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The prehistory of the region of Al-Kharj

Rémy Crassard, Yamandú Hilbert

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AL-KHARJ I

REPORT ON TWO EXCAVATION SEASONS
IN THE OASIS OF AL-KHARJ • 2011–2012
SAUDI ARABIA

Jérémie Schiettecatte

Abdulaziz Alghazzi

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CHAPTER 2

THE PREHISTORY OF THE REGION OF AL-KHARJ

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The significance of al-Kharj region within the Arabian context

Al-Kharj is located in the central part of the Arabian Peninsula thus providing a new point of reference for regional and intraregional comparisons with other sites known in the Kingdom of Saudi Arabia, Yemen, Oman and the United Arab Emirates. Given the dearth of Palaeolithic sites in the area surrounding the city of al-Kharj, the results presented here greatly expand our knowledge concerning prehistoric occupations and population dispersal across the central portion of Saudi Arabia.

Comprehensive studies on the Arabian Palaeolithic are a relatively recent phenomenon, compared to the long-standing traditions of research in Europe, Africa or the Levant. In recent years, the myriad excavations and survey activities in Yemen and Oman (AMIRKHANOV 2006; ROSE 2006; CRASSARD 2009a; DELAGNES *et al.* 2012, 2013; ROSE *et al.* 2011; HILBERT 2012, 2013; HILBERT *et al.* 2012; USIK *et al.* 2013) have provided considerable amounts of data fuelling many discussions and reflections on the role that this region has played across prehistory (AMIRKHANOV 2008; CRASSARD 2008a, 2008b, 2009a, 2009b; MARKS 2008; ROSE & BAILEY 2008; PETRAGLIA & ROSE 2009; PETRAGLIA *et al.* 2011, 2012; CRASSARD *et al.* 2013a).

Equally poorly understood, the Arabian Neolithic is represented by only a few lithic assemblages retrieved from datable context. Thus, the source of the Arabian Neolithic is highly debated: are we dealing with external influence (Levantine), local developments from autochthonous populations (ZARINS 2001, 2013; UERPMANN *et al.* 2009, 2013; CHARPENTIER & CRASSARD 2013; CRASSARD & DRECHSLER 2013; MCCORRISTON 2013; HILBERT 2013), or an amalgamation of both these scenarios? If the Arabian Neolithic is derived from Levantine sources, overlapping technological affinities between both regions should be detectable. Palaeo-environmental and palaeo-climatic studies, on the other hand, indicate that, at least in South-Western Arabia, the prevailing climatic conditions during the early to middle Holocene were conducive to the autochthonous development of a producing subsistence economy (e.g. MCCORRISTON *et al.* 2002; MARTIN *et al.* 2009; LÉZINE *et al.* 2010; PRESTON & PARKER 2013). These studies, combined with extensive lithic analyses are needed to define this period properly and better understand the Neolithic of Arabia.

Based on the aforementioned questions, the 2011 field season of the Saudi-French team was dedicated to the following research agenda:

- Exploring a region where very little work has been done before;
- Exploring a key area for understanding the spread of the first Anatomically Modern Humans (AMH) (Palaeolithic);
- Exploring an area unknown for Early-Mid Holocene occupations (Neolithic).

Methodology

SURVEY METHODOLOGY (OCTOBER 2011)

The survey activities centred on two primary objectives: 1) exploration of the whole periphery around al-Kharj (survey of northern, eastern, southern and western parts around the modern city of al-Kharj); 2) exploration of raw material outcrops, sources of knapping stones for Pleistocene and Early/Mid-Holocene populations. These survey activities were primarily based on the examination of the regional geomorphology and the study of geological maps.

Use of open access satellite imagery (Google Earth) and GPS tracking allowed the survey team to navigate across the studied area without great difficulties. Transects of varying distances (4 to 5 km) across different areas of al-Kharj region were surveyed, mostly on foot. Upon encountering surface lithic scatters, selective collecting of pre-determined diagnostic pieces was carried out. No systematic collecting was undertaken, as only few seemingly pristine surface sites were identified. Given the post-depositional and erosive phenomena that have afflicted the surface scatters encountered, such spatially constrained collection strategies do not reveal the techno-typological characteristics of the representative prehistoric phases. Test trenches were excavated on selected occasions in order to assess the potential for yielding buried archaeological remains at some of the sites (e.g. AK-22).

Twenty-nine sites were discovered during the three weeks of survey (**figs. 17–18**). These were labelled respectively AK-01 to AK-29 (AK standing for al-Kharj). Each site was located spatially using a Global Positioning System device (hand-held GPS); the localities were described with systematic criteria, such as:

- Date of survey;
- Name of the site;
- Name of the closest 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, position of artefacts, density and quantity by m², estimated surface area of the site and estimated explored area, potential 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 potential of the site).

METHODOLOGY OF LITHIC ANALYSIS

Description of the technical process is an important criterion for defining and comparing material cultures and subsequently allows researchers to draw parallels between assemblages (e.g. BAR-YOSEF & VAN PEER 2009; TOSTEVIN 2011). Once these criteria are set, archaeologists condense the information in order to establish local technological industries (*sensu* KLEINDIENST 2006). Understanding prehistoric lithic production techniques is therefore a critical component of Palaeolithic and Neolithic studies, as the lithic industries (stone tools and flaked stones in general) are often the only remnants of human activities found in arid environments due to their resilience against destruction. The sites discovered in the region of al-Kharj in 2011 are surface sites and will not provide any absolute dates. The only way to

place these industries into a comprehensive time-frame is by comparing the techniques used with other dated sites from the Arabian Peninsula and from neighbouring areas. The sites found during the 2011 season have been attributed to the Middle Palaeolithic, which dates roughly to between 150,000 and 50,000 years before present (BP).

Previous research has revealed an abundance of sites attributed to the Middle Palaeolithic period in Arabia (ZARINS *et al.* 1979; WHALEN & SCHATTEN 1997; PETRAGLIA & ALSHAREKH 2003; PETRAGLIA 2005; ROSE 2006). These vestiges are mainly characterized by the use of the Levallois reduction method (see next paragraph for a detailed description). As previously noted, find spots have been primarily associated with surface sites. The high degree of patina observed on the artefacts coupled with the technological observations strongly indicates a Pleistocene age for the majority of these finds. Although the use of patination as an indicator of antiquity should be done with caution (e.g. HURST & KELLY 1961; RÖTTLÄNDER 1975, 1978), its use across comparable environments and similar raw materials offers some degree of reference when placing surface scatters into a chronological frame. The problem remains the absolute dating of surface material and the capability to linking Levallois production with human and faunal remains. Given the lack of contextualized site, it is imperative to provide a comprehensive record of the myriad surface assemblages in order to provide a source for regional comparison between these Levallois-dominated assemblages.

The Levallois concept is characterized by the production of flakes, blades or points in a predetermined manner through the implementation of different methods of flaking (*débitage*) (BOËDA 1994). This concept of *débitage* was used for nearly 500,000 years, from the African Early Stone Age until the Late Stone Age (MARKS & CONARD 2008; BARHAM & MITCHELL 2008). More generally, however, Levallois flake production is associated with the Middle Palaeolithic (DELAGNES *et al.* 2007). The Levallois concept was widely described and illustrated through the study of various assemblages (e.g. BORDES 1961; BOËDA 1991, 1994; DELAGNES 1992; VAN PEER 1992; VAN PEER *et al.* 2010). The Levallois production scheme is recognized across different continents: Europe, Middle East and North-East Africa (e.g. CREW 1975; MEIGNEN & BAR-YOSEF 1988, 1991, 2004; BAR-YOSEF & MEIGNEN 1992; VAN PEER 1992; DIBBLE & BAR-YOSEF 1995; MEIGNEN 1995; DELAGNES & MEIGNEN 2006; DELAGNES *et al.* 2007).

In the Arabian Peninsula, Levallois *débitage* has been identified in Yemen, first by CATON-THOMPSON (1938, 1953) and then by Van Beek (VAN BEEK *et al.* 1963), Inizan (INIZAN & ORTLIEB 1987) and AMIRKHAPOV (1991, 1994). Archaeological investigations of surface sites mention the presence of Levallois *débitage* in Saudi Arabia in the Jubba basin (PETRAGLIA *et al.* 2011), in the United Arab Emirates at Jebel Faya' NE-1 [Jabal al-Fāya] (ARMITAGE *et al.* 2011) and in the region of Filī close to Sharjah (SCOTT-JACKSON *et al.* 2008; WAHIDA *et al.* 2008), in Dhofar (ROSE *et al.* 2011) and in Yemen across the Wādī Wa'sha, the Wādī Ṣanā and the general Ḥaḍramawt region (Eastern Yemen: CRASSARD 2008a, 2009a; CRASSARD & THIÉBAUT 2011), as well as in the Western Highlands at the interface of the Tihāma coastal plain at the Wādī Surdud sites (DELAGNES *et al.* 2012, 2013; SITZIA *et al.* 2012). Thanks to these discoveries across the Arabian Peninsula, the dating of four sites by the Optically Stimulated Luminescence (OSL) method provided dates for the Levallois presence in the Peninsula between, at least, 110,000 to 42,000 BP.

Geological analysis of the micro-regions

GEOMORPHOLOGY OBSERVATION AND NOTES ON AL-KHARJ AREA

The area of al-Kharj is characterized by a variety of geological features that have attracted human populations since prehistoric times, such as the presence of suitable lithic raw material, the varying topographic landscape and the presence of subsurface (and at times

perennial surface) waters (see Chapter 1). A short description of al-Kharj quadrangle will be given here; it is based on the geological maps of the Riyadh quadrangle Sheet 241 and the accompanying explanatory notes published by the Saudi Ministry of Petroleum and Mineral Resources (VASLET *et al.* 1991). Additional field observations made by the authors are also taken into consideration.

A succession of north-west trending *cuestas* composed of Late Jurassic to Cretaceous formations with south-west facing scarps characterize the northern part of the Riyadh area. Further south the scarps are oriented towards the south-west. This change of orientation and the dip of the *cuestas* are caused by the Central Arabian Arch (POWERS *et al.* 1966). At al-Kharj the north to south running scarps are cut by the convergence of the Central Arabian Graben system composed of the Nisāḥ, Awsaṭ, Bu'ayjā' and 'Ujmān, Rufā' and the Mughara grabens (figs. 1, 17).

The west-east axis of the dip from the Red Sea Hills to the Central Arabian Shield caused the emergence of subsurface waters in the form of springs and marshes in the Riyadh area during the Quaternary and beyond. The presence of sub-surface waters is caused by the local tectonics; the rupture of the Arabian Shield by the tectonics that created the Central Arabian Graben systems would have activated natural artesian springs in the area. Given that the evolution of the graben systems underwent several phases, activation of such artesian springs would have been recurrent. The most recent tectonic event affected the Rufā' Graben, offsetting the locally outcropping Rufā' formation by 16 m. Given the lack of agreement concerning the age of the Rufā' Formation, possibly Mid- to Late Quaternary, this tectonic event may have occurred in relatively recent times (Quaternary). Examples of aquifer structures may be seen in the south of the quadrant (VASLET *et al.* 1991).

Of additional interest are the karst sinkholes south of al-Kharj; these features are up to 80 m deep and would have provided important perennial water sources for prehistoric population inhabiting the Central Province.

