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The Bronze and Iron Age funerary landscape in central Arabia

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Abstract: Bronze and Iron Age tombs are a critical element in the archaeological landscape of the central Arabian oasis of al-Kharj. The Saudi-French archaeological Mission in al-Kharj identified seventeen necropolises on the ground, two of them comprising several hundred tombs. In the major necropolis at 'Ayn al-Dila', thirteen graves were excavated in 2013 and 2016, yielding data on the funerary practices and shedding light on chronological issues. This field approach was completed by remote-sensing analysis of the oasis of al-Kharj, which led to the geolocation of c.6,000 tumuli. Spatial analysis of these graves shows a distribution strongly dictated by proximity to building material and water sources as much as by land marking. The close proximity of the two main necropolises to palaeolakes raises the matter of the long-lasting activity of this hydrological feature in the area until the early Bronze Age, questioning the duration of the mid-Holocene humid phase in central Arabia. All in all, remote sensing and fieldwork provide us with an insight into the way of life, appropriation of land, and resources as well as the funerary practices of semi-mobile protohistoric populations.

Keywords: al-Kharj; Saudi Arabia; Bronze Age; funerary practices; landscape archaeology; spatial analysis

The Saudi-French Archaeological Mission in al-Kharj began in 2011. Over five field seasons, the aim of this joint project has been the study of the evolution of the settlement process from prehistory to the modern era in a central Arabian oasis surrounding the city of al-Kharj (Schiettecatte et al., 2011, 2012b; Crassard – Hilbert, 2013; Schiettecatte et al., 2013, 2014, 2015).

Located in the heart of the Najd, in central Arabia, the oasis of al-Kharj is a funnel-shaped valley profiting from water flows and perennial water sources that favoured the past settlement process (Schiettecatte et al., 2012a, 2016). West of the oasis, Jabal Tuwayq, which runs from north to south in central Arabia, is cut by a graben system through which run-offs and underground water flows from the Hijāz converge. Additionally, a series of cuetas, west of Jabal Tuwayq, lead surface and underground water flows along a north–south axis towards this funnel-shaped area (Figure 1). Finally, the chemical dissolution of limestone by groundwater has led to the formation of karst sinkholes south of al-Kharj, which have provided important perennial water sources.

INSERT FIGURE 1

This favourable environment has long been attractive for Arabian mobile and settled populations. Indeed, seventy-five archaeological sites have been located during the survey of the oasis (Figure 2): forty-seven Pleistocene sites; seventeen Bronze and Iron Age sites; and eleven late pre-Islamic and Islamic sites.

INSERT FIGURE 2

We have already devoted papers to the evolution of the settlement pattern in the oasis (Schiettecatte et al., 2012a, 2016), but none have focused on the specific issue of the protohistoric occupation, the remains of which consist only of isolated graves and necropolises. Several issues must be addressed on the chronology and on the way of life of local communities during this period. In this sense, excavations and spatial analyses of the distribution of the graveyards have proved significant.

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The recent excavations by the Saudi-French Archaeological Mission in al-Kharj of thirteen graves in the necropolis at ‘Ayn al-Ḍila’ and the completion of an MA dissertation on Arabian protohistoric funerary practices (Chevalier, 2015) prompted us to tackle these issues and to consider in a new light the Bronze and Iron Ages in the oasis of al-Kharj through the prism of funerary practices.

The Bronze and Iron Age tumuli in the oasis of al-Kharj: description, distribution, typology

The funerary protohistoric sites are an obvious feature in the regional landscape and have been mentioned by earlier travellers and archaeologists (Philby, 1920, p. 169, 1922, Vol. II, pp. 26–27, 38; de Gaury, 1945; Zarins et al., 1979, pp. 22–25; al-Ghazzi, 2011).⁵ These previous works had focused on the two major necropolises of the region of al-Kharj, ‘Ayn al-Ḍila’ and al-‘Afja. They provided a general description of each site and the results of the excavation of a few graves: two were excavated at ‘Ayn al-Ḍila’ but no detailed account of the excavation is provided (Zarins et al., 1979, pp. 24–25); a few graves were excavated at al-‘Afja and a limited publication exists (al-Ghazzi, 2011), but no systematic recording of the necropolises has been attempted nor any absolute dating obtained.

The first stage consisted in achieving a regional map of the distribution of the graves, that is, locating and counting the tumuli visible on high-resolution satellite imagery available online or on Pleiades images (SPOT image™).⁶ The selected area measured 50 × 30km (NW corner: E702922 N2692555 38N; SE corner: E754332 N2656484 38N). To begin with 5,888 potential funerary structures were registered. The mounds whose identification was questionable — possibly rubble heaps or natural relief, amounting to 3% or 193 features — were then removed from this total.

A total of 5,695 potential funerary structures were pinpointed in this way (Figure 3). The validity of the method was tested in the field by comparing the results of the remote-sensing survey with ground observation. It showed that 83 to 96% of the tumuli could be located in this way, depending on the resolution and contrast of available satellite images and on the geological and topographic context. This makes the distribution map representative enough to undertake spatial analyses.

INSERT FIGURE 3

Eleven densely built necropolises were identified, plus three areas dotted with sparse tumuli (Figure 3; Table 1).

Area (Fig. 3)	Place name	Number of potential funerary structures
1	‘Ayn al-Ḍila’ 1	2,814
2	al-‘Afja	1,584
3	Jabal Umm al-Sha‘āl	68
4	Jibāl Umm al-Rūs	144
5	Jibāl Umm al-Rūs	383
6	Al-Kharj Military Factories	168
7	‘Ayn al-Ḍila’ 1 - South	174
8	Wādī Nisāḥ North	38
9	Wādī Ḥanīfa South	18
10	Jibāl Umm al-Rūs	65
11	Jabal al-Qusay‘a	52
12	Wādī Nisāḥ North (sparse)	31
13	Jibāl Mughra (sparse)	62
14	Wādī Abā al-Dharr (sparse)	44

⁵ Although Philby did not overlook the necropolis of al-‘Afja, he initially described it as an ancient settlement (Philby, 1920, p. 167). The comments of Hogarth at the end of Philby’s description rectify the misunderstanding (Younghusband et al., 1920, p. 186), and the correct interpretation was later fully accepted (Philby, 1922, Vol. II, pp. 26–27).

⁶ This was the core of an MA dissertation by A. Chevalier (2015).

Table 1: Necropolises identified in **Figure 3** by remote sensing and the number of potential funerary structures counted on satellite imagery.

These sites showed four types of tombs.

Type 1: dry-stone tumulus, consisting of a heap of rough stones covering the burial place with no apparent masonry (**Figure 4**).

Type 2: circular or rectangular tomb with a dry-stone outer wall made of horizontal courses; the funerary chamber within the structure is bordered with vertical slabs or stone walls and covered by a corbelled vault and a heap of rough stones (**Figure 5**).

Type 3: identical to type 2 with an outer wall of vertical slabs (**Figure 6**).

Type 4: tapered structures, a wedge-shaped tomb described by Zarins as a ‘narrow tail usually built by erecting two vertical slabs less than 50cm apart and filling the space with rubble. The structure gradually lengthens and expands in size until the maximum width is achieved at the end of the “head” (Zarins et al., 1979, p. 24). A small rectangular funerary chamber is located within the ‘head’ (**Figure 7**).

Additional structures of two kinds have sometimes been observed with types 1, 2, and 3:

- Tail: elongated heap of randomly accumulated stones reaching up to 40m in length (**Figure 8**).
- Ring walls: heap of stone accumulated in the shape of a ring, 10 to 25m in diameter, surrounding or tangential to a tumulus (**Figure 9**).

A monumental version of types 2 and 3 consists of a two-step tomb with two superimposed and concentric circular outer walls built with vertical slabs or horizontal layers of stones (**Figure 10**)

INSERT FIGURES 4-5-6-7-8-9-10

Tapered structures and tumuli with additional structures remain uncommon in the region of al-Kharj. They represent only 3% of the corpus: 31 tombs with a ring wall; 58 tombs with a tail; and 98 tapered structures. The distribution of these specific types of tombs (**Figure 11**) shows that tapered structures and tumuli with tails are connected to the main clusters of circular tombs and tumuli. In the two main necropolises, however, they are located on the margins, which can be indicative of a social or chronological difference. With regard to the tombs with a ring wall, they are generally isolated and might be considered as a specific category, either non-contemporaneous with others, or signifying a social distinction between the people buried in them and the rest of the community. They are quite rare in the oasis, in contrast to the Yabrīn necropolis, 200km southeast of al-Kharj where it is a dominant type.

INSERT FIGURE 11

Since most of these categories are present in the necropolis of ‘Ayn al-Dīla’, and considering that it is by far the largest necropolis in the oases, it was decided to carry out excavation during the 2013 and 2016 field seasons.

Excavations at ‘Ayn al-Dīla’ (AD1)

The main necropolis in the oasis

‘Ayn al-Dīla’ 1 (AD1) is 4.4km long and up to 0.5km wide (**Figure 12**). It spreads on the western and northwestern edge of the Jibāl al-Qusay‘a, a clayey limestone plateau bordering al-Kharj valley to the south. The three large water sinkholes of the oasis are located at the foot of the plateau,

immediately to the northwest of the necropolis. Most of the site has been fenced off by the Saudi Commission for Tourism and National Heritage. It comprises *c.*3,000 tumuli.

