Preliminary Report. Third season of the Saudi French Mission in al-Kharj, Province of Riyadh. 24 October - 29 November 2013

Jérémie Schiettecatte, Rémy Crassard, Bruno Gavazzi, Yamandu Hilbert, Pierre Simeon, Elodie Wermuth

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Third season of the Saudi-French mission in al-Kharj

- Province of Riyadh -

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INTRODUCTION

Preamble

Al-Kharj area is one of the major oases of the Najd, in the very heart of the Kingdom of Saudi Arabia. Specific environmental conditions made this area one of the most attractive regions of Central Arabia for settled communities. And as a consequence, the region of al-Kharj appears as an obvious stopping place and main crossroad on the commercial routes that linked Yemen and the Ḥijāz to the Gulf and Mesopotamia.

There is little doubt that the archaeological study of this region will open up new horizons for the comprehension of the peopling and settlement process, and of circulation and contacts within the Arabian Peninsula, from prehistory down to the mediaeval period.

Stimulated by this prospect, a Joint Cooperative Agreement for Archaeological Surveys in the oasis of al-Kharj was signed in September 2011 between the Saudi Commission for Tourism and Antiquities (SCTA), Riyadh, and the Centre National de la Recherche Scientifique (CNRS), Paris. A scientific team was formed under the direction of Abdalaziz al-Ghazzi (King Saud University, Riyadh) and Jérémie Schiettecatte (CNRS, Paris).

The aim of the research is to characterize the diverse prehistoric, protohistoric, pre-Islamic, and Islamic archaeological remains as well as to illustrate the environmental context that made it possible for people to settle in such an arid region.

The third season of survey and excavation was carried out from October 24 to November 29, 2013.

Team

Saudi Part

- Abdallah AL-AKLABĪ (Saudi Commission for Tourism and Antiquities, Bisha)
- Abdalaziz AL-HAMMAD (Saudi Commission for Tourism and Antiquities, Riyadh)
- Abdalaziz AL-HINU (Saudi Commission for Tourism and Antiquities, Riyadh)
- Awadh AL-QARNĪ (Saudi Commission for Tourism and Antiquities, Riyadh)

French Part

- Anaïs CHEVALIER (Université Paris Panthéon-Sorbonne, Master Student) – archaeologist
- Dr Rémy CRASSARD (CNRS, Lyon) – archaeologist
- Bruno GAVAZZI (University of Strasbourg, PhD student) – geophysicist
- Dr Yamandù HILBERT (post-doctoral fellow, Fyssen Foundation, Lyon) – archaeologist
- Dr Michel MOUTON (CEFAS, Jeddah) – archaeologist
- Laetitia MUNDUTEGUY – archaeologist / illustrator
- Alexia ROSAK (University Paris-Sorbonne, Master Student) – archaeologist
- Thomas SAGORY (Ministry of Culture, Paris) – photographer
- Dr Jérémie SCHIETTECATTE (CNRS, Paris) – head of the project
- Dr Pierre SIMEON (postdoctoral researcher, Paris) – archaeologist
- Élodie WERMUTH (Eveha, Paris) – archaeo-anthropologist

Support

The scientific issues dictating our field activities address those set out in four research programmes. These funded the major part of the field activities:

- Programme ‘Oasis d’Arabie déserte’, conducted by G. Charloux (UMR 8167 ‘Orient & Méditerranée’, Paris), funded by the Ministry of Foreign affairs, Paris; this programme also supports field activities in Dumat al-Jandal and Najran;
- Laboratoire d’excellence ‘Resmed – Religion et Société en Méditerranée’, conducted by J.-C. Cheynet (UMR 8167 ‘Orient & Méditerranée’, Paris), funded by the Agence Nationale pour la Recherche in Paris [ANR-10-LABX-72];
- Programme ‘SYRAB – Écrit et écriture dans la formation des identités en monde araméen et arabe IIIe-VIIe siècle’, conducted by Fr. Briquel-Chatonnet and L. Nehmé (UMR 8167 ‘Orient & Méditerranée’, Paris), funded by the Agence Nationale pour la Recherche in Paris [ANR-09-BLAN-0328-01].

- Regular activities of the Research Centre from the Saudi Commission for Tourism and Antiquities, Riyadh, headed by Jamal Omar.

Besides, several institutions and programmes contributed by their financial and technical support to the field activities:

- CNRS through the research centres UMR 8167 'Orient & Méditerranée', Paris and UMR 5133 'Archéorient';
- 'École et Observatoire des Sciences de la Terre' at the University of Strasbourg (logistics);
- Académie des inscriptions et belles-lettres, Paris (academic grant);
- 'Service de Coopération et d'Action Culturelle' of the French Embassy, Riyadh (logistics).
- Fyssen Foundation (subvention recherche 2013).

Acknowledgments

We would like to thank these institutions most warmly for their support. We are also most grateful to people who put their trust in our work and did their best to make fieldwork possible and easier in Riyadh and Paris: HRH Prince Sultan bin Salman bin Abdalaziz (President of Saudi Commission for Tourism and Antiquities [SCTA] and Chairman of the Board of Directors of SCTA), Prof. Ali al-Ghabban (Vice-President of SCTA for Antiquities and Museums, Riyadh), Jamal Omar (Head of the Research and Excavation Centre, SCTA, Riyadh), Jean-Louis Laveille (Cultural Advisor, French Embassy in Riyadh), Cyrille Le Déaut (Cooperation Attaché, French Embassy in Riyadh), Marie-Véronique Diamant (CNRS, Ivry), Magali Picone (Univ. Paris IV).

Al-Kharj 2013 team members:

From left to right. Top: Yamandu Hilbert, Thomas Sagory, Ahmad Muhammad Surur, Rémy Crassard, Bruno Gavazzi, Jérémie Schiettecatte. Bottom: Anaïs Chevalier, Laetitia Munduteguy, Alexia Rosak, Élodie Wermuth.

[Absent: Michel Mouton and Pierre Siméon]

Field workers on Bronze Age necropolis ʿAyn al-Ḍilaʿ 1. From left to right: Muhammad Khan, Laetitia Munduteguy, Abdullah Khan, Abdalaziz al-Hammad, Élodie Wermuth, Anaïs Chevalier and Jérémie Schiettecatte.

Geographic setting

Al-Kharj area is located 70 km south-west of the capital of the Kingdom of Saudi Arabia, Riyadh. The area lies between latitude 23.8° and 24.4° N. and longitude 46.9° and 48° E. (**fig. 1**).

The Najd region is characterized by a hot, dry climate. Modern annual rainfall rarely exceeds 100 mm: for the period 1980–2007, the annual mean was 94.6 mm and the amount of rainfall was irregular throughout the year, with rain occurring mainly from November to April. The hydrological network includes a large wādī system, with no permanent river. However, water resources from several of the largest aquifers of the Arabian Peninsula have allowed agriculture and farming to develop (Sanlaville 2000: 73–75, 210–211).

Al-Kharj is the main city in this area. The rapid growth of the city makes it sprawl into the former palm groves and absorb older villages in its neighbourhood (al-Yamāma, al-Salmiyya, etc.). The second city of the oasis is al-Dilam. This huge agglomeration has more than 376,000 inhabitants. A well-developed road network connects the city of al-Kharj with the capital Riyadh to the north-west, with the United Arab Emirates to the east, and the Wādī al-Dawāsir to the south-west.

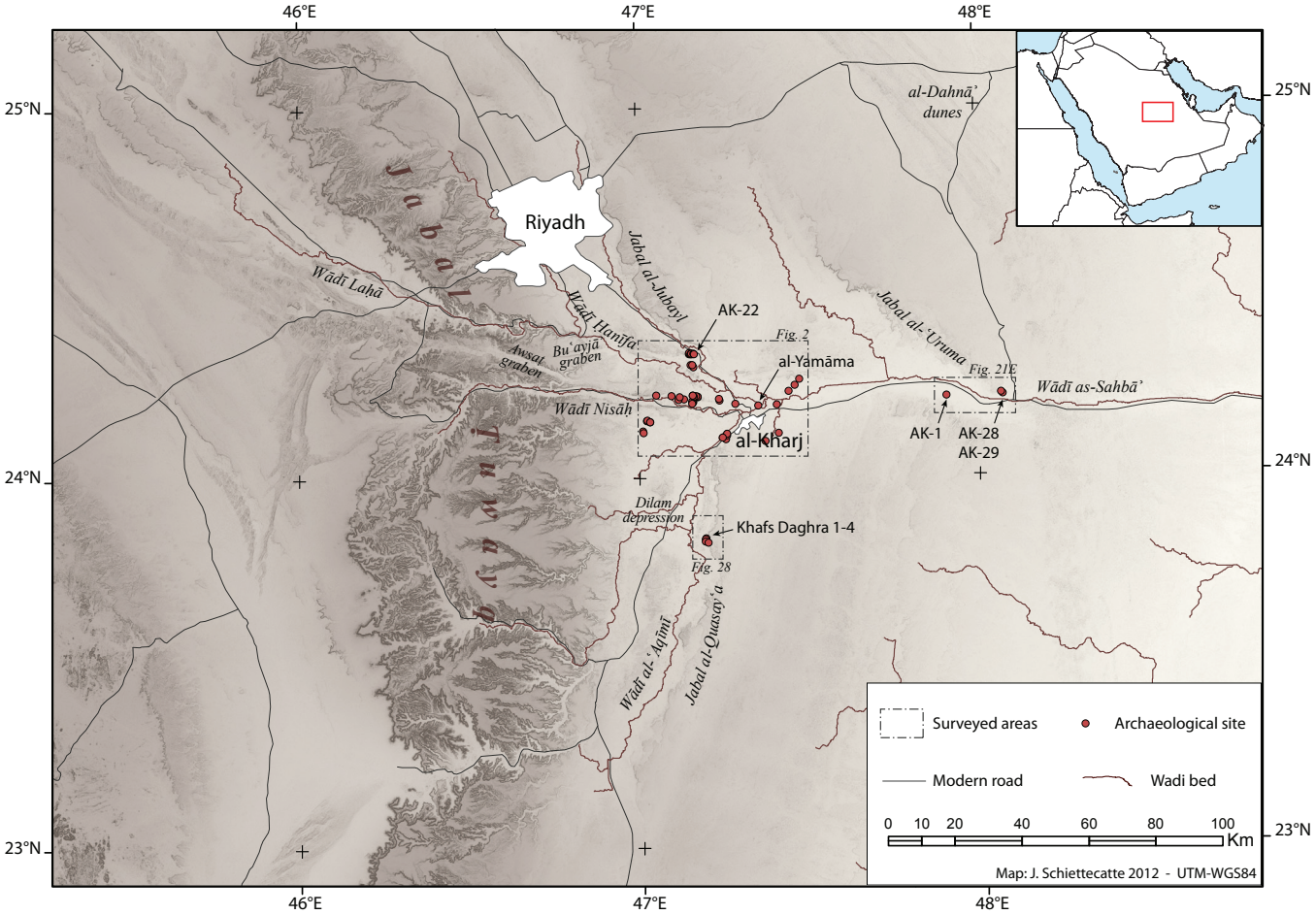

Figure 1 - The location of the oasis of al-Kharj and its setting (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Geological background

The geological context of sedimentary rocks explains the location of al-Kharj area in the Arabian platform. Large units of limestone and sandstone of Jurassic and Cretaceous form more or less eroded plateaus, dissected by valleys (wādīs). Nowadays there is very little flow in them, but in the past it was sufficient to incise them several tens of metres. The major part of wādīs within the oasis of al-Yamāma is influenced by series of grabens originating from the opening of the Red Sea, marked by west-east faults.

In the valleys, more recent sedimentary cover includes both fluvial deposits (silt, clay, etc.) and eolian deposits, with barkhan fields in numerous places. Current erosion comes mainly from wind, since the very low rainfall has minimal impact on the ground. Because of the sedimentary context, karst morphologies are common in the oasis of al-Kharj: the most impressive features are swallow holes south-west of al-Kharj (Vaslet *et al.* 1991: 35–36) (**fig. 2**). Three swallow holes are located in ʿAyn al-Ḍilaʿ, with a diameter of 60 to 80 m, and an average depth of 50 m. These features were formed by the phenomenon of dissolution in calcareous layers.

Figure 2 - The two major swallow holes in ʿAyn al-Ḍilaʿ, looking north-west (photograph: Th. Sagory – Saudi-French Archaeological Mission in al-Kharj).

Topography

The simple geological context provides an easy explanation of the topographical context of the area of al-Kharj.

The oasis is a large, funnel-shaped valley in sandstone and limestone plateaus incised by many wādīs. The joint action of drainage and uplift of the crystalline basement in depth led to the formation of cuestas with escarpments north, north-west and south-west of the oasis.

The area is bounded on the west by a Jurassic mountain, the Jabal Ṭuwayq, through which flows the Wādī Nisāḥ from west to east inside grabens. The Wādī Ḥanīfa comes from Riyadh in the north-west, along the cuesta of the Jabal al-Jubayl, and this escarpment forms the northern boundary of the oasis. South-west, the Wādī al-ʿAyn comes from the slopes of the Jabal Ṭuwayq, and then follows the escarpment of the Jabal al-ʿUruma, on the south side of the oasis. These three main wādīs reach the centre of the oasis and join to form the Wādī al-Sahbāʾ, which crosses the whole oasis from west to east in the valley bounded by the Jabal al-Jubayl and the Jabal al-ʿUruma. It continues toward the east and is lost in the sands of al-Dahnāʾ desert.

The three mountain massifs located around the oasis are almost parallel and bound it to the north, west, and south. The confluence of the wādīs within these mountains forms the cluse of al-Kharj, thus cutting the Jabal al-Jubayl and the Jabal al-ʿUruma into two parts. In this area, the Jabal Ṭuwayq reaches 1,050 m, while the Jabal al-Jubayl and the Jabal al-ʿUruma have average maximum altitudes around 550 m north of the oasis and 500 m south of the oasis.

The central valley with the wādīs slopes gently from west (mean altitude ca. 470 – 480 m a.s.l.) to east (mean altitude ca. 380 m a.s.l.). The oasis ends at the gates of al-Dahnāʾ desert.

The confluence of the main wādīs is unclear within the oasis, partly due to the expansion of the city of al-Kharj and the development of infrastructure (road network, farms, etc.). The wādīs are also partly disturbed by other human activities.

The largest archaeological site, al-Yamāma, is near a heavily altered wādī. It is located within the valley but is several metres higher than the surrounding area, which preserved the site from potential flash floods.

Archaeology in al-Kharj: past research and present issues

The favourable environment which made this oasis so promising for archaeological and historical studies should have been all the more inviting given that this area is frequently mentioned in pre-Islamic poetry and Islamic tradition (Wüstenfeld 1874, Thilo 1958, Bin Khamis 1978, al-Askar 2002, al-Juhany 2002).

In spite of this, archaeological remains in Central Arabia have rarely been noticed. Philby mentioned the presence of tumulus fields, underground water channels and a large ancient settlement, al-Yamāma, during a journey in the Najd in 1917–18 (Philby 1919; 1920). In 1945, Col. G. de Gaury reported the presence of tumulus fields nearby al-Kharj (De Gaury 1945). A few years later, Philby completed the description of the oases of al-Kharj, al-Aflāj and the Wādī Dawāsir (Philby 1949). In 1978, a comprehensive archaeological survey of the Kingdom of Saudi Arabia was carried out in Central Arabia and identified sixteen sites in the oasis of al-Kharj alone (Zarins *et al.* 1979), confirming the potential of the area. Consequently, in the late 1980s and the 2000s, Abdalaziz al-Ghazzi initiated soundings at four sites in the oasis: on the settlement of Ḥazm ʿAqīla (al-Ghazzi 1996, 2009), on that of al-Yamāma (al-Ghazzi 2010), in the necropolis of al-ʿAfja (al-Ghazzi 2011a), and on the water channel of Abraq Farzān (al-Ghazzi 2011b).

Although limited by their duration or by their scope, these previous studies registered the existence of a variety of sites where one could expect to find answers to several of the current research issues in the Arabian Peninsula.

Regarding prehistory, one of the main current research issues in the Peninsula concerns the dispersal of the first Anatomically Modern Humans (AMH) in Arabia during the Palaeolithic. A debate also exists about trying to understand where the Arabian Neolithic comes from: Levantine influence or local developments from autochthonous populations? Recent palaeo-environmental and palaeo-climatic studies revealed the possible influence of the wet phases in the development of a production economy. If much has been done in South and East Arabia, the centre of the Peninsula remains unexplored. Environmental studies combined with lithic analysis have therefore been carried out during the 2011 and 2012 seasons in order to address these issues.

The proto-historical occupation of the oasis is obvious, through the presence of several necropolises that struck all the travellers and archaeologists passing by in the past. At two of them, al-ʿAfja and ʿAyn al-Ḍilaʿ, hundreds of dry-stone turret graves or tumuli are visible. The main issues are the date of their building, and the time span of their use. In Yemen, these tombs delivered artefacts from the third and first millennium BC. Is this indicative of long-lasting funerary practices, or of the reuse of these tombs much later on? Another question regards the cultural affiliation of these funerary practices and people who built the tombs. In West and South Arabia, these tombs were collective and are generally associated with (semi)nomad or pastoralist groups; contrarily, along the Persian Gulf coast and in the Bahrain and Dhahran area, these tumulus tombs were designed for a single body and were the practice of sedentary people. Al-Kharj area is the buffer zone between these two cultural spheres; the study of the burial practices here could be indicative of the very nature of people, of their origin and their way of living. None of these necropolises were investigated during the two first seasons, but their study will start in 2013. Nevertheless, a brief description of them is presented in the 2011–2012 survey report.

Ascribing a time-span to the sedentarisation process in al-Kharj area is also crucial. Did this process begin right from the third millennium BC, as it can be observed in the Oman Peninsula during the Hafit period, or in Bahrain area during the Dilmun period? Or are we to observe in al-Kharj area an alternate and specific model? Is the sedentarisation process linked to the domestication of the palm tree, as in the Oman Peninsula, or to other criteria such as long-distance trade?

Another issue concerns the Late Iron Age and Early Christian era, a transitional period in the Arabian Peninsula. New populations appeared in historical sources and archaeological contexts; they settled in the Oman peninsula (e.g. Mleiha), in South Arabia (penetration of Arab groups in the Jawf valley), in North-west Arabia (Nabataeans). They all shared common features, particularly in their funerary practices. And yet, the origin of these groups is still unknown. The study of a site in Central Arabia could throw new light on this process. Although no occupation from

that period has been revealed in the oasis so far, we are still confident that the most ancient occupation of the site of al-Yamāma, not reached so far, might enlighten us about this issue.

Finally, issues regarding the Late Pre-Islamic and the Islamic period are numerous. A sharp decline of the settlement density can be observed in South, West and North Arabia from the 4th century onwards and accelerated during the 6th century. This process might have been partly linked to changes in the environment. Is this process to be observed in Central Arabia? Arab-Islamic sources and preliminary fieldwork results indicate a different trajectory for this region, which might have been continuously occupied from the Late Pre-Islamic period until the end of the 12th century. Finally, a deep sounding on the site of al-Yamāma indicates a temporary abandonment of the site at the end of the 12th century. One wonders what might have led to such a situation.

As one can see, archaeological research in the oasis of al-Kharj is driven by many questions, and preliminary results are raising new issues. This prompted us to set up complementary field investigations, dealing with the long term, from Palaeolithic to modern times, from the environmental, archaeological and historical point of view.

Purpose of the 3rd season, programme, schedule

The first two field seasons aimed at providing an initial overview of the evolution of regional occupation from the Palaeolithic to the Islamic era. This has been achieved through the creation of archaeological and geomorphological maps of the oasis, and the study of two significant sites: AK-22 (Palaeolithic) and al-Yamāma (Late Pre-Islamic / Early Islamic periods).

The third season is in line with this previous research, the aim being:

- To continue and achieve the excavation of the great mosque of al-Yamāma;
- To continue and achieve the geomagnetic survey of al-Yamāma;
- To initiate research on the Bronze Age in al-Kharj region by the study of the necropolis of ʿAyn al-Ḍilaʿ 1;
- To continue the prehistoric survey of al-Kharj region and resume the study of one of its main Palaeolithic site (al-Kharj 22).

1. Archaeological excavation at the site of al-Yamāma

During the third season, the excavation of the mosque partly unearthed during the second season was resumed with several aims: clearing the main columned hall; looking for previous buildings (most probably more ancient mosques) under the main building by local soundings. This operation was taken in charge by Pierre Siméon and Alexia Rosak from October 27 to November 25, accompanied by Abdallah al-Aklabî and Abdalaziz al-Hinu.

The drawings of pottery and artefacts were done by Laetitia Munduteguy.

The completion of the topographic map of the mosque was done by Jérémie Schiettecatte with a D-GPS Trimble R4.

The geomagnetic survey of the fenced area carried out during the two last seasons continued in the south-western quarter of the site. Due to delay in the delivering of the geophysicist's device, it has only been partially done by Bruno Gavazzi, on November 27-28. Material included geomagnetic sensors, real-time laptop, HMD glasses, and D-GPS.

An aerial photo coverage has been completed thanks to the use of a kite and an air balloon by Thomas Sagory on November 19-24.

Due to the very good state of preservation of the ruins of the mosque at al-Yamāma, its unearthing has to be followed by a restoration of the remains (strengthening of the mudbrick walls and preservation against weathering). During the second season, two specialists of mudbrick restoration (an archaeologist and an architect) from the High School of Architecture in Grenoble (France) defined a procedure of restoration, taking into account the local environment and the very nature of the structures. Part of the restoration process has been implemented over the most sensitive part of the Building 1 ("Mosque") unearthed during this season by Laetitia Munduteguy.

2. Archaeological excavation at the Bronze Age site of ʿAyn al-Ḍilaʿ 1

This season, a new part of the al-Kharj project has been approached: the Bronze Age in the oasis. It was done by excavating five tombs in the largest tumuli field of the region: ʿAyn al-Ḍilaʿ 1. This operation was jointly done by Jérémie Schiettecatte, Anaïs Chevalier, Laetitia Munduteguy, and Élodie Wermuth from October 27 to November 27. They were accompanied by Abdalaziz al-Hammad and Michel Mouton.

The drawings of pottery and artefacts were done by Laetitia Munduteguy.

The completion of the DEM of the area and the topographic map of the tombs was done by Jérémie Schiettecatte with a D-GPS Trimble R4. Detailed map of the structures was done by the excavators.

An aerial photo coverage has been completed thanks to the use of a kite and an air balloon by Thomas Sagory from November 19 to 24.

3. Prehistoric survey of al-Kharj region

From November 20 to November 25, two prehistorians, Rémy Crassard and Yamandù Hilbert conducted a survey of al-Kharj oasis and the surrounding area to identify Palaeolithic sites. They were accompanied by Awadh al-Qarnî.

They completed the study of the Middle Palaeolithic site AK-22, discovered during the first season, and developed this mid-Palaeolithic approach by the study of two sites newly discovered: AK-31 and AK-40.

Recording system

The nomenclature adopted for the recording of sites is as follow:

- Prehistoric sites are named AK (for al-Kharj) followed by a number in the order of their discovery, e.g. AK-01, AK-02, etc.
- Protohistoric and historic sites are named by their location, followed by a number if several sites have been discovered in a single area, e.g. al-ʿAfja, ʿAyn al-Ḍilaʿ 1, ʿAyn al-Ḍilaʿ 2.

The nomenclature we adopted for recording stratigraphic units and structures during the excavation at al-Yamāma and ʿAyn al-Dilaʾ 1 is as follow:

- Stratigraphic units (called UF for *unité de fouille*) are numbered continuously, from 001 to n. Series of numbers have been attributed to the different excavated areas: 001 to 099 in al-Yamāma (area N6); 100 to 199 in al-Yamāma (area O7); 200 to 299 in al-Yamāma (area G17); 1000 to 1099 in ʿAyn al-Dilaʾ 1 (area H9-H10).
- Structures are numbered continuously, from 001 to *n*, preceded by a letter indicative of the nature of the structure (W = Wall; F = Floor; P = Pit; H = Hearth; Ni = Niche; R = Room; A = Access; Po = Posthole; Co = Column; St. = other structure). For example, W.001, W.002, W.003, Co.004, etc. Series of number have been attributed to the different excavated areas: 001 to 099 in al-Yamāma (area N6); 100 to 199 in al-Yamāma (area O7); 1001 to 1099 in ʿAyn al-Dilaʾ 1 (area H9-H10).

The nomenclature we adopted for recording artefacts, pottery and samples from protohistoric and historic sites is as follow:

- Artefacts: initials of the site + number of the stratigraphic unit or 'surf' when sampled on surface + number from 1 to *n*.
  Example 1: WH1.surf.3 for the third artefact collected on surface on the site of Wādī al-Hayāthim 1.
  Example 2: Y.022.5 for the fifth artefact collected in layer no 22 during the excavation at al-Yamāma.
- Pottery: a specific number was attributed to each sherd indicative of a pottery shape (base, rim, handle, etc.). The number is written in the same way as those of artefacts. The only exception concerns sherds sampled on the surface of the site of al-Yamāma, where the abbreviation 'surf' (for surface) is preceded by a square number – the site of al-Yamāma has been divided in squares of 50 × 50 m identified by a letter (A to R from west to east) and a number (1 to 21 from north to south).
  Example 1: Y.001.1 for the first sherd from the first stratigraphic unit during the excavation at al-Yamāma.
  Example 2: Y.P6.surf.1 for the first sherd collected on the surface of the site of al-Yamāma, in the square P6.
- Samples: this category includes non-manufactured material (e.g. ash, bone, charcoal, date stone, eggshell, mother of pearl, shell, slag, plant), building material (baked brick, earthen coat, earthen floor, mudbrick, plaster) or pieces of unidentified artefacts (fragments of bronze, flint, glass, iron and steatite). They are all numbered S (for sample) + number of the stratigraphic unit or 'surf' when sampled on the surface + number from 1 to *n*.
  Example: S.005.1 for the first sample (here bones) collected in the stratigraphic unit no 5 during the excavation at al-Yamāma.

All these data are recorded within a homogeneous recording system which has been set up to meet the requirements of both the survey of al-Kharj area and the excavation of the site of al-Yamāma. It is constituted of several related databases designed using FileMaker Pro 10 software. It has been created by J. Schiettecatte and G. Charloux and is based on databases used by the past on previous projects. It has been completed by a photographic database based on the one used by the Saudi-French Mission in Madāʾin Ṣāliḥ (dir. L. Nehmé, Fr. Villeneuve, D. al-Talhi) and designed by Jérôme Haquet (engineer at the UMR 8167 of the CNRS). These related databases are:

- Database of archaeological sites of al-Kharj area;
- Database of photographs taken during survey and excavation;
- Database of stratigraphic units;
- Database of archaeological structures;
- Database of archaeological artefacts;

- Database of pottery;
- Database of samples.

The database of archaeological sites has been designed so as to be exported and used on a GIS (Geographic Information System), the software being used is ArcGis Desktop 10 designed by ESRI (**fig. 3**).

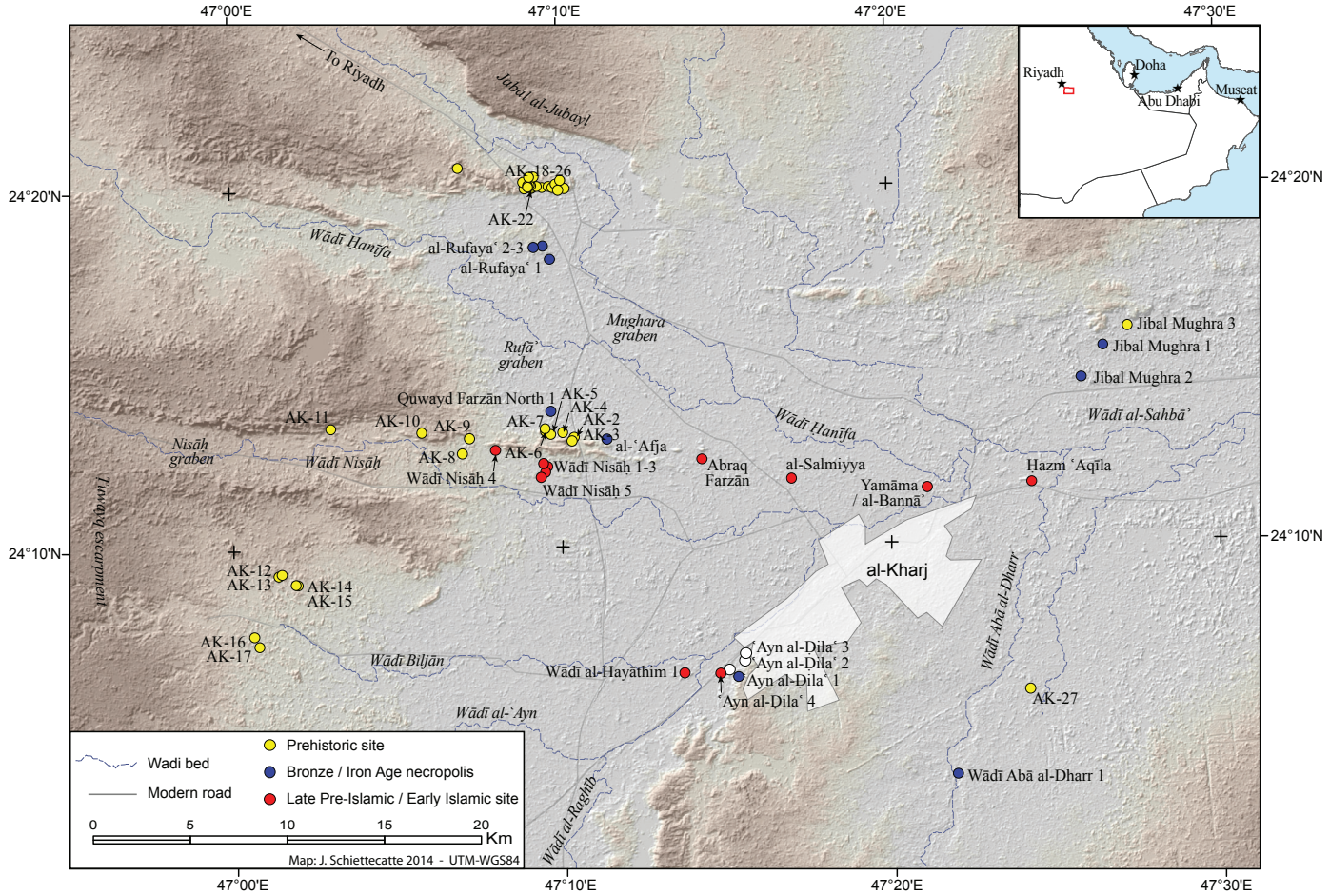

Figure 3: Archaeological map of the oasis of al-Kharj (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

PREHISTORIC SURVEY

Rémy Crassard (CNRS – UMR 5133, Lyon, France)
Yamandu Hilbert (Fyssen Foundation, Post-doctoral fellow – UMR 5133, Lyon, France)

Al-Kharj region: major implications in comparative studies

Al-Kharj, located in the central part of the Arabian Peninsula, provides a new point of reference for comparisons with other regions in the northern part of the Kingdom of Saudi Arabia (e.g. Jubbah basin sites) and the southern part of the KSA (e.g. Mundafan sites), thus allowing comparisons with better-known archaeological regions across the Arabian Peninsula, particularly Yemen, Oman and the United Arab Emirates. As the central region of the KSA has received little attention in terms of its Prehistoric occupation, its exploration itself is a great step forward in expanding our comprehension of its prehistoric occupations and place along migrations and dispersals routes across the Arabian Peninsula.

Comprehensive studies on the Arabian Palaeolithic are a relatively recent phenomenon, compared to the long-standing traditions of research in Europe, South and East Africa or Mediterranean Levant. In recent years, however, the Arabian Peninsula has experienced a considerable expansion of field research, aimed at the categorization of its prehistoric lithic assemblages and the investigation of its place in both human evolution and human dispersal events out of Africa.

The Middle Paleolithic lithic assemblages found in Arabia are mainly characterized by the presence of the Levallois technology. This specific reduction strategy is defined by the production of blanks showing predetermined dimensions and shapes. This predetermination is achieved by diverse variations in core volume preparation. Dated Levallois occurrences are known from various parts of the Arabian Peninsula, namely South-western Yemen (Delagnes *et al* 2012, 2013), possibly the Emirate of Sharjah (Armitage *et al.* 2011), southern Oman (Rose *et al.* 2011, Usik *et al.* 2013) and northern Saudi Arabia (Petraglia *et al.* 2011, 2012), where different types of Levallois reduction have been observed among Arabian Middle Paleolithic assemblages. The discovery of the typically north-east African Nubian Levallois technology in southern Arabia represents a clear technological connection between north-east Africa and the Arabian Peninsula. In Arabia, Nubian technology was initially identified in south-west Oman and attributed to the Nubian Complex of Dhofar. Prior to this, comparable cores had been found in Ḥaḍramawt, eastern Yemen, however, due to sampling constraints in Yemen and the lack of chronological control over these surface assemblages, researchers remained impartial as to whether these cores were related to Levallois-based industries from Africa or the Levant. Preliminary analyses from Yemen supported a connection between South Arabia and the Levant; however, chronological and technological data from Dhofar now suggests an introduction of the Nubian reduction method through the Southern Dispersal Route.

The variability observed within the lithic assemblages from Arabia, therefore, shows different traditions that likely reflect different populations that inhabited the Arabian Peninsula during the second half of the Late Pleistocene, adding to the complexity of the prehistoric record of the Peninsula. To expand and enhance the growing data set of Arabian Paleolithic sites, a Saudi-French archaeological project was initiated in 2011, under the direction of Jérémie Schiettecatte (CNRS) and Abdulaziz al-Ghazzi (King Saud University). A detailed field survey was undertaken in the proximity of the modern town of Al-Kharj, central Saudi Arabia that revealed a total of 29 Middle Paleolithic surface scatters. The results from the archaeological investigation at al-Kharj 22 site in 2011 have already been published (Crassard & Hilbert 2013; Schiettecatte *et al.* 2013). Our studies are focusing on lithic technology and the interpretation of the Levallois methods. In particular, the Nubian Levallois Method has been explicitly discussed, given its distribution across both North Africa and South Arabia.

Lithic Technological Analysis

The Levallois definition and its use in Arabia Middle Paleolithic/Middle Stone Age (MP/MSA) sites are often characterized by the Levallois methods of blank production, in Africa and Eurasia. The Levallois reduction methods are marked by the production of blanks with predetermined shapes (flakes, blades, points) using different methods of flaking (*débitage*), which can be recognized through the study of reduction patterns, or *chaîne opératoire*. The Levallois technology, also understood as a concept, was widely described and illustrated through the study of various archaeological assemblages and experimental data. Characteristic for this type of reduction is a hierarchical use of core surfaces. The dorsal surface, from which the Levallois blanks are removed, is termed the working surface or Levallois surface, while the ventral surface is called the platform surface, as this is from where the preparation of the dorsal surface takes place. Levallois cores are often asymmetric in cross-section due to the arrangement of these surfaces, which undergo different treatment across the reduction phases. Variability within the Levallois reduction is primar-

ily expressed by the diversity with which prehistoric flint-knappers prepared the Levallois surface; an aspect that influences the shape of the desired end product.

Equally characteristic is the preparation of a preferential striking platform by the removal of flakes from the ventral surface, which leads to the faceted butts seen on general Levallois flakes and more specifically on the preferential Levallois blanks. Arabian lithic assemblages containing Levallois technology have been known since the 1930s from surface occurrences found in Yemen, namely in the Ḥaḍramawt region. More recently, stratified sites found in the Tihāma/al-Maḥwit region (Wādī Surdūd) have revealed the chronological range and technological variability of this reduction method in south-western Yemen. Elsewhere in the Arabian Peninsula, assemblages with Levallois technology have been amply recognized. Stratified and dated Levallois occurrences are reported from Aybut al-Auwal in the Dhofar region of Oman, in the United Arab Emirates at Jabal Faya NE-1 and in Saudi Arabia within the Jubbah region. These discoveries have yielded dates provided by the Optically Stimulated Luminescence (OSL) method. In Dhofar, one Nubian Levallois core and approximately 10 flakes and blades have been dated to 106 thousand years ago (kya), while the layers containing Assemblage C at Faya NE-1 have yielded three different dates (127, 123, and 95 kya) falling early within Marine Isotope Stage (MIS) 5. In Saudi Arabia, within the Jubbah region, sites containing Levallois technology have shown a substantial chronological range spanning MIS 7 (211 kya), MIS 5c (95 kya), and MIS 5a (75 kya). Noteworthy here is the possible use of Levallois technology within the lower levels from Jabal Qattar JQ-1, which may represent the oldest manifestation of Levallois reduction in Arabia (MIS 7). An additional Levallois assemblage from the Jubbah area has been excavated at the Jabal Katefeh JKF-1 site, where surface and buried lithics have been associated with sediments dating to the MIS 5a-b (90–85 kya). Among these dated assemblages, the samples from Dhofar are of particular interest given the chronology they provide for the Nubian presence in Arabia. This highly standardized method of blank production represents a technological procedure that aims at the manufacture of triangular flakes and blades, which we regard as technological marker with a high recognition value, due to the either bidirectional, centripetal or bidirectional/centripetal scar pattern on its dorsal surface.

It has been then decided to focus on the Middle Paleolithic period during this 2013 season, with a special interest in documenting the Rufāʾ Graben area, where the AK-22 site was previously discovered.

Methodology

Methodology of the survey

The survey was organized through two poles: 1) exploration of the whole Rufāʾ graben area, 2) systematic exploration of raw material outcrops, sources of knapping stones for Pleistocene populations, through a survey based on geological analysis.

The use of Google Earth was very handy, and this tool helped in accurate surveying. The survey was exclusively made by foot, with a selective or systematic collecting of surface material.

Twelve new sites have been discovered during the time of survey. They have been labelled from AK-30 to AK-41 (AK for al-Kharj). Each site has been spatially located through a Global Positioning System device (handheld GPS). The archaeological localities have also been described with systematic criteria, such as:

- Date of survey
- Name of the site
- Name of the closer topographic feature (e.g. wādī, jabal...)
- Localization (latitude and longitude, altitude, type of topography, anthropic structure in the vicinity, general aspect of the locality)
- Site description (state of preservation of the site, artefacts position, density and quantity by m², estimated surface of the site and estimated explored surface, potentiality of the site, preliminary dating)
- Raw material (state and type of raw material)
- Techno-typology (general dimension of pieces, types of artefacts, preliminary observations on the material, functional interpretation)
- Final notice (general potentiality of the discovered site).

Methodology of the lithic analyses

In anthropological studies, the history of techniques is an important criterion to define and compare cultural production. The latter are called industries when their nature is attested to be of anthropogenic provenance. Understanding techniques is then a critical input to Paleolithic studies, as the lithic industries (stone tools and flaked stones in general) are most of the time the only product of human activities found across arid environments such as the central

area of the KSA. The sites discovered in the region of al-Kharj in 2011 are mainly surface occurrences and are difficult to date in absolute manner. One way to "date" them is then comparing the techniques with other dated sites from the Arabian Peninsula and from neighbouring areas. The sites found this season are mainly from a single period of human history: the Middle Paleolithic roughly dated in central Arabia around 200,000 and 50,000 years ago.

Geological analysis of al-Kharj region

Geomorphology observation and notes on al-Kharj area

The area surrounding the city of al-Kharj, situated ca. 70 km south-east of Riyadh, is marked by a variety of geomorphological features including structural scarps, inselbergs, a complex drainage network, alluvial fans, outwash plains and sand dunes. The convergence of the Central Arabian Graben system, comprising the Nisāḥ, Awsaṭ, Buʿayjāʾ, ʿUjmān, Rufāʾ and Mughara grabens, greatly influences the local geomorphology. While a succession of north-west-oriented scarps mark the northern part of the studied area, the southern scarps are oriented towards the south-west. This change of orientation and the dip of the cuestas are caused by the formation of the Central Arabian Arch, which is related to the Late Tertiary to Quaternary upwrap associated with the Red Sea rifting. The locally exposed lithology is composed of Late Jurassic and Cretaceous formations which are partially blanketed by diverse Quaternary sediments of both eolian and fluvial morphogenesis. We have focused our work on the Rufāʾ graben for this 2013 season (**fig. 1**).

Figure 1. General view of the Rufāʾ graben (R. Crassard - Saudi-French Archaeological Mission in al-Kharj).

Surveyed area during the 2013 campaign: the Rufāʾ graben

Given the limitations encountered during the 2013 al-Kharj prehistoric survey, namely the intense urbanization and agricultural usage of al-Kharj area and the restricted duration of the field season (1 week) this study was constrained to the Rufāʾ Graben already surveyed in its southern fringe during the 2011 season, and revealing the major site of AK-22.

Approximately 30 km in length and between 0.8 and 1.5 km in diameter, in its north-south axis, the Rufāʾ graben is composed of 3 segments, respectively from west to east: the ʿAmmāj segment, the Shaʿāl segment and the Ashqar Marāgha segment. The northern face of the graben is marked by the Jabal Umm ash-Shaʿāl with its roughed cliff rising 80-100 metre above the bottom of the graben. Beyond the cliff this feature extends towards the north-east as a flat undulating plateau composed of beige bioclastic, bioturbated limestone and clayey limestone (Sulayy formation). The graben´s southern face is for the greater part masked by superficial deposits except for its eastern crest also composed of Sulayy formation limestone. The eastern portion of the Rufāʾ Graben is marked by a variety of lacustrine, wetland and Khabra deposits attesting the presence of lakes in the area during the Quaternary.

Survey activities were undertaken close to the contact zone between the Sulayy limestone and the Cretaceous sandstone formations at the eastern portion of the Ashqar Marāgha segment. Here high quality, fine grained quartzite and siltstones presenting a dark weathered cortex have been observed. Surface sites have been found associated with these raw material sources. An attempt to survey the whole graben has been made, but more future work will be needed for completing a real comprehensive and systematic survey.