The paleo-wādīs in the area are marked by the homocline of the Arabian Shelf and the Central Arabian Graben System. Main fluvial structures in the region run from the Ṭuwayq Escarpment across the Ṭuwayq Plateau (fig. 19) in a general west-east course. Towards the centre of al-Kharj area, the wādī courses follow the above-mentioned graben structures such as the Wādī Nisāḥ (fig. 20) and the Wādī al-Sahbā'. South-east of Riyadh, a series of wādīs drain southward into the Wādī al-Sahbā' and have brought considerable amounts of fluvial deposits into al-Kharj cluse. Furthermore, small southward running wādīs dissect the low al-'Uruma escarpment to the east of al-Kharj (VASLET *et al.* 1991).

Lacustrine deposits formed during the early Holocene in al-Kharj cluse; radiocarbon dates of 9,000-7,000 BP (VASLET *et al.* 1991: 33) are consistent with other radiometric readings across Central and Southern Arabia (McCLURE 1976, 1978; PARKER *et al.* 2006a; PREUSSER 2009, CRASSARD *et al.* 2013b). These deposits are characterized by thin lacustrine and palustrine (wetland) sediments.

AREAS SURVEYED DURING THE 2011 SEASON

Given the limitations encountered during the 2011 al-Kharj prehistoric survey, namely the intense urbanization and agricultural usage of the area and the short duration of the field season, this study was restricted to the following areas: The Nisāḥ Graben, the southern area of the Rufā' Graben and the northern part of the Dilam depression. Sporadic visits were also undertaken to assess the potential of the following areas in and around al-Kharj: the eastern part of the Ṭuwayq Plateau, the Mughara graben and the area south-east of al-Kharj (fig. 21).

■ *The Nisāḥ Graben (sites AK-1 to AK-11) (fig. 21a)*

Extending over 75 km and averaging 2.5 km in width between its northern and southern faces, the Nisāḥ Graben is the most prominent of these formations in the area. Starting in the Ṭuwayq Jurassic limestone mountain chain, the Nisāḥ Graben extends eastwards into the suburbs of al-Kharj. This formation is divided into four segments: the Kuḥayl, the Kuḥla, the Sadḥān and the Hayāthim segment respectively from west to east. The Hayāthim segment, is the longest, spanning approximately 40 km, and is marked by diverse geological formations of the Thamām Group. These early Cretaceous formations are characterized by interchanging limestone beds in its lower portion while its upper portions are formed by calcret sandstone members. Undifferentiated Quaternary deposits of both aeolian and fluvial character cover the area within the graben and around its northern and southern edges. The Nisāḥ Graben was not filed by any lacustrine events in the course of the Quaternary or beyond.

While the geology of the eastern portion of the Nisāḥ Graben is well exposed, an extensive aeolian blanket covers its western portion making survey problematic (fig. 22). The eleven sites recorded along the northern and southern face of the Hayāthim segment were associated with raw material outcrops (fig. 18). Primarily beige to brown, black weathered, fine-grained ferruginous sandstone, locally silicate-cemented (quartzite) raw material was used. This resource is found outcropping from the Dughum member (Biyād sandstone). To a lesser extent (in the case of site AK-07) beige cherty limestone outcropping from the Yamāma member (lower early Cretaceous formation) was used. No fine-grained chert outcropping from primary deposits has been observed in this sector.

■ *The Dilam depression (sites AK-12 to 17) (fig. 21c)*

South of the Nisāḥ Graben a low depression dotted with low inselbergs, remnants of Jurassic and Cretaceous limestone, stretches across ca. 20 km (fig. 23). Inactive and partially active gravel sheets, Holocene lacustrine deposits and dune systems mask the geology of the Dilam depression. Extensive farms situated in this area cover these sediments which are extremely conducive to agriculture. To the west, a series of eastwards draining, seasonally active wādīs and gravel sheets may be described. Here the geology of the Dilam depression is most visible; mainly beige to creamy laminated limestone, dolomitic limestone and evaporite solution of the Sulayy formation (Upper Breccia Complex and the Arab C-member of late Jurassic age) are seen.

The sites found in the Dilam depression were either at the foot of low inselbergs, mostly remnants of the Yamāma formation, and across the gravel plain itself. Throughout the low and dissected landscape, disaggregated fluvial deposits of undetermined age were mapped (VASLET *et al.* 1991: 28). These fluvial deposits, possibly related to the Late Tertiary to Early Quaternary uplift of the Red Sea Hills, are to a larger extent (90%) composed of rounded quartz cobbles, and composed for 10% of other well-rounded shield and cover rocks (granite, diorite and rhyolite).

Three sites have been found associated with these unnamed fluvial deposits (AK-14, AK-15 and AK-17). These show a great variety in raw materials used and possibly a chronologically broad attribution.

■ *The Rufā' Graben (sites AK-18 to 26) (fig. 21b)*

Approximately 30 km long and between 0.8 and 1.5 km wide, in its north-south axis, the Rufā' Graben is composed of three segments, respectively from west to east: the 'Ammāj segment, the Sha'al segment and the Ashqar Marāgha segment. The northern face of the graben is marked by Jabal Umm ash-Sha'al with its rough cliff rising 80-100 m 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, which is also composed of Sulayy formation limestone. The eastern portion of the Rufā' Graben is marked by a variety of lacustrine, wetland and *khabra* deposits, attesting the presence of lakes in the area during the Quaternary (fig. 16).

Survey activities were undertaken close to the contact zone between the Sulayy limestone and the Cretaceous sandstone formations in the eastern portion of the Ashqar Marāgha segment. Here, high quality, fine-grained quartzite and siltstones presenting dark weathered cortex were observed. Surface sites have been found associated with these raw material sources.

■ *Additional localities visited (AK-NULL-01 to 06)*

As mentioned above sporadic visits to areas adjacent to al-Kharj quadrangle were made during the 2011 survey campaign. These produced few results compared to the Nisāḥ, the Rufā' Graben and the Dilam depression. Either isolated artefact occurrences or the complete absence of Palaeolithic vestiges were noted. Areas surveyed and found devoid of archaeological sites have been labelled NULL sites and numbered in consecutive order.

AK Null 01 and 02 (fig. 21f) were on the Ṭuwayq plateau. This low limestone plateau is dissected by deeply incised wādī systems running from east to west. The currently dry wādī beds are filled with fluvial detritus composed of poorly sorted limestone gravels and cobbles of varying sizes. A braided pattern characterizes the sediments within the wādī beds and reflects the last event before the wādī dried out. Approximately 50 to 70 m above the wādī bed the extensive undulating limestone plateau stretches, with a gentle west-east dip, for over 30 km towards the east. No raw material sources, either in primary or secondary context could be identified. The high energy sedimentary environment inside the wādī systems were considered to be possible reasons for the absence of Palaeolithic sites in this area.

AK Null 03 was mapped on the Jabal Umm ash-Sha'āl plateau north of the Rufā' Graben; similar to the Ṭuwayq plateau this area is marked by wādī systems running from west to east. These wādī systems were less incised than the Ṭuwayq Plateau. Again the absence of suitable raw material was regarded as cause for the lack of Palaeolithic sites. Also, the intense agricultural use of this area imposed severe constraints to survey activities.

The Mughara Graben has yielded both NULL sites and a few isolated occurrences; north of al-Tawḍiḥiyya, isolated occurrences AK-28 and 29 and a NULL site (AK Null 04) were mapped (fig. 21e). The area was marked by a low, inactive gravel plain, dissected by small seasonally active run offs; outcrops of unnamed fluvial deposits (discussed in the Dilam depression section) were identified here. A few isolated undiagnostic stone tools were found associated with these outcrops. To the north, a gently rising scarp (Yamāma formation) may be seen. Here, a few raw material outcrops were identified. As in similar outcrops around al-Kharj area, the Yamāma formation contained up to one-metre-thick silicified and ferruginized hard ground horizons. These have been used as raw material sources at other Paleolithic sites in the Nisāḥ Graben. Here, these sediments appeared to display a higher iron oxide content, reducing knapping capabilities. Again, the absence of Palaeolithic sites may relate to the lack of suitable raw material.

Results

During the 2011 prehistoric survey, Middle Palaeolithic sites of varying size have been identified. Unfortunately, little evidence hinting at this area's Early/Mid-Holocene occupation was found. Only a few isolated artefacts were discovered and tentatively attributed to a post-Palaeolithic period based on fresher state of weathering, as well as different techniques used by the flint-knappers. This absence does not mean a total absence of Neolithic presence in the region of al-Kharj. The general topography of this flat region could also explain this absence (see Chapter 1), as the alluvial plain surrounding the oasis area has experienced considerable sediment build-up over the course of the Holocene. This sediment accumulation probably caused the re-deposition, dismantling and burial of Early Holocene sites and former surface scatters. Survey of the first terraces and higher mounds equally failed to produce evidence of Early/Mid Holocene human occupation. These higher elevations, however, have produced a considerable quantity of Middle Palaeolithic artefacts, raising the question of whether the absence of younger material is a function of the mode of subsistence and land use of Holocene human groups in the area.

The predominance of Middle Palaeolithic sites could be explained by geomorphology, geology and the analysis of the landscapes in conjunction with the palaeo-environmental data. The various wetter phases that occurred during the Pleistocene would have transformed the hostile environments of Central Arabia into a semi-arid savannah, capable of sustaining a much larger biomass than under present conditions; human populations would be attracted to such environments (PARKER & ROSE 2008; ROSE & PETRAGLIA 2009; FLEITMANN & MATTER 2009). The Middle Palaeolithic period represents a long timeline across which numerous waves of human expansion could have occurred. The various Middle Palaeolithic industries found across al-Kharj area could therefore represent multiple diachronic dispersals of human groups across Central Arabia. Thus, it is possible to argue that the sites discovered around al-Kharj are the product of various stages of peopling across considerable chronological depth. The variability seen across these lithic industries, however, gives considerable information about the cultural and cognitive development of the Hominids who manufactured them. The technological variability of the Levallois *débitage* found within the collected assemblages, coupled with previously known and studied artefacts from the Northern and Southern Arabian Peninsula, indicate some degree of movement across Arabia without erasing the possibility of identifying local variability.

LIST OF SITES DISCOVERED

All 29 sites discovered during the 2011 survey are surface sites characterized by the production of stone tools. The archaeological material found consists of lithics. They are mostly ferruginous quartzite and various other types of coarse-grained raw materials; a small number of artefacts were made on chert. Most of the lithics found have been attributed to the Palaeolithic, most probably the Middle Palaeolithic. **Table 3** lists the localities, the date of discovery, the name of the site, latitude, longitude and approximate altitude (in metres above sea level).

DESCRIPTION OF SITES AND ASSOCIATED LITHIC INDUSTRIES

■ AK-01

Little sign of disturbance by older and younger archaeological occurrences were observed. The presence of possible Bronze Age cairn/tower tombs at the base of the jabal was noted.

Presence of Levallois *débitage* and cores, typical of the Middle Palaeolithic of Arabia (fig. 25). Potential for comparisons with Northern and Southern Arabian Levallois assemblages.

