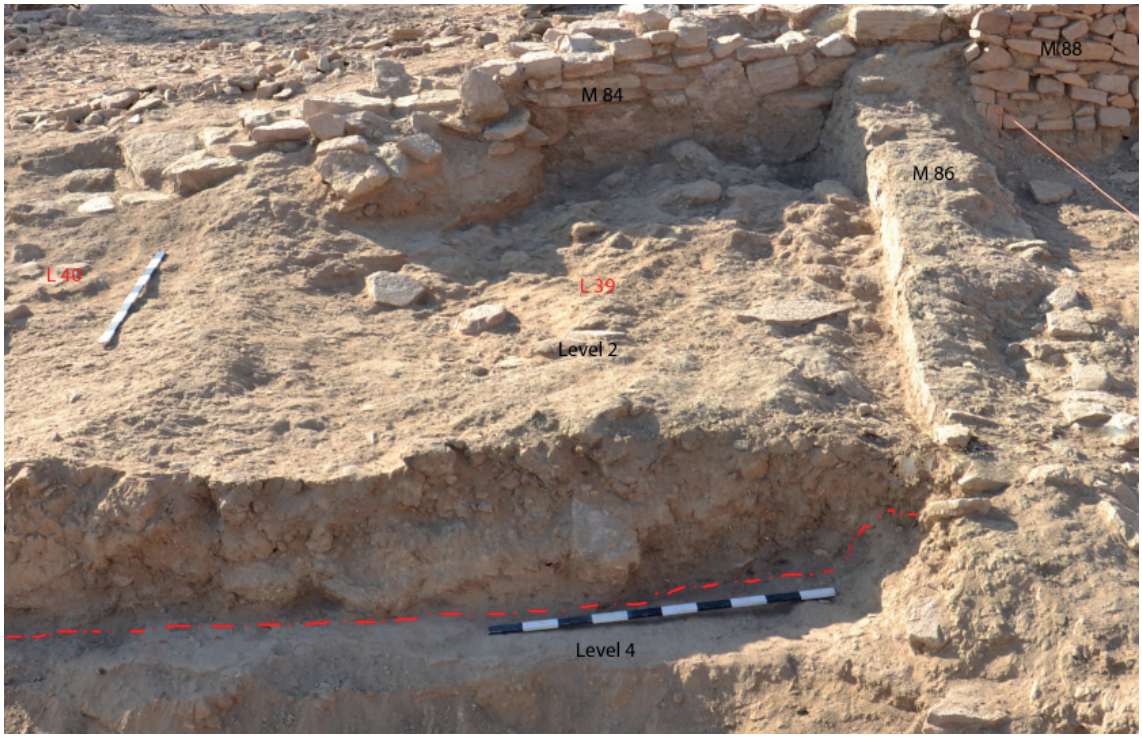


Fig. 46. The north-south section along the perimeter of the east of Trench 6. Level 2, largely characterized by bricks and stones, covers L 39 entirely. Level 4, which is visible only in a small portion, is the plastered floor of L 39

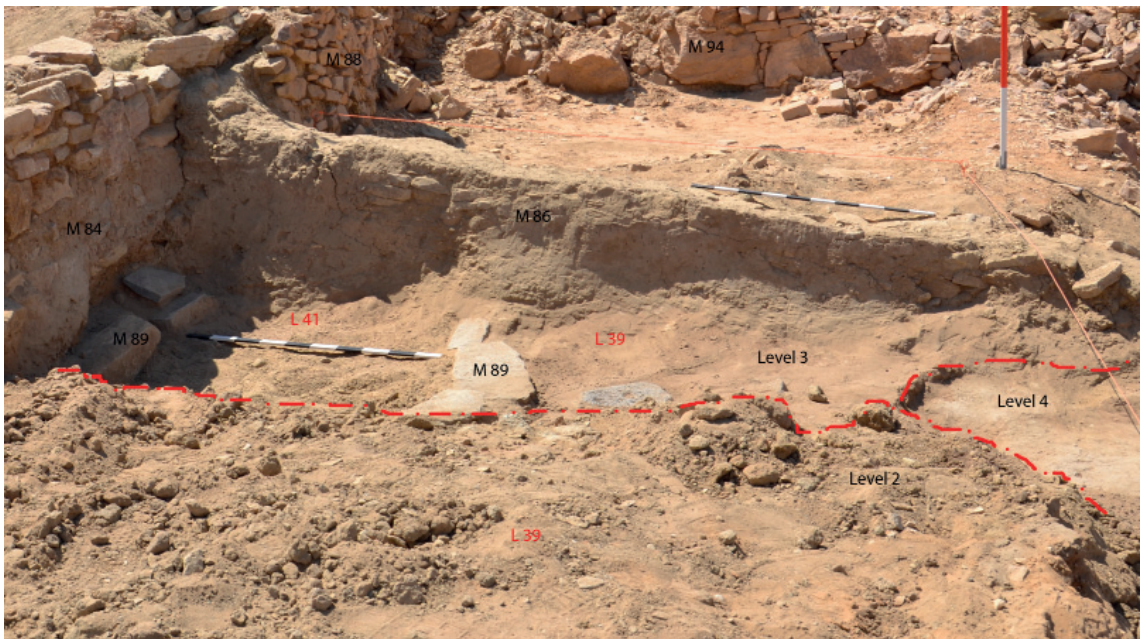


Fig. 47. The inner surface of M 86 from north/north-west: the tin plaster is in good condition throughout the surface. Partially covered by Level 3 and embedded in Level 4 is L 41, brought to light near the south/south-east corner

L 39

The M 84, M 86 and M87 ensemble forms an irregular square plant of 3 x 4 m (L 39). In addition, part of a wall to the west, perpendicular to M 87 that preserved only two regular stones (M 92), seems to have completely or partially delimited the western perimeter of L 39 (**Fig. 48**). With the complete removal of Level 2, Level 3 emerged, a thin layer of sandy earth, probably abandoned, that covers the plastered floor of L 39 (Lev. 4, Figs. 48–49) entirely.

Some crude bricks that are laid out regularly to the bricks of the collapsing layer (Level 2) appear to have formed rectangular support or a stall (M 91) near the north-east corner of L 39 (**Fig. 49**). The south-eastern corner is occupied by L 41, a circular space bound to the east and west by two rows of arched stones (M 89) and embedded in Level 4: the east limit of L 41 leans on M 84 (**Fig. 51**). Incorporated in Level 4 and partially covered by Level 3, a millstone located between M 86 and M 89 emerges. At a brief distance from the latter, along the western boundary of L 39, we found a circular hearth (L 42) delimited by irregular stones (M 90) whose combustion traces have already been identified during the exposure of Level 3.

Both the millstone and the hearth seem to be used in food processing activities (**Fig 51**).



Fig. 48. L 39 after level 2 removal and Level 3 (sandy layer). The environment is marked by M 86, M 84 and M 87 with which M 92 crosses in the north/north-west corner. The west boundary of L 39 is defined by a portion of Level 4, the lined tin plastered floor. Between M 89 and M 86 lies a millstone encased in Level 4 and partially covered by Level 3.



Fig. 49. Detail of M 91 from south/south-west placed by the corner of M 84 and M 87



Fig. 50. L 42 from the west after Level 3 removal; Level 6 is the ash layer in the hearth. The millstone is encased in Level 4 and is located a short distance from L 42



Fig. 51. Overview of L 39 after the removal of Level 3 and clearing of Level 4. L 41 is filled by Level 5, not yet excavated

L 41 and L 44

With the complete removal of Level 3 in L 41 (**Fig. 51**), a collapse level of mudbricks and stone fragments mixed with grey sand (Level 5) was exposed. This level fills the locus completely and is placed on a sand level (Level 8) that covers the bottom of the pit (**Figs. 52–53**).

During the removal of Level 5, it was possible to verify that the ţin coating of Level 4 partially covers the north, east and west walls of L 41; in comparison, the southern wall is covered by stone blocks (M 93) placed uniformly to form the rise of a cyst structure (L 44). This is entirely visible only after removing Level 8 on the bottom of L 41 (**Fig 53**). The structure (Level 9) plan is delimited to the east and the west by two low parallel stone segments (0.55 and 0.31 m respectively), which lean against M 93. The structure was obtained by lining the rocky wall of L 41 with stones at a point, where the plaster is badly preserved or completely absent (**Fig. 54**). On the compact earth plan of L 44 (Level 9), some stone slabs in the state of collapse were found and could allegedly have been part of the structure cover or the stone rise. Following a thorough cleaning of Level 4, three postholes lined with stones and disposed at a 90° angle around L 41 were found. They could represent a possible trace of a hypothetic cover made of perishable material. Such an assumption would be confirmed by the presence of a small rusty bronze nail and small wood splinters found in the postholes (BP 1–3) (**Fig. 54**).

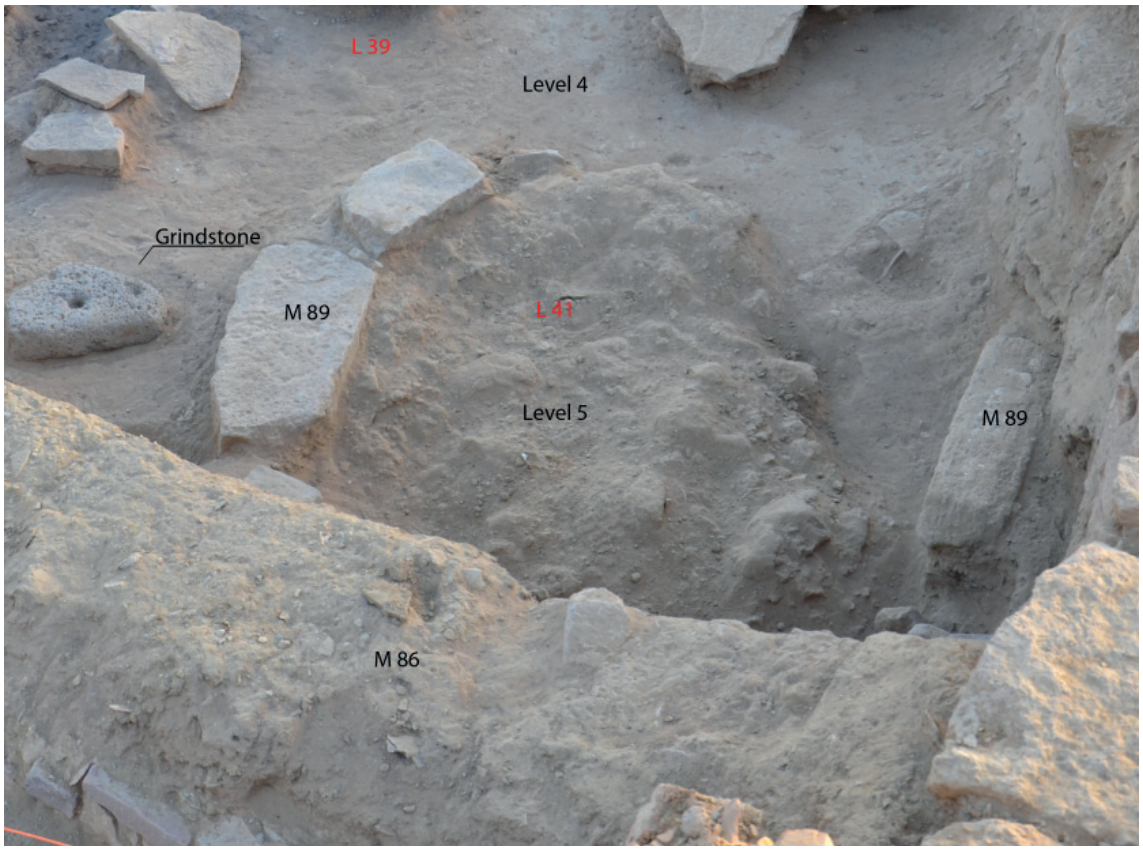


Fig. 52. Detail of L 41 from the south/south-west



Fig. 53. Detail of L 41 after the removal of Level 5. The L 41 walls are obtained by digging on the rock and are partly covered by the plaster of Level 4. At the bottom of the locus, Level 8 is visible, which in turn fills L 44



Fig. 54. Overview of L 44 after the removal of Level 8. Visible around L 4, are three postholes lined with stone

L 40

L 40 consists of a square (4 x 3 m) located between L 33 (Trench 5) to the north and L 39 to the south. Along the outer perimeter, the environment is delimited by M 84, partially preserved (**Fig. 55**).

With the removal of the surface level (Level 1) a layer of aeolian sand (Level 7) and a portion of a rammed earth floor that continues to L33 were brought to light (Level 4, Trench 5).

Level 4 appears compromised by the excavations of Al-Dayel along the north/north-west limit of the floor, right at the point where two semi-circular pits were dug. Presumably, the rammed earth level covered the entire square of L 40 and continued up to the environment to the west that had already been excavated.

At the base of M 84, it is possible to observe an aggregation of stones, with an apparently uniform disposition, that covers a thin burnt layer deposited all over Level 4 (**Fig 56**).



Fig. 55. Overview of L 40 from the west: the east limit of the environment is defined by M 84, partially preserved. At the base of M 84 a portion of Level 4 is preserved, the raw earth floor of L 33. In the entire environment, an aeolian sand deposit is visible (Level 7)



Fig. 56. Detail of L 40 from north/north-west. Highlighted are the two semi-circular holes dug at the base of the ballast of M 84. Along the southern section of the environment, at the base of M 87, the thickness of the two removed levels is visible: the surface level (Level 1) and the aeolian sand deposit (Level 7) that partially covered Level 4. Between Level 4 and the ballast of M 84, a thin burnt layer appears (Level ?)

Space function

L 39, 41–44

In light of this survey, L 39 would be an environment for food preparation and cooking: the presence of a hearth, a millstone, and a hypothetical support plan in a completely plastered and water proof țin environment would justify such assumption (**Fig. 39**).

L 41 and L 44 designate respectively the circular space delimited by M 89 and the cyst structure found within (**Fig. 57**).

L 44 represents a unicum, by shape and size, of all the structures currently identified and excavated in sector A. At first glance, L 44 was interpreted vlos for storing dates, as a date seed was recovered during the removal of Level 8 - the sandy layer of soil found at the bottom of the locus; it is also assumed that the țin plaster that forms part of L 41 would have favored the preservation while keeping the locus dry.

However, with the continuation of the investigation, it has become clear that L 44 is more likely to be interpreted as a cyst tomb, since Level 8 yielded some human bones, and a crescent moon shaped chopper, as a hypothetical object of the grave kit. From a stratigraphic standpoint,

L 39, L 41 and L 44 would appear to be contemporary: the țin plaster that covers the walls and the floor of L 39 (M 86–84–87 and Level 4) also looks partially preserved along the walls of L 41 - a circumstance that would attest the contemporaneity of the various elements. Therefore, we assume that L 44 was the tomb of an individual (age, sex?) dug directly in the L39 environment, in the corner between M 84 and M 86, with a south-east/north-west orientation. From a formal point of view, the tomb seems to be a simple construction that leaves no hints about the prestige of the status of the deceased: the recovered materials are limited to a thoroughly polished chopper, a fragmentary date seed and some interwoven plant fibres.

We must also not forget the presence of three postholes disposed at 90° around L 41 and dug directly into Level 4. For those, we assume the existence of a protective and/or covering structure over the entire locus.

L 40

Given the compromised conditions of L 40, it is hard to provide a specific interpretation of the environment like in the case of L 39; it is, however, likely to be related to L 33 (Trench 5) as both are characterized by the same flattened ground (Level 4) and are delimited by M 84 along the eastern limit (**Fig. 58**).



Fig. 57. Overview of L 39: the hearth (L 42), the millstone and the mudbrick stall (M 91) clarify the function of a food preparation and consumption environment. The south-east corner is occupied by L 41 + L 44, the structure interpreted as a cyst tomb



Fig. 58. Overview of L 39 and L 40 from the west

Trench 7: excavation inside the Mârid Castle (R. Loreto)

Introduction

A first excavation trench (Trench 7) has been opened inside the Mârid Castle (**Figs. 2, 4**). This was the first excavation probe that took place inside the castle after the restoration of the building. Two main objectives were defined:

1) to test the availability of stratigraphy inside the building, what could have been the ancient acropolis of Adummatu, in light of future soundings;

2) to continue with the archaeological study of the acropolis after the very first excavation probe inside the building, conducted by Kh. al-Mu'ayqil in the southern part of the castle courtyard before the restoration of this prestigious building.

Al-Mu'ayqil's excavation

Al-Mu'ayqil's excavation inside the castle took place in 1986, before the restoration works (**Figs. 59–62**). A small test probe measuring 3 x 2 m was carried out in the southern room of the courtyard, north-east of the southern entrance to the open court. According to al-Mu'ayqil, the excavation went down for 3.50 m, without having reached the bedrock (however, in the plan of the probe a bedrock layer is mentioned). The excavation revealed a series of mud floors, a level of collapse and aeolian levels of abandonment; two major features arose: the first one is the identification of a floor decorated by a red and white tessera mosaic; the second one is the collection of Nabataean sherds in the levels beneath the mosaic floor (**Fig. 59**).

According to the historical sources, al-Mu'ayqil identified the mosaic floor as part of the Ukhaydir ibn 'Abd al-Malîk historical phase. Considering that during the sixth cent. AD, mosaic artisans from Byzantium reached Yemen for the construction of the Abraha church in Ṣan'â', it is correct to assume the diffusion of this kind of decoration in northern Arabia.

The presence of Nabataean sherds suggests that the acropolis was already in use during the Nabataean time. However, we do not know what kind of settlements or buildings were on top of it.

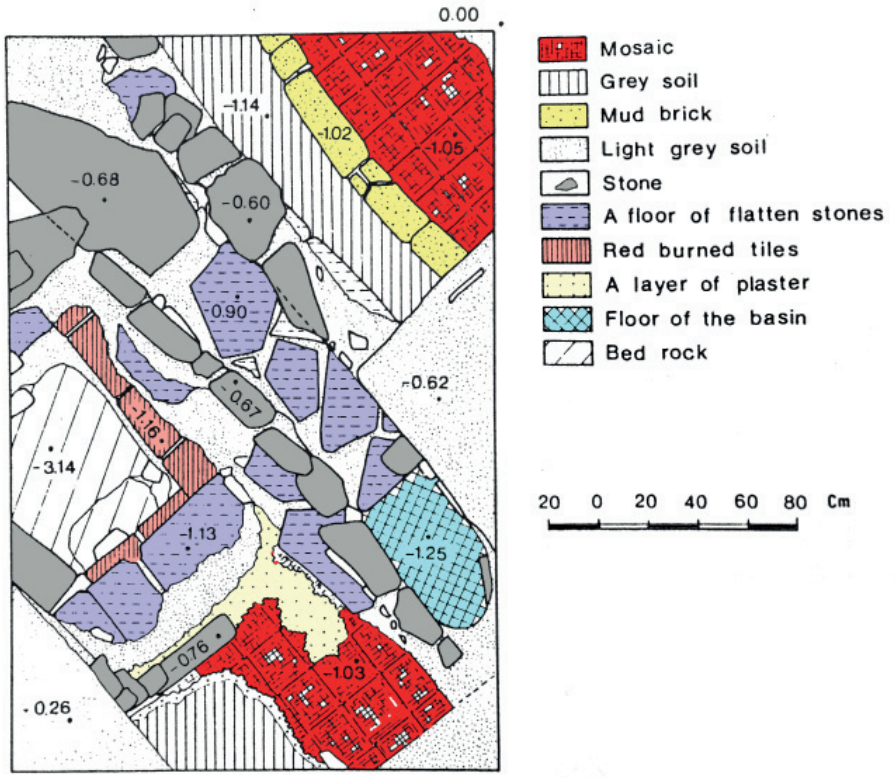


Fig. 59. Plan of al-Mu'ayqil's excavation inside the castle.

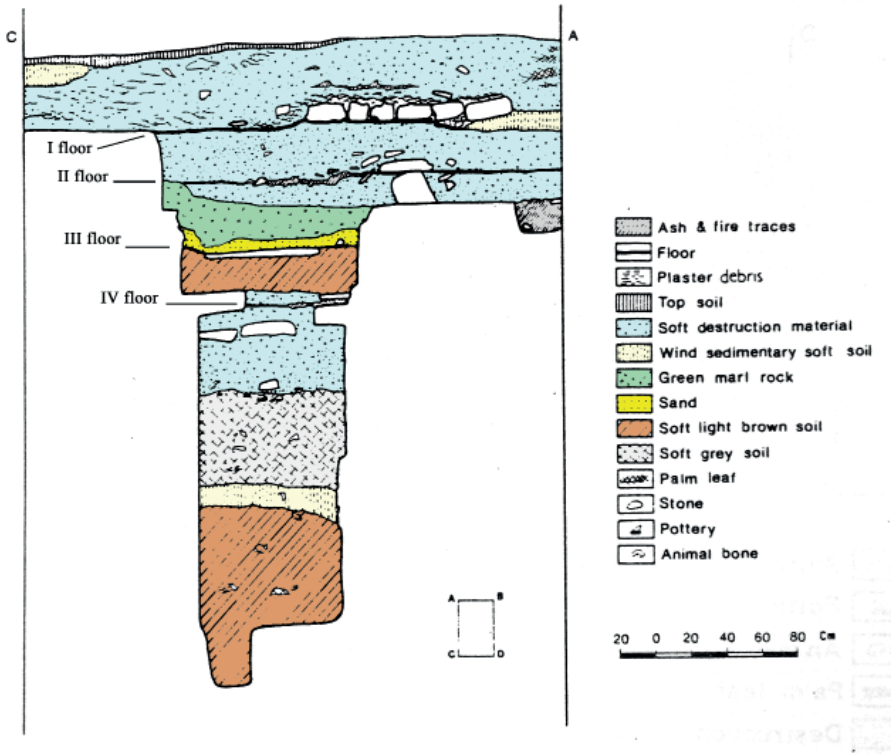


Fig 60. West section of al-Mu'ayqil's excavation inside the castle

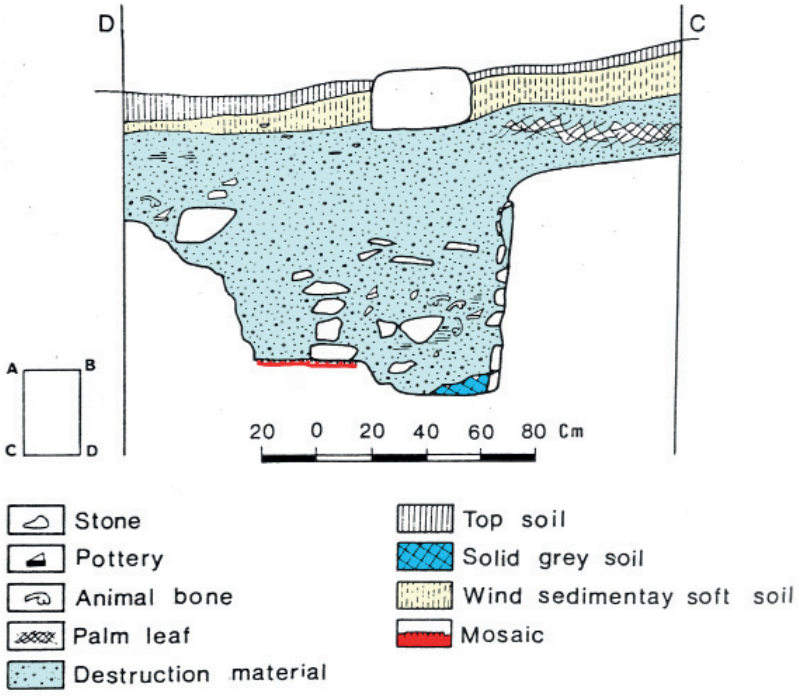


Fig. 61. North section of al-Mu'ayqil's excavation inside the castle.

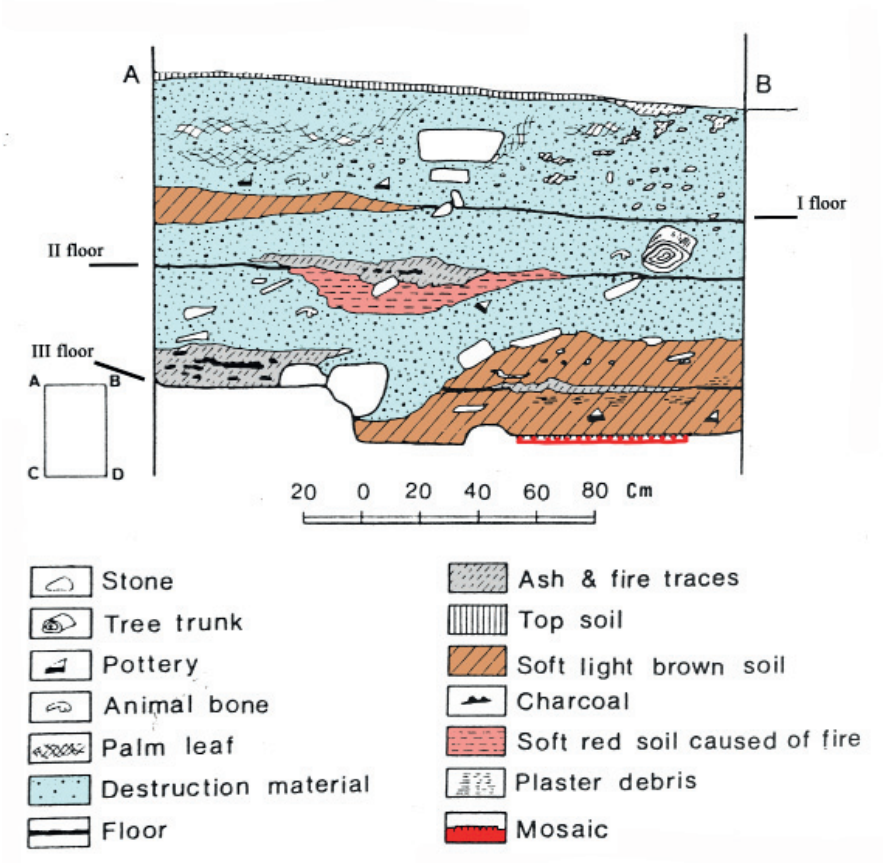


Fig. 62. South section of al-Mu'ayqil's excavation inside the castle

2014 excavation

The trench (3 x 3 m) is located in the north-eastern part of the building (**Figs. 2, 4**), south of the courtyard's north-eastern entrance (it has been completely refilled after the excavation, in order to allow the visitors to walk inside the courtyard).

According to the restoration activities that took place in the building during the last years, the first levels are related to modern human activity:

Level 1: compacted mud with modern debris (0.20 m);

Level 2: a thin concrete layer above which a few flat stones were found (all the rooms inside the castle were paved after the restoration) (0.05 m);

Level 3: an abundant layer of debris from the restoration work (0.50 m ca.);

Archaeological levels start from Level 4 (**Fig. 63**)

Level 4: a layer of brown soil mixed with small stone fragments (ca. 0.70 m);

Level 5: a huge collapse layer made of the same blocks of the ancient Byzantine walls still preserved and related to the last pre-Islamic phase (ca. 0.80 m) (**Fig. 64**). The pottery collected stretches from the Nabataean to the Early Islamic period;

Level 6: a second destruction level made of abundant charcoal. No pottery was found (**Fig. 65**).



Fig. 63. Test probe stratigraphy up to Level 5



Fig. 64. Mârid castle's pre-Islamic structures

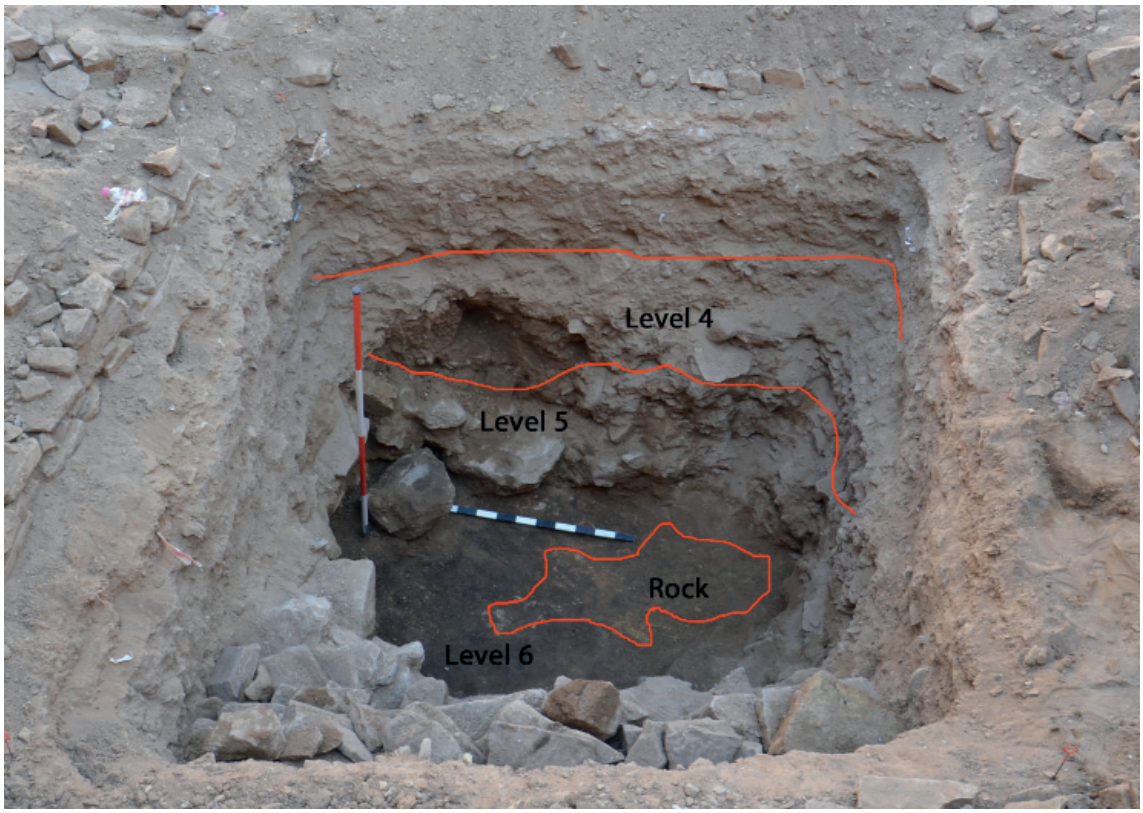


Fig. 65. Test probe complete stratigraphy

Most of the materials came from Level 4 and Level 5, the first archaeological levels after the restoration activities, as documented by Levels 1–3. The only material that can be dated are sherds. Various diagnostic fragments must be underlined among the pottery found in the archaeological strata (Levels 4–6, mostly cooking pots and storage jars). All of them can be placed between the 1st cent. AD – 7th cent. AD: Nabataean bowls (1st – 4th cent. AD) (**Fig. 66**); Sassanian ware (1st – 3rd cent. AD) (**Fig. 67**); Terra Sigillata Africana (1st – 7th cent. AD) (**Fig. 68**). To be verified with future soundings, an interesting piece of data is that no middle or late Islamic ware was collected.



Fig.66. Nabataean bowls (1st – 4th cent. AD)

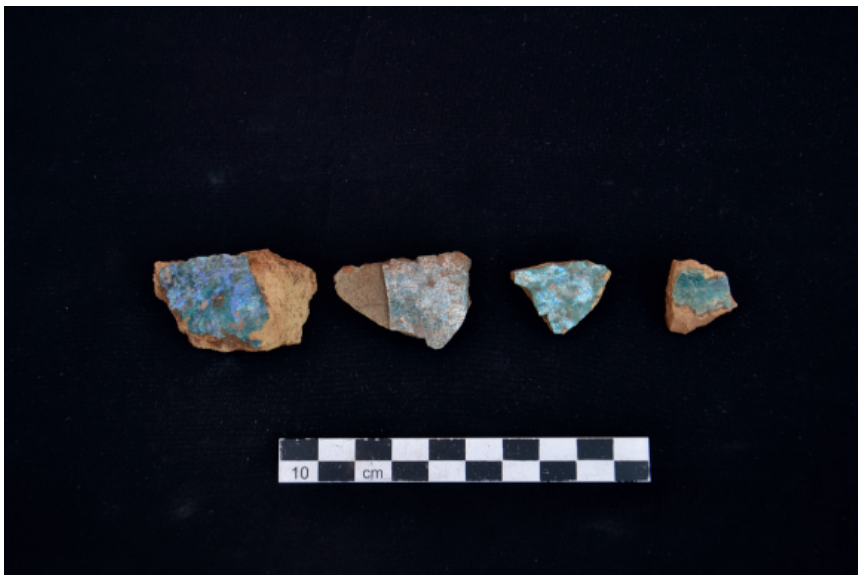


Fig. 67. Sassanian ware (1st – 3rd cent. AD)

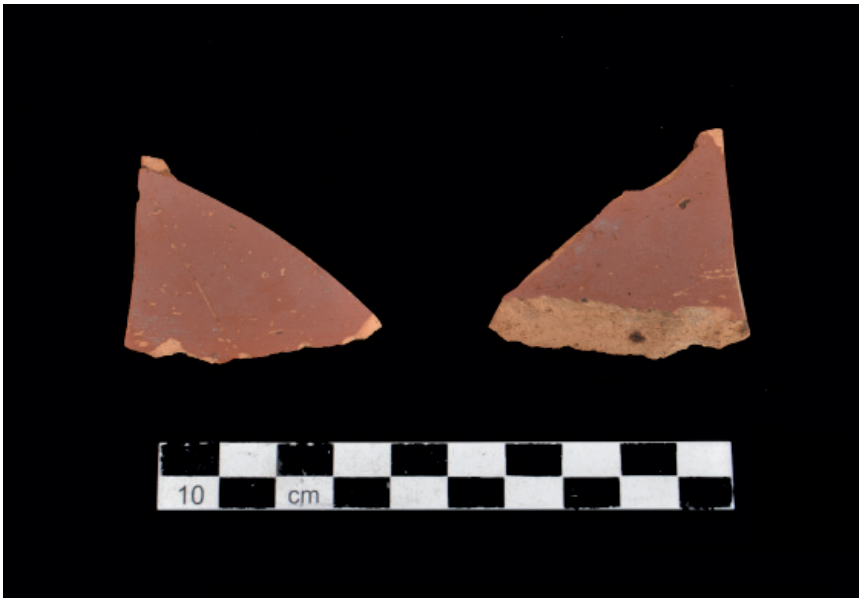


Fig. 68. Terra Sigillata Africana (1st – 7th cent. AD)

The obtained results raise different issues related to the possibility of future excavations inside the building, in order to amend our knowledge of the pre-Nabataean Dûmat al-Jandal. The excavation reached the bedrock after 2.5 m. This is quite deep, and if the bedrock is uniform, could allow us to obtain more data from other excavations inside the building.

The ceramic material collected between Level 4 and the collapse (Level 5) can be dated between the Nabataean Era and the Byzantine-Early Islamic periods - a stratigraphy already seen at the foot of the Mârid Castle, inside Building A, which confirms what historical sources attest: Dûmat al-Jandal's main role in northern Arabia until the new pilgrim routes developed at the beginning of the Abbasid period.

The Western Settlement, Sector C

Guillaume Charloux, Charlène Bouchaud, Anaïs Chevalier, Marianne Cotty, Elise Devidal, Gwenaël Herviaux, al-Malki Thamer, Céline Marquaire, Romain Mensan, Hervé Monchot, Olivia Munoz, Ayidh Abdulhadi al-Qahtani & Dara'an al-Qahtani

The western fortified area in the oasis (sector C), studied since 2010, has continued to deliver its share of surprises during the 2015 campaign. Activities covered both the enclosure wall and the Burj promontory with the opening of nine new soundings (**Fig. 1**).

The first stage of a major stratigraphic and geomorphological study of the sector started under the responsibility of R. Mensan. Soundings (SD) 13 and 14, to which a geomorphological trench was added in SD17, were designed to characterize the substratum of the area and to better identify the occupation rhythms of the site. This series of excavations carried out by mechanical digger due to thick sand accumulation was supplemented by three soundings opened on the enclosure itself (SD16, SD20 and SD21) in order to better determine its sequence of construction.

Sounding 15 (C. Marquaire) showed, once again, the multiple phases of the ancient enclosure, revealing two long parallel walls (unit 1) joining the ancient enclosure (unit 8) that is clearly older.

Sounding 19 (T. al-Malki, A. al-Qahtani & D. al-Qahtani) has uncovered a vast inner staircase that permitted access the walkway of the enclosure. A door blocking was found, as it was the case of the postern in sounding 11, showing the abandonment of the enclosure.

The study of the area encompassed by the rampart was supplemented by the excavation of sounding 17 (G. Herviaux). This was placed at the location of a large concentration of pottery sherds on the surface and of emerging walls at the center of the valley. Like in previous trenches in the area (SD3, 7, 8), it has been shown that these are successive developments linked to crop areas with small water channels and depressions. A lane delimited by low walls is implanted along an axis approximatively perpendicular to the orientation of the valley.

Excavations on the promontory (SD18) by M. Cotty, O. Munoz and A. Chevalier were initially concerned with graves, due to the discovery of human bones at this site in previous seasons. Surprisingly, the installation of a large triangle-shaped structure with two interior niches destroyed the older burials, and modern plundering has, in fact, upset already disturbed developments. The examinations of archaeological features were completed by the following field studies: a study of faunal remains by H. Monchot, botanical remain by C. Bouchaud, and by the drawing of pottery (E. Devidal).