Results

List of discovered sites

Description of sites and associated lithic industries

AK-30

AK-31

AK-32

This site is a discreet 50 × 20 m scatter, located on top of a slight elevation opposite to AK-22. Similar to the other sites in the Rufāʾ area the scatter is located directly on raw material outcrop, on a nearly flat surface and presently very little slope. Technological and typological characteristics include some recurrent Levallois cores, flat preforms, unidirectional convergent or early stage Levallois reduction as well as one well made large Nubian core with type 1 preparation (**fig. 3**.1). Artefacts are found to be of medium or large size class.

AK-33

Isolated centripetally prepared core found on flanks of Jabal, talus. Located on northern cuesta of southern flank of Rufāʾ graben system. The slopes in this general area are covered by eolian sediments impending prospection. Also at site some tested raw material nodules have been found. Raw material is fine grained quartzite (grey in colour).

AK-34

An approximately eight-metre-long and one-metre-thick stone laid wall was found at this location in between Jabals in southern Rufāʾ graben. Unknown rounded (one metre in diameter) structures have been detected in the proximity of the stone wall. Possibly irrigation connected.

AK-35

Site located on top of a jabal being part of the southern ridge of Rufāʾ graben. Surface composed of large limestone blocks, some eolian material and shatter. No raw material present in eminent proximity to the lithic scatter. Raw material source, however, visible (dark quartzite) 500 metres east of the site; additional raw material outcrops found around the Jabal. Raw material is grey quartzite with yellow to beige patina, some dark red quartzite as well. Artefacts are medium to small size; cores fakes, few Nubian mostly preferential Levallois with centripetal preparation (**fig. 3**). Large looted tomb with long tail close by, scatter is approximately 100 by 30 metres.

AK-36

Site Located on southern slope of Rufāʾ graben overlooking raw material source. Artefacts are small to medium in size, small concentration approximately 20 by 30 metres. Low to medium density. Raw material used at site is grey quartzite with beige to yellow patina and some dark red quartzite. Scatter located on steep slope (30 degrees maybe) also some pink quartzite found.

AK-37

Isolated Nubian core on raw material outcrop south-east of Rufāʾ graben, some fakes and tested nodules also found, poor quality outcrop.

AK-38

High-density scatter close to raw material outcrop, some of the surface was bulldozed leaving an undisturbed 30 by 20 metres surface. Cores and flakes located on slight slope, primarily centripetal, preferential and bidirectional or bidirectional crossed Levallois cores and some Nubian like cores. Selective collection of cores made.

AK-39

Low to medium density site on slope, artefacts made on dark and beige quartzite raw material. Site in proximity of raw material outcrop, diagnostic artefacts collected, mainly centripetally prepared preferential Levallois cores and some Nubian cores.

AK-40

AK-41

Surface site on flat surface, approximately 50 by 40 metres. Small medium and large size artefacts. Dark and beige patinated artefacts made on quartzite, some Nubian cores and other Levallois cores, selected diagnostic collected.

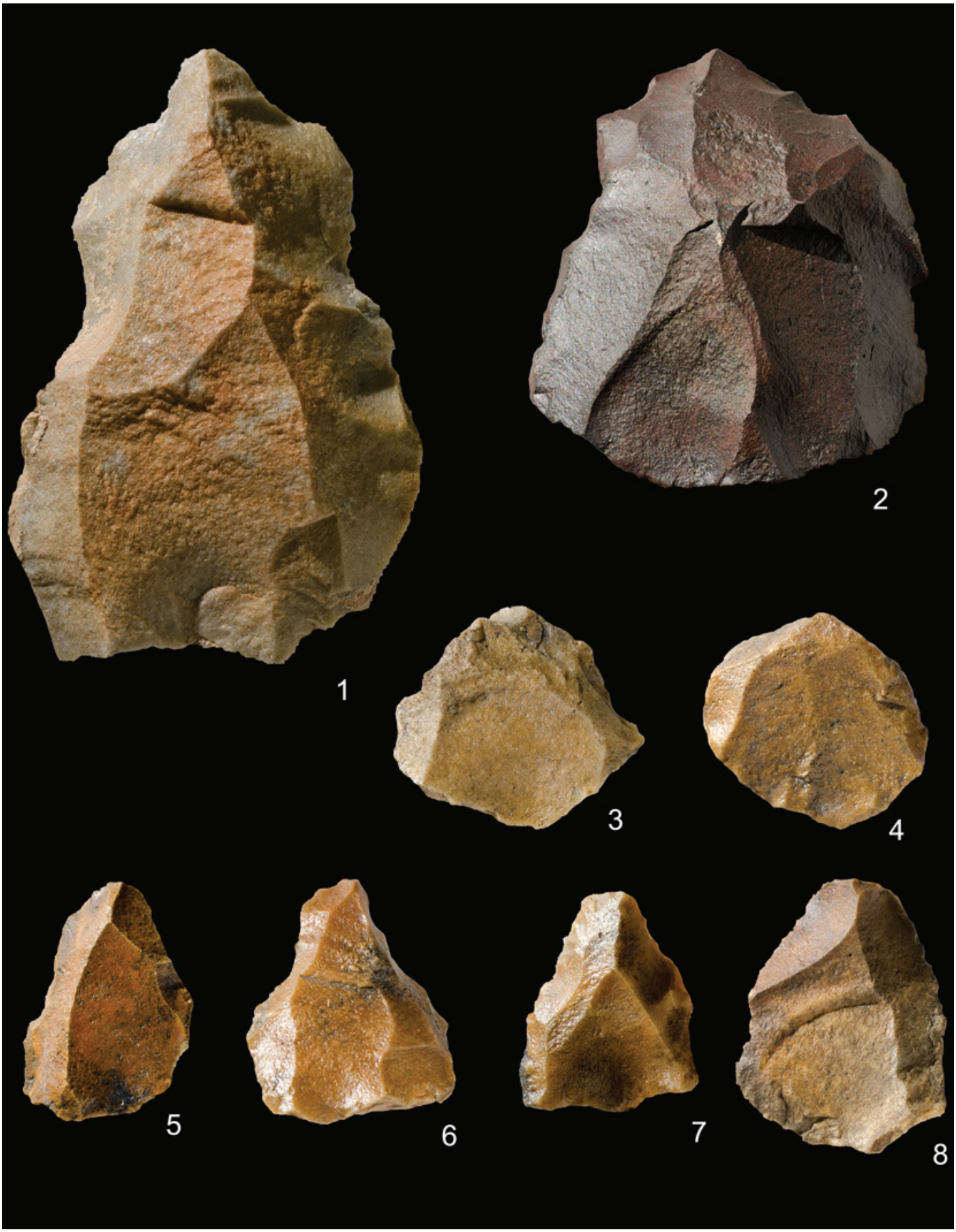

Figure 3. 1) Nubian core with Type 1 preparation from AK-32; 2) Bidirectional crossed Levallois preferential core from AK-31; 3) and 4) Levallois preferential cores from AK-35; 5) to 8) Nubian Levallois cores from AK-40 (Y. Hilbert - Saudi-French Archaeological Mission in al-Kharj).

Conclusion: perspectives for future work

With each season of data collection at al-Kharj new data is disclosed that helps to unravel the prehistory of this region. During the last season of prehistoric survey (from November 19 to 28, 2014) work has concentrated on the previously identified rich area of the Rufāʾ Graben. There, diverse sites pertaining to the Middle Paleolithic of Arabia

have been detected; this period is paramount in human prehistory given the issues of human evolution, admixture and dissemination of AMH across the globe. Arabia, as one of the first areas of the Old World (beyond Africa) to have been colonized by the Genus Homo Sapiens is slowly giving price its secrets. Of utmost importance for the continued research on the Middle Paleolithic of Arabia will be the continued research and investigation of the Rufāʾ Graben system

THE BRONZE AGE NECROPOLIS ʿAYN AL-ḌILAʿ 1

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Élodie Wermuth (Eveha – Paris, France)
With the participation of Anaïs Chevalier (University Paris-Panthéon Sorbonne) & Laetitia Munduteguy

Figure 1: Aerial kite picture of the necropolis ʿAyn al-Ḍilaʿ 1 (photograph: Th. Sagory – Saudi-French Archaeological Mission in al-Kharj).

By far the largest necropolis of the oasis, ʿAyn al-Ḍilaʿ 1 is 4.4 km long and up to 0.5 km wide (**figs. 1-3**). Though most of this necropolis has been fenced by the SCTA, it extends beyond the fence particularly to the south-west.

History of research

The site is mentioned by Philby (Philby 1920: 169) who described it as "a rocky ridge called Qusaia [Jibāl al-Qusayʿa], whose summit is surmounted by a vast concourse of cairn-like mounds of stones and mortar, less striking than though reminding one of the Firzan ruins".

G. de Gaury visited the site in the early 1940s (De Gaury 1945: 152) and described three different kinds of tombs. In 1978, archaeologists taking part in the Comprehensive Survey of the Kingdom of Saudi Arabia registered this site with the label 207-20 (Zarins *et al.* 1979: 23–25). Two kinds of tombs have been distinguished:

Circular tombs: the most numerous type includes ordinary round mounds of dry-stones (De Gaury's type 1 and Zarins's type A). The funerary chambers are said to be delimited by large orthostats (Zarins *et al.* 1979: 23, pl. 8b, 12). Some of these (ca. 15 tombs) are round tumuli, considerably higher, with larger stones and a flat earth-covered top (De Gaury's type 2). To the south-east of the necropolis, Zarins mentions the same kind of tombs encircled by a wall of well-laid stones (Zarins's type B; Zarins *et al.* 1979: 23, pl. 12). One of these circular tombs was excavated (Zarins *et al.* 1979: 24). The funerary chamber had already been plundered. It was encircled by limestone slabs.

Figure 2: Necropolis at ʿAyn al-Ḍilaʿ, tumulus field looking west (photograph: J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Tapered structures (De Gaury's type 3): long mounds or walls about 1 m high and between 9 and 41 metres long. They are concentrated south of the fenced area. At least 24 of these tombs are visible on satellite imagery. After excavation, one of these tapered structures proved to be a tomb (Zarins *et al.* 1979: 25), a funerary chamber was laid out at the head of the structure.

Sherds sampled on the ground in the past have been indiscriminately attributed to the pre-Islamic period (Zarins *et al.* 1979: 27, 34).

Excavating this tumuli field aimed at making clear:

- the morphology and typology of the funerary structures;
- the period of construction of the tombs;
- the evolution of the necropolis (extent, occupation).

Survey and map of the site

On October 27, the first step has been to survey the whole necropolis on foot. The site has been walked through and the different kinds of structures checked out. Four kinds of tomb were identified:

- Circular structures with a peripheral wall made of vertical slabs and a filling of rubble and stones between this wall and the one of the funerary chamber. When visible, the walls of the funerary chamber are either made of standing slabs or horizontal stone courses. Most of these tombs have been plundered, as attested by a funnel-shaped crater on the top.

- Rectangular structures having the same kind of peripheral wall and funerary chamber as the previous one. Apparently not numerous, the excavation of some tumulus has shown that several mounds we thought to be circular tombs were rectangular ones. This kind of tomb could have been more widespread than expected.

- Tapered structure: gathered in the southern part of the necropolis, 16 tapered structures have been registered so far. They are long walls about 1 m high and between 9 and 41 m long, widening at one end, and ending with a linear wall. The funerary chamber is built in the widened end of the structure.

- Wall-tomb: A single wall-tomb has been identified so far, in the southern part of the site. The structure is an elongated heap of rubble and stones, ca. 30 cm high, bordered by small slabs set vertically. It is enlarged in its central part. There, a rectangular funerary chamber is bordered by large limestone blocks set vertically.

Thanks to satellite imagery, a map of the necropolis has been drawn (**fig. 3**). More than 3000 tombs have been numbered and located. To facilitate the location of excavated areas, a virtual grid oriented along cardinal points has been set up. It is a 100-m-grid; each square is named alphanumerically (A, B, C... followed by 1, 2, 3...).

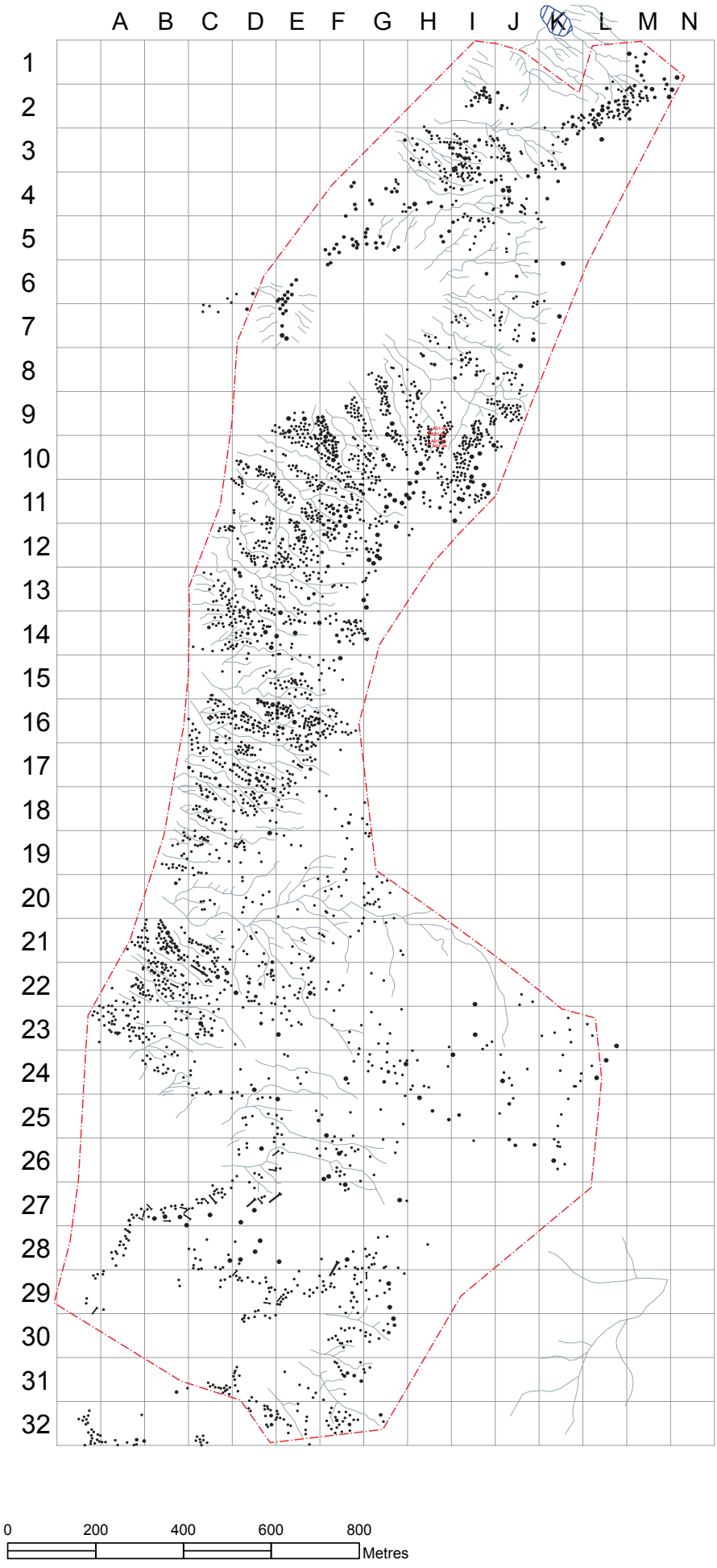


Figure 3: Map of the necropolis at ʿAyn al-Ḍilaʿ 1 (E. Wermuth – Saudi-French Archaeological Mission in al-Kharj).

Choice of the excavated area

Five tombs were excavated during this season in areas H9 and H10 (**fig. 4**). Excavation started with two tombs from square H9: AD1-01 and AD1-02 [for: site ʿAyn al-Ḍilaʿ 1, tombs 01 & 02]. Later on, three tombs were uncovered immediately to the south, in square H10: AD1-03, AD1-04 and AD1-05.

The choice of the tombs was based on the following considerations:

- These tombs are located in the central part of the necropolis, where the tomb density is the highest and the shape homogeneous. As such, they might be representative of the main period of occupation of the necropolis. Marginal architectural types (such as wall-tombs and tapered structure are absent from this area).

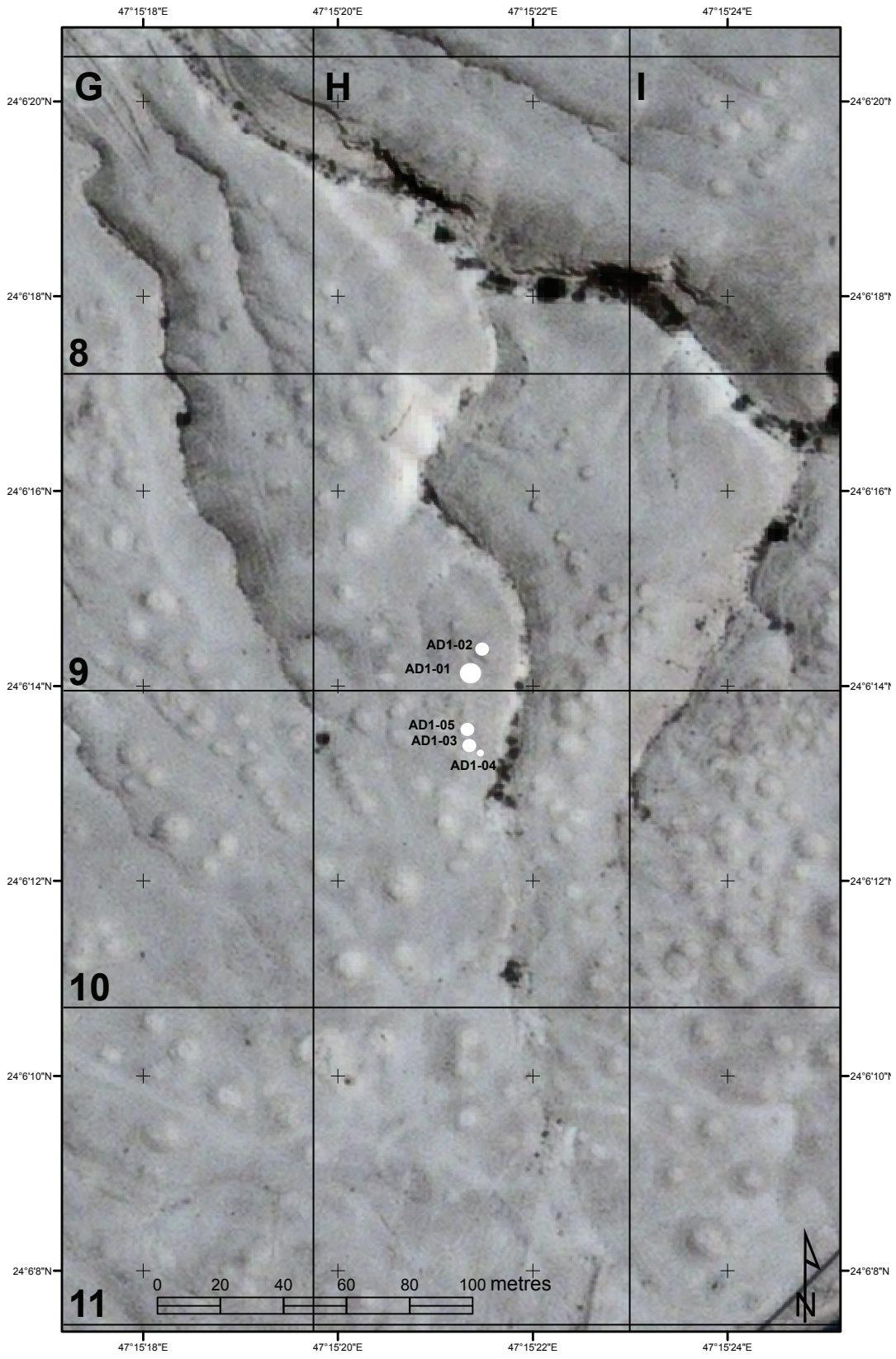


Figure 4 : Location of the excavated graves in areas H9-H10 (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj / Pleiade Imagery ASTRIUM/ SpotImage).

- These tombs are in a regular line along the edge of the plateau. It makes it a coherent group.

- These tombs are built along a gully. Rubbles coming from the excavation can be easily thrown away in this gully and washed away by rainfalls and runoffs. The rubble management is thus simplified.

- AD1-01 has been damaged by recent plundering which made it possible to excavate it quite rapidly, to implement a working methodology and to get an idea of the shape of the graves, thus simplifying the excavation of other tombs in the neighbourhood.

- Other graves in this neighbourhood did not show clear evidence of heavy looting which makes the presence of bones and artefacts probable.

Methodology

The methodology applied on the field was as follow:

1 - A rectangular area was set up around a tumuli in order to include the whole structure and its collapse. This area was supposed to be turned toward cardinal points. Nevertheless, the imprecision of the compass of a hand GPS device lead to a deviation of 10° (**fig. 5**).

2 - The surface was then cleaned on this area by removing surface loose sediment and small stones. A heap made of limestone blocks and packed earth covered by a crust of detrital limestone rapidly appeared.

3 - The excavated area was then divided in two or four parts by drawing a line oriented E-W and/or N-S. Then, the two halves or two opposite quarters of the grave were excavated one after the other. When excavating opposite quarters, it was possible to get both the complete longitudinal and latitudinal sections of the structure. By excavating half the structure, only one section was exposed.

4 - The sections of the structure were drawn (scale: 1:20).

5 - The remaining part of the structure was excavated in order to uncover the structures (surrounding wall, funerary chamber).

6 - Finally, the funerary chamber in the centre of the grave was carefully excavated by applying a certain protocol. According to the principles of field anthropology (Duday *et al.* 1990), each funerary chambers has been excavated along with a detailed photographic coverage, the registration of bones altimetry, and an osteological description in order to highlight the taphonomic process as well as the way each individual has been buried. Sediments have been sieved. Considering the bad state of preservation of bones, their uncovering has been made difficult. Each time it was possible, bones were individuated. The sampling and determination of bones has been completed whenever possible. After the removal of every sediment scraping, zenithal and detailed pictures made it possible to locate and draw the human remains and artefacts. A bench has been systematically left along one side of the chamber in order to show the stratigraphic sequence and possible disturbances. Once the bedrock uncovered in the funerary chamber, the bench was excavated in the same way.

In the laboratory, the poor state of preservation of bones rarely permitted age or sex estimate, nor any kind of observation pertaining to sanitary conditions. No data allowing sexual diagnose has been preserved. Age of death was estimated by considering bone maturation, through the observation of the epiphyseal fusion (Birkner 1980), and dental maturation through comparisons with the tables of maturation provided by Moorees, Fanning & Hunt (Moores *et al.* 1963).

Information related to each structures is detailed at the end of this chapter in **Table 1**, to each stratigraphic unit in **Table 2**, to each artefact in **Table 3**, and to each bone in **Table 4**.

Map and DEM of the investigated area

An accurate map of the excavated area was done by using a D-GPS Trimble R4 (horizontal accuracy: 1 cm; vertical accuracy: 5 cm). More than 200 points were taken on the structures in order to locate them precisely. Moreover, 800 points have been taken over an area of 100 × 60 m in order to draw the Digital Elevation Model (DEM) of the area.

Interpolation (natural neighbour method) on ArcGis software led to the drawing of this DEM (**fig. 5**).

Moreover, interpolation with the software Surfer made it possible to get a 3D view of the mapped land (**fig. 6**).

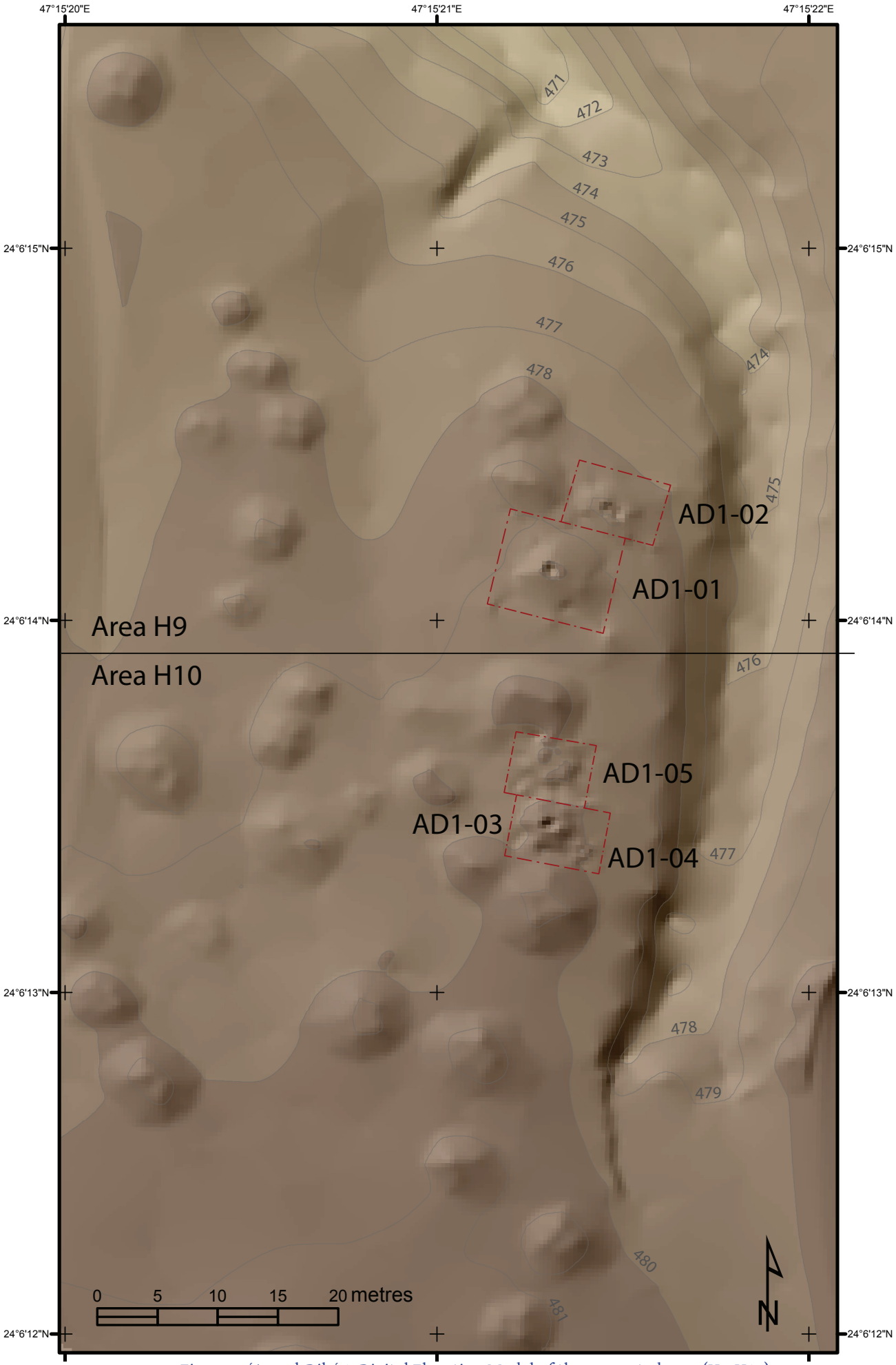


Figure 5: ʿAyn al-Ḍilaʿ 1: Digital Elevation Model of the excavated area (H9-H10) (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

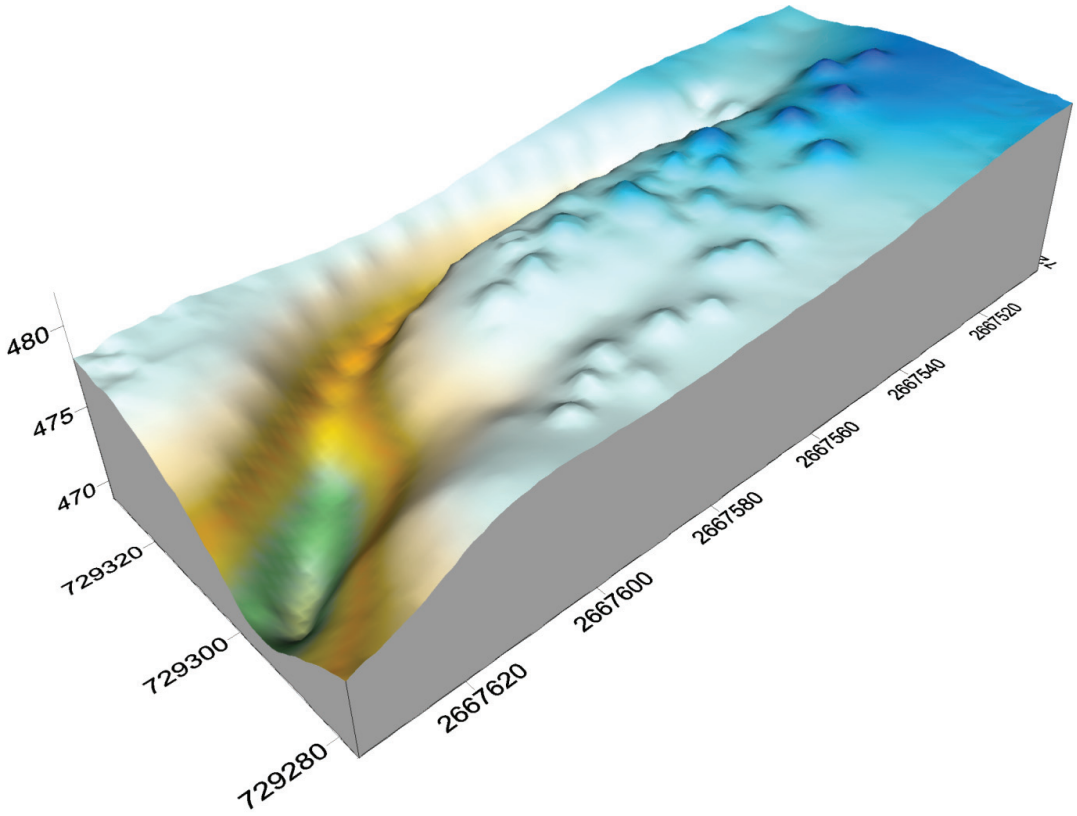


Figure 6: ʿAyn al-Ḍilaʿ 1: 3D view of the working area (H9-H10) (Y. Hilbert - Saudi-French Archaeological Mission in al-Kharj).

Grave AD1-01

Excavated from October 29 to November 27, 2013

Location

ʿAyn al-Ḍilaʿ 1 – Medium-size tumulus (ca. 7 m in diameter) in Area H9, on the edge of the plateau, along a ridge overlooking a gully oriented north-south. 24°06'14,"N – 47°15'21.4"E.

The excavation focused on the south-western quarter, where a funnel-shaped hole dug by looters is located. A collapse layer made of limestone blocks and alluvium of eolian origin was removed in order to identify the walls of the structure.

Architecture & stratigraphy (figs. 7-10)

The structure

The surface of the tomb AD1-01 has been cleaned by removing a layer of small stones and pebbles (limestone) and eolian silts accumulated (UF 1001 - for the location of the UFs: **fig. 10**). It covered a rectangular structure (4.74 × 3.30 m) bordered by 4 linear walls made of limestone slabs set on the edge and partially covered with a crust of melted and hardened lime: W 1002 to the south-east; W 1003 to the south-west [only cleared on its south-eastern extremity; one large rectangular squared block and part of a second one are visible]; W 1005 to the north-east; W 1006 to the north-west.

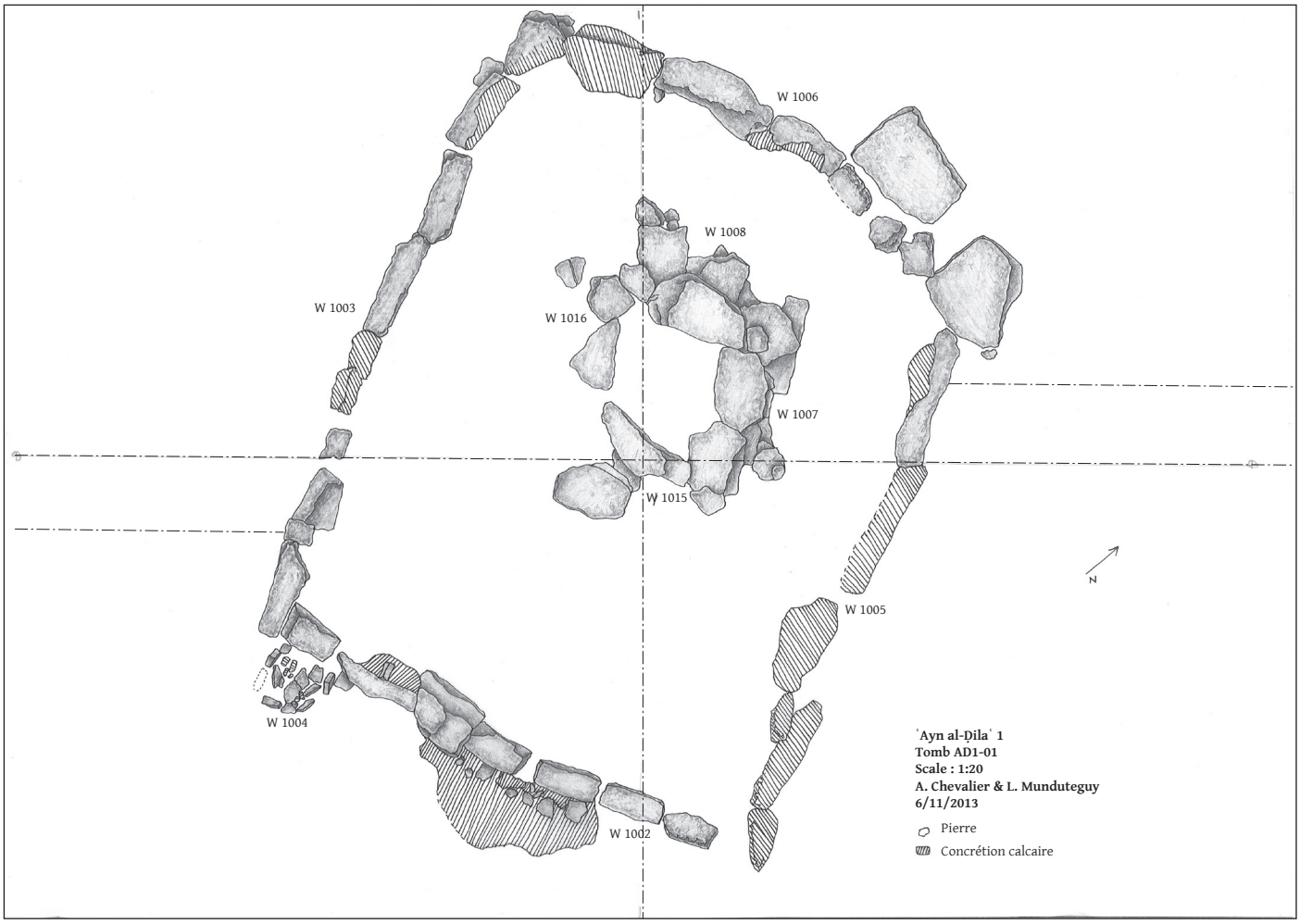
The excavated area has been divided in four quarter according to N-S and E-W axes. The south-eastern quarter and the north-western one have been excavated in order to provide complete NS and EW sections of the area without having to excavate the whole tomb.

The overall surface of the tomb is eroded. The limestone blocks are cracked; they fell down, or melted and then formed a dense lime crust. Some of the standing slabs of the northern corner of the peripheral walls fell down flat on the ground and were covered by a collapse layer.

The south-eastern quarter

This collapse layer made of crumbled limestone blocks mixed with earth and pebbles has been removed in the south-eastern quarter (UF 1002). This area has been perturbed by recent plundering and the digging of a pit (P 1001) within the filling between the funerary chamber and the peripheral wall. The pit is going downward toward north-east.

Outside the tomb, the collapse layer has been removed in the same SE quarter, down to a thin natural crust of lime. At the foot of W 1002, uncovering of small stones strengthening the basis of the vertical orthostats, and to the south-



▲ Figure 7: ʿAyn al-Ḍilaʿ 1: plan of tomb AD1-01 (A. Chevalier & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

◀ Figure 8: ʿAyn al-Ḍilaʿ 1: zenithal picture of tomb AD1-01 (Th. Sagory - Saudi-French Archaeological Mission in al-Kharj).

ern extremity, against this wall, presence of a semi-circular wall (W 1004) made of small flat limestone set on the edge (**fig. 9**). The emptying of this small structure built against W 1002 yielded limestone nodules, pebbles and light brown earth (UF 1005) covering stones laying down flat. This small semi-circular structure might have been set to steady an earthenware jar.

Between the southern bench of the excavated area and W 1003, under UF 1002, we dug a 1 m wide test trench along the N-S central axis. It was filled with an homogeneous and loose earth layer mixed with pebbles, concentration of stones to the north, concentration of crumbled limestone to the south (UF 1004). W 1003 is strengthened by the presence of pebbles against its base, but no foundation trench has been dug below. The stones are laying directly over the ground.

Between the peripheral wall and the funerary chamber, we removed the plundering rejection (UF 1006), an homogeneous, beige white layer made of crumbled or chalky limestone being the original filling turned upside down. Uncovering of the remaining untouched part of the filling made of large limestone blocks, rare pebbles and eolian sediment.

◀ Figure 9: ʿAyn al-Ḍilaʿ 1: tomb AD1-01, W 1004, small structure against the southern wall W 1002, possibly a wedge for a jar (Th. Sagory - Saudi-French Archaeological Mission in al-Kharj).

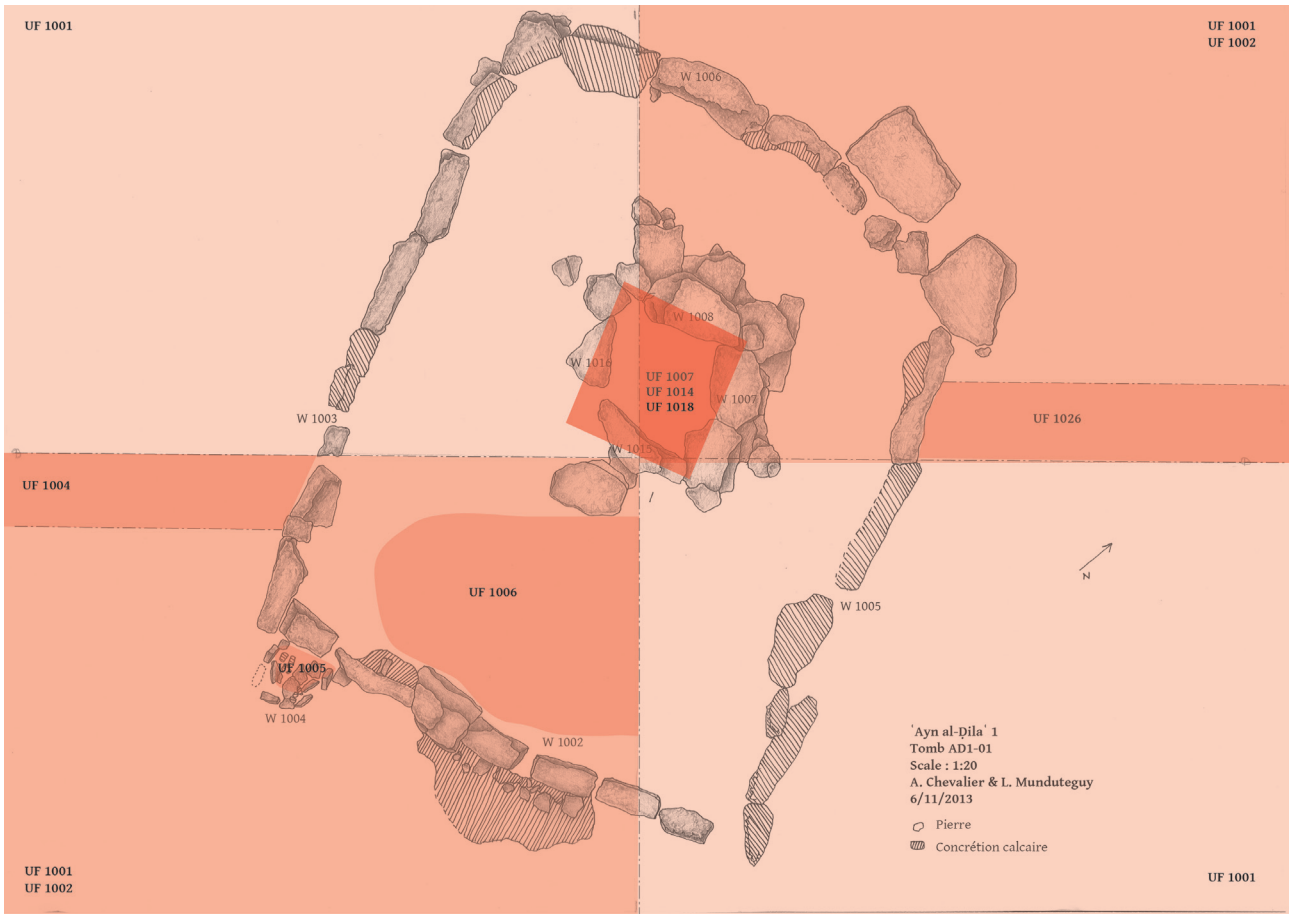
The north-western quarter

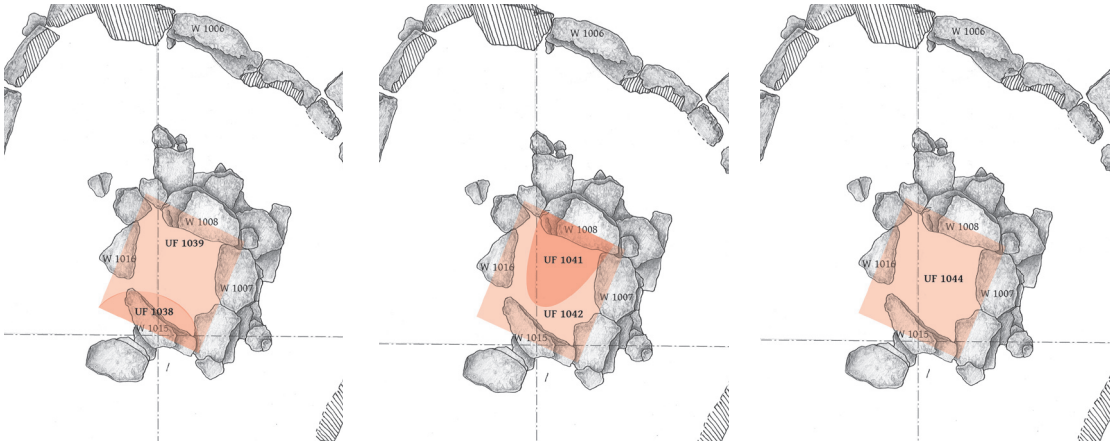
We removed the collapse layer (crumbled limestone blocks mixed with earth and pebbles - UF 1002), uncovered the filling (limestone blocks, rare pebbles and eolian sediment) between the funerary chamber and walls W 1005 and W 1006. Two slabs of W 1006 were laying down flat on the ground and were partly covered by the collapse of the inner filling of the tomb. The outer side of the walls of the funerary chamber W 1007 and W 1008 have been uncovered. The lower part of the walls was made of large orthostats set on the edge; they were covered in the upper part by 2 to 3 courses of stones forming the bottom of a corbelled vault.