SITE	LATITUDE (DECIMAL DEGREE N)	LONGITUDE (DECIMAL DEGREE E)	ALTITUDE (METRES ABOVE SEA LEVEL)	DATE
AK-01	24.212180	47.904730	461	02/10/2011
AK-02	24.215930	47.172590	494	02/10/2011
AK-03	24.217580	47.173770	471	03/10/2011
AK-04	24.219881	47.167978	467	03/10/2011
AK-05	24.218980	47.162014	471	03/10/2011
AK-06	24.220591	47.159326	471	03/10/2011
AK-07	24.221595	47.159159	472	03/10/2011
AK-08	24.210669	47.117059	473	04/10/2011
AK-09	24.217671	47.120739	472	04/10/2011
AK-10	24.220538	47.096546	504	04/10/2011
AK-11	24.222623	47.050613	508	04/10/2011
AK-12	24.154530	47.023319	483	05/10/2011
AK-13	24.155370	47.024801	493	05/10/2011
AK-14	24.150531	47.031849	478	05/10/2011
AK-15	24.150337	47.032837	479	05/10/2011
AK-16	24.126590	47.010537	482	05/10/2011
AK-17	24.121931	47.013013	476	05/10/2011
AK-18	24.333689	47.159155	473	08/10/2011
AK-19	24.333340	47.150241	472	09/10/2011
AK-20	24.335700	47.150731	474	09/10/2011
AK-21	24.336320	47.149659	481	09/10/2011
AK-22	24.333481	47.153702	474	09/10/2011
AK-23	24.333720	47.154454	474	09/10/2011
AK-24	24.334178	47.156502	477	10/10/2011
AK-25	24.334149	47.162540	475	10/10/2011
AK-26	24.333563	47.164320	474	10/10/2011
AK-27	24.097690	47.402649	439	12/10/2011
AK-28	24.214588	48.070783	369	13/10/2011
AK-29	24.219290	48.065610	384	13/10/2011

Table 3 | List of prehistoric sites discovered during al-Kharj survey 2011

■ AK-02

Surface site on the second terrace of a flat inselberg chain (**fig. 26**). Raw material is present and characterized by slabs of pale quartzite (beige with darker striation). Artefacts present a light patination. The artefacts are undiagnostic, mostly large flakes and single platform, unidirectional cores. No Levallois technology was observed. Cairn tombs, 3 m in diameter, were noted in the general area of the lithic scatter. A connection between the structures and the surface scatter is unlikely.

■ AK-03

Surface site close to the asphalt road along the northern edge of a small mountain chain north of Wadi Nisāḥ. The surface scatter covers an 80 × 40 m area at the foot of the jabal (**fig. 27**). Artefacts were found on a relatively flat surface with a slight dip to the N/NW towards the gravel plain. The site is cut by two erosion gullies filled with aeolian sediments. Middle Palaeolithic Levallois (centripetal recurrent) cores and *débitage* and one biface preform were collected (**fig. 28**). The artefacts are generally intermediate to large in size. Their patination and weathering varies, suggesting that the site consisted of at least two occupation events. Some of the artefacts present classical rounded edges from wind/water weathering (desert varnish). Raw material, mostly yellow quartzite, has been observed near the site. Possibly Bronze Age tombs were identified in the proximity of the scatter on a shallow slope.

■ AK-04

The site covers an area of approximately 50 × 50 m in the proximity of a dark weathered sandstone outcrop (**fig. 29**). Very low artefacts density (less than 1 piece/m²). Quartzite was seen outcropping close to the site (approximately 50 m away). Artefacts were found on a slightly inclined surface. A few Middle Palaeolithic artefacts, mostly big flakes with heavy patination; no cores were found (an informal collection was undertaken).

■ AK-05

The site AK-05 covers ca. 50 × 50 m in the immediate proximity of an inselberg (**fig. 30**); artefacts are scattered across a flat surface. Low artefact density (0–3/m²). Flakes showing well-faceted striking platforms (Middle Palaeolithic) were observed. Cores were also collected and were identified as Levallois centripetal recurrent cores. Quartzite raw material is available in the vicinity of the site (50 m).

■ AK-06

Site on the foot of a black quartzite jabal (raw material outcrop), on a slightly dipping surface facing south (**fig. 31**). Artefacts made on quartzite, low density (0–3 per m²). Informal collection of Levallois centripetal recurrent cores and flakes (Middle Palaeolithic) (**fig. 28**).

■ AK-07

Site on top of an inselberg (above AK-06), with a flat surface dipping slightly towards the centre (**fig. 32**). Moderate to high density of artefacts with 1–7 per m². Concentrated zones of lithic scatters were observed. Raw material outcrops directly in the proximity of the site. Exogenous raw material was found at the site (like chert, a raw material not outcropping on site). The Levallois centripetal recurrent reduction method characterizes the artefacts collected. Many cores and some Levallois flakes were identified.

■ AK-08

Site directly on a raw material outcrop (large quartzite blocks) on the south side of a small isolated mound in the middle of a confluence of the Wādī Nisāḥ and one of its small

tributaries (*shi'b*) (**fig. 33**). The site may be described as having low artefact density (0–2 per m²). Artefacts are spread across a gentle slope and display a dark patina. The site covers ca. 30 × 20 m. Artefacts are for the most part large undifferentiated/undiagnostic flakes with unidirectional scar patterns. Although the technology may be described as largely undiagnostic, the heavy weathering observed on the artefacts suggest a Pleistocene age.

■ **AK-09**

Site close to some raw material (yellow quartzite slabs/blocks). Located at the foot of the northern chain of the Wādī Nisāḥ on a slightly inclined alluvial surface (**fig. 34**). The artefacts are heavily weathered (desert varnish) in comparison to the freshly eroding raw material found at the site. The site is marked by a low density (0–1 per m²) of artefacts generally exhibiting Levallois (mainly centripetal recurrent) technology. Site spreads across an area of ca. 50 × 20 m and is likely to be Middle Palaeolithic.

■ **AK-10**

Isolated preferential centripetal preparation Levallois flake and big almond-shaped plano-convex biface. Poor visibility since the area is covered by sand. A few quartzite flakes with no specific technological attributes are present. Very low artefact density (less than 1 per m²) on a slightly sloping area.

■ **AK-11**

Site is located directly on a raw material outcrop and marked by a low to moderate artefact density (0–3 per m²). The site spreads across an area of ca. 30 × 30 m, starting on a moderate to steep slope across to a slightly dipping surface below the raw material outcrop (big blocks of dark quartzite). A small erosion gully cuts the talus slope of the jabal close by; erosion did not affect the surface scatter. Low to moderate density, mainly intermediate and large flakes (possible preform preparation on site). A good example of Middle Palaeolithic recurrent centripetal Levallois core was collected (**fig. 28**).

■ **AK-12**

A few isolated (0–1 artefacts per m²) finds spread across approximately 100 m². The site is located close to a low-lying limestone scarp remnant. Raw material is present on the slope of the limestone hill (dark quartzite). One large biface and a few undiagnostic flakes were recorded; chronological attribution is difficult (**fig. 28**).

■ **AK-13**

The site is located on top of a limestone inselberg on a raw material source (dark quartzite), above site AK-12 (**fig. 35**). Reduction of a few single blocks of raw material; these were collected exhaustively for possible and most probable refits. Reduction of large 40 to 50 kg raw material blocks, most probably for using huge flakes as cores; this is probably a raw material procurement site. Artefacts concentrate in small patches of 2 m².

■ **AK-14**

High density site on a low alluvial fan remnant situated on low gravel plain (unnamed alluvial deposits) (**fig. 36**). Moderate to high density site with approximately 1–7 artefacts per m². The site spreads across an area of 100 × 200 m. AK-14 is located on a slight slope and on flat terrain delineated by low hills. Varied raw materials have been identified at the site and are incorporated within the unnamed alluvial deposits; mainly middle-sized blocks and slabs of flint/chert and a little quartzite (also possibly chalcedony). Multi-occupational site with a robust Pleistocene/Middle Palaeolithic component. Some possibly Holocene flaking

was also observed, unfortunately chronological attribution is based on undiagnostic *débitage* and lighter patination in comparison to Pleistocene material. The Pleistocene component is marked by centripetal recurrent Levallois, Levallois preferential, single and multi-platform cores, and biface technologies.

■ **AK-15**

Continuation of site AK-14. High density scatter on low alluvial fan remnant positioned on low a gravel plain west of AK-14. Approximately 1–7 artefacts per m². Site spreads across 10 × 20 m and up onto the slopes of one of the surrounding small hill. Varied raw materials, mainly middle-sized blocks and slabs of flint/chert and quartzite (refits were made on site from an exhaustive collection). Mainly Pleistocene/Middle Palaeolithic. There may be some Holocene flakes and elongated flakes (few). The technology is characterized by centripetal recurrent Levallois, Levallois preferential (**fig. 37**).

■ **AK-16**

Low density site (0 to 1 artefact per m²) spread across an area of 20 × 50 m. The scatter is situated on a limestone inselberg directly on the raw material source (**fig. 38**). Artefacts are on a slightly inclined slope. Fine-grained raw material. A Levallois core and a few flakes indicate a likely Middle Palaeolithic surface scatter.

■ **AK-17**

Low density site (0–2 artefacts per m²) on an elevated alluvial fan remnant situated on a flat alluvial plain. A few flakes and Levallois cores. Varied types of raw material ranging from dark quartzite, flint and chert of different colours. The site spreads over an area approximately 50 × 50 m. Raw material of small dimensions has been found present near the scatter. As a function of the diminutive size of the raw material, artefacts are equally diminutive. Patination and technological observation support the idea of AK-17 dating to the Middle Palaeolithic.

■ **AK-18**

The site was found north of al-Kharj city, along the King Abdulaziz Highway that leads to the greater Riyadh area. The surface scatter is situated in the proximity of a raw material outcrop (dark quartzite) (**fig. 39**). Fine-grained ferruginous sandstone and some pieces made on chert have also been identified indicating some raw material transport to and from the site. The scatter is generally marked by its low density (0–3 artefacts per m²). The site extends over approximately 20 × 30 m. Different stages of patination were observed, indicating repeated visits to the site. Single platform unidirectional and Levallois cores were identified; also a heavy, thick laminar component coupled with an elongated flake production was observed on site.

■ **AK-19**

Surface site on the foot of a jabal, on a raw material outcrop (dark quartzite). A low density artefact scatter (0–2 artefacts per m²) on a slope marks the site. Artefacts are large to medium sized. The flakes and cores generally have a dark patination, though some have a lighter patina, indicating a multi-component site in terms of its occupational history. The principle mode of *débitage* identified fits comfortably within the Levallois production system. The scatter covers approximately 100 × 20 m and was partly destroyed by caterpillar machines on its south boundary. Diagnostic pieces, mainly Levallois cores or cores with Levallois intention (facial *débitage*) were collected. Preparation of selective striking platforms; complete peripheral preparation is very rare.

■ AK-20

Site on a low rise located in a small valley between hills and inselbergs of quartzite. Raw material was found at the site; mostly dark and yellow quartzite. The site is a low density scatter (0–4 artefacts per m²), over approximately 20 × 20 m, on a flat surface. Levallois technology (small to medium-sized flakes) and one small (probably Holocene) biface (fig. 40).

■ AK-21

Site on a low rise, the remnant of a low terrace covered by dark quartzite. Raw material present (dark and yellow quartzite). Site covers an area of approximately 50 × 20 m, on the lower and middle slope. Moderate density (0–3 artefacts per m²). Levallois technology (small to medium-sized flakes), with a collection of Levallois recurrent centripetal cores (fig. 41).