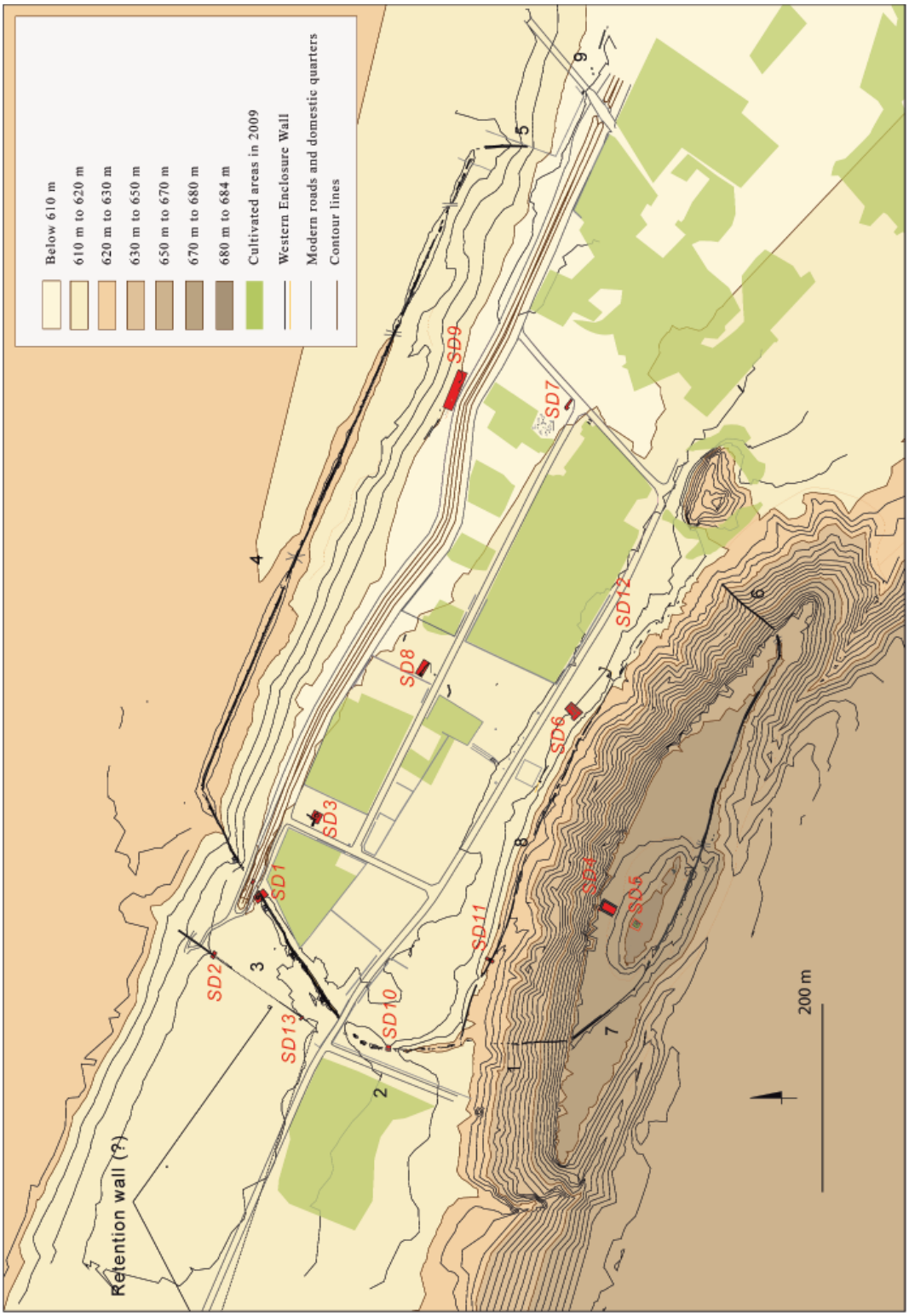


Fig. 1. Plan of the western settelement at Dûmat al-Jandal (sector C)

Soundings 13, 14, 16, 17, 20 & 21. New observations on the western enclosure

Romain Mensan [1]

Context and objectives of the soundings

In the oasis of Dûmat al-Jandal, sector C is a depression bordered to the south by a relief dominating the region (70 m from the bottom of the valley) [2] and its various strata bear witness to the local geological history (Jawf formation: *Units of purple olive-green and gray graptolitic shale alternate with massive beds of reddish brown to gray in part cross-bedded and commonly micaceous sandstone. Varicolored silty shale characterized the shale, and numerous thin beds of limestone and dolomite occur in the 1/3 upper part of the deposit. The Jawf formation is capped by a white yellowish limestone deposit finishing the relief*'.[3]

To the north, the depression is limited by a blue-grey limestone plateau markedly lower than in the south, giving the valley an asymmetrical appearance.

Sector C encompasses both archaeological remains on the top of the relief in the south and those located at the bottom of the depression. Here, a large enclosure wall has been mentioned by the relevant literature for a long time.[4] It is built at the foot of the Jawf formation in the south and north on a ledge of the limestone plateau. The dating, as well as the function of this enclosure, remain uncertain for the moment; the evidence is that this monument encloses a space where very few traces of human occupation are detectable for the moment. At present, the main remains are surface-facing structures: such as the enclosure and associated facilities, including buildings 6 [5] and 12.[6]

Considring the wide superficy to be investigated, we have decided to mechanize our intervention, in coordination with the head of the mission G. Charloux, to multiply our chances of acquiring information and be able, if needed, to conduct deeper excavation.

1. TRACES-UMR 5608.
2. Charloux et al. 2010: 147.
3. Powers, Ramirez, Redmond & Elberg 1966: 113.
4. Charloux 2012.
5. Makinson 2012: 247.
6. Cotty 2013.

Several soundings have therefore been opened:

- Soundings 16, 20 and 21 at different parts of the enclosure (units 8 and 3) with the aim to understand its construction method but also its position in the landscape.

- Soundings 14 and 17, within the space found by the enclosure, with the objective to evaluate the sedimentary and therefore archaeological potential of this area.

- Sounding 13, outside the enclosure (unit 3) and on the retention wall.

These different operations should enable us to understand the sector's archaeological potential by providing information on the site formation processes.

The operations carried out

Unit 8, soundings 16 & 21

Two soundings, SD16 and SD21, were opened at the level of the enclosure in the southern part of sector C. The main purpose of these two interventions was to understand the construction of the monument, to know what it is based on, and to observe if there are any further developments associated with it.

Sounding 16 (Fig. 1)

The sounding is located to the west of hole 6 in the southern part of sector C directly against the enclosure. Our aim was to clear its northern facing to observe its construction method and survey its base to detect built structures.

The sounding was opened using a mechanical digger; it is rather a trench of 4.50 x 2.40 m. The use of a mechanical digger seemed adequate due to the aeolian sand filling observed throughout sector C.



Fig. 1 Sounding 16. Western and front section

Because the mechanical digger was not equipped with "caterpillars" (metal-belted tracks), it was complicated to access the enclosure because of the very loose slope surface. To do this, we had to regularly survey the slope and look out for the obstacles so that the machine could progress. However, the various pits located in the axis of the sounding 16, not listed but perfectly followed, did not deliver any building remains. The clearing of the surrounding wall (Unit 8) allowed us to observe two stratigraphic sections, a frontal and a western one.

Description of the different units observed in the western section (from top to bottom):

- **M2038**: remains of a wall in grey-bluish limestone, mounted dry, part of which has slipped on the slope, it is preserved at 0.60 m.

- **M2037**: a raw mudbrick wall preserved over 14 courses; its foundation is made of grey-blue limestone bonded by an adobe mortar on the substratum. The brick type is variable; on average, they are 0.40 m long and 0.15 m thick. The structure is sliding into the slope.

- **M2036**: limestone wall [7] preserved over 1.60 m, built with very variable modules of which the largest can be 0.25 m thick and 0.25 m long. Its northern facing is very well preserved.

- **the substratum**: structure M2036 rests directly on the sector substratum consisting of multi-colored marls coming from the Jawf formation.

- **US 2196**: fill from the slope, consisting of wind-blown/demolition sand coming from the enclosure. Several materials can be observed: limestone slabs from the dismantling of M2038, and a portion of a brick wall from the dismantling of M2037. No archaeological material was observed. The layer covers the entire area.

Stratigraphic and interpretative description of the western section (from bottom to top):

A first limestone construction (M2036) was built directly on the bedrock; it is preserved at its maximum height of over 1.60 m. Attached to the north-facing of M2036 and on its base, a second raw mudbrick structure based on a limestone platform (M2037) is raised to the top of M2036 by 0.80 m. Finally, on the brick elevation, the third construction is of a grey-blue limestone, M2038. It is not aligned with the brick structure's facing, built of dry stone, marks the maximum elevation of this feature.

7. The M2038 structure is constructed with grey-blue dolomitic limestones that are observable in the upper third of the relief, while the M2036 structure is constructed in the white-yellow limestone from the upper part of the Jawf Formation.

Preliminary Overview:

The sounding 16 reveals the composite construction of the enclosure, using three different materials: yellow-white limestones, mudbrick and limestones in small blue-grey slabs. First, a limestone structure M2036 was built, then an imposing brick structure above and against M2037, and finally a small structure in dry stone on top (M2038). The enclosure at this spot delivers a polyphase construction that seems to be the result of several monument repairs.

Sounding 21 *(Fig. 2)*

Located about 230 m west of sounding 16, we took advantage of the ancient destruction of a part of the enclosure (unit 8) by a water floods to reveal a segment of the monument. This operation denuded a north-south section and again showed the composite and multi-phase nature of the enclosure.

The whole structure is 2.25 m thick in the north-south, and it is divided into three parts from north to south: the first structure of mudbrick (M2041) is attached to a second yellow-to-white limestone structure (M2042) and finally a third grey-blue limestone building (M2043) composes the south-facing of the enclosure.

- **M2041**: mudbrick wall, 1.15 m wide, preserved on 1.40 m of height. It is based on a platform, 0.5 m high in grey-blue limestone bonded by an adobe mortar, resting on a filling of aeolian sand. This foundation consists of a cladding of two layers of grey-blue limestone, attached to it is a sediment blockage bound by adobe mortar. This foundation supports a mudbrick massif constituted of bricks with orange sand inclusions. The brick type is 0.30 m long and 0.15 m thick. This construction leans against the south facing of the M2042 structure. It is built on sand containing limestone blocks from a demolition.

- **M2042**: wall in yellow to white limestone, 1.10 m wide, preserved at 2.50 m height. Its northern facing is coated with adobe mortar on which the M2041 structure is placed. The wall stands on the substratum, which is in contrast to M2041 installed directly above the sand.

- **M2043**: a structure present only on the south side made of blue-grey limestone mounted in dry stone and acting as the south facing of the enclosure.

Stratigraphic and interpretative description of the north-south section (from bottom to top):

A first yellow-white limestone structure M2042 is constructed directly on the marl substratum. Then, joined to its north facing, there is a brick structure based on a grey-blue limestone platform, M2041, installed upon sand containing demolition. A third dry-mounted grey-blue limestone structure acts as the south facing for the whole.

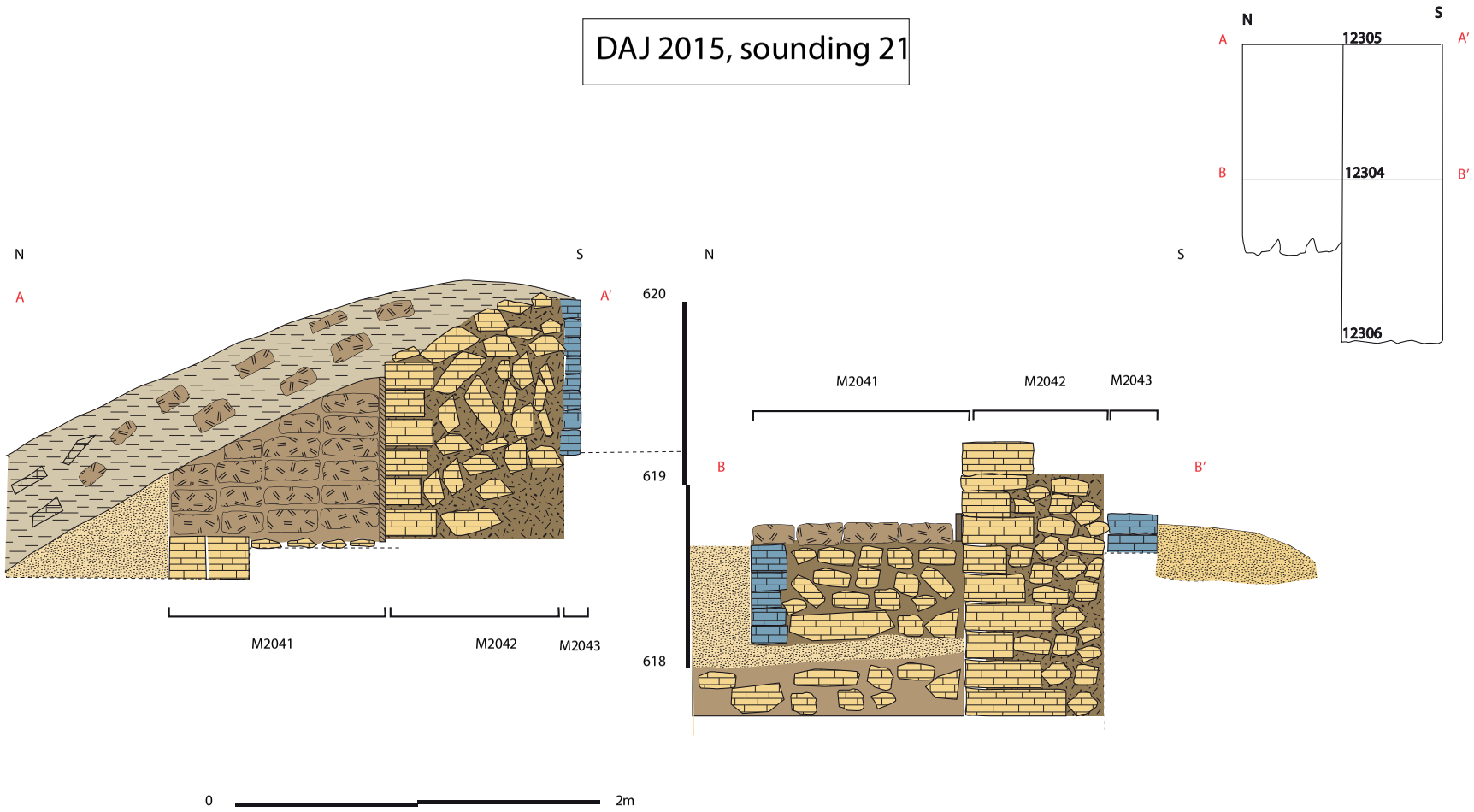


Fig. 2. Sondage 21. North-south section

Overview:

The construction system observed here is the same as in sounding 16. The enclosure has provided us with two phases; the first phase in yellow-white limestone (M2036 and M2042) coming from the upper part of the Jawf formation in soundings 16 and 21, based on the substratum. A second phase sees the use of grey-blue limestone (upper third of the Jawf formation) and mudbrick (M2037 and M 2041) that leans against the north facing of the previous phase, and in some cases even overcomes it. This second stage of construction shows that during its building phase, the first structure had already evolved. Indeed, in sounding 16, this imposing brick structure installed on a limestone masonry base (M2037) is directly built on the substratum. On the other hand, in sounding 21, this same structure (M2042) is constructed on aeolian sand including demolition fragments. This difference in foundation implies an evolution of the first structure, perhaps even a phase of abandonment. Finally, the third method of construction was observed in the two soundings, the addition of a dry-stone blue-grey limestone construction found on the brick structure in sounding 16 and the south facing in sounding 21. We did not excavate the south facing of the enclosure in sounding 16, but the facing probably is made with the same type of masonry as in sounding 21. Moreover, in sounding 21, this structure is found leaning against the south facing but not on the brick structure, presumably because it is not preserved.

Geoarchaological research in the valley: soundings 14 & 17

The surface that the enclosure circumvents is vast, and it is crucial to understand the type of occupation here and its date. Seven soundings were opened during previous campaigns (SD1, 3, 6, 7, 8, 9 and 12) in this objective. Only two of them 6 and 12[8] delivered ancient dwellings. These were located by the southern enclosure and comprised pottery from the first centuries AD. Other remains may be buried deeper inside the enclosure, but the sedimentary cover was still not properly understood. To obtain answers, we opened two new trenches, SD14 and SD17, in order to evaluate the sediment that fills the depression and to search for past settlements.

Sounding 14 *(Figs. 3-4)*

Two small test trenches, close to each other and oriented east-west, SD14a and SD14b, have been opened with a mechanical digger at the bottom of the southern enclosure. In SD14a, we reached a mudbrick structure after 1 m of the survey, whereas in the second, SD14b, the first structure M2031 appeared after barely 0.20 m. We decided to excavate only SD14b (**Figs. 3 and 4**).

8. *Ibid.*

Stratigraphy of the northern section (from top to bottom):

- **US 2174**: surface soil with a thickness of 0.40 m, consisting mainly of aeolian sand bearing fragments of mudbricks related to the demolition of a structure.

- **US 2175**: at the base of US 2174, a lithified zone of 5 cm in the northern section and ash in the southern section. This level, now only visible in section, was removed by the mechanical digger but was present on the entire eastern half of the sounding. This vast burned layer constitutes the upper part of the filling of the structure L2182.

- **US 2176**: accumulation of 0.60 m of aeolian sand with interstratified silt. This level also contains mudbricks from the demolition of a structure.

- **US 2177**: hardened aeolian sand covering several mudbricks resulting from demolition.

- **US 2178**: level of 0.20 m thick soil on which L2183 and the base of structure M2031 rest. It is a hardened sandy loam which does not appear to be adobe since no binder could be distinguished.

- **US 2179**: very loose aeolian sand containing pottery.

Description of the structures:

- **L2182**: circular structure delimited by seven vertical bricks laying on the side. The mudbrick type is 0.24 m wide and 0.10 m thick. The seven bricks reveal on their inner face the presence of a white coating, presumably lime. The first 10 centimeters of the filling consist of ash, fragments of burnt sediment, and burnt pebbles. We note that this filling 2175 begins well above the structure and therefore, is not exclusive to it. On the other hand, there is no lithification on the bricks delimiting the structure. The remainder of the filling consists of aeolian sand 20 cm below the structure: a broken plate in situ associated with a horn and a pestle were discovered.

- **L2183**: in the northeast corner of the sounding against wall M2031, a very localized ash level was identified. It is structured by a stone directly in contact with the wall and by another in the center of the ash concentration. This structure does not contain any goods. Three charcoal samples were exported for dating, after archaeobotanical treatment.

- **M2031**: brick wall on a stone foundation with a width of 0.42 m. The mudbrick elevation is preserved at 0.80 m and rests on a foundation made up of three courses of stones rising to 0.30 m for the moment - the excavation of this sector is not finished, and we have not reached the base of the foundation. The structure L2183 is located opposite the facing of the foundation of M2031. The preservation of the brick elevation is mediocre at best, but the distinguishable brick types are 0.42 m long and 0.21 m wide. However, generally, this brick ensemble seems very heterogeneous.

- **M2032**: brick structure, oriented east-west, preserved over 0.35 m, based on an indurated sand-silt US2178. Unlike M2031, there is no stone foundation. The western part of the wall

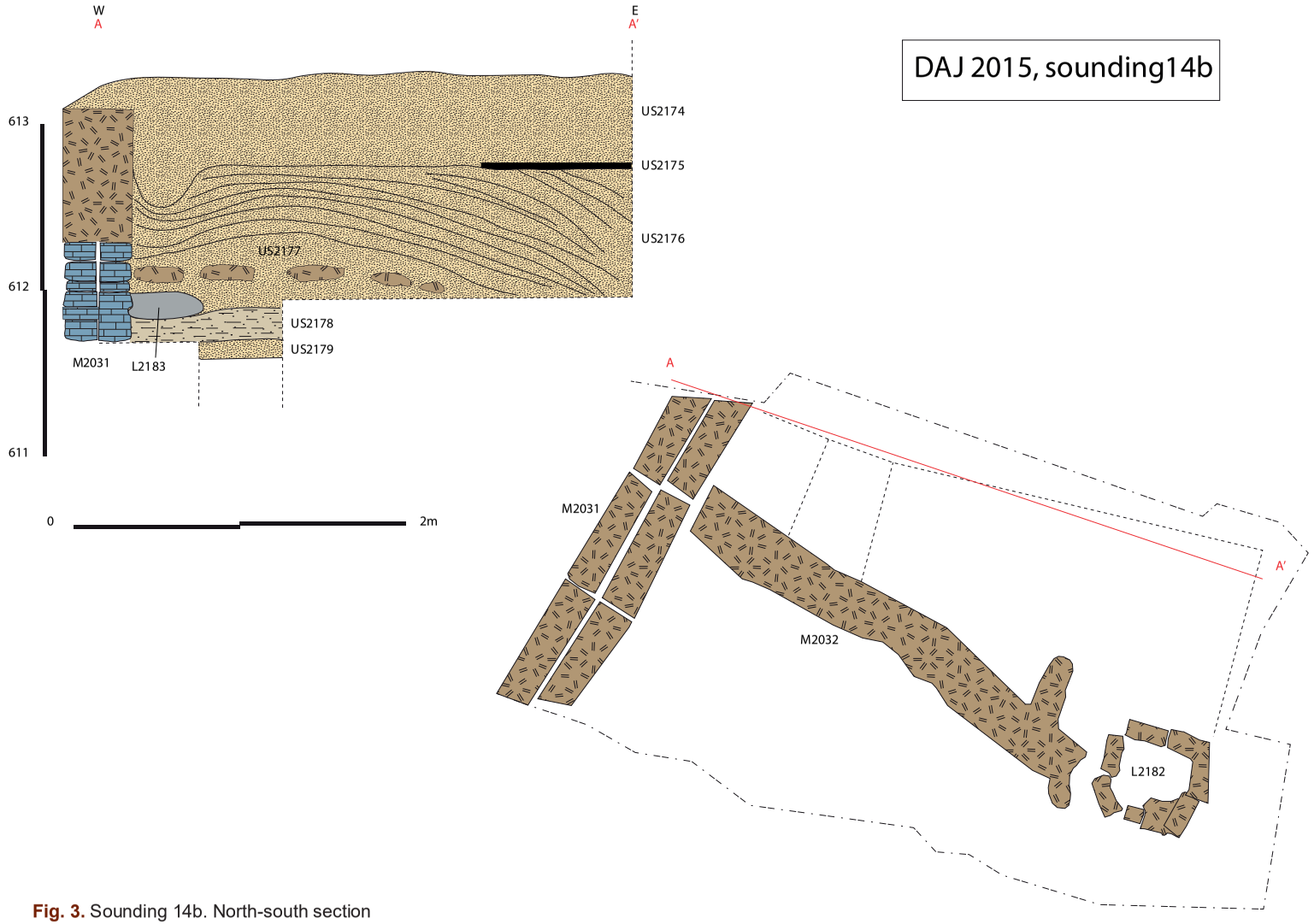


Fig. 3. Sounding 14b. North-south section



Fig. 4. Soundin 14b orthorectified image

is joined to M2031, the bricks observed are very large, and their arrangement is chaotic. We can observe several vertical courses associated with horizontal courses. In this section, the structure is clearly cut by L2182.

Preliminary Overview:

The two test trenches opened below the enclosure level show that there are remains of anthropic development not far from the surface (1 m below the surface for SD14a, and 0.20 m for SD14b). We could not reach the substratum in this area, since we needed to investigate the structures. However, the presence of these vestiges, notably L2183 as well as unit 2175, both of which have provided organic matter, will enable us to date events that are well contextualized. Indeed, these structures are not buried very deeply, in the same way as what was observed in soundings 6 and 12. It is a matter of extracting direct and well-contextualized dates from a fill, in order to determine whether one investigates recent or old structures. The main sedimentary agent in the filling is aeolian sand. As we have detailed in the stratigraphy, the sedimentation rate of wind-blown sand can be extremely rapid, so it is imperative to obtain chronological markers in absolute dating in this type of filling.

Sounding 17 *(Figs.5)*

The area around SD17 has been extensively stripped over a large area due to the presence of structures levelled on the surface.[9] In order to observe the deep sedimentary sequence, as well as the presence of other structures, a trench (5 m long and 2.60 m deep), was opened at the plumb of wall M2200.

Stratigraphic log of the north section (from top to bottom):

- **US2507**: surface soil formed by bricks sand amounting to 0.50 m.
- **US2508**: remobilized marly green silt corresponds to a recompacted backfill: 0.30 m.
- **US2509**: indurated clay sand with strong carbonation and red coloring backfill: 0.30m.
- **US2510**: fine brown sand with coarse marl fragment: 0.60 m.
- **US2511**: medium brown to yellow sand with marl fragment: 0.80 m.

Reading the stratigraphic section allows us to cut it in two distinct phases from top to bottom. The first one (A) groups units 2507, 2508 and 2509, and the second (B) the units 2510 and 2511. The units of phase A are extremely heterogeneous, with sediments reshaping the multi-colored margins of the substratum. The green coloration of unit 2508 and the red coloration of unit 2509 attests this. The carbonate base of the profile of phase A shows signs of a water

9. See Herviaux in this volume (SD17).

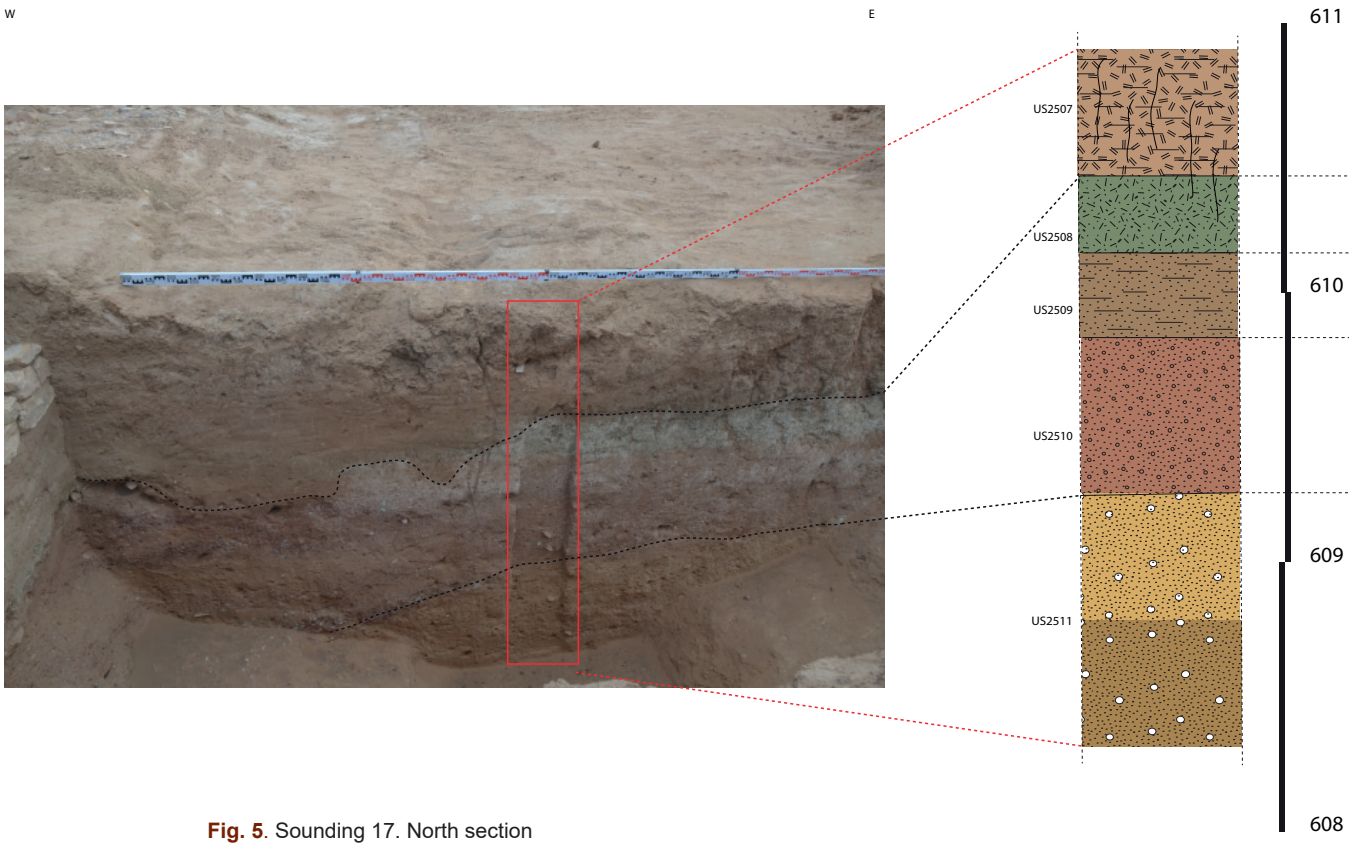


Fig. 5. Sounding 17. North section

impregnation. This phase A appears to be the result of a backfilling of the area. Phase B units are sands with decreasing granulometry from the bottom to the top of the profile, unit 2510 with fine sands, and unit 2511 with medium sands. These sand deposits are alluvial and could be the result of the wadi activity. Indeed, from a geomorphological standpoint, trench 17 is located in the lower part of the depression draining the old wadi, which is now completely clogged here. The total absence of construction vestiges can be justified because it was a rather humid area at a certain point. On the other hand, the remains found on the surface testify that at the time of their construction, the wadi was already clogged or channelled in the northern part of the depression as can be seen at present.

Overview:

These two interventions (SD14 and SD17) within the enclosure show very different sedimentary profiles. On the southern side of the depression, we find a filling of aeolian sand covering slightly buried structures (SD14a and 14b), while in the bottom of the depression the filling shows phases of backfilling on a wet zone (SD17). The occupation of the bottom of the depression has necessarily been constrained over time by the presence of wetland which may explain the lack of structure in depth; a thorough investigation in this sector might confirm this hypothesis.

Unit 3, soundings 13 & 20

Soundings 13 and 20 were opened on the western part of the rampart (unit 3).

Sounding 13

Two test trenches SD13a and 13b were opened between the main enclosure M2001 (unit 3) and the retaining wall M2033.[10] The first sounding, SD13a, was conducted a few meters to the west of M2001 to see if there was a relation between M2001 and M2033. The second sounding (SD13b) was opened in order to clear the east facing of M2033. To do this, we opened a large hole in contact with the wall.

Sounding 13a

The sounding was opened using a mechanical digger; we managed to descend to a depth of 4 m. As the excavation took place in very loose aeolian sand, only one stratigraphic log was recorded due to the fragility of the layers.

Observed stratigraphy (from top to bottom):

- **US2169**: aeolian sand constituting the surface soil, no archaeological material has been recovered: thickness 0.60 m.

- **US2170**: aeolian sand with fine levels of interstratified silts (soil crusting): thickness 1 m.

- **US2171**: 1.60 m below the surface, a black level containing organic matter with a thickness of 0.20 m was observed and sampled. On aeolian sand, much charcoal associated with dried excrements of camels interrupts the aeolian filling. This level constitutes a “floor”.

- **US2172**: aeolian sand filling, no archaeological material was taken: thickness of 1.50 m.

- **US2173**: sandy brown to green silt containing fragments of remobilized marl. We sampled some sediments as well as some charcoal: observed thickness 0.20 m.

Subsequently, the profile breaks down into two sequences of deposits: a first strictly aeolian sequence with sand deposits: US2169, 2170 and 2172. Wedged between this homogeneous sequence, a soil level, US2171, was identified. The second observed sequence is at the profile base, characterized by a deposit of brown-to-green silt reshuffling marl fragments from the substratum, US2173.

10. Sounding opened in 2013 not completed, see Charloux et al. 2018: 122.

The silt deposit could signify alluvial sedimentation certainly coming from the old activity of the wadi. We could not dig deeper for safety reasons, and thus cannot completely describe the alluvial sequence. The deposits of aeolian sand, amounting to over 3 m, constitute the majority of the profile and represent the predominant sedimentation process in the whole sector C. Here, we are outside the enclosure against M2001 (unit 3). It is normal for the accumulation to be very large, with the wall acting as a barrier to the progression of the sand inside the depression.

The main question we are interested in, particularly concerning the construction of the enclosure, is the sedimentation rate of these aeolian sands. The soil level containing organic matter, US2171, must give us an idea of this sand accumulation since it is at 1.50 m from the current surface. Its dating would hint at the speed of recovery of this part of the enclosure.

It should be noted that the western enclosure itself was cleared during the first excavations in 1986 and during the 2010 operation and that, therefore, the sedimentation above ground level 2171 was much greater than during our intervention since the sand covered the entire wall.

Finally, this sounding did not find traces of deeper-lying human occupation levels that could have had any connection with the "retention" wall M2033 further to the west. The second sounding SD13b aims to locate the foundation of this wall.

Sounding 13b (Fig.6)

Wall M2033 was logically called a "retention" wall. Firstly, due to its western face showing a slope. Secondly, because it is the last imposing construction west of sector C in the bed of the wadi.[11] We have opened a sounding on its eastern face, to clear it and to reach its foundation. This test trench allowed us to document the construction method of M2033 and uncover a new structure, M2034, whose upper course is buried at 1.50 m under the upper course of M2033.

Description of the structures:

- **M2033**: grey-blue limestone structure, oriented north-south, 1.20 m wide at the top and preserved at the height of over 2 m. We could not reach its foundation, with the structure M2034 blocking both east and west sides, the base of the wall was not cleared. Its west facing shows a 0.25 m slope on the visible part. Additionally, the east facing also shows a counter-slope of 0.25 m.

- **M2034**: grey-blue limestone structure, oriented north-south, 0.20 m wide and preserved over a height of 0.20 m. Its west facing is 45 cm from the east facing of M2033, and there seems to be no architectural relationship between the two. This wall is associated with a ground-level marked by lithification and ashes US2185 and 2186.

11. Charloux 2010.

Observed stratigraphy, north section (from top to bottom):

- **US2188**: accumulation of aeolian sand partially covering M2033. According to the topography, up to 2.5 m of filling could be observed.

- **US2181**: layer of adobe and sand with stones and mudbricks. This is a demolition level of M2033.

- **US2182**: aeolian sand containing limestone fragments from the demolition of M2033, no mudbricks.

- **US 2183**: brown to green silty sand containing marl nodules.

- **US2184**: aeolian sand: 15 cm.

- **US2185**: level of ashes found between structures M2033 and M2034.

- **US2186**: lithified level with ashes located opposite the east facing of M2034. There are lithified mudbricks found in this level. They do not appear to be organized and seem to be part of the demolition.

These two units, 2185 and 2186, were the subject of an archaeobotanical analysis carried out in the field, and the first results show the absence of organic matter.

- **US2187**: silty sand, unit comprised between M2033 and M2034.

- **US2189**: silty sand, identical to that of, found opposite the east facing of M2034.

- **US2190**: coarse sand.

- **US2191**: fine sand.

- **US2192**: coarse sand.

- **US2193**: sandy silt.

- **US2194**: coarse sand with gravel.

- **US2195**: very friable white limestone.

Preliminary overview:

Two major periods can be distinguished in the stratigraphic reading of sounding 13b. An initial period, comprising US2194 and US2189, and a scond one comprising US2181 to US2188. The latter two phases alternate some aeolian filling US2188 and US2182, a demolition phase US2181; and a level US2183 in contact with the course of M2034 could be the level of preparation for mounting a mudbrick wall. Indeed, two limestone structures have been recognized, but there is clearly a phase in mudbrick, not preserved in situ, but found in the demolition.

This brick phase seems to be associated with M2033 since it is in contact with the structure's upper courses. Concerning M2034 apart from its association with the 2185 and 2186 (clearly marking a soil level at the base of the structure), we have not established any stratigraphic relationship with M2033, and no foundation trench could be distinguished. Wall M2033 delivers a very peculiar morphology with a slope on its west facing and a counter-slope on its east facing.

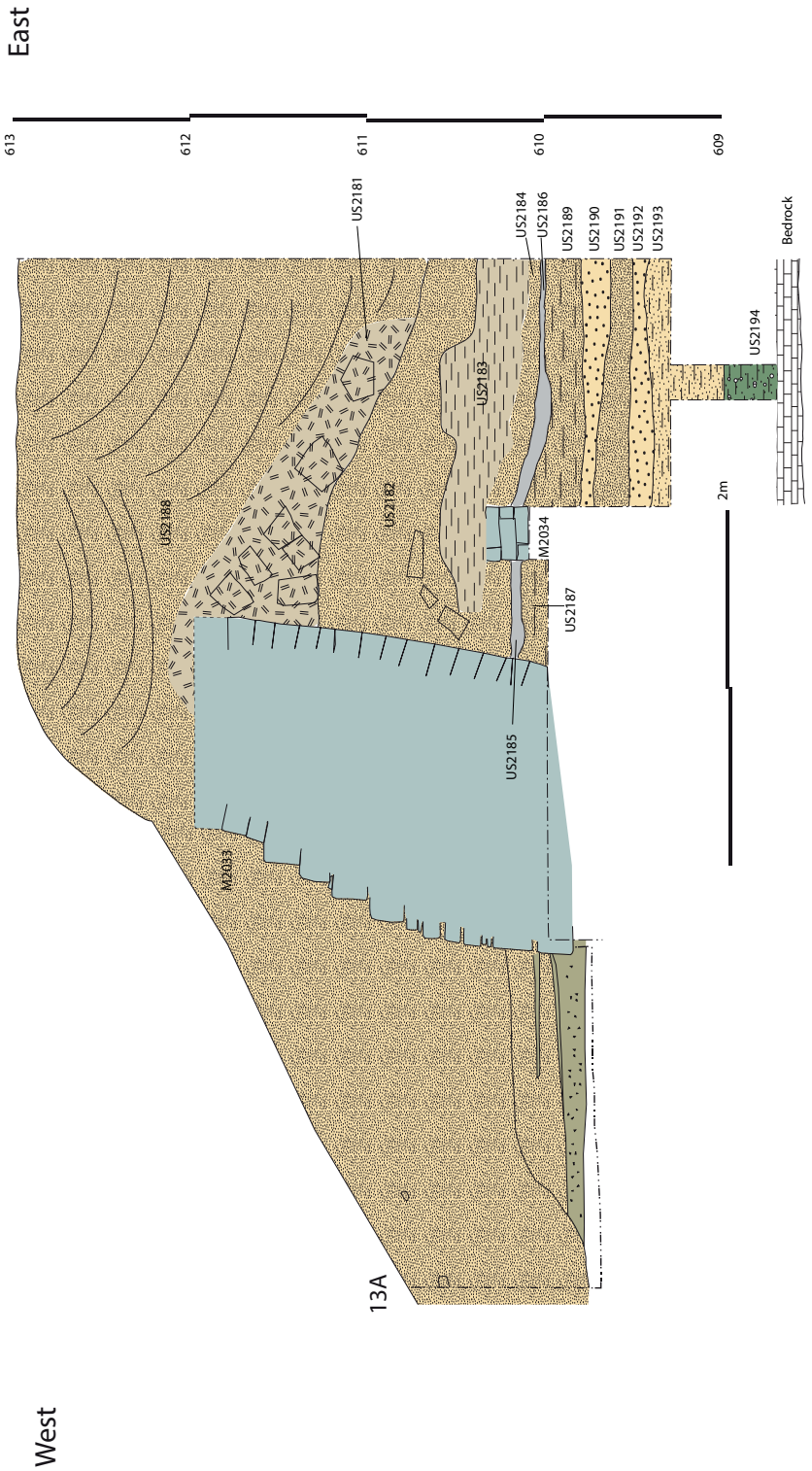


Fig. 6. Sounding 13b. North section

This configuration leads us to ask ourselves the question of its state of conservation: how did this structure not shift? Indeed, we have not reached its foundation to the east, which could probably have helped us with a better conclusion. The second part of this stratigraphy is an alternation of deposits of coarse to fine sand, with silts at the base deposited on the calcareous substratum. This sequence would reflect an alluvial deposit mode. The silts seen at the bottom of the sequence in SD13b US 2193 and those of SD13a US2173 were observed more than 3 m from the current surface. These two levels appear to be correlated.