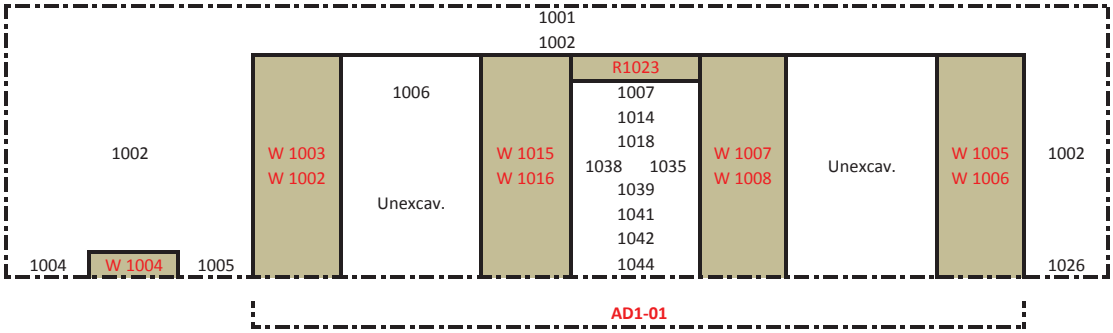
Between the northern bench of the excavated area and W 1005, under UF 1002, we dug a 1-m-wide test trench along the N-S central section crossing the excavated area in the middle. We removed earth, pebbles and limestone concretion being an interface between the bedrock and the collapse layer (UF 1026).

The north-eastern quarter

Only the surface layer (UF 1001) has been removed there in order to complete the map of walls W 1002 and W 1005.







▲ Figure 10: ʿAyn al-Ḍilaʿ 1: Tomb AD1-01 - Location of the stratigraphic units.
Upper part: UF 1001; 1002; 1004; 1005; 1006; 1007; 1014; 1018.
Central part, Left: UF 1038; 1039; Central part, Middle: UF 1041; 1042; Central part, Right: UF 1044.
Lower part: schematic vertical location of stratigraphic units.
(Plan: A. Chevalier & L. Munduteguy; Graphic works: J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

The south-western quarter

Only the upper part of this quarter has been cleaned (UF 1001) in order to delineate the funerary chamber, which straddles over this quarter and the north-western one.

The funerary chamber (R 1023)

In the middle of the structure, an almost square funerary chamber is bordered by four perpendicular walls made of one or two standing limestone slabs (W 1007 to the NE, W 1008 to the NW, W 1015 to the E and W 1016 to the S). The covering system above the room is partly preserved, being made of corbelled large stones set diagonally above the walls. The capstone is missing, possibly being a sign of an ancient plundering of the room.

The room is 1.30 m × 1.00 m, and 1.10 m high.

Two successive burials have been excavated within it (**fig. 11**).

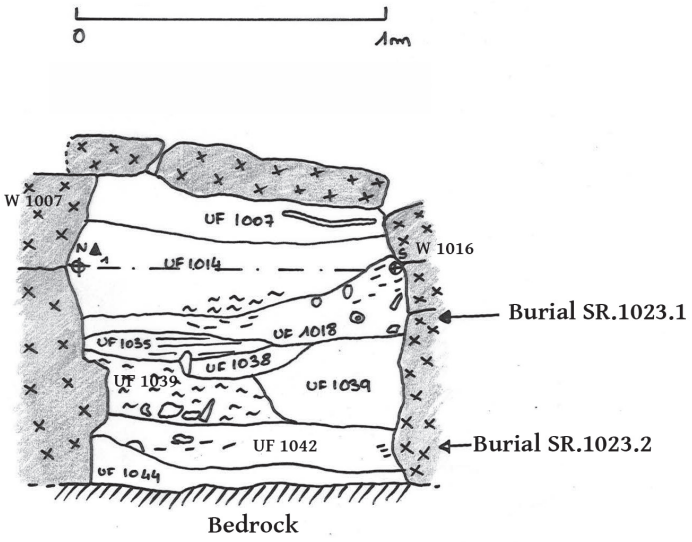


Figure 11: AD1-01. Stratigraphic section of burial room R 1023 (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

The lower burial SR.1023.2

The lower burial lies directly above the bedrock, in a 20-cm-thick layer which includes three stratigraphic units (UF 1041, 1042, 1044).

UF 1041 is a layer of dense grey to white silt with inclusions of pebbles and lime nodules. It seals the long and powdery bones of a single individual (S.R.1023.2). Under this thin layer, UF 1042 is a layer of loose brown earth with pebbles and limestone nodules. UF 1044, in continuity with UF 1042, is the lowest layer of the earlier burial immediately above the bedrock. It is made of loose, brown to black silt.

Bones are present in both UF 1042 and 1044. They have been unearthed, located and – when possible – sampled through 4 successive clearings out. Bones were scattered all over the surface of the room (**fig. 12**). They are in a very bad state of preservation and their anatomical distribution is uncomplete. Thus determining bones was a hard task, but for skull fragments, which were scattered but less spoiled (**fig. 13**).

No bone doubloons have been identified, reinforcing the hypothesis of a single individual. No anatomical consistency has been seen, but the scattering of bones and artefacts over the whole area of the burial chamber, rather than in a small cluster, would indicate a (disrupted) primary burial rather than a secondary deposit.

With regard to the presence of a sternebra, the absence of abrasion on the dental enamel, and the tooth size, the individual would be less than 15 years old. According to the bone morphology, the individual fits within the 10 to 14 years old interval. Teeth examination showed no dental deficiency-related stress.

Considering the horizontality of UF 1042 and 1044 and the absence of pit or digging through these layers, we are inclined to think that the disrupting of bones is the consequence of a re-opening (and the looting) of the burial at a time the funerary chamber was not filled in with eolian silt, i.e. a short time after the burial (less than a few centuries).

The funerary deposit included:

At the interface between UF 1041 and UF 1042: 3 shells;

UF 1042, western part: seashells, one carnelian bead (**fig. 14**);

UF 1042, eastern part : 2 bivalve seashells;

UF 1044, western part: a small grinder (pebble) (**fig. 14**), few seashells.

The carnelian bead is the only diagnostic artefact indicative of a chronological attribution. According to Olivier Brunnet who was kind enough to share his expertise on this artefact (personal communication): "The bead morphology is common. In the Oman Peninsula, most of the carnelian beads having this shape are attributed to the Umm an-Nar period, but this shape is still attested in the Iron Age. The hole seems to have been drilled with the technique of the bipolar rotary drilling. This technique was quite common during Bronze Age and was the unique technique used to drill such long beads." Considering this, a date to the Early Bronze Age is likely but we cannot exclude a more recent period.

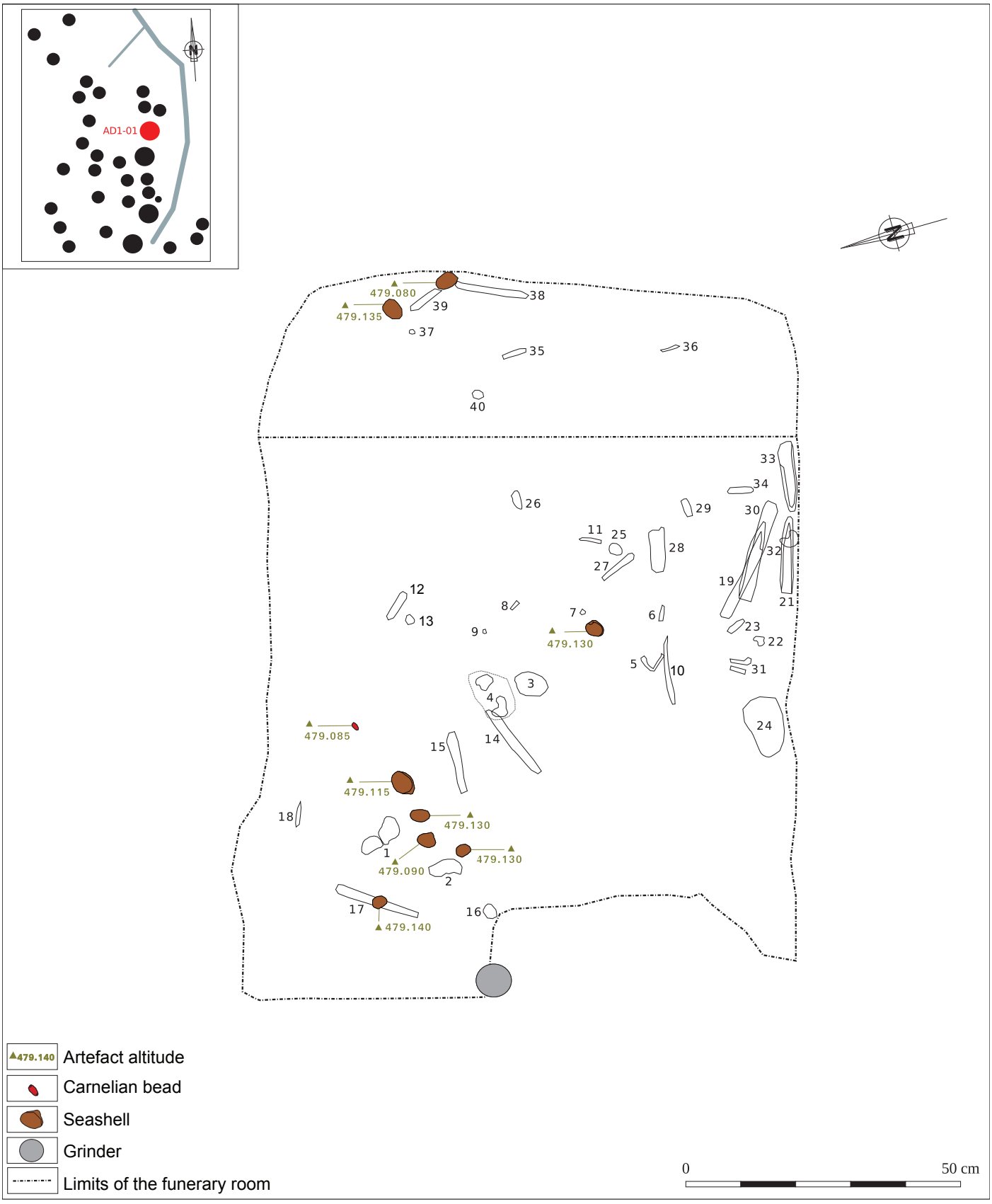


Figure 12: Tomb AD1-01, R 1023, lower burial S.R1023.2. Distribution of bones and artefacts (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

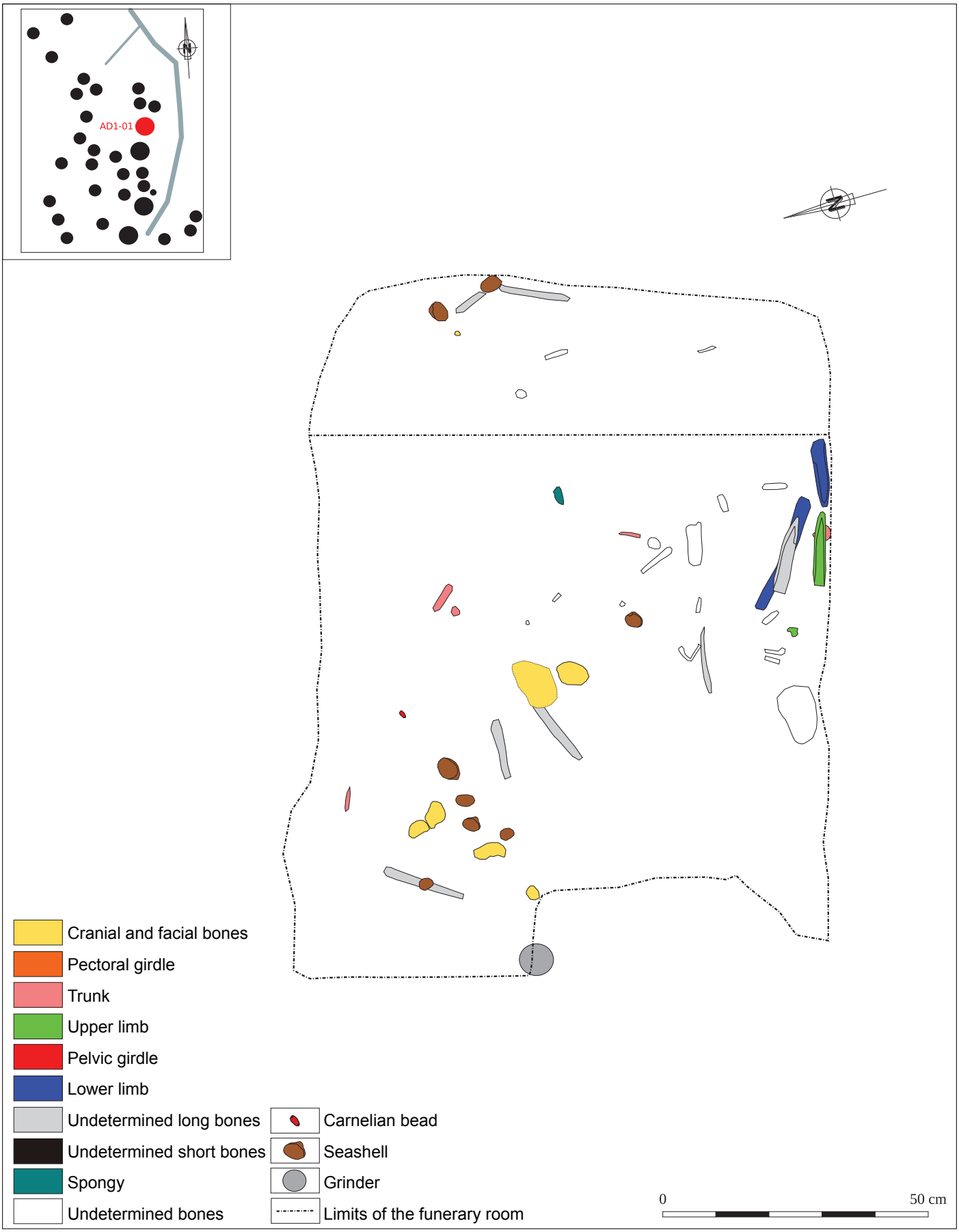


Figure 13: Tomb AD1-01, R 1023, lower burial S.R1023.2. Distribution of anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

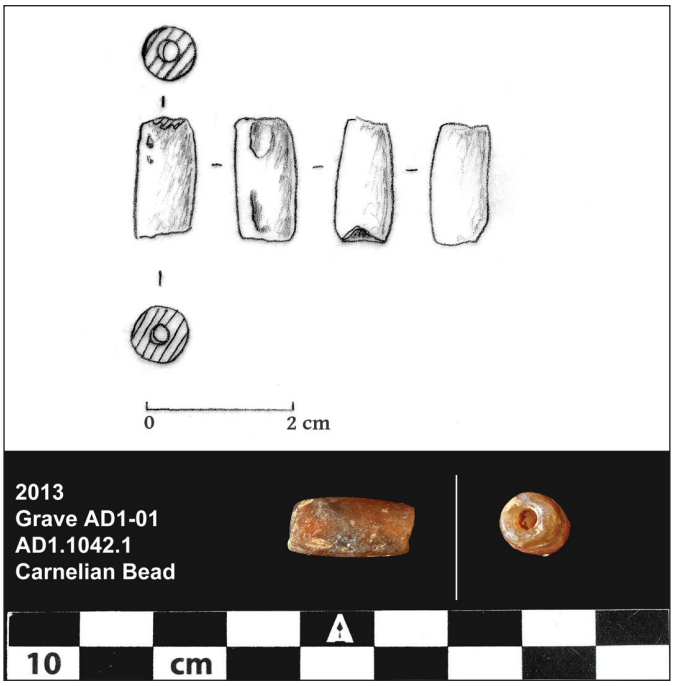


Figure 14: Tomb AD1-01, R 1023, artefacts associated with lower burial S.R1023.2 (L. Munduteguy - Saudi-French archaeological Mission in al-Kharj)

The upper burial SR.1023.1

Above the earlier burial, a 20-cm-thick accumulation (UF 1035, 1038, 1039) probably results from the percolation of eolian sediments and chemical dissolution of the limestone within blocks in the funerary chamber after its reopening (looting?).

UF 1039, directly above the lower burial, is a layer of loose grey silt with inclusions of small pebbles and limestone nodules. Above it, UF 1035 is a thin layer of loose grey sediment and UF 1038 is a pocket of loose brown earth with inclusion of small pebbles and limestone nodules.

Above this filling a second/upper burial took place in the funerary chamber. Bones were contained within a layer of loose homogeneous silt with inclusions of few small limestone blocks, pebbles, and a couple of large blocks to the west (UF 1018). A large number of bones were concentrated in the eastern half of the funerary chamber (**fig. 15**). Bones are largely decayed (powdery state). They nevertheless include almost all the parts of the body, including vertebras and skull. If their state of conservation allowed an identification *in situ*, their sampling was almost impossible due to their spoilage.

The excavation of the individual was realized in 11 horizontal clearings out (2 for the excavation of the bench in the eastern part of the room); it allowed the identification and determination of the largest number of bones (**fig. 16**).

Bone determination indicated the presence of a single mature individual (no bone doubloons). The spatial distribution of bones made it possible to analyse the distribution of anatomical series and to look for consistency in the burial deposit (**fig. 17**).

Bones are gathered in the eastern half of the room, ca. 30 cm under the capstones. They lay on a sloping ground (from south to north). The spatial distribution is coherent: cranial and facial bones and trunk elements (vertebras, ribs) are denser to the south; there is a consistency in the distribution of the group of central ribs. Upper limbs are also concentrated in the southern part. Bones from the hands (most particularly the left hand) are present and gathered together. Lower limbs, less present, are more randomly scattered. These observations are suggestive of a primary burial. Nevertheless, displacements are sometimes noticeable: some elements from the trunk such as vertebra have been found ca. 50 cm away; such is the same for the mandible.

With the exception of the discovery of small rodent bones which might have implied an intrusion and taphonomic impact, no substantial digging was visible in the layers above the second burial. Thus, bone migrations are most probably the consequence of the initial position of the body, of its natural decay and to the presence of an empty space around the body allowing the fall of bones from south to north according to the slope of the burial ground. Basically, bone distribution indicates a body lying on the left side, with upper and lower limbs bent and with the upper part of the body leaning against the southern wall W 1016.

Bones from the trunk are better preserved and showed a degenerative joint disease pathology (osteoarthritis).

The deposit associated to this burial has been found in the north-east corner of the room and might have been deposited on the ground rather than worn by the deceased (**fig. 18**). It includes a bronze ring (AD1.1018.1), an undetermined iron artefact (AD1.1018.2), 8 beads carved in seashell (AD1.1018.3), two stone beads (AD1.1018.4, AD1.1018.5)

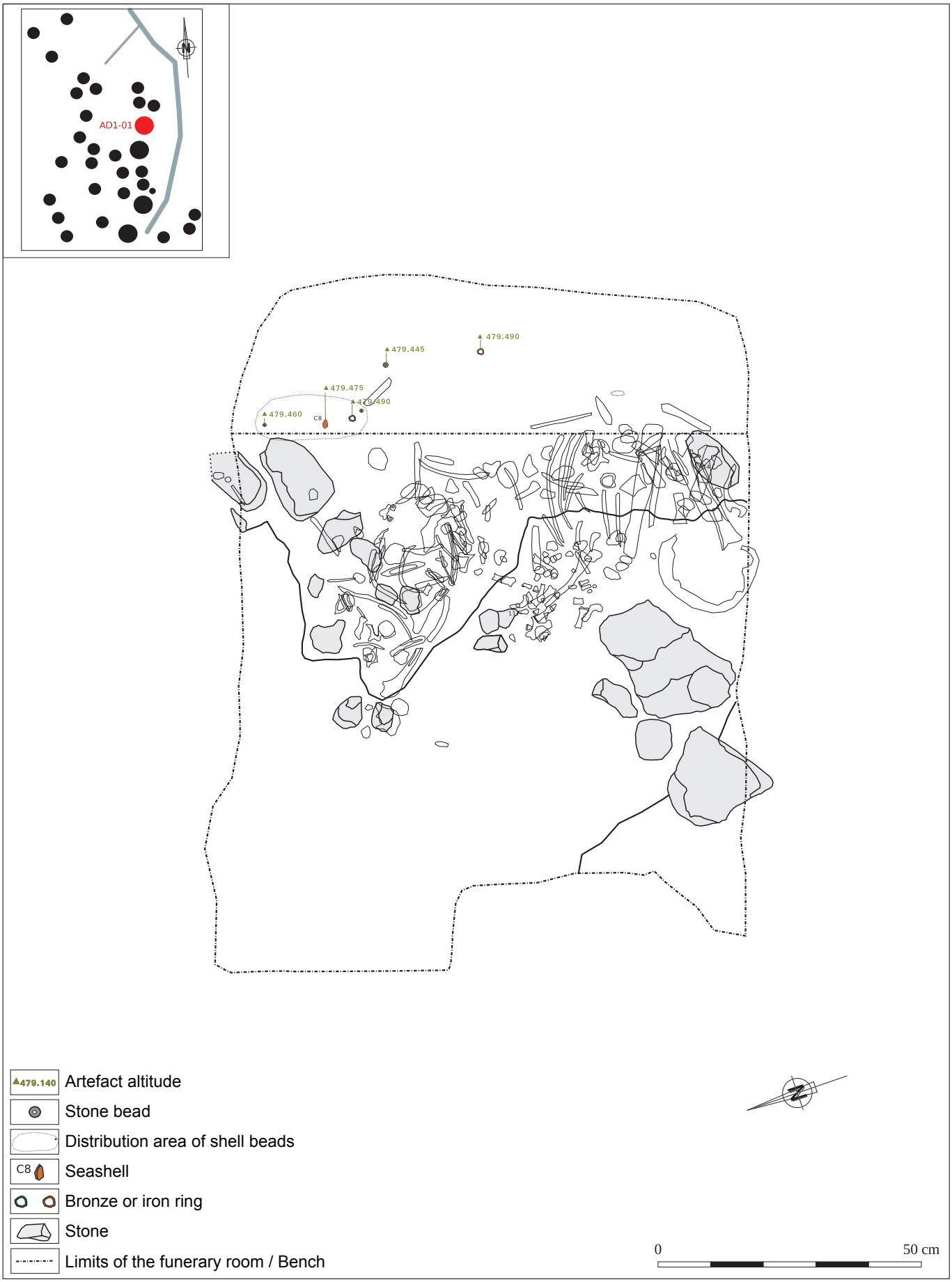


Figure 15: Tomb AD1-01, R 1023, upper burial S.R1023.1. Distribution of bones and artefacts (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

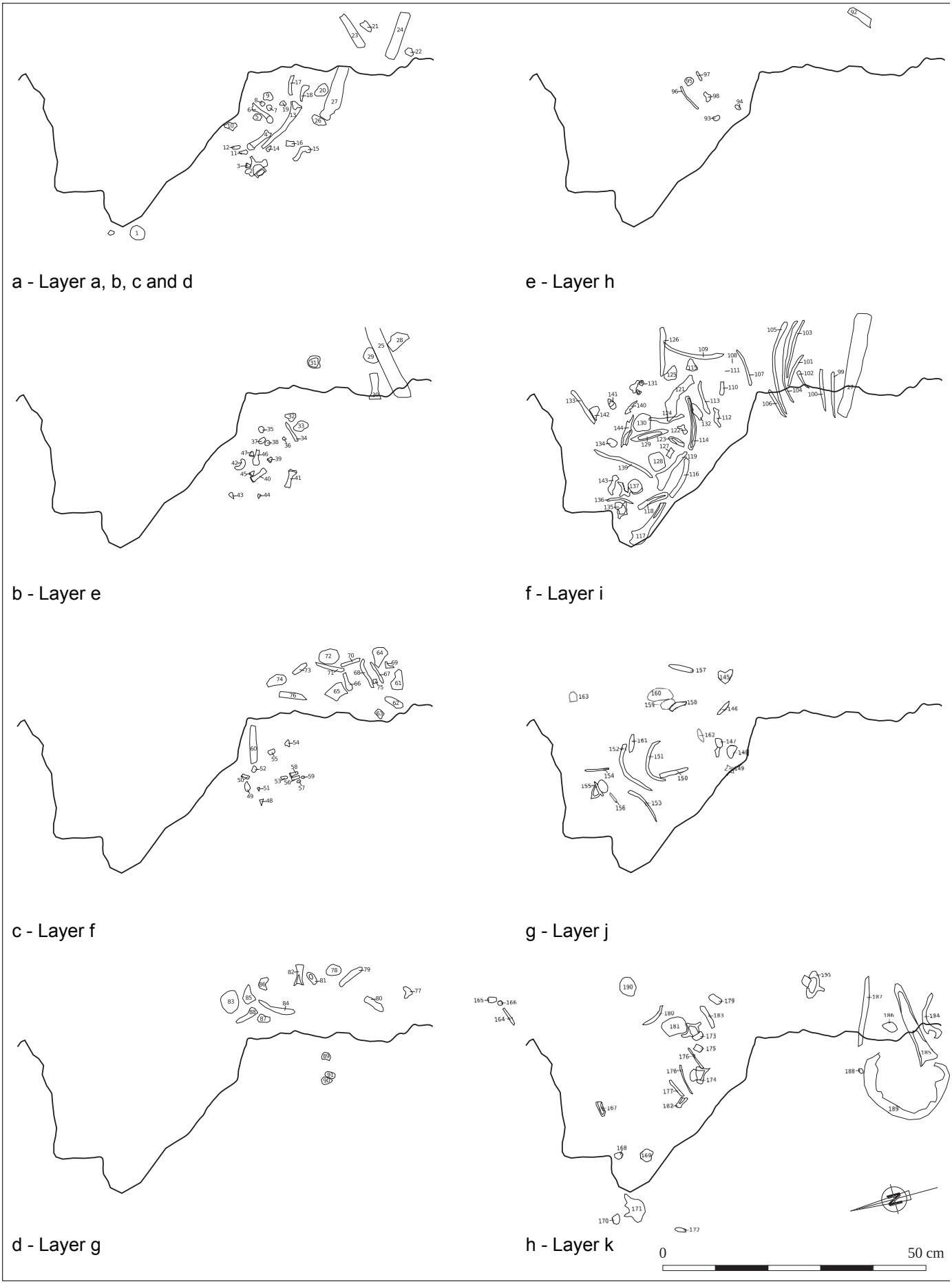


Figure 16: Tomb AD1-01, R 1023, upper burial S.R1023.1. Distribution of bones by horizontal layers (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

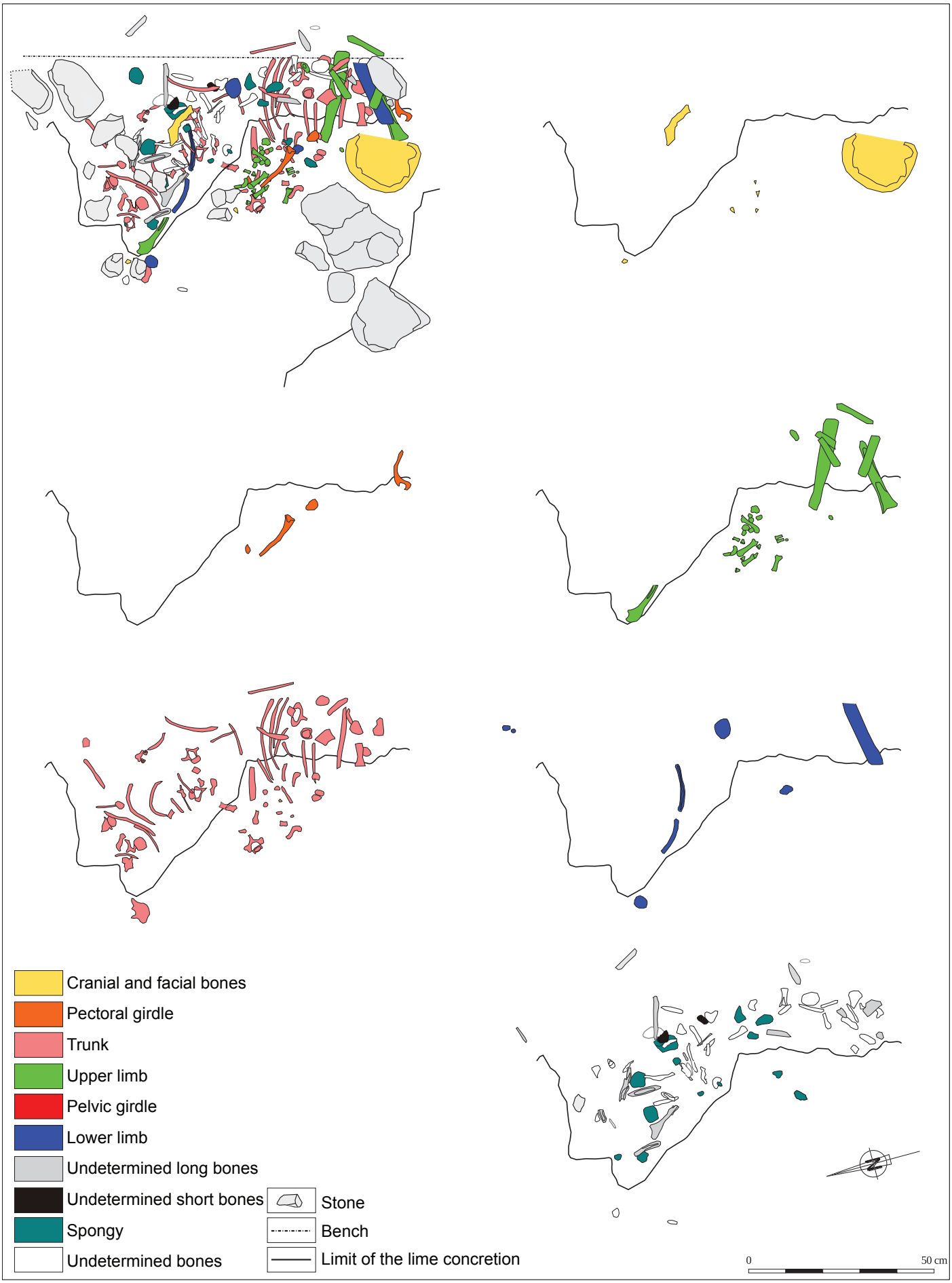


Figure 17: Tomb AD1-01, R 1023, upper burial S.R1023.1. Distribution of anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

and a sawn seashell (AD1.1018.6) of the *Cypraea* type (for the details regarding artefacts: see **Table 3)**.

The filling of the burial room above the body (UF 1007 and 1014) is indicative of an empty space progressively filled up with the percolation of silts and limestone fragments from the capstones.

Directly above the layer containing the bones (UF 1018), UF 1014 corresponds to post-abandonment filling including a succession of compact layers of earth and lime nodules and layers of homogeneous and loose sediment mixed with small pebbles and small stones. It is the result of percolation of sediment and chemical dissolution of limestone from the walls or capstones. Above it, the upper layer in the funerary chamber (UF 1007) is an homogeneous, compact, light brown layer including small lime stones, above a large limestone block, possibly part of the capstone.

To sum up, grave AD1-01 is a large rectangular tomb containing two successive burials. The lower one (S.R1023.2) was followed by a re-opening of the tomb (looting?) and then covered by the percolation of earth. Later, a second corpse was buried (S.R1023.1) at a higher altitude. This might have taken place long after the previous one according to the sedimentation between the two burials, the difference of altitude and the different deposits. If the lowest one was accompanied by a carnelian bead which might be a clue for a burial from the Early Bronze Age – waiting for the ^{14}C datings, this remains hypothetical –, the second burial contained an iron artefact (AD1.1018.2) which is an evidence of a more recent burial.

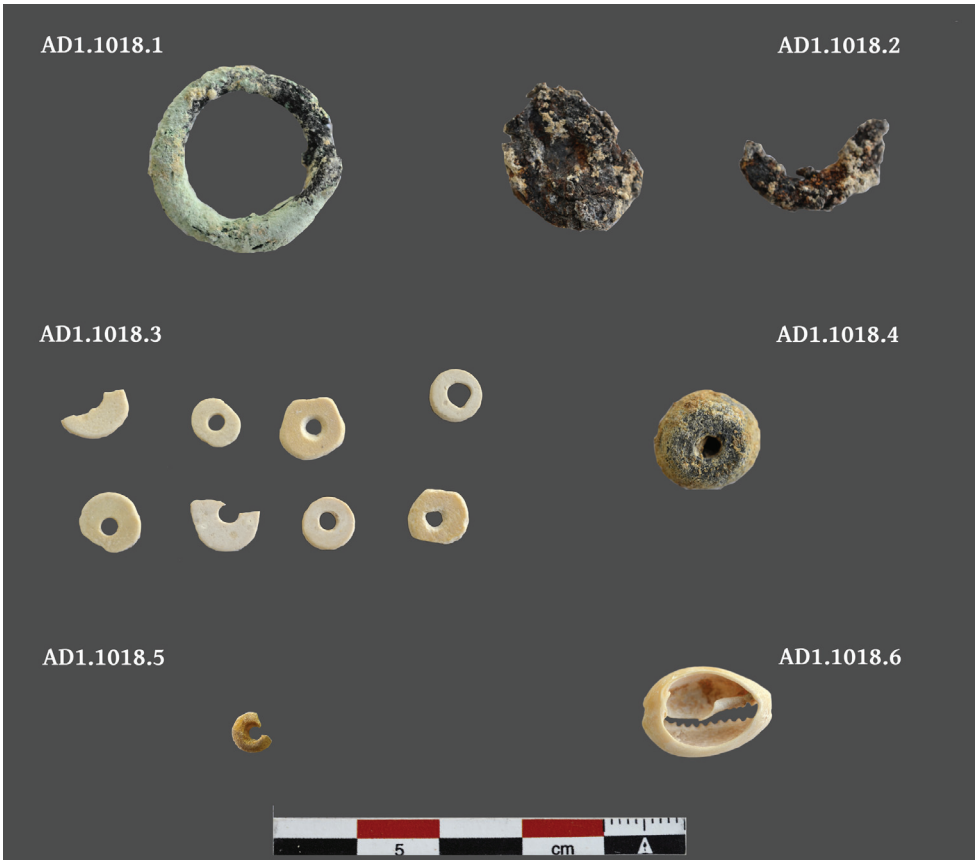


Figure 18: Tomb AD1-01, R 1023, upper burial S.R1023.1. Funerary deposit (Y. Hilbert - Saudi-French archaeological Mission in al-Kharj).

Grave AD1-02

Excavated from October 30 to November 19, 2013.

Location

ʿAyn al-Ḍilaʿ 1 – small-size tumulus (less than 5 metres in diameter) in Area H9, on the edge of the plateau, along a ridge overlooking a gully oriented north-south, immediately to the north of AD1-01. The grave proved to be a rectangular tomb constituted by a peripheral wall and a small, rectangular funerary chamber (**figs. 19-20**).

A square of 7 × 5 m has been set up around the tomb and the surface of the area cleaned by removing surface loose sediment and small stones.

Architecture & stratigraphy (figs. 19-22)

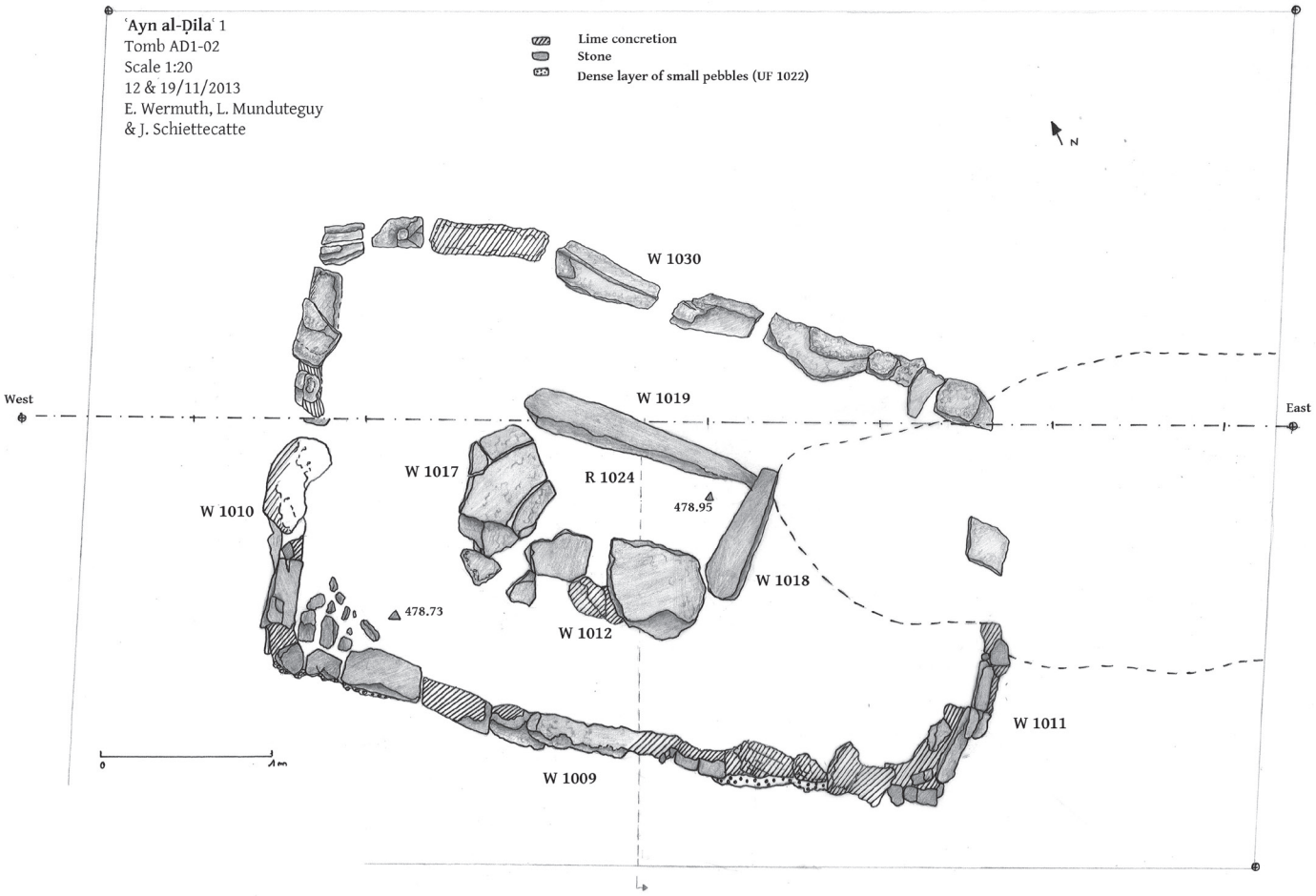
The structure

A surface layer covering the tumulus was removed (UF 1003) on a height of 10 to 20 cm. This surface layer of grey/brown limestone fragments, eolian sandy silt and pebbles covered the peripheral walls W 1009, W 1010 and the walls bordering the funerary chamber W 1012, W 1017, W 1019. This surface layer was the upper part of a collapse layer which covered the whole grave (UF 1008).

The excavated area was divided in two equal parts by an east-west bisection. The excavation focused on the southern half of the tumulus. There, the collapse layer (UF 1008) has been removed. It was made of loose homogeneous silt mixed with small lime stones and pebbles. The outer walls of the tomb were fully uncovered to the west, east and south of the tomb (respectively W 1009, W 1010 & W 1011). One of the wall of the funerary chamber (W 1012) and the inner filling between the outer wall and the funerary chamber was exposed (pebbles and thick layer of limestone concretion). This filling was sealed by a crust of lime (chemical dissolution of limestone blocks).