■ AK-22

Surface site in a slight dip. Moderate to high density (1–15 artefacts per m²). The site spreads across 30 × 50 m. Source of raw material present (dark and yellow quartzite) ranging from poor to high quality. A massive number of Levallois cores were collected on the site. The collection also includes blanks and some technical pieces (debordant flakes, centripetal recurrent flakes and possible end products) (figs. 43–45). Lithic industry is characterized by Levallois preferential *débitage* with a strong tendency towards point and flake production. Also, the presence of Levallois preferential bidirectional technology (with obvious preparation of the distal part of the core) is noted. Tools were also collected, such as side-scrapers and informally retouched blanks. The patination is homogeneous, as are the technological patterns. Little faceting of butts on flakes. *Débitage* and cores range from small to large size. A topographic map of the site and its surroundings was done using a total station (11/10/2011) (fig. 42). Two small test pits were dug (12/10/2011) on the site, but it proved to be only a surface site. Artefacts were incorporated within a 10 to 30 cm thick colluvial horizon situated on top of an evaporite layer.

■ AK-23

Same as AK-22 only a lower concentration, on the NE part of the dip. Numbered as a different site, it is in reality a small extension of AK-22, after a small space without artefacts. A few pieces only (fig. 41).

■ AK-24

Low density (0–2/m²) site on a raw material outcrop (dark quartzite). The site is located on the foot of a jabal, and extends across an area of 10 × 10 m. A few flakes and Levallois preferential technology were observed. Two isolated Levallois cores with preferential flake.

■ AK-25

On the foot of a jabal, close to a raw material source (red/black quartzite, and maybe a little chert). Collection of a few pieces of grey/beige chert, including Levallois and tools. Partly destroyed by bulldozers, no potential. 40 × 5 m (0–1/m²).

■ AK-26

Surface site along a lower terrace at the foot of a jabal, on a raw material (dark quartzite and chert) outcrop, flakes and cores scattered across 80 × 15 m both on the slope and flat surface, medium-size Levallois preferential. Mainly large artefacts were observed, few flakes, as they were probably washed away from the upper parts of the terrace and the jabal. Low density (0–2 per m²).

■ **AK-27**

Isolated finds close to a low raw material outcrop (Yamāma formation, due to the presence of fossilized wood). A blade-dimensioned blank with lateral retouch found, probably Holocene. Artefact made on non-local raw material, fine-grained grey chert.

■ **AK-28**

Isolated artefact found on flat gravel plain. Much rounded quartz gravel present, ca. 3–10 cm in size (unnamed alluvial deposits see-AK-14, AK-15 and geological map). Chert present at site. Artefact made on grey chert with striations, steep abrupt retouch on lateral edge of chunk.

■ **AK-29**

Isolated artefacts on elevation, quartz and quartzite side scraper collected. Very low concentration: attribution is not possible. Raw material not found, aside from a little quartz gravel.

AK-22 as a reference site for the Middle Palaeolithic in Central Arabia

MAIN DESCRIPTION OF LOCALIZATION: TOPOGRAPHY, GEOLOGY, RAW MATERIAL VARIABILITY AND TEST-TRENCHES

The surface scatter of AK-22 is located at the eastern portion of the southern fringe of the Rufā' Graben, within the Ashqar Marāgha segment. The 20 × 60 m scatter is on a slight east to west slope and flanked by Dughum Member inselbergs on its northern and southern sides (**fig. 42**).

As was stated above, the Rufā' Graben is marked by the contact between the Sulayy Limestone and the Cretaceous Dughum member and Yamāma formations. At AK-22, only the Dughum member outcrops are visible, while the closest reported Yamāma formation outcrops are 6 km to the east and west of the site. The Dughum outcrops, characterized by secondarily ferruginized and silicified, fine- to coarse-grained, beige to brown sandstone (quartzite) of the Biyāḍ formation, were identified as the source of the locally used raw material. These are present within the lowest portion of the Dughum lithology.

This quartzite is by far the most common raw material used at the site; violet siltstone is used to a lesser extent. A depression filled with recent aeolian sediments dissected by small erosion gullies marks the immediate surroundings of the site. Additional Dughum member cuestas are visible to the north-east, east and south-east of the site. Large Rufā' formation outcrops (lacustrine deposits of possible Late Quaternary age) were reported 2 km south of AK-22.

In order to assess the potential for buried artefacts and possibly estimate the age of the AK-22 assemblage, two test-pits were dug close to the erosion gullies cutting the lower portion of the site (**fig. 42**). Although both trenches were placed less than 2 m apart from each other, the sediment sequence revealed very distinct strata.

Test-pit 1, placed on a slight dip on the northern side of the erosion gully, presented a 15–20 cm-thick, coarse colluvium horizon containing small- to medium-sized, poorly sorted limestone clasts. This horizon also contains artefacts showing no difference in patination from the artefacts collected on the surface. Technologically, little difference was seen between the buried and the exposed artefacts indicating a rather recent displacement of this stratum. The upper colluvium horizon is on top of a cemented, evaporitic layer containing equally poorly sorted, deteriorating sandstone clast inclusions. This layer appears to be cut

by erosion gullies that have subsequently been filled in with detrital sediments; no artefacts were found in this layer.

A trench 80 cm deep was dug into the southern side of the erosion gully that cuts through the southern section of AK-22. No artefacts were found in any of the strata uncovered. The upper 10–15 cm was composed of loose, recent aeolian sediment. The underlying sedimentary unit was composed of fine- to coarse-grained deteriorated sandstone. This unit becomes more cemented towards the bottom of the section. No inclusions were observed, supporting the notion of little post-depositional disturbance. Patches of evaporite appear throughout the section.

Central for additional work and possible dating of the deposition of the AK-22 artefacts is the relation between the lower cemented strata observed in both test-pits and the activation of the erosion gully that cuts through the site. Currently, no conclusive date based on the stratigraphy revealed at the site can be given. It can be said that the displacement, which affected the colluvium horizon containing the artefacts, was fairly recent. Hopefully, additional test-pits along the course of the erosion gully may reveal artefacts that were buried prior to the latest post-depositional displacement of the scatter.

LEVALLOIS OCCURRENCES AT AK-22: RECURRENT VS. PREFERENTIAL

Of considerable importance for discussions concerning technological analogies and human dispersal from Africa into Arabia and expansion events within the Peninsula is the presence of specific forms of the Levallois method identified at the site AK-22 (figs. 43–45). Preferential flake production is the most frequently documented Levallois *débitage* method at the site. Nevertheless, the recurrent centripetal or recurrent uni-/bi-directional methods have also been observed. Investigation of the cores reveals a consistent preparation using the distal part of the core, a peculiarity that has already been observed in assemblages from the southern part of the Arabian Peninsula (Dhofar and Ḥaḍramawt). This particular type of preparation, in conjunction with the observed Levallois core morphologies, suggests an intrinsic connection between the AK-22 samples and the Nubian Complex sites found across North Africa and Southern Arabia (fig. 46). The material from AK-22 provides an excellent reference for discussion and comparisons with assemblages from the main Middle Palaeolithic sites known in the Arabian Peninsula, such as Jubba, al-Mundafan, Ḥaḍramawt, Dhofar, Jebel Faya [Jabal al-Fāya] and Filī (CRASSARD & HILBERT 2013).

Conclusion: future work

Because no Early/Mid-Holocene occupation was detected during the 2011 survey, it is important for work to concentrate on this aspect during the next survey seasons at al-Kharj. The Rufā' formation, composed of lacustrine deposits interfingered with aeolian sediments described by VASLET and colleagues (1991), will be of interest over the coming seasons of the prehistoric survey. Given the presence of Tertiary cobbles in the lacustrine portions of the exposed section in the Rufā' area (fig. 16), a Quaternary age for these deposits has been suggested by the authors. Ages of MIS 9, 7 or 5 for these sediments are conceivable. The study of the geological maps has also revealed the presence of lacustrine sediments with good potential for surveying, especially around the Nisāḥ Graben. The area around the site of al-Yamāma, and the area south-east of al-Kharj are also promising. The region of Dūmat al-Jandal, in the province of al-Jawf also offers a good prospect for new comparative work, along with the Najrān region, where Pleistocene and Holocene lakes have already been surveyed by members of our team (CRASSARD *et al.* 2013a).

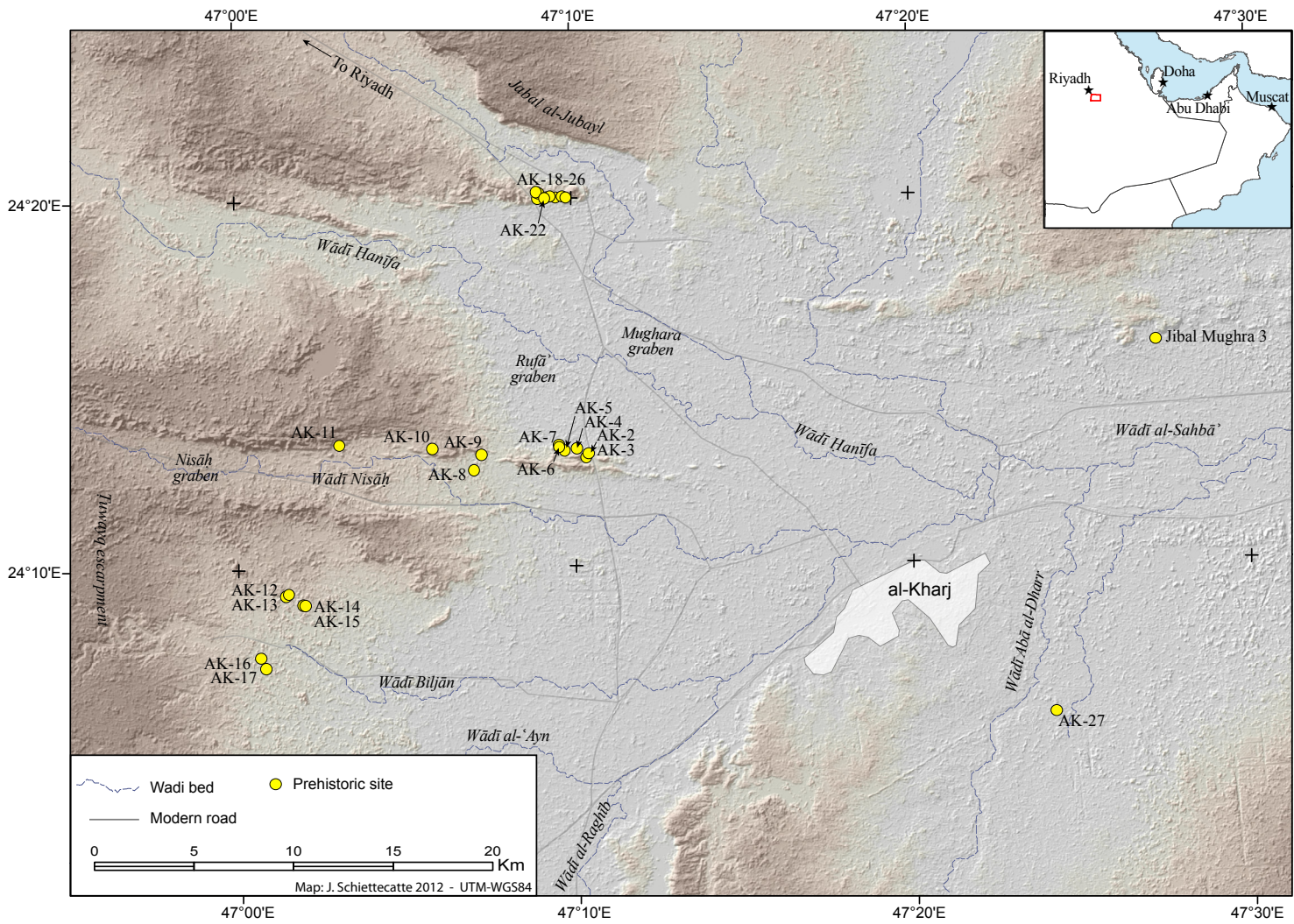


Figure 17 Map of the Palaeolithic sites in the region of al-Kharj (J. Schiettecatte – French-Saudi Archaeological Mission in al-Kharj)