Philby described the site as ‘a rocky ridge called Qusaia [Jibāl al-Qusay‘a], whose summit is surmounted by a vast concourse of cairn-like mounds’ (Philby, 1920, p. 169). G. de Gaury visited the site in the early 1940s (de Gaury, 1945, p. 152). In 1978, archaeologists taking part in the Comprehensive Survey of the Kingdom of Saudi Arabia registered this site with the number 207-20 (Zarins et al., 1979, pp. 23–25).

One can essentially distinguish between circular/rectangular tombs and tapered structures. The former are the most numerous (de Gaury’s type 1 and Zarins’s type A). They include a peripheral wall made of vertical slabs and a filling of rubble and stones between the peripheral wall and that 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. Some fifteen tombs are considerably taller, with larger stones and a flat earth-covered top (de Gaury’s type 2). To the southeast of the necropolis, Zarins mentions the same kind of tombs encircled by a wall of well-laid stones (Zarins’s type B). One of these was excavated (Zarins et al., 1979, p. 24). The funerary chamber had already been plundered. The Saudi-French Mission excavated seven tombs of this type.

The tapered structures (de Gaury’s type 3) are about 1m high and 9 to 41m long. At least twenty-four of these tombs are visible on satellite imagery; they are all concentrated south of the necropolis, together with the other types of tombs. One of these had been previously excavated (Zarins et al., 1979, p. 25) and reported to be looted and empty. The Saudi-French Mission has excavated five tombs of this type.

In the past sherds sampled on the ground have been indiscriminately attributed to the pre-Islamic period (Zarins et al., 1979, pp. 27, 34).

During its third field season (2013), the Saudi-French archaeological mission chose to excavate five tombs labelled AD1-01 to AD1-05 (Figure 13) to the north of the necropolis (area H10)⁷ (Figure 12), where the tomb density is the highest and their shapes homogeneous. The tombs were lined up along the edge of the plateau and built along a gully.

During the fifth field season, the excavation at AD1 was resumed (January 2016) to the south of the necropolis in areas A28, B27, C27, and D27 (Figure 14). Eight tombs were excavated and labelled AD1-06 to AD1-13. They are all located on the very edge of the limestone plateau.

INSERT FIGURES 12-13-14

The main characteristics of the thirteen tombs excavated so far are summed up in Table 2.

Tomb number	Type	Dimensions	Human bones	Artefacts
AD1-01	Type 3 – rectangular	4.7 × 3.3m	Presence	Beads (carnelian, seashell, stone) Bronze ring Iron object Pottery sherds Stone tool
AD1-02	Type 3 – rectangular	4.5 × 2.9m	-	Bronze object Pottery sherds
AD1-03	Type 3 – circular	Diam.: 3.9m	Presence	-
AD1-04	Type 2 – circular	Diam.: 1.5m	-	-
AD1-05	Type 3 – circular	Diam.: 4.4m	Presence	Bronze sword Pottery sherds Seashell

⁷ For practical reasons, the necropolis was divided into 100 × 100m squares, numbered 1 to 32 from north to south and labelled A to N from west to east (Figure 12).

AD1-06	Type 4 – Tapered structure	17.9 × 3.5m	-	Bronze object
AD1-07	Type 4 – Tapered structure	17.7 × 4m	-	-
AD1-08	Type 4 – Tapered structure	12.2 × 1.8m	-	-
AD1-09	Type 4 – Tapered structure	12.5 × 3.9m	-	-
AD1-10	Type 3 – circular	Diam.: 3.1m	-	Pottery sherds
AD1-11	Type 1 (?) + ring wall	Diam.: 2.9m Diam. of the ring wall: 13m	-	-
AD1-12	Type 3 – circular	Diam.: 4.5m	Presence	Animal bones Bronze objects
AD1-13	Type 4 – Tapered structure	17 × 2.1m	-	Shell beads

Table 2: Tombs excavated at AD1 (type, dimensions) and their artefacts.

Architectural features

Rectangular tombs

Two rectangular tombs were excavated (AD1-01, AD1-02), both in area H10 (Figure 15). Before excavation, they resembled a small- to medium-sized tumulus (5 to 7m in diameter). The two rectangular structures are bordered by four linear walls made of limestone slabs set on edge on the bedrock, sometimes strengthened by small pebbles at the base. Between these peripheral walls and the funerary chamber, the space was filled with large limestone blocks, pebbles, and loose sediment.

In the middle of the structure, a rectangular funerary chamber (1.3 to 1.7m long, 1.1 to 1.2m wide, and up to 1.1m high) was bordered by four perpendicular walls made of one or two standing limestone slabs, sometimes reinforced at the back by an abutment of stones. The covering system above the room was made of a corbelled vault. The capstone was either missing or present at the foot of the outer wall, as a reminder of ancient plundering.

INSERT FIGURE 15

Circular tombs

Five circular tombs were excavated, three in area H10 (AD1-03 to AD1-05), one in area A28 (AD1-10), and one in area C27 (AD1-12) (Figure 16). Apart from the generally circular shape, they share the same characteristics as the rectangular tombs described above. A peripheral wall was built of limestone slabs set on edge and small stones were inserted at the foot of the wall to strengthen the standing slabs. In the centre, the walls surrounding the funerary chamber were generally made of large slabs set on edge and their corners covered by capstones laid flat (corbelled roof). In one case (AD1-10), the corbelled vault had been built directly on the bedrock. The space between the circular peripheral wall and the funerary chamber was randomly filled with limestone blocks of different sizes and pebbles. In the case of AD1-05, a second circular wall surrounding the funerary chamber was laid above the inner filling. This small circular wall was preserved as a single course, made of irregular small to medium limestone blocks and giving the grave a two-step profile.

The funerary chambers are fairly small: 0.5 to 1.5m long, 0.5 to 0.95m wide, and 0.6 to 0.95m high.

Tomb AD1-04 is somewhat different (Figure 16). Discovered next to AD1-03 under the same tumulus, this small tomb (1.5m in diameter) is not bordered by a wall but simply made of limestone blocks laid one on top of the other. The central space, left empty, constituted the chamber. The covering system is missing. The chamber was only 20cm high and filled with a natural filling following a looting. No capstone, bones or artefacts were found inside.

INSERT FIGURE 16*Circular structure surrounded by a ring wall*

A single circular structure surrounded by a ring wall has been identified so far on the site (tomb AD1-11) (Figure 17). It is located in area D27, south of the necropolis and close to the concentration of tapered structures. Unlike the tapered structures, however, it is built 70m away from the ridge of the plateau, and not on the very edge. The grave thus appears slightly isolated.

Identified by remote sensing, the ring wall is hardly visible on the ground. It is only characterized by a denser concentration of small stones and pebbles, which could be the result of the silting up and weathering of a low structure.

A 20m-long east–west trench was dug, crossing both the ring wall from side to side and the tomb in the middle. The central tumulus (St1171) was built above the bedrock and badly preserved at a height of 20cm.

The two portions of the ring wall that were cleared showed dry-stone masonry with its inner part filled with loose stones. It measures 13m in diameter. Tumulus St1171 is c.2.9m in diameter. It is slightly off centre in the circle delineated by the ring wall and shows no clearly visible wall, only a small depression in the structure interpreted as a funerary room. No bones or artefacts were discovered.

INSERT FIGURE 17*Tapered structures*

Five tapered structures were excavated, one in area A28 (AD1-09), two in area B27 (AD1-06 and AD1-07), one in area B28 (AD1-08), and one in area C27 (AD1-13) (Figure 7, 18).

All these tombs are wedge-shaped, the widening of the head being more or less emphasized. They are bordered by four walls generally built with medium to large limestone slabs set on edge directly on the bedrock. In some cases, the external walls combined orthostats and courses of dry-stone masonry (AD1-08 and AD1-09). The length of the excavated tombs varies from 12.15 to 17.9m and the width from 1.8 to 4m.

No specific orientation of these graves has been favoured, some being oriented northeast–southwest (AD1-06 and AD1-09), others east–west (AD1-07 and AD1-08), or else northwest–southeast (AD1-13). The only common characteristic with regard to the location was the close proximity to the ridge of the plateau.

According to a small sounding done in tomb AD1-07, the filling between the outer walls includes stone blocks of various sizes, rubble, and sandy sediment.

A small funerary chamber is located in the head of the tomb, directly on the bedrock. It was covered with a corbelled roof made of limestone slabs. Some were still preserved. In two of the tombs (AD1-06 and AD1-07), the walls of the funerary chamber were made of huge stone slabs set on edge, sometimes completed with blocks of stone. The funerary chamber in the other graves was lined with walls in dry-stone masonry. The size of the funerary chambers varied from 0.5 to 1.15m in length, 0.5 to 1.1m in width, and 0.6 to 1m in height.

INSERT FIGURE 18

Stratigraphic sequence

In each of the two excavated areas, a common stratigraphic sequence was observed, the main difference between them being the rapid accumulation of aeolian sand to the south (areas A-B28, B-C27), which limited the chemical dissolution of the limestone observed further north (area H10).