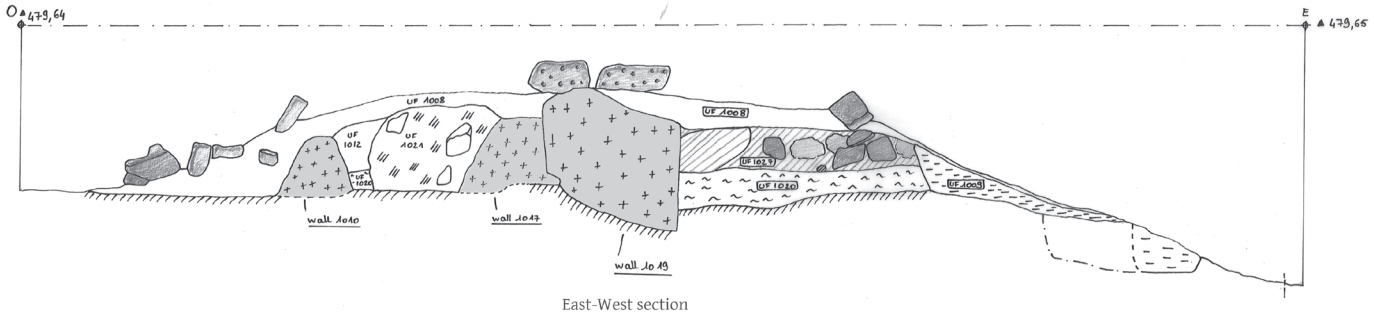
On the eastern side of the grave, a white concretion covering the eastern part of tomb AD1-02, from the top of W 1018 to the base of the tomb and cutting W 1011 (eastern peripheral wall) was removed (UF 1009). It corresponds to the filling of a large gully following the natural slope of the plateau, probably resulting from weathering and erosion. The origin of this gully is possibly due to the plundering of the grave which has weakened the eastern wall and induced the gullying process.

Figure 19: ʿAyn al-Ḍilaʿ 1: zenithal picture of tomb AD1-02 (Th. Sagory - Saudi-French Archaeological Mission in al-Kharj).

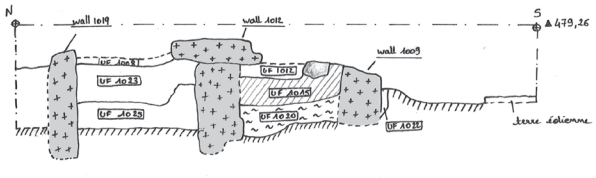


▲ Figure 20: ʿAyn al-Ḍilaʿ 1: plan of tomb AD1-02 (E. Wermuth & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

▼ Figure 21: ʿAyn al-Ḍilaʿ 1: stratigraphic sections of tomb AD1-02 (E. Wermuth & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).



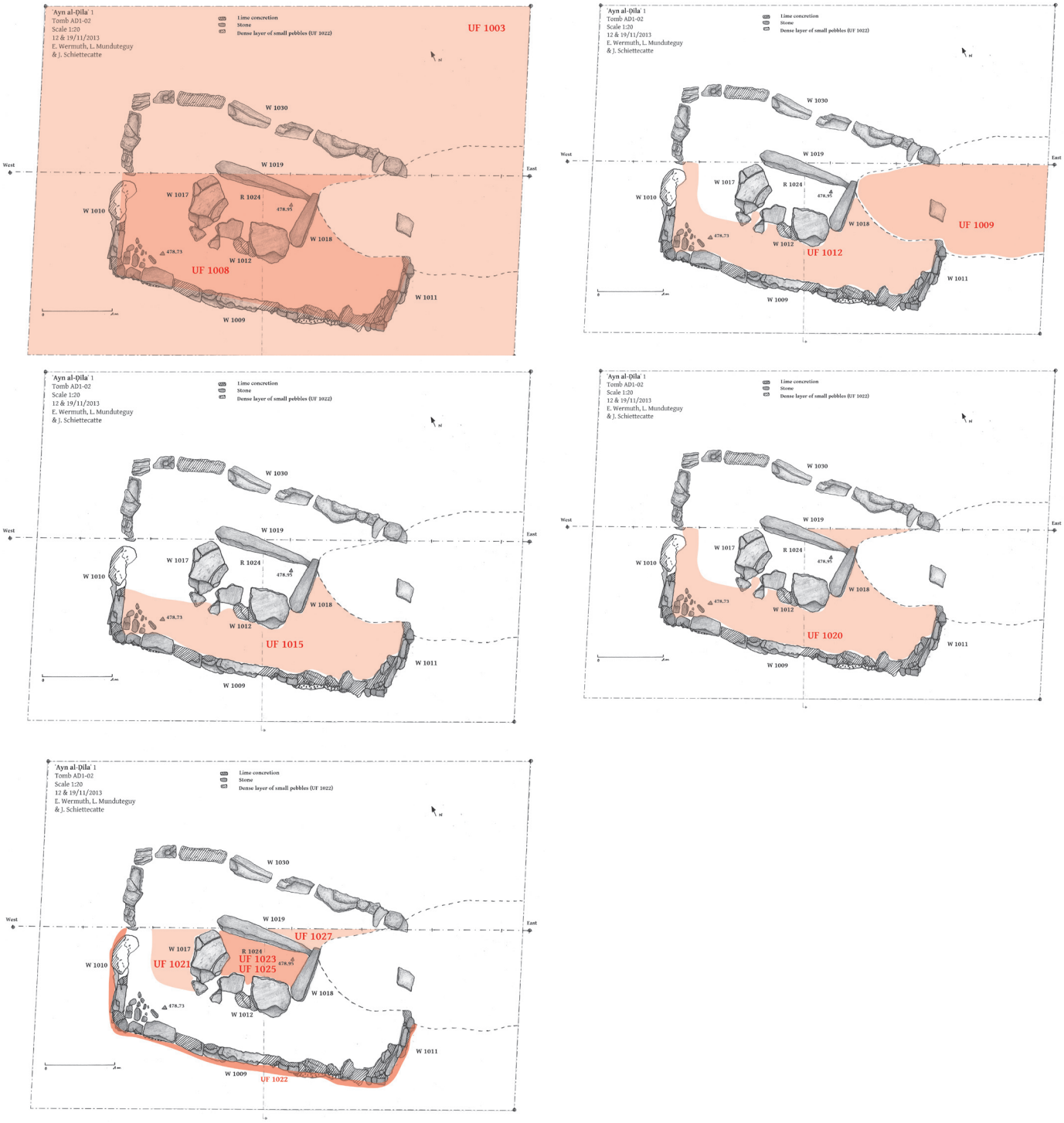
East-West section



North-South section

0 1 m

ʿAyn al-Ḍilaʿ 1 - 2013
Tomb AD1-02
Stratigraphic sections
Scale 1:20
9 & 14/11/2013
E. Wermuth, L. Munduteguy - Saudi French archaeological Mission in al-Kharj



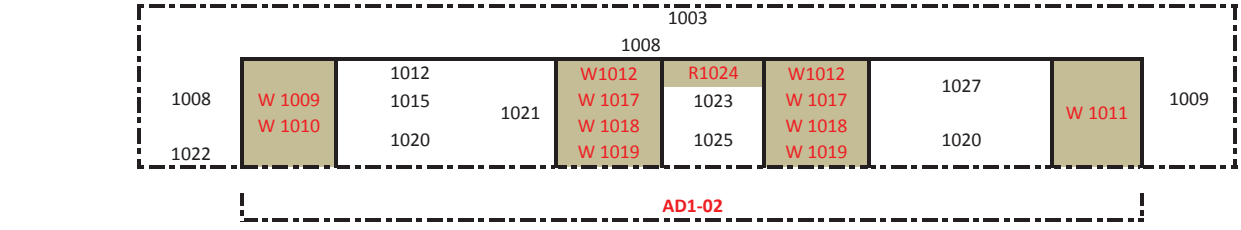


Figure 22: ʿAyn al-Ḍilaʿ 1: Tomb AD1-02 - Location of the stratigraphic units.
Upper part: location on plan.
Lower part: schematic vertical location of stratigraphic units.
(Plan: E. Wermuth & L. Munduteguy; Graphic works: J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

The southern wall of the grave (W 1009) is built with rectangular, limestone blocks (**fig. 23**). Some are reinforced at the rear with smaller stones. The western outer wall (W 1010) is built with limestone blocks and covered with limestone concretion. The eastern outer wall (W 1011) is made of limestone blocks and its central part is missing, possibly due to a destruction consequently to looting and weathering (?).

The inner filling between the peripheral walls and the funerary chamber is made of several successive layers of filling up: at the base, a layer of silt and pebbles (UF 1020) constitutes the interface with the bedrock. The bedrock has been dug for setting the slabs of the peripheral wall on the edge (UF 1022); this trench was filled up with pebbles. Against the inner side of the peripheral walls, a layer of concretion melted with small limestone blocks is abutting the wall (UF 1015). It might have been voluntarily set to strengthen the walls. Similarly, a concentration of heavy limestone blocks, now completely crumbled, were put in the filling between the peripheral wall and the funerary chamber, against wall W 1017 (funerary room), probably to strengthen it and stabilize its stones.

To the south, this filling was completed by a layer of loose sandy silt with limestone pebbles (UF 1012); to the north by a layer of large limestone blocks sealed with a compact brown sediment (UF 1027).

The funerary chamber (R 1024)

In the centre of AD1-02, the funerary chamber (R 1024) is rectangular. It was built by digging two trenches in which large slabs were set on the edge: the single slab of the northern wall W 1019 and the slabs of the southern wall (W 1012). The western wall (W 1017) is built with a large single limestone slab (now crumbled) abutting against W 1012 and W 1019 and reinforced at the back by an abutment of stones (UF 1021). The eastern wall (W 1018) is built with a large single limestone slab also abutting against W 1012 and 1019.

In the upper part, the funerary chamber (R 1024) was filled in with light brown sediments mixed with a lot of pebbles and concretion (UF 1023). In its lower part, the chamber was filled in with a compact layer of light brown sediment (UF 1025) with fewer pebbles than in UF 1023. On the ground of the room, the bedrock is covered with limestone concretions.

The funerary room did not yield bones nor artefacts. One can guess it has been totally emptied by looters (providing that the tomb was previously used for burial).

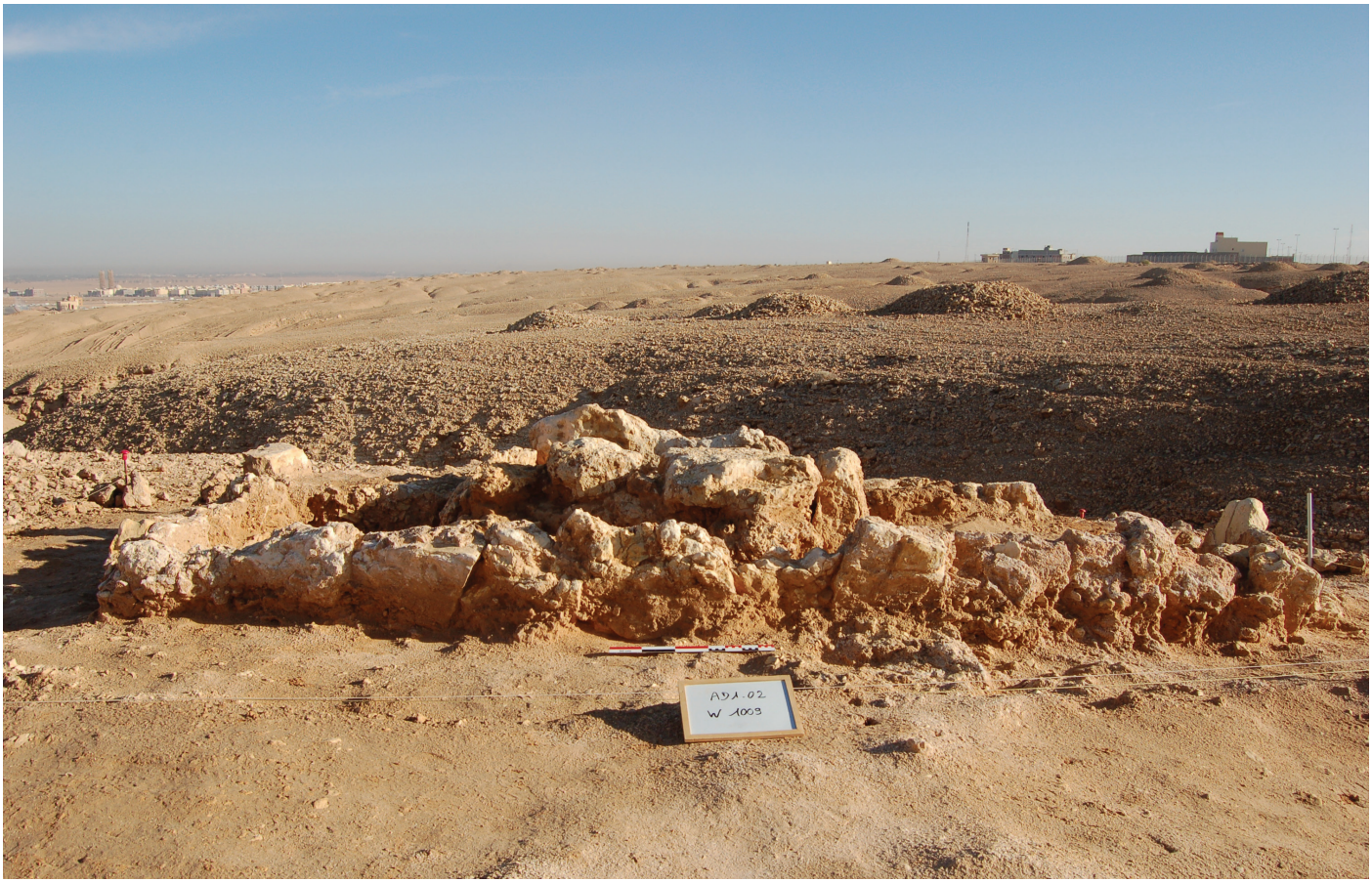


Figure 23: ʿAyn al-Ḍilaʿ 1: Tomb AD1-02; foreground: W 1009. Looking north (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

Graves AD1-03 & AD1-04

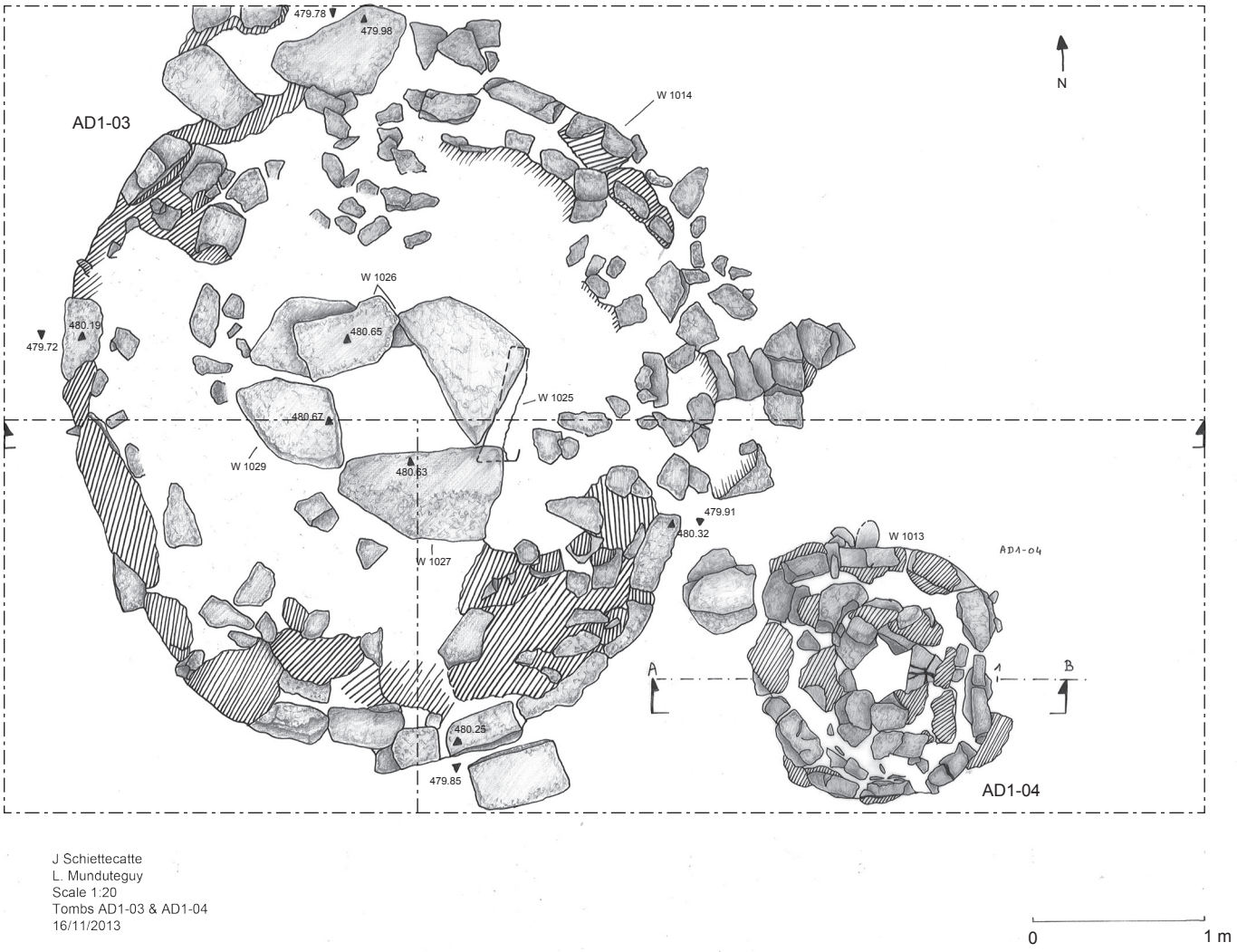
Excavated from October 29 to November 26, 2013.

Location

ʿAyn al-Ḍilaʿ 1 – medium-size tumulus in Area H10, on the edge of the plateau, along a ridge overlooking a gully oriented north-south, immediately to the south of AD1-05. This tumulus was simultaneously covering two circular tombs: AD1-03 and AD1-04 (**fig. 24**).

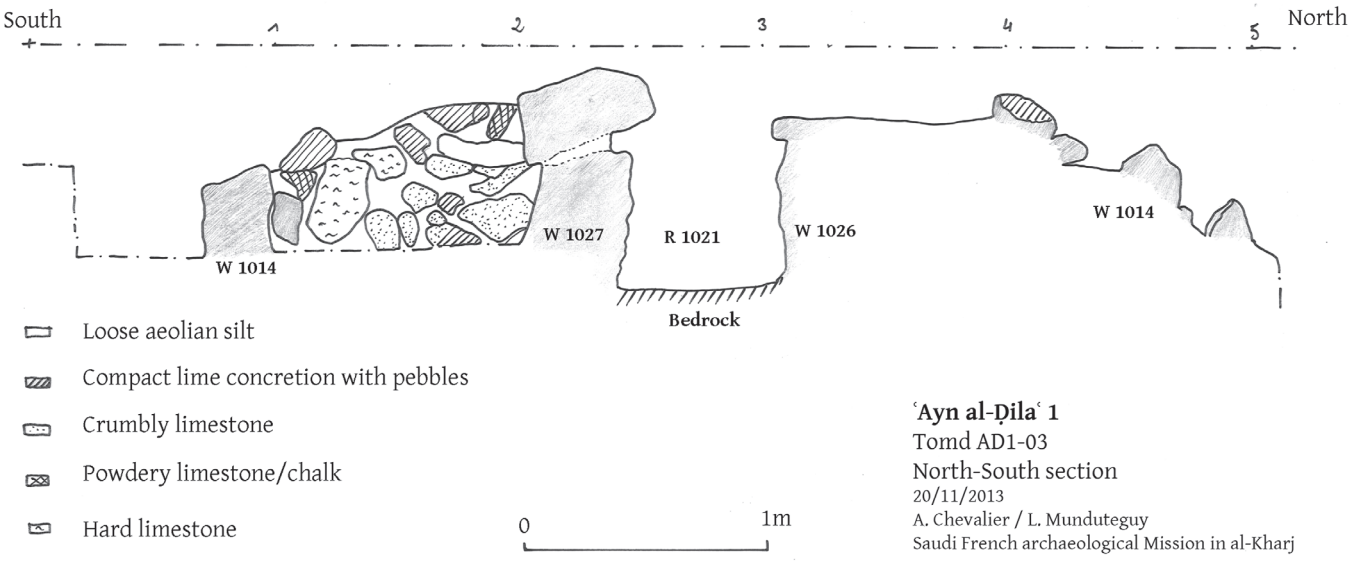
A square of 7 × 5 m has been set up around the tombs and the surface of the area cleaned by removing surface loose sediment and small stones.

Figure 24: ʿAyn al-Ḍilaʿ 1: Aerial picture of tombs AD1-03 (top) and AD1-04 (bottom). Picture is turned to west (Th. Sagory - Saudi-French Archaeological Mission in al-Kharj).



▲ Figure 25: ʿAyn al-Ḍilaʿ 1: plan of tomb AD1-03 & AD1-04 (J. Schiettecatte & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

▼ Figure 26: ʿAyn al-Ḍilaʿ 1: stratigraphic section of tomb AD1-03 (A. Chevalier & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).



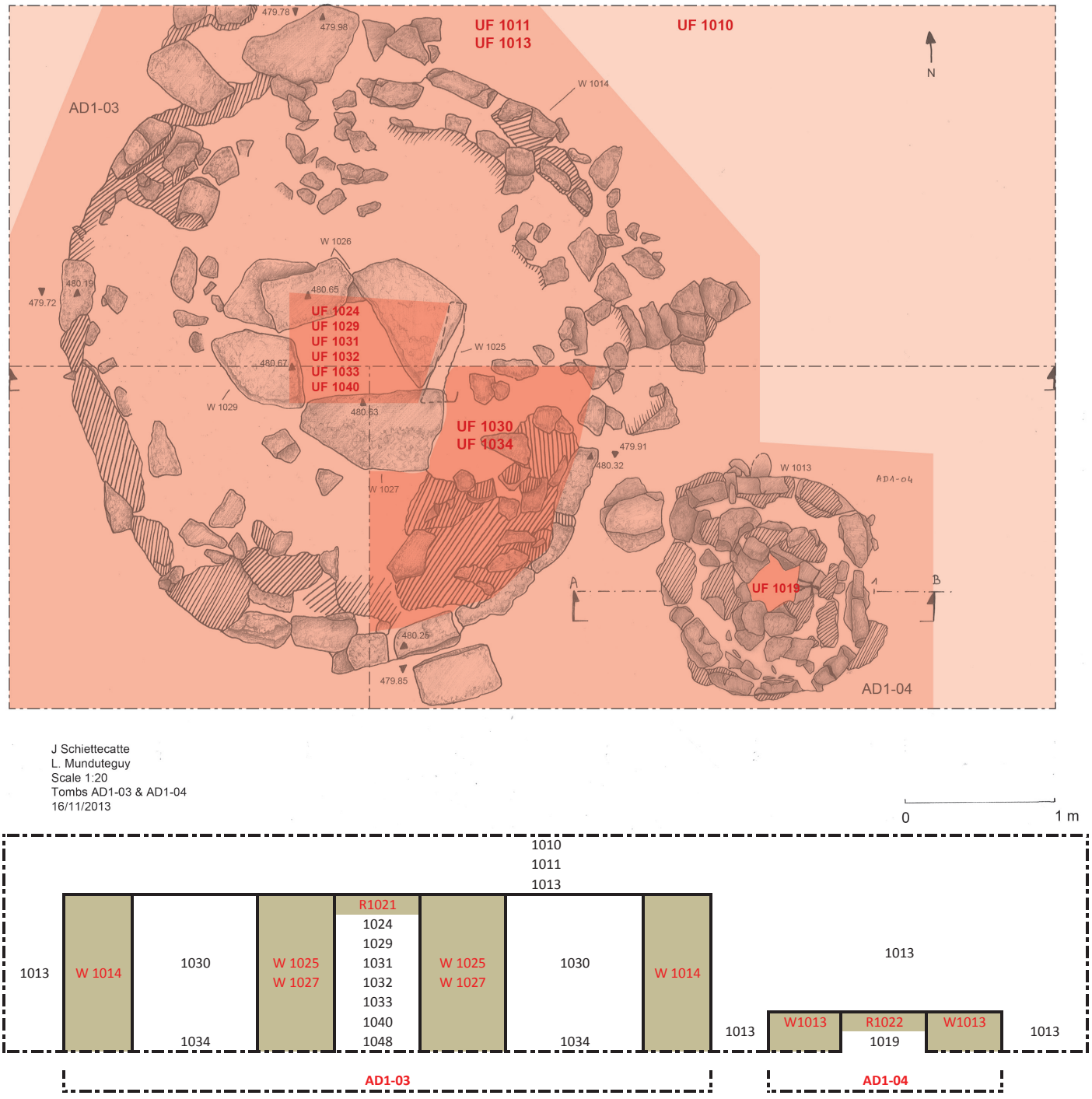


Figure 27: ʿAyn al-Ḍilaʿ 1: Tomb AD1-03 & AD1-04 - Location of the stratigraphic units.
Upper part: location on plan.
Lower part: schematic vertical location of stratigraphic units.
(Plan: J. Schiettecatte & L. Munduteguy; Graphic works: J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

Architecture & stratigraphy (figs. 24-27)

The structures of AD1-03 and AD1-04

A surface cleaning was realized over the whole excavated area (7 × 5 m). The removing of surface loose stones, pebbles and silt of eolian origin (UF 1010) lead to the uncovering of two circular funerary structures built up side by side: AD1-03 and AD1-04. Both these structures were covered by medium stones stuck in a layer of concretion (beige to pink). This concretion is the result of limestone crumbling and compacting under the effect of weathering. This decayed layer (UF 1011: collapse and erosion post-abandonment) has been partly removed over tombs AD1-03 and AD1-04. This concretion included limestone blocks.

Once this surface cleaning achieved, the excavated area has been divided into two parts on both halves of an east-west bisection. Excavation started in the southern half and was thereafter extended to the northern one.

A collapse layer (UF 1013) including small stones and eolian sediment with calcareous and chalky blocks was removed. The top of the walls delineating the tombs (W 1013 around AD1-04 and W 1014 around AD1-03) as well as those circumscribing the funerary chamber of AD1-03 (W 1025, W 1026, W 1027, W 1029) were uncovered. These latter walls were made of a large slab set on the edge and their corners were covered by capstones laid flat (corbelled roof).

The peripheral walls W 1013 and W 1014 were made of limestone slabs set on the edge. Many slabs of W 1013 were covered by a thick concretion of lime. To the NW, the slabs of the walls have fallen down and were covered with the collapse of the inner filling (rubble, stones, silt). The removal of the collapse layer (UF 1013) along W 1013 showed the presence of small stones inserted at the foot of the slabs to strengthen the standing slabs.

In the south-eastern quarter of tomb AD1-03, the filling between the circular peripheral wall W 1013 and the funerary chamber was excavated and fully removed down to the bedrock. Two successive stratigraphic units have been distinguished although both belong to the same building event which consisted in filling the empty space randomly with limestone blocks of different sizes and few pebbles. With time, some of the limestone blocks went through chemical dissolution, leading to the formation of concretion (mostly in the upper part of the filling, or to the softening of these blocks into chalk (see the white patches on **fig. 28**).

The lower part of this filling (UF 1034, ca. 35 cm thick) consists in melted blocks of chalky limestone, concretion and limestone blocks ca. 40 cm long. The upper part (UF 1030, ca. 25 cm thick) included large limestone blocks covered with concretion and pebbles (interface between construction and collapse). Stones were either soft or crumbled.

Figure 28: ʿAyn al-Ḍilaʿ 1: AD1-03 - filling between the peripheral wall (W 1014) and the eastern wall W 1025 of the funerary chamber R 1021 (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

The funerary chamber of AD1-03 (R 1021)

The chamber is rectangular (1.1 × 0.8 m), 0.95 m high, and bordered by four large limestone slabs set on the edge (W 1026 to the north, W 1025 to the east, W 1027 to the south, and W 1029 to the west). It was covered with large slabs set upon the corners of the walls.

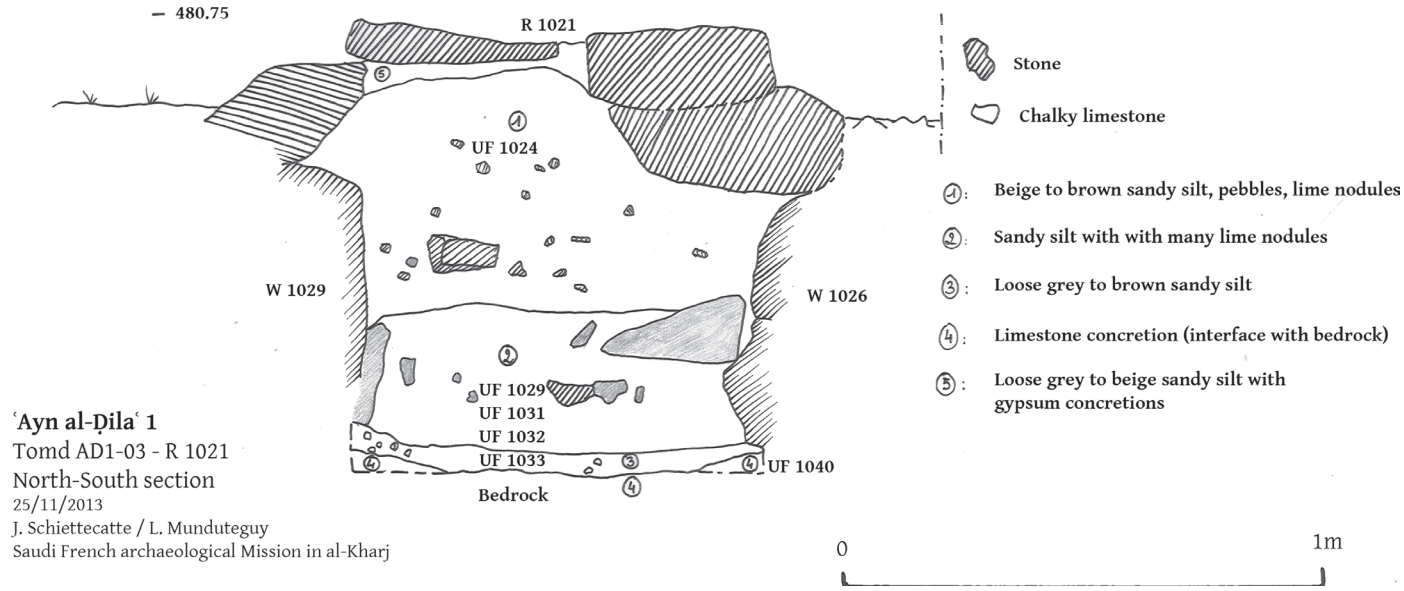
Seven stratigraphic units have been isolated (**figs. 29-30**), from bottom to top:

UF 1048: thin layer (2 to 8 cm) of loose earth above bedrock;

UF 1040: 18-cm-thick layer taking the shape of a bowl under UF 1033 made of limestone with a few loose earth in the corner of the room. Presence of small powdery chalky blocks of limestone (probably from the natural bedrock);

UF 1033: Layer (18 cm) of loose silt with small pebbles and small limestone nodules. Two limestone blocks in the NW corner. Presence of small fragments of unidentifiable bones and small fragments of charcoal. Remains of a highly perturbed burial after one or several plundering events. No artefacts left;

UF 1032: Dense layer (ca. 6 cm) of earth with a slope converging toward the centre of the room. Inclusion of small pebbles. This layer might have been exposed, evidence of percolation in the corners, traces of weathering of lime and earth;



▲ Figure 29: ʿAyn al-Ḍilaʿ 1: Stratigraphic section of funerary chamber R 1021 (J. Schiettecatte / L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

◄ Figure 30: ʿAyn al-Ḍilaʿ 1: AD1-03 - Stratigraphic section of funerary chamber R 1021 (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

UF 1031: 10 to 15 cm of loose orange earth with inclusion of limestone nodules. Near W 1027: compact earth and limestone. Near W 1029: loose earth with soft blocks of chalk;

UF 1029: Compact layer (10 to 25 cm) of earth with limestone concretions and inclusion of small stones. Limestone concretions are more dense in the western half. They form a kind of dome;

UF 1024: Compact layer (35 to 50 cm) of limestone pebbles mixed with eolian sediment and presence of powdery chalky limestone blocks to the west.

To summarize, UF1040 and 1048 are part of the original digging of the burial ground in the bedrock. UF 1033 constitutes the highly perturbed remaining part of the original burial (S.R1021.1). Very few bone fragments have been found in three successive clearings out and in spite of the sieving of all the sediment (**fig. 31**). Bone identification was impossible due to alteration and splitting up. The burial was most probably plundered and the room left opened after the event.

Thereafter, the room was progressively filled up with eolian deposits and the fall of capstone fragments (UF 1029, 1031, 1032), then by eolian deposits and the percolation and fall of small limestone fragments from the top of the walls and capstones (UF 1024).

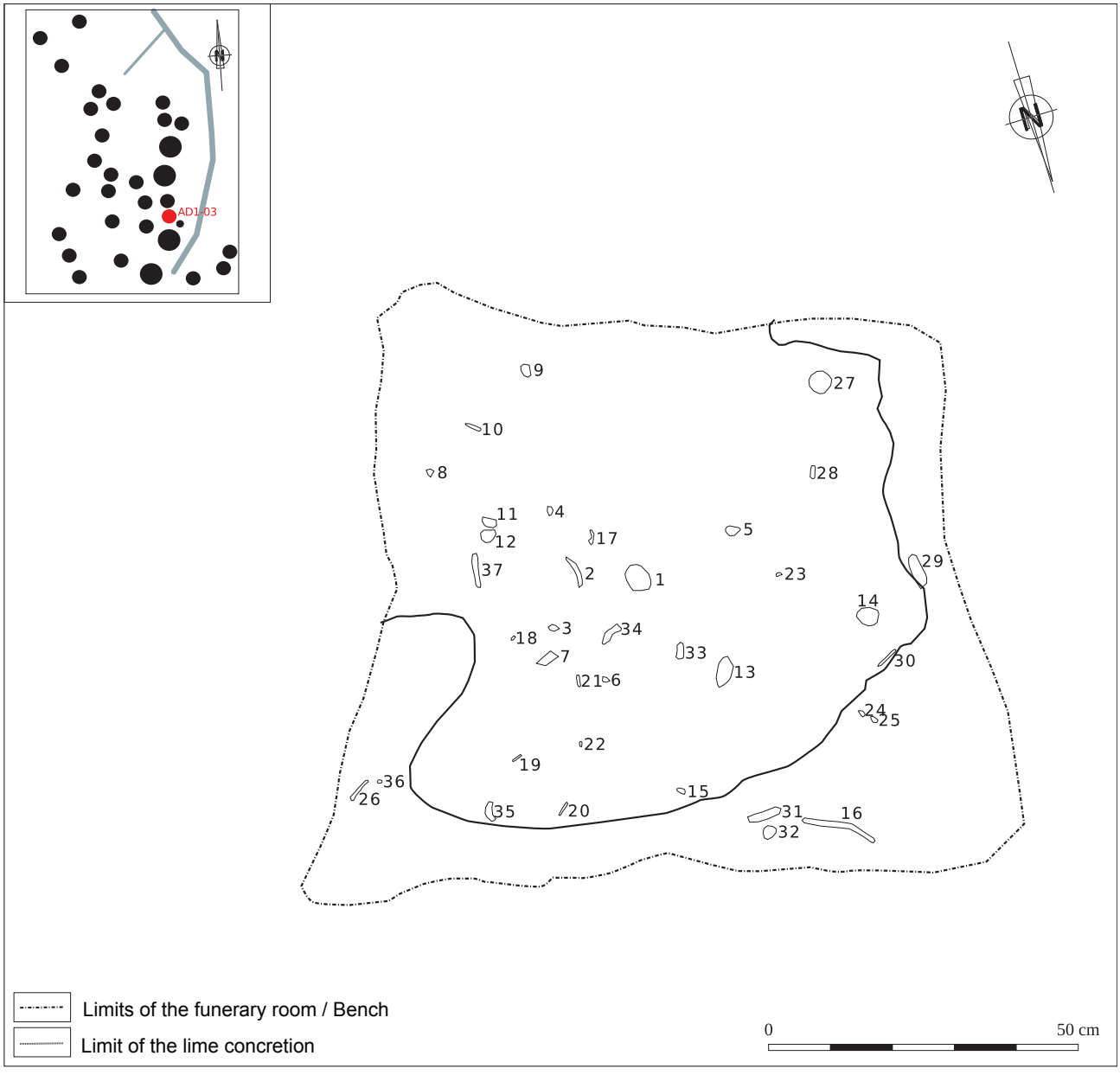


Figure 31: Tomb AD1-03, R 1021, burial S.R1021.1. Distribution of bone fragments (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

The funerary chamber of AD1-04 (R 1022)

The funerary chamber (R 1022) of tomb AD1-04 is roughly circular. On the contrary to other excavated tombs, R 1022 is not bordered by walls but simply by the limestone blocks laid one above the other within the area circumscribed by W 1013 (**figs. 32-33**). The central space, left empty, constituted the chamber. The covering system is missing. The chamber was emptied down to the bedrock (UF 1019), over 20 cm. It was filled up with compact silt mixed with pebbles and lime concretions, which can be seen as a natural filling following a looting of the tomb (no capstone, no bones nor artefacts have been found within the chamber).

Figure 32: ʿAyn al-Ḍilaʿ 1: tomb AD1-04 from above. Picture is turned to north (J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

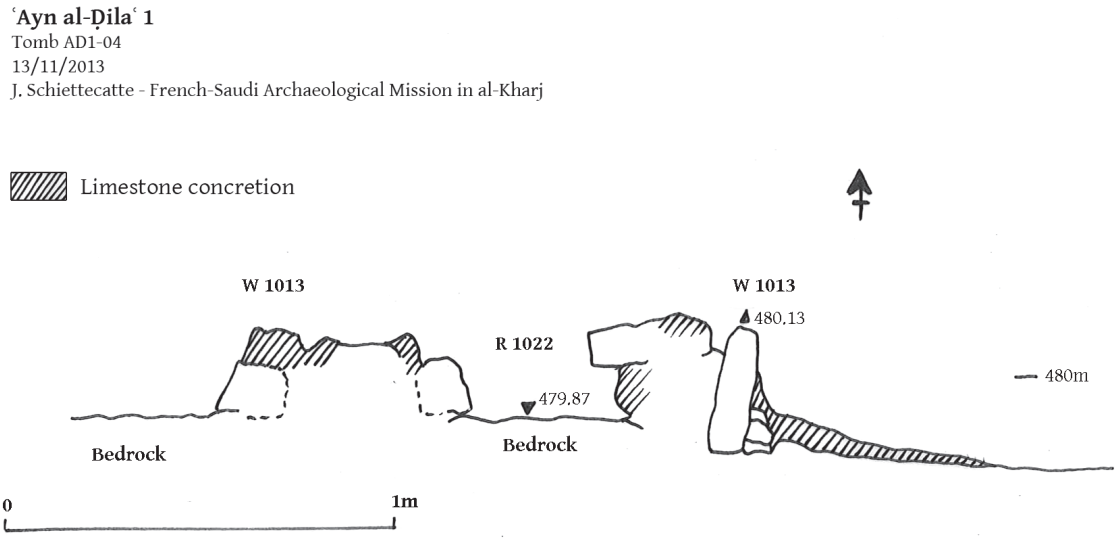


Figure 33: ʿAyn al-Ḍilaʿ 1: section of tomb AD1-04 (J. Schiettecatte / L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

Grave AD1-05

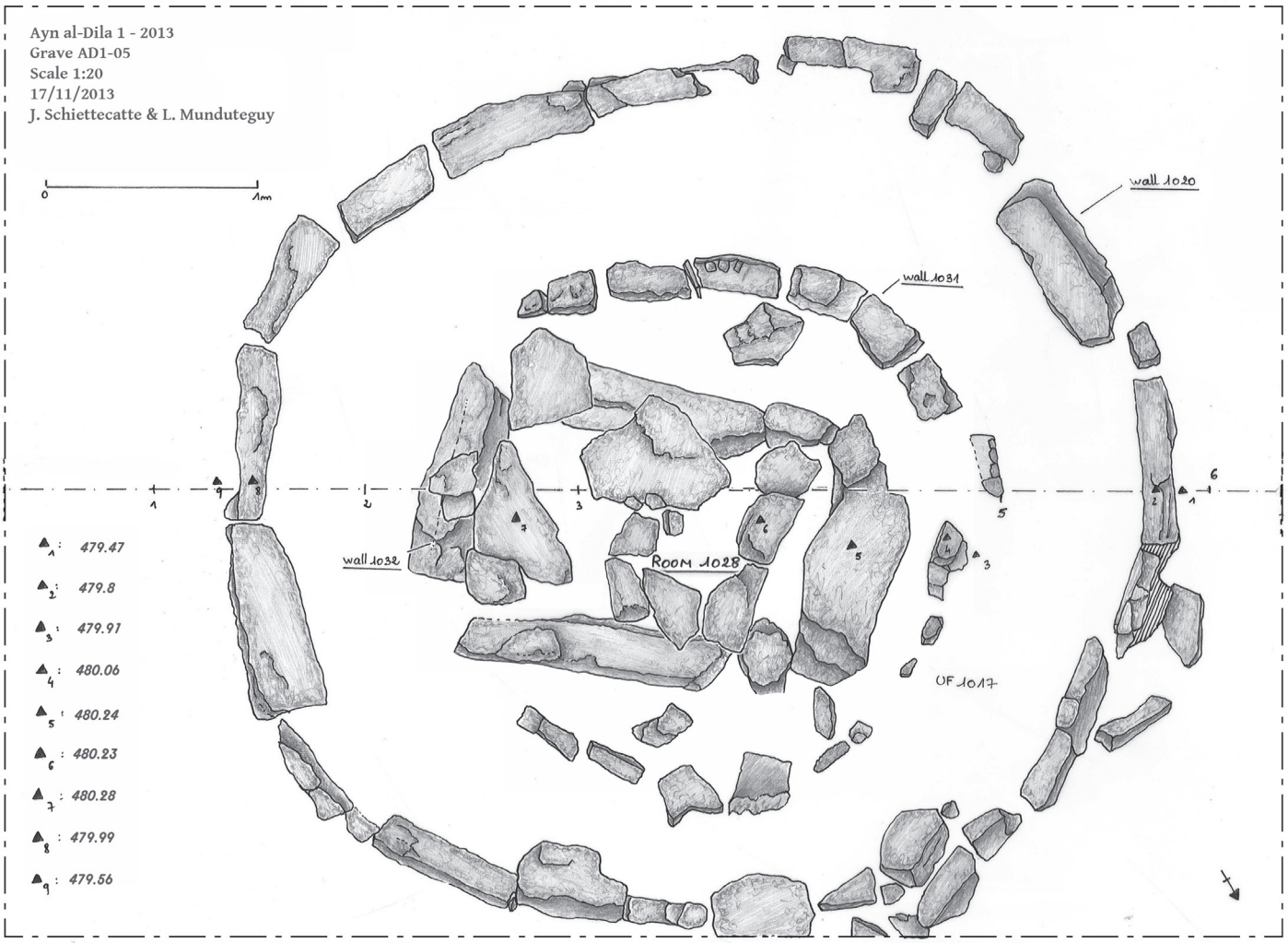
Excavated from October 29 to November 28, 2013.