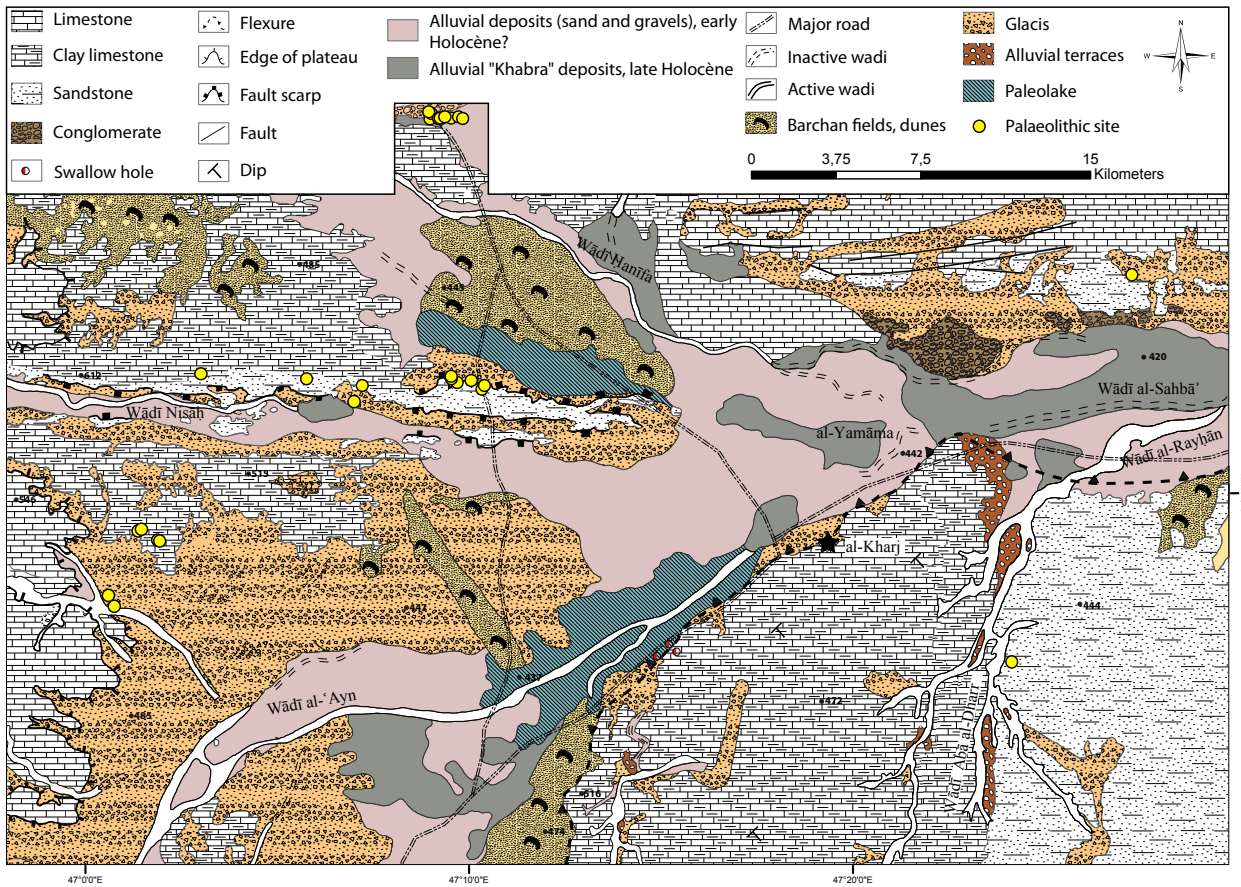


Figure 18 Palaeolithic sites superimposed on the geomorphological map of al-Kharj area (A. Chabrol, G. Fortin and J. Schiettecatte)



Figure 19 Fluvial structure incised in the Tuwayq escarpment (photograph: R. Crassard – French-Saudi Archaeological Mission in al-Kharj)



Figure 20 Graben structure of the Wādī Nisāḥ, across the Jabal Ṭuwayq (photograph: R. Crassard – French-Saudi Archaeological Mission in al-Kharj)

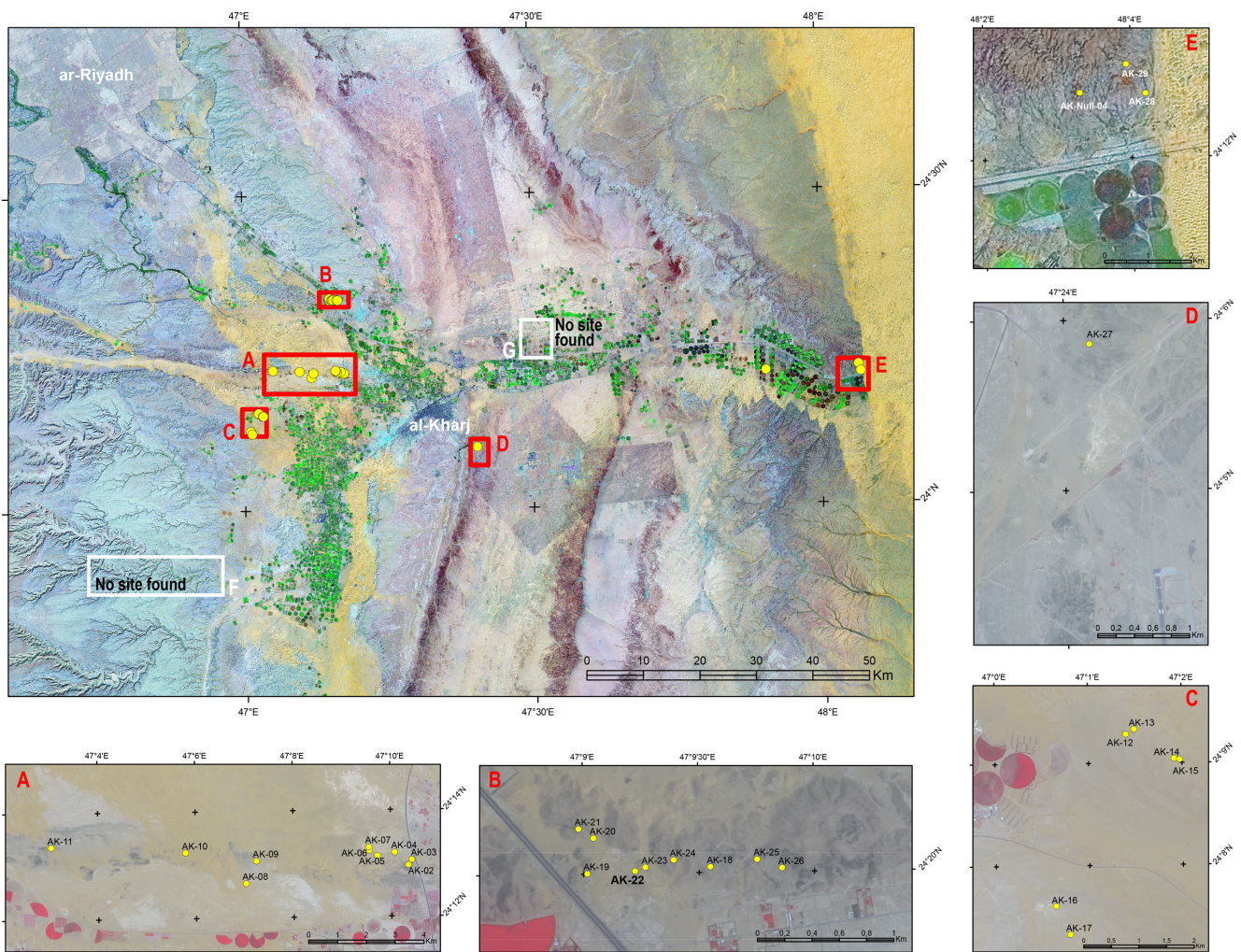


Figure 21 Map of the surveyed prehistoric areas (J. Schiettecatte – French-Saudi Archaeological Mission in al-Kharj. Map A, B, C and D include content © CNES 2012, Distribution Astrium Services/Spot Image S.A., France, all rights reserved. Map A and E include content © Landsat ETM+, all rights reserved)



Figure 22 The Nisāh Graben
(photograph: R. Crassard –
French-Saudi Archaeological
Mission in al-Kharj)



Figure 23 The Dilam depression
(photograph: R. Crassard –
French-Saudi Archaeological
Mission in al-Kharj)



Figure 24 Site AK-01 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)

Figure 25 Site AK-01: AK-01.9, preferential Levallois core with centripetal preparation; AK-01.21, recurrent centripetal non-preferential Levallois core; AK-1.14, 18, 20, 26, 35, flakes (drawings: L. Munduteguy – French-Saudi Archaeological Mission in al-Kharj)

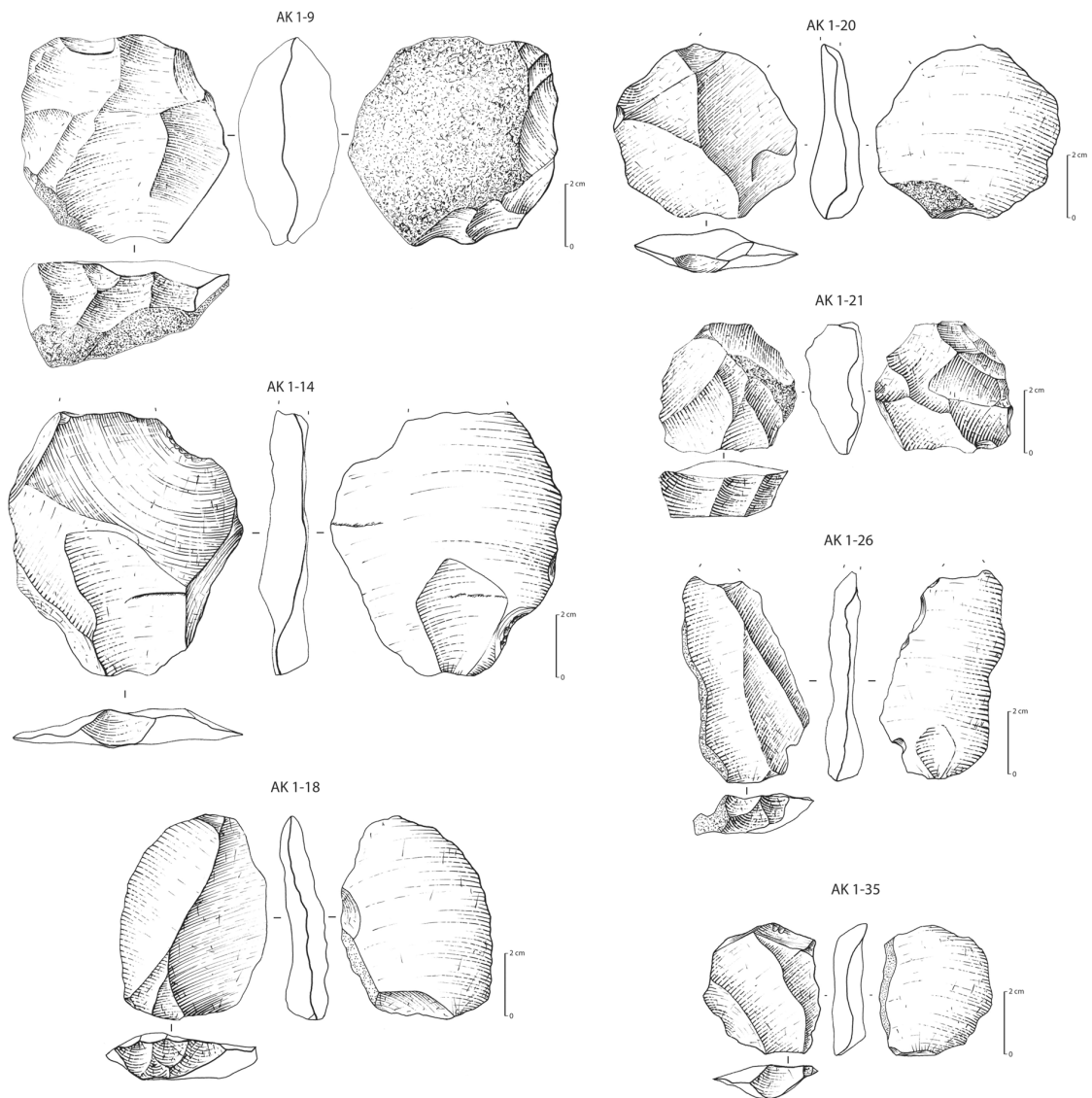




Figure 26 Site AK-02 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 27 Site AK-03 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)