In general, the tombs were built above a thin sandy indurated brown soil with inclusion of gravel and small pebbles covering the bedrock in the southern area, and on top of a gypsum crust covering the bedrock to the north. In some cases, this thin natural superficial layer had been dug to hold the vertical slabs in place.

After their abandonment the structures collapsed resulting, in the southern area, in a layer of hard sandy silt, rubble, and stones of various sizes above and around the structure; and in the northern area, in a layer of small stones, aeolian sediment, calcareous and chalky blocks that had undergone chemical dissolution, leading to the formation of a hard concretion.

A surface layer of sandy silt had settled all over the structures. The silting becomes thicker towards the south of the necropolis.

In the funerary chambers, original deposits were rare. Taphonomic conditions and looting have led to the disappearance of most of the human remains and few of the artefacts have been left untouched. In the southern part of the necropolis, only layers of aeolian sand accumulation have been found in the chambers, resulting from the reopening of the graves by looters, which was followed by a rapid silting. Further north, the slower rhythm of deposits has led to the progressive collapse of the base of the corbelled vault within the room.

Human remains

Several processes contributed to the decay of the graves and burials. To begin with, to the north of the necropolis the building material — a chalky limestone — underwent a natural chemical dissolution, which led 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 and are systematically splintered or powdery. In addition to these natural phenomena, the tombs were almost systematically reopened, either for reuse (AD1-01) or for plundering, which was clearly 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. To the south, the reopening of the chambers led to the exposure of human remains and an accumulation of aeolian sand, both of which contributed to the desiccation, crumbling, and disappearance of the bones. Thus, the presence of human remains was extremely rare, in spite of careful sieving of the sediments. Only four graves yielded human bones: three circular tombs (AD1-01, AD1-03, and AD1-05) and one tapered structure (AD1-13), only two of which contained bones in a suitable condition for detailed examination (AD1-01, AD1-05).

Grave AD1-01: two successive burials

In the funerary chamber R1023 of grave AD1-01, two successive burials were excavated.

Lower burial SR.1023.2 lies directly above the bedrock, in a 20cm-thick layer of loose brown silt with pebbles and limestone nodules (UF 1042 & 1044). Bones in a very bad state of preservation were scattered all over the surface of the room (Figure 19) and their anatomical distribution was incomplete. Identification of the bones was thus a difficult task, except for skull fragments, which were scattered but less damaged.

No evidence of more than one individual was found, and neither was any anatomical consistency observed, 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.

The presence of a sternal foramen, absence of abrasion on the dental enamel, and tooth size indicate that the individual was less than 15 years old. According to the bone morphology, the individual belongs within the 10 to 14 year-old age range. Examination of the teeth showed no dental deficiency-related stress.

In view of the absence of a pit or any digging through the layers, we are inclined to think that the disruption of the bones is the consequence of a reopening and looting of the burial when the funerary chamber was not filled with aeolian silt, in other words a short time after burial.

INSERT FIGURE 19

Upper burial SR.1023.1 lies above a 20cm-thick accumulation covering the earlier burial and resulting from the percolation of aeolian sediments and chemical dissolution of the limestone in the funerary chamber after it was reopened.

Bones were contained within a layer of loose homogeneous silt with inclusions of a 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 (Figure 20). Bones were largely decayed (powdery state), but nevertheless comprised almost all parts of the body, including the vertebrae and skull. Although their state of preservation allowed identification *in situ*, their sampling was almost impossible due to their damaged condition.

Bone identification indicated the presence of only a single mature individual. The spatial distribution of bones made it possible to analyse the distribution of anatomical series and to look for consistency in the burial deposit. Bones were concentrated in the eastern half of the room, c.30cm under the capstones. They lay on sloping ground (from south to north). The spatial distribution is coherent: cranial and facial bones and trunk elements (vertebrae, ribs) were denser to the south; there was consistency in the distribution of the group of central ribs. Upper limbs were also concentrated in the southern part. Bones from the hands (especially the left hand) were present and grouped together. Lower limbs were more randomly scattered. These observations are suggestive of a primary burial. Nevertheless, displacements were sometimes noticeable: some elements from the trunk such as the vertebrae were found 50cm away; the same was observed for the mandible.

With the exception of the discovery of small rodent bones, which might imply 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, its natural decay, and the presence of an empty space around the body, allowing the bones to fall from south to north according to the incline of the burial ground. In general, bone distribution indicates the body was leaning against the southern wall lying on the left side, with upper and lower limbs bent.

Bones from the trunk were in a better state of preservation and showed degenerative joint disease pathology (osteoarthritis).

INSERT FIGURE 20

To sum up, grave AD1-01 is a large rectangular tomb with a small rectangular funerary chamber that contained two successive burials. The lower one (S.R1023.2) was followed by a reopening of the tomb — probably by looters — and then covered by soil percolation. Later, a second individual was buried (S.R1023.1) on a higher level. This might have taken place long after the first one, as indicated by the sedimentation between the two burials, the difference in height, and the different deposits.

AD1-03: indeterminate bone fragments

The funerary chamber (R1021) of grave AD1-03 only contained the highly disturbed remains of the original burial (S.R1021.1). Very few bone fragments were found and their identification was not possible due to alteration and splitting. The burial was most probably plundered and the room left open after the event.

AD1-05: a single burial

Within the funerary chamber (R1028) of grave AD1-05, two successive stratigraphic events were identified: a burial and a reopening of the tomb followed by a partial collapse of the capstones, soil percolation, and post-abandonment filling of the room.

The lower part of the chamber contained the remains of burial S.R1028.1. It was excavated in two successive layers: UF 1045, directly above the bedrock, was a dense layer of brown to beige silt with inclusions of small pebbles and numerous bone fragments; UF 1037 was a dense layer of silt and pebbles with a few intrusive limestone blocks in the centre due to later looting of the grave. Numerous fragmentary and powdery bones were found.

Bones were scattered to the south, centre, and east of the chamber (Figure 21). To the west, the fall of large limestone blocks from the capstones had disrupted the bones. The limited number of bones, their alteration, and their bad state of preservation made osteological observations difficult. Their spatial distribution by anatomical series did not show any particular organization. The presence of small bones leads us to believe this to be a primary burial. The association of lower limb bones with the 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.

Nevertheless, bones from the trunk and skull fragments found in close proximity to lower limbs, and isolated skull fragments in the southeastern part of the room are indicative of an intrusion in the chamber subsequent to the burial.

Small bones and a diaphysis indicate that the individual was mature. Nothing can be said about its position or the way he/she was buried.

INSERT FIGURE 21

AD1-13: a tapered structure with a single bone fragment

Funerary chamber R1202 of grave AD1-13 yielded a single bone fragment in a sandy layer covering the bedrock and covered by the collapse of the eastern wall of the room. This decayed fragment of the diaphysis of a long bone (tibia?) testifies to the presence of at least one burial (S.R1207.1) in the tapered structure and underlines how the harsh taphonomy of the southern part of the necropolis impacted on human remains. Its presence precludes identifying these particular structures as cenotaphs.

Common features for the protohistoric funerary practices in the oasis of al-Kharj

From the few circular graves that have yielded human remains, a few general traits recur: these graves contained primary burials and 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 years old) was buried (primary burial). The same grave was reused later for the primary burial of a mature individual oriented north–south, on the left side, with bent legs. This second burial had apparently no association with the first one.

Other excavated circular tombs did not yield enough bone material to determine the nature of the graves. Nevertheless the funerary chambers are similar in size and shape to AD1-01 and AD1-05 and might also have contained a single individual. No selection by age was observed. In view of the tiny dimensions of tomb AD1-04, young immature individuals might have been buried here.

Interestingly, two circular tombs excavated in other necropolises of the oasis of al-Kharj showed the same features. On two occasions, A. al-Ghazzi excavated the complete skeleton of a mature individual in the right lateral decubitus position and buried in a circular tomb. The first at al-'Afja, in tomb O6 (al-Ghazzi, 2011, p. 291); the second at Umm al-Sha'al 1, Tomb 6 (al-Ghazzi, 2015, p. 156).

Chronological issues

Artefacts

Dating the tombs on the basis of funerary deposits is quite speculative because the rare artefacts that have been found are common objects (see Table 2, Figures 22–23). The dozens of sherds discovered in only four tombs are of moulded bowls generally in a coarse grey to beige sandy fabric (Figure 22). Most of the artefacts are small bronze objects, stone tools, and beads in soft stone, seashell, and carnelian.

A *terminus ante quem* for the development of the necropolis is provided by a short socketed spearhead found on the surface (Figure 23: AD1.surf.2), which is reminiscent of similar artefacts from the necropolis of al-'Afja, Yabrīn oasis, the Dhahrān necropolis, and the island of Bahrain, all dated to the early second millennium BC (Bibby, 1973, fig. 57; al-Mughannam, 1988, fig. 3a; Cleuziou, 1989, p. 29; Lombard, 1999, p. 68; al-Ghazzi, 2011, fig. 109).