Location

ʿAyn al-Ḍilaʿ 1 – medium-size tumulus (ca. 4 × 6 m) in Area H10, on the edge of the plateau, along a ridge overlooking a gully oriented north-south, immediately to the north of AD1-03.

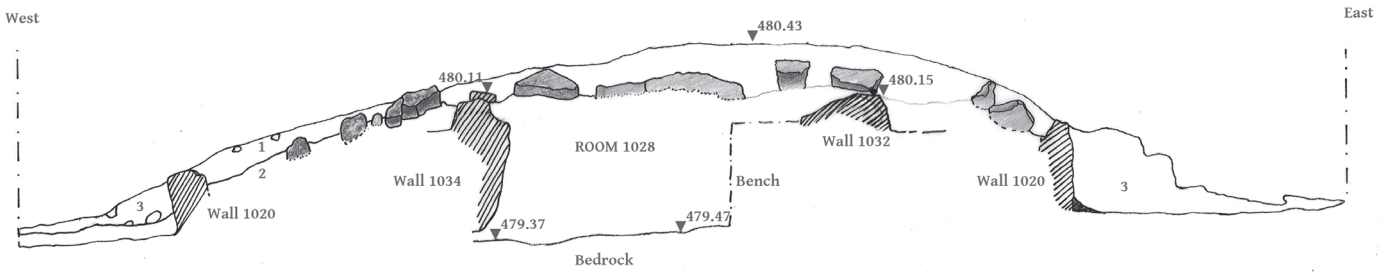
An area of 6 × 5 m has been set up around a tumulus and the surface of the area has been cleaned by removing surface loose sediment and small stones (UF 1016) (**fig. 34**).

Figure 34: ʿAyn al-Ḍilaʿ 1: Aerial picture of tombs AD1-05. Picture is turned to south (Th. Sagory - Saudi-French Archaeological Mission in al-Kharj).



▲ Figure 35: ʿAyn al-Ḍilaʿ 1: plan of tomb AD1-05 (J. Schiettecatte & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

▼ Figure 36: ʿAyn al-Ḍilaʿ 1: stratigraphic section of tomb AD1-05 (J. Schiettecatte & L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).



Glacis abutting the peripheral wall (W 1020 to the east)

1 Concretion of aeolian earth, gypsum and pebbles (UF 1017)

2 Loose earth with small pebbles and melted lime

3 Lot of pebbles with aeolian silts and some limestone blocks (< 30 cm) (UF 1028)

0 1 m

ʿAyn al-Ḍilaʿ 1
Tomb AD1-05
East-West section
19/11/2013
J. Schiettecatte & L. Munduteguy

Architecture & stratigraphy

The structure

A surface cleaning was realized over the tumulus and surface loose stones, pebbles and silt of eolian origin were removed (UF 1016); this lead to the uncovering of the funerary structure AD1-05, a circular grave (**figs. 34-36**).

A compact layer of gypsum concretion, resulting from limestone crumbling under the effect of weathering followed by a hardening process, together with limestone blocks, pebbles, eolian sediment was covering the top of the structure. This collapse layer has been removed above (UF 1017) and around (UF 1028) the grave.

Several structures appeared: peripheral wall W 1020, fragmented capstones of the funerary chamber R 1028, the top of its walls W 1033, W 1034, W 1035 and W 1036. Moreover, a second circular wall surrounding the funerary chamber was founded above the inner filling, W 1031. This small circular wall was preserved on a single course and only to the N, W and S of the funerary chamber. It is made of irregular small to medium limestone blocks.

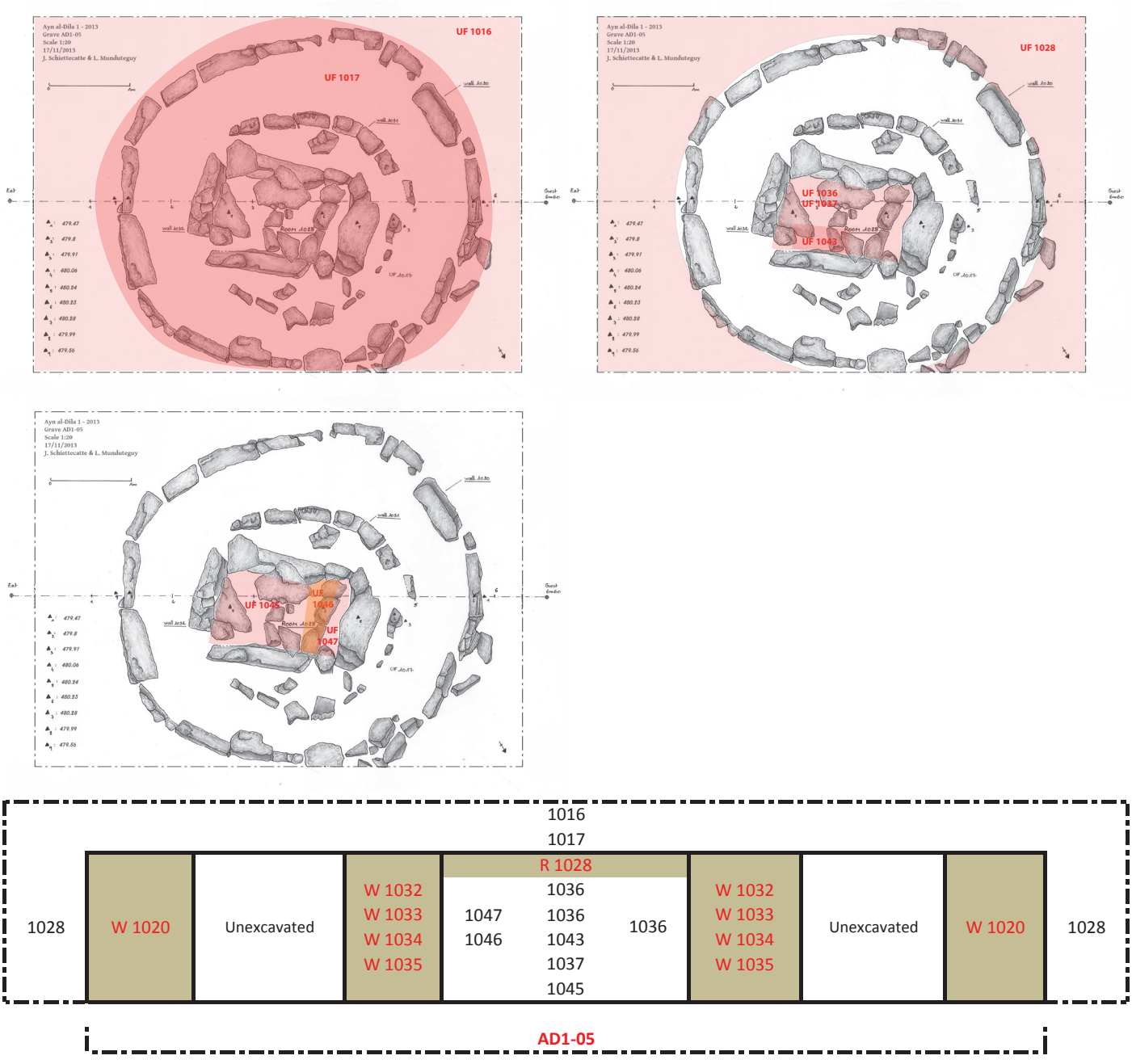


Figure 37: ʿAyn al-Ḍilaʿ 1: Tomb AD1-05 - Location of the stratigraphic units.
Upper part: location on plan; Lower part: schematic vertical location of stratigraphic units
(Plan: J. Schiettecatte & L. Munduteguy; Graphic works: J. Schiettecatte - Saudi-French Archaeological Mission in al-Kharj).

The removing of the collapse layer around the structure (UF 1028) lead to the unearthing of the outer face of W 1020, which is made of orthostats set on the edge, and reinforced at the base by small blocks of limestone.

The filling between the peripheral wall and the funerary chamber has not been excavated.

The funerary chamber (R 1028)

The funerary chamber R 1028 is a rectangular room, 1.53 × 0.95 cm. It is 73 cm high (alt. 479.37 to 480.10 m a.s.l.).

It is bordered:

- to the east by W 1032, built with a thick limestone slab (102 × 38 × 80 cm) set on the edge;
- to the north by W 1033, built with a large roughly squared limestone slab (120 × 30 × 84 cm) set on the edge and two smaller limestone blocks laid one on the other;
- to the west by W 1034, built with a single limestone slab (123 × 41 × 86 cm) set on the edge;
- to the south by W 1035, built with a large roughly squared limestone slab (110 × 35 × 73 cm) set on the edge and a smaller limestone block.

Within the funerary chamber, two successive stratigraphic events were identified: a burial (UF 1045 and 1037) and a reopening of the tomb followed by partial collapse of the capstones, percolation and post-abandonment filling of the room (UF 1043, UF 1046, 1047, 1036) (**fig. 38**).

Burial S.R1028.1

The lower part of R 1028 contained the remains of a burial. It has been excavated in two successive layers:

UF 1045 (**fig. 39**), directly above the bedrock, is a dense layer of brown to beige silt with inclusions of small pebbles and numerous fragments of bones. A 30-cm-wide bench was initially kept in the eastern end of the room. At the base of this bench, a 10-cm-long handle of a bronze sickle sword was discovered above the bedrock; its blade kept going under the bench. Thus, due to the lack of time, only the northern half of this bench was excavated in order to uncover the whole artefact (**fig. 40**). The blade is 30 cm long and 4 cm wide. Its extremity is missing. The artefact is broken between the handle and the blade. Deposited at the Riyadh National Museum, its restoration has been done under the supervision of A.A. al-Zahrani (**fig. 41**).

UF 1037 is in continuity with UF 1045, it is a dense layer of silt and pebbles with few intrusive limestone blocks in the centre due to the later looting of the grave. Numerous fragmentary and powdery bones were found scattered in the southern and central part of the room.

Considering both these stratigraphic units, bones are scattered to the south, centre and east of the chamber (**fig. 42**). To the west, the fall of large limestone blocks from the capstones disrupted the bones. The limited number of bones, their alteration, and their bad state of conservation made the osteological observations difficult. Their spatial distribution by anatomical series (**fig. 43**) did not show any particular organization. The presence of small bones makes us believe this burial to be a primary one. The association of lower limb with tarsus in the centre of the room, and between fragments of humerus and scapula in the eastern part show anatomical connections reinforcing the hypothesis of a primary burial.

However, bones from the trunk and fragments of skulls have been found in close proximity with lower limb. Other skull fragments were isolated in the south-eastern part of the room. This could be indicative of an intrusion in the grave after the burial (looting?).

Small bones and diaphysis indicate that the individual was mature. Otherwise, nothing can been said about its position or the way he was buried.

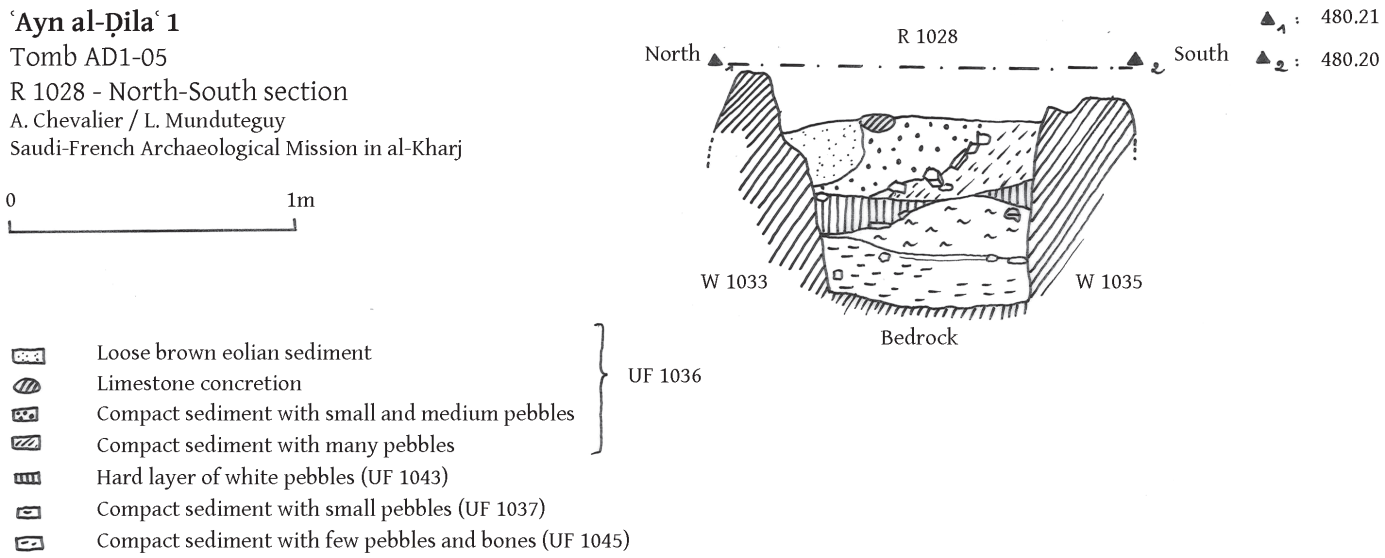
The collapse layers

In addition to the perturbation of the bone distribution, the upper layers of the burial are indicative of the collapse of capstones and of the percolation of silts, stones and pebbles within the room, possibly following the reopening of the chamber (by looters?) (**fig. 38**).

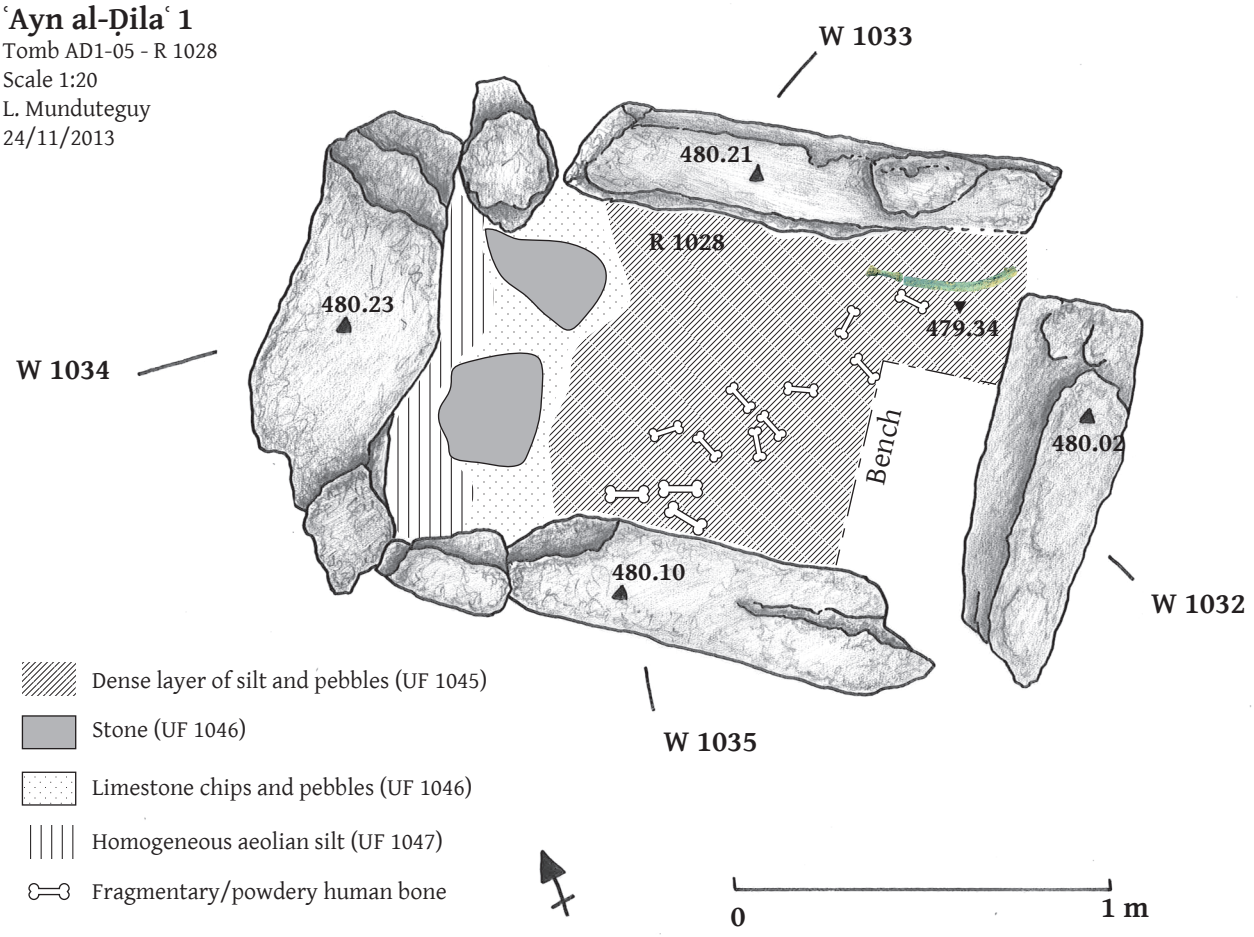
To the west, directly above UF 1037/1045, three large limestone blocks mixed with small pebbles and chips of limestone have fallen down in the funerary chamber over the burial (UF 1046). Between these blocks and the western wall W 1034, a homogeneous layer of eolian silt accumulated (UF 1047), probably as a consequence of percolation following the collapse of the blocks previously mentioned (**fig. 39**).

To the north-east, a thin layer of small pebbles (UF 1043) accumulated above UF 1037.

All these levels were sealed by a 38-cm-thick layer (UF 1036) of loose silt and sand mixed with limestone pebbles, and few small limestone blocks.

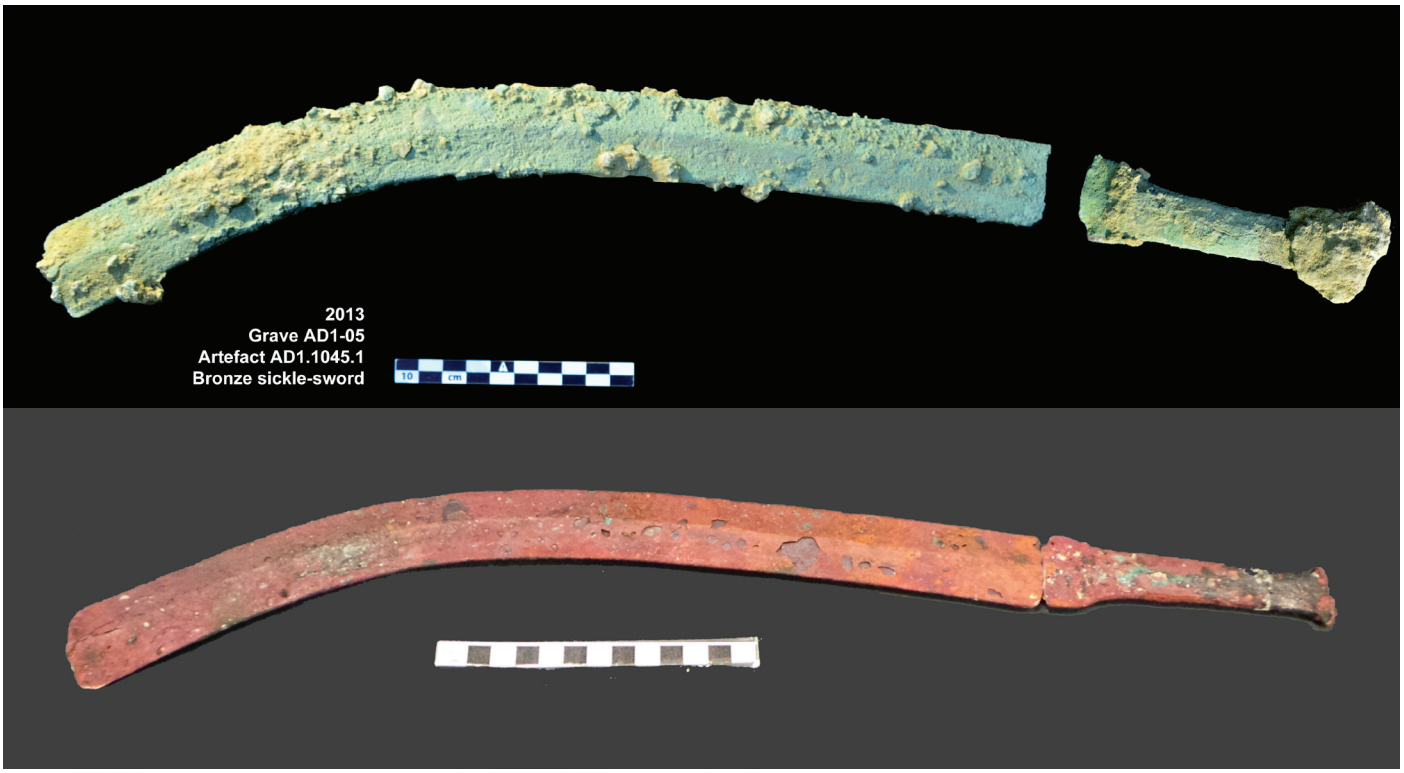


▲ Figure 38: ʿAyn al-Ḍilaʿ 1. Tomb AD1-05: Stratigraphic section of the bench kept in the funerary chamber R 1028 (A. Chevalier / L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

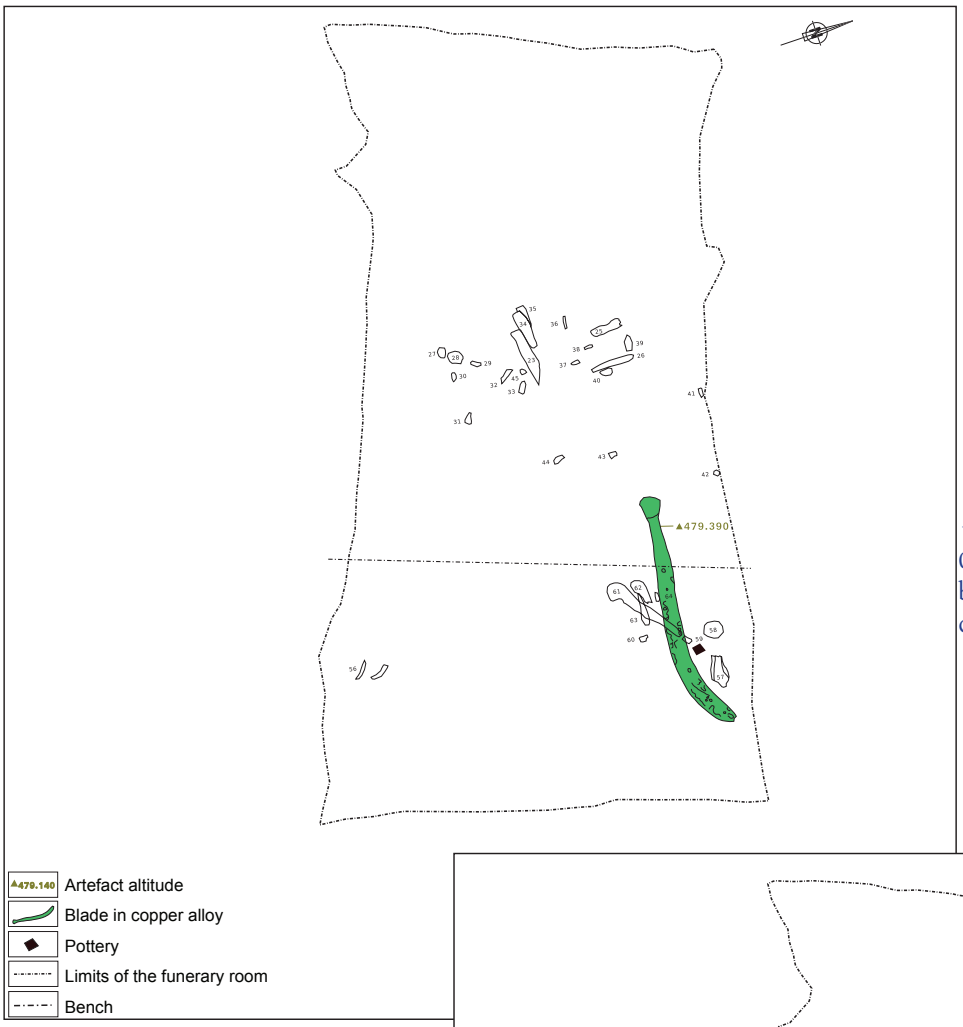


▲ Figure 39: ʿAyn al-Ḍilaʿ 1: Schematic plan of the base of UF 1045, UF 1046 and UF 1047 in R 1028 (J. Schiettecatte / L. Munduteguy - Saudi-French Archaeological Mission in al-Kharj).

▲ Figure 40: ʿAyn al-Ḍilaʿ 1: Tomb AD1-05, R 1028, Bronze sickle sword (AD1.1045.1), before (left) and after (right) the removal of the eastern bench (A. Chevalier - Saudi-French archaeological Mission in al-Kharj).

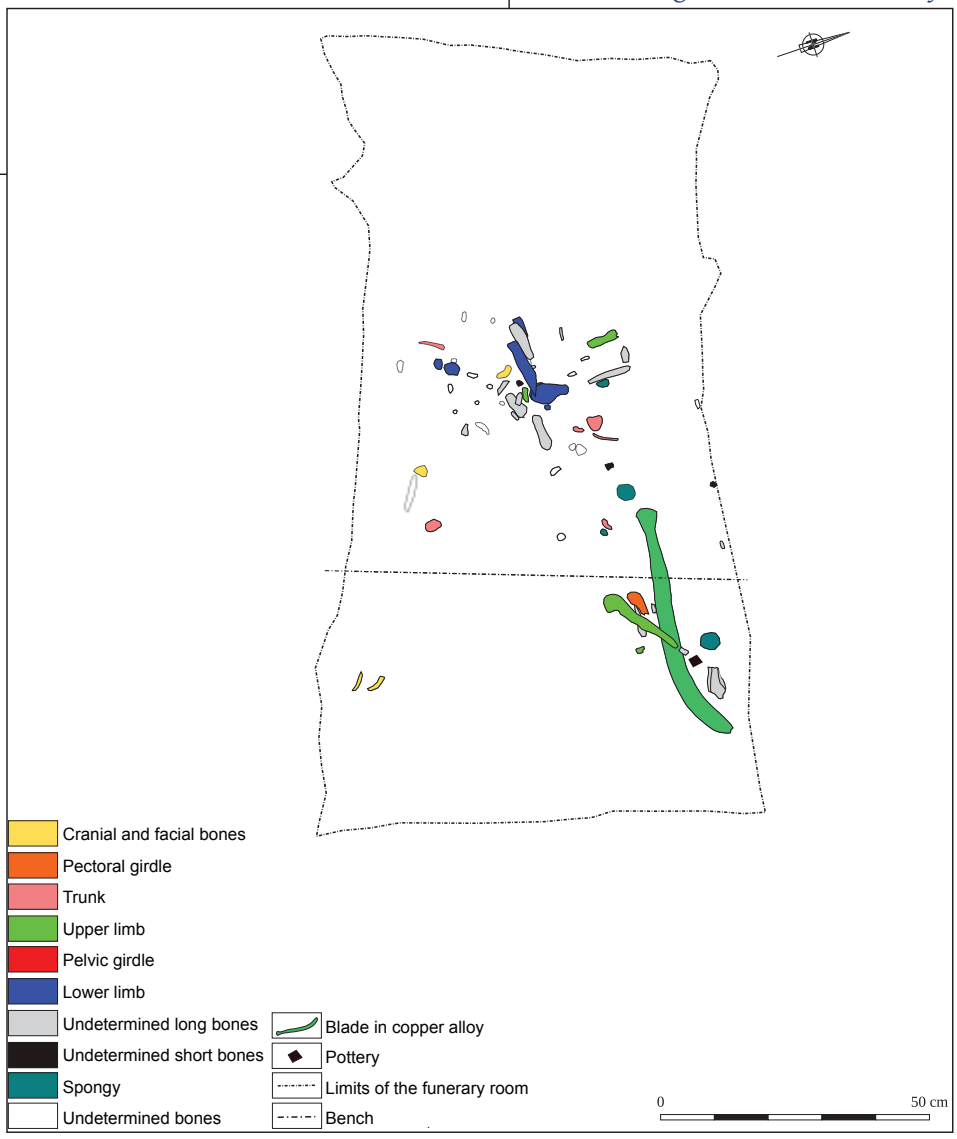


▲ Figure 41: Bronze sickle sword (AD1.1045.1), before (top) and after (bottom) its restoration in the Riyadh National Museum (L. Munduteguy - Saudi-French archaeological Mission in al-Kharj / A. A. al-Zahrani - Riyadh National Museum).



◀ Figure 42: ʿAyn al-Ḍilaʿ 1: Tomb AD1-05, R 1028, S.R1028.1. Distribution of bones (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).

▼ Figure 43: ʿAyn al-Ḍilaʿ 1: Tomb AD1-05, R 1028, S.R1028.1. Distribution of anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).



Synthesis

Regarding funerary practices

In spite of the variety of shapes (rectangular vs circular), the five excavated tombs shared the same architectural features: a rectangular funerary chamber is built with large slabs set on the edge; a peripheral wall made of smaller standing slabs, and reinforced at the base by small stones, surrounds this chamber; the space between these two features is filled with limestone blocks and rubble.

These graves were intended for a single individual. Tomb AD1-05 contained the primary burial of a mature individual. Tomb AD1-01 was the best preserved: a first immature individual (10-14 y. old) has been buried (primary burial) with a funerary deposit including different categories of artefacts (a stone tool, set of beads in stone, seashells and carnelian). Later on, the same grave was reused for the primary burial of another individual, a mature oriented north-south, on the left side, with bent knees. This second burial had apparently no connections with the first one: a chronological gap seems to separate the two events according to the deposit (cf. *supra*) and a layer of earth clearly cut them off. When the second burial was deposited, the first one was no more visible.

Tombs AD1-02, 03 and 04 did not yield bone material making it possible to determine the nature of the graves (single or collective). Nevertheless the size of the funerary chamber of AD1-04 hardly enables the deposit of more than a single immature. The funerary rooms of the two others are similar by their size and shape to AD1-01 and AD1-05 and possibly have contained a single individual too.

Once built and used, several processes contributed to the decay of these graves. Firstly, the building material, a chalky limestone taken directly on the ground, went through natural chemical dissolution which lead to the crumbling of the stones, and the formation of thick concretions over the structures. The bones have consequently been badly damaged by the taphonomic process. When preserved, bones are systematically splintered or powdery. In addition to these natural phenomena, the tombs were almost systematically re-opened, either for reuse (AD1-01) or for plundering, which seems to have been the case for all the excavated graves and for most of the graves in the necropolis as indicated by the funnel visible at the top of most of them. Fortunately, the looting has not always been systematically done. Tomb AD1-05 has been opened and visited from the west; the deposit in the north-eastern corner (some bones and a bronze sickle sword) has thus been preserved.

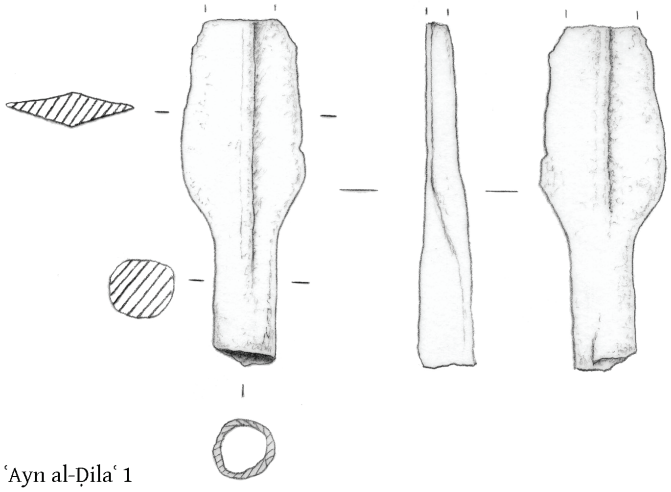
Regarding the date

Waiting for the results of ^{14}C on the bone apatite of vertebras, we only have a few clues for dating the building and use of the tombs:

- The use of the same architectural principles for the building of the tombs in areas H9-H10 would be indicative, at least in that part of the necropolis, of an almost contemporary practice.

- A *terminus ante quem* to the building of the first tombs has been provided by the discovery of a short socketed spearhead in an area close to the excavated one (**fig. 44**) which is reminiscent of the one found in the necropolis of al-ʿAfja in the oasis of al-Kharj in 2004–2005 by A. al-Ghazzi (al-ʿAfja, Area 2, no. 4 - al-Ghazzi 2011a: 204, pls. 10, 109), or those found in the Yabrīn oasis, Dhahrān, and Bahrain, dated to the early second millennium BC (Bibby 1973: fig. 57; al-Mughannam 1988: pl. 3/A; Cleuziou 1989: 29; Lombard 1999: 68 nos. 50-52).

- Finally, the material found within the graves gave us an idea of the long duration of the use of this place: the carne-



ʿAyn al-Ḍilaʿ 1
Surface
AD1.surf.2
Socketed spearhead

◀ Figure 44: ʿAyn al-Ḍilaʿ 1, surface (area F9). Socketed spearhead AD1. surf.2.

(L. Munduteguy - Saudi-French archaeological Mission in al-Kharj).

lian bead of the oldest burial in AD1-01, assigned to the EBA-IA; the presence of an iron artefact in the earliest burial in AD1-01, dated at the earliest from the first millennium BC; the discovery of a bronze sickle sword whose closest parallel dates back to the LBA (Gernez 2007: fig. 5, no. 3).

Thus, the necropolis was a burial place for population living in the area from the Early Bronze Age down to the Iron Age. Nevertheless, it cannot be said whether the occupation of this place was continuous or interrupted for a long time. The reoccupation during Iron Age of more ancient necropolis is well attested in the oasis at al-ʿAfja, or in Ḥaḍramawt, Yemen (Crassard *et al.* 2011; Mccorriston *et al.* 2011).

Regarding the location

No settlement dated to this period has yet been discovered. It is not possible to say whether this necropolis was that of mobile groups or if contemporary settlements are to be sought beneath the sedimentary deposits in the alluvial plain.

The location of this necropolis is dictated by the local geology and geomorphology (Schiettecatte *et al.* 2012). It is located at the interface between a limestone plateau and the alluvial plain, and more specifically by a source of water in the plain. The site ʿAyn al-Ḍilaʿ 1 is located on the north-western edge of the Jabal al-Qusayʿa, a clayey limestone plateau (Early Cretaceous Sulayy formation) in close proximity to the water sinkholes and ʿAyn al-Ḍilaʿ 2, 3 and 4 (**fig. 3** [p. 13]).

Beyond its proximity to the sinkholes, the necropolis ʿAyn al-Ḍilaʿ 1 also overlooks the lacustrine deposits of a palaeolake crossed by the Wādī al-ʿAyn. The former lakes would have been filled with water due to a rise of the water-table, probably during periods of wetter climate. A radiocarbon date on a shell from the lake of al-Barra shows lacustrine activity during the Early / Mid-Holocene humid optimum (^{14}C date of 7,000 ± 400 years BP-uncal by Vaslet *et al.* 1991: 33). But the fact that the two largest Bronze Age necropolises of al-Kharj area (ʿAyn al-Ḍilaʿ 1 and al-ʿAfja) are located almost on the shores of palaeolakes suggests a possible rise of water-tables and an increase in lake levels during the Early Bronze Age, a wetter period recognized as the Mid-Late humid Holocene. It is regionally attested in the ʿAwāfī lake sequence in the UAE (Parker *et al.* 2006a, 2006b), in the Dead Sea transgression phases (Migowsky *et al.* 2006), and in the Ḥaḍramawt fluvial system (Berger *et al.* 2012).

Therefore, the location of this necropolis is dictated by both the geological context (rocky outcrops providing building material) and the hydrological context (proximity of water sources). Lastly, the topography might have also been decisive: necropolises in al-Kharj region are spread over terraces, plateaus and outcrops, away from the threat of floodwaters, and are in a dominant position. As markers in the landscape, they could have been part of the appropriation of land by protohistoric populations.