Sounding 20 (Fig.7)

We carried out a small intervention on the top masonry of western wall M2001 to understand the layout of the various components of the monument. These components are stone walls, stone buttresses and mudbrick structures.

The first observation that triggered the operation is that one of the buttresses is attached to the east facade of M2001 in its southern part, but not to its northern part.

This anomaly indicates a mode of construction in several phases, which we have tried to describe in detail. We noticed three phases in the construction of this monument:

- **M2001**: grey-blue limestone wall with a thickness of 1.25 m, this structure is the same as that observed in sounding SD1.

- **M2035**: brick wall founded on a grey-blue limestone bedrock bound by adobe. This structure is contiguous to M2001 on its eastern facing; it is the same structure as M2002, observed in SD1. This system of two connected structures is interrupted at the level of the attached bastion, as on its south side. From there on, a completely different system is applied to ensure the continuity of M2001/2002, this new system constitutes our third phase:

- the bastion (b) is attached to an 80 cm thick stone wall (f) against which a mudbrick wall (g) was connected. This mudbrick wall is surmounted by three structures (c, d and e) (Cf. **fig. 7**, section BB').

These observations of this enclosure wall's construction mode once more reveal that this monument has been the object of numerous repairs and that its state today is the result of multiple interventions. Although it is still difficult today to produce a chronology of this enclosure, it is important to consider that it has evolved over the course of time and that its maintenance in sector C has always been of great importance.

Discussion

The enclosure wall is the main monument in sector C. As seen with soundings 16 and 21, its construction was done in multiple phases. Moreover, it seems that it can be reasonably regarded as having chronological rather than technical phases of development.

One of the arguments going in this direction is the change of materials:

- the use of yellow-white limestone for the construction of the first enclosure

- then the use of brick masonry on grey-blue limestone foundations.

The systematic abutment of an imposing brick structure on the interior face of the enclosure can be interpreted as a consolidation of a wall that would pour into the slope. Conversely, the exterior facing of the enclosure is covered by a structure made of small limestone slabs that were observed in sounding 21 but also in sounding 15. This is only valid for the southern enclosure, for the northern enclosure no primary limestone structure could be detected. Did it ever exist? The dating of the enclosure is at present undecided, and it will probably be the last monument to be dated within our investigations.

The main identified remains within the enclosed area are located in SD6, SD12, SD14a and 14b (landfill between 0.20 m and 1 m). This little landfill and the preservation of some structure (L2182) do not convey the idea of very old age, especially when the major agent of sedimentation is aeolian sand. This being said, it is imperative to date the organic materials taken from the SD14b and SD13a in order to evaluate the rate of sedimentation of the sand. On the other hand, more direct evidence clearly shows more recent presence in sector C (e.g. a piece of textile in the triclinium and a date of the door blocking in SD11). This is not completely unexpected in view of the Islamic occupation known in sector A. A Nabatean-Roman presence is also indisputable (e.g., *triclinium* and pottery).

One must surrender to the fact that this is certainly not a single-phase site, and that the best-preserved periods will be the most recent ones.

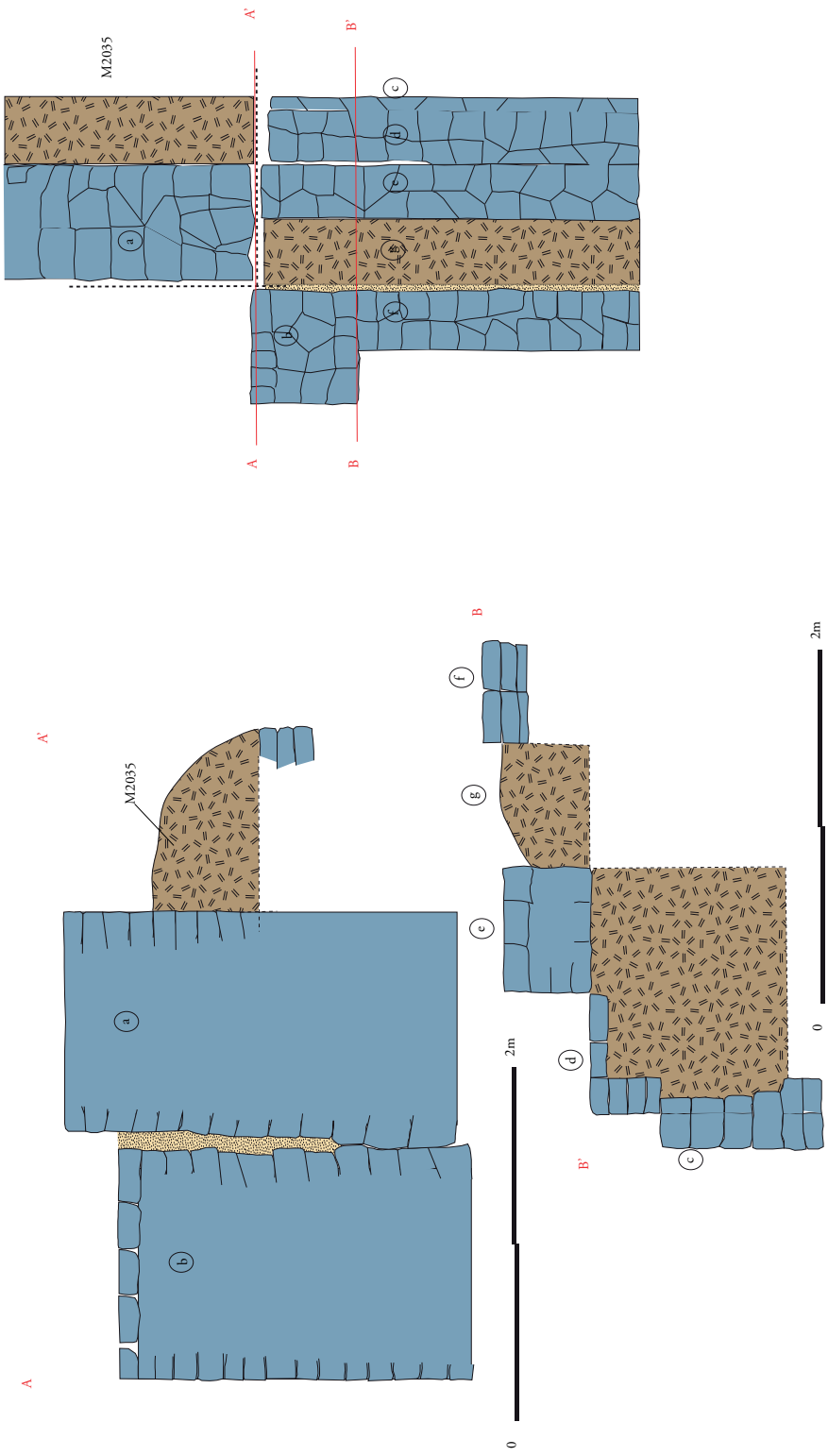


Fig. 7. Sounding 20. Restituted sections to the left and top plan to the right (East to the right)

Sounding 15. Rampart Units 1, 2 & 8

Céline Marquaire [1]

The excavation trench SD15 is located in sector C in the oasis of Dûmat al-Jandal, precisely at the junction of three units of the enclosure wall[2]:

• unit 1, consisting of a single straight wall oriented north-south, descending the Rijm al-Burj. It is approximately 1 m thick, entirely made of limestone;

• unit 2, consisting of a double or, in some places, triple wall north-south oriented, built in mud brick and limestone, whose thickness varies from 2 to 3 m;

• unit 8, also consisting of a double or triple wall in mudbrick and limestone, oriented east-west and previously considered as an internal partition of the area.

This location is therefore essential for our research, as it requires a survey that would clarify the continuity of unit 1, hardly visible before the excavation (**Fig. 1**),[3] thus confirming the long-term occupation of this sector.

Moreover, our intention was to verify whether unit 1 (and, by extension, units 6 and 7, the other sections of the enclosure surrounding the Rijm al-Burj) represents a post-construction phase. In such a case, the function of unit 8 would be called into question. It would mean that it was not thought of its creation as an internal partition wall at the time. Furthermore, we would like to verify this hypothesis, encouraged by the excavation of a triclinium dated to the 1st century AD on the Rijm al-Burj [4] and the various phases of construction of the postern in unit 8.[5]

We opened sounding SD15 from 2 to 26 March 2015. This task required the help of a dozen workers and the occasional use of a mechanical digger.

1. Université Paris I – Panthéon-Sorbonne.
2. Charloux et al. 2014a: 161, fig. 12.
3. Charloux et al. 2016b: 149–165.
4. Charloux et al. 2016b: 187–206 et 189–216.
5. Charloux et al. 2016b: 149–165.



Fig. 1. View of the sector of SD15 before the excavations. Looking north

Preliminary operations

IInitially, we cleaned the surface on a large scale and removed the various debris and vegetation littering on the ground. Subsequently, we cleared the M2410 limestone walls courses (north-south oriented), M2411 (M2410), M2412 and M2419 (both east-west oriented, the first one connected to M2411 and in its alignment to the second one) and M2413 (oriented northeast-south, west of M2410), (**Figs 2 and 3**). Finally, after removing the US2373 layer of aeolian sand around these walls, the mechanical digger cleared between 1-1.5 m of sand from this same layer to the west of M2410. During this operation, a child's skeleton was found at the northeast junction of M2412, M2411 and M2410.[6]

6. See Munoz in this volume (Anthropological Study SD15).



Fig. 3. View of the walls M2413 and M2410. Looking north

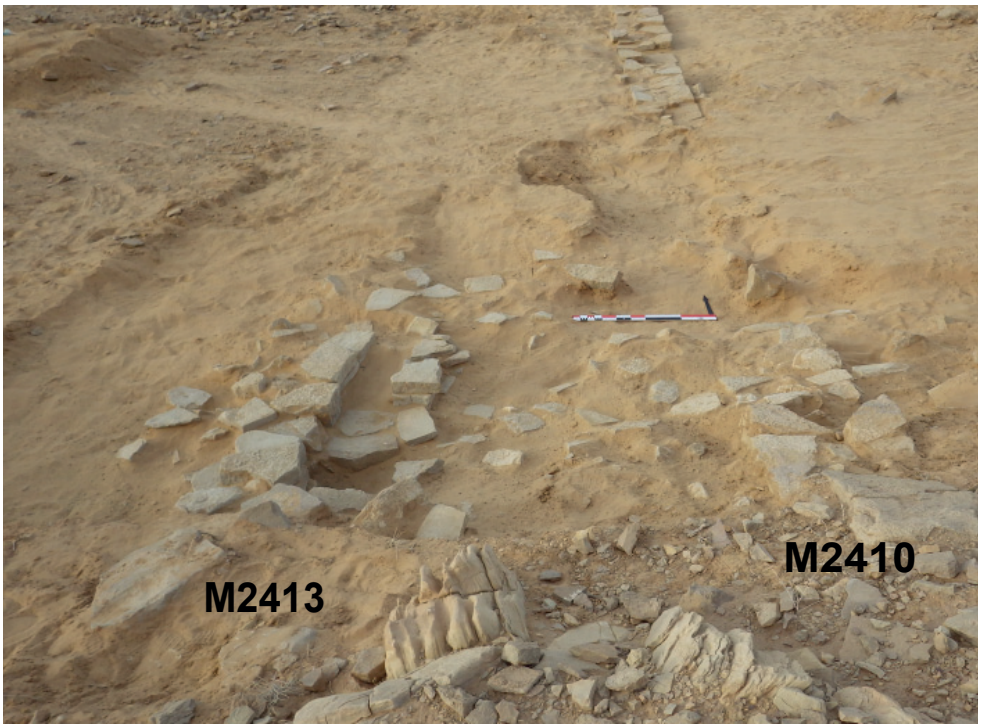


Fig. 2. View of the walls M2412, M2419 and M2410 and the buttress M2411. Looking north

Several structures have also been discovered during this task, including the long north-south wall M2414, west of M2410. It encouraged us to execute more tes trenches in order to explain their nature and chronology (**Fig. 4**) :

- *SD15a*: Between the walls M2410 and M2413, south of the perimeter of the excava tions;
- *SD15b*: east of M2413, south of the perimeter of the excavations;
- *SD15c*: covering a vast area between walls M2410 and M2414;
- *SD15c*: at the south-east corner of SD15c, at the junction between walls M2410 and M2412;
- *SD15d*: located between SD 15a and b, and SD15c, west of wall M2410;
- *SD15e*: an area cleaned extensively to the east of wall M2410;
- *SD15f*: at the junction of M2417, M2418, M2411 and M2419, north of the latter two walls.

At this point, we will focus on the relative chronology of the enclosure within SD15, detailing each phase of construction.

Phase 1. Installation of the rampart

The first construction phase is marked by the installation of the east-west oriented wall of unit 8, consisting of several sections of masonry: M2412 and M2419; and buttress M2411 (100 x 75 cm), the whole being reinforced, inside the enclosure, by a wall of bricks (M2418). We note that the buttress is connected with M2412 while a "*coup de sabre*" (vertical slit) separates it clearly from M2419 (**Fig. 5**).

Besides a perfect alignment between M2412 and M2419, these two walls also have the same thickness of 1 m and are made up of limestone blocks. Moreover, we have observed a constant occurrence of two major limestone block types: the first, elongated, 49 cm long by 7 cm high; the second, more huddled, 40 cm long and 17 cm high. Moreover, these same blocks also characterize the facing of M2411. Thus, the south facing of M2419 (distinct from its north face; **Fig. 6**) as well as those of M2411 and M2412 are similar. They consist of horizontal courses and a pseudo-isodome apparatus. All these facts seem to indicate the same phase of construction for these elements constituting unit 8. The discovery of the enclosure corner farther east confirms the unit's contemporaneity with unit 2 since the masonry is continuous (**Fig. 7**).

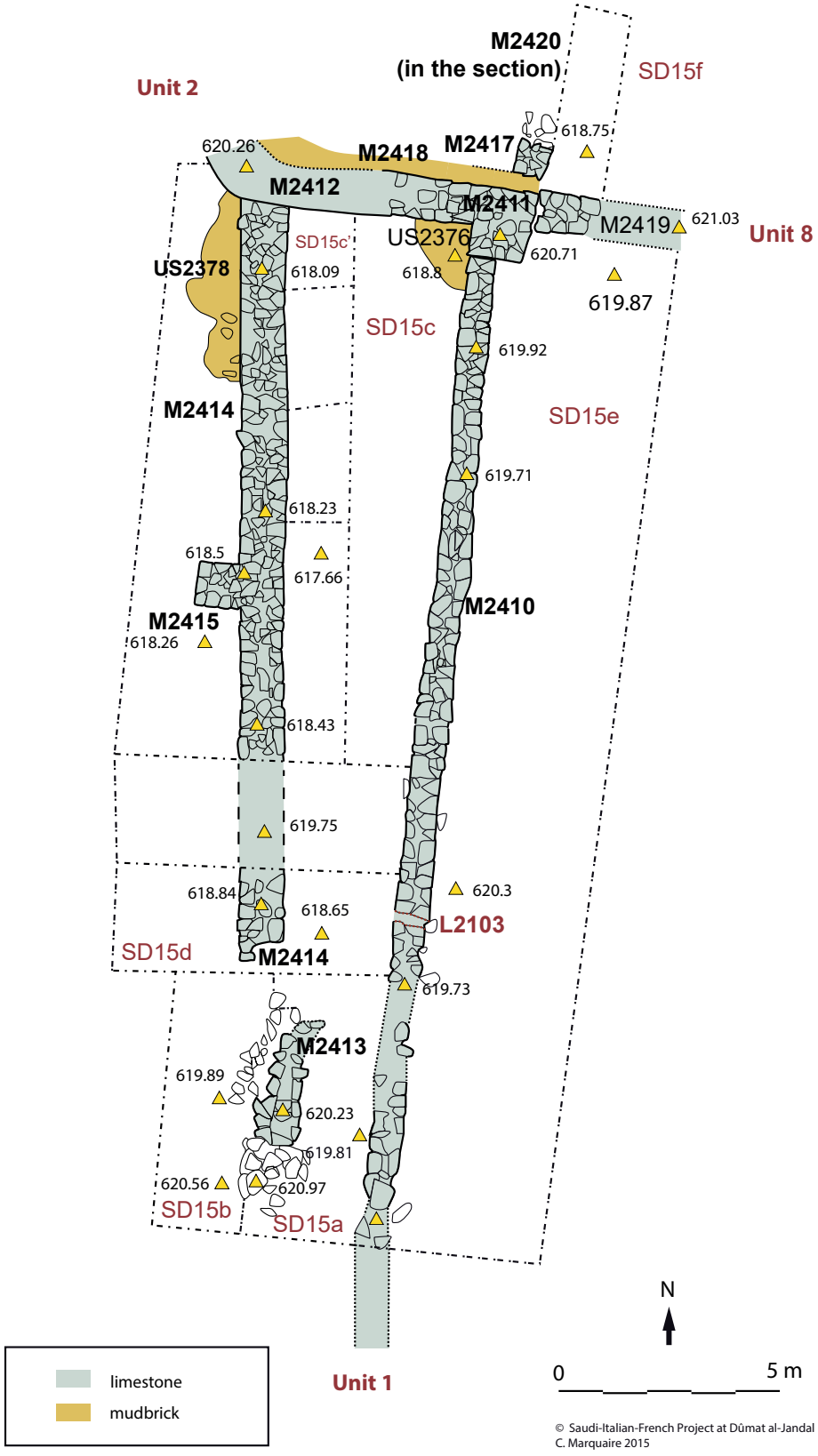


Fig. 4. Plan of SD15



Fig. 5. View of the walls M2410 and M2419. The buttress M2411, between the two walls, is separated to M2419 and M2410 by vertical slits. Looking north

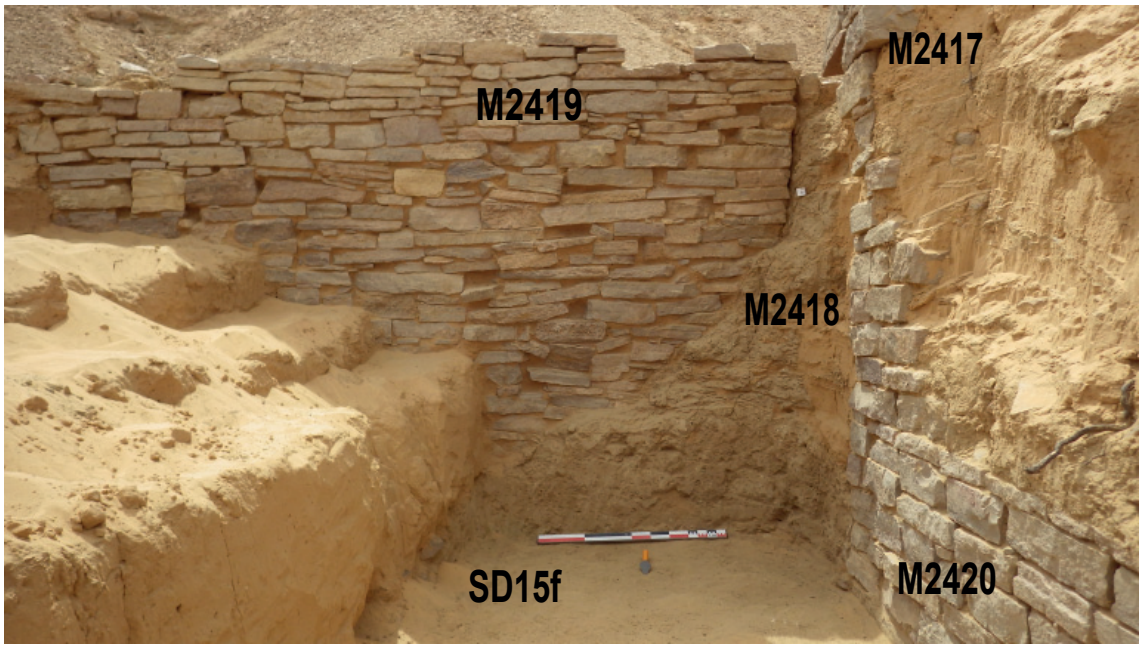


Fig. 6. View of the north face of M2919 in SD15 f. In the East, we can see the mudbrick wall (in part collapsed) M2418 and the buttress M2417 erected on the wall M2420. Looking south



Fig. 7. View of M2414 (in the foreground), M2412, M2411, M2419, and M2413: we can see the continuity of the masonry towards the unit 2. Looking north-east

In SD15c, we reached the foundation level of the wall of unit 8, made entirely in limestone, at the south side of wall M2412. Based on a layer of beige-orange colored aeolian sand, US2391 (at an elevation of 616.03 m at the northwest corner of SD15c and 616 m at the northeast corner of the same sounding; **Fig. 8**), this foundation was not the object of any particular reinforcement at the origin. This is similar to the enclosure foundations observed during the previous campaigns at various points of the rampart.

Thin and scattered pieces of very sandy mudbricks were cleared at the northeast corner of SD15c (US 2392), 10 cm below this foundation level. Should we see here the trace of preparation of this sector before the establishment of the enclosure? The hypothesis remains open regarding this first layer of occupation, marked by the L2108 locus above US2392, while three "crustings" at 616.37 m, 616.48 m and 616.54 m of altitude indicate several phases of use after its construction but before its enlargement (**Fig. 8**): with a thickness of 2 cm, they alternate with layers of marly sand and aeolian sand. Wall M2418 (partially collapsed in SD15f; **Fig. 6**) and the structure US2376 (**Fig. 4**), both of mudbrick, are located at strategic points in the enclosure. Indeed, the angles constitute particularly fragile points; their reinforcement by these mudbrick structures on either side of M2411 and M2412 is relevant, although, in the absence of the foundation levels of these massifs, we cannot determine when these were designed. In fact, have they been thought of in this first phase or - as we have already seen elsewhere in the rampart - have they been added later?

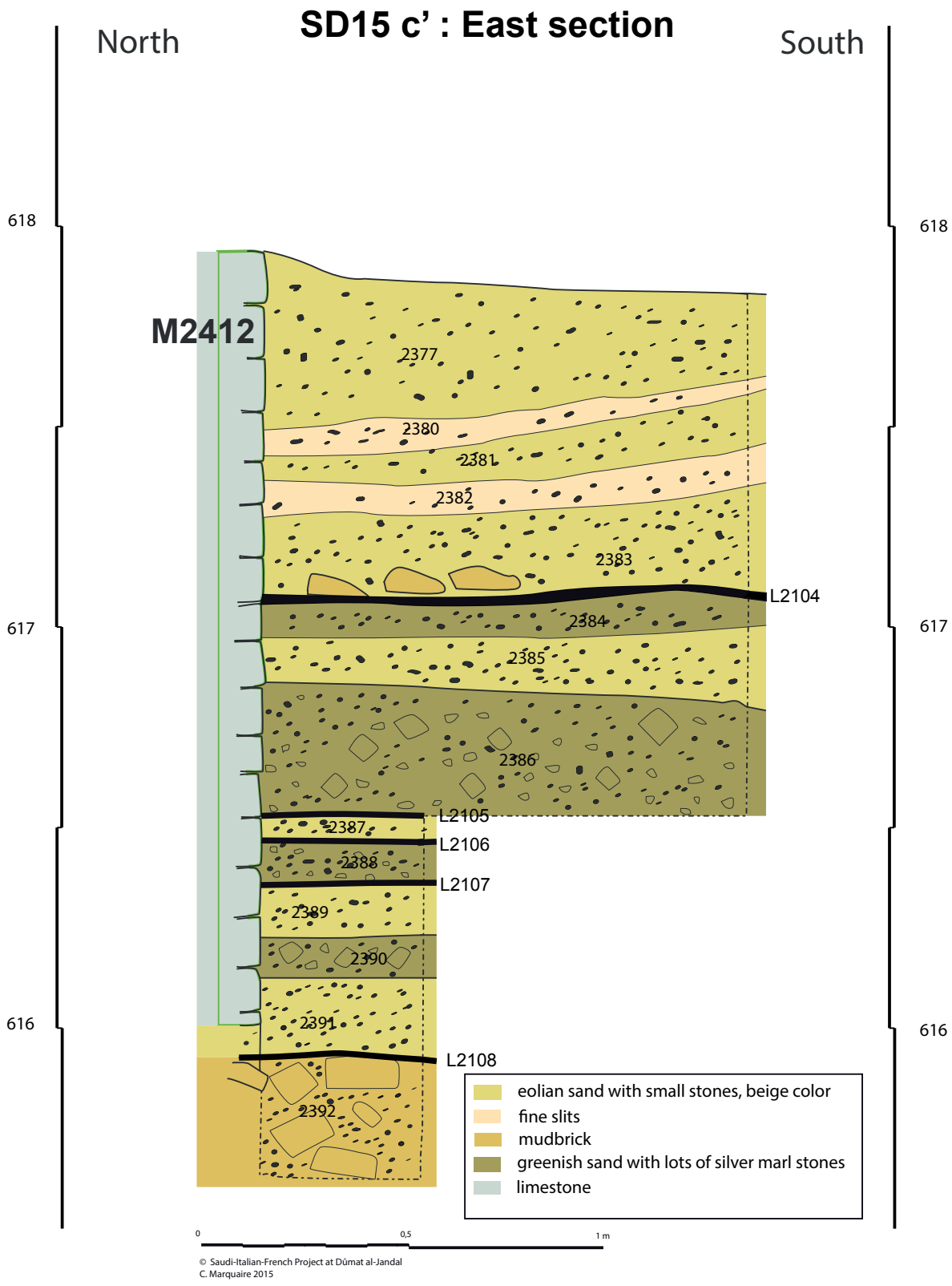


Fig. 8. SD15: East section

Phase 2. Enlargement of the enclosure

The creation of wall M2414, whose continuity could be followed in SD15c and SD15d (**Fig. 4**), occurred during a second construction phase. Indeed, if the "coup de sabre" separating it from wall M2412 is not surprising given the construction technique of the enclosure, it is the foundation difference between these two walls that allows us to confirm it. The foundation level of M2414, reached at the junction of these two walls, is 616.65 m (**Fig. 9**). Thus, we observe a difference of 60 cm between these two states. Unlike M2412, it was built on a layer of marly sand (US2386).

The foundation level of this same wall in SD15d allowed us to observe that its construction followed the natural relief because it rises to 618.72 m and is directly built on bedrock, a layer of green marl named US2374 (**Fig. 10**).

Wall M2414 was provided with a buttress called M2415 since we can observe that the two structures are connected (**Figs. 4 and 11**). Again, the facings of this wall and its buttress are characterized by regular courses despite greater variations in the dimensions of the blocks used, of which we find, as for M2412 and M2411, essentially two types:

1. Elongated blocks: 20 cm high and 39 cm long; 40 x 15 cm and 32 x 12 cm on average;

2. Smaller blocks: 40 cm high and 8 cm long; 42 x 6 cm and 60 x 5 cm on average.

The crust L2104 found on the section is SD15c (**Fig. 8**), at 617.07 m altitude, indicates possible use after this construction. No material was found in the layer above it (US2383 composed of orange-colored sand but still containing some pieces of mudbrick), nor in the following layers alternating sand mixed with fine silt and aeolian sand (US2382, 2381 and 2380). Only layer US2377, composed of beige aeolian sand, between 617,50 and 618,60 m altitude in SD15c delivered some pottery sherds and then, also in SD15c, layer US2375 (**Fig. 12**), which is characterized by greenish sand mixed with marly residues superimposed in thin layers between 618.50 and 619.20 m of altitude.

As in the first phase of construction, a mudbrick structure with a retained overstructure of 618.09 m, US2378, was cleared northwest of M2414 (**Fig. 4**). We do not think it is a collapsed overstructure of M2414 because it reaches a preserved height of 1.44 m at this point. This is probably too high to consider the construction of a mudbrick wall on a stone base. Thus, the hypothesis of reinforcement of this strategic point, at the junction of M2414 and M2412, is more plausible, especially considering the precarious foundation of this wall. At this stage of research, while the base of US2378 has not been reached, we cannot know if this structure was already planned from the construction of M2414.



Fig. 9. View of the M2414 and M2412 foundations. Looking west



Fig. 10. View of M2414 in SD15 d and its foundation on the bedrock. Looking east

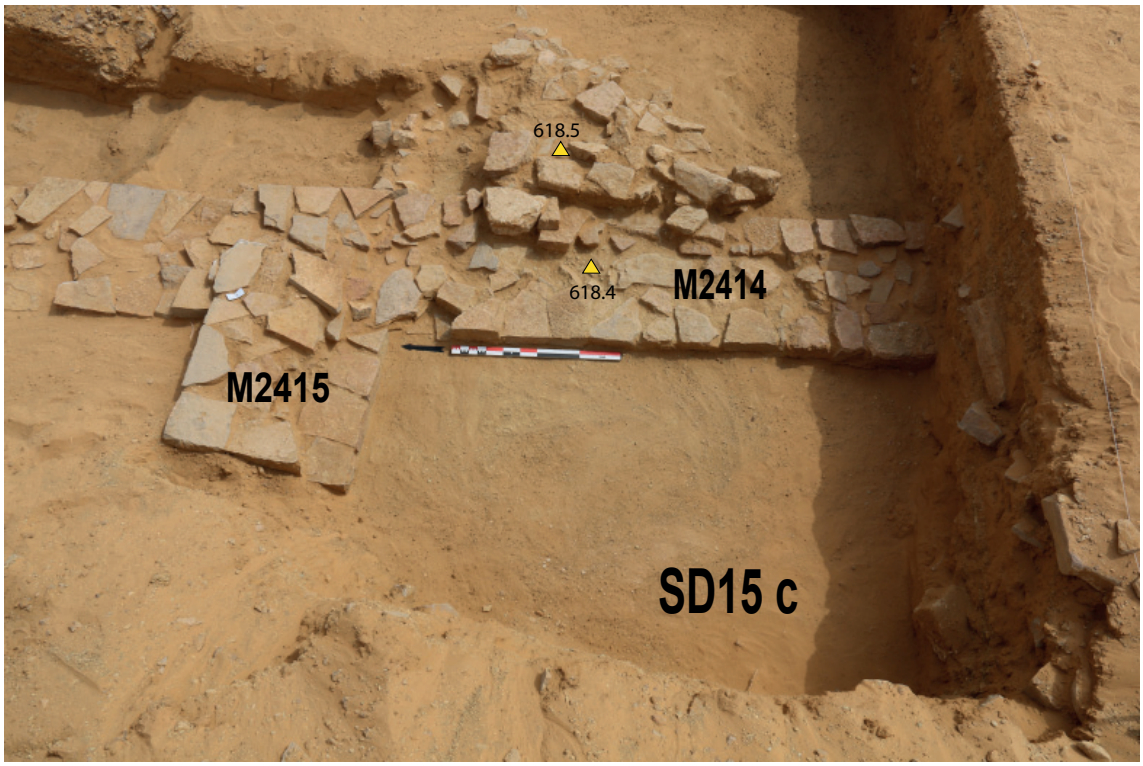


Fig. 11. View of M2414 and its buttress M2415. The elevation of M2414 is collapsed on its east side. Looking east.

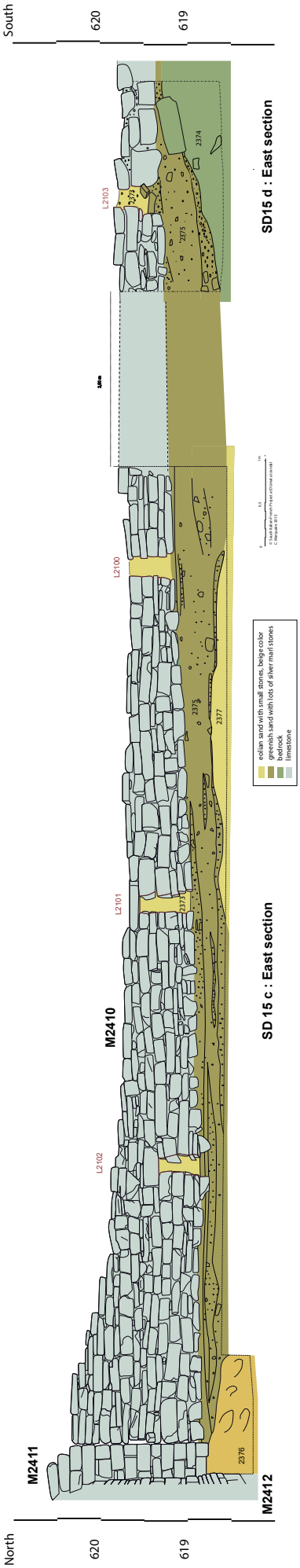


Fig. 12. Section of the M2410 West cladding in SD15 c and SD15 d

Phase 3. Collapse of M2414 or deliberate dismantling?

The overstructure of M2414 is partially collapsed on its eastern flank, south of SD15c (**Fig. 11**). It seems that this destruction is well localized. Should one see here the traces of an attack at this precise point? Or deliberate destruction of this wall to reuse its building blocks? Especially since this demolition layer did not exceed the 15 cm of thickness, it could just be a bed of scattered stones.

Phase 4. Construction of the walls M2410 and M2413: change of function?

Wall M2410, oriented north-south, is built entirely in limestone on a layer of sand mixed with thin marley chips, US 2375 in SD15c and SD15d before leaning directly on the bedrock in SD15a. Therefore, it does not follow the natural relief in favor of a horizontal course [7] (**Figs. 12 and 4**). It is composed of blocks with dimensions similar to those observed during the study of the facing of M2414 with modules varying from:

- 37 x 15 x 33 cm, corresponding to the first module observed in the construction of M2414;

- 43 x 8 x 28 cm, or dimensions close to those of the second module observed in the construction of M2414.

This is why the hypothesis of reuse of the materials of M2414 during the construction of M2410 appears to be the most plausible. Besides the foundation difference established in relation to the structures mentioned above (**Fig. 13**), other features clearly distinguish this masonry from the previous phases of construction:

- The foundation level of M2410 reaches the 618.75 m altitude at its lowest point in SD15c;
- the small thickness of this wall, ranging from 60 to 68 cm;
- and its heterogeneous apparatus (**Fig. 12**).

Indeed, the facing is quite poorly preserved, comprising less horizontal courses, and the thickness of this wall is given only by two stones laying to the side.

7. The horizontal construction of the wall has already been observed in 2010, see Charloux et al. 2014a: 158

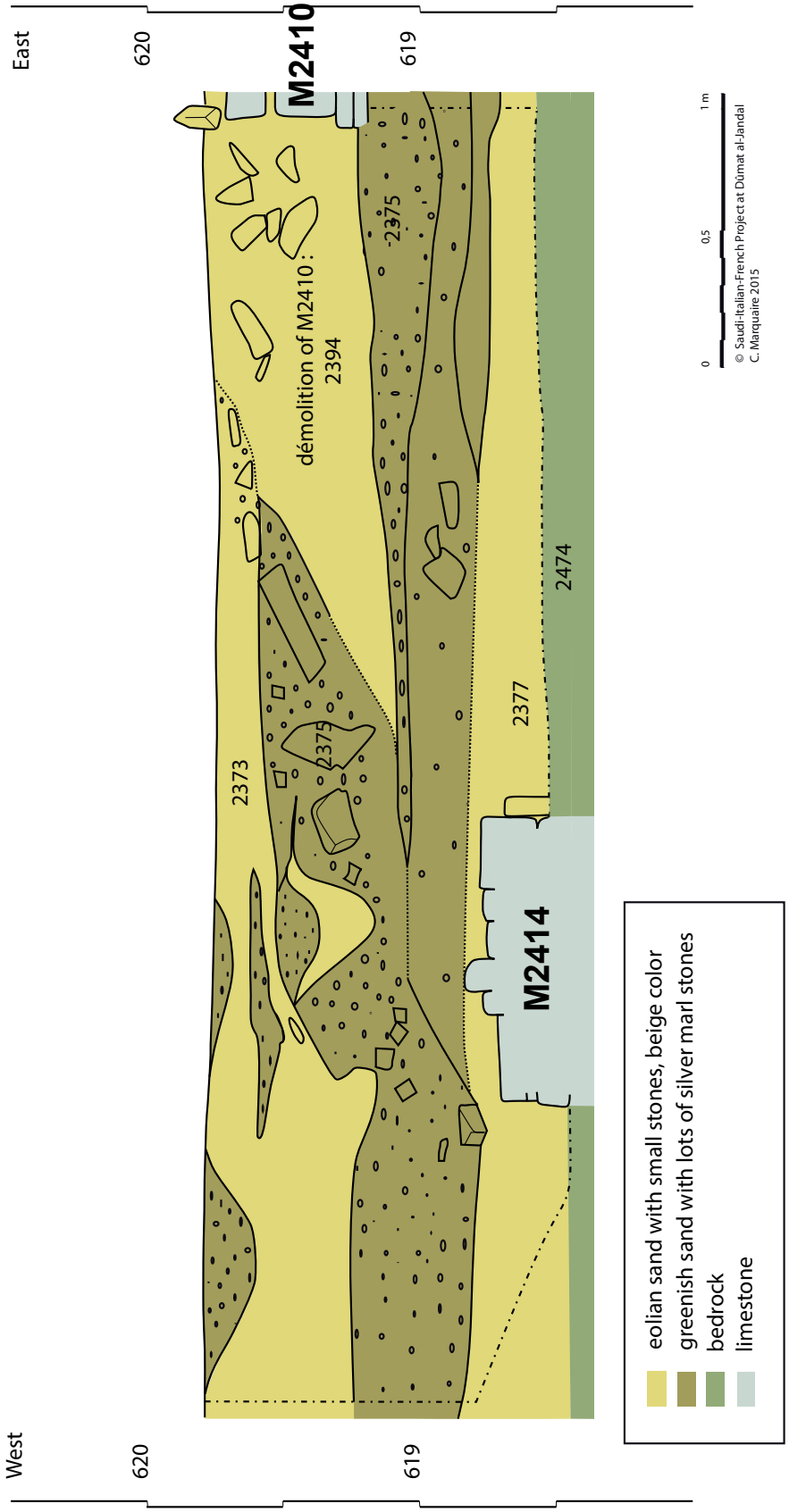


Fig. 13. SD15 d: North section. We can see the difference between M2414 and M2410 foundations and blocks of the M2410 collapsed

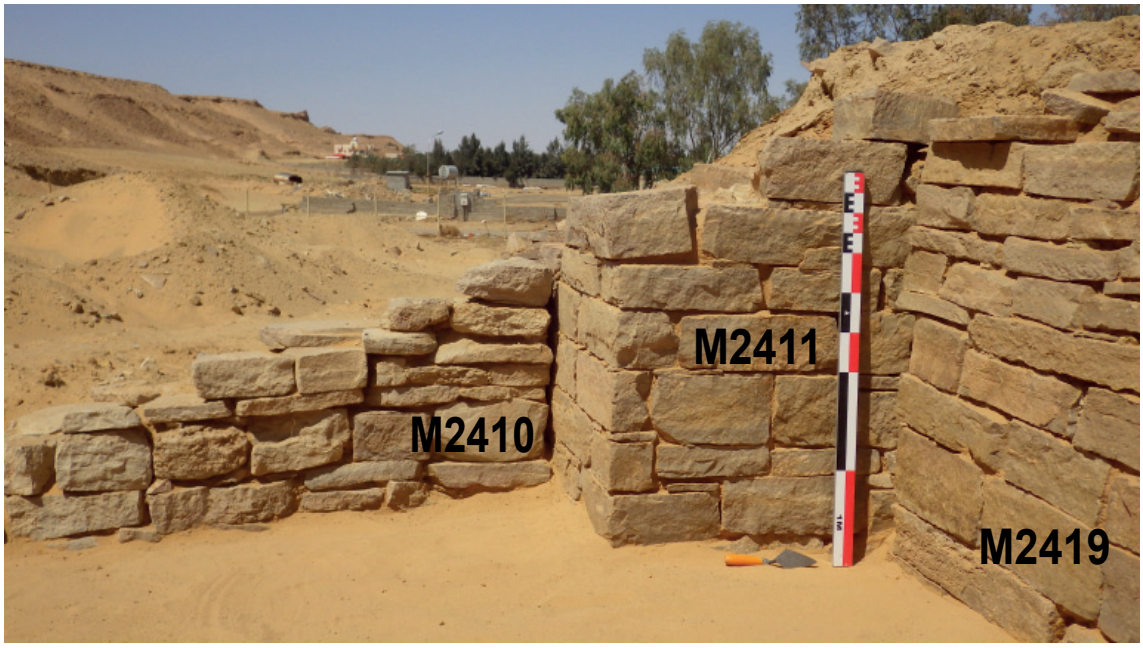


Fig. 14. View of M2410, the buttress M2411 and M2419 in SD15e. Looking north-west

Finally, wall M2410 was added to the previous units by joining this north-south wall in alignment with the buttress M2411, however, without reaching its thickness - an ultimate testimony of its later addition (**Fig. 14**).