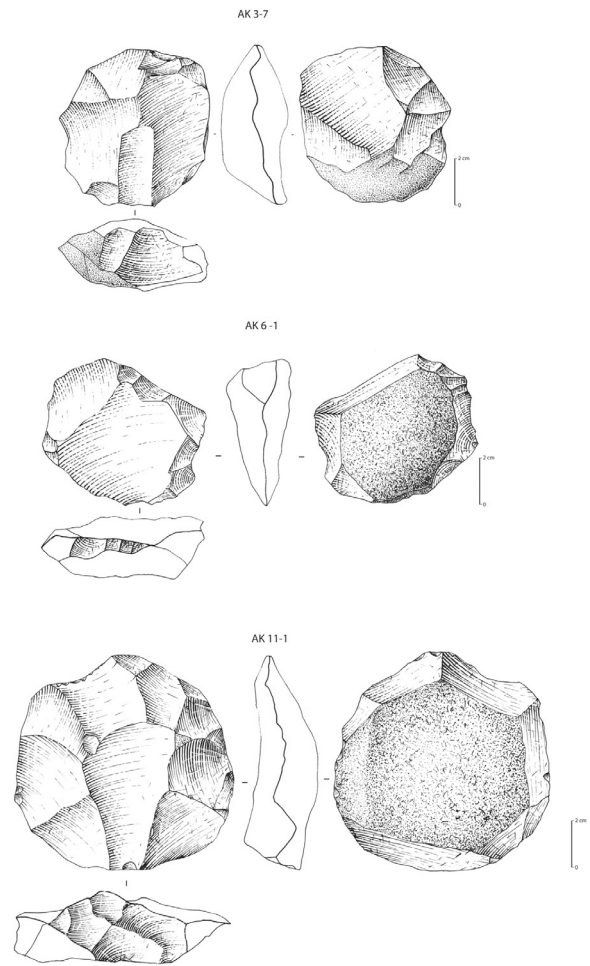


Figure 28 AK-03.7: recurrent centripetal non-preferential Levallois core; AK-06.1: preferential Levallois core with centripetal preparation; AK-11.1: preferential Levallois core with centripetal preparation; AK-12.1, sub-triangular handaxe with untrimmed but (drawings: L. Munduteguy – French-Saudi Archaeological Mission in al-Kharj)

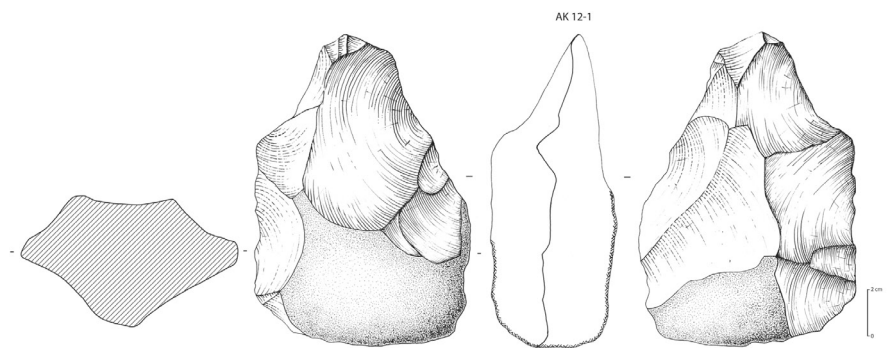


Figure 29 Site AK-04 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 30 Site AK-05 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 31 Site AK-06 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



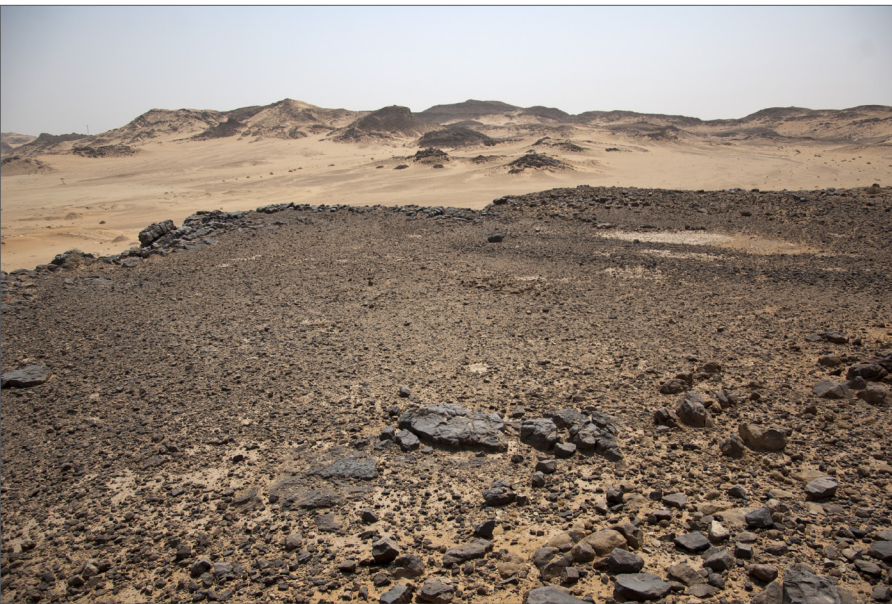


Figure 32 Site AK-07 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 33 Site AK-08 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 34 Site AK-09 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj).

Figure 35 Site AK-13 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 36 Site AK-14 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 37 Site AK-15: AK-15.13, preferential Levallois core with centripetal preparation (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 38 Site AK-16 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)



Figure 39 Site AK-18 (photograph: Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)

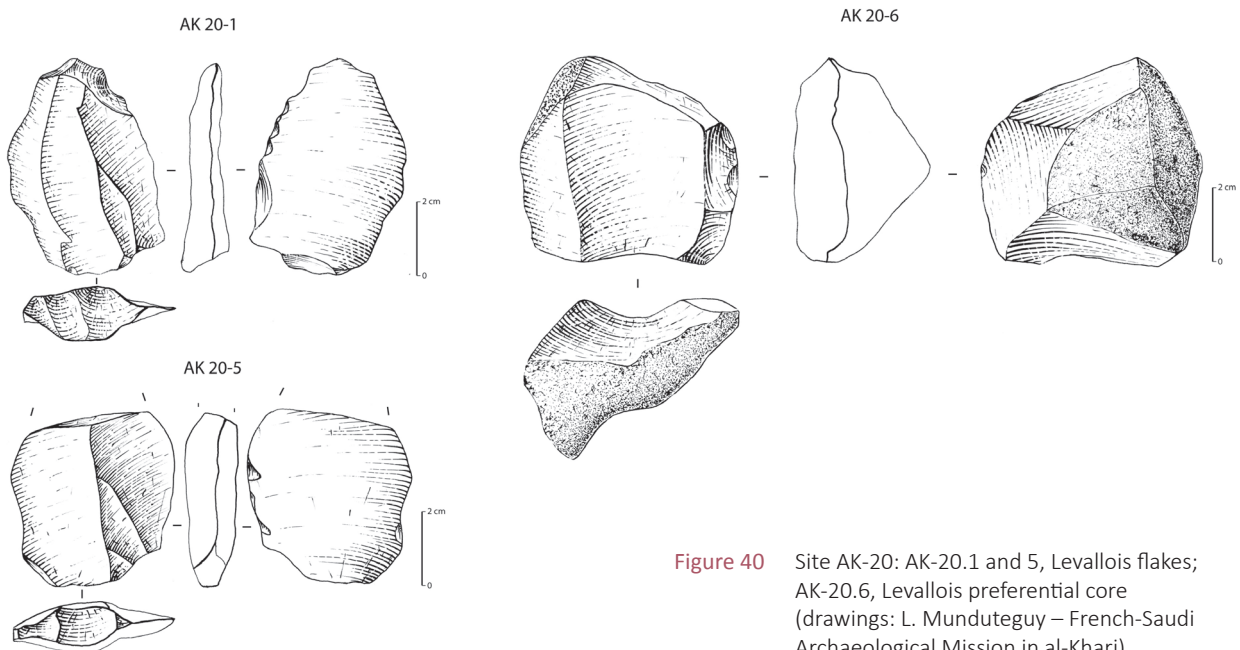


Figure 40 Site AK-20: AK-20.1 and 5, Levallois flakes; AK-20.6, Levallois preferential core (drawings: L. Munduteguy – French-Saudi Archaeological Mission in al-Kharj)