In AD1-01, two artefacts deserve attention. In the lower burial, a carnelian bead (Figure 23: AD1.1042.1) is the only artefact indicative of a chronological attribution. Its morphology is common, but in the Oman peninsula most the carnelian beads of this shape are attributed to the Umm an-Nar period, even if this shape is still attested in the Iron Age. The hole was drilled with the bipolar rotary drilling technique, the only one used for such long beads during the Bronze Age.⁸ A date of the Early Bronze Age is likely but a more recent period cannot be excluded. For the upper burial, the presence of an unidentified iron artefact is evidence of a more recent burial.

In AD1-05, a bronze sickle sword was discovered above the bedrock. The blade is 30cm long and 4cm wide (Figure 23: AD1.1045.1). Its extremity is missing. The sword is broken between the handle and the blade. There is no parallel in Arabia for such a weapon.

To sum up, the rare artefacts found within the graves indicate a long use of the necropolis, from the late Early Bronze Age (socketed spearhead, carnelian bead) to the first millennium BC at the earliest (iron artefact). This chronological span was confirmed by the results of ¹⁴C analysis.

INSERT FIGURE 22-23

Radiocarbon dating

Three bone samples from the three individuals buried in graves AD1-01 and AD1-05 were collected for AMS ¹⁴C dating on the bioapatite. Sample preparation was conducted at the MNHN Lab and carbon isotope analysis was undertaken by the Laboratoire de mesure du carbone 14 (Saclay, France). The results are presented in Table 3 and Figure 24.

⁸ We are most grateful to Olivier Brunet who was kind enough to share his expertise on this artefact.

AMS Lab #	Tomb	Burial	Nature	%C	$\delta^{13}\text{C}$ AMS	Radiocarbon activity (pMC)	Radiocarbon age (^{14}C yrs BP)	Calibrated date [intcal09.14c (Reimer et al., 2009)] Two Sigma Ranges [start:end] relative area
SacA42311	AD1-01	SR- 1023.1	Bone apatite (Vertebra)	0.8	-8.9	73.85 \pm 0.26	2,435 \pm 30	[cal BC 751: cal BC 686] 0.215 [cal BC 667: cal BC 639] 0.067 [cal BC 618: cal BC 615] 0.002 [cal BC 594: cal BC 405] 0.715
SacA42312	AD1-01	SR- 1023.2	Bone apatite (Vertebra)	0.9	-14.7	63.15 \pm 0.23	3,690 \pm 30	[cal BC 2195: cal BC 2170] 0.049 [cal BC 2145: cal BC 2010] 0.895 [cal BC 2000: cal BC 1977] 0.054
SacA42313	AD1-05	SR- 1028.1	Bone apatite (epiphysis)	0.7	-10.4	63.86 \pm 0.22	3,600 \pm 30	[cal BC 2030: cal BC 1888] 1

Table 3: ^{14}C ages measured on bone apatite from the AD1 necropolis (Calibration conducted with the CALIB Radiocarbon Calibration Program ©1986–2011 M. Stuiver and P.J. Reimer)

INSERT FIGURE 24

The results of these ^{14}C analyses are consistent with the stratigraphical context and confirm the hypothesis drawn on the basis of burial deposits. The lower burial in tomb AD1-01 dates to the end of the Early Bronze Age (2195–1977 cal BC). After looting and a period of abandonment characterized by a collapsed layer and silt accumulation, the tomb was reused for a second burial in the Iron Age (751–405 cal BC), as was suggested by the deposit of an iron artefact.

The burial within tomb AD1-05 is contemporaneous with the first burial in AD1-01 and dated to the end of the EBA (2030–1888 cal BC).

The use of circular and rectangular tombs bordered by a wall of standing slabs is a practice that started no later than the end of the Early Bronze Age at ‘Ayn al-Dīla’. Some of these graves were reused during the Iron Age. The process of reoccupation of Bronze Age tombs more than a millennium after their abandonment is frequently attested in Ḥaḍramawt, Yemen (Crassard et al., 2011; McCorriston et al., 2011). At ‘Ayn al-Dīla’, however, it is not possible to ascertain whether the occupation was uninterrupted or not.

As regards the tapered structures, a date for their construction and use cannot yet be put forward. Their contemporaneity with other kind of structures remains a question mark pending new ^{14}C analysis currently being processed.

The funerary landscape of the oasis: spatial analyses

The remote-sensing survey mentioned above (Figure 3) has been the cornerstone of spatial analyses, the aim of which was to understand the distribution of the necropolises within the oasis. The analyses consisted in the integration of archaeological data vis-à-vis their topographical, geomorphological, and geological context in order to assess the role of the graveyards as landmarks and the weight of environmental factors in determining of their location.

Landmarks and territorial appropriation

A first approach has been to address the issue of necropolises and tombs as landmarks. The frequent location of Arabian cairns and tumuli on the crests, plateaus, and heights has often been mentioned (Ingraham et al., 1981, p. 69; Hashim, 1996, p. 106; Steimer-Herbet, 2004, p. 93), and hence they were endowed with a role as markers of socially organized territories (de Maigret, 1996,

pp. 333, 335; Cleuziou, 1997, pp. 100–106; Steimer-Herbet, 2004, pp. 94, 96; McCorrison, 2011, pp. 203–204).

To explore this hypothesis in the oasis of al-Kharj, an attempt to quantify the proportion of potential funerary structures located by remote sensing in the various topographical contexts has been made, by using the methodology of landform analysis developed by Weiss (n.d.), which consists in producing a map of the Topographic Position Index (TPI). On this map, the high and low points are identified on a Digital Elevation Model (DEM) by computing the difference in height between a location and its surroundings. The value attributed to each cell can be positive, near zero, or negative. ‘Positive TPI values represent locations that are higher than the average of their surroundings, as defined by the neighbourhood (ridges) [in red on Figure 25]. Negative TPI values represent locations that are lower than their surroundings (valleys) [in blue on Figure 25]. TPI values near zero are either flat areas or areas of constant slope [in yellow on Figure 25]’ (Weiss, n.d.).

INSERT FIGURE 25

In the oasis of al-Kharj, the TPI map (Figure 25) essentially shows three dominant features: the ridges of the *cuestas* and the crest lines in red, which overlook the neighbouring landscape; the lower slopes down from these dominant positions in blue, which are towered by these reliefs; and the alluvial plain, an almost flat area, in yellow. Interestingly, the projection of the necropolises over the TPI map shows that almost 72% of the tombs are located in areas overlooking the neighbouring landscape (red areas), that is, 4,087 out of 5,695 potential funerary structures. If the pattern is not systematic, nevertheless the large majority of the tombs are located on highly visible, elevated areas of the landscape. Moreover, groups of tombs overlooking neighbouring areas are concentrated on the edge of the confluence of the three main regional wadi systems — Wādī Ḥanīfa to the north, Wādī Nisāḥ to the west, and Wādī al-‘Ayn to the southwest —, a preferential grazing area (see below), reinforcing the hypothesis that necropolises had a role in the process of territorial appropriation by protohistoric populations.

Environmental conditions

Beyond the territorial dimension, the location of the necropolises was dictated by two environmental features: the proximity to building material and to a source of water.

Geological conditions

The projection of potential funerary structures on the geomorphological map of the oasis (Figure 26) shows that all the necropolises are located directly on geological formations of limestone and sandstone. The sites al-Rufaya 1, 2, and 3 are spread across a limestone terrace. The sites Jibāl Mughra 1 and 2 and al-‘Afja are located on sandstone outcrops. The sites of ‘Ayn al-Ḍila 1 and Wādī Abā al-Dharr are on the western and northwestern edge of Jabal al-Qusay‘a, an Early Cretaceous clayey limestone *cuesta*. Sheltered from the seasonal floods of the wadis, these locations provided a direct source of building material. The tombs are all built with rough rocks extracted *in situ*.

This explains why most of the tombs at ‘Ayn al-Ḍila’ are located along the gullies or on the ridge of the plateau, up the escarpment: these are the cut-off point of gently inclined clayey geological beds, c.20 to 30cm thick, where vertical seams in the limestone produce the brick-like appearance of the bedrock. Blocks can be easily extracted with minimal effort. This is particularly evident at AD1-06 (Figure 7), where the slabs surrounding the tapered structure have the same thickness as the geological bed that lies alongside it.

The nature of the building material also impacted on the architectural possibilities. At ‘Ayn al-Ḍila’, the small thick limestone blocks used as standing slabs only enabled low structures to be built, whereas the large thin slabs at al-‘Afja could be used for tall monumental graves.

INSERT FIGURE 26

Hydrogeological conditions

The necropolises never spread far from the alluvial plain and the wadi beds (Figure 26); the proximity to grazing areas and water sources might have been decisive and the concentration of most of the tombs in only two necropolises, ‘Ayn al-Ḍila’ and al-‘Afja, is due to the hydrogeology of the area. A map of the tomb density (Figure 27) shows that 77% (4,398 tombs out of 5,695) of potential funerary structures are concentrated in these two necropolises. Both these sites are specific in two ways.