Openings 20 cm wide were prepared within the M2410 wall: loci L2102, L2101, L2100 and L2103 (from north to south) (**Fig. 12 and 15**). Intervals are not identical:

- 2,80 m between L2102 and L2101;
- 3,50 m between L2101 and L2100;
- 4,40 m between L2100 and L2103.

Their structure is rudimentary: simple opening installed on the ground to a height of about 45 cm. Above them, the masonry of M2410 normally resumes. These openings could be drains. Due to its thin and precarious aspect, wall M2410 was probably not defensive.

In the same phase (4), it is necessary to consider a change in the function of the area. The construction of wall M2413 is probably contemporary to M2410 since its level of foundation in SD15b reaches 619.9 m like the one of M2410 in SD15a at 618.8 m of altitude, both on the marl layer that characterizes the bedrock (**Fig. 4**). It is located approximately 1.7 m west of M2410 and it follows a line roughly parallel to the latter south of SD15b, before redirecting to M21410 farther north. It is the least well-preserved structure of the area with only two stone foundations flanking a central course. This configuration evokes a canalization system, although the poor state of conservation of M2413 prevents us from asserting this function with certainty. However, this hypothesis, coupled with that of the drains in M2410, refers to hydraulic type installations during this last phase of use of the sector.

At this stage, it is difficult to know which wall, M2414 or M2410, is the one whose continuity is visible upstream of the Rijm al-Burj (unit 1). Indeed, if M2414 seems to vanish to the south in SD15d, however, it seems perfectly aligned with unit 1. Could it be that M2414 was levelled to its foundations at this location (SD15d) during the construction of M2410? On the other hand, several elements support the attribution of wall M2410 for unit 1. During the 2010 campaign, it was determined that the thickness of unit 1 wall actually varied from 70 to 90 cm while its masonry is characterized by two beds of stones placed on their sides, representing further points of convergence with M2410.



Fig. 15. View of the opening L2102 in wall M2410

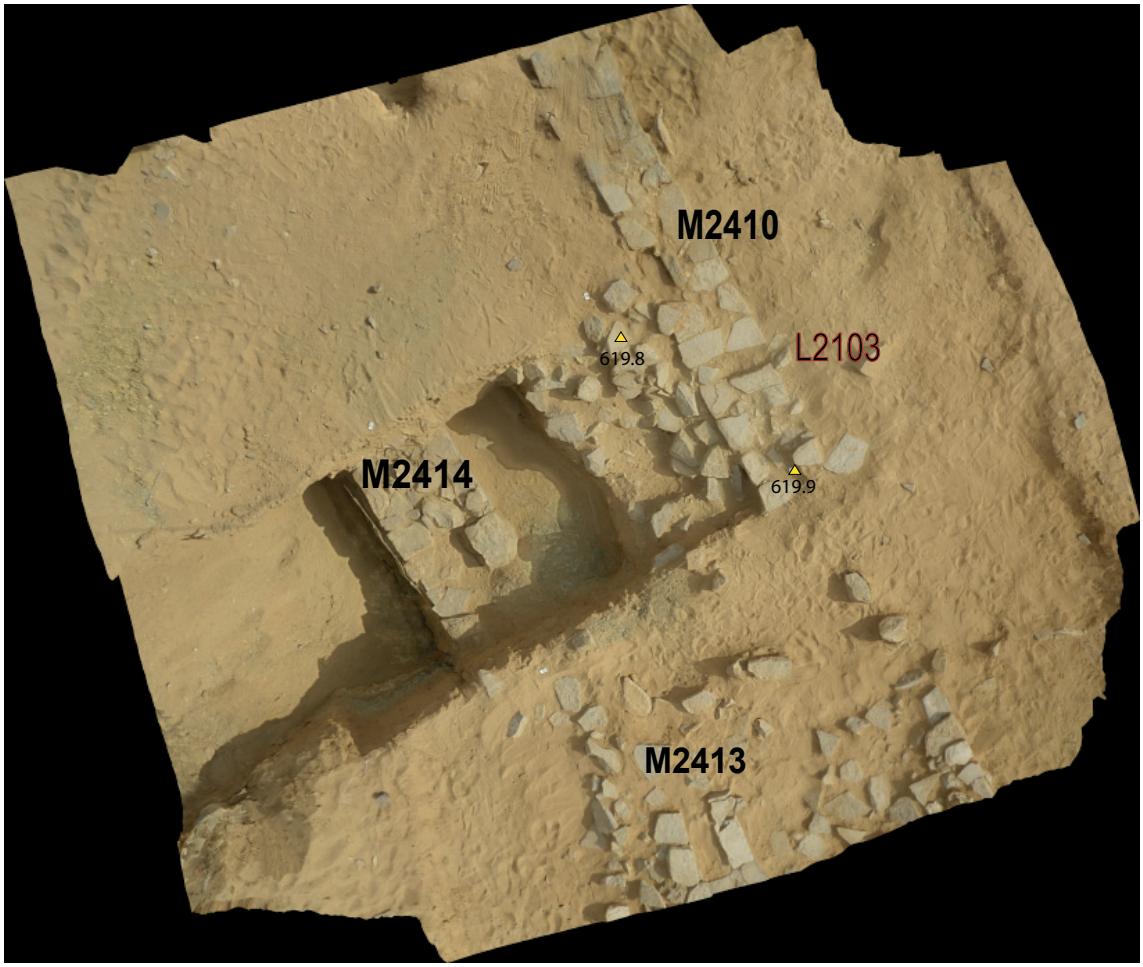


Fig. 16. Orthophoto of SD15 d. We can see the M2410 collapsed. Looking north-east

Phase 5. Partial collapse of M2410 and abandonment

The last phase of use of the area corresponds to the collapse of wall M2410 and its consecutive abandonment. Indeed, a demolition layer, US2394, corresponding to this wall was revealed to the west of it, in SD15c and SD15d (**Figs. 13, 18 and 17**) on the layer of marly sand US2375. Some ceramic sherds have been found in the US2373 aeolian sand layer above this demolition. Other ceramic sherds were also found in layer US2373 in SD15e and SD15f.

Another layer of demolition US 2395, at the southwest corner of SD15c, is more enigmatic (**Fig. 18**). It actually seems to come from a structure other than those found during the excavations. As a result, we suggest that it must probably be the collapse of a structure originally located to the east of SD15d and not included in our excavation perimeter.

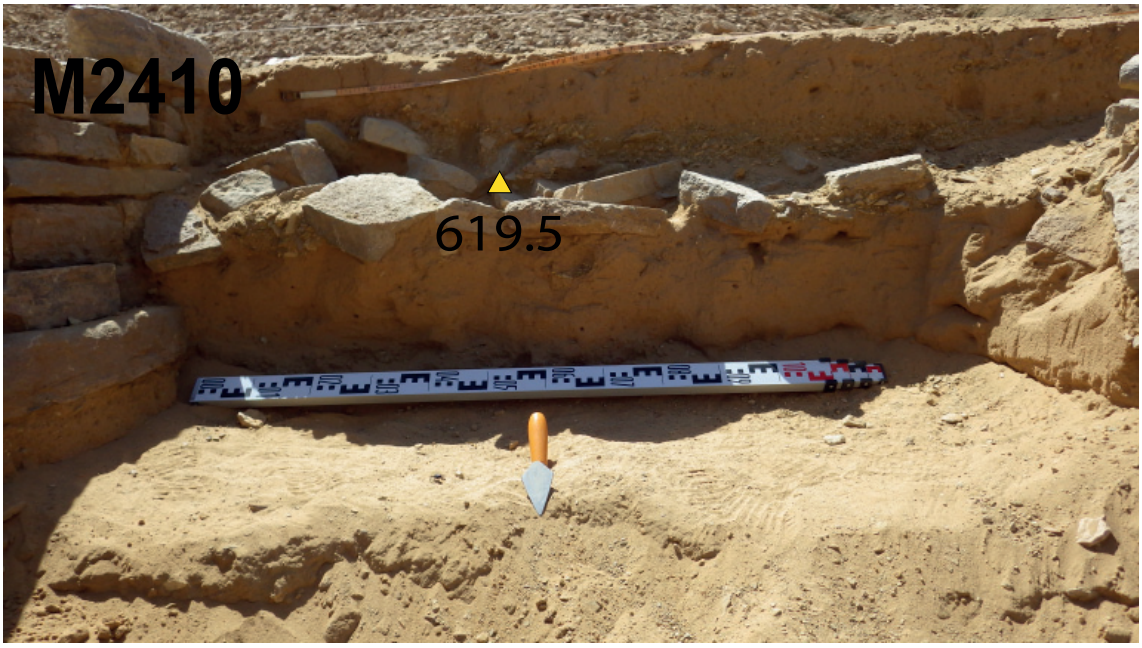


Fig. 17. Collapsed limestone structure in the South-East corner of SD15 c. Looking south



Fig. 18. View of the SD15 c south section. On the left, we can see the collapsed M2410 structure. On the right, another collapsed structure. Looking south

Wall M2420 and buttress M2417

We deliberately chose to mention wall M2420 and the pseudo-buttress M2417 in SD15f (**Figs. 6 and 19**), outside of our relative chronology, and without relationship with the other soundings. Since the foundation level of M2420 has not been reached, it is difficult to determine which phase its construction belongs to or even whether it was the subject of a phase distinct from those mentioned above.

During the excavations, we reached the altitude 618.75 m without excavating the foundation of M2420. The beautiful apparatus characterizing the eastern facing of M2420, unlike the much more anarchical M2410, favors the hypothesis according to which M2420 would be prior to M2410. However, we could not confirm this or attribute its construction to one of the phases preceding the construction of M2410. Wall M2420 could be followed by a length of 2.20 m along its eastern facing before giving way to a new layer of mudbrick, US2379, whose lower level remains unknown. The existence of this wall inside the compound raises new problems for the coming campaigns: why and when was this wall built? Is its role connected to the functioning of the rampart?

In a second phase, mudbrick wall M2418 collapsed, forming a large 1.62 m high demolition layer (**Fig. 6**). Why was the pseudo-buttress M2417, based on M2420 in US2373 (aeolian sand) added later? Is there a protection around M2418 mudbrick wall? Here are some questions that only a new excavation can answer. Again, the excavation of this area has delivered some sherds of ceramics, as well as animal bones (goat and dromedary) discovered in the layer of aeolian sand US2373.

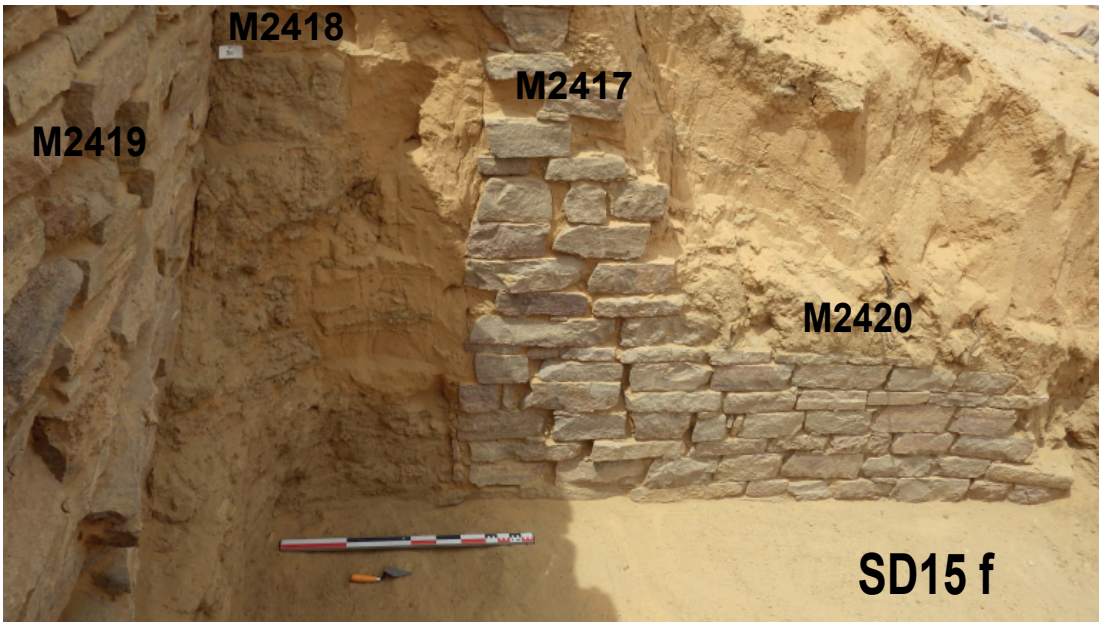


Fig. 19. View of the wall M2420 and the buttress M2417. On the left, the mudbrick wall M2418 and the limestone wall M2419. Looking west

Conclusions

Excavations in sector SD15 have confirmed the hypothesis of a later addition of the enclosure encompassing the Rijm al-Burj (units 1, 6 & 7). Indeed, the addition of wall M2414 and its buttress is well attested. Therefore, we should not consider Unit 8 of the enclosure as an internal partition. Subsequently, these various stages of construction should be dated. For this purpose, samples of mudbricks taken from US2376 and US2379 (**Fig. 4**) for radiocarbon analysis may be able to anchor the various states of the enclosure with greater certainty. Indeed, due to a lack of identifiable material, only a few sherds without characteristic shapes have been found in soundings SD15c, d and f (US 2373, 2375 and 2377). These analyses are essential in establishing a reliable chronology.

Subsequently, with the addition of new walls whose defensive purpose is unlikely, it seems that the function of this sector has changed though time. Should we, therefore, conclude that the entire sector on the Rijm al-Burj was not protected when the rampart in the valley was built?

Finally, the succession of these numerous construction phases again highlights the long occupation and redevelopment within sector C. During the coming missions, excavations should explore the function and sequence of structures in sounding SD15f.

Sounding 17: Agricultural Land Use in Sector C

Gwenaël Herviaux [1]

Introduction

Archaeological context

Sounding 17 is located in the intramural western part of the oasis (**Fig. 1**), in sector C. This large area was surveyed in previous seasons. Sounding 3, northernmost and carried out in 2010, consisted in excavating agricultural walls and different facilities linked to crop irrigation which could not be dated.[2] Sounding 7,[3] excavated farther east in 2013, revealed typical layers of an antique garden. Finally, sounding 8,[4] provided similar remains with SD3 dated to the late pre-Islamic period. Therefore, the central intramural space of the western oasis seems to be mainly dedicated to agriculture.

Sounding 17 is situated in an approximately central position in the valley. The opening of this sector was motivated by the presence of a wall (M2201) visible on the surface and by the presence of many Nabataean-Roman pottery sherds. As noted above, the dating of the archaeological structures in sector C remains unprecise, due to the lack of good context and diagnostic material. The presence of large quantity of ceramics possibly associated with walls and buildings permitted us to better apprehend the nature of the site, to observe the presence or absence of other archaeological remains and if they were connected or not with habitat, or storage space, etc.

1. Archaeologist, independant.
2. Charloux et al. 2014a: 203.
3. Lanoë & al-Qahtani 2018: 283.
4. Cotty & al-Tawati 2018: 293.

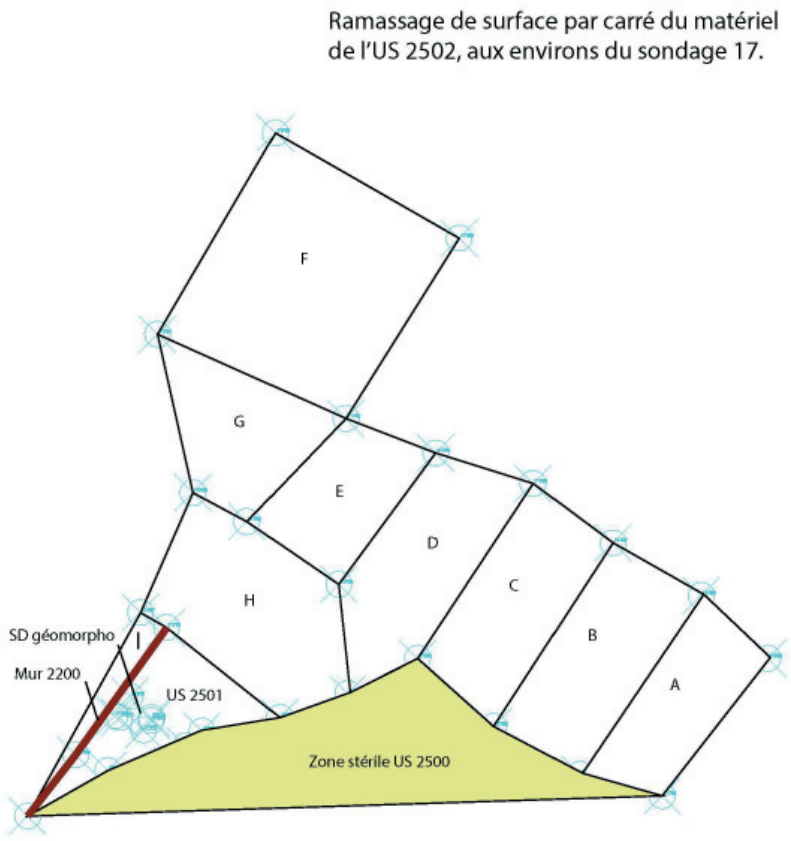


Fig. 1. Survey area around Sounding 17

Excavation method

After a series of punctual soundings in previous seasons, it was decided to excavate more extensively this year. The excavation was opened on March 2, 2015, and was achieved on March 25. The use of a mechanical digger with a smooth bucket of 1.60 m was necessary to remove the modern level and the aeolian sand deposit covering the area (**Fig. 2**). The work was done gradually, under the supervision of an archaeologist. The material was isolated to be positioned correctly in relation to the stratigraphy. The study then continued with the aid of three workers. It consisted in the cleaning of the area and stratigraphic excavation. A test trench was opened in the centre of the area to display the stratigraphy. The studied surface extends over 400 m². All masonry remains were covered with earth at the end of the excavation with the same mechanical vehicle, to leave them protected after our departure (**Fig. 22**). The remains were numbered starting from the number (US)2500 for stratigraphic units, from M2200 for masonry structures, and from L2250 for loci. The sections were drawn by hand at 1/20. The plans have been prepared using orthophotographs.



Fig. 2. Sounding 17 looking to the south-west, after the passage of the mechanical digger and clearing.

Results of the excavation

The excavation revealed structures related to agricultural activity (plot walls and an irrigation system) and which constitute the core of the remains discovered in sounding 17. This area is very little stratified (**Figs. 3-5**), but it reveals a perennial occupation, which serves as a basis for restoring the different major phases.



Fig. 3. Overview of the northern part of sounding 17, looking to the west.

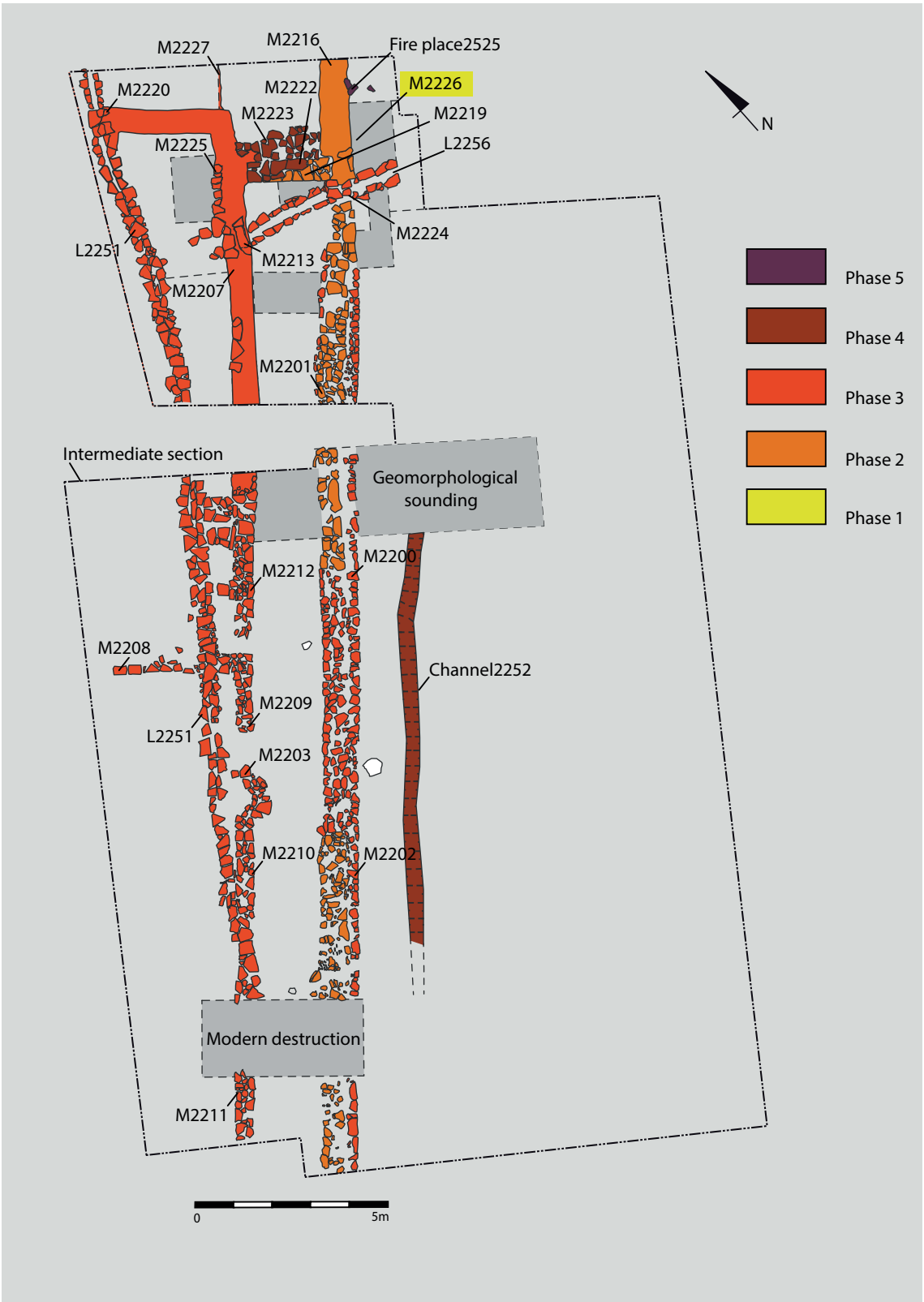


Fig. 4. Plan of archaeological remains found in sounding 17

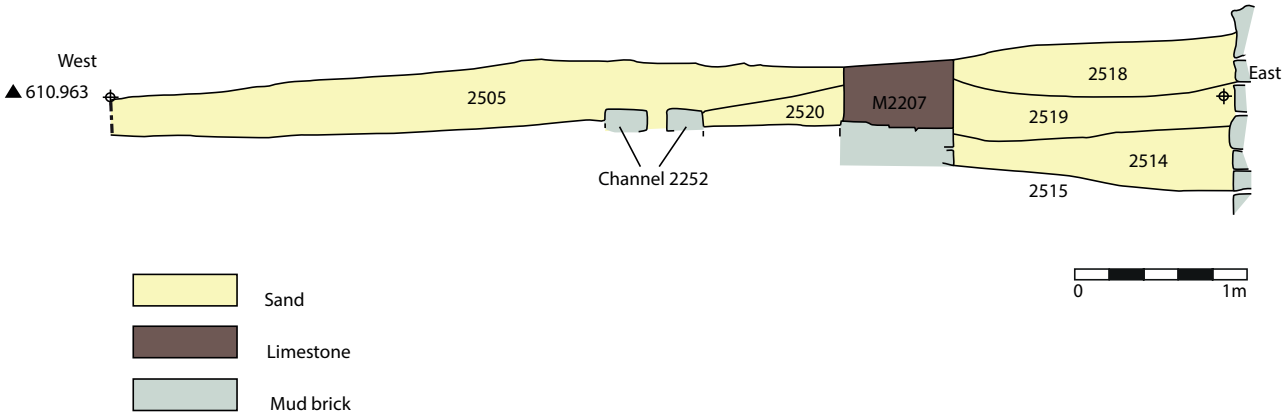


Fig. 5. The west-east section in the centre of sounding 17 illustrates the poor stratification in the area

The substratum

We have not reached the substratum in the area despite two deep test trenches (**Figs. 4 & 6**) of 2.45 m for the first and nearly 3 m for the second on the east side of wall M2201.

Phase 1

A first test trench was conducted against the east edge of the oldest structure in the area, wall M2226 (**Figs. 4**). Oriented north-south, it has been recognized over a length of almost 4.5 m and a height of 1.70 m. Its width could not be verified. It was composed of ten irregular courses of roughly cut white limestone, with mud mortar and well faced. It seems to trace a first north-east/south-west orientation that later building will respect.

Wall M2226 could be observed only in the deep sounding in the north. We do not know its development further north beyond the limits of the sector or whether it continues further south under walls M2216 and M2201 constructed on its top.

The wall is high and it was founded very deep (alt. 607.81 m) compared to the posterior structures in the same area (alt. 610.027 m for wall M2219, which is the deepest structure after M2226). It raises the question of the wall's function and the important stratigraphic accumulation which is deposited against it.

As we noted above, two test trenches were opened against wall M2226. At a distance of 7 meters, they showed the same stratigraphy. The backfill 2511 is constituted of medium brownish sand and an alluvial deposit. Above it, we found backfill 2510, brownish and fine sand

with marl fragments. Both layers seem to have been deposited after wall M2226. Indeed, no foundation trench was seen against the structure. However, it was not possible to verify if the layers extend on the west side of wall M2226. The late discovery of the wall and the impossibility of using mechanical means in the area without causing too much damage to the other remains, prevented us from opening a deeper trench.

At this stage, it is impossible to define wall M2226 nature and function without a larger "window".

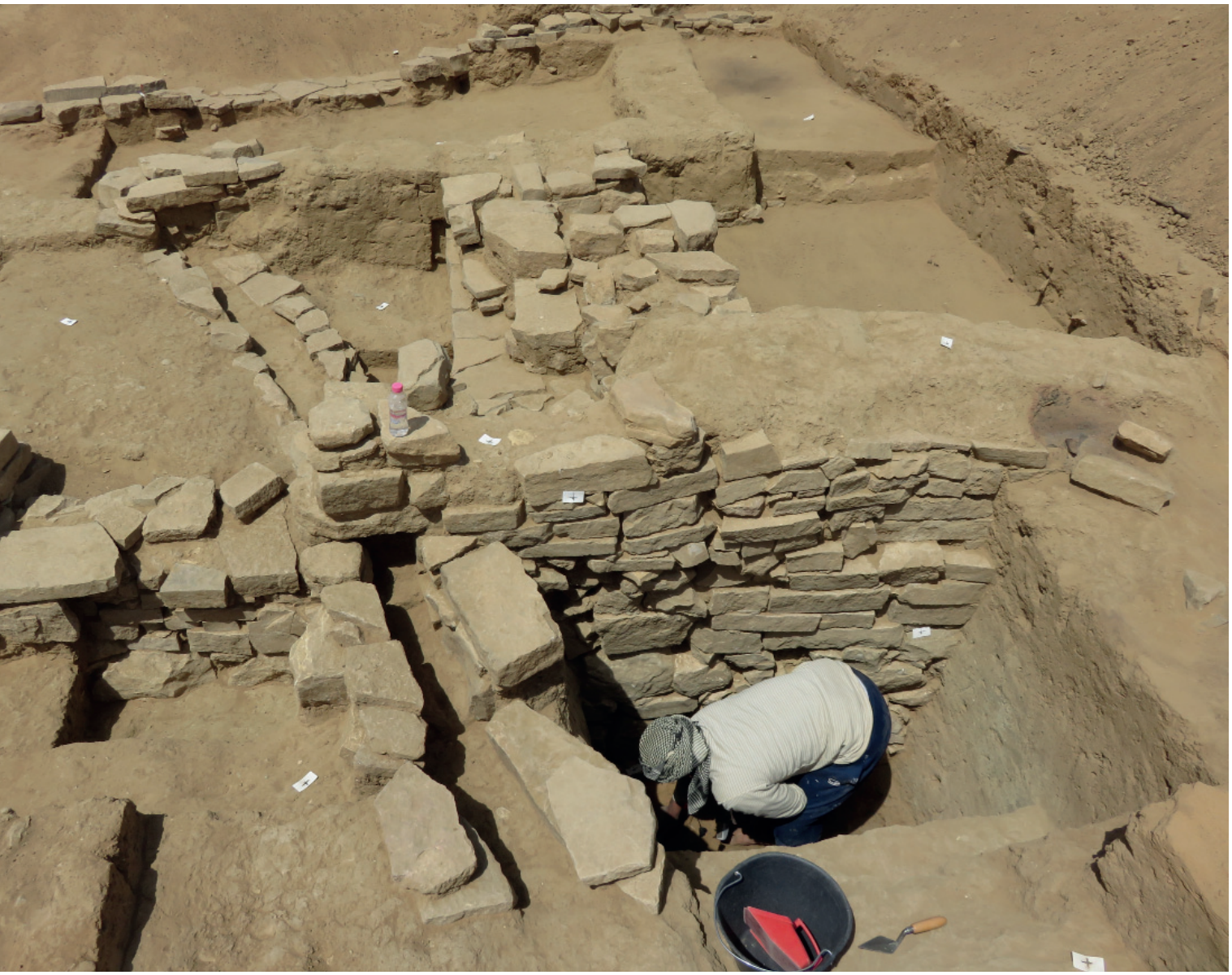


Fig. 6. Sounding 17 looking west

Phase 2

Wall M2219

In a second phase, a north-east/south-west wall numbered M2219 (**Figs. 4 & 7**) was built against the east facing of wall M2226 at the altitude 610.02 m. Wall M2219 has an observable length of 2.82 m. It has been restored to 0.6 m width, preserved at the height of 0.34 m, and has a very well made south-facing wall. Three courses of medium and large modules of blue limestone linked with mud are preserved on the installation layer 2531. This latter consists of fine brown indurated sand mixed with gravel. The western extremity of wall M2219 is hidden by M2207's masonry. We cannot say whether the extremity is levelled or whether it shows signs of collapse. A test trench was opened against the west side of wall M2207, on the axis of wall M2219 (**Fig. 4**). No trace of wall M2219 was found there. We do not know if the structure was still present further to the west, if it stopped abruptly or if it had a return in line with wall M2207.

This last hypothesis seems to be the most probable. A return of M2219 to the south can explain the form and the greater width of M2207, a posterior structure at this location. Indeed, M2207 seems to use an older structure by integrating its masonry. An addition numbered M2225 is installed on the west side of M2207, north to water channel L2254 (**Fig. 4**). It consists of three courses of white limestone blocks, between two courses of mudbricks of wall M2207. It is quite weathered, but this section of wall M2207 probably existed during an older phase and is contemporary to M2219. The mudbricks from M2207 are of different composition in this area, suggesting that they perhaps do not belong to the same construction phase. The eastern extremity of the wall is preserved in negative (**Fig. 8**).

The second phase is partially marked by the construction of wall M2219 against wall M2226 still in elevation. It is, however, not linked to any other known structure. Unfortunately, we do not know which space it delimits or what was its function – despite the fact that it is particularly well built in comparison with other walls.



Fig. 7. Wall M2216 in the background and wall M2219 in the foreground.

Walls M2201, M2216 and M2202

While wall M2219 was still preserved in elevation, the second phase of wall M2226 was built above. Wall M2201 (=M2216) incorporates, as we have seen, wall M2219. Wall M2226 has a north-east/south-west orientation and was observed on 2 x 0.64 x 0.9 m. It is composed of medium and large white limestone modules linked with mud. Not straight, M2201 has a slightly irregular appearance.

Thus, it looks like this set of walls formed a long plot wall - although no typical garden layer has been observed during the excavation. The overstructure of its southern end is today destroyed (**Fig. 4**). The orientation of wall M2202 has slightly shifted to the west. By their alignment, both structures M2201 & M2202 appear contemporary. M2202 is oriented north-south and is 8.8 m long, 0.68 m wide, and 0.3 m high. The building material is characterized by small and medium modules of white limestone joined with mud. The interruption of the masonry to the north seems to show an entrance that separates it from M2201 in the second phase of the area's occupation (**Fig. 4**).

These two walls fixed definitely the limit and extension of the gardens. It stayed there until the abandonment of the agricultural area.

On the east side of this limit, the backfill continued to accumulate (US 2509, a silty clay - indurated and carbonated). Above it, we removed marl 2508 which delivered a few sherds of ceramics and the bovine head of a terracotta figurine.

The late discovery of wall M2226 has not left us the time to check if walls M2201 and M2202 are built throughout and directly on wall M2226 (Phase 1).



Fig. 8. The west section of the test trench dug by the mechanical digger (looking west). In the bottom, there is a succession of sedimentation layers on which is installed the reinforcement M2200. In the background, wall M2201

Phase 3

The third phase is marked by the restructuring of the area bounded by the long wall M2201=M2216 and M2202 to the east (**Fig. 4**). At the end of the second phase, the well-built wall M2219 was destroyed, while wall M2201=M2216 was still elevated. Here, only three courses were preserved, and the top was the altitude of the floor of the third phase (alt. 610.367 m).

Consecutively, the western area had been reorganized, by the construction of the water channel L2251 (**Fig. 9**). The floor was also raised by 0.7 m (Phase 2) and more than two meters (from Phase 1).



Fig. 9. The north extremity of water channel L2251, looking to the north. The cover is preserved at the junction with wall M2207

Channel L2251

Water channel L2251 (**Figs. 4 and 9**) is the first building ascribable to the third phase.

It has a very uncertain slope, possibly from South to North (alt. 610.67 m at the northern end, 610.69 m at the southern end, but 610.77 m in the centre of the area). It is built directly on layer US2535, an indurated dark brown mud mortar with inclusions of small white limestone blocks.

Its two side walls are constituted of medium white limestone stones generally set on a single course. However, the roof (alt. 611.08 m) is preserved and installed on four courses at the junction with wall M2207. Here, the height of the water channel opening is 0.30 m x 0.10/0.15 cm. The roof, like the base, is composed of large flat white well-cut limestones. The water channel crosses the whole sounding 17.

While the water channel probably runs to the north outside sounding 7, it might have been destroyed by a modern excavation to the south: L2250 (**Fig. 4**). This modern pit of 4 m (east-west) by 2 m (north-south) unfortunately prevented us from understanding the structure's southern end. Indeed, the water channel seems to be interrupted on the south side of the modern digging. The reason is unknown.

In the same axis, we have to notice a wall M2211, whose relationship with the water channel is unknown: it is a double facing wall (1.8 x 0.44 m) with three courses of small and medium blocks of white limestone.

The area to the west of the water channel L2251 was very probably dedicated to cultivation activities in the past.

M2208 is the only structure observed in this area. It is an east-west oriented wall, poorly preserved, which consists of medium and large white limestones. With a length of 2.2 m and a width of 0.35 m, it is built against the water channel L2251.

A street runs on the east side of the water channel L2251.

The street

A north-east/south-west street (1.77 m wide) constitutes the central "public" space of the area. It is delimited in the east by wall M2200, and in the west by a series of walls built against water channel L2251.

The east side of the street

Wall M2200

The limit imposed by walls M2202 and M2201=M2216 is preserved and consolidated by the reinforcement wall M2200 (**Figs. 4 and 10**). This wall, 0.87 m thick, comprises two courses of medium limestones in the east. Its western side is not properly built. It consists of 4-5 layers of



Fig. 10. Wall M2201 appeared after the dismantling of threshold M2228.

stones with a slope to the west due to coarse quality of the construction. Mudbricks are installed on these foundation stones.