Table 1: ʿAyn al-Ḍilaʿ 1: List of structures

Structure	Area	Tomb	Material	Location	Stone work	Nb of courses	Stone mean size
Pit 1001	H9	AD1-01	-	In the south-eastern quarter of tomb AD1-01, plundering pit going downward toward north-east.	-	-	-
Wall 1002	H9	AD1-01	Limestone	South-eastern wall of tomb AD1-01	Vertical slabs	1	50 × 20 × 30
Wall 1003	H9	AD1-01	Limestone	South-western wall of tomb AD 1-01	Vertical slabs	1	60 × 20 × 40
Wall 1004	H9	AD1-01	Limestone	Semi-circular structure / wall set against wall 1002 in its southern extremity, south-east of tomb AD1-01	Vertical slabs	1	15 × 15
Wall 1005	H9	AD1-01	Limestone	North-eastern wall of tomb AD1-01	Vertical slabs	1	75 × 30 × 15
Wall 1006	H9	AD1-01	Limestone	North-western wall of tomb AD1-01	Vertical slabs	1	45 × 13 × 40
Wall 1007	H9	AD1-01	Limestone	North-eastern wall of funerary room R 1023	Irregular courses	4	ca. 40 × 40
Wall 1008	H9	AD1-01	Limestone	North-western upper wall of funerary room R 1023	Irregular courses	4	Large to medium blocks
Wall 1009	H9	AD1-02	Limestone	Southern wall of AD1-02	Vertical slabs	1	40 × 20 × 30
Wall 1010	H9	AD1-02	Limestone	Western wall of AD1-02	Vertical slabs	1	40 × 20 × 30
Wall 1011	H9	AD1-02	Limestone	Eastern wall of AD1-02, partly destroyed (weathering?)	Vertical slabs	1	30 × 30 × 10
Wall 1012	H9	AD1-02	Limestone	Southern wall of funerary room R 1024	Vertical slabs	3	40 × 20 × 20
Wall 1013	H10	AD1-04	Limestone	Outer wall of tomb of AD1-04	Vertical slabs	1	20 to 40 cm
Wall 1014	H10	AD1-03	Limestone	Circular outer wall of tomb AD1-03	Vertical slabs	1	40 × 25 × 14
Wall 1015	H9	AD1-01	Limestone	South-eastern wall of funerary room R 1023.	Irregular courses	3	Large to medium blocks
Wall 1016	H9	AD1-01	Limestone	South-western wall of funerary room R 1023	Irregular courses	5	Large to medium blocks
Wall 1017	H9	AD1-02	Limestone	Western wall of funerary room R 1024	Vertical slabs	1	90 × 44 × 50
Wall 1018	H9	AD1-02	Limestone	Eastern wall of funerary room R 1024	Vertical slabs	1	80 × 20 × 50
Wall 1019	H9	AD1-02	Limestone	Northern wall of funerary room R 1024	Vertical slabs	1	150 × 20 × 70
Wall 1020	H10	AD1-05	Limestone	Circular outer wall of AD1-05	Vertical slabs	1	60 × 40 × 30

Length	Width	Height	Upper altitude	Lower altitude	Under stratigr. unit	Above stratigr. unit	Stratigr. unit filling the structure	Stratigr. unit against the structure	Abutting structure
180	ca. 90	60	480,31	479,42	1001	1002	1006	1006 1002	-
280	28 55	20 30	479.89 (centre) / 479.54 (south)	479.44	1002	Bedrock	-	1002 1005	W 1003 W 1004
480	25 38	17	479.76 (west) / 479.62 (east)	479.38	1002	Bedrock	-	1002	W 1002
42	18	37	479.49	479.31	1002	Bedrock	1005	1002	W 1002
400	30 40	20	479.78	479.30	1002	Bedrock	-	1002	W 1002 W 1006
260 (unearthed)	54	13 30	479.58	479.04	1002	Bedrock	-	1002	W 1005 W 1003
115	113	40	480.13	479.00	1002	Bedrock	-	1002 1007 1014 1018	W 1008 W 1015
98	109	40	480.09	479.00	1002	Bedrock	-	1002 1007 1014 1018	W 1007 W 1016
390	40	20	479.16	478.75	1008	Bedrock	-	1012 1015 1022 1020	W 1010 W 1011
255	54	20	479.06	478.52	1008	Bedrock	-	1012 1015 1020 1022	W 1009
120 (preserved)	29	12	478.96	478.67	1008	Bedrock	-	1012 1009	W 1009
140	58	23	479.10	478.52	1008	Bedrock	-	1012	W 1017 W 1018
150 cm in diameter	20 30	20	480.12	479.09	1010	Bedrock	-	1013 1019	-
400 in diameter	50	20	480.28	479.89	1010	Bedrock	-	1013 1030 1034	-
105	113	20 30	480.10	479.00	1002	Bedrock	-	1002 1007 1014 1018	W 1007 W 1016
130	115	30	480.08	479.00	1002	Bedrock	-	1002 1007 1014 1018	W 1008 W 1015
90	35	44	479.06	478.71	1008	Bedrock	-	1012 1023 1025 1021	W 1012 W 1019
80	53	20	479.18	478.65	1008	Bedrock	-	1012 1017 1020 1008 1009 1023 1025	W 1012 W 1019
150	80	20	479.29	478.49	1008	Bedrock	-	1023 1025	W 1017 W 1018
440 cm diameter	38	30	479.79	479.41	1016-1017	Bedrock	-	1017	-

Structure	Area	Tomb	Material	Location	Stone work	Nb of courses	Stone mean size
Room 1021	H10	AD1-03	Limestone	Rectangular funerary room of tomb AD1-03. Covered with corbelled vault (4 slabs above the corners of the room)	-	-	-
Room 1022	H10	AD1-04	Limestone	Circular funerary room of tomb AD1-04	-	2 3	25 × 15 × 7
Room 1023	H9	AD1-01	Limestone	Rectangular funerary room of tomb AD1-01, bordered by slabs (limestone) set on the edge and covered with corbelled vault.	-	-	-
Room 1024	H9	AD1-02	Limestone	Rectangular funerary room of tomb AD1-02	-		
Wall 1025	H10	AD1-03	Limestone	Eastern wall of funerary room R 1021	Vertical slab	1	70 × 24
Wall 1026	H10	AD1-03	Limestone	Northern wall of funerary room R 1021	Irregular courses	2	110 × 34
Wall 1027	H10	AD1-03	Limestone	Southern wall of funerary room R 1021	Vertical slab	1	85 × 50
Room 1028	H10	AD1-05	Limestone	Rectangular funerary room of tomb AD1-05, bordered by large blocks of limestone	-	-	-
Wall 1029	H10	AD1-03	Limestone	Western wall of funerary room R 1021	Vertical slabs	2	60 × 45
Wall 1030	H9	AD1-02	Limestone	Northern outer wall of tomb AD1-02	Vertical slabs	1	40 × 30 × 35
Wall 1031	H10	AD1-05	Limestone	Tomb AD1-05, between peripheral wall W 1020 and funerary chamber R 1028, at the top of the inner filling, small circular wall preserved on a single course and only to the N, W and S of the funerary chamber	Irregular	1	20 to 30 cm long
Wall 1032	H10	AD1-05	Limestone	Eastern wall of funerary room R 1028	Vertical slab	1	102 × 38
Wall 1033	H10	AD1-05	Limestone	Northern wall of funerary room R 1028	Vertical slabs	1 or 2	120 × 30 & 40 × 30
Wall 1034	H10	AD1-05	Limestone	Western wall of funerary room R 1028	Vertical slab	1	100 × 35
Wall 1035	H10	AD1-05	Limestone	Southern wall of funerary room R 1028	Vertical slab	1	110 × 35

Length	Width	Height	Upper altitude	Lower altitude	Under stratigr. unit	Above stratigr. unit	Stratigr. unit filling the structure	Stratigr. unit against the structure	Abutting structure
110	95	80	480.67	479.72	1010 1011 1013	Bedrock	1024 1029 1031 1032 1033 1040 1048	1030	W 1025 W 1026 W 1027 W 1029
38	25	29	480,07	479,87	1011 1013	Bedrock	1019	1013 1019	-
70 (top) 138 (bottom)	110	68 (top) 95 (bottom)	478.10	479.00	1002-1007	Bedrock	1007 1014 1018 1035 1038 1039 1041 1042 1044	1002	W 1007 W 1008 W 1015 W 1016
130	70	64	479.17	478.57	1008	Bedrock	1012 1023 1025	1008 1020 1021 1027	W 1012 W 1017 W 1018 W 1019
70 (upper stone)	70	24 (upper stone)	480.42	479.72	1013	Bedrock	-	1024 1029 1031	W 1026 W 1027 R 1021
110 (upper stone)	92	34 (upper stone)	480.64	479.72	1013	Bedrock	-	1024 1029 1031	W 1025 W 1029 R 1021
85 (upper stone)	90	50 (upper stone)	480.62	479.72	1013	Bedrock	-	1024 1029 1031	W 1025 W 1029 R 1021
156	73	107	480.10	479.37	1017	Bedrock	1036 1037 1043 1045 1046 1047	1017	W 1032 W 1033 W 1034 W 1035
60 (upper stone)	90	45 (upper stone)	480.62	479.72	1013	Bedrock	-	1024 1029 1031 1032 1033 1040	W 1027 W 1026 R 1021
410	40	28	478.85	478.45	1008	Bedrock	-	1012 1020	W 1010
240 in diameter	15 20	20 30	480.06	479.91	1017	Filling between outer wall and funerary room	-	1017	-
102	80	38	480.17	479.37	1017	Bedrock	1036 1037	1017 1036 1037	W 1033 W 1035 R 1028
150	84	30-40	480.21	479.37	1017	Bedrock	-	1017 1036 1037	W 1032 W 1034 R 1028
123	86	41	480.23	479.37	1017	Bedrock	1036 1037	1017 1036 1037	W 1033 W 1035 R 1028
150	73	30	480.10	479.37	1017	Bedrock	1036 1037	1017 1036 1037	W 1032 W 1034 R 1028

Table 2: ʿAyn al-Ḍilaʿ 1: List of stratigraphic units (UF)

Number	Area	Interpretation	under UF	above UF	Contact with structure	Upper altitude	Lower altitude
1001	H9 (AD1-01)	Surface	surface	1002	AD1-01	480.37 - 478.91	480.34 - 478.89
1002	H9 (AD1-01)	Surface erosion / collapse and rejection of plundering	1001	1004 - 1005 - 1006 - 1007 - 1026	AD1-01 P 1001 - W 1002 W 1003 - W 1004 W 1005 - W 1006 W 1007 - W 1008 W 1015 - W 1016	480.34 - 478.89	480.30 - 478.84
1003	H9 (AD1-02)	Surface	surface	1008	AD1-02 - W 1009 W 1010 - W 1012 W 1017 - W 1019 W 1030	479.49	478.22
1004	H9 (AD1-01)	Surface south of the tomb / Eolian deposit / collapse	1002	Bedrock	AD1-01 - W 1003	479.38	479.14
1005	H9 (AD1-01)	Collapse and natural filling of a small structure	1002	Bedrock	AD1-01 W 1004 - W 1002	479.45	479.31
1006	H9 (AD1-01)	Looting rejection	1002	Arbitrary stop in the inner filling	AD1-01 W 1002 - W 1015	479.40	479.12
1007	H9 (AD1-01)	Post-plundering filling of the funerary room	1002	1014	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.91	479.79
1008	H9 (AD1-02)	Collapse and weathering	1003	1009 - 1012 - 1015 - 1021 - 1023 - 1027	AD1-02 - R 1024 W 1009 - W 1010 W 1011 - W 1012 W 1017 - W 1018 W 1019	479.28 to 478.70	479.13 to 478.69
1009	H9 (AD1-02)	Filling of a pit due to erosion (or looting?)	1008	Bedrock	AD1-02 - W 1011 W 1018	479.00 to 478.33	478.70 to 478.23
1010	H10 (AD1-03 and AD1-04)	Surface AD1-04 and AD1-03	surface	1011	AD1-03 - AD1-04	480.85 - 479.99	480.80 - 479.94
1011	H10 (AD1-03 and AD1-04)	Collapse and erosion of AD1-04 and AD1-03	1010	1013	AD1-03 - AD1-04	480.80 - 479.94	480.75 - 479.89
1012	H9 (AD1-02)	Construction layer	1008	1021, 1020	AD1-02 - W 1009 W 1010 - W 1011 W 1012 - W 1018	479.11 to 479.01	478.95 to 478.80
1013	H10 (AD1-03 and AD1-04))	Collapse and erosion of AD1-04 and AD1-03	1011	1019 - 1024 - 1030	AD1-03 - AD1-04 W 1013 - W 1014 R1021 - R 1022 W 1025 - W 1026 W 1027 - W 1029	480.75 - 479.89	480.66 - 479.69
1014	H9 (AD1-01)	Post-plundering filling of the funerary room	1007	1018	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.79	479.75 to 479.54

Location	Description
Surface of the excavated area around and over tomb AD1-01	Surface layer of eolian silts with a large number of small stones and pebbles (limestone) covering a hard layer of white concretion (melted lime / gypsum due to natural weathering)
South-eastern and north-western quarter of the excavated area of tomb AD1-1	Removal of chalky limestone blocks mixed with eolian sediment and pebbles covering the peripheral walls W 1002 & W 1003 and a layer of white concretion in the plundering pit P 1001. In the SE quarter, lime crust and powdery limestone blocks alternating with silt and pebbles. In the NW quarter, uncovering of large blocks (inner filling) and the peripheral walls W 1005 and W 1006 (standing slabs) as well as the outer face of two walls bordering the funerary chamber (W 1007 & W 1008).
Excavation area of AD1-05 - whole surface (7 × 5 m)	Surface layer covering the whole area removed on 10 cm. Layer of grey/brown limestone, eolian sandy silt and pebbles. Uncovering of the peripheral walls W 1009, W 1010 Uncovering of the walls bordering the funerary chamber W 1012, W 1017, W 1019.
South-eastern quarter of the excavated area of tomb AD1-1. Sounding in the western part of the South eastern quarter, along the north-south section crossing the excavated area, between the bench along the excavated area and W 1003 (outside the tomb).	Homogeneous and loose sand layer. Pebbles. North-western area of the trench : concentration of stones (no limestone) South-eastern area : concentration of crumbled limestone Wall 1003 is built on pebbles, no foundation trench has been dug previously to the setting up of the slabs of the wall.
South-eastern quarter of the excavated area of tomb AD1-1 South-east and outside tomb AD1-01, against W 1002 in its southern extremity.	Filling of the small half-circular shaped structure (W 1004) built with small standing slabs of limestone stones against W 1002. Filling made of pebbles, lime nodules and sandy earth more or less homogenous, of light brown colour. Uncovering of stones lying flat on the ground, the structure might be a wedge for an earthenware jar.
South-eastern quarter of the excavated area of tomb AD1-1. In the filling between peripheral wall W 1002 and W 1015 of the funerary chamber ; filling of the pit P 1001.	Cleaning of the bottom of a pit (P 1001) dug by looters in the filling of tomb AD1-01 between the peripheral wall and the funerary chamber. Homogeneous layer, of beige white colour, with powdery limestone and pebbles. 6 Stones lying flat or set on the edge (the largest being 50 × 30 cm). 1 seashell (Cypraea)
Tomb AD1-01, funerary chamber R 1023, between W 1007, W 1008, W 1015, W 1016. Started in the NW quarter of the excavated area and later extended to the whole surface of the funerary chamber (encroaching on the SW quarter).	Upper layer covering the whole funerary chamber R 1023. Homogeneous layer of light brown eolian loose sediment, inclusion of small limestone blocks in the centre and small pebbles in the SE corner.
Tomb AD1-02 - Southern half of the excavated area (7 × 2.5 m).	Loose and homogeneous sandy layer mixed with stones of different sizes and pebbles. Uncovering over the filling of the tomb (between the peripheral wall and the funerary chamber) of a thick layer of limestone concretion (eastern area). Outer walls unearthed on the west, east and south (W 1009, W 1010, W 1011).
Tomb AD1-02 - Southern half of the excavated area, eastern part, between W 1018 (Eastern wall of the burial chamber) and the eastern limit of the excavated area.	Removal of a hard homogeneous layer mostly made of limestone concretion, small limestone pebbles. This white concretion covers the eastern part of tomb AD1-02, from the top of the Wall W 1018 to the base of the tomb. It cuts W 1011 (eastern peripheral wall). It corresponds to the filling of a large gully following the natural slope of the plateau, probably resulting from weathering and erosion. The origin of this gully is possibly due to the plundering of the grave which has weakened the eastern wall and induced the gullying process.
Excavation area of AD1-03 and AD1-04 - whole surface	Surface cleaning of AD1-04 and AD1-03: removing of small stones and pebbles from plundering rejection, weathering and collapse. Removing of eolian sand down to a limestone concretion layer.
Excavation area of AD1-03 and AD1-04 - whole surface	Above tombs AD1-03 and AD1-04, removal of limestone blocks, earth and lime concretion in a light brown compact sandy layer. Uncovering of the top of walls W 1013 and W 1014.
Tomb AD1-02 - Southern half of the excavated area, between the peripheral wall (W 1009, W 1010, W 1011) and the funerary chamber (W 1012, W 1017, W 1018)	Homogeneous and loose sandy layer. Light brown colour. Few limestone pebbles. Filling of Tomb AD1-02 between the peripheral wall and the funerary room.
Excavation area of AD1-03 and AD1-04 - above the structures and between them	Southern half of area of tomb AD1-03, including AD1-04. Extended later to the northern half. Cover the whole tomb AD1-03 et AD1-04. Removal of eolian sediment with calcareous and chalky blocks, small stones. Uncovering of the top of the walls delineating the funerary chamber R1021: W 10215, W 1026, W 1027, W 1029. These walls are covered by capstones laid flat above the corner of the walls (corbelled roof). Removal of the collapse along the peripheral walls of both tombs. At the basis of these walls (W 1013 - W 1014), presence of a dense crust of melted lime. Between the 2 graves, presence of large limestone blocks. At the foot of the slabs bordering AD1-04 (W 1013), small stones to strengthen the slabs.
Tomb AD1-01, funerary chamber R 1023, between W 1007, W 1008, W 1015, W 1016	Succession of layers of homogeneous and loose sediment with small pebbles and small stones, with hardened layers of earth and lime nodules. Result of infiltration of sediment and chemical dissolution of limestone from the walls or capstones (after plundering?). It covers powdery bones of a lower burial (UF 1018) : long bones, ribs, phalanx.

Number	Area	Interpretation	under UF	above UF	Contact with structure	Upper altitude	Lower altitude
1015	H9 (AD1-02)	Construction layer	1008 - 1012	1020	AD1-02 - W 1009 W 1010 - W 1011 W 1012 - W 1018	478.95	478.80
1016	H10 (AD1-05)	Surface	surface	1017	AD1-05	480.5 to 479.7	480.43 to 479.53
1017	H10 (AD1-05)	Collapse / erosion over the tomb	1016	1028 - 1036	AD1-05 - R 1028 W 1020 - W 1031 W 1032 - W 1033 W 1034 - W 1035	480.43 to 479.97	480.15 to 479.86
1018	H9 (AD1-01)	2nd burial	1014	1035 - 1038	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.75 to 479.54	479.50 to 479.46
1019	H10 (AD1-04)	Filling of the room (collapse + eolian accumulation)	1013	Bedrock	AD1-04 - W 1013 R 1022	480.07	479.87
1020	H9 (AD1-02)	Construction layer	1009 - 1015 - 1027	Bedrock	AD1-02 - W 1009 W 1010 - W 1011 W 1012 - W 1018	478.85 to 478.81	478.71 to 478.58
1021	H9 (AD1-02)	Stone layer	1008	Bedrock	AD1-02 - W 1017	479.20	478.70
1022	H9 (AD1-02)	Construction layer	1008	Bedrock	AD1-02 - W 1009 W 1010 - W 1011	478.93	478.75
1023	H9 (AD1-02)	Post-abandonment Filling of funerary room	1008	1025	AD1-02 - R 1024 W 1012 - W 1017 W 1018 - W 1019	479.12	478.92 to 478.80
1024	H10 (AD1-03)	Post abandonment Filing of the burial room r 1021	1013	1029	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	480.65	480.31 / 480.16
1025	H9 (AD1-02)	Post-abandonment Filling of funerary room	1023	Bedrock	AD1-02 - R 1024 W 1012 - W 1017 W 1018 - W 1019	478.92 to 478.80	478.66
1026	H9 (AD1-01)	Surface south of the tomb / Eolian deposit / collapse	1002	Bedrock	AD1-01 - W 1005	479.06 to 478.86	478.92 to 478.80
1027	H9 (AD1-02)	Construction layer	1008 - 1009	1020	AD1-02 - W 1018 W 1019	479.13	478.81
1028	H10 (AD1-05)	Accumulation against W 1020, outside the grave	1017	Bedrock	AD1-05 - W 1020	479.84/ 479.69	479.42
1029	H10 (AD1-03)	Post abandonment Filing of the burial room r 1021	1024	1031	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	480.31 / 480.16	480.07
1030	H10 (AD1-03)	Construction (filling between the chamber and peripheral wall)	1013	1034	AD1-03 - W 1014 W 1025 - W 1027	480.51	480.25
1031	H10 (AD1-03)	Post abandonment Filing of the burial room r 1021	1029	1032 -1033	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	480.07	479.96 (top of UF 1032) - 479.9 (top of UF 1033)
1032	H10 (AD1-03)	Post abandonment Filing of the burial room r 1021	1031	1033	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	479.96	479.9

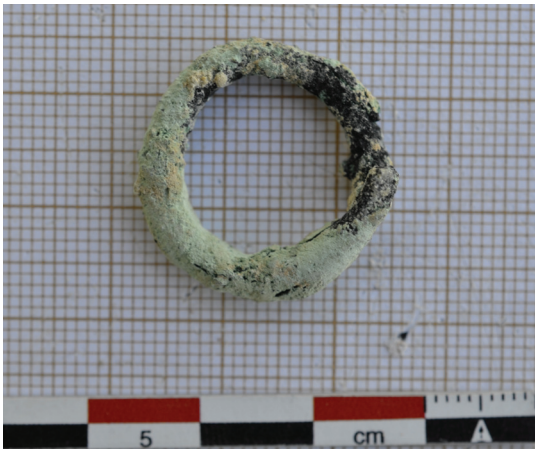
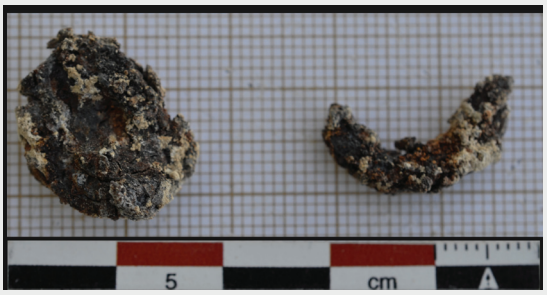
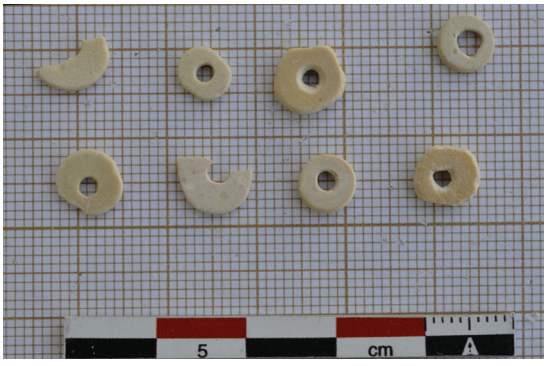
Location	Description
Tomb AD1-02 - Southern half of the excavated area, between the peripheral wall (W 1009, W 1010, W 1011) and the funerary chamber (W 1012, W 1017, W 1018)	Layer mixing small to medium limestone blocks, lime concretion lying against the inner part of the peripheral wall (W 1009, W 1010, W 1011). Possibly a layer aiming at stabilizing the vertical slabs of the outer walls.
Excavation area of AD1-05 - whole surface	Surface layer of loose eolian sediment and stones of different sizes.
Over the southern half of the tomb and later on extended to the whole surface of tomb AD1-05	Removal of a collapse layer located over and around the tomb. Compact layer of gypsum concretion with limestone blocks, pebbles, eolian sediment covering the top of the inner filling (between the peripheral wall and the funerary chamber. Uncovering of the peripheral wall W 1020, of the fragmented capstones of the funerary chamber R 1028, of the top of its walls W 1033 W 1034 W 1035 W 1036. Discovering of a second circular wall surrounding the funerary chamber, founded above the inner filling, W 1031.
Tomb AD1-01, funerary chamber R 1023, between W 1007, W 1008, W 1015, W 1016	Upper burial of tomb AD1-01 (2nd and later one). Layer of loose homogeneous silt with inclusions of few small limestone blocks, pebbles, and a couple of large blocks to the west Presence of a large number of bones concentrated in the eastern half of the funerary chamber. Bones are largely decayed (powdery state). They nevertheless include almost all the parts of the body, including vertebras and skull. After excavation of a bench preserved in the western part of the room for stratigraphical section, discovery in the NE corner of a bronze ring, an iron ring, shells and beads in stone and seashell.
In funerary room R 1022, tomb AD1-04	Filling of the funerary chamber of the small tomb AD1-04. Natural filling post abandonment. No evidence of bones nor artefacts. R 1022 is bordered by limestone slabs set one above the other to circumscribe the funerary room. Layer of compact sediment made of earth mixed with pebbles and lime concretions.
Tomb AD1-02 - Southern half of the excavated area, between the peripheral wall (W 1009, W 1010, W 1011) and the funerary chamber (W 1012, W 1017, W 1018)	Lower part of the filling between the burial chamber and the peripheral wall (W 1009, W 1010, W 1011). Homogeneous layer of light brown sediment with many pebbles directly above the bedrock.
Tomb AD1-02 - Southern half of the excavated area, along the eastern wall of the funerary chamber W 1017.	In the filling between the peripheral wall W 1010, abutting wall W 1017 (funerary room), concentration of heavy limestone block, now completely crumbled, probably to strengthen and stabilize the stones of W 1017.
Tomb AD1-02 - Southern half of the excavated area, along the outer face and at the base of the peripheral walls W 1009, W 1010, W 1011.	Hard and compact layer of pebbles stabilizing the base of the slabs set on the edge constituting the peripheral walls W 1009, W 1010, W 1011.
Tomb AD1-02, burial chamber R 1024, between W 1018, W 1019, W 1017 and W 1012.	Upper layer of the natural filling of the funerary chamber after its emptying. To the West : loose, heterogeneous layer of light brown sediment with pebbles. To the East : hardened layer with a few pebbles and concretion. Presence of a bronze fragment (unidentified artefact) and a red and black sherd.
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Filling of the upper part of R 1021. Layer in slope (W-->E). Limestone pebbles mixed with eolian sediment : compact layer. Powdery chalky limestone blocks to the West.
Tomb AD1-02, burial chamber R 1024, between W 1018, W 1019, W 1017 and W 1012.	Lower layer of the natural filling of the funerary chamber after its emptying (providing that the tomb was used for burial. Compact layer of light brown sediment, homogeneous. Sediment looser than UF 1023, with fewer pebbles than in UF 1023. At the base, limestone concretion and bedrock. In the SE corner, tiny fragments of charcoal.
North-western quarter of the excavated area of tomb AD1-1. Test trench along the north-south section which crosses the excavated area in the centre, between the bench along the excavated area and W 1005.	20 cm deep trench at the foot of the external wall of the tomb W 1005. Removal of silt, pebbles and limestone concretion completely crumbled down to the bedrock.
Tomb AD1-02 - Southern half of the excavated area, along the outer face of W 1019, the northern wall of the funerary chamber.	Upper part of the filling layer between the burial chamber and the peripheral wall W 1030. Large limestone blocks, compact brown sediment, lime concretion.
Outside grave AD1-05, along the peripheral wall W 1020	Unearthing of the outer face of W 1020, made of orthostats set on the edge, fixed at the basis by small blocks of limestone. Removal of a dense layer and thick layer of accumulation / collapse including eolian silts, lot of pebbles and a few fragments of limestone (> 30 cm). Presence of a single sherd (black fabric, mineral temper, red slips)
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	In R 1021, layer in a West (up) - East (down) slope Compact layer of earth with limestone concretions and inclusion of little blocks of stone. Limestone concretions are more dense to the western half. They form a kind of dome. To its eastern foot, accumulation of earth.
1/4 SE of the tomb, between the peripheral wall W 1014 and two of the walls bordering the funerary chamber, W 1025 and W 1027	Removing of the filling between W 1014 (peripheral wall) and the funerary chamber (R1021) in the South eastern part of the tomb made of large limestone blocks covered with concretion and pebbles (interface between construction and collapse. Stones are either soft and crumbled.
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Generally, loose orange earth with inclusion of limestone nodules Near W 1027: compact earth and limestone. Near W 1029: loose earth with soft blocks of chalk.
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Dense layer of earth with a slope converging toward the centre of the room. Inclusion of small pebbles. This layer might have been exposed, evidence of percolation in the corners, traces of weathering of lime and earth. Exposition after plundering?

Number	Area	Interpretation	under UF	above UF	Contact with structure	Upper altitude	Lower altitude
1033	H10 (AD1-03)	Post-burial/plundering Filing of the burial room r 1021 - exposure - bone fragments	1032	1040 - 1048	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	479.9	479.72
1034	H10 (AD1-03)	Construction (filling of the burial room r 1021)	1030	Bedrock	AD1-03 - W 1014 W 1025 - W 1027	480.25	479.89
1035	H9 (AD1-01)	Filling between two burials	1018	1038 - 1039	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.54	479.43
1036	H10 (AD1-05)	Natural Filling and collapse in funerary chamber	1017	1037 - 1043	AD1-05 - R 1028 W 1032 - W 1033 W 1034 - W 1035	480.15	479.77
1037	H10 (AD1-05)	Filling and collapse in the funerary chamber over burial	1036 - 1043	1045 - 1046 - 1047	AD1-05 - R 1028 W 1032 - W 1033 W 1034 - W 1035	479.77	479.6 to 479.77
1038	H9 (AD1-01)	Filling between two burials	1018 - 1035	1039	AD1-01 - R 1023 W 1015	479.52	479.34
1039	H9 (AD1-01)	Natural filling after plundering of 1st burial	1038 - 1035	1041 - 1042	AD1-01 - R 1023 W 1007 - W 1008 W 1016	479.48	479.19
1040	H10 (AD1-03)	Filling between the chamber and peripheral wall)	1033	1048	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	479.99	479.81
1041	H9 (AD1-01)	1st burial	1039	1042	AD1-01 - R 1023 W 1008	479.20	479.10
1042	H9 (AD1-01)	1st burial	1041	1044	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.10	479.06
1043	H10 (AD1-05)	Collapse layer	1036	1037	AD1-05 - R 1028 W 1033	479.75	479.62
1044	H9 (AD1-01)	Construction layer / 1st burial	1041 - 1042	Bedrock	AD1-01 - R 1023 W 1007 - W 1008 W 1015 - W 1016	479.06	479.00
1045	H10 (AD1-05)	Layer of the funerary chamber with burial	1037	1046 - Bedrock	AD1-05 - R 1028 W 1032 - W 1033 W 1035	479.6 / 479.77	479.36
1046	H10 (AD1-05)	Collapse layer	1037 - 1047	1045	AD1-05 - R 1028 W 1033 - W 1035	479.74 to 479.64	479.47
1047	H10 (AD1-05)	Eolian earth percolation after collapse	1037	1046	AD1-05 - R 1028 W 1033 - W 1034 W 1035	479.63	479.49
1048	H10 (AD1-03)	Digging of the burial room r 1021	1033 - 1040	Bedrock	AD1-03 - R1021 W 1025 - W 1026 W 1027 - W 1029	479.81 to 479.72	479.78 to 479.64

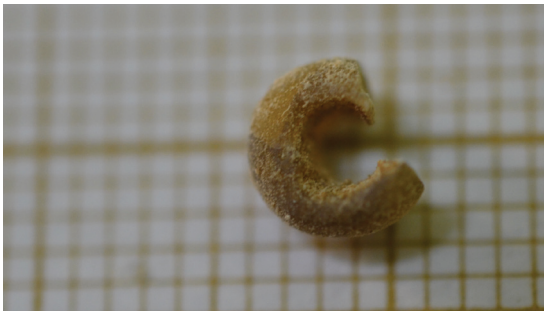
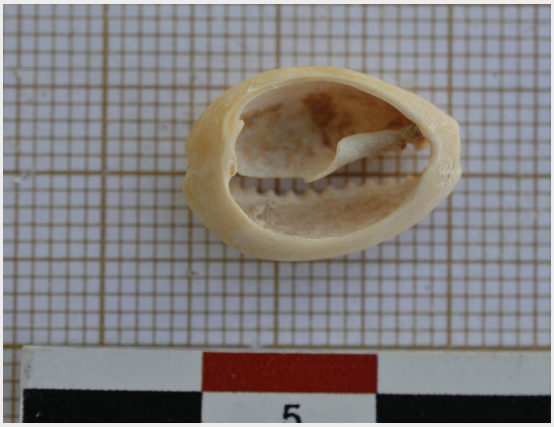
Location	Description
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Loose earth with inclusions of small pebbles and small limestone nodules. Two limestone blocks in the NW corner. Presence of small fragments of unidentifiable bones and small fragments of charcoal. Remains of a highly perturbed burial after one or several plundering. No artefacts left. Lower part of this layer bordered by lime mixed with earth (UF 1040)
Tomb AD1-03 1/4 SE of the tomb, between the peripheral wall W 1014 and two of the walls bordering the funerary chamber, W 1025 and W 1027	Removing of the lower part of the filling between W 1014 (peripheral wall) and the funerary chamber (R1021) in the South eastern part of the tomb made of melted blocks of chalky limestone, concretion and limestone blocks ca. 40 cm long. These blocks are not in their original state of conservation, they suffered from weathering and natural chemical dissolution.
Tomb AD1-01, funerary chamber R 1023, between walls W 1007, W 1008, W 1015, W 1016	Under the 2nd burial (UF 1018). Thin layer of loose grey sediment.
Funerary chamber, R 1028, tomb AD1-05, between W 1032 - W 1033 - W 1034 - W 1035	Layer of loose silt and sand mixed with limestone pebbles. Few small limestone blocks. Stop at the base of this layer with the appearance of a long powdery bone.
Funerary chamber, R 1028, tomb AD1-05, between W 1032 - W 1033 - W 1034 - W 1035	Dense layer of silts and pebbles. Few small limestone blocks in the centre. In the corner, loose sandy silts. Along W 1033, covered by a layer of crushed stone and pebble (UF 1043). To the south, 3 fragmentary and powdery bones. They don't seem to be in their original location (plundering?). To the centre, numerous bone fragments (long bones, skull fragments, vertebras).
Tomb AD1-01, funerary chamber R 1023, against W 1015	Under the more recent burial (2nd burial, UF 1018), loose brown earth with inclusions of small pebbles and limestone nodules forming a pocket within UF 1035.
Tomb AD1-01, funerary chamber R 1023, between walls W 1007, W 1008, W 1016	Loose grey / white layer with inclusions of small pebbles and limestone nodules covering a more ancient burial (UF 1041 & UF 1042).
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Limestone with a few loose earth in the corner of the room, at the base of UF 1033. Presence of small powdery chalky blocks of limestone. This layer takes the shape of a bowl under UF 1033.
Tomb AD1-01, funerary chamber R 1023, against W 1008	Layer of dense grey to white silt with inclusions of limestone pebbles and lime nodules. Identical to UF 1039 but more compact. Upper layer of the earlier burial sealing the bones of a single individual (S.R.1023.2). Imprints of long bones (powdery). Under this thin layer, excavation of the burial (UF 1042). 3 shells at the interface between UF 1041 and UF 1042.
Tomb AD1-01, funerary chamber R 1023, between walls W 1007, W 1008, W 1015, W 1016	Layer of loose brown earth with some inclusions of pebbles and limestone nodules. Fragments of powdery bones: long bones, some vertebras well preserved. Bones are concentrated in the SE / E part of the room. Funerary deposit concentrated : 1) in the western part of the room : Shells, cornelian bead, small charcoals. 2) in the Eastern part : 2 bivalve seashells
Northern part of the funerary chamber, R 1028, tomb AD1-05, along W 1033	Along W 1033, between UF 1036 and UF 1037, lenticular layer of dense small pebbles (splintered stone)
Tomb AD1-01, funerary chamber R 1023, between walls W 1007, W 1008, W 1015, W 1016	Lower part of the earlier burial immediately above the bedrock. Layer of loose, brown to black silt. In the western part, presence of a small grinder (pebble), few shells and charcoals
Eastern part of the funerary chamber, R 1028, tomb AD1-05, between W 1032 - W 1033 - W 1034 - W 1035	Continuity of UF 1037 : Dense layer of brown to beige silt with inclusions of small pebbles; fragments of bones. At the base of the eastern bench, uncovering above the bedrock of the 10-cm-long handle of a bronze sickle sword whose blade keeps going under the bench. Excavation of the bench in order to get the whole artefact. The blade is 30 cm long and 4 cm wide. Its extremity is missing. The artefact is broken between the handle and the blade.
Western part of the funerary chamber, R 1028, tomb AD1-05, between W 1032 - W 1033 - W 1034 - W 1035	Large limestone blocks fallen down in the funerary chamber over the burial : 3 large stones mixed with small pebbles, chips of limestone. Dimensions of the large stones : 28 × 30 × 15 cm; 22 × 19 × 8 cm; 28 × 30 cm
Western part of the funerary chamber, R 1028, tomb AD1-05, along W 1034 and the large stone of UF 1046	Homogeneous eolian silt probably coming from percolation after collapse (1043, 1046), between W 1034 (to the west) and the 3 fallen blocks (UF 1046).
Funerary chamber, R 1021, tomb AD1-03, between W 1025 - W 1026 - W 1027 - W 1029	Loose earth

Table 3: ʿAyn al-Ḍilaʿ 1: List of artefacts

Number	Area	Locus	Type	Material	Dimensions (mm)	State of conservation	
AD1.1006.1	AD1 - Area H9	1006	Shell	Seashell	19 × 12,5 × 3,5	Sawn on backside	
AD1.1018.1	AD1 - Area H9 Tomb AD1-01	1018	Earring / Ring	Copper alloy / Bronze	22 × 23	Corroded	
AD1.1018.2	AD1 - Area H9 Tomb AD1-01	1018	Undetermined	Iron	2 × 23	Fragmentary, corroded, oxidized	
AD1.1018.3	AD1 - Area H9 Tomb AD1-01	1018	Beads (x 8)	Seashell	ca. 9 × 7	6 complete, 2 fragmentary	
AD1.1018.4	AD1 - Area H9 Tomb AD1-01	1018	Bead	Grey stone (steatite?)	14 × 12	Complete	

	Description	
	Marine shell (Cypraea) sawn on the back side.	
	Regular ring with circular section	
	Two fragments of iron artefacts, one having a shape of a fragmentary ring / hook, the other being part of a small sphere.	
	Set of 8 beads cut in seashells. Roughly circular, flat, pierced in the centre by a 2 mm wide hole and polished.	
	Small bead in a dark grey stone (burnt stone? steatite?). Convex lateral side. Both extremities flattened. Transverse hole.	

Number	Area	Locus	Type	Material	Dimensions (mm)	State of conservation	
AD1.1018.5	AD1 - Area H9 Tomb AD1-01	1018	Bead	Orange stone (quartzite?)	5 × 5	Broken	
AD1.1018.6	AD1 - Area H9 Tomb AD1-01	1018	Shell	Seashell	16 × 11	Sawn on backside	
AD1.1042.1	AD1 - Area H9 Tomb AD1-01	1042	Bead	Cornelian	16,5 × 7,5	Complete - missing flakes on the edge	
AD1.1044.1	AD1 - Area H9 Tomb AD1-01	1044	Grinder	Sandstone	Æ 53 to 57	Complete	

	Description	
	Small circular bead with a circular section broken on one side (1/4 is missing). The bead is carved in a brown/ orange stone, possibly a quartzite.	
	Marine shell (Cypraea) sawn on the back side.	
	Cornaline bead, cylindrical, slightly rounded profile, longitudinal hole. Light orange.	
	Small sandstone pebble, soft and flatten on one side. Light grey.	

Number	Area	Locus	Type	Material	Dimensions (mm)	State of conservation	
AD1.1045.1	AD1 - Area H10 Tomb AD1-05	1045	Sword	Copper alloy / Bronze	400 × 40	Corroded, broken in 2 pieces, tip is missing	
AD1.surf.1	AD1 - Area K7	Surface	Blade	Copper alloy / Bronze	Frag. 1 : 127 × 37 × 8 Frag. 2 : 45 × 38 × 6 Frag. 3 : 14 × 32 × 7	Corroded, oxidized, broken in 3 pieces, partly preserved	
AD1.surf.2	AD1 - Area F9	Surface	Spear head	Copper alloy / Bronze	60 × 22	Corroded - fragmentary	

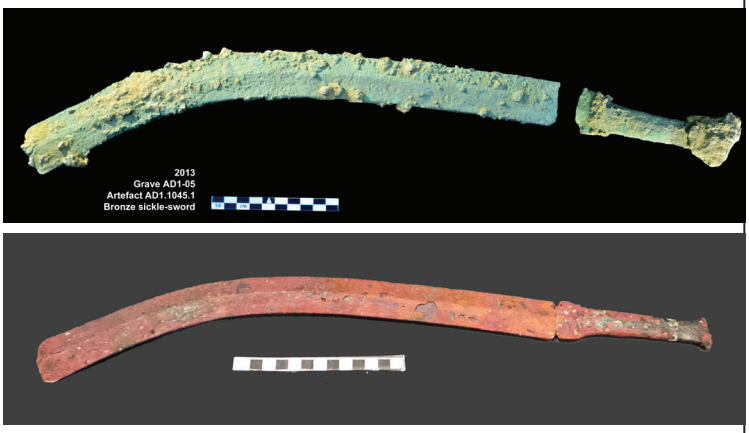
	Description	
	Elongated sword with curved bladed, rhomboid section. Handle is flattened and slightly widens on both extremities. No ornamentation nor inscription visible after restoration. The tip is missing.	
	3 fragments of a bronze artefact. Curved, flat, with an asymmetric rhomboid section. Most probably a blade. It has been sampled on the ground of the necropolis, north-east of the site. It could be a modern object recently thrown away. Nevertheless, the state of preservation of the spear head AD1.surf.2 is similar and it does not preclude this artefact to be more ancient than expected.	
	Spear head in bronze. The head is broken. Socketed at the basis; laurel leaf shape and rhomboid section of the blade. Longitudinal rib on both faces of the blade.	