INSERT FIGURE 27

First, each of them is located near the only two perennial sources of water in the region: an artesian spring flows at Abraḡ Farzān, 1km east of the eastern limit of the necropolis of al-‘Afja,⁹ and ‘Ayn al-Ḍila’ is only a few hundred metres southeast of three sinkholes which until recently were filled with water.¹⁰

Second, both necropolises overlook Holocene lacustrine deposits, which are evidence of palaeolakes (Figure 26). These deposits were investigated and sampled at al-Hayāthim, near ‘Ayn al-Ḍila’ (Chabrol et al., 2015).¹¹ Alternating sandy and silt deposits at a height of 5m clearly indicate Holocene changes in the local environmental dynamics. The stratigraphy is mainly composed of alluvial sandy sediments, probably deposited by wadi flows. The 1.5m-thick lacustrine deposits are only present at the top of the sequence and are mainly composed of very hard brown clay layers encrusted with gypsum, attesting to past shallow brackish water. This conspicuous former lake could have been filled with water, causing a rise in the water table. To assess the period of activity of this palaeolake, OSL sampling was carried out at the base of the sequence, 2m below the early lacustrine deposits. OSL age is $17,390 \pm 1,745$ (Table 4), which clearly indicates that the upper humid sequence is Holocene but without further dating, it is not possible to ascertain whether the palaeolake was still active at the time the necropolis started to expand. Previous work on the second palaeolake of al-Barra, near al-‘Afja, shows lacustrine activity at least during the mid-Holocene humid optimum (¹⁴C date on a shell indicated $7,000 \pm 400$ yrs BP, 6688–5043 cal BC) (Vaslet et al., 1991, p. 33). It is likely that there were no more real lakes in the EBA but the close proximity of the two largest necropolises of al-Kharj area to palaeolakes suggests a possible rise of the water table, making these areas moist lands and preferential grazing areas. This would imply that EBA had been having temporary wetter periods comparable to those identified in the ‘Awāfi lake sequence in the UAE (Parker et al., 2006a, pp. 472–473, 2006b, p. 129), in the Dead Sea transgression phases (Migowski et al., 2006), and in the Ḥaḍramawt fluvial system in Yemen (Berger et al., 2012), and labelled as mid-Late humid Holocene.

Sample #	Laboratory #	Aliquots	Particle Size (µm)	Equivalent Dose (Gray)	Overdispersion (%)	U (ppm)	Th (ppm)	Cosmic dose rate (mGray/yr)	K (%)	Dose rate (mGray/yr)	OSL age (yrs)
Yam P2 OSL 1	BG4081	37/50	425–500	3.81 ± 0.29	63 ± 7	0.31 ± 0.01	0.65 ± 0.01	0.17 ± 0.02	0.06 ± 0.01	0.22 ± 0.02	$17,390 \pm 1,745$

⁹ Used to supply an underground water channel (*kharaz*) in the Islamic period, it is now dried up due to a drop in the water table as a result of extensive use of mechanical pumping for intensive agriculture.

¹⁰ As for the spring at Abraḡ Farzān, the water from these sinkholes was diverted thanks to the use of *kharaz* towards the core of the oasis in the alluvial plain in the eleventh century AD at the latest (Schiettecatte et al., 2012a, pp. 1388–1393, 2016).

¹¹ The study was conducted during the 4th field season by A. Chabrol (École française d’Athènes), M. Diniès (Deutsches Archäologisches Institut, Berlin), and E. Fouache (Paris Sorbonne University – Abu Dhabi).

Table 4: Optically stimulated luminescence (OSL) age on quartz grains from fluvial deposits at al-Hayāthim, Saudi Arabia (OSL dating undertaken by the Dept. of Geology, Baylor University, Waco TX).

Conclusion

The study of seventeen necropolises and the excavation of thirteen tombs at ‘Ayn al-Dīla’ have revealed that despite appearances, the protohistoric graves are quite homogeneous; the building technique is generally the same and the changes are above all a consequence of the variations in the local substratum. The only major differences concern the shape (cairns vs. tapered structure) and the presence of additional structures (a tail or a ring wall).

Human remains discovered in six tombs from three different graveyards, have consistently supported the hypothesis that graves were meant for a single primary burial with no age discrimination. The few artefacts and radiocarbon dating on the bone apatite indicated a development of these funerary practices during the final centuries of the Early Bronze Age (*c.*2200–1900 BC). It does not preclude occasional reuse of graves in the Iron Age (eighth–fifth cent. BC). These results only stem from the excavation of cairns, but tapered structures were built in an identical way, and their chamber was seemingly also meant for a single individual. This speaks in favour of a common, perhaps contemporaneous, tradition.

In the region of al-Kharj, the location of all the necropolises was strongly dictated by both the geological context — choice of areas providing sources of building material — and the hydrological context. The proximity of watered areas has been decisive in the development of the graveyards, the location of the two main necropolises being dictated by the presence of an artesian spring in one case, of sinkholes in the other, and of former palaeolakes in both cases. Lastly, the topography might also have been critical: the necropolises are spread over terraces, plateaus, and outcrops, away from the threat of floodwaters and in a dominant position. As markers in the landscape, they could have been part of the appropriation of land by protohistoric populations.

Characterizing the way of life of these populations is necessarily conjectural. The regional absence of any evidence of a sedentary life — neither settlement nor agricultural practices — before the fifth century BC (Schiettecatte et al., 2016) would prompt us to define them as mobile groups. The size of the two major necropolises — respectively *c.*3,000 and *c.*1,600 tombs — as well as the systematic presence of primary burial where human bones are preserved would indicate, however, that the communities which buried their dead there were only moving around within a small radius. The probable presence of preferential grazing areas at the location of former palaeolakes or near the sinkholes and an artesian spring, would have encouraged people to adopt this way of life.

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Captions

Fig. 1: Location of the oasis of al-Kharj and its setting (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 2: Archaeological map of the oasis of al-Kharj (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 3: Map showing the distribution of the protohistoric necropolises and isolated tumuli in the oasis of al-Kharj (A. Chevalier).

Fig. 4: Wādī Abā al-Dharr: dry-stone tumulus (Type 1) (A. Chevalier).

Fig. 5: al-‘Afja: circular tomb with an outer wall in dry-stone masonry (Type 2) (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 6: al-‘Afja: circular tomb with an outer wall in vertical slabs (Type 3) (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 7: ‘Ayn al-Ḍila’: excavated tapered structures AD1-06, AD1-07, and AD-08 (Type 4) (Th. Sagory – Saudi-French Archaeological Mission in al-Kharj).

Fig. 8: Qawīd Farzān: tomb with a tail (G. Fortin – Saudi-French Archaeological Mission in al-Kharj).

Fig. 9: Wādī Nisāh: tumulus surrounded by a ring wall (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 10: al-‘Afja: monumental two-step tomb (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).

Fig. 11: Map showing the distribution of the specific types of tombs in the oasis of al-Kharj (A. Chevalier).