The plot wall M2200 closes the garden plot to the east, while an entrance is opened north of the area (**Fig. 11**), before reaching M2216. New stone courses are added on the western face of wall M2216: they consist of medium and large size white limestone blocks set at the bottom of mudbricks.

The entrance between the east garden and the street

An entrance was installed to the north of the area (**Figs. 4 and 12**). During the reinforcement of the eastern boundary walls, a new entrance was opened : it was materialized by threshold M2228 (**Fig. 11**). This entrance is composed of flat medium and large blue limestone blocks, likely coming from the destruction of M2219.



Fig. 11. Threshold M2228, looking to the west.

The northern side of the entrance opens to the water channel L2256. No traces of a previous entrance has been observed, but its existence would not be surprising, particularly at the corner formed by walls M2219 and M2201.

The west side of the street

A series of small connected walls was built against water channel L2251 (. These walls were erected in order to create a limit parallel to wall M2200, and to organise a set of small cultivation areas.

Walls M2203 and M2210

The north-east/south-west wall M2210 (**Figs. 4 & 12**) is 2.55 m long, 0.46 m wide and preserved on two courses. Its facings are constituted by small and medium white limestone blocks linked with mud. Its western side was used as a wall for the water channel L2251.

Wall M2210 gave a straight appearance to the street, while the north-south oriented wall M2203 (**Figs. 4 & 13**) created a space large enough for agri/horticulture. It forms a semi-circle 1.10 m long and 0.25 m wide. Built the same way as M2210, it is preserved in one course. It leaves a passage for water of 8 cm between water channels L2251 and wall M2203, the same space as between wall M2212 and water channel L2251 further to the north.



Fig. 12. The west side of wall M2210 used as a wall for the water channel L2251, looking to the east



Fig. 13. Walls M2203 and M2210 in the foreground and water channel L2251 in the background, looking to the west

Wall M2209

Further to the north, wall M2209 (**Fig. 4**) is in the shape of an "L". It is 1.88 x 0.4 m for the north-east/south-west section, and 0.9 x 0.46 m for the north-west/south-west section. It is preserved on two courses linked with mud. This wall has a facing on both sides and is built with small and medium white limestone blocks. The return east-west is oriented on wall M2208.

To the south, it is separated from M2203 by an entrance of 0.79 m. It created an agricultural space of 2.47 m north-south by 0.43 m east-west.

Wall M2212

Wall M2212 (**Fig. 4 and 14**) is 3.77 x 0.58 m in the north-east/south-west segment, and 1.33 x 0.87 m in the east-west segment. It consists of two courses of medium and large modules of white limestone blocks linked with mud.

This wall creates two agricultural spaces. They are separated by a small offshoot of 0.28 x 0.39 m, leaving a water passage between the two spaces that is 7 cm wide. The same space is observed between wall M2203 and the water channel L2251 further south.

The northern space is a rectangle of 0.96 m (north-south length), and the second is of a 1.16 m north-south length. M2212 is separated by an entrance of 0.28 m from M2209.



Fig. 14. A small space along water channel L2251, looking to the west

Walls M2207 and M2225

Wall M2207 (**Fig. 4**) is the largest of the series of walls abuting water channel L2251 to the east. It forms a "U" adapted to the curving aspect of the water channel L2251 (9.88 x 0.58 m in the north-east/south-west section) and consists of two courses of medium and large blocks of white limestone linked with mud. The wall's return to the south is 1.33 m in length, 0.66 m in width; to the north, it is 3.22 m long, and 0.66 m wide. Here, the angle has a certain offset with the rest of the structure. It allows creating an agricultural space 9.44 m long, 0.77 m wide to the south and 2.44 m to the north.

As previously observed, the segment between water channel L2256 and wall M2219 was integrated to the masonry of wall M2207 in Phase 2 (the mudbricks are here different). This explains the greater width at that location. On the other side of M2219, to the north, wall M2207 follows the west side of the segment (in the axis of M2225) but keeps the same width as the southern section. This explains the shift observed in the plan.

In Phase 3, wall M2225 seems to function with the water channel L2254, as testified by a common stone used in both masonry at the southern end of M2225.

US 2515, a possible floor used for the installation of wall M2207, consists of light brown sand indurated with charcoal, gravel, and a pocket of grey clay.

Wall M2227

The north-east/south-west wall M2227 (**Fig. 4**) appears in an archaeological section to the north of the area. It has been identified over a length of 1.1 m. Mudbricks are installed on a course of blue limestone blocks attached to wall M2207. Its construction seems less careful than the walls described previously. It is slightly offset from the east-facing of wall M2207. North of M2219, all of the construction seems less clean.

M2219 was perhaps a small terrace wall, or a walkway across the street, or it was raised by a mud structure which has left no traces?

Water channel L2256

The water channel L2256 (**Figs. 4, 15 and 16**) is preserved along 5.77 m and oriented west-east. It has a descending slope towards the east (alt. 610.58 m [west] and 610.47 m [east]) in order to irrigate agricultural land east of M2201. The water channel has five different segments (from east to west):

Segment M2221 is made of three courses of small and medium white limestone blocks. It has an opening between 0.12 and 0.18 m.

The feature M2224 allows the water running into the wall M2226. It is built at the same time and perfectly integrated into the entrance M2228. It is made of 6-7 courses of small and medium white limestone blocks and one large for the roof. The opening is 0.3 m high and 0.15 m wide.



Fig. 15. Water channel L2256, looking to the west.

An identical feature M2213 is prepared inside wall M2207. It consists of four courses of medium blue limestones blocks probably coming from the demolition of wall M2219. Like the threshold M2228, it demonstrates the contemporaneity of the structures. The opening forms a square (0.24 m).

Between M2224 into the wall M2216, and M2213 into the wall M2207, the segment of the channel M2213 has an opening between 0.12 and 0.18 m on top of layer 2527.

Finally, to the west of M2213, water channel L2217 presents a different type of construction with different orientation. Poorly preserved, it consists of medium and large blocks of white limestone without any mud. The opening is larger: 0.3 m. The bad preservation of the western part of the structure prevented us from understanding the connection between L2256 and L2251.

Water channel L2256 respects a different orientation than the other structures in the area. It seems to be built ex-nihilo.

Phase 3 highlights the same agricultural activity than phase 2, with the developement of a street.



Fig. 16. Water channel L2256 and surrouding structures, looking to the north

Phase 4. Deterioration of the area

Over time, wall M2200 eroded along its entire length. To the south, US 2514 and 2512 covered the area surrounding wall M2200. These are the demolition layers of the overstructure of the wall which was made of fallen mudbrick mixed with with gravel, pottery sherds, few traces of charcoal and a lot of sand.

To the north, the entrance M2228 was partially filled at the beginning of Phase 4 with a mixture of sand and deteriorated mudbricks coming from the overstructure of wall M2200. This natural filling showed us a possible lack of maintenance of the area.

Modification of the entrance created a much smaller passage, but in the same place. The new entrance M2215 shares the same north wall (that is the south wall of water channel M2215) as the previous entrance M2228 (**Fig. 17**). The south side consists of mudbricks and medium and large white limestone blocks, all linked by mud. It has an opening 0.62 m wide. The "threshold" M2529 is made of earth and iregular stones. It allowed a passage for humans and water. A coin was found in the entrance.

Water channel M2256 was completely filled in.



Fig. 17. Entrance M2215 inside wall M2200, looking to the west



Fig. 18. View to the north of the entrance, looking to the north.

The street

We are uncertain whether the street was entirely or partially closed during Phase 3. However, it is proven that it was closed by structure M2222 during Phase 4.

Structure M2222 is made of three courses of medium and large blocks of blue limestone and mudbricks. It blocked the entire width of the street for 1.55 m just north of entrance M2215 and is installed on wall M2219 (**Fig. 18**).

In a second step, the ground rises north of M2222. Subsequently, another structure M2223 was positioned against M2222 (**Fig. 19**). It consists of small and medium blue limestone blocks, without facing. It seems to integrate small water channels that vary between 0.6-0.9 m in length, 0.22-0.3 m in width, and 0.1 to 0.2 m in height. It is possible that these water channels drained excess water from the northern plots by the entrance M2215.

At this point, one might ask if all the neighboring patches were always cultivated : all structures seem really coarse and not built for sustainable long-term occupation.

A north-east/south-west water channel L2252 was dug in US2512 - the demolition of M2200 to the east. Uncovered over 20 m, it has a bowl-shaped profile (width: 0.4 m; depth: 0.2 m) (**Fig. 20**).



Fig. 19. Wall M2222 and structure M2223 in the background, looking to the north



Fig. 20. The north-south water channel L2252, looking to the south

The north segment of M2207 and wall M2222 gradually trap the demolition of surrounding structures. Indeed, the demolition layer 2216 is developed only between water channel L2251 and the north-south section of M2207, thus proving that wall M2207 is still standing at this time. Demolition 2216 consists of small, medium and large white limestones modules, with sand and clay coming from mudbricks of M2207, some gravel, and a few traces of animal bones. The bovine head of a figurine was found in this layer.

To the east, between M2207 and M2200, there lies the demolition 2517 of walls M2222 and M2200. It consists of indurated clay from mudbricks of both walls, with very small modules of white limestone, and pockets of light brown sand. Demolition 2516 finally clogs up the entrance of wall M2200 (**Fig. 21**).



Fig. 21. Top iew of the north area of the sounding, looking to the south

Phase 5. Abandonment of the area

While M2216 is levelled to the north, a small fireplace, US 2525 of 0.44 m diameter was installed. It is circular in shape and partially lithified the wall. A wedging of three medium modules of white limestone was conserved. Additionally, a sample of the sand with charcoal was taken for dating.

The latest archaeological levels found in the area consist of layers of aeolian yellow sand. These are US 2504, 2505, 2506, 2518, 2519, 2520, 2522. They were recorded separately at the opening of the excavation areas.

The surrounding area revealed a lot of pottery on the surface. A systematic collect (US 2501 and 2502) and examination of all the ceramics was carried out. This concerned the smaller ceramic sherds in particular, as they do not seem to be in place. They were probably scattered together with land particles transported by the wadi alluvium or from ancient settlement areas as fertilizer for modern agriculture.

However, it is true that compared with other soundings, the archaeological layers in sounding 17 have delivered more material. Therefore, one may ask whether there is a dwelling or warehouse in the immediate vicinity.

Finally, modern digging destroyed walls M2200, M2201 and water channel L2251 on the southern end of the excavation area.

Conclusion

The first human occupation in the area is poorly understood: a deep structure lied on the area's main north-south axis (Phase 1).

It is only after a major sedimentation period (over 2 m) that the area showed sign of a more structured occupation (Phase 2): a garden area was delimited to the east by a series of plot walls.

During Phase 3, a street was created, bordered by two long walls and a series of small gardens. These were fed by a network of water channels bringing water from distant areas.

Phase 4 is marked by the closure of the street at some point and the modification in the organiation of the area, whhic was still devoted to agriculture.

In the last phase (Phase 5), the area was gradually abandoned and covered by wind-blown sand.



Fig. 22. Filling of sounding 17 at the end of the excavation, looking to the south.

Sounding 18. The platform on the Rijm al-Burj

Marianne Cotty,[1] Olivia Munoz[2] & Anaïs Chevalier [3]

Introduction[4]

The "Rijm al Burj" – the "ruins of the tower", a name given to it by 19th-century explorers – [5] is a 650 m by 100 m (max.) tongue-shaped geological mound, which overlooks the whole valley and the region. This promontory is a perfect natural defensive position, as well as an indicator of the oasis visible from far away. It reaches 68 m (max.) high above the valley bottom and 15 m above the wide adjacent plateau located to the south, beyond a small depression 15 m deep and 40 m wide. The wide space on the outcrop is mostly flat, but an east-west elongated rocky hill is localized in its centre south. The space located on top of the outcrop is partially encircled by the enclosure's southern wall (unit 7) (**Fig. 1**). In 2011, a previous excavation identified several massive structures on the north edge of the outcrop: a triclinium (L2017) and two towers (L2018 and L2027).[6] The Nabataean triclinium is an open-air banqueting hall consisting of three benches placed to form a large U-shaped public space open to the south. It provides a wonderful view of the entire region and the western part of the oasis. It has been dated from 1st cent. BC to 2nd cent. AD.[7]

The two towers are massive and well-constructed. They were probably used for strategic and military purposes - perhaps in relation to the enclosure. Here, the discovery of inscriptions and a coin suggest a dating range between the 4th–5th cent. AD.[8] At that time, no other remains were identified through the geophysical survey.[9] During the 2015 season, a survey of the plateau identified 17 structures as burials and various stone masonry architecture. Unfortunately, all of these remains have suffered from looting.[10] Among them, a stone structure located in the central

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4. Please note that this preliminary report written at the end of the fieldwork was recently modified and amended after the 2016 season and in Munoz et al. 2020.
5. Euting 1896: 125; Musil 1927: 467.
6. Charloux et al. 2016b (*Dûma* 2) & 2018a (*Dûma* 3).
7. Charloux, Bouchaud et al. 2016a.
8. Charloux et al. 2016b: 223–225 (*Dûma* 2).
9. Munschy & al-Khatib 2016 (*Dûma* 2).
10. See Chevalier (Dry stone structures) in this volume.

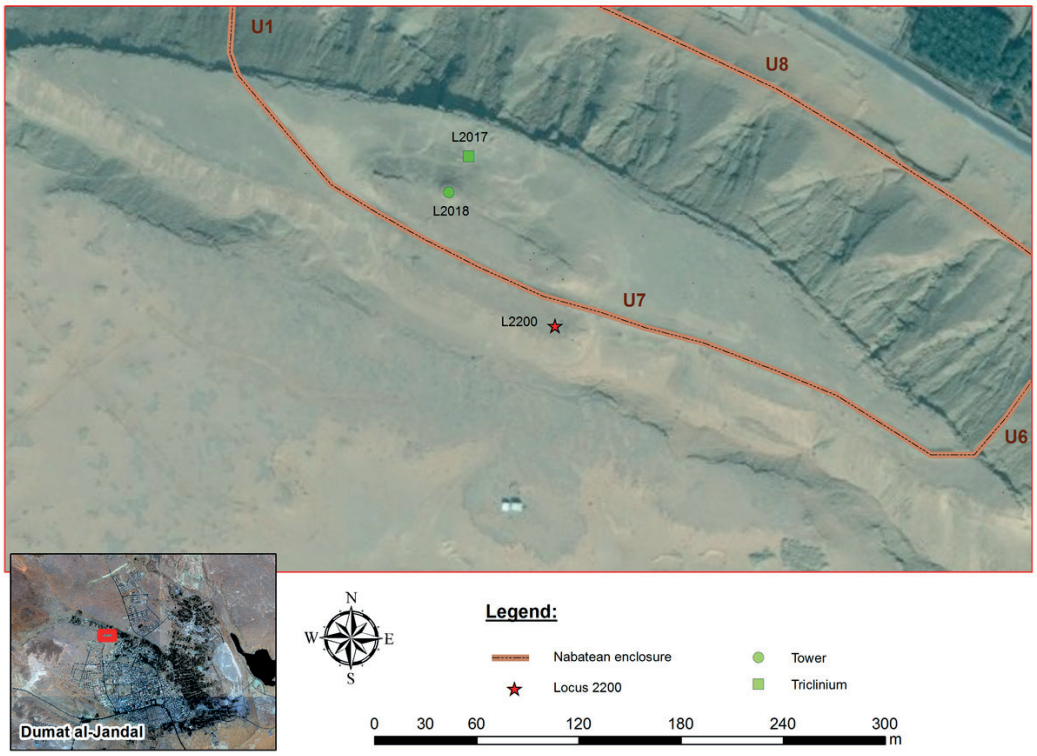


Fig. 1. View of Rijm al-Burj and its remains excavated in 2011

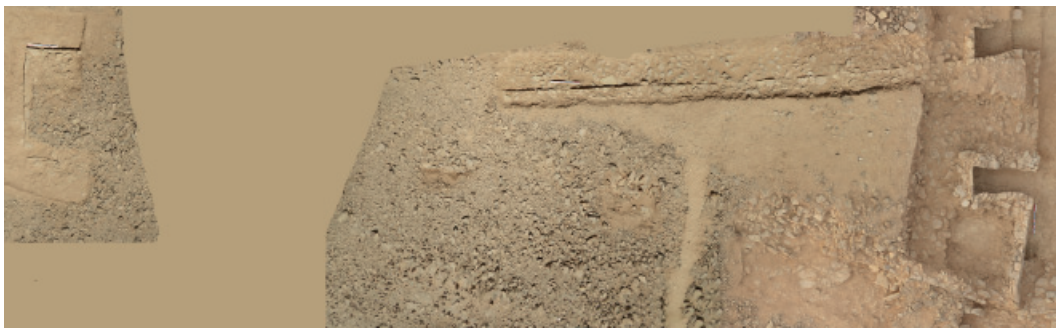
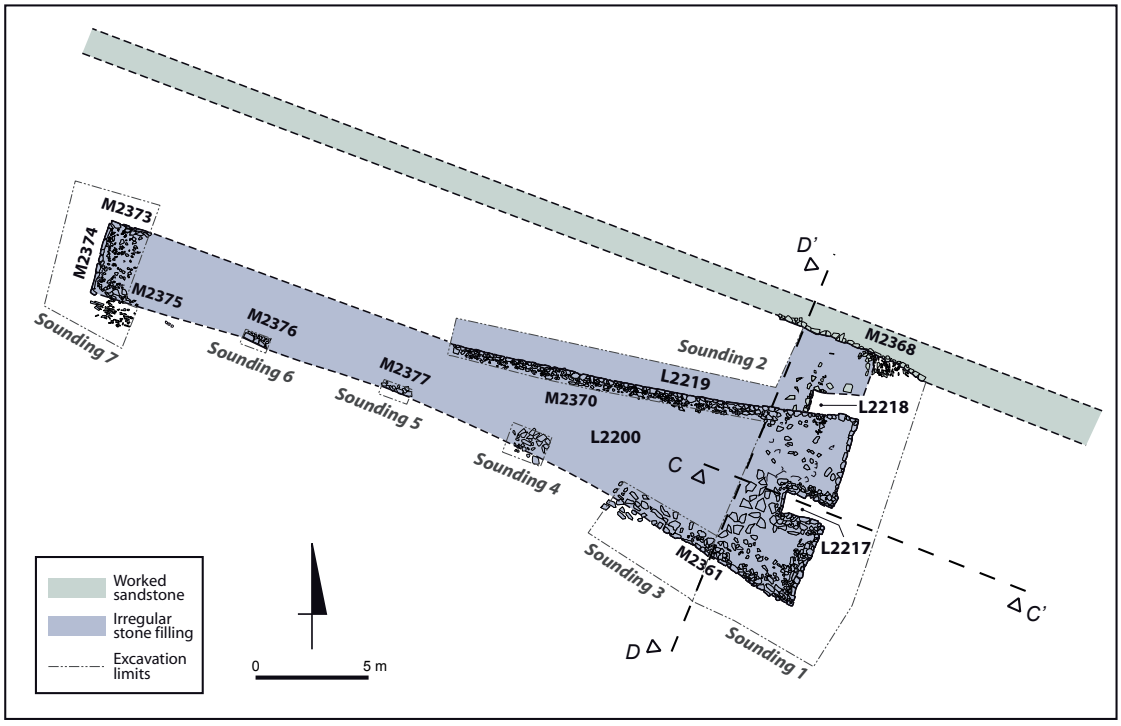


Fig. 3. SD 18 Kite view

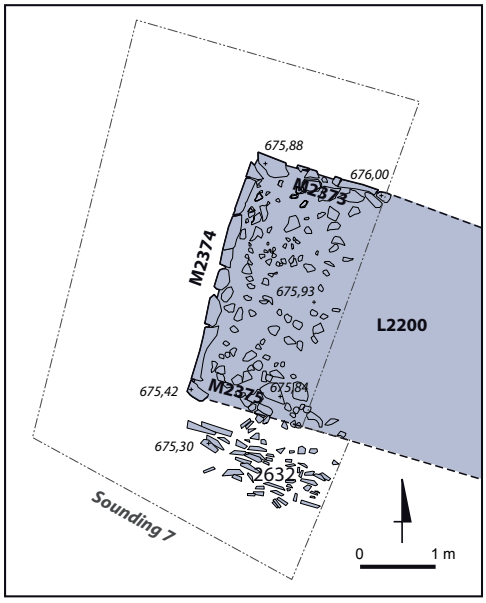
part of the southern edge of the outcrop (SD18), outside enclosure Unit 7, was of particular interest.

A looting pit identified in 2013 [11] drew our attention since many human bones and a carnelian bead were left behind by the looters. We also found a stone masonry wall suggesting the presence of a tomb. However, it turned out to be a more complex structure. It has not been possible to excavate the whole structure, but in order to understand it, we decided to explore it through seven soundings: sounding 1 faces east, the northward sounding 2 is located towards the enclosure (Unit 7). Soundings 3, 4, 5 and 6 are situated on the southern part of L2200. Sounding 7 concerns the western part of the structure (**Fig. 2 and Fig. 3**). Below, we describe the different phases recognized during the excavation.

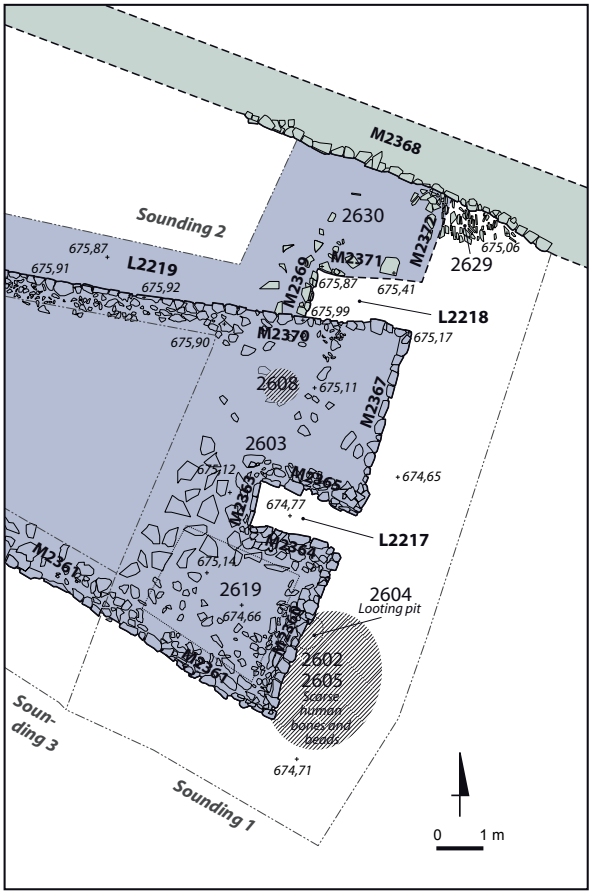
11. Identified at the time as L2020 (Charloux et al. 2016b: 183–226).



SD 18. General plan



SD 18. Detail of Sounding 7



SD 18. Detail of Soundings 1 , 2 and 3

Fig. 2. SD18 general plan

Phase 1

The first identified phase concerns the main structure called L2200. It is a large building of trapezoidal shape oriented east-west and has a total length of 34.30 m. This monument is wider in the east than in the west; the entire eastern façade being 8.70 m long while the western façade is 3.40 m in length. The eastern façade presents something like an inner quadrangular niche, identified as L2217.

The south-eastern façade is made of a long wall built in dry stone masonry of which four different parts have been brought to light: M2375 (S7), M2376 (S6), M2377 (S5) and M2361 (S1 and S3). M2361 is the part of the south wall forming the angle south-east of L2200 (**Fig. 4**). Cleared on a length of 6.88 m, this section of the wall is built directly on the bedrock. The wall, built with irregular stones (the average size is 40 x 20 x 10 cm), is preserved at 75 cm of height, and 11 courses are still standing to the east. A heap of very large stone blocks, identified as US2601, was found at the foot of the wall at this location (**Fig. 5**). Towards the west, the wall rises to keep only one course in place and then disappears. M2377 was cleared for a length of 1.40 m, while M2376, further to the west, was unearthed for a length of 1.30 m. These soundings have allowed us to unearth the highest course (at an altitude of 675.56 m), made of average-sized blocks (20 x 32 x 8 cm). Therefore, we chose to ignore the height of the wall preserved in this location. Located at the south-east corner of L2200, M2375 is preserved only in the form of a stone that marks the return of a wall facing to the east-west towards the corner with wall M2374. South of the negative of M2375, US2632 corresponds to the demolition of this wall. The wall appears visibly collapsed towards the south and consists of irregular flat stones (50 x 10 x 4 cm on average) reversed to the side.

The western façade (S7) is made of a wall M2374 that is 3.40 m long. Also built in dry-stone masonry, four courses have been cleared over a height of 25 cm. The south-east corner appears more levelled with a single preserved course on the same level (**Fig. 6**).

The north façade was uncovered in two parts of the walls called M2373 (S7) and M2370 (S1 and S2). M2373 (**Fig. 7**) was exposed at a length of 1.83 m. The wall, built in dry-stone masonry, is very poorly preserved (with stones that crumble in layers). We uncovered this wall at a height of 0.20 m. It shows two to four courses still in place. A layer of white indurated sediment has been identified at the base of this wall section (US2631). M2370 was revealed for a length of 18.30 m in sounding 2 (**Fig. 8**). This sounding has allowed us to uncover only the highest course of this wall (altitude: 675.87 m). However, in sounding 1, the eastern portion is known in its entire height; in fact, the wall is preserved at 0.70 m, and 14 courses could be identified at its best-preserved parts. The wall appears strongly levelled to the north-eastern corner and has only kept one course (**Fig. 9**).

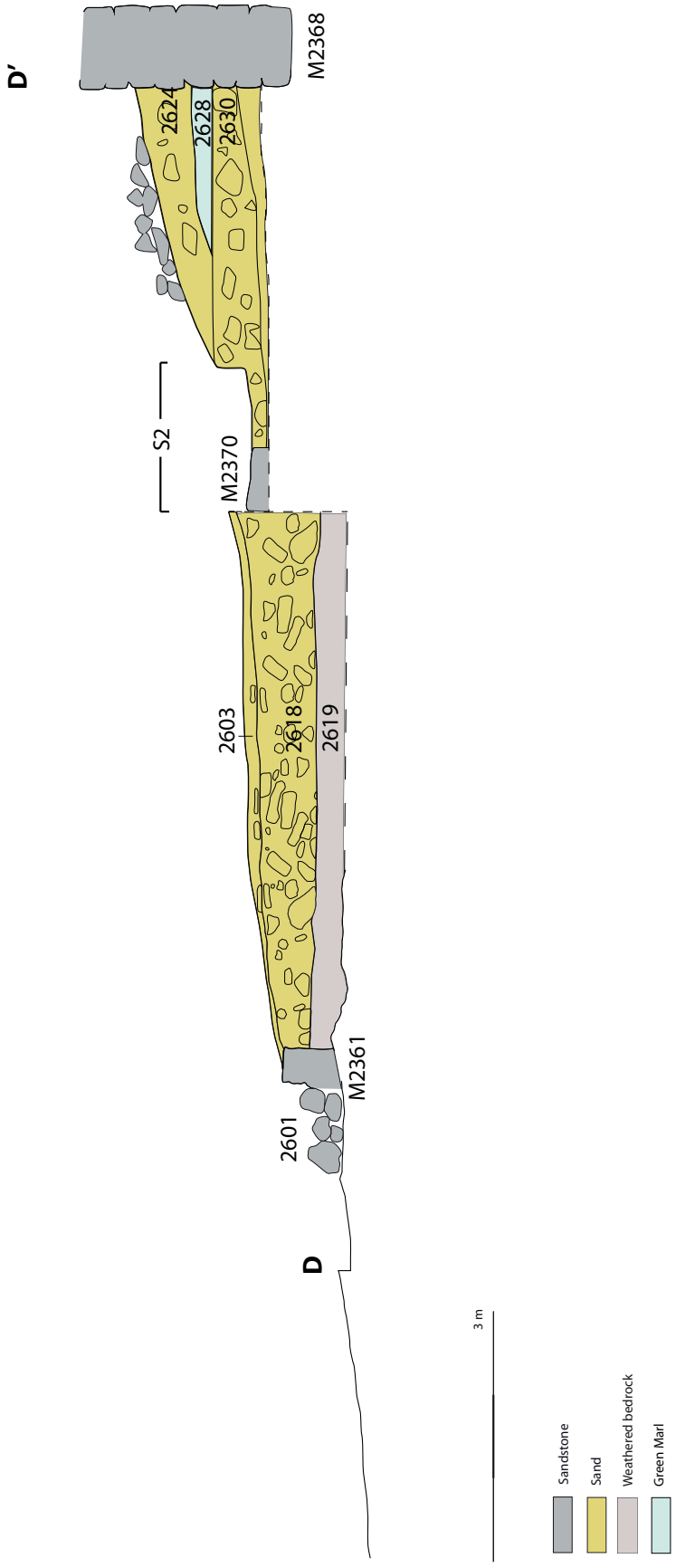


Fig. 5. Section DD'

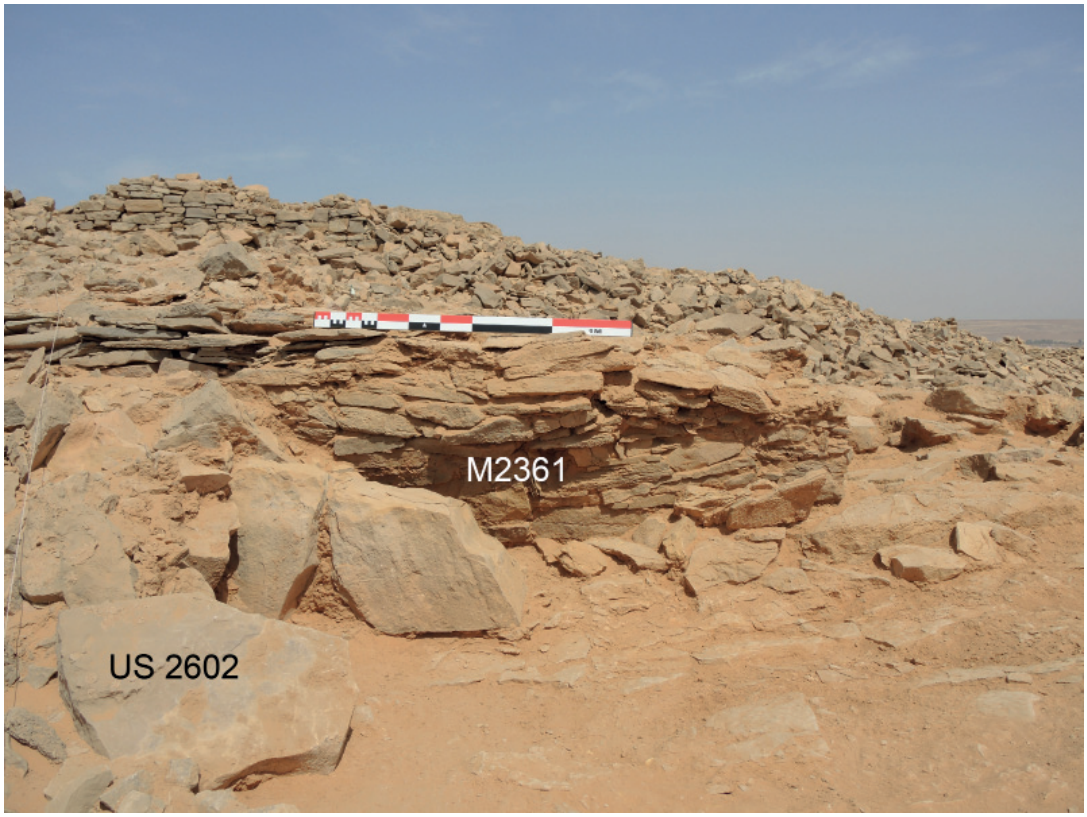


Fig. 4. Sounding 1. M2361 after removing part of US2602



Fig. 6. Sounding 7. View from the north-west



Fig. 7. Sounding 7. M2373 view from the north

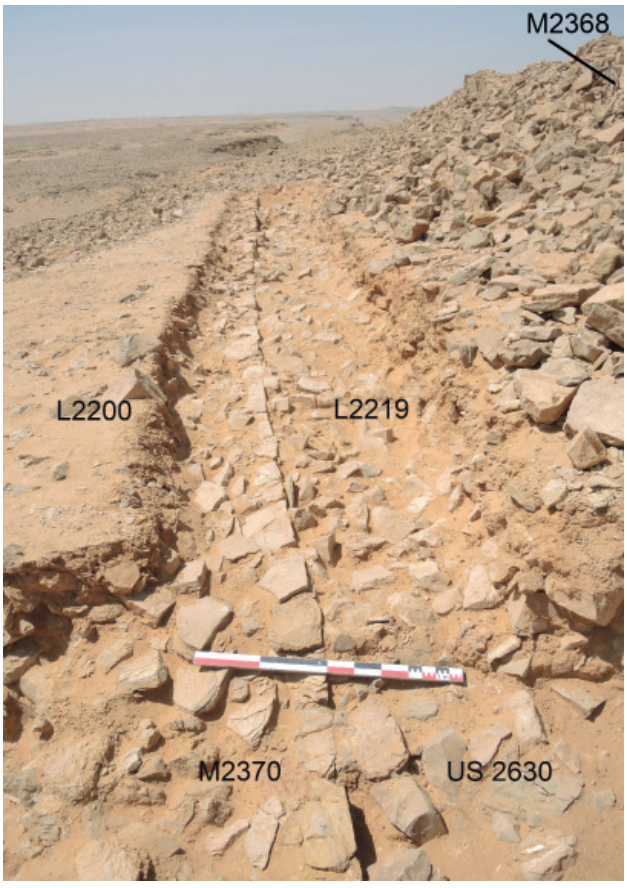


Fig. 8. Sounding 2. Blocking (US 2630) against the M2370. View from the east

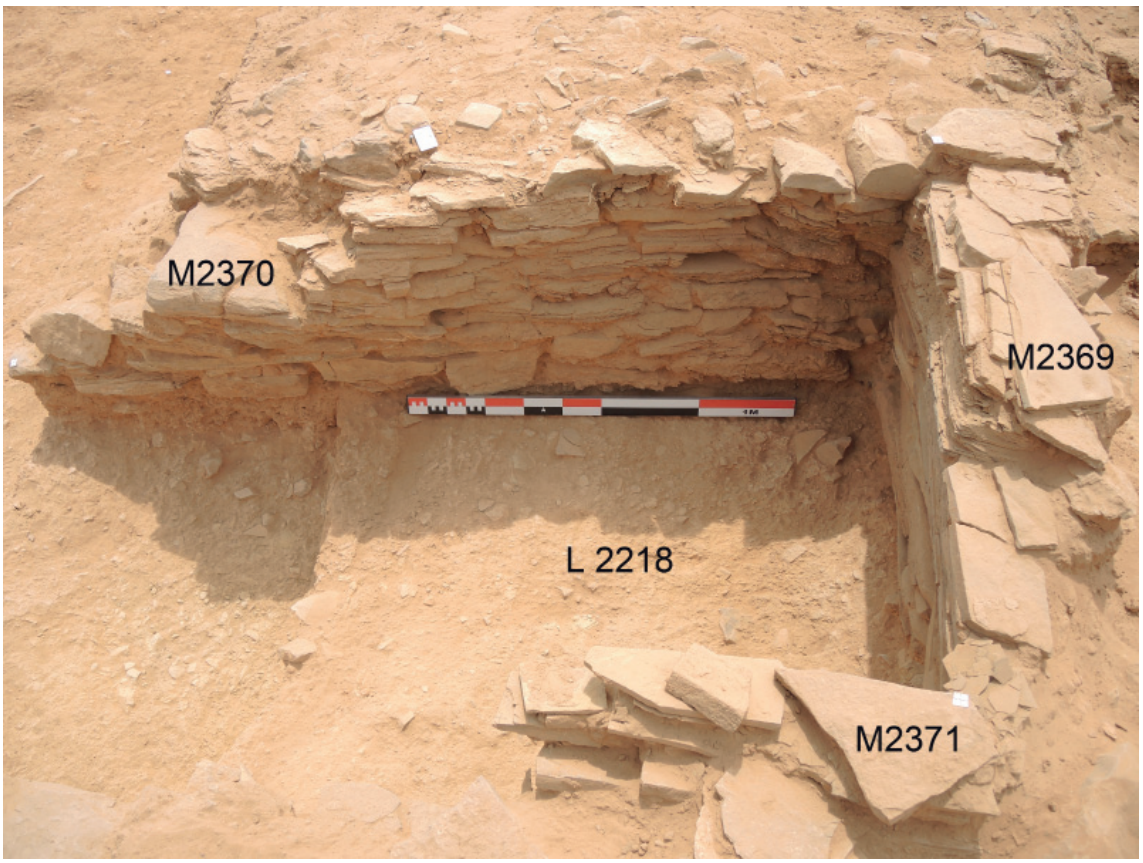


Fig. 9. Sounding 2. L2218. View from the north

The eastern façade, revealed in sounding 1, consists of walls M2360, M2367 and L2217. South wall M2360 is 3.80 m long and up to 0.78 m high. This wall presents a destroyed façade (Fig. 10) thanks to looters who dug a hole of about 3 m in diameter (US2602 – 2607 – 2605 – 2604 – 2612 – 2614). Moreover, it is made of 11 courses of stones (**Fig. 18**).

This wall was built on the bedrock to the south (altitude: 674.69 m) and on a layer of whitish hardened sediment to the north (US2619 inside – US2623 outside of L2200 (**Figs. 5 & 10**). We followed M2367 for a length of 4.20 m. This wall stands preserved on a foundation of stones of average sizes (20 x 34 x 5 cm) that also rests on US2623. Between the two walls, there lies the space L2217, consisting of walls M2363, M2364 and M2365. This space is a niche of irregular quadrangular shape (**Fig. 11**). M2364 (**Fig. 12**), to the south, is 2 m long and preserved on six courses of flat stones, 0.70 m high. To the north, the wall parallel to the latter is M2365 with its 2.20 m length, stands at 0.80 m high over six courses. This wall appears strongly levelled near the angle formed with M2367. Moreover, at its foot, it presents signs of collapse towards the east (US2621). Finally, the wall located to the west, M2363, is only 1 m long and preserved at a height of 80 cm with ten courses of very diverse stones. These walls are built on a layer of white hardened sediment (US 2619 – 2623) (**Fig. 5**).