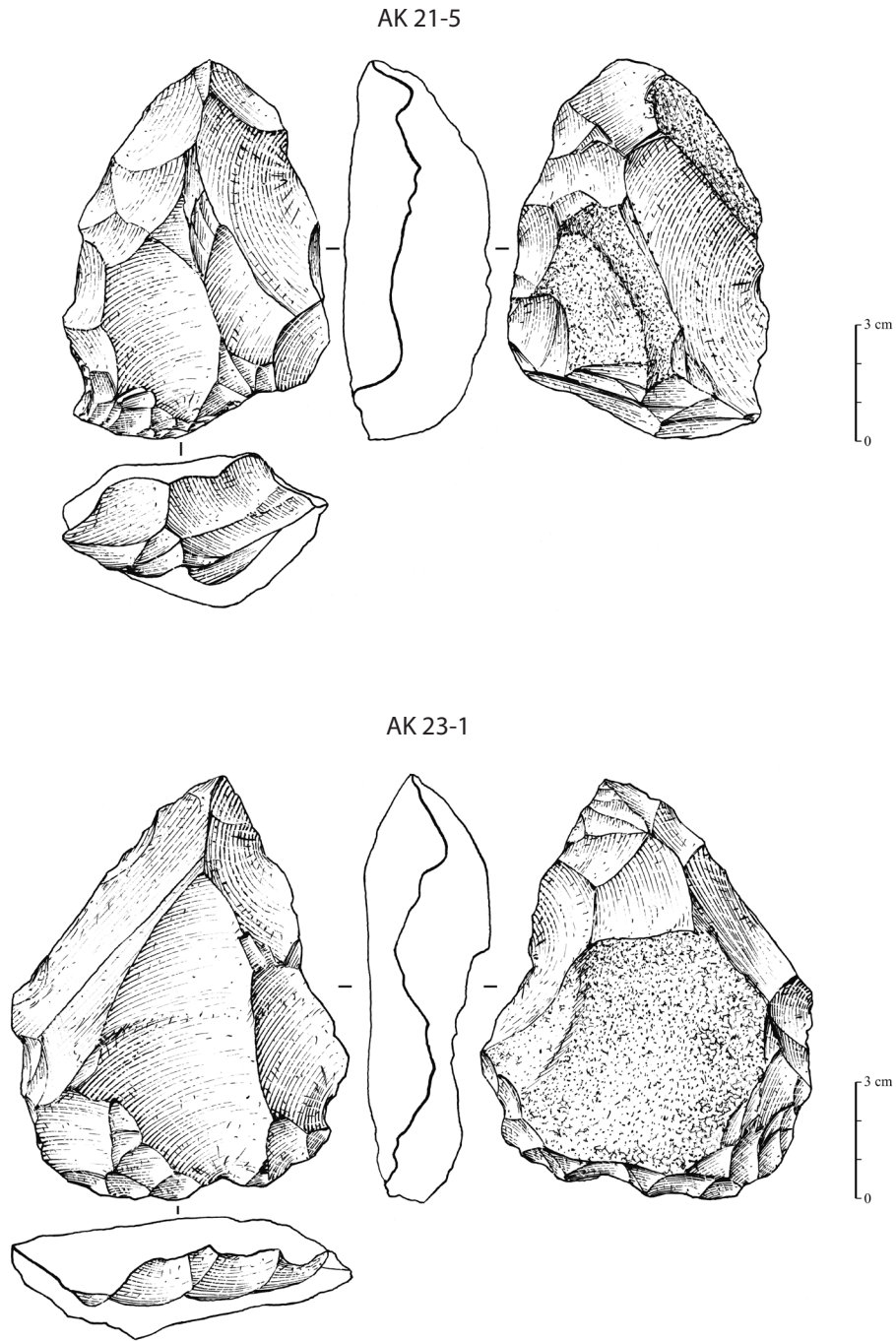


Figure 41 AK-21.5, abandoned un-struck Nubian core;
 AK-23.1, Nubian core with type 1 preparation
 (drawings: G. Devilder – French-Saudi
 Archaeological Mission in al-Kharj)

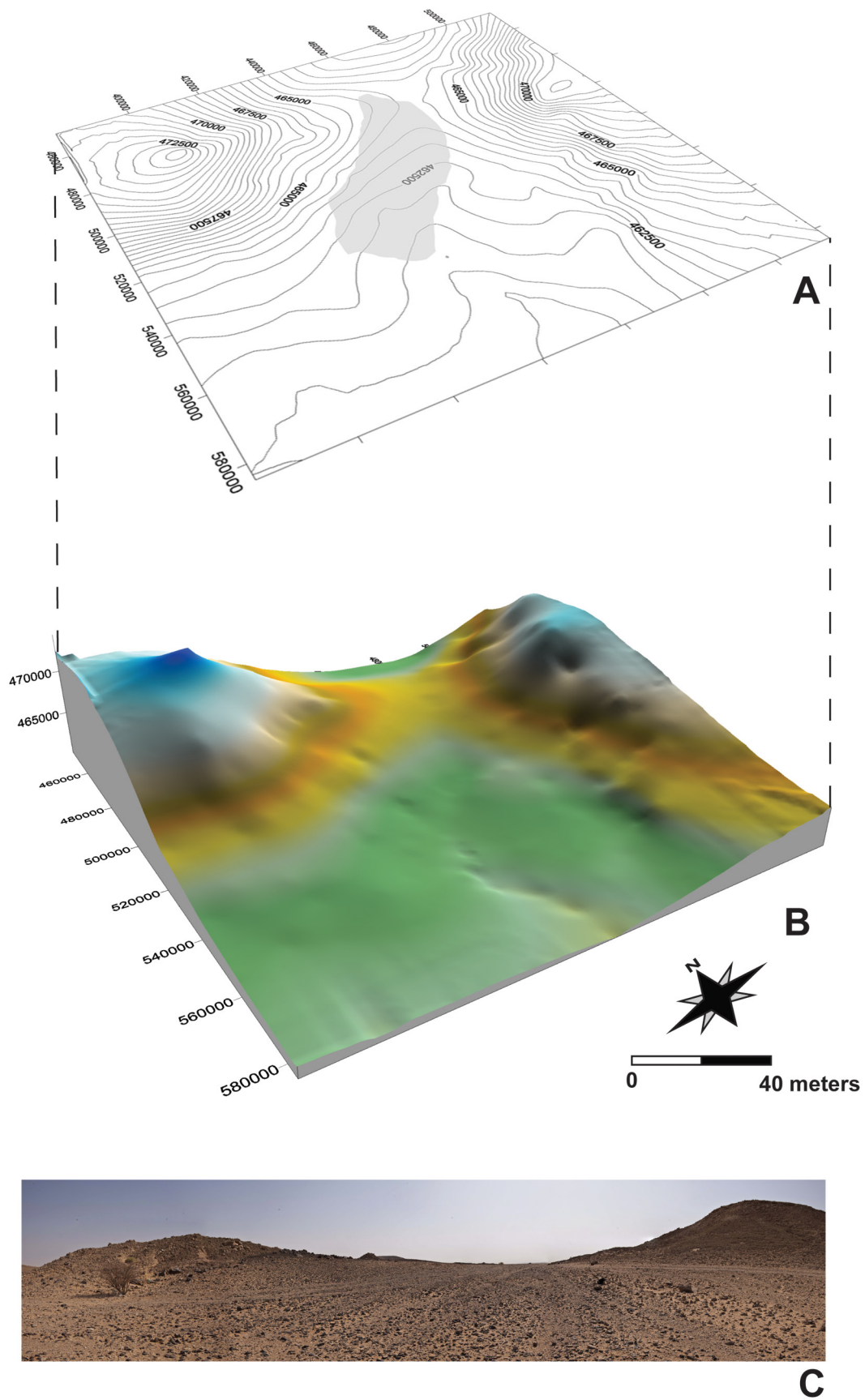


Figure 42 Topographic map of the site AK-22 (Y. Hilbert – French-Saudi Archaeological Mission in al-Kharj)

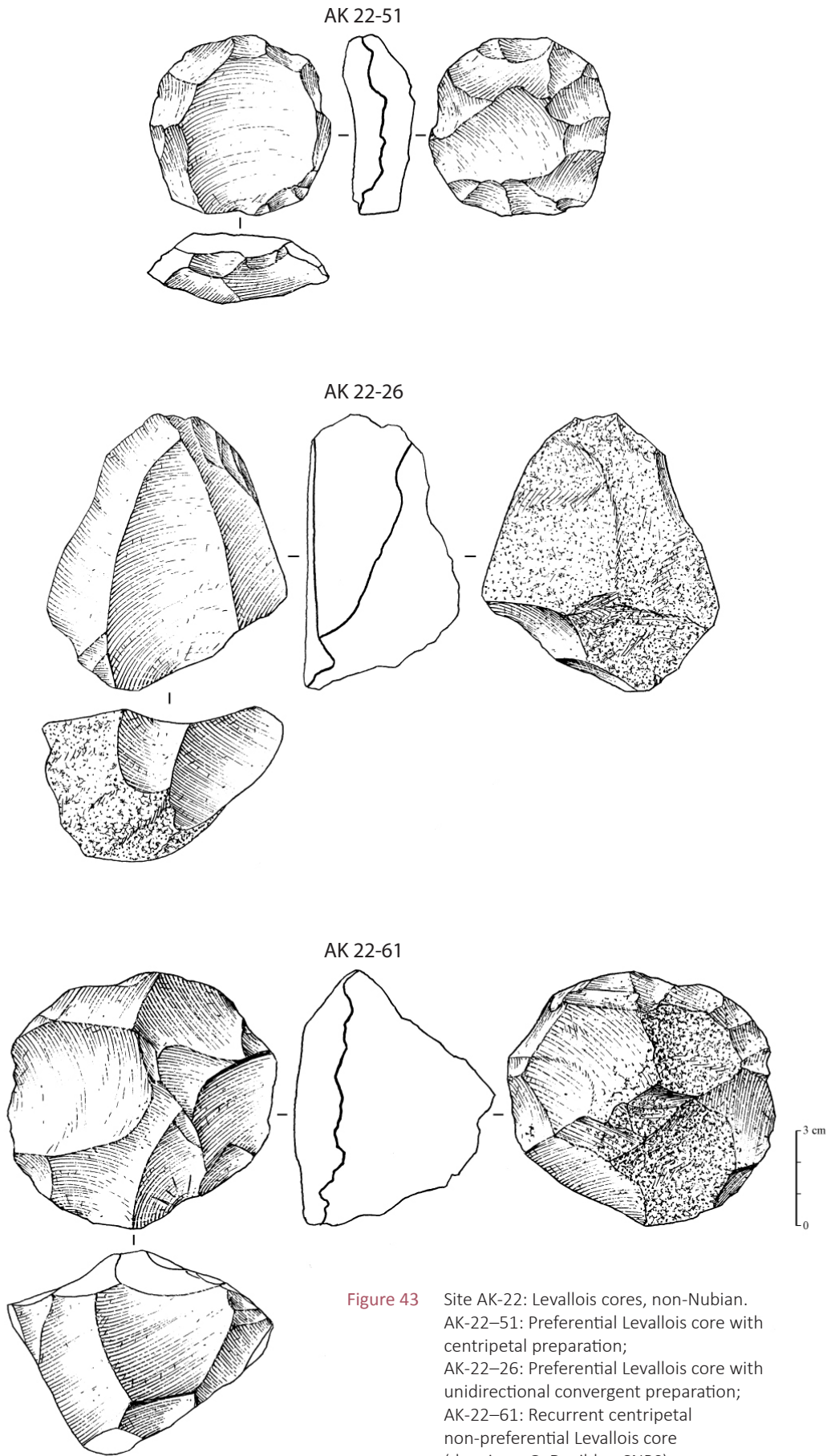


Figure 43 Site AK-22: Levallois cores, non-Nubian.
 AK-22-51: Preferential Levallois core with centripetal preparation;
 AK-22-26: Preferential Levallois core with unidirectional convergent preparation;
 AK-22-61: Recurrent centripetal non-preferential Levallois core
 (drawings: G. Devilder, CNRS)