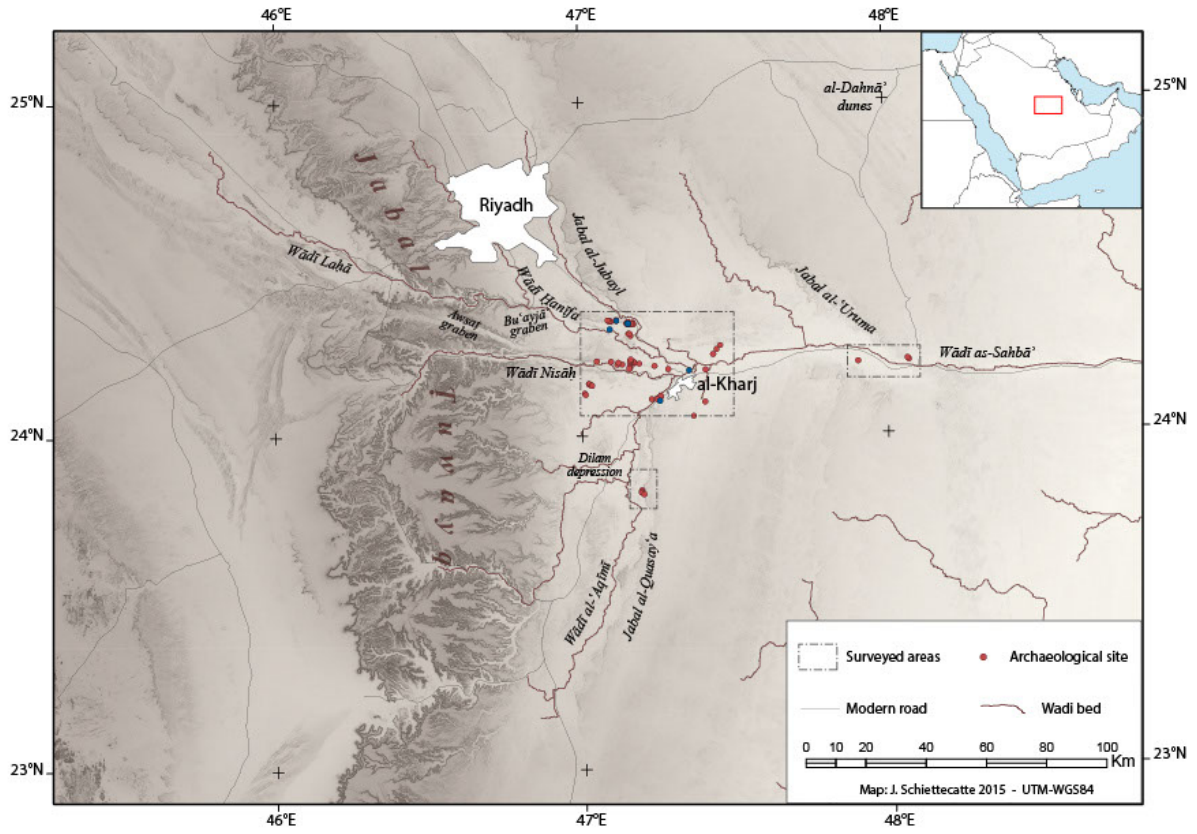
- Fig. 12: Map of the necropolis of 'Ayn al-Dīla' (AD1) (J. Schiettecatte – E. Wermuth – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 13: 'Ayn al-Dīla' 1: plan of the excavated area H10 (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 14: 'Ayn al-Dīla' 1: plan of the excavated areas A28, B27, C27, D27 (J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 15: 'Ayn al-Dīla' 1: plan of rectangular tomb AD1-01 (A. Chevalier – L. Munduteguy – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 16: 'Ayn al-Dīla' 1: plan of circular tombs AD1-03 and AD1-04 (L. Munduteguy – J. Schiettecatte – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 17: 'Ayn al-Dīla' 1: plan of tomb with a ring wall AD1-11 (A. Chevalier – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 18: 'Ayn al-Dīla' 1: plan of tapered structure AD1-06 (A. Chevalier – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 19: Tomb AD1-01, lower burial S.R1023.2. Distribution of artefacts and anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).
- Fig. 20: Tomb AD1-01, upper burial S.R1023.1. Distribution of artefacts and anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).
- Fig. 21: 'Ayn al-Dīla' 1: tomb AD1-05, burial S.R1028.1. Distribution of artefacts and anatomical series (E. Wermuth - Saudi-French archaeological Mission in al-Kharj).
- Fig. 22: 'Ayn al-Dīla' 1: bowls from grave AD1-10 (L. Munduteguy – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 23: 'Ayn al-Dīla' 1: artefacts from graves AD1-01, AD1-05, AD1-12, AD1-13 and surface (L. Munduteguy – Saudi-French Archaeological Mission in al-Kharj).
- Fig. 24: ^{14}C ages measured on bone apatite from AD1 (J. Schiettecatte, after CALIB Radiocarbon Calibration Program ©1986-2011 M. Stuiver and P.J. Reimer).
- Fig. 25: Map of the topographic position of the potential funerary structures in the oasis of al-Kharj. Red: high locations; blue; low locations; yellow: flat areas (A. Chevalier).
- Fig. 26: Geomorphological map and necropolises of the oasis of al-Kharj (A. Chabrol - G. Fortin - J. Schiettecatte – Saudi French Archaeological Mission in al-Kharj).
- Fig. 27: Map showing the tomb density in the oasis of al-Kharj (A. Chevalier).

Table 1: Necropolises identified in [Figure 3](#) by remote sensing and the number of tumuli counted on satellite imagery.

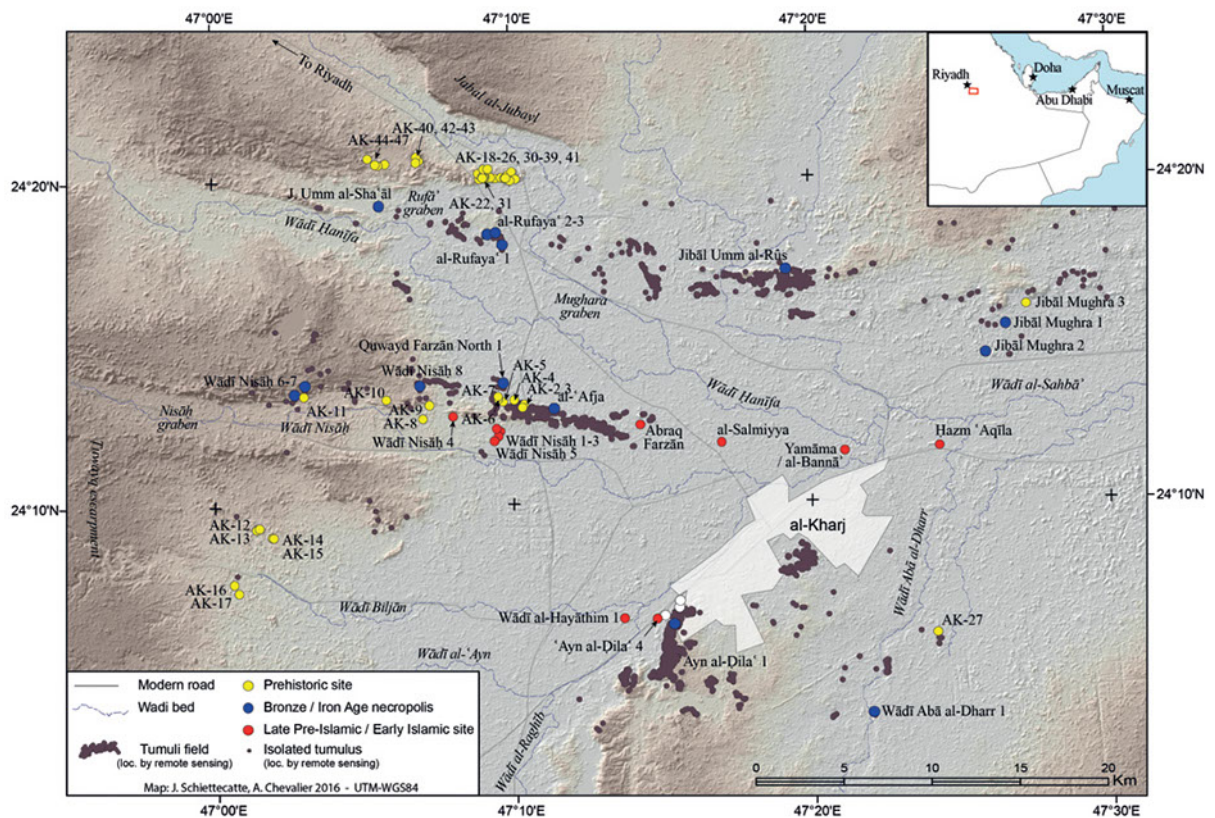
Table 2: Tombs excavated at AD1 (type, dimensions) and their artefacts.

Table 3: ^{14}C ages measured on bone apatite from AD1 (Calibration made with CALIB Radiocarbon Calibration Program ©1986-2011 M. Stuiver and P.J. Reimer).

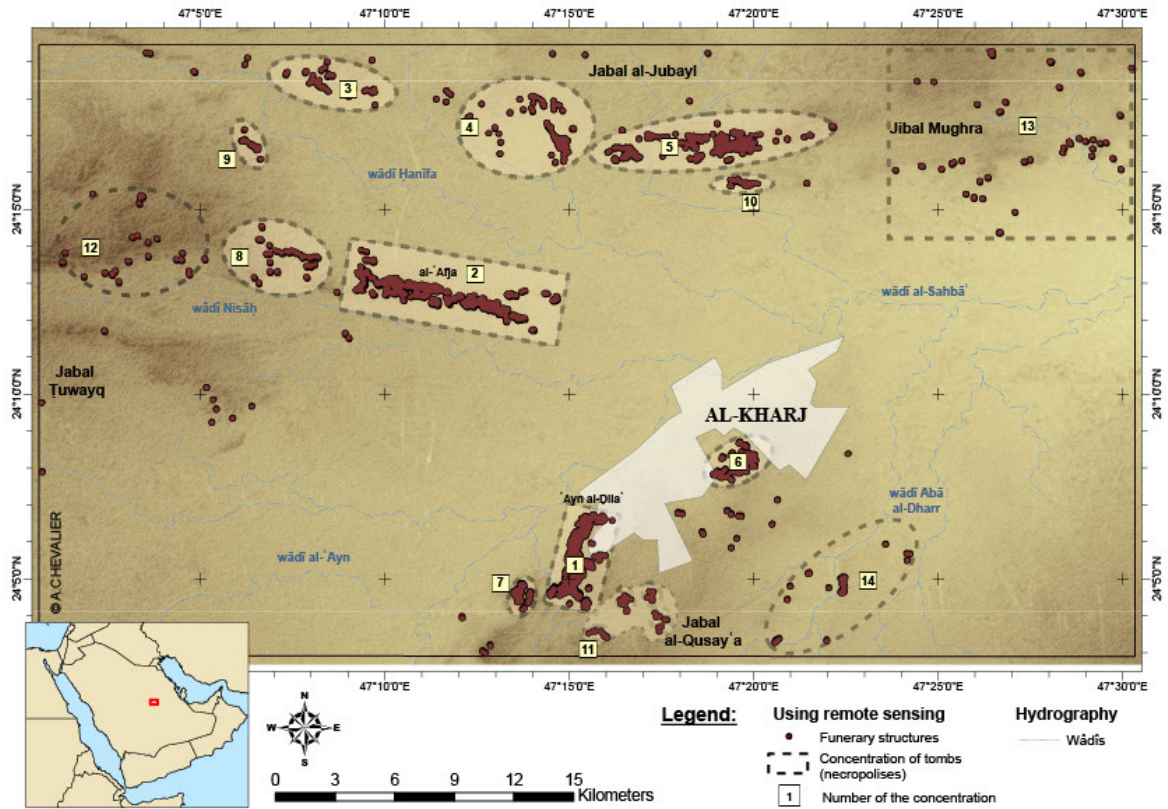
Table 4: Optically stimulated luminescence age on quartz grains from fluvial deposits at al-Hayāthim, Saudi Arabia (OSL dating undertaken by the Dept. of Geology, Baylor University, Waco, TX).