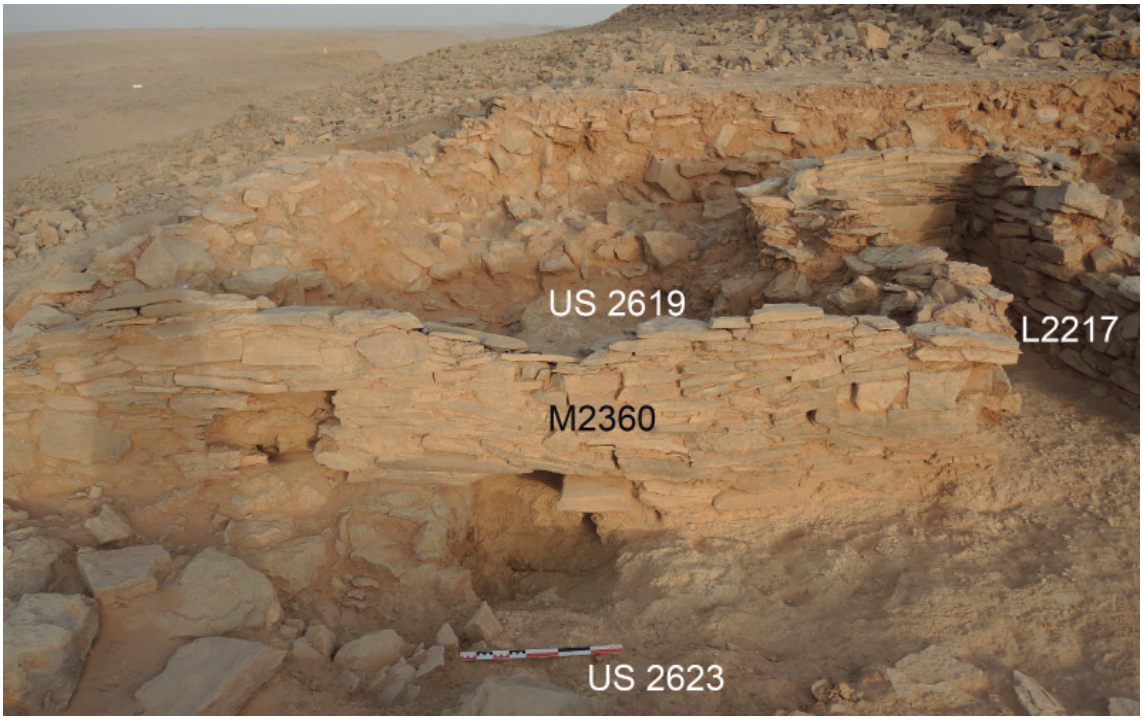


Fig. 10. Sounding 1. Eastern part of L2200. View from the east (see section Fig. 5)



Fig. 11. Sounding 1. L2217

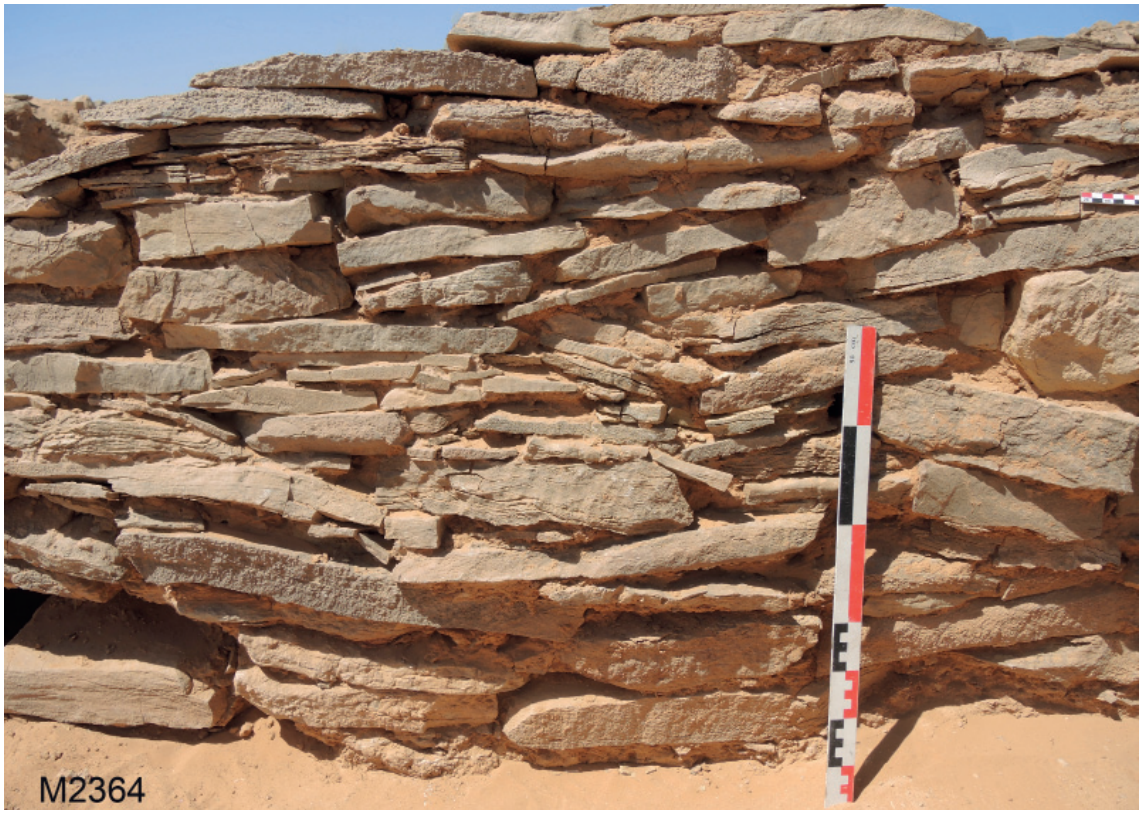


Fig. 12. Sounding 1. Masonry of M2364

Architecture and general construction mode of structure L2200

The architectural ensemble is built on the bedrock and, in some places, on an indurated white sediment layer. This sediment appears to constitute a levelling layer made to uniform the surface and acts as a foundation for constructing a large ensemble on a horizontal plane.

The walls of the entire structure (L2200 and L2217) have only one external facing. The irregular stones used for this construction are arranged to obtain only an external facing (**Fig. 13 and 5**). It seems likely that these stones derive from the natural disintegration of the bedrock, as they do not appear to be squared. Therefore, the entire building is constructed of walls of dry stones masonry and made with a coarse technique. The chaining is simple, and in some places, the walls are even made up of simple stacks of large stones blocked by stones of smaller sizes. For example, this is the case of wall M2363, which is constructed at the base and in the center, with large blocks of stones of an average length of 0.65 m.

Furthermore, slabs of grey stones of low thickness were added and small stones wedged into the spaces at the intersection with walls M2364 and M2365. This construction method gives rise to heterogeneous façades that can present important results (M2361 and M2371) and show the walls' badly coarsly made angles.

During the excavation of sounding 1, the filling of L2200 was uncovered. It was composed of irregular stones mixed with brown sediment (US2603). This filling is uniformly distributed over the whole structure, with sometimes more compact layers (US2611). Subsequently, it is difficult to distinguish between the internal filling of the structure and the demolition that came later and spilt outwards from L2200. A sounding reaching the bedrock was carried out in the south-east corner of the structure to understand its internal organization better. US2603, which is based on US2618 (orange-brown soil with stone blocks), results from this sounding, the latter level being based on US2619 (whitish hardened level). Thus, it seems that L2200 is a full structure, filled with a rubble filling of irregular stones (**Fig 5**).



Fig. 13. Sounding 1. Eastern part of L2200. Kite view

The human remains in the filling of L2200

Some human bones were found at two locations in this stone filling, north of L2217 (US2608 and US2617) (altitude: 675.50 m). We did not recognize any limit of digging, or any particular modification or dipping of the filling stones during our work, which would suggest a subsequent deposit to the internal filling of the structure. The bone remains were crushed by the stone blocks under which they lay and were very poorly preserved and crumbly, making their excavation and sampling a delicate operation.

The identification of the remains, when possible, was carried out on-site. The main reason is that the remains tend to fragment during the sampling, making any later identification impossible. We have identified several long bones (US2608) represented only by portions of the diaphysis with a severely altered cortical surface (femur and radius, as well as three fragments of unidentified diaphyses). The long bones were grouped in a bundle and deposited flat without any observed anatomical connection (**Fig. 14**). The maximum conserved length of the diaphyses is 25 cm. Some of the long bones exhibited axial deformations, attributable to the crushing weight of stones and the sediment that covered them. This suggests that they still carried traces of collagen at the time of their burial since in the opposite case (completely dry bones), they would have fractured. Several other fragments were associated with this deposit: a 10-cm long diaphysis fragment of an undetermined bone, a cranial cap fragment about 10 cm in diameter, a femoral head fragment, a fragment of the vertebral arch, and a foot fragment (tarsus).

On the same level, at about 10 cm, a sea gastropod shell with a perforated apex (Oliva sp. ?) and a pearl in a shell were found (O.2608–1) (**Fig. 15**). Farther north, other long bone fragments and altered coxal bone remains have been recovered, resting horizontally, in association with some caprine tooth fragments (US 2617).

These observations argue in favour of one or more intentional bone deposits already dislocated but not fully mineralized at a time when structure L2200 was not completely filled. The poor state of conservation of human remains has limited their identification; at least one individual is represented. The size of the bones found corresponds to an adult skeleton.

However, the absence of the extremities of the long bones does not make it possible to ascertain the state of synostosis of the epiphyses: one can therefore only assert that at least one individual over the age of 15 is represented.

The presence of archaeological features in the same area as the bones may suggest a deposit for funerary purposes, although the specific terms of this deposit remain enigmatic.

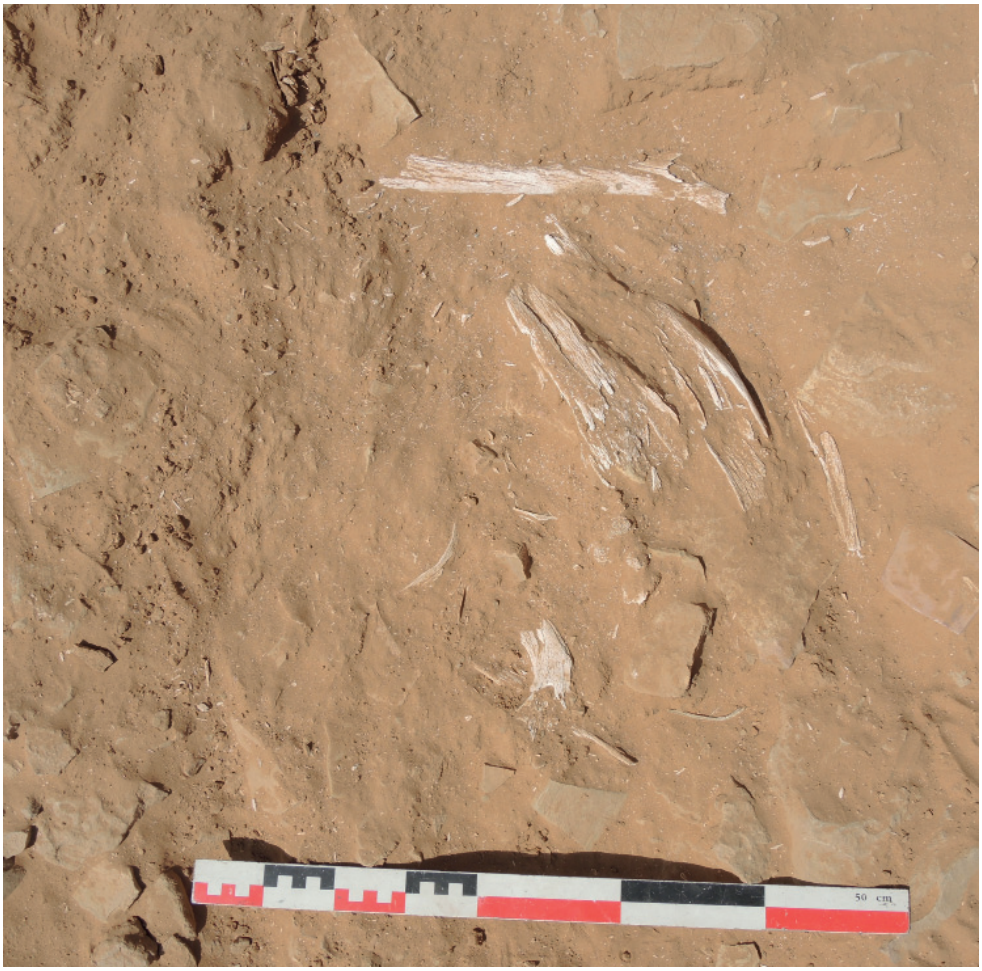


Fig. 14. US2608



Fig. 15. Perforated shell O.2608. 1, pin: 2615–1 and O.2606–1 beads from US 2605 and 2606

Phase 2

L2219 is an extension of the first structure bordering M2370. It extends northwards, and we note that the construction techniques are the same as in Phase 1. On the eastern façade (**Fig. 16**), there is also a niche (L2218). It is composed of wall M2369, leaning against M2370, and M2371. These walls have a masonry similar to that of the L2217 of Phase 1: it is a dry stone masonry, rather rough but with a structural consistency. M2369 (north-south wall) has retained 14 courses (H. 0.70 m) of different stone modules of varying colors. At the upper level, it is made of shallowed slabs (shale) (**Fig. 17**). This wall is attached and chained to M2371 (oriented east-west). Moreover, it leans strongly towards the east; there are only one to two foundation blocks of whitish sandstone, 25 x 20 cm in size (altitude: 674.40 m). Some stones laid flat near the rampart might correspond to its north-south return (M2372). In the east, we can observe many stacked and collapsed stones, (US2629) which undoubtedly correspond to the collapse of wall M2372.

It is not known how far M2372 continues northward beyond Unit 7 of the rampart (M2368). The absence of chaining between wall M2369 and wall M2370 clearly indicates that L2219 is a later addition to structure L2200. The walls of locus L2219 rest, as in Phase 1, on a white indurated substratum (US2623). It is found at an altitude of 675.29 m. However, during the excavation, the bedrock was not reached everywhere.

Like the monument in Phase 1, the external faces of M2369-M2371 and M2372 retain rubble filling of irregular stones and blocks 0.20-0.30 m long. This very dense filling (US2630) in windblown sand rests against M2370 (Fig. 8), (Fig. 5). In sounding 2, this blocking (US2630) can be tracked for nearly 15 m, but it has not been identified to the west in sounding 7. We do not know the total area of structure L2219.

Phase 3

This phase corresponds to a stage of destruction. Identified in sounding 1, it is manifested by sliding of blocks and rubble mixed with sandy sediment towards the east (**Fig. 18**). The fillings of niches L2217 and L2218 are quite different from each other. No stratigraphic index determines whether the phases of the destruction of the two sites and if the filling of the two niches are contemporary or not.

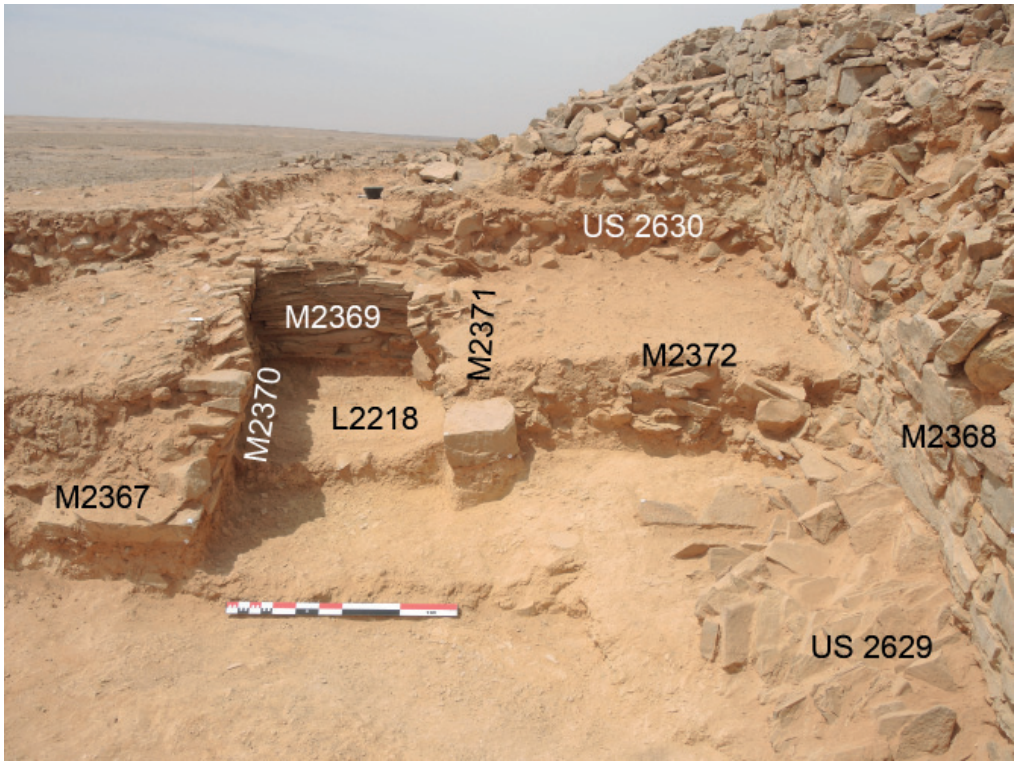


Fig. 16. Sounding 2. View from the east



Fig. 17. Sounding 2. Structure L2218. View from the east

Niche L2217

Different sediment levels have been identified, filling space L2217 (US2606, US2613, US2615, US2616, US2620 and US2622). The sediments are sealed by blocks of collapsed stones (US2613) (**Fig. 11**). The US2616 (max alt. 675.05 m) is a level of burnt sand, stone, pockets of coal and ashes (P.2616, see C. Bouchaud in this volume). This layer contained burnt and unburned gastropods (Melanopsidae) and gravels with a smooth and shiny surface.1 We also observed mica chips and some faunal bones. Two bone pins (O.2606–1) (O.2615–1) were also found at 674.93 m altitude (**Fig. 15**). US2620 lies flat underneath block fragments. It is a loose sandy level more organic than the upper one, containing particular remains of pupae and pellets of silt. At the bottom, four stones are stuck in the white substratum (US 2623), but it seems unlikely that this is intentional (**Fig. 11**). Moreover, no closure system to separate this space from the outside has been demonstrated. Subsequently, it seems that the niche was open on the outside, fully oriented to the east.

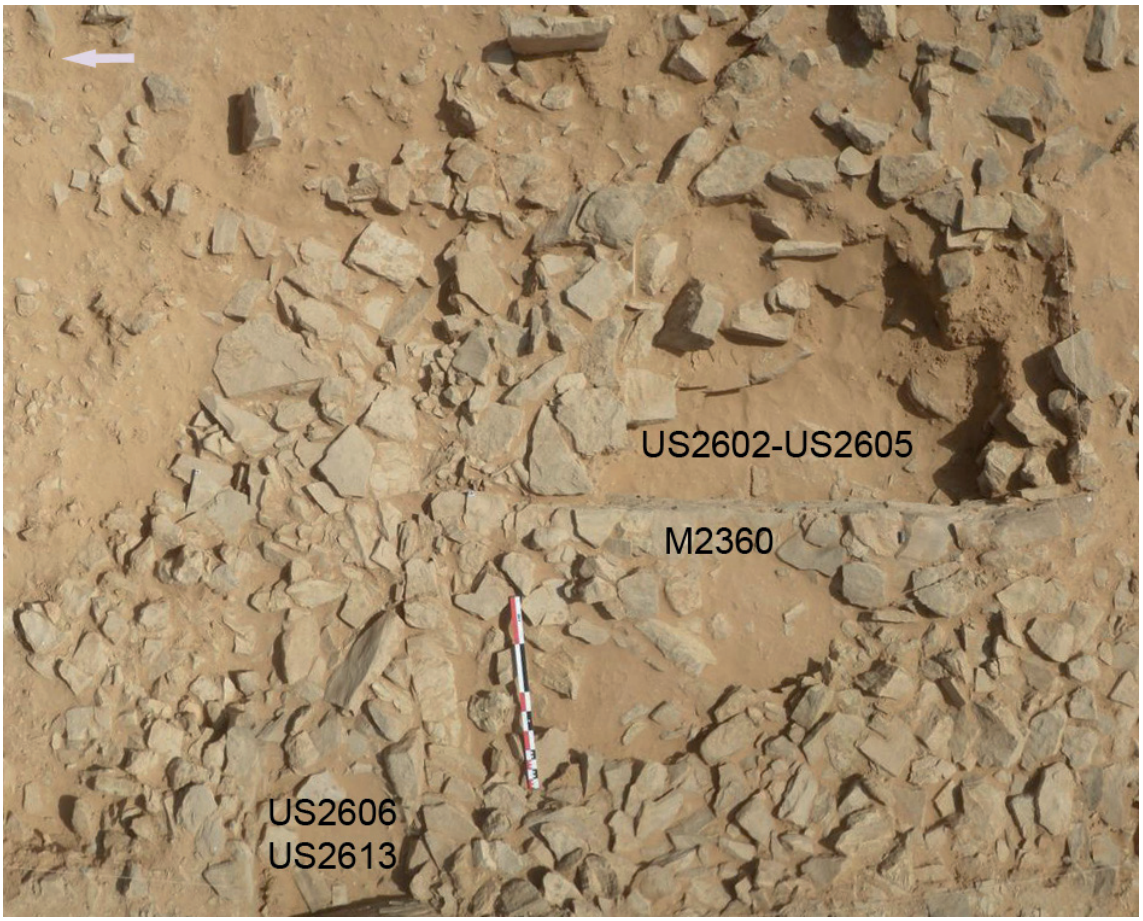


Fig. 18. Sounding 1. Top view

Niche L2218

The filling of space L2218, constituted by US2625–2626 and 2627, is characterized by a sandy yellow to orange soil sealed by blocks from the demolition. Unlike the filling of locus L2217, we did not observe a carbonaceous or organic level or any faunal bones (**Fig. 19**). Nevertheless, some flint tools (O.2627–1 and –2) document human activity in this locus.

To the north, part of rampart Unit 7 (M2368) is built on a collapsed wall (US2629-M2372) (**Fig. 16**). Before this, a layer of preparation consisting of green marl (US2625) based on US2629, has been deposited. This foundation technique was observed in other soundings in the oasis (see SD6, SD9 [12] and SD12 [13]). The foundations of the U7 rampart lie at an altitude of 675.05 m, and the last preserved foundation reaches an altitude of 677.70 m. We do not know the original height of enclosure M2368, the upper levels of which are partially destroyed as documented by the accumulation of collapsed stone blocks on both sides of the rampart (US 2624) (**Figs. 13 and 20**).

Only the relative chronology allows us to confirm the posteriority of the rampart in relation to the structures presented above. No archaeological features have been found in the area to date this construction. We can also note the difference in treatment of blocks used for the rampart and those of structures L2200 and L2219. The segment M2368 consists of blocks of grey to green sandstone, some of which are carefully shaped (**Fig. 21**). At this point, we want to emphasize the use of the pseudo-isodomic masonry as on the other segments of the rampart. Observations recently made on other parts of the rampart (SD15)[14] have made it possible to compare the different construction techniques and will probably provide elements of relative chronology necessary for the comprehension.

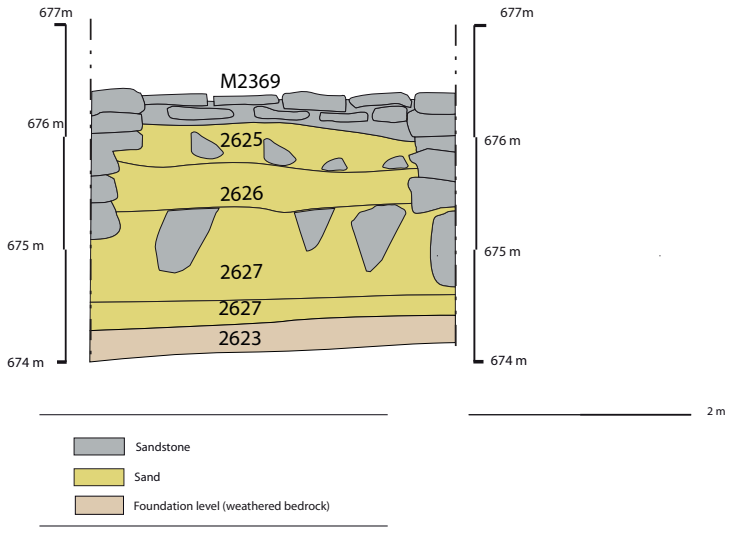


Fig. 19. Section L2218

12. Lanoë, SD9: 305–321 in Charloux et al. 2018a (*Dûma* 3).
13. Cotty, SD 12: 167–179 in Charloux et al. 2018c (*Dûma 4*).
14. See Marquaire SD15 in this volume.



Fig. 20. M2368 and its demolition (US2624)



Fig. 21. Sounding 2. M2368 and US2629. View from the south

Human remains and the beads, east of M2360

To the east of wall M2360, a looting hole spotted in 2013 (US2604) attracted our attention at the beginning of the excavation. Some bone fragments and a carnelian bead appeared in the sediment pile misplaced by the looters (US2602, 2605). The excavation had altered the lower courses of wall M2360 (**Fig. 10**), and it appeared that the sediment originated from the inside of structure L2200, a hypothesis that subsequently proved false.

The clearing of looted space has revealed many fragmented and scattered human remains without any apparent organization. Its large part had oblique dips, as well as several stone and shell beads (O.2605–1 to –12) (**Fig. 22**). This material was mixed with a loose, orange-brown, windblown sand sediment. Moreover, it also contained many large irregular stones to the south and east of the structure, similar to those from the demolition of structure L2200.



Fig. 22. Beads. O.2605-1 to O.2605-12

Preliminary anthropological study

The anthropological study of the exhumed bones, carried out in the laboratory during the 2015 campaign, made it possible to determine the minimum number of individuals represented in this assemblage as well as their age. In addition to that, the osteological profile (represented bones) provided information about the constitution of this assemblage and the disturbances it has undergone.

2197 indeterminate fragments or splinters (cranial cap, long bone diaphysis, or spongy bone fragments) were collected, as well as 450 identified bone fragments. The MNI (minimal number of individuals) is 5: four adults and one child (1–4 years old) are represented. The MNI structure reveals an imbalance between large and small bones, indicating an open system,[15] i.e. with bone inlets and/or outlets (**Fig. 23**). The presence of bone fragments and beads in different parts of the stratigraphy and with various dips indicates that they are in a secondary position. We do not know where they come from (the primary deposit) and we can only assume they are from a funerary structure located nearby and disrupted by at least one episode of looting. What is suggested by the presence of small bones and beads is that they probably escaped the misplacement over a longer distance. The presence of a stone tomb (L2201), a few meters to the east, whose circular shape clearly evokes the funerary monuments of the Middle Holocene in the region, reinforces this hypothesis. The bone remains, and the beads could thus come from structure L2201 itself, an emptying/pillage of it, or another grave closer to the place of discovery of the remains, of which there are no visible architectural features. In any case, the state of conservation of the bones is rather decent despite their fragmentation. This suggests that they have not been exposed to climatic agents (weathering). Finally, it excludes the possibility that they could have been placed in the open in front of wall M2360.

Conclusion

The function of structure L2200 remains uncertain. The first days of the excavation we assumed that this structure was a protohistoric tomb. In fact, several funerary monuments occupy the plateau overlooking the wadis, and several tombs have been spotted on the promontory of Rijm al-Burg.[16] Human remains and the bead extracted from a looting pit cutting through wall M2360 only confirmed this hypothesis. It finally turned out that the material came from outside structure L2200; since it proved difficult to connect the material found in the looting earth with the structure.

15. Gallay & Chaix 1984.
16. See Chevalier (Stone structures) in this volume.

On the other hand, the discovery of human remains laid out flat in a bundle (US2608 and 2617) in the filling of structure L2200 suggests a possible funerary purpose at some point of its use. Apart from these bone remains and some associated small finds, there are few elements that allow the attribution of a specific function to this structure.

From an architectural standpoint, structure L2200 finds parallels with a type of protohistoric tombs already observed in Arabia, the so-called "cuneiform" tombs. This type of tomb is found throughout the Arabian Peninsula, both in the south (Yemen), in central and western Saudi Arabia, and to a lesser extent in the north.[17] A number of these structures were also reviewed in the survey reports compiled by the Saudis in the 1970s and the 1980s.[18]

The cuneiform tombs are generally composed of a triangular part extended by a wall of stones up to several tens of meters. The funerary chamber is typically located in the triangular part. However, some tombs can also take the shape of very elongated trapeziums and have bigger dimension. None of these structures has yet been the subject of real research programs until now: their internal organization remains unknown. The structure of the Rijm al-Burj could also resemble the quadrangular or pseudo-trapezoidal platforms identified in the Levant, in the Negev. Some examples are also attested in the Arabian Peninsula.[19] These structures are also solid and generally of modest size, but they can reach 30 m, as at some Negev sites (from the end of the 3rd millennium B.C. [20]). Although these platforms seem to be associated with tumuli, their function remains unknown. The presence of an niche on the largest of the sides of the trapezium observed at Dûma is attested neither on the cuneiform tombs nor the platforms known hitherto. This niche and the subsequent construction of a second structure, also comprising an niche, raise the question of the utility of such arrangements. Did they have a simple ornamental purpose? Or did they define a dedicated space? Indeed, the artefacts and the ash layers discovered in these niches hint at human activity. Our next field campaign should make it possible to understand the plan of the second platform better - in particular its extension to the north.

The other point that is currently difficult to clarify is the relationship between structure L2200 and the tomb possibly present in the vicinity. It is feasible that the bone remains and beads found to the east of wall M2360 derive from it, and as one or more episodes of plunder have disrupted them. For the time being, there is no dateable feature to determine whether the structures are contemporary or if their use is spaced in time. At the most, it can be said that the assemblage is anterior to the demolition of structures L2200 and L2219 since the demolition layer covers the entire surface concerned. Several human bone samples were taken during this campaign for radiocarbon dating.[21]

17. Chevalier 2015.
18. Zarins et al. 1979: pl.7–8; Zarins et al. 1980: pl.5; Ingraham et al. 1981 and Zarins et al. 1981: pl.11 and 56; Gilmore et al. 1982: pl. 6 and 8; Hester 1984: pl.92; Hamud 2000: pl. 45.
19. Steimer 2004: 90; for an example see Kharg (Zarins et al. 1979: Pl 12.12).
20. Haiman 1996: 6–8.
21. The samples were transferred to A. Zazzo (MNHN, CNRS UMR 7209) and were integrated into a series of AMS datations on bioapatite, covering all funerary structures explored at Duma during the 2015 campaign (application submitted by Olivia Munoz and Antoine Zazzo at ARTEMIS, September 2015). See Munoz et al. 2020.

Hopefully, the results will clarify the chronological relationship between the various funerary structures identified (L2200, the possibly violated tomb, and the tombs identified during the surveys on the promontory and in the vicinity of Dûma); eventually, this series of dates should contribute to the establishment of a chronological framework for the different types of funerary monuments of North Arabia.

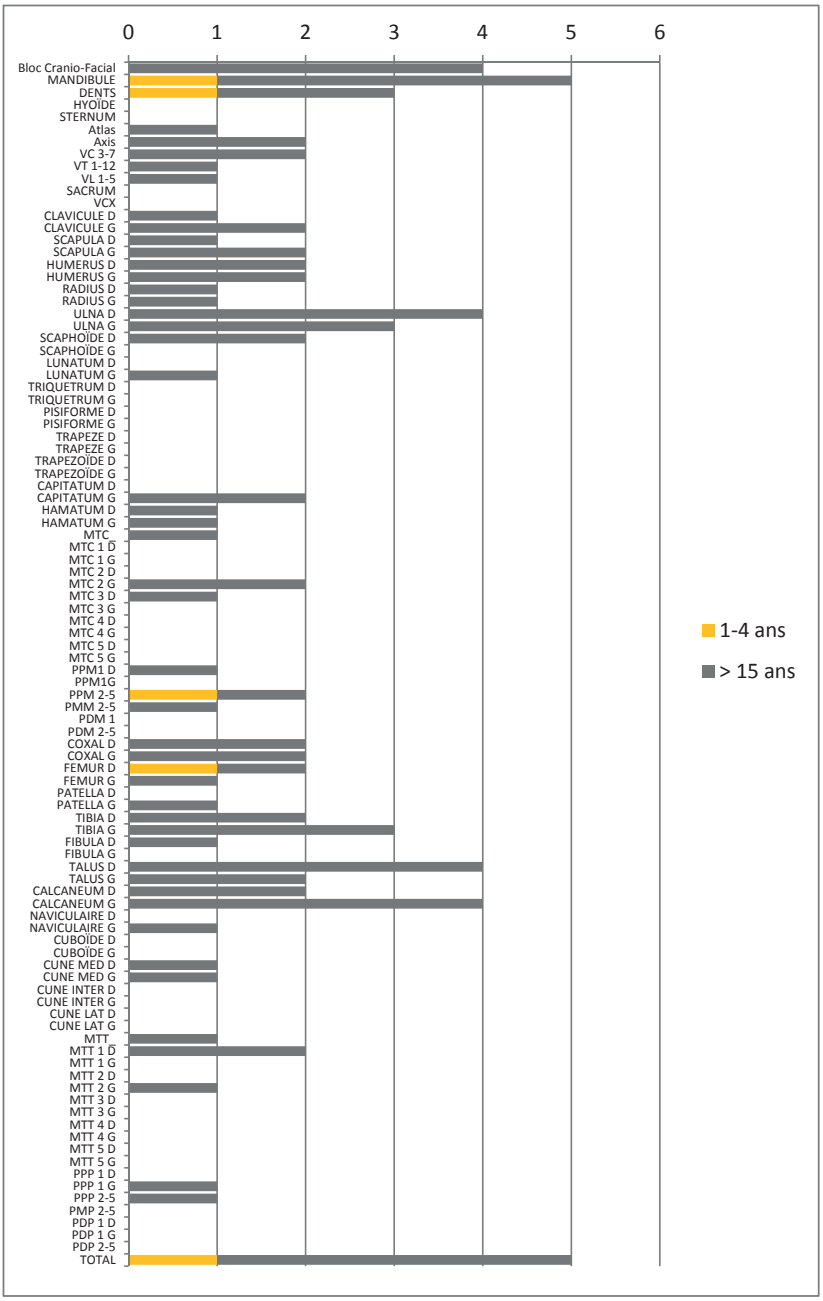


Fig. 23. SD18. Anthropological study table

Sounding 19. A Staircase at the Rear of Rampart Unit 4

Thamer Al-Malki, Daraan Al-Qahtani & Ayidh Al-Qahtani [1]
assisted by Guillaume Charloux & Romain Mensan

As part of our project in 2010, the joint Saudi-French component of the team started excavations in the western area (also called Sector C) of the oasis of Dûmat al-Jandal. The enclosure wall surrounding this area comprises nine units (1-9) which were described in the 2010 report (*Dûma* 1).

Sounding 19 was opened this year in the center of unit 4, at the edge of the northern limestone plateau. This spot was chosen in accordance with Dr Guillaume Charloux at the location of a wide stone structure (inner bastion?) implemented against the southern face of the enclosure.

This report aims at describing unearthed structures and excavated layers (**Fig. 1**).

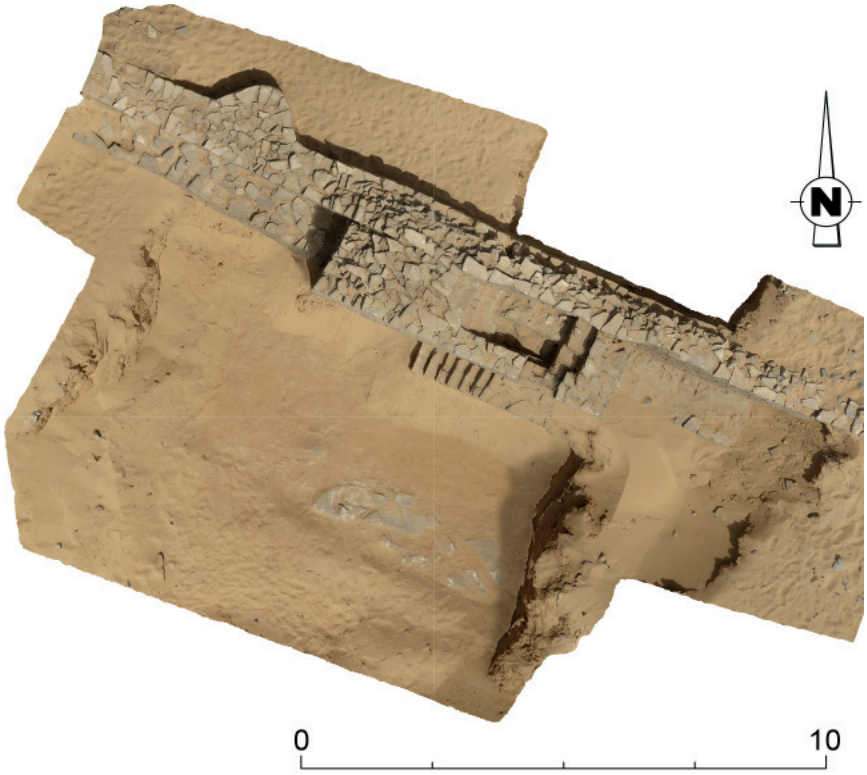


Fig. 1.
Orthophotography of sounding 19 (DJ2016a1751B).

1. Saudi Commission for Tourism and National Heritage SCTH, Riyadh

Phase 1

The east-west oriented wall M2601 (unit 4), nearly 5 m high, is built of finely-cut limestone blocks whose thickness varies from 0.50 to 0.70 m.

A semi-circular buttress M2602, supporting and retaining the main enclosure from outside (to the north), is made of small slabs connected with wall M2601.

Parallel and abutting to M2601 stands M2607, which is a 0.97 m wide wall made of courses of identical stones. The upper mudbrick elevation of wall M2607 is badly preserved in this area.



Fig. 2. The west side of the U-shaped construction L2402 linked to the main enclosure M2601 and to wall M2607 (DJ2015a1051B).