Table 4: ʿAyn al-Ḍilaʿ 1: List of registered human bones

Tomb AD1-01 - Burial S.R1023.1

Passe	No	Détermination	Altitude	Dimensions	Observations
Passe a	Os bougés	Fragment de condyle fémoral, première vertèbre coccygeale, extrémité sternale d'une côte, petits fragments de spongieux et de côtes			
Passe b	Os bougés	Corps de vertèbre cervicale, 2 épines de vertèbres (dernière cervicale ?), fragment de spongieux (os court type tarse ?)			
Passe c	Os bougés	2 fragments de diaphyse, un petit fragment de spongieux, une extrémité sternale de côte			
Passe d	Os bougés	Dent (27 ?), cuboïde droit, fragments de spongieux et de diaphyses indéterminés			
	1	Tête fémorale	479,51	3,5*3,5 cm	
	2	Vertèbre cervicale 3 ou 4	479,54		
	3	Phalange médiale de main	479,55		
	4	Métacarpe 3 gauche	479,54		
	5	Fragment d'épiphyse distale d'ulna ?	479,51		
	6	Métacarpe 2 gauche	479,51		
	7	Fragment d'épine transverse de vertèbre ?	479,52		
	8	Fragment d'os carpien (hamatum ?)	479,52		
	9	Fragment d'épiphyse proximale d'ulna gauche	479,51		
	10	Fragment de vertèbre lombaire (surface articulaire supérieure)	479,53		
	11	Fragment de vertèbre lombaire (épine dorsale) ou fragment de sternum	479,50		
	12	Fragment de tête humérale	479,50		
	13	Clavicule droite	479,52		
	14	Epiphyse proximale de phalange proximale de main (1er rayon ?)	479,51		
	15	Fragment de vertèbre indéterminée	479,51		
	16	Corps de vertèbre cervicale	479,51		
	17	Fragment d'extrémité sternale de côte	479,50		
	18	Fragment d'extrémité sternale de côte	479,50		
	19	Fragment de vertèbre ?	479,50		
	20	Fragment d'os court ou plat (manubrium, tarse ?)	479,51		
	21	Fragment de diaphyse d'os long indéterminé	479,65	Largeur : 1,5 cm	
	22	Fragment de diaphyse d'os long ?	479,65		
	23	Fragment de diaphyse d'os long (humérus ?)	479,64	10*2 cm	
	24	Fragment de diaphyse d'os long de radius	479,68	Largeur : 2,4 cm	Section en goutte, non prélevé
	25	Fragment de diaphyse d'os long de membre inférieur (fémur ou tibia)	479,65	16*3 cm	
	26	Fragment de spongieux (lié à l'os long 27 ?)	479,55		Spongieux convexe, très dense, épiphyse distale de fémur ?)
	27	Humérus	479,53	Largeur : 3 cm	
Passe e	28	Fragment d'os long ?	479,68		Non prélevé
	29	Corps de vertèbre thoracique (vers moitié du segment)	479,65		Envoyée en datation
	30	Côte ?	479,65		Os plat très fin, non prélevé
	31	Corps de vertèbre thoracique (vers les trois quarts du segment)	479,65		Envoyée en datation
	32	Fragment de spongieux indéterminé	479,52		
	33	Naviculaire gauche	479,51		

Passe	No	Détermination	Alti-tude	Dimensions	Observations
	34	Fragment de côte	479,53		
	35	Fragment d'os court, carpe ou métacarpe	479,53		
	36	Fragment d'os carpien ou extrémité vertébrale de côté ?	479,53		
	37	Os carpien indéterminé	479,53		
	38	Os carpien indéterminé	479,53		
	39	Extrémité proximale de phalange proximale de main	479,53		
	40	Extrémité proximale de phalange proximale de main	479,53		
	41	Extrémité proximale de phalange proximale de main	479,52		
	42	Epiphyse proximale humérale ?	479,52		
	43	Racine de dent	479,52		
	44	Racine de dent	479,52		
	45	Extrémité proximale de phalange distale de main, 1er rayon	479,52		
	46	Fragment de côte	479,53		
	47	Phalange distale de main	479,53		
Passe f	48	Racine de dent	479,49		
	49	Fragment de spongieux d'os plat type sternum	479,49		
	50	Phalange médiale de main	479,50		
	51	Racine de dent	479,50		
	52	Tête de métacarpe indéterminé	479,50		
	53	Tête de côte	479,50		
	54	Tête de côte	479,49		
	55	Scaphoïde gauche	479,51		
	56	Epiphyse distale de phalange médiale de main	479,51		
	57	Tête de côte	479,51		
	58	Phalange médiale de main	479,51		
	59	Epiphyse proximale métacarpe 1 gauche	479,50		
	60	Négatif de côté	479,50		Non prélevé
	61	Fragment de spongieux	479,61	5*2,2 cm	Spongieux très dense : vertèbre lombaire ou épiphyse d'os long de membre inférieur ?
	62	Négatif de côté	479,62		
	63	Fragment d'os plat indéterminé	479,61		Non prélevé
	64	Négatif d'os indéterminé	479,63		Os long ? Suite de numéro 25 ?
	65	Corps de vertèbre indéterminé	479,60		
	66	Négatif de côte ?	479,63		Non prélevé
	67	Négatif de côte ?	479,63		Non prélevé
	68	Fragment de vertèbre ?	479,61		
	69	Négatif de côte ?	479,63		Non prélevé
	70	Négatif de côte ?	479,63		Non prélevé
	71	Négatif de côte ?	479,63		Non prélevé
	72	Os indéterminé	479,63		Non prélevé
	73	Négatif de côte ?	479,61		Non prélevé
	74	Fragment de spongieux	479,58	4*2 cm	Epiphyse d'un os long indéterminé
	75	Fragment de vertèbre	479,61		Lié à numéro 68 et 29 ?
	76	Fragment de diaphyse d'os long indéterminé	479,57	5*1,5 cm	Os fin, de l'avant-bras ?
Passe g	77	Fragment de vertèbre ?	479,61		Non prélevé
	78	Corps de vertèbre thoracique de la première moitié du segment	479,59		
	79	Fragment de côte	479,61		Non prélevé

Passe	No	Détermination	Alti-tude	Dimensions	Observations
	80	Négatif d'os indéterminé	479,61		Non prélevé
	81	Fragment d'os long de l'avant-bras (ulna ?)	479,60		Non prélevé
	82	Fragment de côte ?	479,61		Non prélevé
	83	Fragment de spongieux : tête de fémur avec début du col ?	479,58		Non prélevé
	84	Fragment de côte ?	479,58		Non prélevé
	85	Fragment de spongieux	479,58		Non prélevé
	86	Négatif d'os indéterminé	479,59		Non prélevé
	87	Fragment de spongieux indéterminé	479,58		Non prélevé
	88	Négatif d'os indéterminé	479,58		Non prélevé
	89	Fragment de corps vertébral thoracique, de la première moitié du segment	479,51		
	90	Fragment de corps vertébral thoracique, de la première moitié du segment	479,53		
	91	Fragment de corps vertébral thoracique, de la première moitié du segment	479,53		
Passe h	92	Fragment de diaphyse d'os de l'avant-bras	479,57	2 cm d'épaisseur	Non prélevé
	93	Fragment de spongieux	479,56		
	94	Fragment de corps de vertèbre	479,56		
	95	Fragment de spongieux	479,54		Non prélevé
	96	Fragment de côte	479,54		Non prélevé
	97	Fragment de diaphyse d'os long indéterminé	479,54		Non prélevé
	98	Fragment de spongieux (de vertèbre ?)	479,55		Non prélevé
Passe i	99	Côte	479,49		Non prélevé
	100	Côte	479,49		Non prélevé
	101	Côte	479,49		Non prélevé
	102	Côte	479,49		Non prélevé
	103	Côte	479,49		Non prélevé
	104	Côte	479,49		Non prélevé
	105	Côte	479,49		Non prélevé
	106	Côte	479,57		Non prélevé
	107	Côte	479,57		Non prélevé
	108	Côte ?	479,55		Non prélevé
	109	Côte	479,51		Non prélevé
	110	Fragment d'os indéterminé	479,55		Non prélevé
	111	Fragment d'os indéterminé	479,55		Non prélevé
	112	Fragment d'os indéterminé	479,54		Non prélevé
	113	Fragment d'os indéterminé	479,55		Non prélevé
	114	Fragment de diaphyse d'os long : fibula ?	479,53		Non prélevé
	115	Négatif d'os indéterminé	479,53		Non prélevé
	116	Fragment de diaphyse d'os long : suite de la fibula ?	479,55		Non prélevé
	117	Fragment de diaphyse d'os long : ulna ?	479,49		Pendage de 3,5 cm
	118	Fragment de diaphyse d'os long : fibula ou ulna ?	479,51		Pendage de 2 cm
	119	Fragment de diaphyse d'os long : tibia ?	479,53		Pendage de 1,5 cm, non prélevé
	120	Suite de 121	479,53		Non prélevé
	121	Fragment de mandibule	479,53		Non prélevé
	122	Fragment de vertèbre indéterminée	479,53		Non prélevé
	123	Négatif d'os indéterminé	479,54		Non prélevé
	124	Négatif d'os indéterminé	479,53		Non prélevé
	125	Fragment d'os plat indéterminé	479,52		Non prélevé
	126	Fragment de diaphyse d'os long indéterminé : avant-bras ?	479,52		Non prélevé

Passe	No	Détermination	Alti-tude	Dimensions	Observations
	127	Corps de vertèbre cervicale	479,53		
	128	Fragment de spongieux indéterminé	479,52		Non prélevé
	129	Fragment de diaphyse d'os long indéterminé	479,52		Non prélevé
	130	Fragment de spongieux indéterminé, vertèbre lombaire ?	479,53		Non prélevé
	131	Vertèbre indéterminée	479,52		Non prélevé
	132	Négatif d'os indéterminé	479,54		Non prélevé
	133	Côte ?	479,51		Pendage de 4 cm, non prélevé
	134	Fragment de corps de vertèbre cervicale	479,52		
	135	Vertèbre cervicale	479,50		Non prélevé
	136	Côte	479,49		Non prélevé
	137	Vertèbre thoracique	479,51		Non prélevé
	138	Négatif d'os indéterminé	479,50		Non prélevé
	139	Côte	479,52		Non prélevé
	140	Négatif d'os indéterminé	479,53		Non prélevé
	141	Négatif d'os indéterminé	479,52		Non prélevé
	142	Négatif d'os indéterminé	479,54		Non prélevé
	143	Corps de vertèbre ?	479,53		Non prélevé
	144	Fragment de diaphyse d'os long ?	479,54		Non prélevé
Passe j	145	Fragment d'os indéterminé	479,54		Non prélevé
	146	Fragment d'os indéterminé	479,52		Non prélevé
	147	Corps de vertèbre cervicale	479,52		
	148	Négatif d'os indéterminé	479,52		Non prélevé
	149	Fragment de corps de vertèbre ?	479,52		Non prélevé
	150	Négatif d'os indéterminé	479,52		Non prélevé
	151	Côte	479,52		Non prélevé
	152	Côte	479,51		Non prélevé
	153	Côte	479,51		Non prélevé
	154	Côte	479,51		Non prélevé
	155	Fragment de vertèbre thoracique ?	479,51		Non prélevé
	156	Négatif d'os indéterminé	479,51		Non prélevé
	157	Négatif d'os indéterminé	479,51		Non prélevé
	158	Fragment d'os indéterminé	479,51		Non prélevé
	159	Fragment de spongieux indéterminé	479,51		Non prélevé
	160	Négatif d'os indéterminé	479,51		Non prélevé
	161	Négatif d'os long indéterminé	479,51		Non prélevé
	162	Fragment d'os indéterminé	479,54		Non prélevé
	163	Corps de vertèbre lombaire	479,52		Présence d'ostéophytes sur la face antérieure des disques supérieur et inférieur
Passe k	164	Extrémité distale de MTT 1	479,54		Non prélevé
	165	Os court indéterminé	479,54		
	166	Fragment d'os long indéterminé	479,54		
	167	Négatif de diaphyse indéterminée	479,52		Non prélevé
	168	Négatif de spongieux indéterminé	479,51		Non prélevé
	169	Négatif de spongieux indéterminé	479,51		Non prélevé
	170	Négatif d'os indéterminé	479,47		Non prélevé
	171	Fragment de vertèbre ?	479,47		Non prélevé
	172	Négatif d'os indéterminé	479,47		Non prélevé
	173	Vertèbre thoracique	479,53		
	174	Vertèbre thoracique	479,51		Non prélevé
	175	Corps de vertèbre thoracique	479,53		

Passe	No	Détermination	Alti-tude	Dimensions	Observations
	176	Fragment de diaphyse indéterminée	479,53		Non prélevé
	177	Côte	479,52		Non prélevé
	178	Côte	479,52		Non prélevé
	179	Os court indéterminé	479,53		Non prélevé
	180	Côte	479,52		Non prélevé
	181	Fragment de spongieux indéterminé	479,53		Non prélevé
	182	Fragment d'os indéterminé	479,52		Non prélevé
	183	Fragment d'os indéterminé	479,54		Non prélevé
	184	Négatif de scapula	479,58		Non prélevé
	185	Humérus	479,58		Pendage de 5 cm, non prélevé
	186	Vertèbre cervicale ?	479,55		
	187	Côte	479,53		Non prélevé
	188	Os carpien : trapézoïde ?	479,52		
	189	Crâne	479,50		Hauteur conservée de 3 cm
	190	Fragment d'épiphyse d'os indéterminé	479,48		Non prélevé
	191	Vertèbre indéterminée	479,53		Non prélevé
Berme	192	Fragment d'os long type avant-bras	479,60	17 cm de long, 2 cm de diamètre	Non prélevé
	193	Négatif d'os indéterminé	479,51		Non prélevé
	194	Négatif d'os indéterminé	479,52		Non prélevé
	195	Fragment d'os long type avant-bras ?	479,55		Non prélevé
	196	Côte	479,53		Non prélevé
	197	Côte ?	479,46		Non prélevé

Tomb AD1-01 - Burial S.R1023.2

Passe	No	Détermination	Alti-tude	Dimen-sions	Observations
Passe a	Os bougés	Fragments de crâne			envoyé en datation
	1	Fragment de crâne	479,30		
	2	Fragment de crâne	479,30		
	3	Fragment de crâne	479,29		
	4	Fragment de crâne	479,32		
	5	Négatif d'os indéterminé	479,26		Non prélevé
	6	Négatif d'os indéterminé	479,26		Non prélevé
	7	Négatif d'os indéterminé	479,25		Non prélevé
	8	Négatif d'os indéterminé	479,25		
	9	Négatif d'os indéterminé	479,25		Non prélevé
Passe b	Os bougés	M1 gauche et M2 ? Inférieures, fragment de crâne			Les dents n'ont de conservées que l'émail et fragments de racine ne dépassant pas le collet (en formation ? Ou altération ?), elles n'ont pas de traces d'usure ni de stress
	10	Fragment de diaphyse d'os long indéterminé	479,18	11*1 cm	Non prélevé
	11	Négatif d'os indéterminé	479,17		Assez fin : côte ?, Non prélevé
	12	Côte ?	479,14		Non prélevé
	13	Sternèbre	479,11		
	14	Fragment d'os long indéterminé	479,15	15*2 cm	Non prélevé
	15	Fragment d'os long indéterminé	479,17	19*2 cm	Non prélevé

Passe	No	Détermination	Altitude	Dimensions	Observations
	16	Fragment de crâne	479,20		
	17	Fragment d'os long indéterminé	479,15	20*3 cm	
	18	Côte	479,13		
Passe c	Os bougés	Fragments de dents (dont prémolaire), de spongieux			Prémolaire avec racine présente mais brisée
	19	Négatif d'os long indéterminé	479,17		
	20	Fragment d'os long de l'avant-bras	479,15	12*2 cm, diam. 1 cm	
	21				
	22	Fragment d'extrémité proximale d'ulna ?	479,17		
	23	Fragment d'os indéterminé	479,16		Non prélevé
	24	Négatif d'os indéterminé	479,14		Non prélevé
	25	Fragment d'os indéterminé	479,16		Non prélevé
Passe d	26	Fragment de spongieux indéterminé	479,13		
	27	Fragment de diaphyse indéterminé	479,13		Non prélevé
	28	Fragment de diaphyse indéterminé	479,12		Non prélevé
	29	Négatif d'os indéterminé	479,09		Non prélevé
	30	Fragment de diaphyse d'os long : fémur ?	479,15	25*2 cm	Pendage de 1,5 cm
	31	Négatif d'os indéterminé	479,12		Non prélevé
	32	Corps de vertèbre thoracique	479,13		envoyé en datation
	33	Fragment de diaphyse d'os long : tibia ?	479,14	14*3 cm	Non prélevé
	34	Fragment d'os indéterminé	479,11		Non prélevé
Berme	35	Négatif d'os indéterminé	479,17		Non prélevé
	36	Négatif d'os indéterminé	479,12		Non prélevé
	37	Fragments de dents	479,14		
	38	Fragment de diaphyse d'os long	479,10		Non prélevé, fin
	39	Négatif de diaphyse d'os long	479,14		Non prélevé, fin
	40	Négatif d'os indéterminé	479,08		Non prélevé
Os sous pierre		Fragments de crâne			

Tomb AD1-03 - Burial S.R1021.1

Passe	No	Détermination	Altitude	Dimensions	Observations
Passe a	1	Négatif d'os indéterminé			Non prélevé
	2	Négatif d'os indéterminé			
	3	Négatif d'os indéterminé			Non prélevé
	4	Négatif d'os indéterminé			Non prélevé
	5	Négatif d'os indéterminé			
	6	Négatif d'os indéterminé			Non prélevé
	7	Négatif d'os indéterminé			
	8	Négatif d'os indéterminé			Non prélevé
	9	Négatif d'os indéterminé			Non prélevé
	10	Négatif d'os indéterminé			Non prélevé
	11	Négatif d'os indéterminé			Non prélevé
	12	Négatif d'os indéterminé			Non prélevé
	13	Négatif d'os indéterminé			Non prélevé
	14	Négatif d'os indéterminé			Non prélevé
	15	Négatif d'os indéterminé			Non prélevé

Passe	No	Détermination	Altitude	Dimensions	Observations
	16	Négatif d'os indéterminé			Non prélevé
Passe b	17	Négatif d'os indéterminé	479,89		Non prélevé
	18	Négatif d'os indéterminé	479,95		Non prélevé
	19	Négatif d'os indéterminé	479,95		Non prélevé
	20	Négatif d'os indéterminé	479,97		Non prélevé
	21	Négatif d'os indéterminé	479,94		Non prélevé
	22	Négatif d'os indéterminé	479,95		Non prélevé
	23	Négatif d'os indéterminé	479,89		Non prélevé
	24	Négatif d'os indéterminé	480,00		Non prélevé
	25	Négatif d'os indéterminé	480,01		Non prélevé
	26	Négatif d'os indéterminé	480,02		Non prélevé
Passe c	Os bougés	Fragments de spongieux indéterminés			
	27	Négatif d'os indéterminé	479,95		Non prélevé
	28	Négatif d'os indéterminé	479,89		Non prélevé
	29	Négatif d'os indéterminé	479,89		Non prélevé
	30	Négatif d'os indéterminé	479,95		Non prélevé
	31	Fragments de spongieux indéterminés	479,89		
	32	Négatif d'os indéterminé	479,91		Non prélevé
	33	Négatif d'os indéterminé	479,88		Non prélevé
	34	Négatif d'os indéterminé	479,90		Non prélevé
	35	Négatif d'os indéterminé	479,96		Non prélevé
	36	Négatif d'os indéterminé	479,91		Non prélevé
	37	Négatif d'os indéterminé	479,87		Non prélevé

Tomb AD1-05 - Burial S.R1028.1

Passe	No	Détermination	Altitude	Dimensions	Observations
Passe a	1	Négatif d'os indéterminé	479,760		Non prélevé
	2	Fragment de côte ?	479,760		Non prélevé
	3	Négatif d'os indéterminé	479,700		Non prélevé
Passe b	Os bougés	Fragment de crâne			
	4	Fragment de crâne	479,670		
	5	Fragment d'os indéterminé	479,670		Non prélevé
	6	Fragment de diaphyse indéterminée	479,660		Non prélevé
Passe c	7	Fragment de crâne	479,660		
	8	Fragment de spongieux indéterminé	479,640		Non prélevé
	9	Négatif d'os indéterminé	479,655		
	10	Négatif d'os indéterminé	479,660		Non prélevé
	11	Négatif d'os indéterminé	479,660		Non prélevé
Passe d	12	Fragment d'os indéterminé	479,605		Lié à 09 ?
	13	Négatif d'os indéterminé	479,605		Non prélevé
	14	Négatif d'os indéterminé	479,605		Non prélevé
	15	Négatif d'os indéterminé	479,625		Non prélevé
	16	Négatif d'os indéterminé	479,640		Non prélevé
Passe e	Os bougés	Fragments de spongieux indéterminés			
	17	Fragment d'os long	479,585		

	18	Fragment de corps de vertèbre cervicale ?	479,615		
	19	Corps de vertèbre thoracique	479,585		Envoyé en datation
	20	Epiphyse indéterminée	479,645		
	21	Fragment d'os indéterminé	479,645		Non prélevé
	22	Fragment d'os indéterminé	479,645		Non prélevé
	23	Fragment de diaphyse d'os long type fémur	479,585	10*2,5 cm	Visible en totalité passe g, pendage de 4 cm
	24	Corps de vertèbre thoracique	479,590		
	25	Fragment de diaphyse d'os long type humérus	479,575		Visible en totalité passe g
	26	Fragment de diaphyse d'os long indéterminé	479,560		Visible en totalité passe g
Passe g	Os bougés	Fragments de diaphyses et de spongieux indéterm., fragment de plateau tibial et une extrémité indéterminée			
	27	Fragment d'os du tarse (cuboïde ou cunéïforme)	479,525		
	28	Talus droit	479,530		Envoyé en datation
	29	Fragment d'os indéterminé	479,515		
	30	Fragment d'os indéterminé	479,530		
	31	Fragment d'os long indéterminé	479,550		
	32	Fragment d'os long indéterminé	479,575		
	33	Fragment d'os long indéterminé	479,560		Non prélevé
	34	Fragment d'os long indéterminé	479,590		
	35	Fragment d'os long membre inférieur	479,560		Tibia ?
	36	Fragment d'os long indéterminé	479,545		
	37	Fragment d'os indéterminé	479,560		
	38	Fragment d'os indéterminé	479,590		Non prélevé
	39	Fragment d'os indéterminé	479,540		
	40	Fragment de spongieux indéterminé	479,560		
	41	Fragment d'os long indéterminé	479,545		
	42	Fragment d'os court : tarse ?	479,550		
	43	Fragment d'os indéterminé	479,550		
	44	Fragment d'os indéterminé	479,570		
	45	Fragment d'os court ou épiphyse indéterminé	479,535		
Passe h	46	Fragment de spongieux d'os court indéterminé	479,485		
	47	Fragment de diaphyse d'os long indéterminé	479,460		Non prélevé
	48	Côte ?	479,470		
	49	Fragment de côte ?	479,480		
	50	Fragment de diaphyse d'os long type fémur ou humérus	479,480	diam. 2 cm	
	51	Fragment de diaphyse d'os long type humérus	479,480		section circulaire
	52	Calcaneum droit	479,500		Repose sur sa face latérale
	53	Esquille de diaphyse d'os long	479,500		Non prélevé
	54	Esquille de diaphyse d'os long	479,480		Non prélevé
	55	Fragment d'os courts	479,520		Tarse ? Clavicule ?
Berme	56	Fragments de crâne	479,650		
	57	Fragment d'os long	479,550		Diamètre large
	58	Fragment de spongieux indéterminé	479,550		
	59	Fragment d'os indéterminé	479,540		Non prélevé
	60	Fragment de spongieux : épiphyse d'ulna ?	479,555		
	61	Humérus	479,540		
	62	Fragment de scapula	479,540		
	63	Fragment d'os long indéterminé	479,540		
	64	Fragment d'os indéterminé	479,540		Non prélevé

AL-YAMĀMA - A LATE PRE-ISLAMIC / ISLAMIC SETTLEMENT

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Description of the site

This site is the largest ancient settlement reported in the region of al-Kharj. It is located in the centre of al-Kharj oasis, 1 km to the north-west of the Industrial City, and west of the confluence of the Wādīs Ḥanīfa and Nisāḥ.

The existence of this site was first reported by H. St. J. Philby in 1920. During the Comprehensive Survey of Saudi Arabia in 1978, the site received the registration number 207-30 (Zarins *et al.* 1979: 27, 30). Finally, soundings were carried out in the late 1980s by Abdalaziz al-Ghazzi, north and west of the site, for his PhD thesis at the University College London. They revealed well-preserved mudbrick structures. A pottery typology was subsequently put together (al-Ghazzi 2010).

The archaeological area stretches over 75 ha, north-west of a village named al-Yamāma, on the edge of palm groves. Two other names are locally used to designate the site: al-Bannāʾ and al-Mahraqa. Al-Bannāʾ is a recent name meaning the source of mud that could be reused for recent building activity by inhabitants of the neighbourhood.

The site has been identified with the mediaeval city of Jaww al-Khiḍrima (al-Juhany 2002: 45; al-Ghazzi 2010: 45–47) mentioned by Ibn Khordādhbeh as 'Jaww al-Khiḍrima' (Khordādhbeh 1889: 113) and by al-Balādhurī as 'al-Khiḍrima' in the 9th cent. AD (Balādhurī 1916: 141–142), by al-Masʿūdī as 'Jaww' in the 10th century AD (al-Masʿūdī 1861–1877 iii: 106, 276, 287–288), and by Yāqūt as 'Jaww al-Khaḍārim in Yamāma' (*Jaww al-Khaḍārim bī-l-Yamāma*) in the 12th cent. AD (Yāqūt 1866–1873 ii: 120, 161). Finally, two South Arabian pre-Islamic inscriptions mention the toponym Jawwān (*Gwn*) in association with Kharjān (*Ḫrgn*) and Yamamatān (*Ymmtn*), respectively inscription ʿAbadān 1, dated to AD 360 (Robin & Gajda 1994) and ʿIrāfa 1 from the 5th cent. AD (Gajda 2004). The toponym Jawwān is likely to be identified with the mediaeval Jaww [al-Khiḍrima] also associated with the valley of al-Kharj and the region of al-Yamāma (regarding the toponyms Jaww, al-Kharj and al-Yamāma).

Today, al-Yamāma is only used to name a village in the vicinity of al-Kharj, near the archaeological site. We are inclined to see it as a legacy of the time when this site, the ancient Jaww al-Khaḍārim, was nicknamed al-Yamāma.

Most of the archaeological area was fenced in the 1980s. It enclosed a 75-ha-wide area, 1,000 m from north to south and 750 m from east to west. Many mudbrick structures are visible on the ground, together with a large quantity of pottery sherds. Archaeological structures are also to be seen outside the fenced area, principally to the north-west of the site. Another concentration of outcropping mudbrick walls has been located 700 m north-east of the site (**figs. 1-2**).

According to South-Arabian inscriptions, Arab-Islamic sources, pottery sampled on the ground, surface coins dated to the early Christian era (al-Ghazzi 2010: 89–90, pl. 23/1–2), the deep sounding carried out in the northern part of the site and the excavation of Buildings 1 and 2, the occupation of the site dates from at least the 2nd to the 18th cent. AD (Schiettecatte *et al.* 2013; Schiettecatte & al-Ghazzi (ed.) in press).

Building 1 - the Mosque

The construction straddles areas N6 and O6, in the northern part of the site.

During the first excavation season (2011), the north-west corner of a large columned hall that was partly visible on surface was exposed in the southern part of Sounding 1. Two large mudbrick walls (W. 002, oriented E–W, and W. 006, oriented N–S) bordering a room (R. 013) with a plastered floor (F. 015) and two large mudbrick columns standing on this floor were brought to light (Co. 004–005). This construction was named Building 1.

During the second season (2012), we concentrated our efforts on the excavation of this large building. Several things proved it to be the Great Mosque of the site (**fig. 2**): the presence of a large columned hall with three rows of ten columns preceded by a large courtyard to the east and a square recess (*miḥrāb*) built in the middle of the western wall (*qibla* wall). The fact that very few artefacts were found, despite sieving the fill and rubble, also supports this interpretation.

The third season (2013) was devoted to pursuing and extending the excavation of the mosque (area N6, Building 1) and its surroundings. Excavations were carried out from October 27 to November 26 (**figs. 3-4**).

The aim was manifold: first, to complete the excavation of the southern half of the prayer hall (R. 013, first and second naves) near the second *miḥrāb* (Ni. 049), in order to precise the occupation phases of the mosque and pre-existing

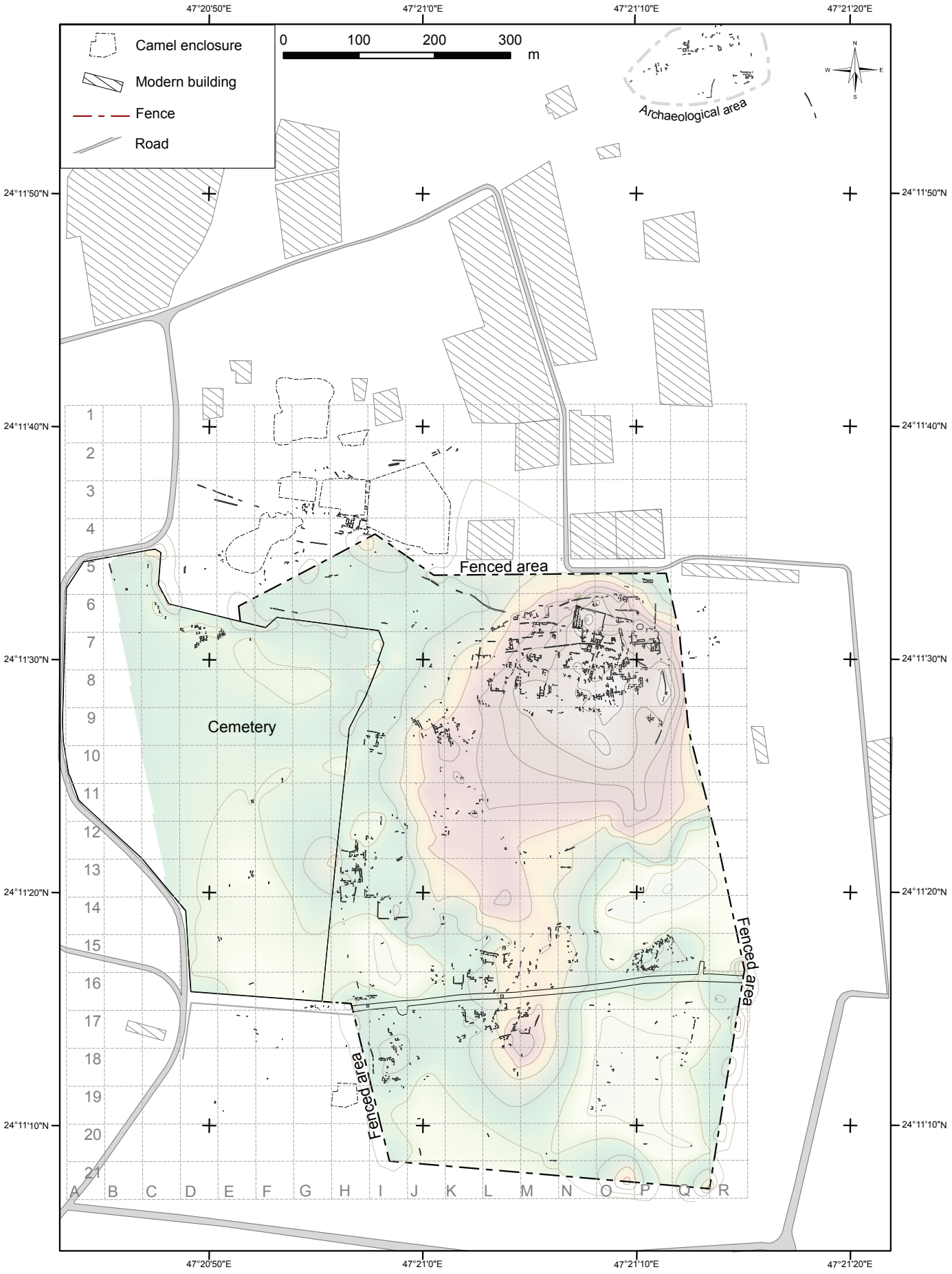


Figure 1: Al-Yamāma: topographic map of the site (M. Niveleau, J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Figure 2: Al-Yamāma: detailed map of areas N6, O6, N7 and O7 – Location of Soundings 1 & 2 and Buildings 1 & 2 (M. Niveleau, J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Figure 3: Aerial view of Building 1, the prayer hall and the courtyard (Thomas Sagory - Saudi-French archaeological mission in al-Kharj).

Figure 4: Plan of Building 1 and location of the working area in red (Mathieu Niveleau – Saudi-French archaeological mission in al-Kharj).

Figure 5: R.013, looking south, floor F.015 appears on the right (1st occupation level), F.046 and F.086 to the background (4th occupation level). In the central part, the baulk oriented north-south preserved for the 1st and 2nd seasons, and dismantled during this 3rd season (P. Siméon - Saudi-French archaeological mission in al-Kharj).

building; second, to extend the excavation towards the courtyard and determine the layout of the eastern limit of the mosque in order to understand the transitional zone between the eastern nave of the prayer hall and the courtyard, to plot and date the colonnade bordering the northern side of the courtyard, and to answer complementary questions still under examination: localization of a main door, ablutions room and a minaret.

Building 1 (Mosque): Stratigraphy

The prayer hall

A large south-north baulk (28 × 1.5 m) was still standing in Building 1 (**fig. 5**) (in order to understand and draw the complete inner stratigraphy of the building). It has been removed this season: 1) because of wind and heavy rainfall erosion since the previous field season; 2) to draw the plan of the building; 3) to extend the excavation in the eastern nave and the courtyard.

The 5th occupation level (UF 001, 063, 065, 066, 067, 068, 069, F. 039)

This level is the most recent phase of occupation of Building 1. Most of it has been unearthed and removed during the second season, but for the southern part of the prayer hall, within the baulk, and south-east of the baulk. It was covered by a thick surface layer of collapsed mudbricks in eolian sand deposit, and few stones concentrated around the summit of columns Co. 031 and 032. This surface layer corresponds to the final abandonment of the site. This layer, mainly preserved in the baulk, was removed this season.

Under the collapse layer, a floor corresponding to the latest occupation level, F. 039, was made of compact earth. Preserved in the western nave, it covered a collapse layer between W. 006 and Co. 023, and extended within the southern *miḥrāb* (Ni.049).

In the southern part of the western nave, the top of a structure (W. 089) appeared below the collapse layer. It was set between W. 006 to the west, W. 043 to the south, and the buttress W. 034 to the east.

In the southern part of the eastern nave, a compact layer, probably due to the collapse of W. 043 was preserved along W. 036, W. 081 and W. 037. It recovered an eolian deposit (UF. 067), and under it floor F. 039. A foot imprint was found

in this zone. F. 039 was abutting W. 036, W. 037 and W. 062; at that time, W.081 was a mudbrick threshold and the space between W. 036 and W. 037 was used as a doorway.

During this late occupation, the access to the prayer hall was restricted by the setting up of small mudbrick walls, 5-to-6-courses-high, between the columns (W. 056, W. 057, W. 058, W. 059). Late wall W. 044, built behind the central *miḥrāb* (Ni. 160) in order to close it to the west has a similar shape and is also contemporary to the formation of F. 039.

The 4th occupation level (UF 042, 073, 069, F. 046, F. 086)

In the southern half of Building 1, excavation in the 2nd season (2012) was stopped above floor F. 046, characterizing the 4th occupation level. This floor was a thick succession of layers made of hard and compacted earth and sand. It was up to 20 to 30 cm thick at the foot of Columns Co. 019, 020, 022, 026, 027, 028 and 029, often slightly sloping to the west. This floor corresponded to floor F. 086 in the courtyard; it was originally preserved in most of the prayer hall (R. 013); it has been found again during the excavation of the whole central baulk.

In front of the southern *miḥrāb* (Ni. 049), a large palm leaf mat (2.30 by 0.60 m) left its imprint in floor F. 046. It displayed six chains (each being 7.5 cm wide), parallel to the *qibla* wall (W. 006) (**fig. 6**). Within the southern *miḥrāb* (Ni. 049), the sand layer immediately above F. 046 yielded a fragment of the foot of a little bowl with a white glaze (Y.042.1, porcelain imitation?) and a fragment of the rim of a coffee cup in porcelain with a chocolate glaze on the outside, dated to the late 17th-early 18th centuries (Y.069.1).

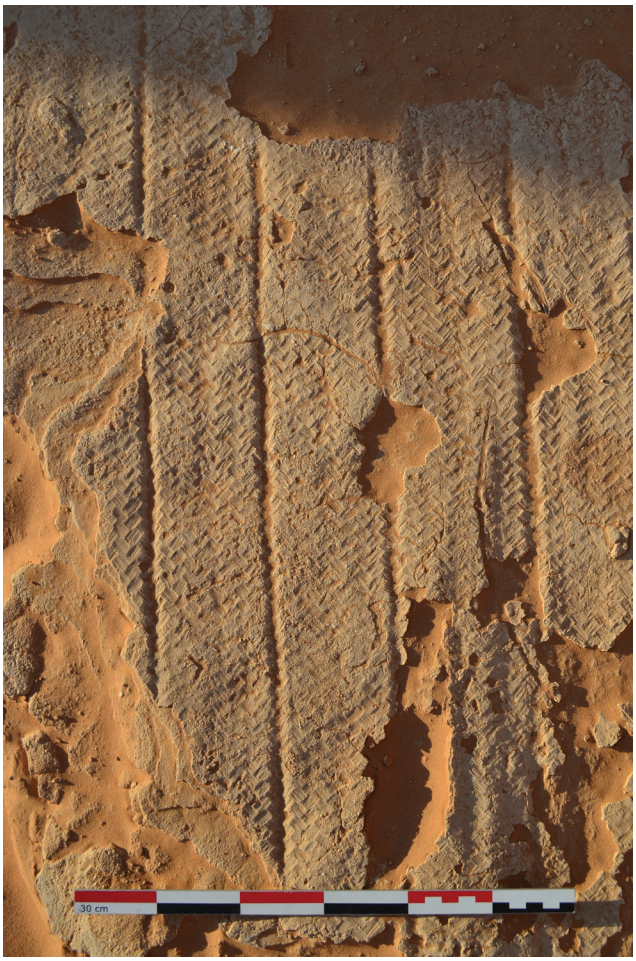


Figure 6: Building 1, western nave, in front of Ni. 049. Mat imprint on the floor F. 046 parallel to the *qibla* wall (W. 006) (P. Siméon - Saudi-French archaeological mission in al-Kharj).

The 3rd occupation level (UF 075, 079, 087, F. 014)

Under floor F. 046, a thick layer of compacted eolian sand was covering a floor of hardened sand in the western nave. More than twenty foot imprints were found at the bottom of column Co. 020 and west of Co. 022. Some of these might be the imprint of shoes run up in natural fibres (**fig. 7**); one is an imprint of a cat paw.

A second mat of rough palm leaves (1.40 by 0.90 m) has been located between Co. 020 and W. 006, it displayed twelve chains (each 8-9 cm wide) (**fig. 8**). During the first season (2011), similar palm leaf mat imprints had already been discovered, on the same floor F. 014, 15 m to the north, in the north-western corner of the prayer hall R. 013. We may assume that such mats were covering the whole western nave, along the *qibla* wall (W. 006).

During the removing of F. 014 (UF. 079), small rounded pebbles (ca. 2 cm) were found at the foot of Co. 022, 023 and 025, as well as in the western nave (UF. 086). They are very abundant in the courtyard level (UF. 087). They indicate the setting of F. 014.

The 2nd occupation level (UF 082, 088, F. 015)

This level has been excavated in the southern half of the prayer hall and in the baulk (central nave). After the removing of a ca. 20-cm-thick layer of dense orange sand under F. 014, we uncovered floor F. 015, a hard floor made of plaster. Three little coins were discovered in this level along the walls W. 006, W. 043 and the Co. 020. Over F. 015, thirteen new engraved game boards were uncovered and drawn: the game of 'fourteen' (*arbaʿata ʿashara*), 'alquerque' (or *qirkat*), and a chess board (**fig. 17**).

The 1st occupation level

A meticulous study of F. 015 (**fig. 9**), at the base of stratigraphic units UF 082 and 088, has confirmed the evidence of an occupation before the laying out of the plaster floor (already seen during the 2012 season in the northern half of the prayer room). Traces of four levelled structures (St. 173, 174, 175 and 176) in F. 015 (beside the three levelled columns St. 091, 092, 093 and the levelled buttress W. 090 already registered before) testify to the existence of an older structure visible on the ground previously to the building of the mudbrick columns currently visible. These more ancient structures show traces of yellow and dark red painting over plaster (**fig. 10**). They testify to a former building with columns and pillars, some of them painted in bright colours.

Figure 7: Foot imprints on floor F. 014 (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Figure 8 – Palm-leaf mat imprints on floor F. 014 along the *qibla* wall W. 006 (P. Siméon - Saudi-French archaeological mission in al-Kharj).

The courtyard

The eastern nave of the prayer hall opens onto a courtyard filled with a 80-cm-thick eolian deposit (UF 072). Within this layer, a thin dark brown floor (F. 170) is clearly connected to the surface (presence of cigarette ends and plastic bag).

The southern part of the courtyard (UF 038 & 072, F. 086)

In the southern part of the courtyard, a room belonging to a house abutting the southern wall of the mosque (W. 043) was uncovered (**figs. 11-12**). Pottery material is similar to that of the house excavated in 2011 (Building 2, sounding 2, area O7), and makes it possible to date the occupation of this structure to the 17th-18th centuries AD. Its northern wall fell flat on the ground of the mosque courtyard, its inner side up showing a small arch niche (Ni. 164). This fallen wall is made of sixteen courses of mudbricks; it lays over a 40-cm-thick layer of eolian sand deposit (UF 038 & 072).

This sand layer (UF 038 & 072) covers floor F. 086, an uneven compact surface (428.57 m to 428.94 m). This floor corresponds to F. 046 into the prayer hall. It is visible on the whole surface of the courtyard.

The northern and central part of the courtyard (UF 083, 085 & 087)

The northern half of the courtyard was excavated by digging four successive trenches (5 × 10 m) oriented east-west. Their upper part was a thick surface eolian deposit (UF 068 – identical to UF 072 in the southern part).

Along the colonnade preceding the eastern nave, two thick occupation levels appeared beneath floor F. 086 (UF 083, 085, 086 & 087). They distinguish themselves from any other occupation level inside the prayer hall. Many charcoals, ash patches, stones, animal bones and ceramic sherds indicate a plausible domestic activity in this area contemporary to the 3rd and 4th occupation layers identified within the prayer hall. Flint stones found in two of these levels (Y.086.2 and Y.087.1) are seen as gun flints and indicate that these layers might have been contemporary to the latest phase of occupation of the site (16th cent. onwards).

Figure 9: Overview of the floor F.015, western nave of R. 013, looking north (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Figure 10: Detail of dark red painting overlapping external plaster of St. 173 (P. Siméon - Saudi-French archaeological mission in al-Kharj).

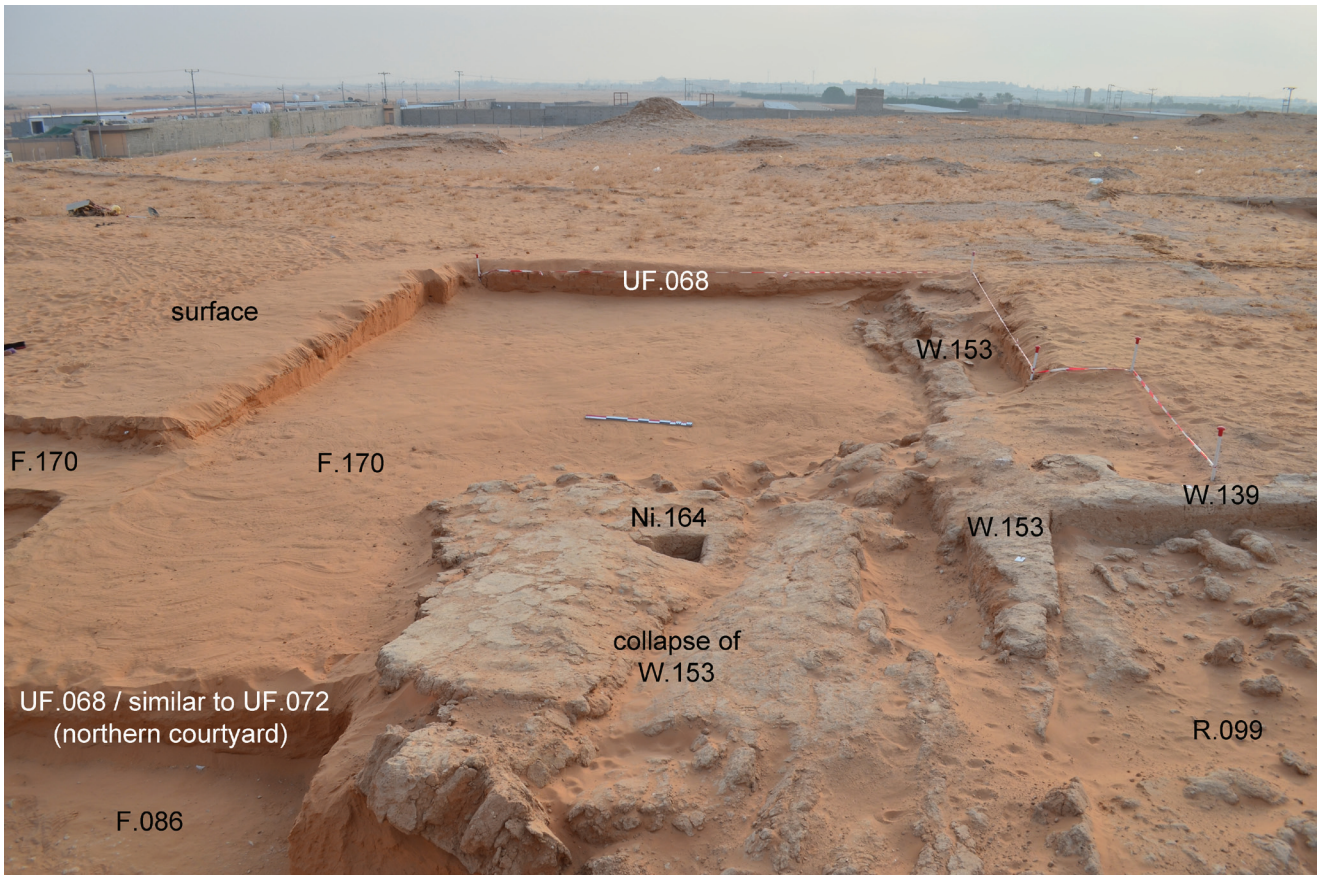


Figure 11: Overview of the southern part of the courtyard, looking east. Foreground: Wall W. 153 fallen flat on the ground (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Figure 12: Detail of room R. 099, belonging to the house abutting the southern wall of the mosque W. 153, looking south-west (P. Siméon - Saudi-French archaeological mission in al-Kharj).