Fig_1_Regional_Map



Fig_2_Kharj_2016_Survey



Fig_3_Necropolises



Fig_4_Type 1



Fig_5_Type 2



Fig_6_Type 3



Fig_7_Tapered Structures



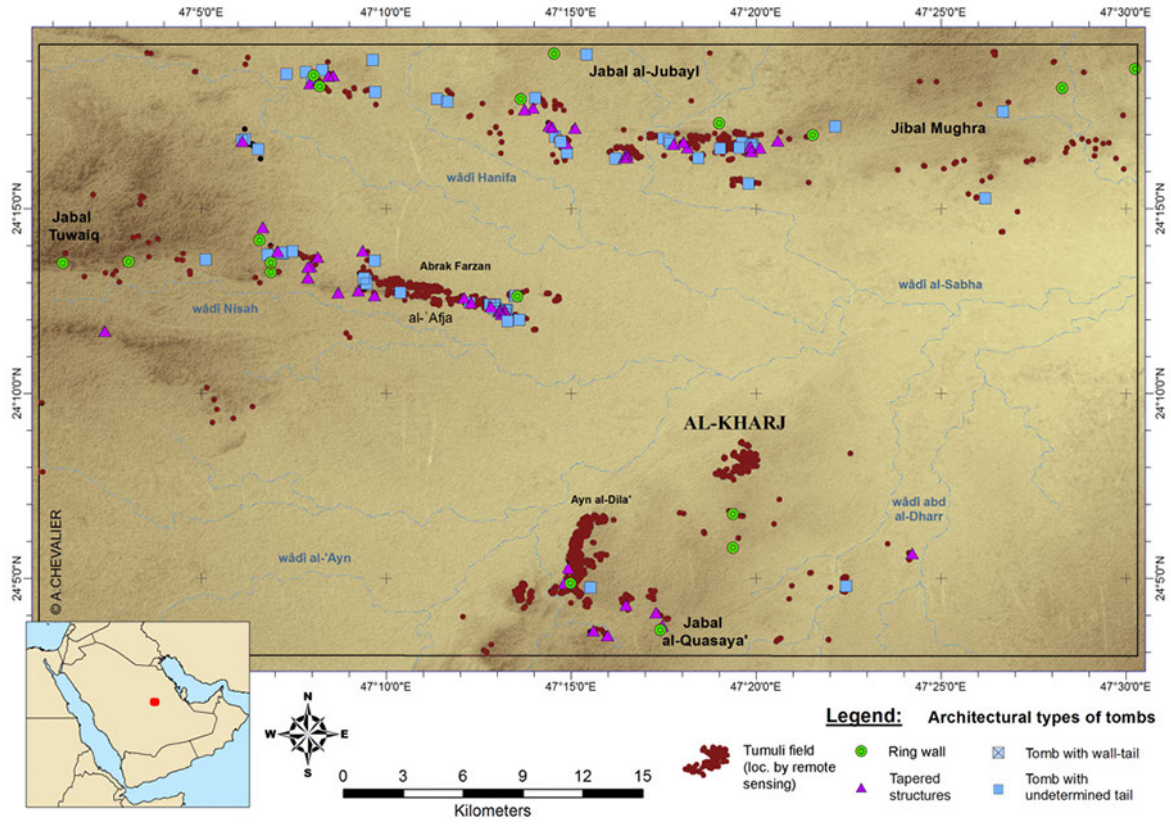
Fig_8_Tail



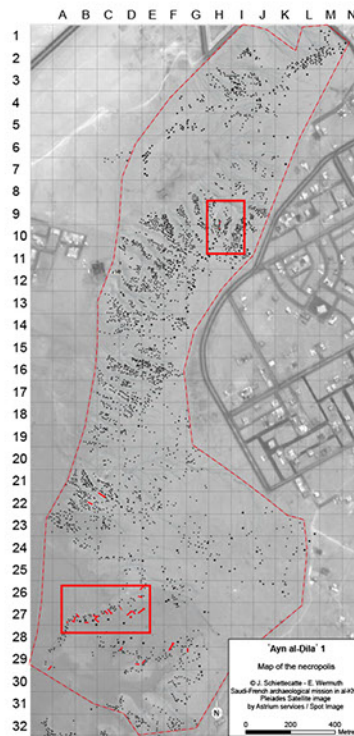
Fig_9_RingWall



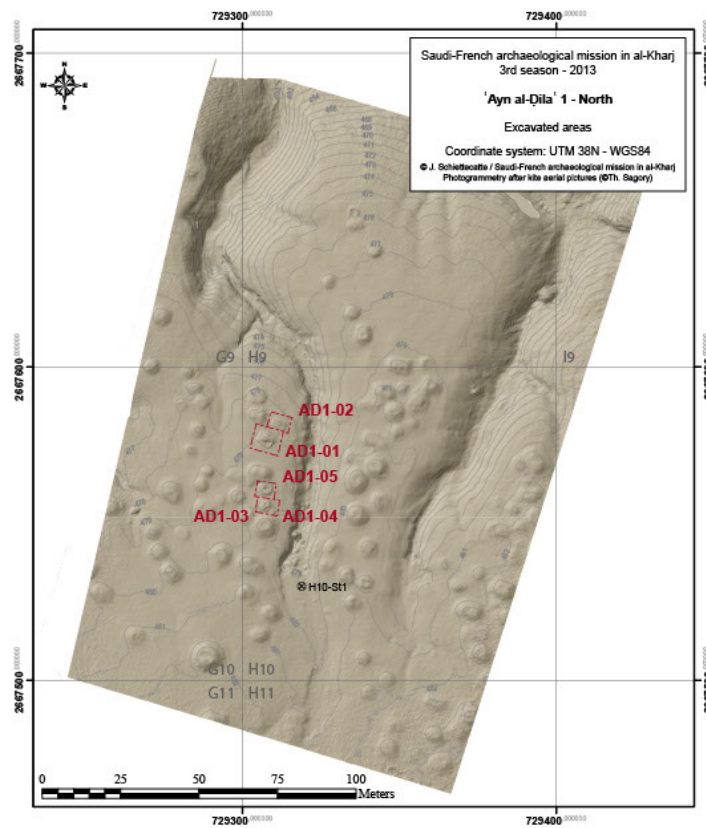