Phase 2

To the south, a large U-shaped structure numbered L2402 made of three walls abuts to the enclosure M2601 and wall M2607. Its western side is constituted by wall M2605 and its eastern side by wall M2604 (with a thickness of 0.68 m and a length of 1.62 m). Both walls are linked with the east-west wall M2603-M2604 (thickness of 0.52 m and a length of 4.26 m), which lies parallel to M2601.

The western wall M2605 of the rectangular structure is north-south oriented; with a length of 1.52 m, made of slab courses and connected to M2604.

The east facing of structure L2402 is made of slab courses marked by rectangular limestone blocks positioned obliquely between M2064/M2605 and M2061, therefore linking both walls. Therefore, the U-shaped construction under investigation was annexed to the main enclosure M2601 and to wall M2607 in a second stage (**Fig. 3**).

A narrow door L2403, installed inside L2402, separates M2603 from M2604, although this distinction between walls observed from the top is virtual since the lower part is a unique wall.



Fig. 3. The southern side of Unit 4 before excavation (DJ2015a0358B).

Inside structure L2402, we observed eight stone steps leading from door L2403 to the destroyed surface of structure L2402, probably built in order to reach the circulation level of the mudbrick elevation of wall M2607.

Front of this staircase, a six-stepped stone structure L2404 was added against the southern face of L2402 (**Fig. 4**).

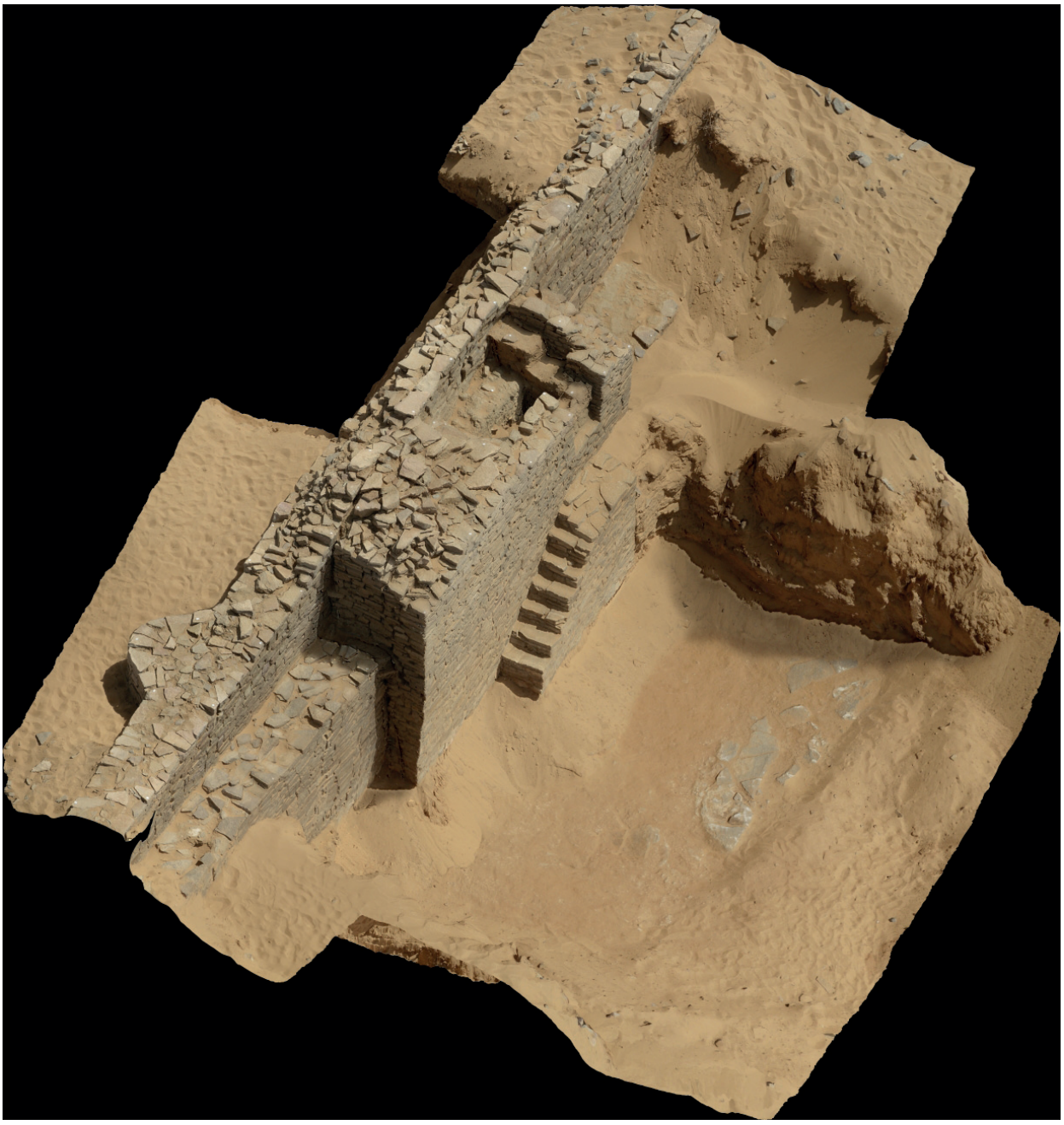


Fig. 4. Oblique view of sounding 19 (orthophoto, DJ2015a1788B).

Phase 3

The narrow gate L2403, observed between M2603 and M2604 in L2402, was closed during an abandonment phase by a mudbrick wall numbered M2606. This wall is made of two mudbrick courses (width 0.35 m and length 0.82 m). The upper course is dark brown, while underneath is the lower course in light brown color numbered M2608 (**Fig. 5**).

Inside the structure, only scattered little fragments of pottery were found, without any other archaeological material. The structure was filled with successive layers of aeolian sands and mudbrick collapse accumulated over time (layers 2801 and 2802) (**Fig. 6**).



Fig. 5. The blocked doorway L2403 (DJ2015a0349B).

To the south of the construction were scattered stones of different size that might have fallen from the original room.

Sounding excavated on the northern and southern sides of M2601 / unit 4 (**Fig. 7**) revealed a very similar stratigraphy of successive aeolian sand layers and mudbrick collapse.

In the sounding made north of wall M2601, we noticed three layers:

The first layer 2801 (covering the whole area) is made of aeolian orange-tinged yellow sands mixed with stones fallen from the rampart; no archaeological remains were found except a few pottery fragments.

The second layer 2802 is hard and in light-greenish brown color, comprising bricks mixed with pebbles, stones and twigs.

Adjacent to the main enclosure is the third layer 2803, floored with collapsed mudbricks. It is bright brown, mixed with little pieces of limestone. Closer to M2602, there are a few heaps of fallen mudbricks, probably coming from the wall M2607. To the north of the main enclosure lies a hard mudbrick layer mixed with stones and some pottery sherds.

This sand and mudbrick filling probably come from to the collapse of the area or its abandonment.



Fig. 6. Steps and filling inside structure L2402 (DJ2015a1040B).



Fig. 7. The northern side of unit 4 of the enclosure (DJ2015a0340B).

Synthesis

The excavations unravelled a large rectangular U-shaped structure, probably a staircase leading to the enclosure. It may also have been a watchtower.

Another mudbrick structure was possibly built on this staicase since we found some mudbrick fragments on top of it.

Little pottery sherds permitting further dating were found scattered over and within the layers. Finally, we hope to be able to date the blocking of door L2403.

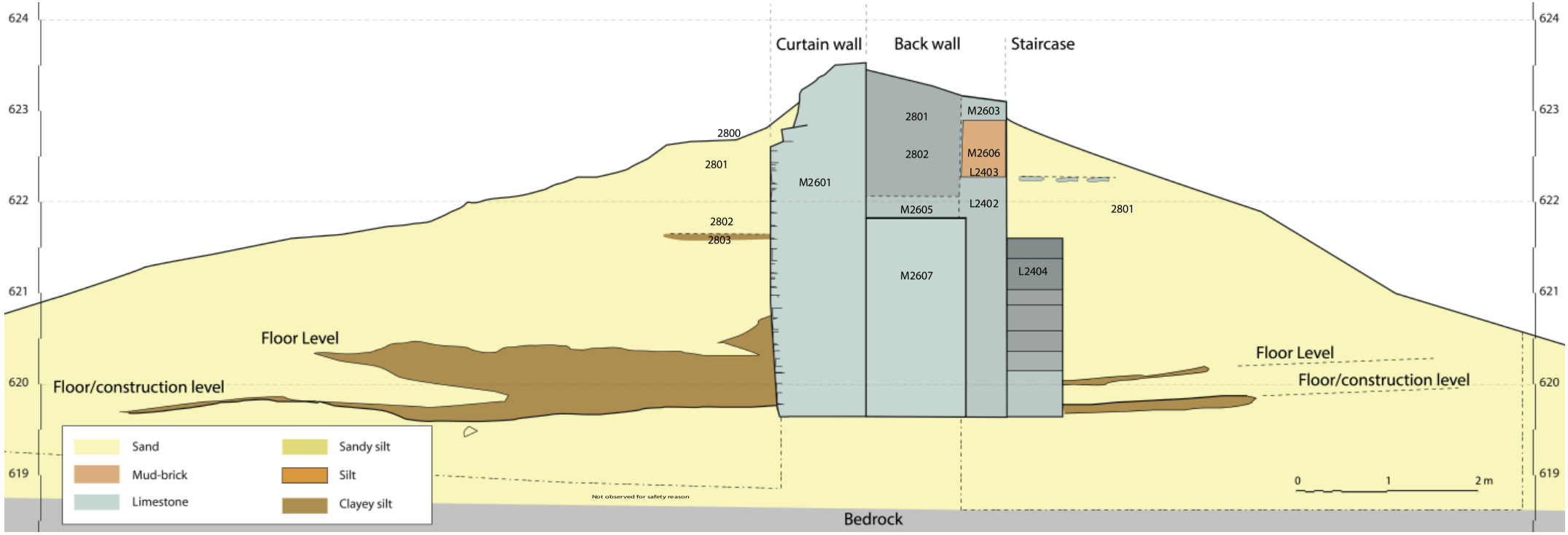


Fig. 8. Eastern section; SD19

Dûmat al-Jandal 2015. Archaeobotanical Report

Charlène Bouchaud [1]

Introduction

The fieldwork took place from March 11 to March 20, 2015. It represented a second archaeobotanical campaign at Dûmat al-Jandal[2] and was founded by the EmOAD project (Emergence of the desert Arabian Oasis. At the origin of the subsistence and production economies in an arid environment. Idex SUPER-Convergence, dir. J. Schiettecatte). The research goals of the archaeobotanical analysis in Dûmat al-Jandal are as follows: Firstly, it studies the plant economy of the site in order to reconstruct the agro-system dynamics and fuel management practices, the different plant uses and processes in domestic, cultic and funerary contexts. Secondly, it looks at the paleo-environmental dynamics through times. This two-fold study is part of a wider archaeobotanical project, including Madâ'in Sâlih (Hegra) and al-Kharj (al-Yamâma) that will contribute to a better understanding of the origin and development of the oasis agrobiodiversity and its impact on the environmental evolution.

The studied material is composed of all the plant macro-remains preserved within the sediment excavated on the archaeological site, i.e., on the one hand, the seeds, fruits and other non-woody remains, such as leaves and roots (carpological remains), and on the second hand, charcoal fragments (anthracological remains). Work during the field season consisted mainly of processing the soil samples (from the 2012-2015 archaeological seasons) to extract plant macro-remains from the sediment before exporting them to France, where they will be analyzed in the archaeobotanical laboratory of the National Museum of Natural History (UMR 7209). The study of the carpological remains will be used mostly for reconstructing the agrosystem evolution and the natural herbaceous vegetation. In contrast, the charcoal analysis will contribute to our knowledge of fuel selection and a paleo-environmental reconstruction.

1. Researcher CNRS, UMR 7209 – Archéozoologie, archéobotanique. Sociétés, pratiques, environnements, Muséum Nationonal d'Histoire Naturelle.

2. The first archaeobotanical work was carried out in 2013 and focused on the analysis of the plant macro-remains found during the excavation (2012-2013) of the triclinium L2017 in sector SD4 (Charloux, Bouchaud et al. 2016a, Charloux et al. 2016b).

Methodology

Sampling strategy

The sampling strategy was defined in order to assess the preservation of the plant material in the different sectors excavated and to evaluate its potential in terms of richness and biological diversity. In agreement with the archaeological team, small samples of sediment (0.1–10 litres) were randomly taken in various layers mostly composed of occupation layers, pit fillings, fireplaces, ovens (tannur), ashy deposits, and other organic layers (**Table 1**). We assume that the assemblage of plant macro-remains preserved in these samples is mainly related to human activities and selection processes. Thus, their study will offer mainly paleo-ethnobotanical outcomes before being used for paleo-environmental exploration.[3]

Two different layers (US 2186 and 2226) – already used in a plant macro-remains analysis – were sampled for phytoliths (a mineral concretion produced by plants) to compare the results obtained through the two approaches.

Forty-five samples, corresponding to 33 different excavation units (loci) excavated by archaeologists during the present and last campaigns (2011-2015) and representing a total amount of 254.8 litres of sediment, were processed. Nine samples came from the triclinium (SD4), nine from the vast terraced structure (SD6) on the slope of the valley, two from the ancient garden located in the valley, at the bottom of the sandstone outcrop called Rijm al-Burj (SD8), five from SD12, six from the sounding situated at the foot of the western part of the ancient enclosure wall (SD13), seven from the sounding on the slope of the valley (SD14b), one from the vast hydraulic structures (SD17), three from the southern part of the hill (SD18) and one from the new sector D, which corresponds to a small sounding located in the modern oasis in the valley.

As the archaeological work is still in progress, the samples cannot be chronologically classified, and they are being considered as a whole.

Sample processing

The sediment samples were first dry-sieved on a column of geological sieves (2 mm and 0.5 mm mesh sizes)[4].

The largest pieces of material (2 mm fractions) were hand-sorted in the field to separate charcoal fragments, seeds, fruits, and other types of organic material (like dung, or remains of food preparation), bones (macro and micro-fauna) and archaeological artefacts (such as pottery fragments)[5]. The refuses of the 0.5 mm fraction were sometimes hand-floated in order to decrease the time consumed by sorting (Table 1).

3. Théry-Parisot et al. 2010.
4. Three samples were not processed and directly examined with a binocular microscope (L.2006, 2219, 2186–3).
5. Many thanks to Ariane Thomas and Hervé Monchot who spent a part of their precious time to sort the sieve refuses.

The flottation process consisted of pouring the sediment slowly in a bucket partly filled with water. The charred elements, lower in density than water, floated on the surface and were collected thanks to a flexible sieve (0.3 mm mesh size).

The latter was then left to dry in the shade (to avoid any fragmentation of the charred elements during the drying stage).

All the 2 mm fractions were sorted during the fieldwork. The 0.5 mm fractions were partly sorted using a binocular field microscope. Charcoal was only sorted to the 2 mm fraction, except for one sample (2221) because of the high concentration of small twigs in the 0.5 mm fraction.

3. Identification

As is usual in the Arabian Peninsula, the plant material is only preserved by charring. No mineralized or desiccated plant items were found.

The carpological remains coming from the thin (0.5 mm), and heavy (2 mm) fractions could be identified thanks to a binocular microscope (magnification: 8 to 60) by the observation of morphological criteria; notably shape, size, the epidermis ornamentation or hilum position, and the comparison with modern material[6]. Some preliminary identification was made during the campaign, but certain specimen could not be identified or counted.

Charcoal coming from the 2 mm fraction should be identified with a high-power microscope with incident light (not present on the field). The analysis requires that each fragment of selected charcoal be broken into three sections (transversal, tangential, radial). The identification is based on the observation of the cell structure (the number of vessels, their disposition, the width of the rays, type of intervascular punctuations, etc.), which are characteristics of a species or a genus according to the specific atlas of reference.[7] Some samples were identified during the campaign due to their pronounced characteristics (e.g., date palm, see below).

In order to continue with the first identifications, the sieved and partly sorted samples were exported to the archaeobotanical laboratory of the National Museum of Natural History (UMR 7209).

6. Cappers et al. 2012; Cappers & Neef 2012; Cappers & Bekker 2013.
7. Fahn et al. 1986; Neumann et al. 2001.

The first results

Richness, diversity and future sampling strategy

Except for the sounding SD4, corresponding to the excavation of the triclinium (L. 2017) at the top of the hill of the western sector C, the plant material is very poor, probably because of the soil conditions and the nature of the occupation in this area.

First, poor preservation can be explained by the humid and salty soil conditions which have a negative effect on the preservation of the organic material, even if the latter is charred. For instance, it was somewhat surprising to observe that the contexts from sounding SD13, interpreted as ashy layers by the excavator (because of the grey/dark colour with visible traces of ashes), did not contain any fragments of charcoal. Indeed, the lowest part of sector C – i.e. where the majority of the samples come from – is subjected to regular water table fluctuation. Until recently, Dûmat al-Jandal was a wetland due to the presence of a lake at the current location of the sebkha.

Secondly, the excavated areas located at the bottom of the valley and on its slope probably correspond to the ancient gardens. Paradoxically, these contexts are not very favorable for the preservation of the plant material. Most of the seeds and fruits are generally not used or processed in the gardens, and they are less likely to be burnt and thus, preserved.

Of the 45 samples, only 27 contain charcoal and 16 any seed and fruit remains. The triclinium (SD4) and the sounding on the slope (S14b) offer the richest assemblage, whereas SD6 and SD13 are the poorest ones.

The preliminary carpological study

At least six taxa have been recognized (Table 2). They can be classified according to economic and ecological factors as cultivated fruit (1 taxon), cereals (2 taxa), pulses (1 taxon) and wild plants (2 taxa).

Fruit: The only clearly cultivated fruit is the date palm (*Phoenix dactylifera*). Fragmented and charred whole date palm seeds (the "stones" or "pits") were recorded several times, suggesting the existence of a palm grove in the vicinity. Furthermore, fragments of charred date palm stipe (the "trunk"), petiole (rachis of the leaf) were found among the charcoal assemblage (e.g., 2182 in SD14b) All these elements clearly indicate the cultivation of the date palm and its large use as food, fuel and building material, as it is always the case in the oases of the Arabian Peninsula.[8] Although the samples have not been dated, the large presence of date palm remains allows us to qualify the scheme obtained through the previous archaeobotanical analysis of the triclinium, which is caracterised by the absence of date palm charcoal and the dominance of the

8. Bouchaud et al. 2012.

grapevine wood found in the different fireplaces of the structure. It probably results from human selection processes.[9]

Cereals: Two different species were identified: hulled barley *Hordeum vulgare* and free-threshing wheat *Triticum aestivum/turgidum/durum*. These cereals have been domesticated in the Near East since the Neolithic before spreading to the surrounding regions.[10] The available specimen do not allow us to distinguish whether the free-threshing wheat remains correspond to tetraploid wheat r*iticum turgidum subsp. durum/turgidum* or the bread wheat *Triticum aestivum subsp. aestivum*. Tetraploid wheat was dominant in the Southern Near East during Antiquity.[11]

Remains of archaeobotanical by-products– straw and chaff – were sporadically found in two samples (2029 and 2326). Their presence is likely to illustrate their use as fuel (and probably fodder, see below) after the processing stages of cereal crops: threshing, winnowing, and dehusking.[12]

Pulses: Only broken specimen were found, making their identification difficult.

Wild plants: Two taxa have been recognized. Both correspond to wild desert plants, *Medicago cf. arabica* and *Plantago* that were largely found in the sediment samples of the triclinium.[13]

Conclusion

This second archaeobotanical campaign allows us to clarify different points. Firstly, it highlights preservation issues concerning any organic matter at the bottom of the valley and in the ancient gardens and underlines the necessity to obtain archaeobotanical samples from domestic contexts. Secondly, the small preliminary observations confirm the presence of a date palm grove in Dûmat al-Jandal. Even if it is currently not possible to know the chronological period of these discoveries, the results seem to be different from those obtained in the triclinium,[14] pointing towards possibly distinct selection processes of plant material in this last structure.

9. Charloux, Bouchaud et al. 2016a.
10. Zohary et al. 2012.
11. Bouchaud 2019.
12. Van der Veen 1999.
13. Charloux et al. 2016b, 2018a.
14. Charloux, Bouchaud et al. 2016a.

Year	Area	N° locus	Context	N° Sample	Sample detail	Sample Volume (l)	Dry-sieving		Flot-tation after sieving	Charcoals	Seeds & fruits
							2 mm	0,5 mm	0,5 mm		
2011	C-SD1	2006		2006		0,2					
2011	C-SD3	2025	looting pit	2025		0,2		x		x	x
2011	C-SD3	2026	fireplace	2026		0,2		x		x	x
2011	C-SD3	2029	pit	2029		0,7		x	x		x
2011	C-SD3	2030		2030		4	x	x			
2011	C-SD4	2052	ashy layer	2052		0,1		x		x	x
2012	C-SD4	2071	fireplace	2071–2	2071–1 in 2013	10	x	x	(x)	x	
2012	C-SD4	2073	fireplace	2073		0,7		x			
2012	C-SD4	2076	pit filling	2076		3	x	x			
2012	C-SD4	2059	pebble preparation	2059		1	x	x			
2012	C-SD4	2068	occupation	2068		1	x	x			
2012	C-SD6	2205	sandy layer	2205		4	x	x	x		
2012	C-SD6	2214	mud brick collapse	2214		10	x	x	x		
2012	C-SD6	2219	floor	2219		10					
2012	C-SD6	2221	occupation	2221		7	x	x		x	x
2012	C-SD6	2226	pit filling	2226–1		7	x	x	(x)	x	
2012	C-SD6	2226	pit filling	2226–2		4	x	x		x	x
2012	C-SD6	2229	sandy layer	2229		8	x	x	(x)	x	
2012	C-SD 8	2317	dark layer	2317		7	x	x			
2012	C-SD 8	2326	ashy layer	2326		10	x	(x)		x	x
2012	C-SD 12	2332		2332		8	x	x	(x)	x	
2012	C-SD 12	2333		2333		0,2		x		x	
2012	C-SD 12	2336		2336		2	x	x		x	
2012	C-SD 12	2337		2337		5	x	x		x	
2012	C-SD 12	2343		2343		1		x		x	
2015	C-SD13a	2171	ashy layer	2171		2	x	x	(x)	x	x
2015	C-SD13a	2173	wadi deposit?	2173		2,5			x		
2015	C-SD13b	2185	ashy/organic layer	2185–1		10	x	x	x		
2015	C-SD13b	2186	ashy/organic layer	2186–1		10	x				x
2015	C-SD13b	2186	ashy/organic layer	2186–2		8	x				
2015	C-SD13b	2186	ashy/organic layer	2186–3		1					x
2015	C-SD14b	L2182	Tannur?	2182–1	Up	2	x	x	x	x	x
2015	C-SD14b	L2182	Tannur?	2182–2	Middle	4	x	x	(x)	x	x
2015	C-SD14b	L2182	Tannur?	2182–3	Middle	4	x	x	(x)	x	
2015	C-SD14b	L2182	Tannur?	2182–4	Middle	12	x	x	(x)	x	x
2015	C-SD14b	L2182	Tannur?	2182–5	Bottom	7	x	x	(x)	x	x
2015	C-SD14b	L2183	Ashy layer	2183–1		10	x	x	(x)	x	x
2015	C-SD14b	L2183	Ashy layer	2183–2		10	x	(x)		x	x
2015	C-SD 17	2512	mud brick collapse	2512		9	x	x			
2015	C-SD 18	2616	occupation	2616–1		10	x	x		x	
2015	C-SD 18	2616	occupation	2616–2		10	x	x	(x)	x	
2015	C-SD 18	2616	occupation	2616–3		10	x	x	(x)		
2015	C-SD 18	2616	occupation	2616–4		10	x			x	
2015	C-SD 18	2616	occupation	2616–5		10	x	x	(x)	x	
2015	D	5523		5523		9	x	x	(x)	x	

(x) : the fraction has not been sorted

Table 1. Data samples, process and nature of plant remains

Area	SD3				SD4	SD6			SD8	SD13		SD14						
N° locus	2025	2026	2029	2052	2171	2221		2226	2326	2186	2186	2182		2182	2182	2183	2183	2183
N° Sample	2025	2026	2029	2052	2171	2221		2226–2	2326	2186–1	2186–3	2182–1		2182–2	2182–4	2183–5	2183–1	2183–2
Mesh sieving (mm)	0.5	0.5	0.5	0.5	2	2	0,5	2	2	2	2	2	0,5	2	2	2	2	2
CARPOLOGICAL REMAINS																		
Cereals																		
*Hordeum vulgare*_caryopsis				+														
*Hordeum vulgare*_rachis			+															
*Triticum aestivum/durum*_caryopsis									+									+
Triticum aestivum/durum_rachis									+									
Cerealia									+									
Pulses																		
Fabaceae_seed										+	+		+					
Fruit trees																		
*Phoenix dactylifera*_seed						+	+		+				+	+	+	+		+
*Phoenix dactylifera*_perianth								+				+		+	+			
Wild plant																		
Medicago cf. *arabica*_seed		+		+														
Plantago sp._seed	+	+	+	+														
Others																		
Indeterminate																	+	
Bones												+	+			+		
Coproliths camel					+													
Coproliths indeterminate	?																	
Indet-Arc					+													
Shell													+					
ANTHRACOLOGICAL REMAINS	+	+		+	+	+	+	+	+			+		+	+	+	+	+
Phoenix dactylifera_stipe												+		+				

Table 2. Preliminary carpological qualitative results, Sector C

Preliminary Report on the Anthropological Study of a Child Skeleton (SD15)

Olivia Munoz [1]

Context of discovery

These human bones were recovered on March 5th 2015, during the excavation carried out with a mechanical digger in the SD15, close to the fortification wall. The bones were lying in sandy sediment, and the excavators have not noticed any evidence for a structure. Following this discovery, a collection of the remains still present has been made, and part of the sediment has been sieved in order to retrieve the remaining bones. However, this could not be made exhaustively due to the large amount of sand already removed.

The study of the collected bones has been carried out during the campaign in a laboratory (March 2015).

Conservation

The skeleton is incomplete, but the bones recovered are well preserved (see **Figs. 1, 2 and 3**). Several elements of the skull are missing (maxillary and upper teeth, zygomatic bones), as are some of the upper parts of the post-cranial skeleton (scapulas, clavicles, sternum, upper limbs). **Table 1** describes the preserved bones.

Age of death

The age at death was assessed by scoring the grade of mineralization of the teeth: 3.08–5.7 years (37–68 months).[2]

1. CNRS, UMR 8215, Trajectoires.
2. Moorrees et al. 1963.

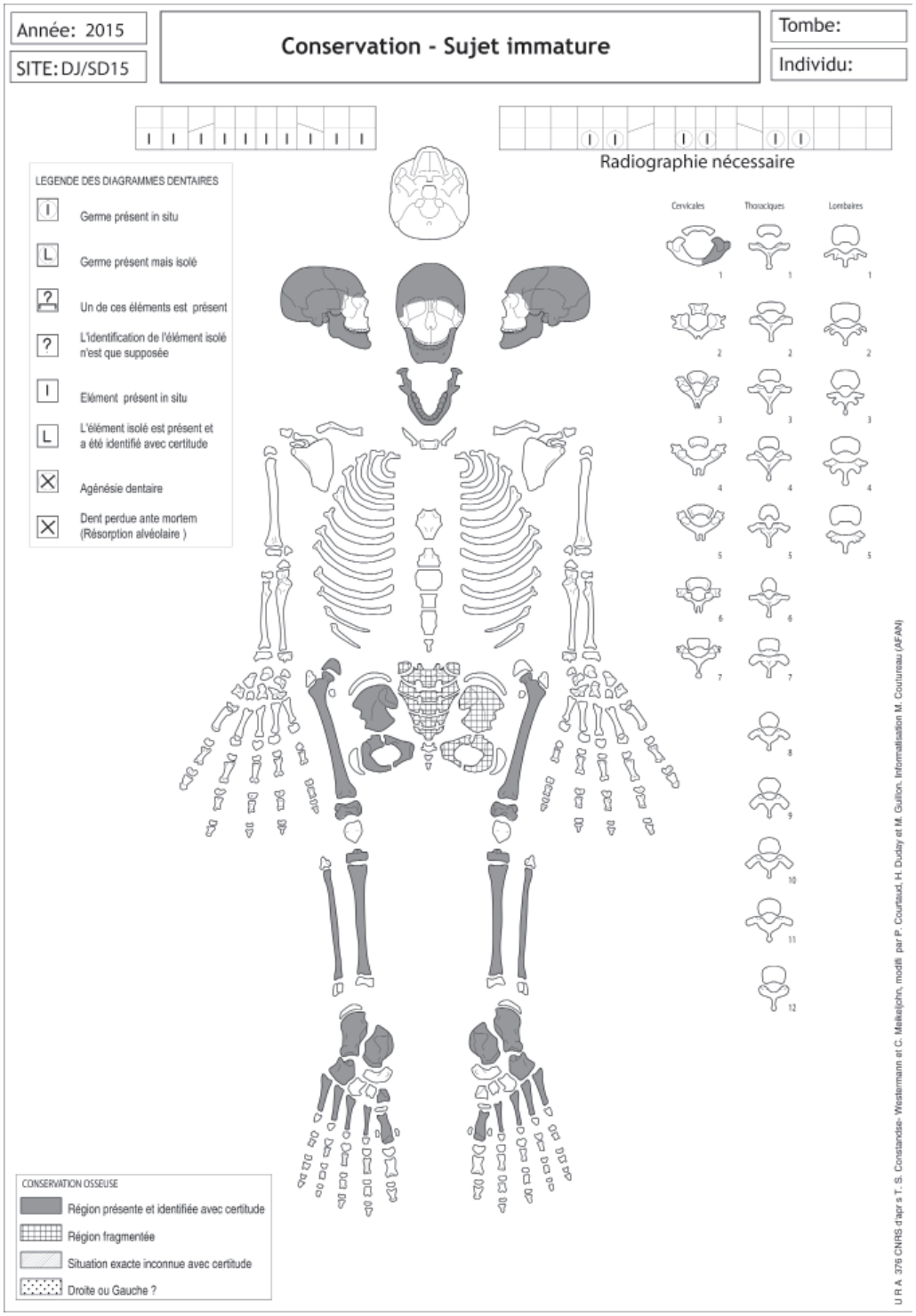


Fig. 1. Preservation form (present parts are colored in dark grey, fragmented bones are figured with tiles).

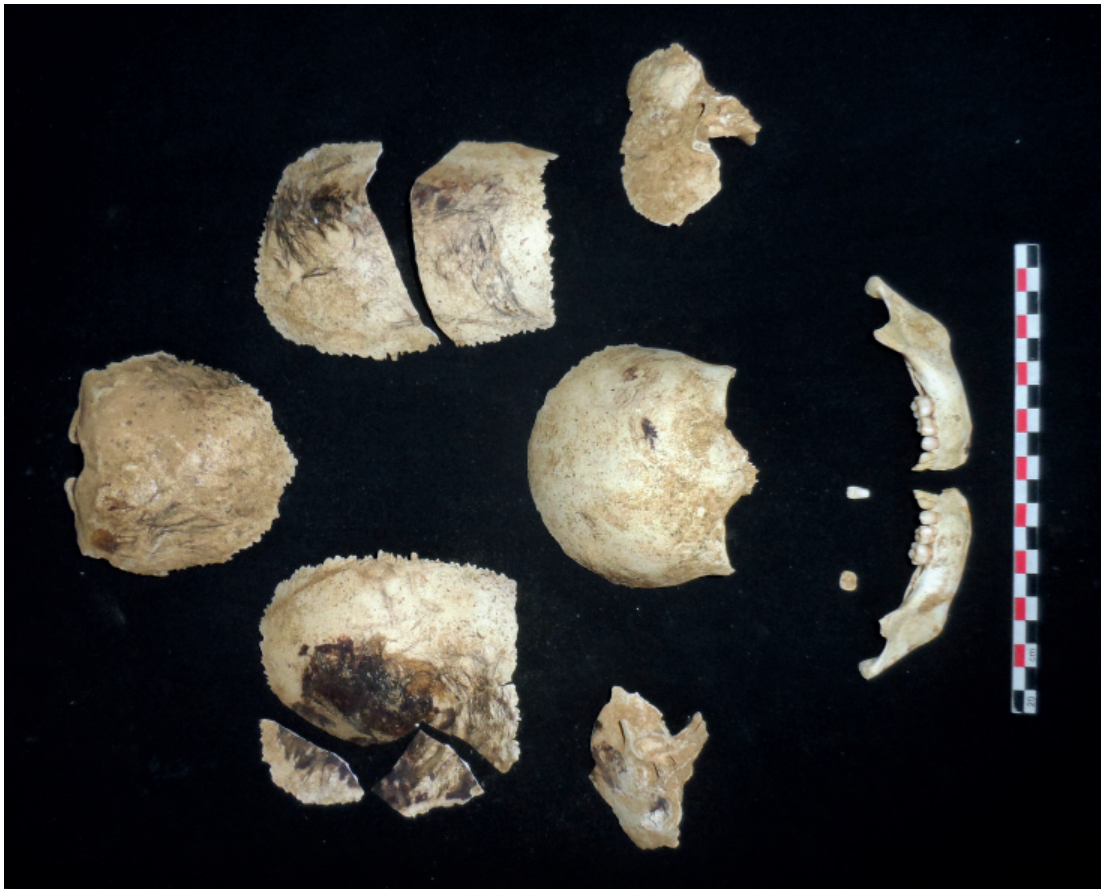


Fig. 2. View of the bones from the skull and mandible. Note the presence of hair on the skull bones and the brown-colored residue on the right parietal



Fig. 3. View of the bones from the pelvis and the lower limbs

Anatomical part	Bone	Side	State of preservation	Remark
Skull	Frontal	Axial	Complete	Presence of Hair
	Parietal	Right	Complete, fragmented	Presence of Hair
	Parietal	Left	Complete, fragmented	Presence of Hair
	Temporal	Right	Almost complete	Presence of Hair
	Temporal	Left	Almost complete	Presence of Hair
	Occipital	Axial	Almost complete	Presence of Hair
	Ethmoid		Fragmented, fragmentary	
	Sphenoid		Fragmented, fragmentary	
Mandible	Mandible	Axial	Complete, fragmented	
	Deciduous teeth		all present	
	Permanent teeth		Non-erupted germs, Right and Left Lower M1, M2, I1 and I2 are present.	A radiographical examination is necessary to check for the presence of other non-erupted permanent teeth in the mandibular.
Vertebra	Atlas	Axial	Arch fragment	
	Thoracic	Axial	Several fragments	
	Lumbar	Axial		
	Sacral	Axial		
Coxal	Ilium, ischium and pubis	Right		
	Ilium, ischium and pubis	Left	Fragmentary	
Lower limb	Femur + unfused proximal and distal epiphyses	Right	Complete	
	Femur + unfused distal epiphysis	Left	Complete	
	Tibia + unfused proximal epiphysis	Right	Complete	
	Tibia + unfused proximal epiphysis	Left	Complete	
	Fibula	Right	Complete	
	Fibula	Left	Complete	
Tarsal bone	Talus	Right	Complete	
	Talus	Left	Complete	
	Calcaneus	Right	Complete	
	Calcaneus	Left	Complete	
	Cuboïd	Right	Complete	
	Cuboïd	Left	Complete	
	Medial cuneiform	Right	Complete	
Foot	Metatarsal 1	Right	Complete	
	Metatarsal 1	Left	Complete	
	Metatarsal 2	Right	Complete	
	Metatarsal 2	Left	Complete	
	Metatarsal 3	Right	Complete	
	Metatarsal 3	Left	Complete	
	Metatarsal 4	Right	Complete	
	Metatarsal 4	Left	Complete	
	Metatarsal 5	Right	Complete	
	Metatarsal 5	Left	Complete	
	4 proximal phalanges	?	Complete	

Table 1: Inventory of the bones recovered in Sector C / SD 15

Observations

The permanent right lower incisor (I1R), still included in the mandible, shows severe enamel hypoplasia (several marked lines and a pit, **Fig. 4**) indicating several physiological stress episode during the mineralization of the crown (between 1–3.5 years old).

On the glabella (frontal bone), two circular depressions, about 3 mm in diameter, are observed on either side of the vestigial metopic suture (pathology, stigma, post-mortem alteration?) (**Fig. 5**).

The presence of black hair is observed on different bones forming the skull (frontal, parietals and occipital, Figs. 2, 6), as well as a dark red colored residue, mainly on the right parietal (**Fig.** 2). The long bones of the lower limbs are covered in places with an organic residue dark in color (**Figs. 3, 7**).

Associated with the child's bones, we found some bird long bones. Some of them show traces of gnawing by small rodents and a small rodent coxal bone (?).

In the bag that contained human bones, the remains of organic material, dark in colour (wood?) were present. Cylindrical concretions made of sandy sediment were also found, which could correspond to the action of insects or rodents into the sediment surrounding the child skeleton.