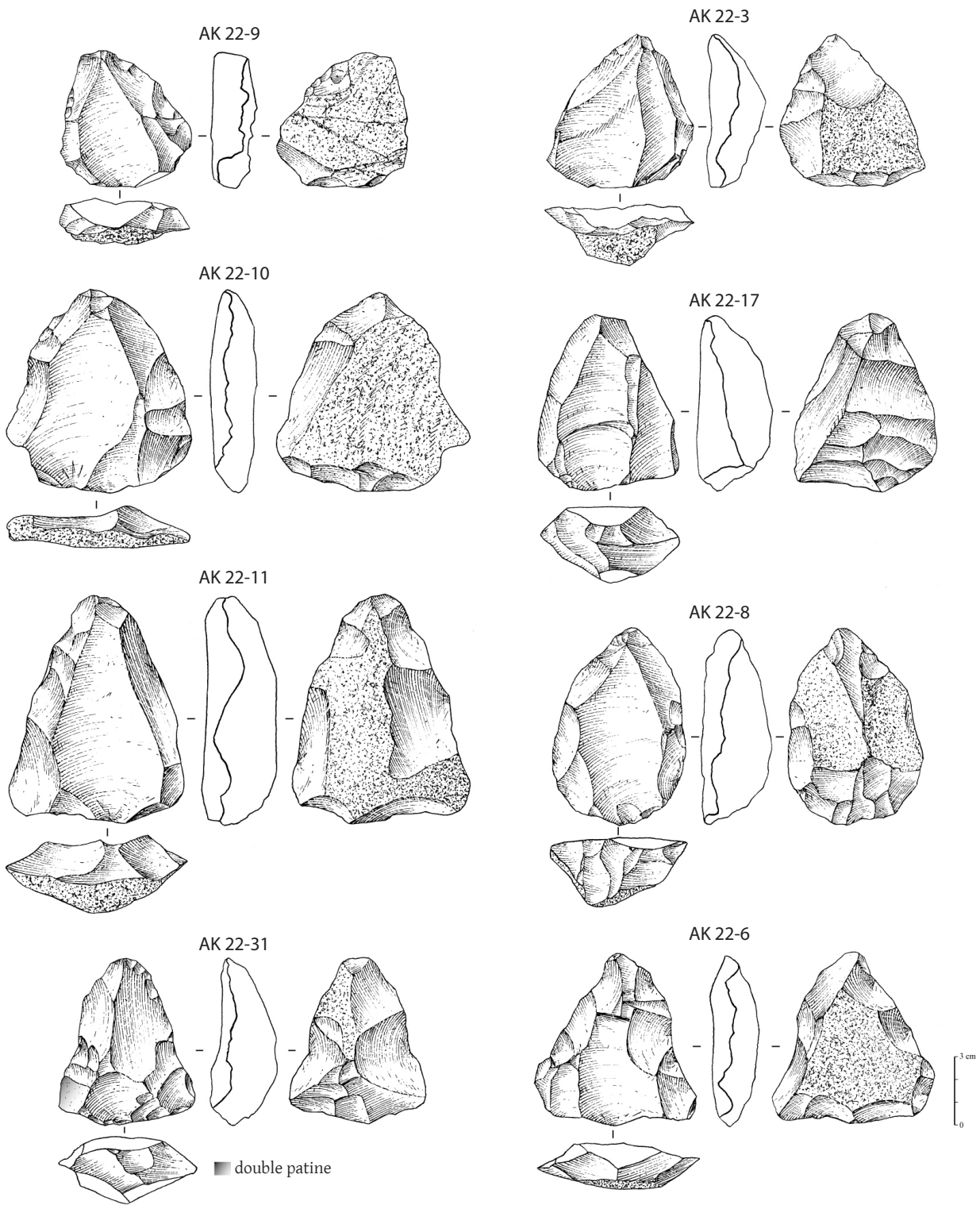


Figure 44 Site AK-22: Nubian preferential Levallois cores (drawings: G. Devilder, CNRS)

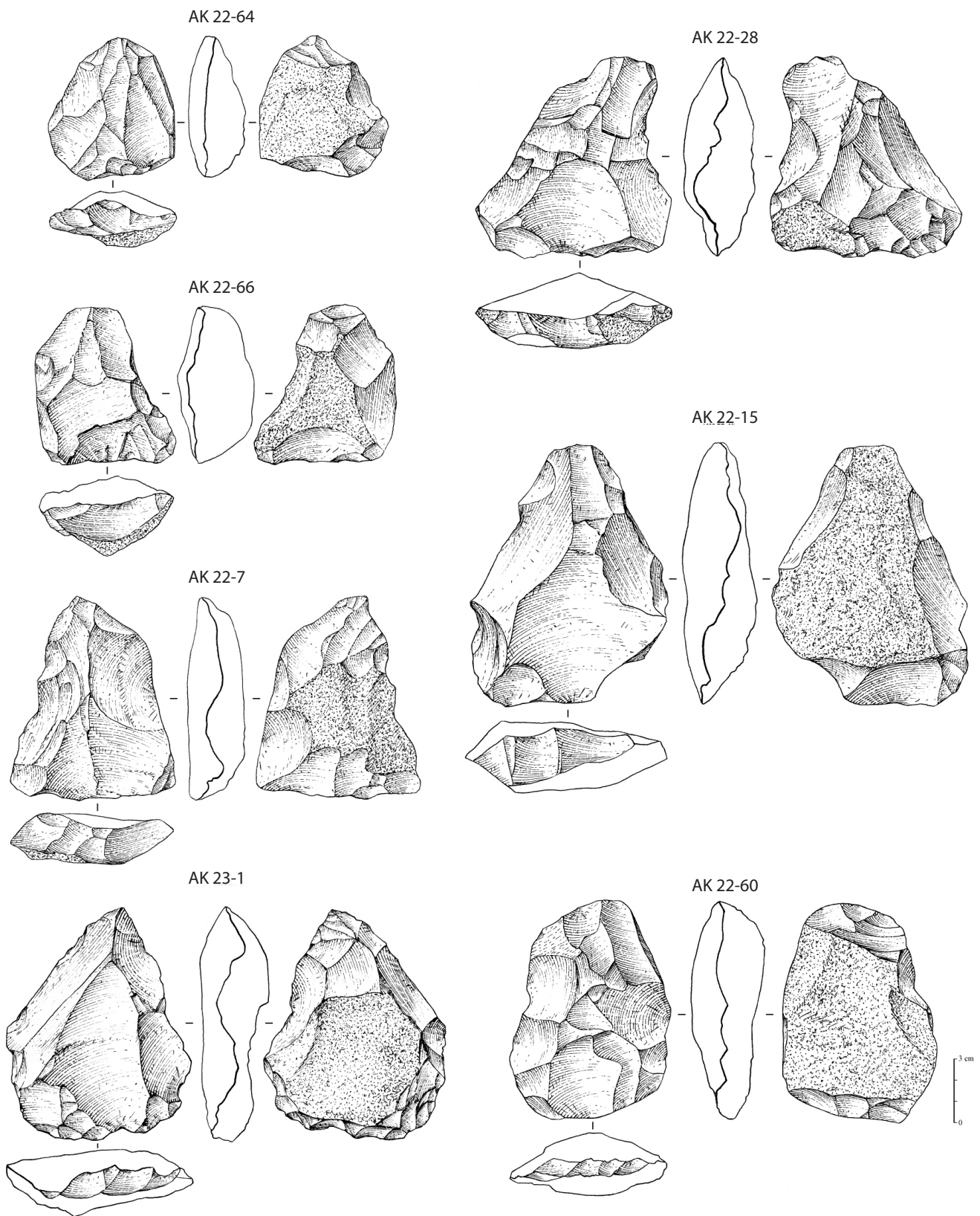


Figure 45 Site AK-22: Nubian preferential Levallois cores (drawings: G. Devilder, CNRS)

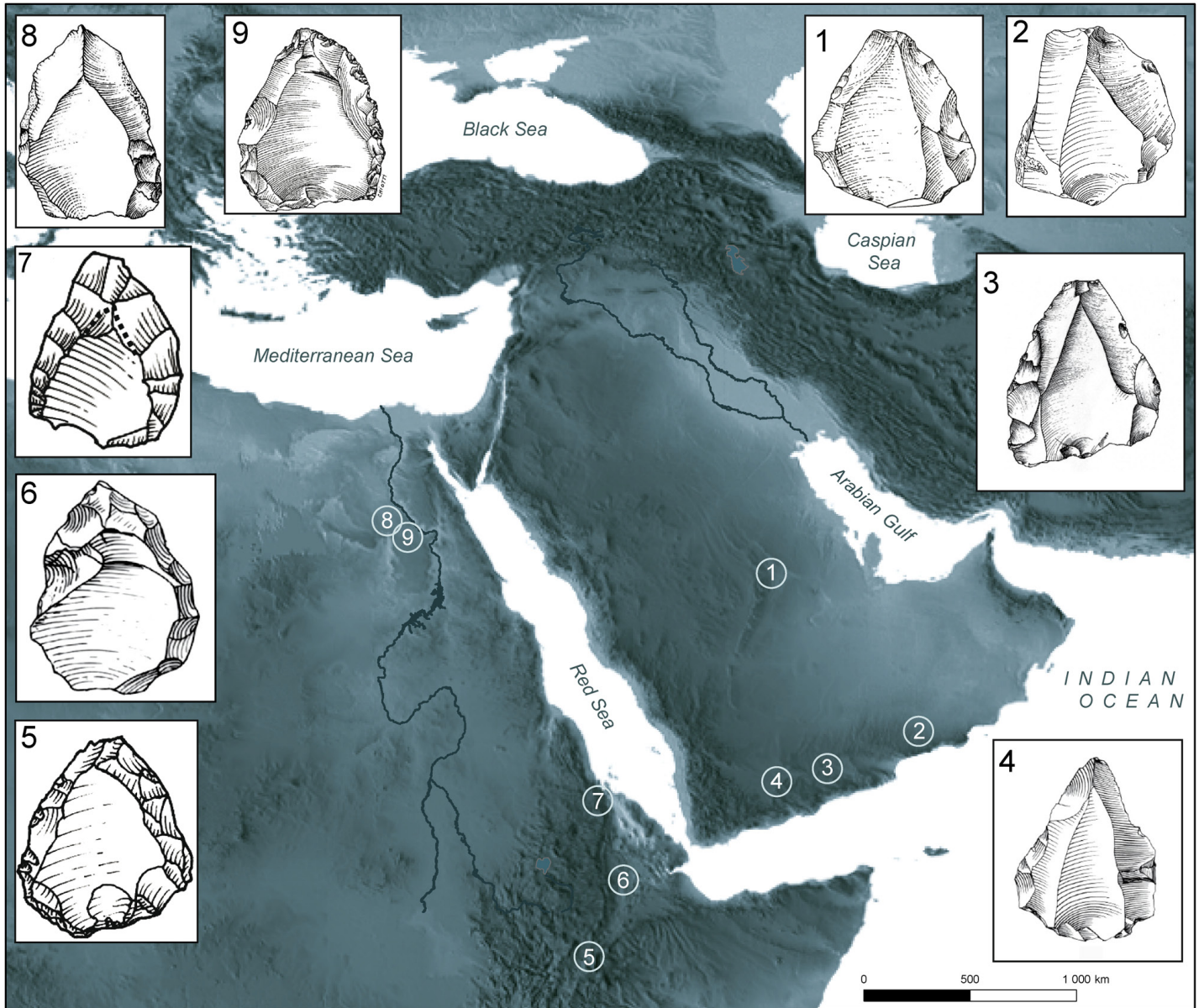


Figure 46 Distribution of main sites with Nubian cores in Eastern Africa and Arabia (map: O. Barge, E. Régagnon, R. Crassard & Y. Hilbert, CNRS, Lyon). Illustrated cores do not represent actual size. 1. AK-22 (this study); 2. Aybut al-Auwal (ROSE *et al.* 2011); 3. Shabwa (INIZAN & ORTLIEB 1996); 4. Ḥaḍramawt (CRASSARD 2008a); 5. Aduma (YELLEN *et al.* 2005); 6. Gademotta (WENDORF & SCHILD 1974); 7. Asfet (BEYIN 2013); 8. Nazlet Khater 1 (VERMEERSCH *et al.* 1990); 9. Abydos (CHIOTTI *et al.* 2007)

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