The peristyle

Along the northern wall of the courtyard (W. 002), an eolian sand deposit was covering a collapse layer (UF 080) with melted mudbricks and stones. It corresponds to the collapse of W. 002, which was probably exposed and levelled as indicated by a foot imprint on its surface. It partly covers six small columns (Co. 082, Co. 098, Co. 163, Co. 167-169). They are all 40 cm in diameter. A single course of mudbricks laid flat on the ground between Co. 98 and Co. 163 (W. 097) corresponds to the building of a doorstep (A. 177); it is contemporary to a small buttress (W. 181) applied against the eastern side of Co. 077 and related to F. 086 (4th occupation level).

The six columns parallel to the northern wall (W. 002) delineate a covered peristyle bordering the courtyard to the north (**fig. 13**). This line of columns does not seem to continue further east beyond W. 095, as shown by the enlargement of the excavation of 5 × 5 m to the east. The collapse layer UF 080 deeply slopes and abuts an architectural geometric ornament (W. 172) sunk in eolian sand deposit (UF 068). This ornament is a crowstep (80 x 70 x 36 cm) (**fig. 14**).

The entrance into the prayer hall, between Co. 076, Co. 077 and W. 078, contains two successive mudbrick doorsteps (A. 177 and A. 178) related to floors F. 086 and F. 014.

Figure 13: Northern part of the courtyard, the colonnade is parallel to the northern wall of the courtyard (W. 002), looking west (P. Siméon - Saudi-French archaeological mission in al-Kharj).

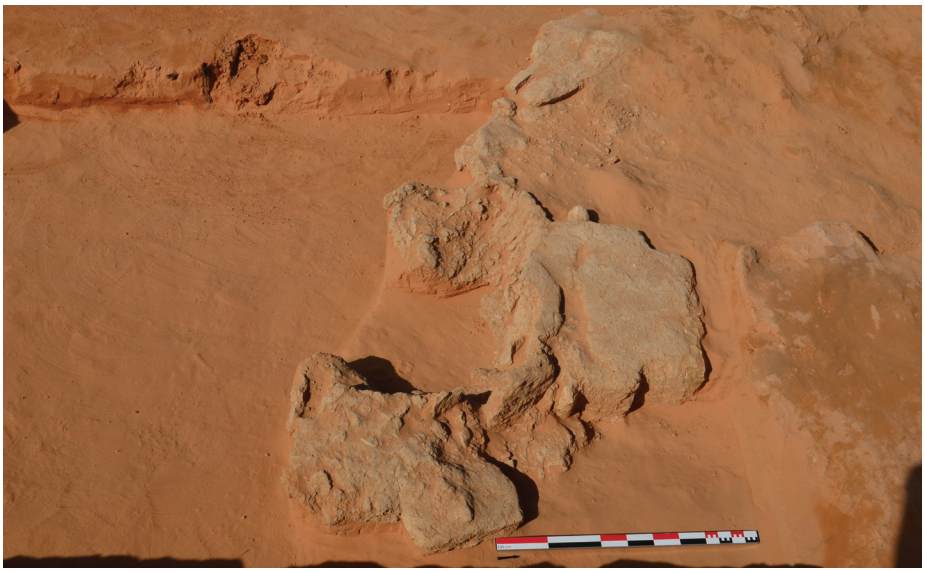


Figure 14: Detail of the architectural ornament (W. 172: merlon?), looking west (P. Siméon - Saudi-French archaeological mission in al-Kharj).

The surroundings of Building 1 (UF 062, F. 087)

Outside Building 1, north-west of the mosque, a thick and compact floor (F. 087) made of melted mud was abutting the outer face of W. 006 (**fig. 15**). Sherds lay flat on it. Pit P. 094 was dug through this floor. Filled up with eolian sand and covered by three reemployed fired bricks with a central finger imprint (UF. 078), it contained the burial of an immature (see the complementary report of the burial P.094.1 below).

The lower part of wall W. 006 is larger (ca. 1.50 m) than the upper part, the latter having been rebuilt in a later phase of occupation. The lower part shows six regular courses of mudbricks. Outside the mosque, the outer face of this wall is covered with plaster in the lower part. For the moment, it is not possible to say whether this plastered wall belonged to the inner part of a building abutting the mosque or not. It is nevertheless connected with the former state of the Building 1 (previous to the laying of F. 015).

Figure 15: North-western outer part of Building 1, looking south (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Building 1 (the mosque): Architectural observations

The enlargement of the excavation to the southern half of R. 013 provided a complete view of the four latest occupation levels in the mosque, corresponding to successive floors, from bottom to top: F. 015 (hard plastered floor) ; F. 014 (compact sand with imprint of palm leaf mat); F. 046 = F. 86 (compact sand with imprint of palm leaf mat) and F. 039 (compact sand). The presence of an older stage of occupation already pointed out during the previous seasons has been confirmed. The study of floor F. 015 shows former levelled columns and buttresses, indicating the presence of an older building as large as Building 1. These structures were covered with painted plaster, partially visible (**fig. 10**). The levelling of these structures was followed by a complete reorganization of Building 1: restauration of floor F. 015 with patches of compact earth, construction of new columns and restauration of the peripheral walls (thinner than they used to be). A future sounding under F.015 should complete our comprehension of older phases.

The discovery of dated porcelain in the 4th occupation level (together with that of an ottoman earthenware pipe bowl fragment found in the 5th occupation level in 2012) is a precious chronological marker. It confirms the chronology postulated during the previous seasons (Schiettecatte & Siméon in press): Building 1 was used as a mosque from the Abbasid time onward (according to a ^{14}C date obtained on a sample from floor F. 015). At least the two latest occupations can be ascribed to the Ottoman period.

Due to the size of the western and central naves of the prayer hall (25 × 2.5 m) and considering that the space required by each believer was approx. 1.2 × 0.7 m, the prayer hall (*musalla*) could have hosted a maximum of 150 to 160 worshippers praying at the same time.

An unusual feature is the presence of two *miḥrābs*, a large and central one (Ni. 160) and a smaller one (Ni. 049) in the southern half of the *qibla* wall (W. 006). During the excavation, we paid a special attention to the zone adjoining the *miḥrāb* in order to find traces of a built *minbar*. Only a single masonry step above F. 039 has been found, next to the central *miḥrāb* (Ni. 160); it was unfortunately damaged by pit P. 040. This built step is the only structure directly associated with the *miḥrābs*. Excavations did not yielded any evidence of a wooden structure. Only floor F. 015 shows many traces of fire and is darkened in the south-western part of the prayer hall (R. 013), much more than in any other parts of the Building (**fig. 9**). This could be indicative of the presence of a former wooden structure in this area.

During this season, a mudbrick structure was discovered in the southern end of the western nave. It is a massive mudbrick stepped podium (three steps - W. 089) (**fig. 16**). It was in use from the 2nd to the 4th occupation levels. This earth structure is built directly above F. 015. During the 5th occupation level, this structure was covered by a thick collapse and then by floor F. 039. A door was then opened into the *qibla* wall before being finally closed later on by a small mudbrick wall (W. 051) . This three-step structure dominates the entire western nave. Its function remains unclear. Was this structure, which stood against the *qibla* wall, 3 m away from the *miḥrāb,* a *minbar*? A chair for the imam during teaching? Or is it a testimony of unknown religious or juridic local practices?

The excavation of the southern half of R. 013 and the uncovering of F. 015 in its entirety yielded thirteen additional game boards engraved on the floor (six were already known from previous fieldwork) (**fig. 17**). It confirmed the well-known status of mosque as *madrasa*.

Enlargement of the excavation towards the courtyard provided new evidence for the comprehension of the transition between the prayer hall (*musalla*) and the courtyard. A clear demarcation between inner and outer spaces existed during the 3rd, 4th and 5th occupation levels, with the construction of mudbrick doorsteps between the buttresses and

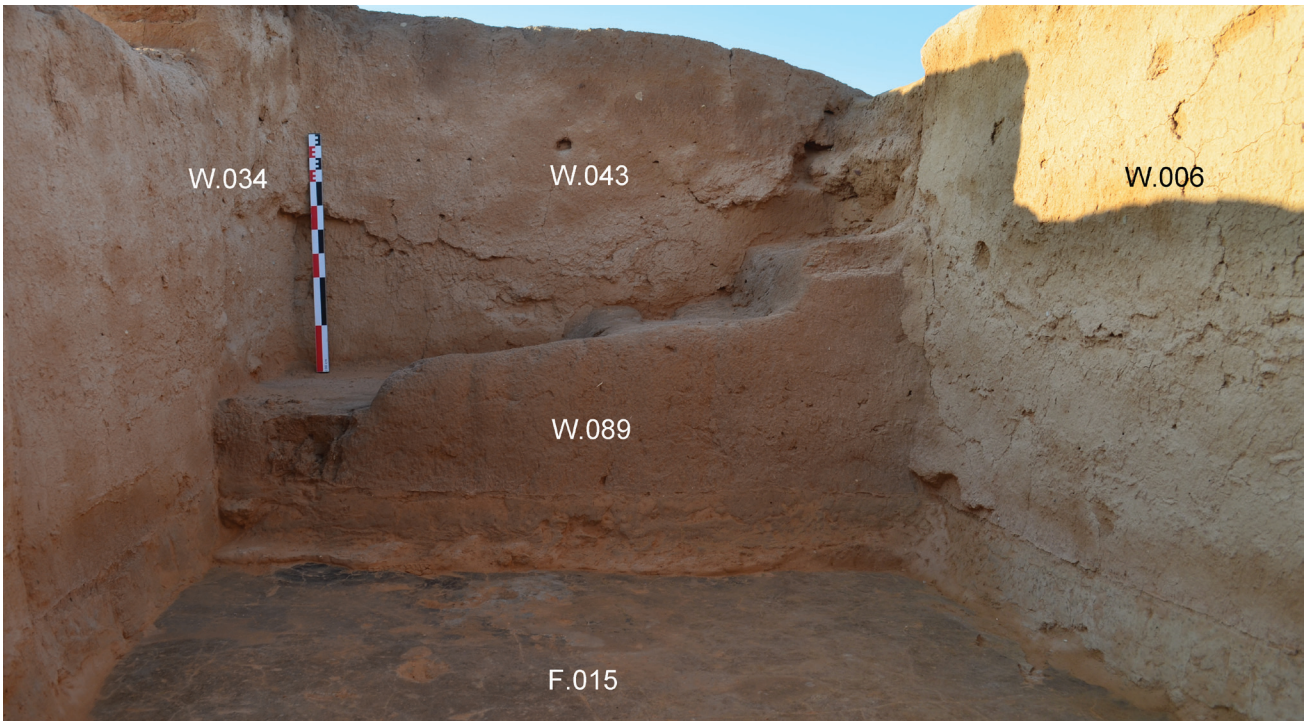


Figure 16: Detail of the mudbrick three-step structure W. 089 at the southern end of the western nave of R. 013 (Building 1), looking south (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Figure 17: Building 1, R. 013. Detail of floor F. 015: two superimposed gaming boards: a draughtboard on the left; a game of 'fourteen' board on the right, looking south (P. Siméon - Saudi-French archaeological mission in al-Kharj).

columns cutting the eastern nave off the courtyard (i.e. between W. 036 and W. 078).

The link between the mosque and its inhabited neighbourhood is still unclear. Neither the main access to the mosque nor the ablution room have been located so far.

Restoration

During this season, provisory restoration of Building 1 has been conducted in order to prevent the weathering and erosion of the remains until the next season. The upper parts of most damaged walls of the mosque were covered by a geotextile and then earth coating (mixture of crushed mudbricks from the collapse with water, straw and camel dung). The same process was applied on the top and foot of all the columns and pilasters to prevent surface weathering (**fig. 18**).

Figure 18: Building 1 - Earthen coat protection applied above geotextile at the base of a column (J. Schiettecatte - Saudi-French archaeological mission in al-Kharj).

Burial S.P.094.1

By Élodie Wermuth (EVEHA, Paris)

As mentioned above, the excavation to the north-west of Building 1 revealed a pit (P. 094) dug through floor F. 087. Filled up with eolian sand and covered with three reemployed fired bricks with a central finger imprint (UF. 078), it contained the burial of an immature. This section is devoted to the this specific burial.

Méthodologie

Selon les principes de l'anthropologie de terrain (Duday *et al.* 1990), la sépulture P.094 a fait l'objet d'une fouille fine. Un enregistrement photographique détaillé, un relevé altimétrique des os, et une description ostéologique ont été réalisés afin de comprendre les effets taphonomiques et d'estimer l'espace de décomposition et le mode d'inhumation de l'individu. En raison de la position du sujet sur son côté droit, plusieurs passes ont été nécessaires pour dégager les ossements et les enregistrer au fur et à mesure de la fouille. Pour chaque passe, la prise de photographies zénithales et de détails a permis de redessiner le squelette en post-fouille.

En laboratoire, l'estimation de l'âge au décès a été effectuée par le biais de différentes méthodes dont nous avons confronté les intervalles de résultats. L'étude de la maturation dentaire, qui est la plus corrélée à l'âge chronologique (Bruzek *et al.* 2005) a été réalisée en utilisant les tables de maturation de Moorees, Fanning et Hunt (Moorees *et al.* 1963). La mesure des os longs a permis de donner un intervalle d'âge selon les tables de L. Scheuer et S. Black (Scheuer & Black 2000), qui font la synthèse des méthodes les plus couramment utilisées.

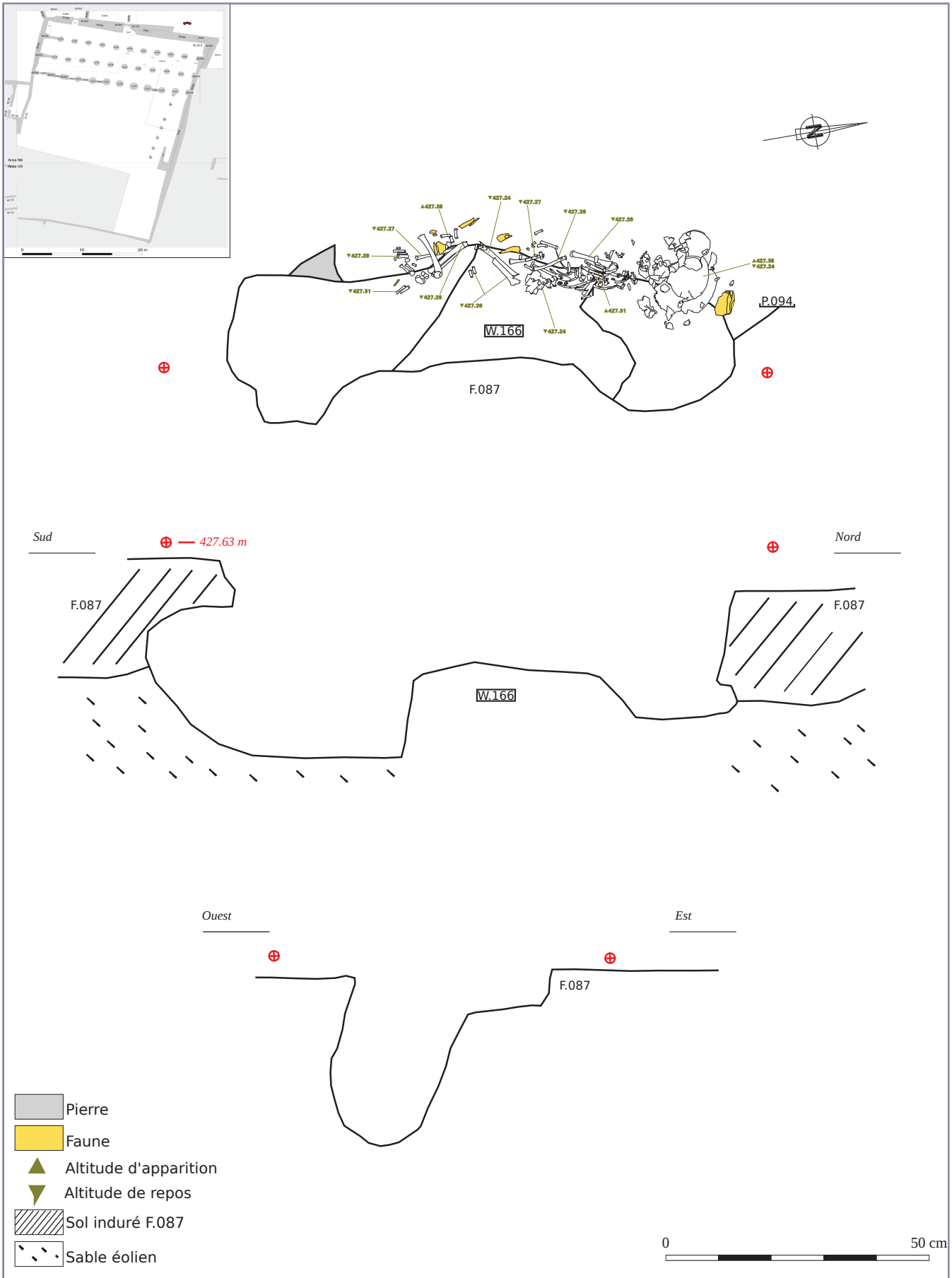
La sépulture S.P.094.1

L'inhumation S.P.094.1 est une sépulture individuelle primaire implantée au nord-ouest à l'extérieur de la mosquée, dans le niveau de sol F. 087. De forme sub-rectangulaire, la fosse est orientée nord-sud, et part en sape vers l'ouest, où se niche le corps. Creusée dans le sol F. 087 et dans le sable, son profil est irrégulier. A la base du creusement apparaît un mur plus ancien (W. 166) sur lequel repose le squelette (**figs. 19-21**).

Sa longueur totale est d'un mètre ; sa largeur en fond de fosse est de 0,43 mètre à la tête et 0,32 mètre aux pieds. La profondeur conservée de la structure est complète, et mesure 0,28 mètre à la tête et 0,30 mètre aux pieds. Elle est comblée par l'UF 077, constituée de sable légèrement compact, homogène, de couleur orange. Des briques comblent la partie supérieure et servent de couverture. Elles se retrouvent à l'extérieur de la mosquée sur un niveau d'occupation domestique que le mobilier a daté vers le 17e siècle. La sépulture a pu ainsi être datée de la même période, et être catégorisée comme sépulture islamique. Les ossements ont été ré-enfouis après étude dans la nécropole voisine du site.

Figure 19: al-Yamāma (area N6): Pit P. 094 before excavation (P. Siméon - Saudi-French archaeological mission in al-Kharj).

Figure 20: al-Yamāma (area N6): Pit P. 094 and burial S.P.094.1 (E. Wermuth - Saudi-French archaeological mission in al-Kharj).



P.094.1	**Planche n° 1**
DAO : E. Wermuth, 2013 *Relevés : A. Rosack, 2013*	AL-YAMAMA (AL KHARJ, KSA) 2013

Figure 21: al-Yamāma (area N6): Plan and section of pit P. 094 and burial S.P.094.1 (E. Wermuth & A. Rosak - Saudi-French archaeological mission in al-Kharj).

Données anthropologiques

La conservation osseuse est bonne, et la représentation du squelette quasi complète (**figs. 21-22**). Le tableau ci-dessous illustre le poids des ossements conservés.

Segment	Bloc cranio-facial	Dents	Membres supérieurs	Ceinture scapulaire	Tronc	Ceinture pelvienne	Membres inférieurs	Esquilles	Total
Poids (g)	74	4	14	2	24	4	30	4	156

Tableau 1: Poids de représentation des éléments anatomiques

La conservation a permis l'observation précise des ossements. ceux-ci apparaissent à une altitude de 427,35 m, et reposent à 425,24 m. L'individu repose en décubitus latéral droit, tête au nord, regard vers l'ouest. Les membres inférieurs sont fléchis vers l'ouest. Les membres supérieurs semblent en extension.

Le crâne repose sur le côté gauche. Il est effondré, et très fragmenté. Trois dents ont migré vers le nord de la tête.

Certains segments de vertèbres sont en logique anatomique, dont deux vertèbres cervicales en connexion, deux vertèbres centrales, et les quatre dernières lombaires. Elles apparaissent par l'arc gauche (non fusionné). Les côtes gauches sont effondrées en position fermée mais sont en logique anatomique. L'une d'entre elle a migré vers le côté est, tandis que deux arcs vertébraux ont chuté vers l'ouest. Deux côtes gauches sont en position ouverte et semblent bouleversées. Les côtes droites, visibles lors du démontage, sont en position ouverte et en logique anatomique.

La clavicule gauche a été retrouvée dans le volume crânien, et des fragments de scapula retrouvés au contact direct du crâne.

L'humérus gauche repose sur sa face médiale et se situe de long du corps ; il est passé sous les côtes gauches, indiquant une chute. L'humérus droit n'a été visible qu'à la fin du démontage et a été détruit par une racine. Un fragment de diaphyse en place semblait indiquer une position dans l'axe du corps et une face de repos postérieure. La partie proximale de l'ulna gauche a chuté vers l'ouest et s'est effondré dans le grill thoracique. Sa moitié distale est dans l'axe du corps mais son épiphyse distale est dirigée vers le nord, impliquant qu'elle a été bouleversée. La cassure est post-mortem et bien taphonomique. L'ulna droit repose sur sa face médiale, et est dirigé vers le bassin mais sans logique anatomique avec l'humérus. Les deux radius sont parallèles, dans l'axe du corps vers le bassin. L'angle du coude gauche, selon la position des os de du bras et de l'avant-bras, serait anatomiquement impossible et suggère que le radius a également subi une chute ou a été bouleversé. Le droit apparaît dans une position plus naturelle, il repose sur sa face postérieure, dans la logique de l'humérus droit. Toutes les phalanges et métacarpes sont épars dans le volume corporel, entre la cage thoracique et le bassin.

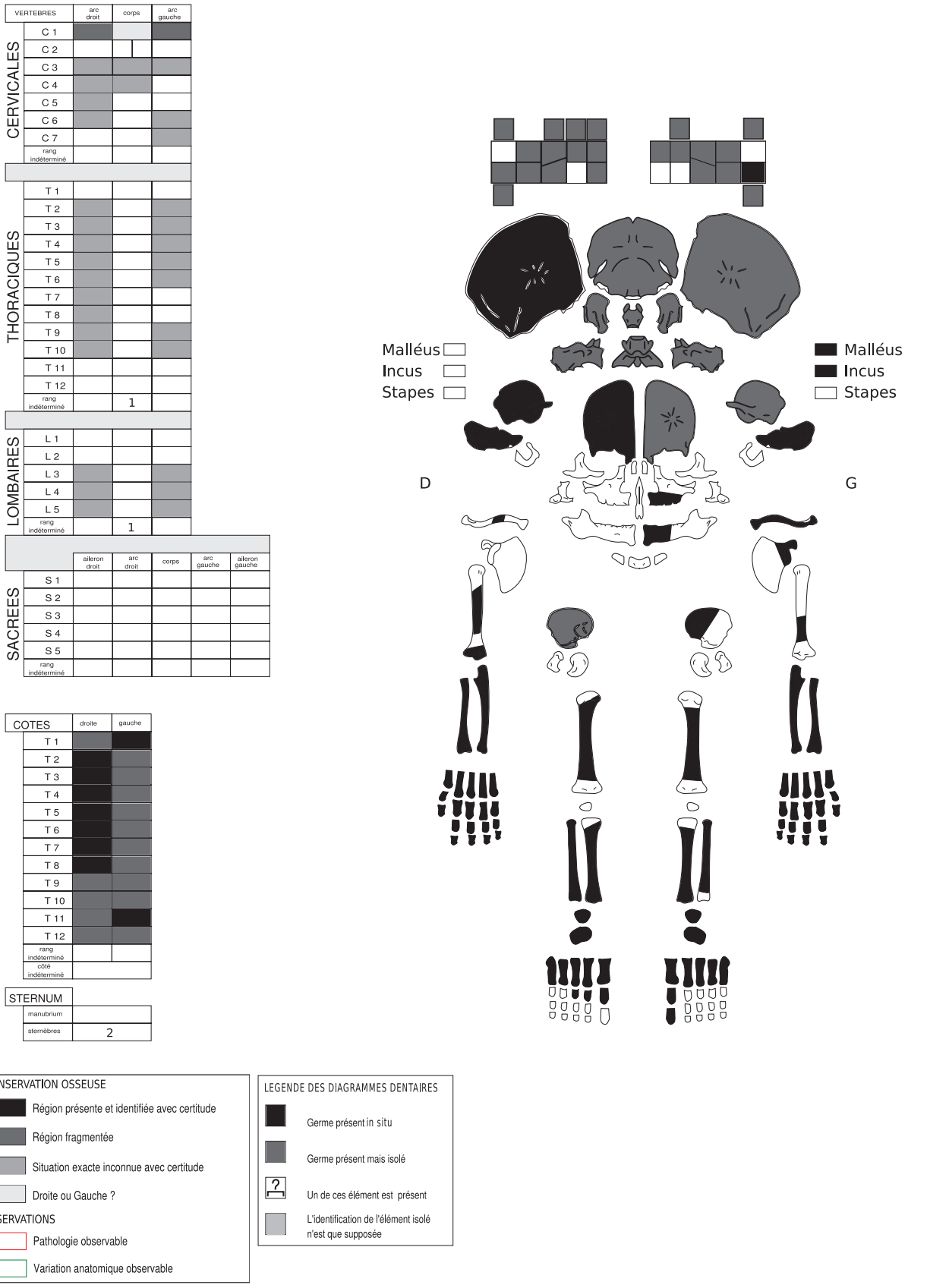
Le coxal gauche repose sur sa face médiale, en logique anatomique avec les dernières vertèbres lombaires, dans un léger pendage nord-est/sud-ouest. Le droit repose dessous, lui aussi à plat, sur sa face latérale.

Le fémur gauche est en logique anatomique avec le coxal, orienté vers le sud-ouest. Le tibia et la fibula, en connexion entre eux, sont quant à eux orientés vers le sud-est. Le genou paraît ainsi en logique anatomique et le membre fléchi à 90°. Le pied est également fléchi à 90°, ainsi orienté vers le sud-ouest. Talus, calcaneum et deux métatarses sont en connexion. Les trois autres ont chuté vers le sud-est. Le fémur droit est en logique anatomique avec le coxal droit, il repose sur sa face latérale et suit la même position que le fémur gauche, vers le sud-ouest. La fibula droite, en place, laisse penser que la jambe droite suivait la gauche dans la position fléchie. Le tibia droit a été bouleversé et sans cohérence anatomique avec le reste du membre mais reste bien dans le volume corporel. Il repose sur sa face latérale au-dessus de la jambe gauche. Le pied droit est en connexion, en position étendue et rejoint le pied gauche.

Le maintien de connexions est observable en même temps que des effondrements en logique anatomique, notamment ceux des volumes thoraciques et pelviens, et la position des jambes. Les altitudes ne montrent pas de pendage pouvant expliquer les migrations. La perturbation des ossements souvent observable est limitée aux volumes corporels. Elle est très probablement due, à la vue des mouvements par exemple du tibia droit et des avant-bras, à l'intervention d'un facteur extérieur type petit animal fouisseur. Ces observations laissent penser que la décomposition s'est réalisée en espace semi-colmaté, car peu bouleversé en dépit des articulations non connectes des immatures en très bas âge. Les limites de migrations et les connexions impliqueraient un mode d'inhumation en enveloppe souple type linceul.

En laboratoire, la maturation dentaire à partir des tableaux de Moorees a été observée sur les canines, les premières et les secondes molaires déciduales mandibulaires. Scorées respectivement à R1/4, Crc et Cr3/4, la méthode a permis d'évaluer l'âge au décès à un intervalle entre 6 mois et 1 an. Ces résultats sont confirmés par les tableaux de mesures osseuses de Scheuer et Black observés sur l'humérus droit (mesure sur le terrain 86 mm), les ulna gauche (79 mm) et droit (80 mm), sur les radius gauche (72 mm) et droit (72 mm), et sur les tibia et fibula droits (respectivement 94 et 91 mm).

Au vu de l'âge au décès, il n'est pas possible de déterminer le sexe de l'individu. Aucune lésion pathologique n'a été observée, ni aucun signe de stress carentiel.



Représentation osseuse de P.094.1	**Planche n° 2**
Infographie : E. Wermuth, 2013	AL-YAMAMA (AL KHARJ, KSA) 2013

Figure 22: Fiche de conservation osseuse de S.P.094.1 (E. Wermuth - fiche inspirée de Courtaud 1996).

Magnetic cartography

By Bruno Gavazzi
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Method

Objectives of the geomagnetic measurements

The survey has been carried out on November 27-28, 2013 as a part of the Saudi-French archaeological mission on the site of al-Yamāma. The aim of the study was to reveal the human-made structures buried within the ground. This survey was the continuity of the work done during the two previous field seasons.

Devices

The device used on the site was the "backpack" (**fig. 23**) which is composed of the following parts:

- Four fluxgate magnetometers from Bartington are fixed on an aluminium stick 50 cm apart from each other. Thus the magnetic field can be measured simultaneously at a distance of 25 and 75 cm in both directions from the centre of the stick. The cadence of measurement is 300 per second, with a precision of 1nT. This combination is attached on a backpack in such a fashion that the stick will stand in front of the operator, 1 metre above the ground.
- A GPS antenna Trimble 5800 is fixed to the top of the backpack. The position is measured every second.
- An electronic digitizer is attached to the backpack; it acquires, stores and displays on a head mounted display (HMD) the magnetic and GPS data, allowing the operator to follow pre-determined routes. A controller to start and stop the measurements as well as to record points of importance (such as obstacles, metallic wastes, etc.) is plugged to the device.
- All of the components are powered by a 15V, 6600 mAh Li-on battery.

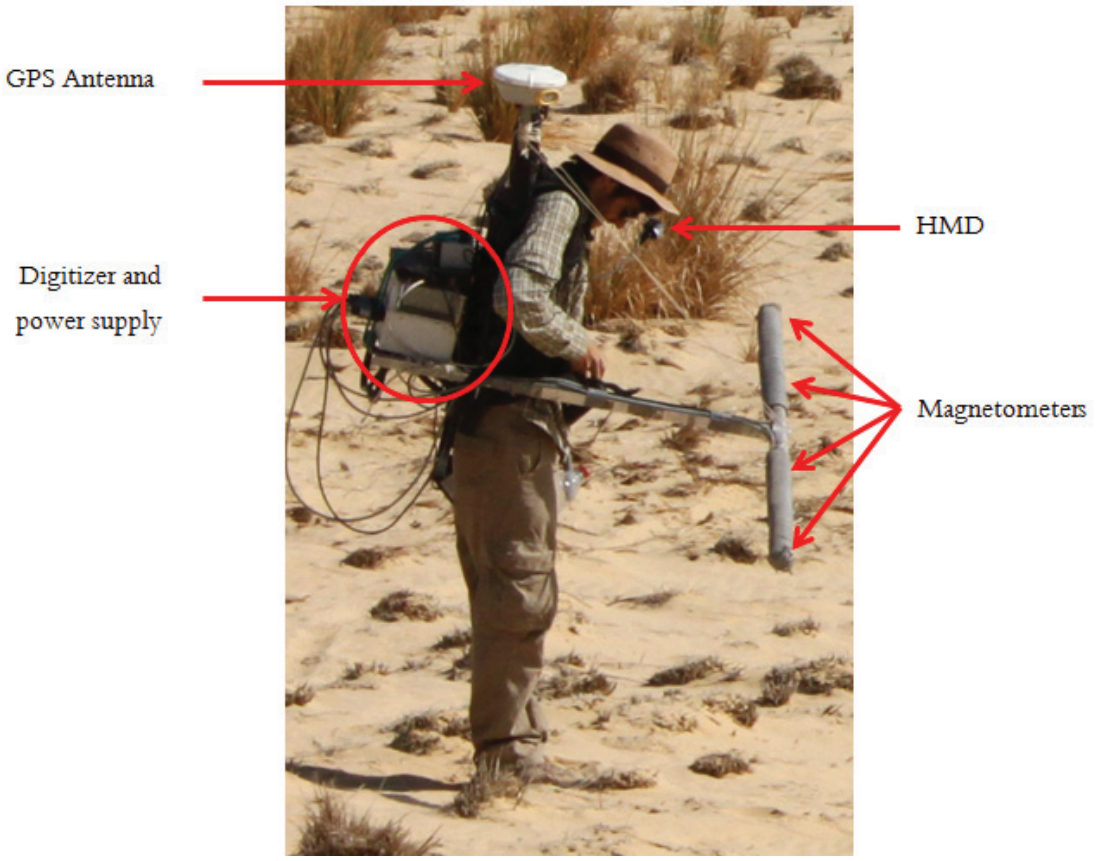

Figure 23: The «Backpack» device (Photograph: F. Colin)

Fashion of measurement

Once the Backpack is set and on the back of the operator, the process is as follows:

- Calibration: the captors are calibrated above a set point in order to correct the differences of offset, sensibility and angle for each captor. We keep the same calibration point for the entire campaign.
- Static point: in order to correct the temporal variation (triggered mainly by the effects of temperature changes on the captors), we measure the field above an identical point before and after each session of measurements.
- Mapping: the operator follows parallel profiles set every 2 metres and shown on the HMD. The start and end of each profile, as well as obstacles are recorded using the remote. Thus, with respect to the spacing of the captors, we obtain magnetic profiles every 50 cm.
- In order to calculate the anomalies, measurements along transversal profiles are made, perpendicular to the previous ones.
- At the end of the process the static point is measured once again and the captors re-calibrated.

Data processing

After extraction, the data are processed using applimag, a software developed by the E.O.S.T in a matlab environment. The different steps can be summarized as follows:

- 1) Data are calibrated: the differences of measurement between the magnetometers for the same magnetic field are reduced. This is due to the fact that each captor is not perfectly identical to the others.
- 2) The time-related variations are removed, using the differences between the starting and ending static points, by considering a linear variation.
- 3) Data are checked and every incoherent result removed (they are due to the obstacles, someone approaching too close to the operator, important vibrations of the device, etc.).
- 4) Anomalies are calculated, i.e. the differences between the regional field and the measured one. They are calculated by using the average at the intersecting points with the transversal profiles.
- 5) To display the data, a grid of anomalies is calculated with a step of 0.25 m and a sharp smooth (0.1).
- 6) Often some differences of the intensity between captors or profiles are visible, mostly due to the imprecisions of localization and calibration. An elegant solution to reduce this effect is to recalculate the anomalies using a soft-grid.

Further treatments will be then done as post-field operations, in laboratory.

Results

During the two days of measurements, an area of 35 000 m² was covered in the south-western part of the site (**figs. 24-25**).

Even if the data will need some post treatments, some features are already visible: Human made structures are characterised by high frequency anomalies, i.e. a strong contrast within a short distance. The structures pointed by black arrows are good examples: they are most probably walls. Meanwhile, the low frequency anomalies (i.e. the large uniformly coloured sheets) are very likely due to the geological features of the site underground.

Conclusion

The new results obtained during the two days of survey during the 2013 season confirm the rich potential of archaeological features in the south western part of the site. The completion of the survey towards the western edge is highly recommended to assess completely the different structures of the site.

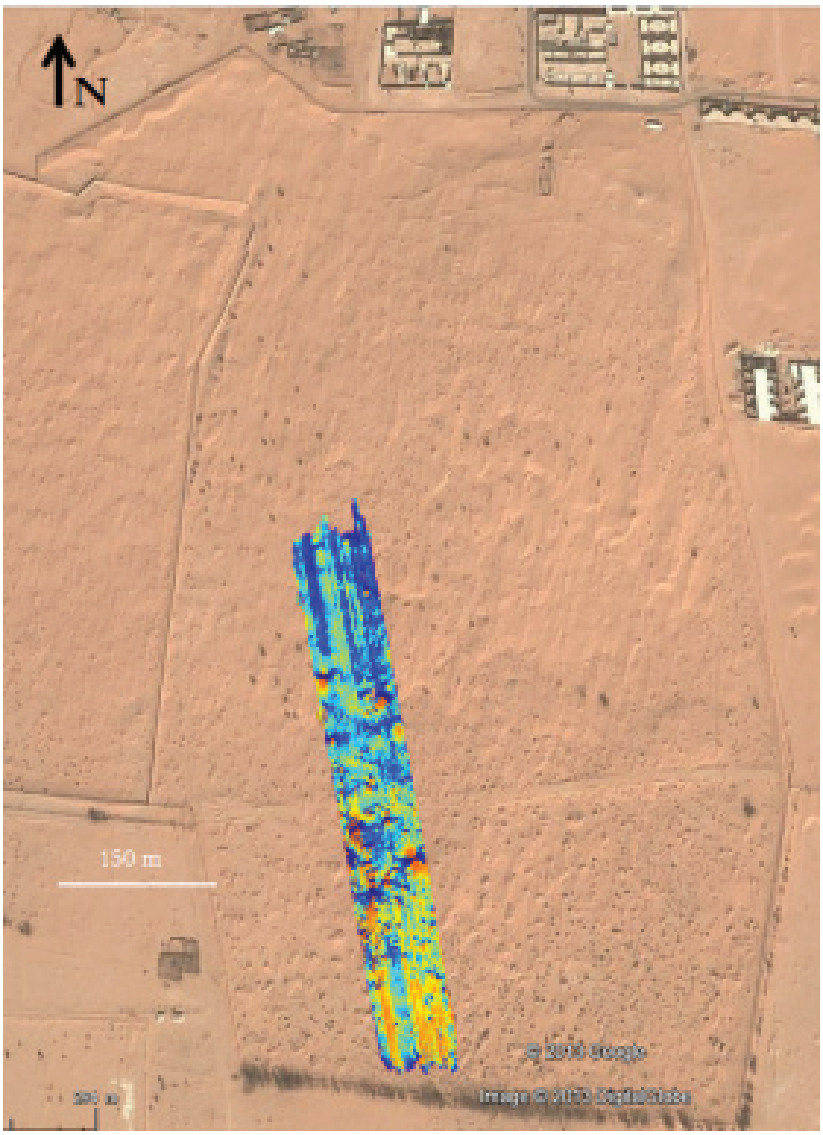

Figure 24: The investigated area on a satellite image from GoogleEarth (B. Gavazzi).

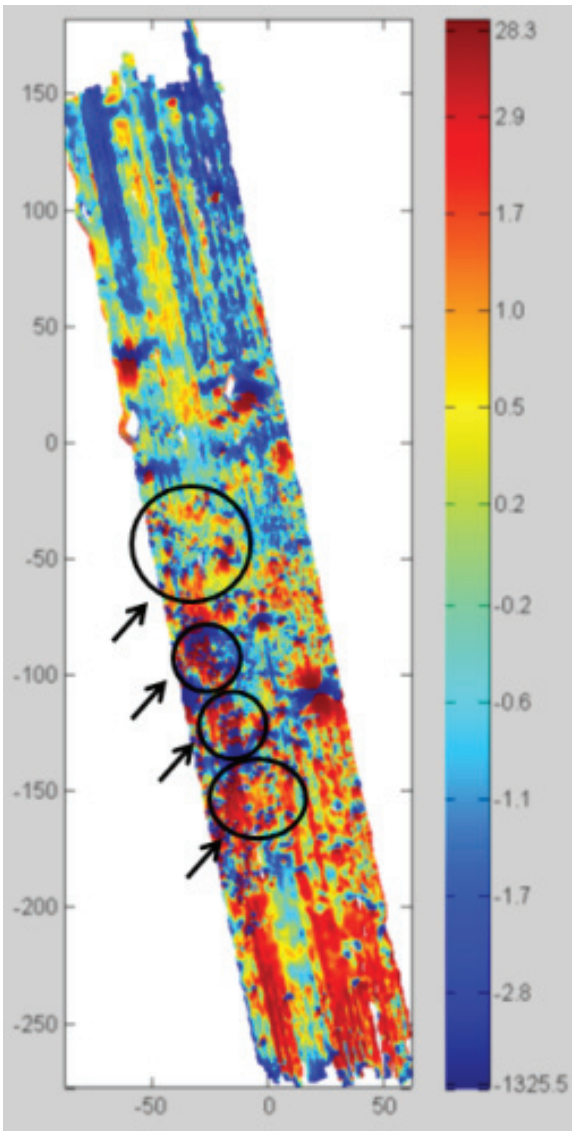

Figure 25: Map of the magnetic anomalies (B. Gavazzi).

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