Fig. 4. Enamel hypoplasia (lines and pit) on the right central lower incisor

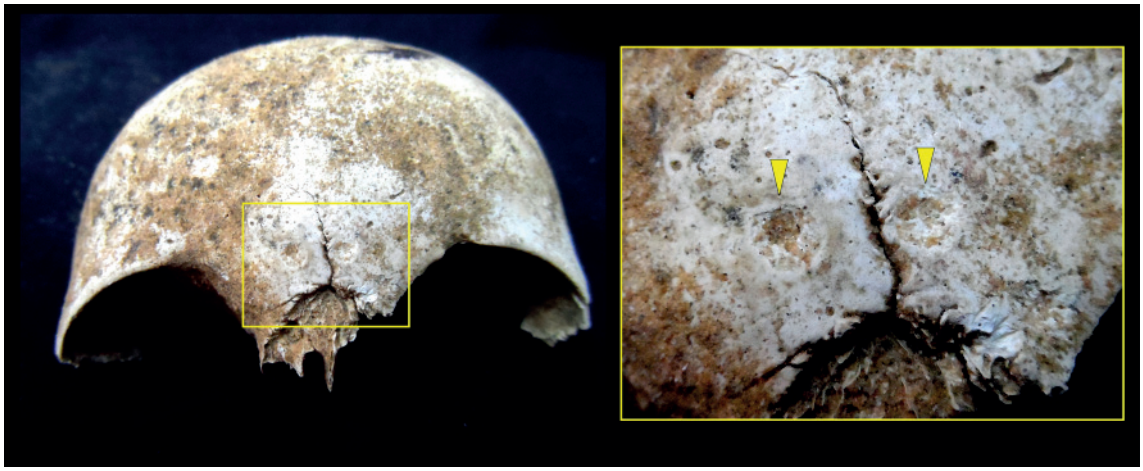


Fig. 5. Two circular depressions on the glabella (frontal bone)



Fig. 6. Preserved hair on the occipital

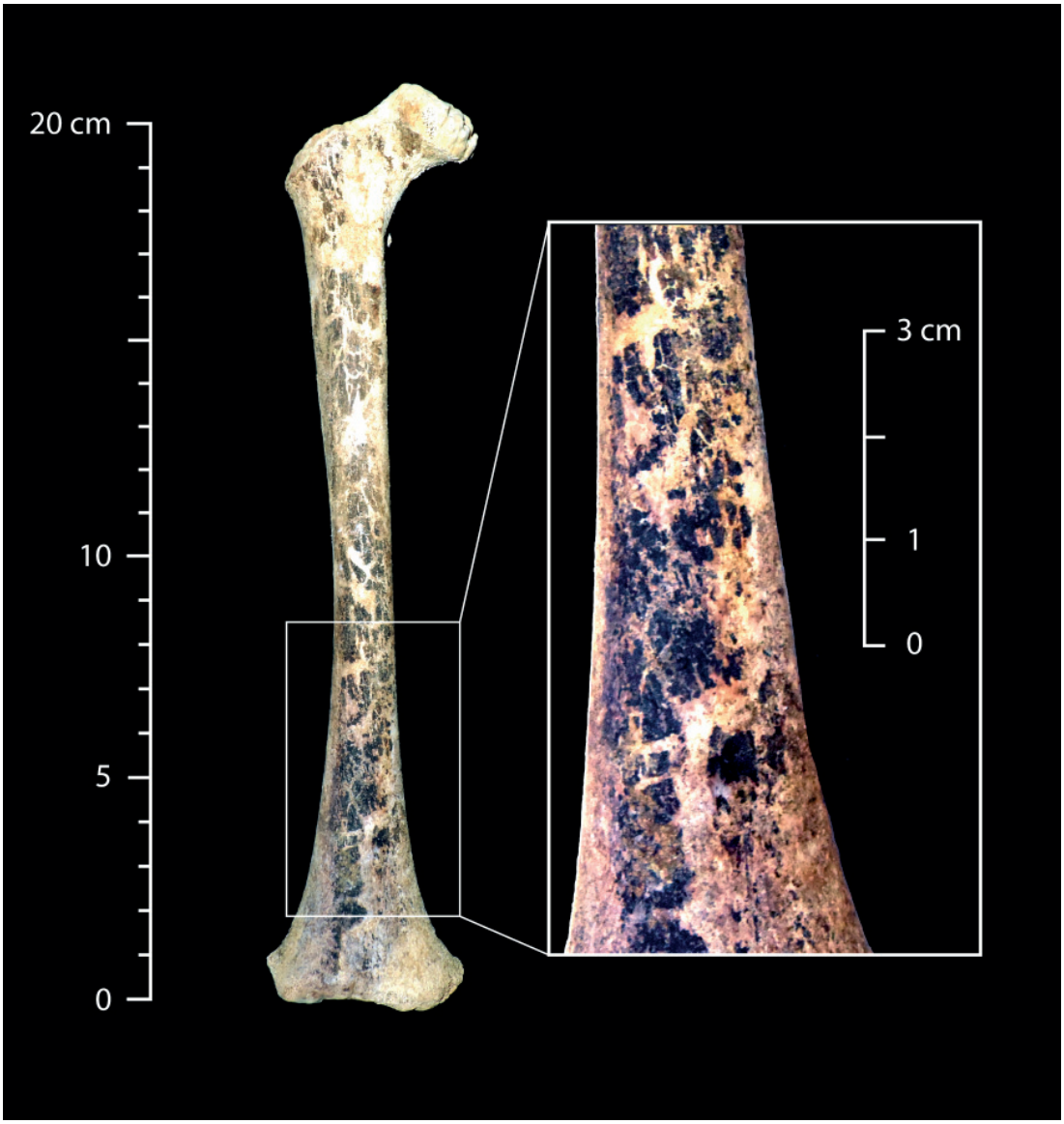


Fig. 7. The organic residue is visible on the right femora

Conclusions

The skeleton of a young child – 3 to 6 years old, was recovered during the excavation of the fortification wall in Sector C, SD15 during the 2015 campaign at Dûma. Several bones were missing, probably due to the excavation process. The preservation of organic tissue and hair suggests an Islamic date for this individual. There is no contextual element to determine if these remains correspond to a funerary deposit or to another kind of event (accidental?).

Rescue Excavations in Sector D (Al-Sunamiyat)

Marianne Cotty, Olivia Munoz & Anaïs Chevalier, assisted by Gwenaël Herviaux [1]

Introduction

In the mid-1980s, the Saudi archaeologist Khaled Abdulaziz al-Dayel had brought to light the so-called "Hellenistic tombs" in the western part of the oasis, in the quarter known as al-Sunamiyat.[2].This quarter is located between the historic area and the western enclosure. Despite being attributed more precisely to the Nabataeans by Khalil al-Muaikel,[3] these tombs did not draw the least interest of specialists for this historical period. The discovery went relatively unnoticed, except by a few local researchers, until a recently published re-examination of the architectural data and the grave goods.[4] The architectural data and the material discovered both reveal a unique plan: chambered, quadrangular tombs executed in masonry containing a large proportion of exotic grave goods. (**Fig. 1**)



Fig 1. Tomb Trench D (excavation Al Dayel 1988: 38–40, 43–44) (after Rashid 2003 : 127)

1. Louvre Museum, CNRS, Univ. Paris 1, independent.
2. al-Dayel 1986: 64–79; al-Dayel 1988: 37–46.
3. al-Muaikel 1994.
4. Charloux et al. 2014b.

These unusual characteristics do not point to a purely "Nabataean" origin, but rather demonstrate Dumat's connection to the great Levantine and Mesopotamian cultural spheres between the 1st century BCE and the 2nd century AD.

Compared with an aerial image from 1964, the extent of the necropolis has been today reduced to its north-western half, and recent urban works have reduced it even further (**Fig. 2**). A review by the Saudi-Italian-French project during the 2013 season [5] shows that the area is on the way to be entirely built over. It was therefore urgent to study and even to protect this area with a fence. For this reason, one of the objectives of the 2015 season was to explore a section still devoid of buildings between a residential area and the modern roads. Due to the short time left and the size of the area, we decided to apply techniques used in preventive archaeology. In agreement with the SCTH, the excavation, therefore, focused on this area of nearly 10 ha forming a slight depression punctuated by a few mounds (average altitude of the area is 607 m). It seemed that the land had recently been levelled. The area is circumscribed by the asphalt road, a residential area, an Islamic cemetery and gardens (**Fig. 3**).

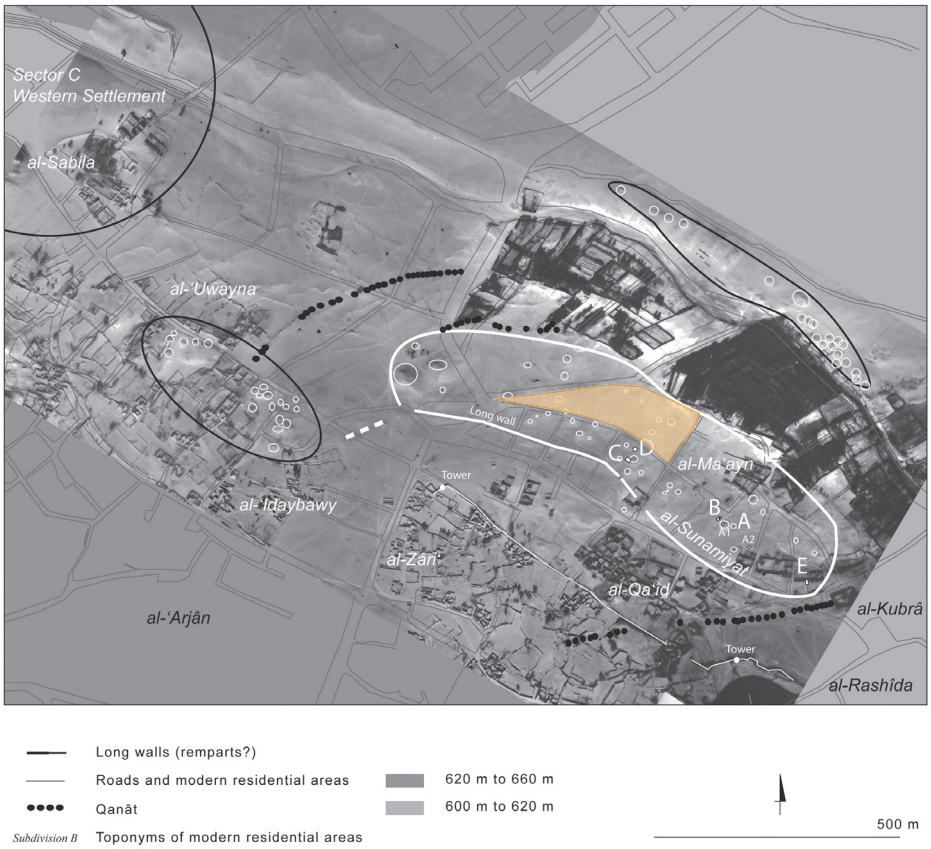


Fig. 2. The supposed extension of the ancient necropolis (white oval) based on the localisation of mounds (white dots) and ancient excavations trenches (white squares) (©Archaeological Project in Dumat al-Jandal, G. Charloux; 1964 aerial image of the oasis courtesy of Hussain Ali Al-Khalifah, director of the Jawf branch of the SCTA). In orange: the studied area during the 2015 season, Sector D.

5. Charloux et al. 2018b: 70 (*Dûma 4*).

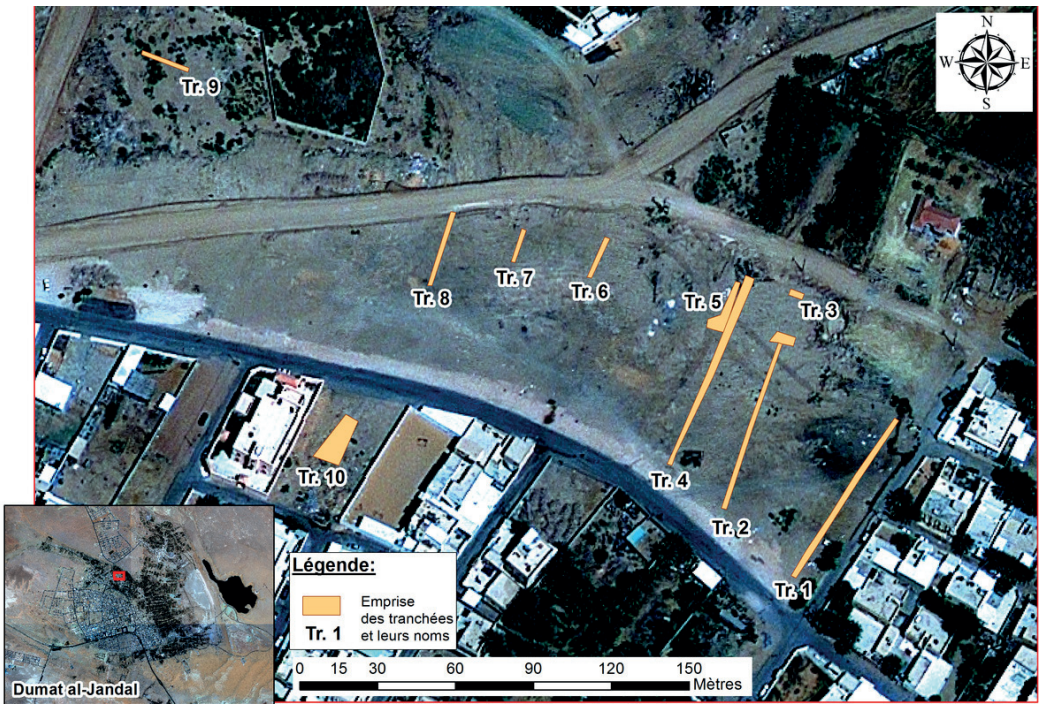


Fig 3. Sector D. Location of the 2015 trenches

Description

In this area, called Sector D, 11 trenches were made using a mechanical excavator equipped with a 1.50 m wide, smooth bucket. The soundings have variable length (ranging from 15 to 80 m) and a simple stratigraphy: a more or less sandy orange to brown silty deposit mixed with modern materials covers the bedrock (5500, 5501, 5504, 5505, 5506). At the southern three-quarters of the site, the bedrock appears close to the surface (between 0.20 and 0.30 m) (**Fig. 4**). In the north, it seems to follow a very steep dip. Thus, in TR3, we observed nearly 2.30 m of sediment (5505) without reaching the bedrock (**Fig. 5**).

Out of the 11 trenches, only three yielded archaeological features (TR2, 4–5 and 10). In trench 4–5, an east-west oriented channel (M5510) preserved on 4–5 courses has been identified attesting to agricultural activities in this area in recent times. This type of development is common in the oasis (e.g. SD8, SD17).

The TR2 allowed us to unearth artefacts to the south, and to the north (5501), fragments of slabs and blocks, human bones as well as ceramic furniture. These remains were mixed with sherds of modern glass, metal, painted cement and plastic rubbish (5502).



Fig 4. Sector D. Trench being excavated



Fig 5. Sector D. Trench 3

TR2 delivered a large quantity of ceramics (some 100 sherds)[6] and two sherds of green-glazed ceramic (**Fig. 6**) as well as five rims of calcite vessels (**Fig. 7**). Unfortunately, these remains have been very strongly disturbed, and the stratigraphic context is non-existent. Trench 10 (TR10) was placed between two residential blocks, as a stone alignment was visible on the surface. This dry stone structure (oriented north-south), about 10 m long, was only uncovered over three courses (**Fig. 8**). Towards the east, bordering this alignment, we found a concentration of burnt human bones, charcoal and burnt stones (5523–5524 and 5526) over an area of about 2 m. This concentration of bones was not far from a flat ceramic surface (5524–5525). Here, about fifty sherds were removed, including some green-glazed ceramics (**Fig. 9**).



Fig 6. Ceramics from US 5501 (C.5501–2–1–8–4–5–3–9–10–6–7)



Fig 7. O–5501.1 ; O–5502.1.2

6. With the typical decorative motifs such as zig-zag lines, palm leaves, etc.

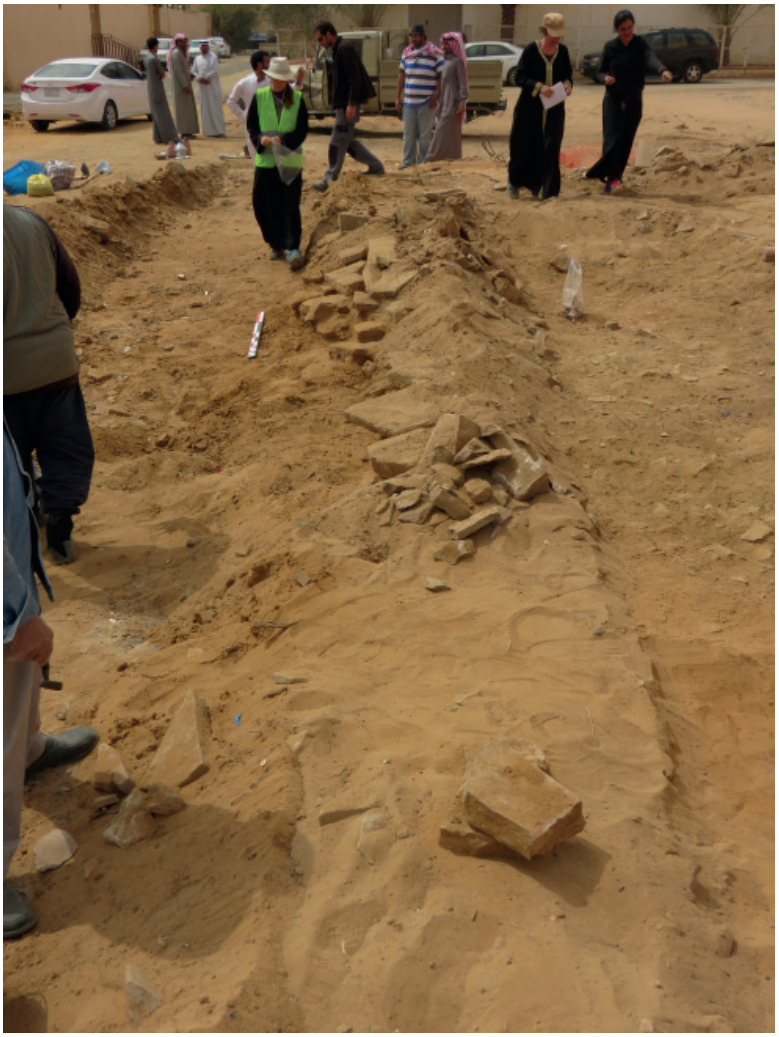


Fig. 8. Sector D. Trench 10

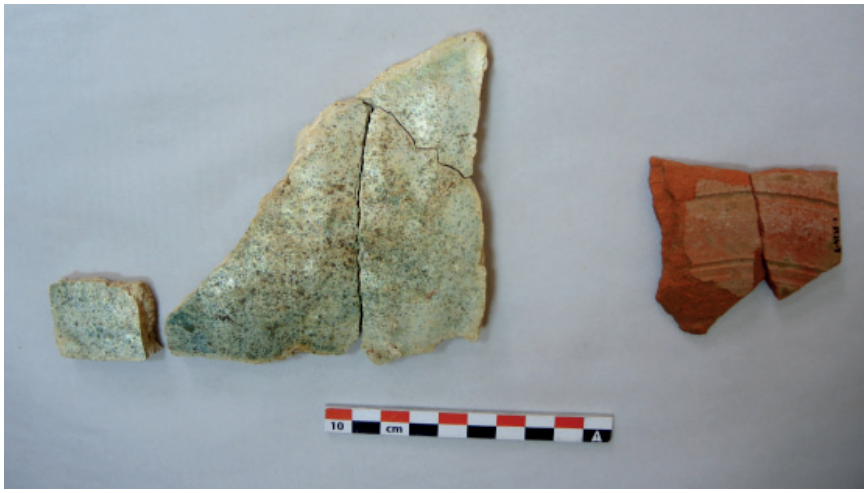


Fig. 9. Ceramics from US 5524 (C.5524–12–9)

Preliminary anthropological assessment

Much of the sediment collected by the shovel was sieved with a fine (2 mm) and a coarse mesh (5 mm). The collection of human remains is therefore not exhaustive, as the context is greatly disturbed. The bones are mostly fragmented and show signs of intense cremation.

Trench 2, 5501

The laboratory study carried out on-site during the 2015 campaign, mainly aimed to determine the Minimum Number of Individuals (MNI) represented in this assemblage (5501), to estimate its composition by age, and to understand the original context of the human remains collected.

MNI and the distribution across age groups

An identification of the collected remains determined the MNI represented in the assemblage. Eight individuals were recognized, including a perinatal, a 3–6-year old child, a 10–14-year old child and five individuals over 15 years old (**Tab. 1**).[7] We do not know if these individuals came from one or more graves.

Age group	perinatal	0–1	1–4	5–9	10–14	> 15	Total
N individuals	1	0	1		1	5	8

Table 1. Distribution of individuals across age groups

The osteological profile (structure of the MNI by type of bone) denotes a disturbed or open assemblage, which is not surprising given the context of discovery and collection of bone remains - since we observe significant shifts between the different anatomical parts (**Fig. 10**). This situation is undoubtedly further exacerbated by the degree of fragmentation of the assemblage, which restricts, for example, the identification of certain large long bones. These are mainly represented by fragments of diaphysis - and thus lessen their contribution to the MNI.

7. For the age estimates of immature individual, we focused on the dental mineralization and the synostosis of the epiphyses. (Moorrees et al. 1963a and 1963b; Sheuer & Black 2000 and 2004)

Although the bones of the extremities (hands and feet) are not very well represented, we still note their occurrence and other small-sized remains (teeth isolated from their alveoli, dental roots, fragments of cervical and coccygeal vertebrae, etc.). This suggests that the area explored by the trench included a funerary space, where primary burial deposits probably took place.

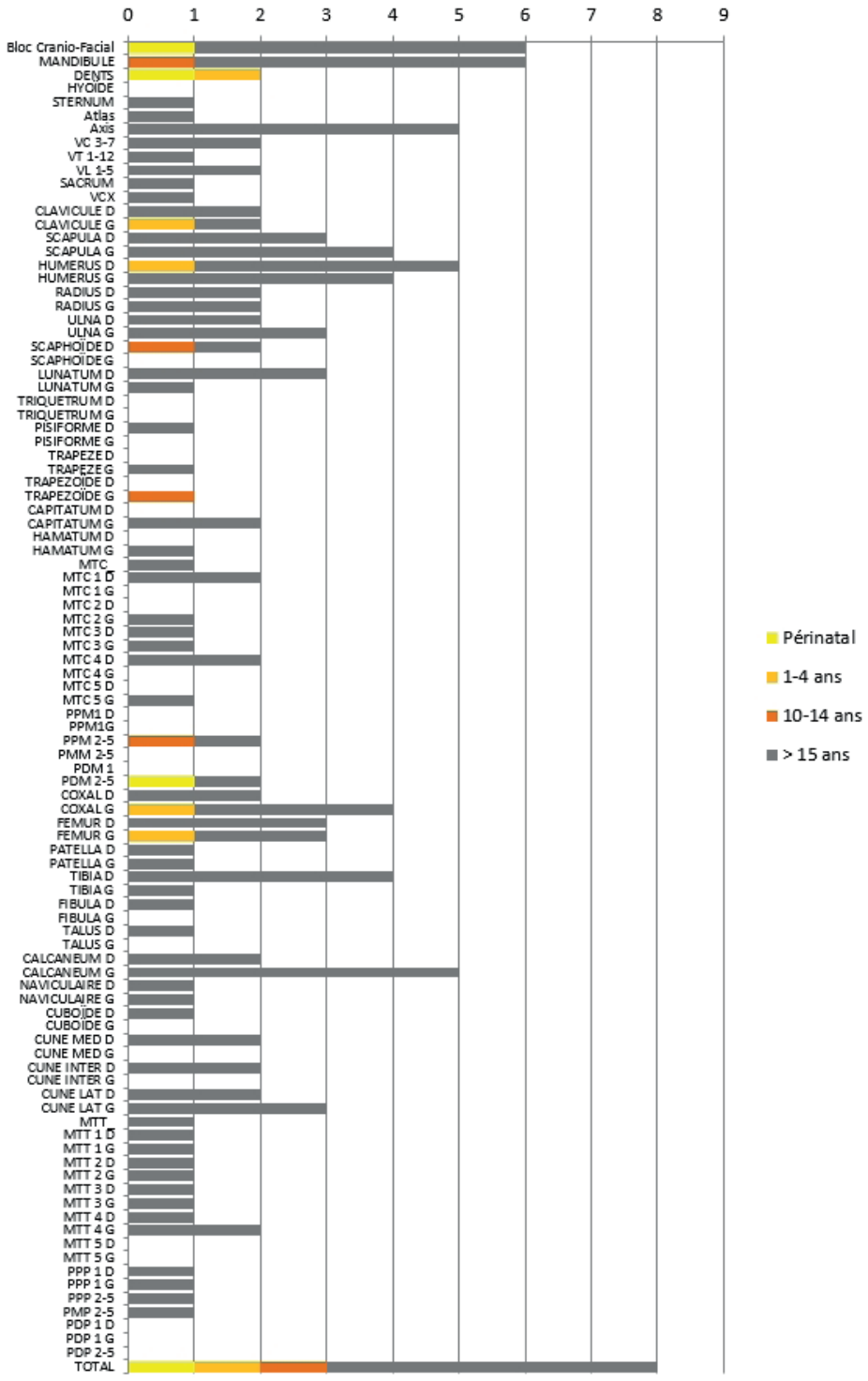


Fig. 10. Al-Sunamyiat, Minimum number of individuals (MNI) refined by age, anatomical order



Fig .11. Sector D. TR2. Example of alteration of spongy bone fragments by fire, with colors varying from light brown (not burnt or heated) to blue-white (intense cremation)

Cremation

The vast majority (99.3%) of the recorded fragments (n = 1658) show traces of cremation, the intensity of which varies (ranging from brown to a white-bluish color (**Fig. 11**). Some remains - about 15 % of pieces identified - show concentric cracks, as well as axial deformations (long bone diaphyses) usually attributed to cremation of fresh bone.

The absence of any measuring equipment during the assessment did not allow us to weigh the material, which is why the quantitative analysis is limited to classification and a count of the fragments by color – meant to estimate the proportion of bones for each stage of cremation. Cremation is well-attested both in Nabatean and Roman funerary practices, but it remains poorly understood. Practices seem to vary, and interpretations must be taken with caution. The most common practice appears to be the cremation of burnt material on reduced bodies.[8]

Dental and bone pathologies

The mandible and maxilla fragments no longer had teeth in place in the alveoli. Moreover, we recorded the ante mortem losses. They affect 32.2% of the alveoli (19/59 observed), and three quarters (75%) of the subjects observed (n = 4) have at least one. This large proportion, comparable to that observed for agricultural Bronze Age populations in Bahrain [9] or Oman,[10] suggests that these individuals lived on a diet rich in carbohydrates (dates, cereals, etc.).A few

8. Sachet 2006: 130–134
9. Littleton & Frohlich 1993
10. Munoz 2014 and 2017

degenerative pathologies have been noted: temporomandibular joint of a right shows signs of micro-vascularization, small holes as well as marginal exostosis; vertebral body has cavities – the so-called Schmörl nodules. On the other hand, two cases of cribra orbitalia have been noted in the frontal bones of individuals over 15 years old, indicating possible nutritional deficiencies.

Discrete characteristics

Two of the frontal fragments observed have the same discrete character (double supraorbital foramen, suggesting a family link between the two individuals).

Green coloration

Certain fragments display a green discoloration, which could correspond to prolonged contact with a copper alloy object. It is unknown whether these are jewelry or other items associated with the deceased, or whether contact took place after the disturbance of the primary burial(s).

The human remains found in TR2 indicate the presence of at least eight individuals, including five older than 15 years, and three children (a newborn, a 3 to 6-year old child, and a 10 to 14-year old teenager). The age structure and the presence of individuals with the same discrete osteological features suggest that family kinship may have played an important role in regrouping these individuals in the same tomb or sepulchral area. The pathologies noted indicate a diet rich in carbohydrates, compatible with an agricultural lifestyle.

Trench 10

Two fragments of a skull cap (<5 cm) of adult size coming from a carbonaceous area, were recognized (5523, 5524). One is a parietal fragment, the other an occipital fragment. They could belong to the same skull and therefore represent at least one individual. Both fragments show a uniform black coloration, indicative of fire treatment. Due to the urgency of the excavation, we do not have detailed information about the archaeological context. This prevents us from determining whether the space opened during the excavation corresponds to a pyre area, or any other structure intended to cremate a deceased partially or as a whole. Several other unburnt remains were discovered in 5526, a few meters from the features mentioned above a fragment of coxal bone (ilium), and a fragment of a metatarsal shaft, as well as some unspecified fragments. The lack of any grave goods directly associated with human remains or stratigraphic information limits the chronological attribution of this assemblage, which is why samples from US 5523 and US 5526 were taken for AMS radiocarbon dating.

Materials

Although the excavation was interrupted at TR10 and no remains were found in TR2, the bone remains and finds provide valuable information about the ancient necropolis of Al Sunamiyat. Unsurprisingly, we note that the material in these trenches is close to that discovered during the Saudi excavations. The graves of Trench C and Trench D [11]yielded the following finds: coins, intaglio jewelry and a figurine, as well as some green-glazed ceramics (cups, bowls and jars). Moreover, note that the calcite vases (O–5501.1; O–5502.1.2) (**Fig. 7**) must have been part of a grave assemblage from the necropolis - despite their discovery to the south of the TR2 (about 15 m from the bones mixed with slabs). Calcite vessels have also been found in tombs at Medain Saleh and Petra,[12] and these came from workshops in southern Arabia. Likely, the stone vase fragments found this year at Dûmat al-Jandal are also of exotic origin, as are some of the grave goods from the al-Sunamiyat's tombs.[13]

Conclusion

Despite our efforts and those of the Saudi authorities to save and study this endangered site, it is now gone. However, despite everything, this rescue operation made it possible to verify the existence of old burials in the area. The remains of TR2 represent one or more burials disturbed by repeated alterations, while TR10 could be a pyre area. Several samples of human bones were taken during this campaign for radiocarbon dating.[14] This should help us to ascertain the period of use of the necropolis. The material discovered in the 1980s made it possible to propose a date ranging from the 1st century BC to the 2nd century AD.[15] Ultimately, this series of dates should help us to establish a chronological framework for the different types of funerary monuments in Arabia.

11. Dayel 1988, 1986
12. Sachet: 167; Augé, Bernard, Dal-Prà et al., 2010: pl. 7.18.d
13. Charloux, Cotty & Thomas 2014: 8–17
14. The samples were entrusted to A. Zazzo (MNHN, CNRS UMR 7209) and should be integrated into a series of AMS dates on bioapatite, concerning all the funerary structures explored in Dumat during the 2015 campaign (request submitted by Olivia Munoz and Antoine Zazzo at ARTEMIS, September 2015). Munoz et al. 2020
15. Charloux, Cotty & Thomas 2014: fig. 15

Zooarchaeology, Season 3. Dûmat al-Jandal 2015

Hervé Monchot [1]

The analyses of the faunal material from the excavations of 2012, 2013, and 2014 for sector A, and 2010, 2013, and 2015 for sector C of the site of Dûmat al-Jandal (DAJ) were initiated with the 2015 field mission. Thus, the examination of the corpus of sector A (the historical area, dir R. Loreto) and sector C (the western wall and its surroundings, dir. G. Charloux) will be completed. The methodology follows the one published in 2012.[2]

Sector A

Without going into details (the work is still in progress) and as indicated in the previous results, the bone assemblage presents a predominance of camel (*Camelus dromedarius*) [3] and ovicaprid (sheep/goat - Ovis aries/*Capra hircus*) bones. These species make up a significant proportion of the assemblage from DAJ throughout the excavated sequences, and the zooarchaeological results clearly show a subsistence economy largely based on these animals. The high proportion of camel and ovicaprid is not unusual in this area, since they were the most common among the exploited terrestrial animals in Late Pre-Islamic/Early Islamic contexts at Dûmat al-Jandal or even earlier periods (Nabataean) in Saudi Arabia.

Other species are marginally represented; such as gazelle (Gazella sp.), dog (*Canis lupus familiaris*), and equids (certainly donkey, *Equus asinus*).

However, the most interesting discovery made during this season is undoubtedly the Arabian oryx which is well represented in the sector A (**Fig. 1**). Three species from the genus oryx have been recognized: the scimitar oryx (*Oryx dammah*), which inhabited the semi-arid deserts of North Africa and the Saharan region, the Arabian oryx (*Oryx leucoryx*) originally found in Syria, Iraq, Palestine, Sinai and Arabian Peninsula, and Oryx gazelle, which inhabits eastern and southern Africa.[4] The Arabian oryx (or white oryx) is a medium-sized antelope with a distinct shoulder hump, long, straight horns, and a tufted tail. It has adapted to arid or semi-arid steppe and sandy deserts and can go for several weeks without drinking water. It is able to withstand

1. Labex RESMED – Université Paris Sorbonne, UMR Orient & Méditerranée.
2. Monchot in press In Charloux & Loreto.
3. Monchot 2014.
4. Nowak et al. 1983.

the extreme heat of the Arabian Peninsula deserts and to travel long distances in search of the sparse pasture found in these regions.[5] Today, the Arabian oryx is not found in the wild, becoming extinct in the early part of this century.

If the oryx had been suspected in previous reports, this time it is well-confirmed thanks to the presence of two characteristic fragments of the horncore (**Fig. 2**) and many cranial and post-cranial bones. The Arabian oryx bones present osteomorphological and osteometrical features easily differentiated from ovicaprids, wild or domestic.[6]



Fig. 1. Arabian oryx (*Oryx leucoryx*)



Fig. 2. A fragment of the Arabian oryx horncore from sector A at DAJ

5. Harrison & Bates 1991.
6. Peters et al. 1997.

This identification was also confirmed by the comparison done with specimens from the National Museum of Natural History in Paris. The Arabian oryx bones were present throughout the stratigraphy (e.g., levels 3a, 14, 19, 18, 21) and were represented by 81 bones:

- 4 skull fragments (two fragments of horncore, one occipital condyle and one second left lower molar), one atlas, one thoracic vertebra, vertebrae,
- 7 fragments of the scapula,
- 21 fragments of the humerus (14 distal extremity, 3 proximal extremity and 4 fragments of distal diaphysis),
- 9 fragments of the radius (7 proximal extremities and two distal extremities);
- 5 fragments of the proximal ulna,
- 5 fragments of the coxal (acetabulum),
- 9 fragments of the femur (5 proximal extremities, 3 distal extremities and one fragment of proximal diaphysis),
- 8 fragments of tibias (7 distal extremities and one proximal extremities),
- 3 talus,
- 5 calcanei,
- 2 center-quartal bones,
- one first phalanx
- and one distal metapodial.

There are certainly more bones in the assemblage, but the state of fragmentation does not allow a rigorous scientific identification (i.e., due to possible confusion with big ovicaprids). The presence of oryx bones suggests an important hunting activity by the inhabitants, also confirmed by the presence of the gazelle.

While the Arabian oryx must have been quite abundant in Prehistory (especially in the UAE), it is still extremely rare to find unequivocal evidence for the presence of the Arabian oryx in the southern Levant and the Arabian Peninsula during late Antiquity and the Middle Ages. One fragment of horncore was identified at Tell Hesban,[7] as well as at the site of Tel Nov [8] in the Golan Heights. At these sites, the absence of post-cranial remains does not appear to be related to sampling issues. The number of faunal assemblages studied is quite large and from disparate parts of these regions (including the desert areas). Moreover, many of these collections have a high sample size in themselves. Consequently, it can be suggested that both horncore fragments may represent remains of complete horns brought to the sites as exotic trade items - perhaps to be used for manufacturing or artefacts or ornaments.[9] Thus, DAJ is one of the most important archaeological sites showing skeletal remains of the oryx.

7. von den Driesch & Boessneck 1995.
8. Horwitz et al. 1999.
9. Horwitz et al. 1999.

Sectors C and D

1435 bones from sector C were identified this year. They came from 9 soundings [10] and are mainly ovicaprid and camel remains (**Tab. 1**). Subsequently, to summarize, 298 bones came from sounding 1, 89 bones from sounding 3, 557 bones from sounding 6, 79 bones from sounding 12, 68 bones from sounding 14b, 53 bones from sounding 15, 22 bones from sounding 17, 217 bones from sounding 18, and finally 52 bones from sector D. These soundings were executed to better understand the space encircled by the ancient enclosure wall, and therefore to explain its function.

The great majority of bone remains consists of undetermined elements (fragments, splinters), which is completely normal given the strong impact of weathering on these assemblages, especially if we consider a "modern" age for them. Moreover, we find remains of ovicaprids, dromedary, and a lesser degree of dogs, cattle or donkeys. The only shell fragment found in 2060 (SD6) belongs to a giant clam (*Tricdana gigas*). Numerous bird bones were discovered, and the species identification is still in progress at the National Museum of Natural History in Paris.

US	SOND	Tot	cap	bos	cam	equ	ost	dog	fox	rod	bird	shell	LH	MH	SH	Ind
2000	SD1 (surface)	6	1													5
2003	SD1	2														2
2005	SD1	19	1													18
2008	SD1	23			1											22
2013	SD1	56	4				1							17		34
2014	SD1	146						21								125
2018	SD1	46	4													42
2021	SD3	18	1						2							15
2022	SD3	34	2		2								5			25
2024	SD3	1			1											
2025	SD3	3														3
2027	SD3	2	2													
2031	SD3	7	1		1			1								4
2037	SD3	10												10		
2038	SD3	8	3													5
2047	SD3	6	1										1			4
2056	SD6	7	2													5
2058	SD6	17								1	1					15
2060	SD6	33	2		3							1				27
2062	SD6	115	6										53			56
2064	SD6	23	9						1	1						12
2182	SD14b	68	7								3				1	57
2208	SD6	2														2

10. The reader can be referred to this report but also to previous reports for an accurate description and location of these soundings/surveys.

2214	SD6	10														10
2219	SD6	18														18
2224	SD6	43	6		1			3	1		11		2			19
2225	SD6	4	1													3
2227	SD6	3														3
2228	SD6	114	7		5	1					9					92
2229	SD6	5	1		1											3
2233	SD6	7									1					6
2335	SD6	15	6								1					8
2236	SD6	60														60
2237	SD6	1	1													
2238	SD6	15											15			
2239	SD6	28	9								1		11			7
2241	SD6	7			1											6
2242	SD6	13	4													9
2245	SD6	1			1											
2246	SD6	7	1		4						2					
2247	SD6	9	2		1											6
--	SD12	28	13		1	1					1		2			10
2336	SD12	1			1											
2337	SD12	5	4								1					
2340	SD12	2	1		1											
2342	SD12	2	2													
2345	SD12	1														1
2346	SD12	32	10										1			21
2350	SD12	2	1		1											
2351	SD12	2	1													1
2352	SD12	4					1									3
2373	SD15	35	11		10			1								13
2375	SD15	18			2											16
2503	SD17	6	2													4
2504	SD17	9	2			1										6
2505	SD 17	4	1													3
2514	SD17	1					1									
2516	SD17	1			1											
2523	SD17	1	1													
2602	SD18	60	1	46									6			7
2603	SD18	12		2												10
2605	SD18	12														12
2611	SD18	72	28	13									1			30
2613	SD18	27		17												10
2615	SD18	8		3												5
2616	SD18	21	1	5												15
2618	SD18	5		5												
2621	SD18	3		1												2
5501	Sect D	23	4		5											14
5503	Sect D	20	3		1											16
5525	Sect D	6	2		1						3		2			3

Tab. 1. Faunal list by sondages and US for sectors C and D from DAJ.
[cap = caprine; bos = cattle; cam = camel; equ = equids; rod = rodent; LH = large herbivore; MH = medium herbivore; SH = small herbivore; ind = indeterminate]

Abbreviations

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