Fig_10_Monumental



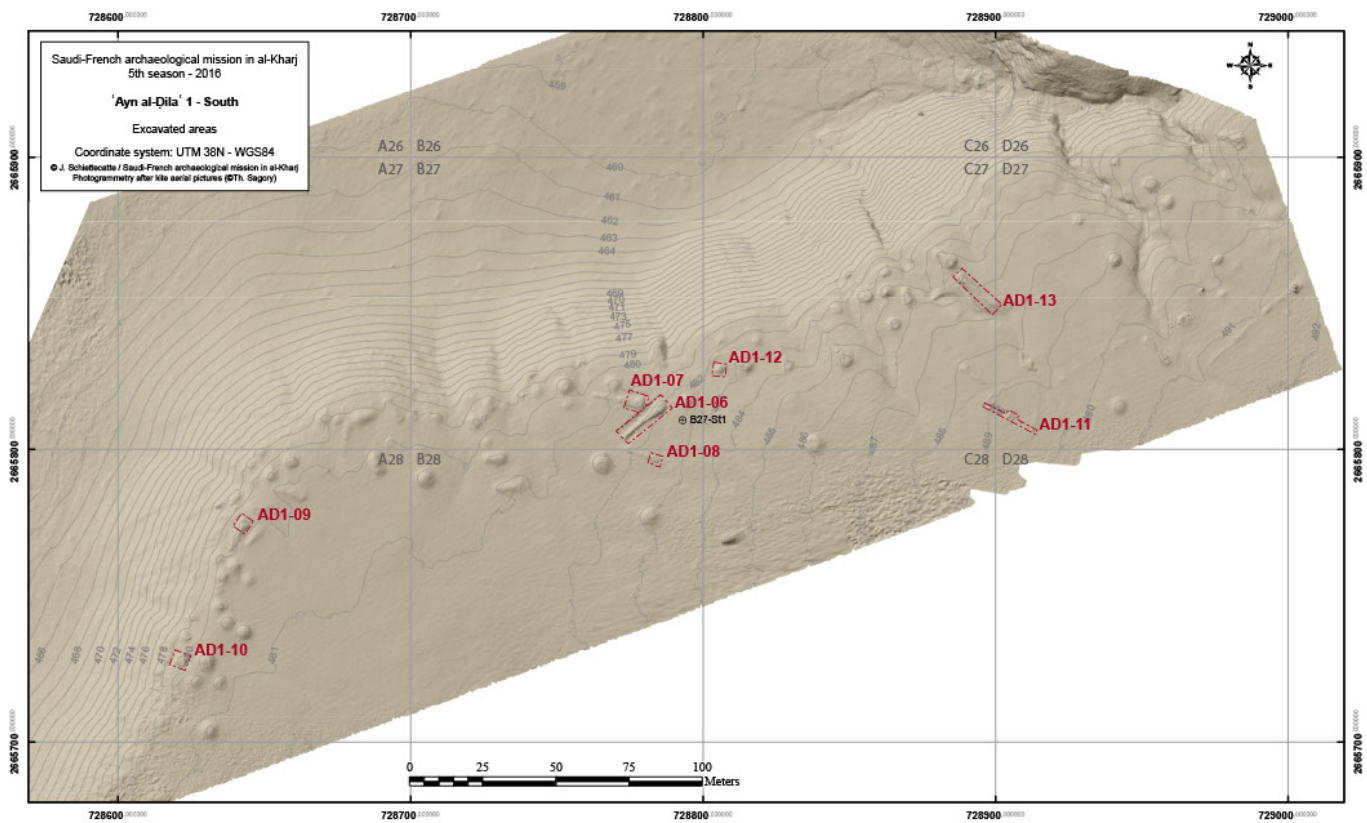
Fig_11_Map types



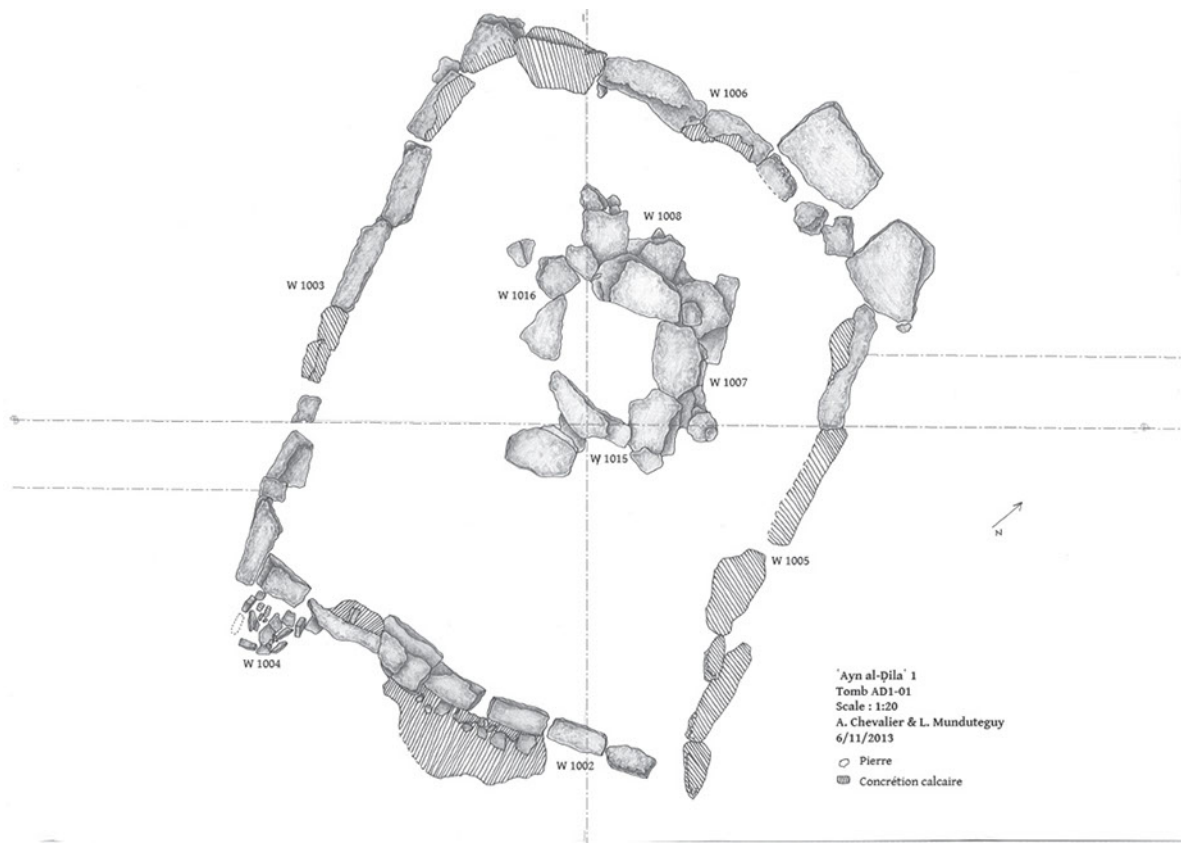
Fig_12_AynDila_Plan



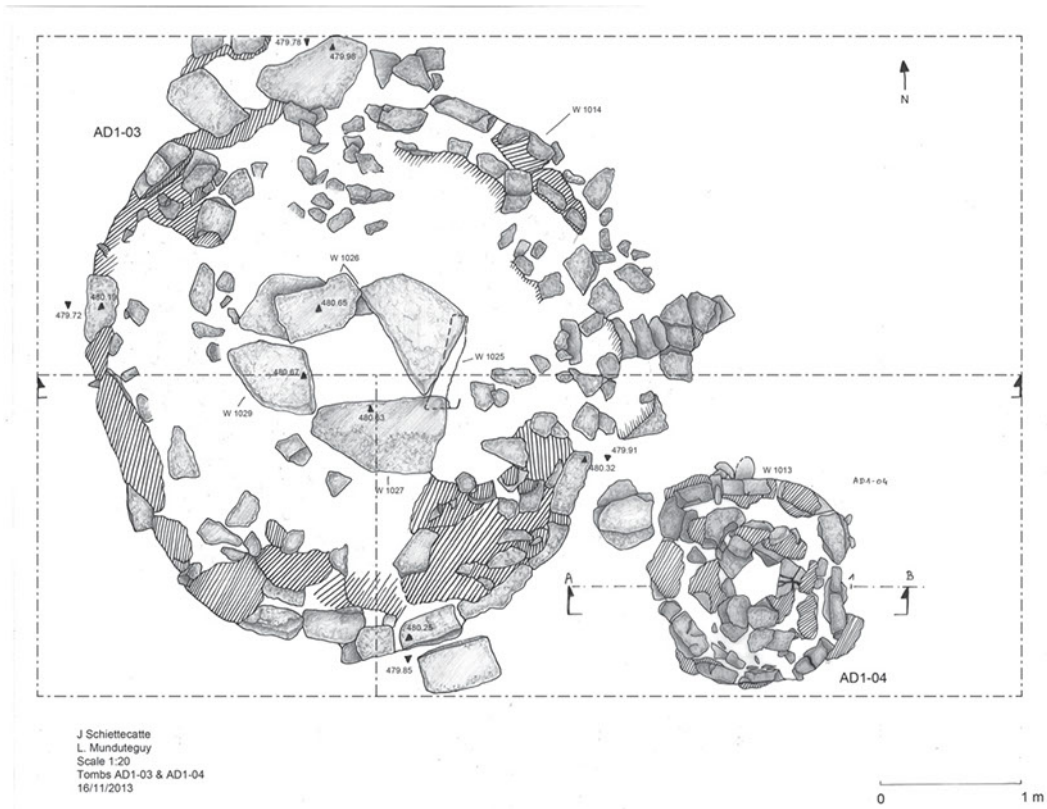
Fig_13_AynDila_Plan_H10



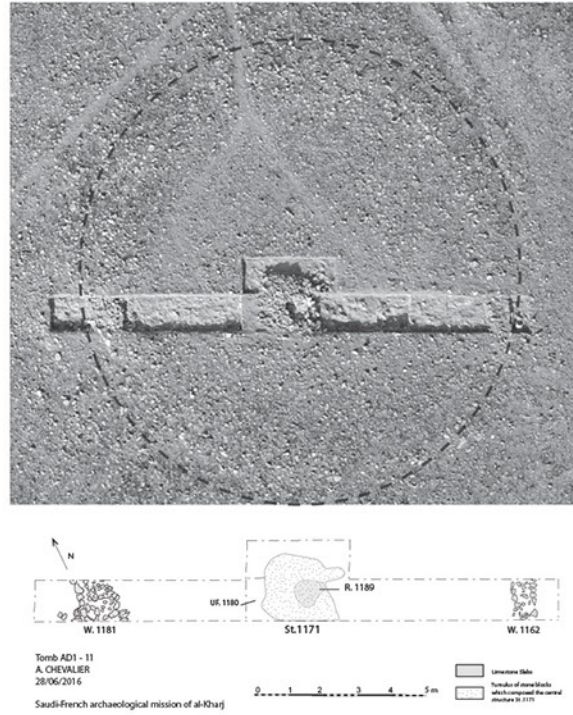
Fig_14_AynDila_Plan_B27



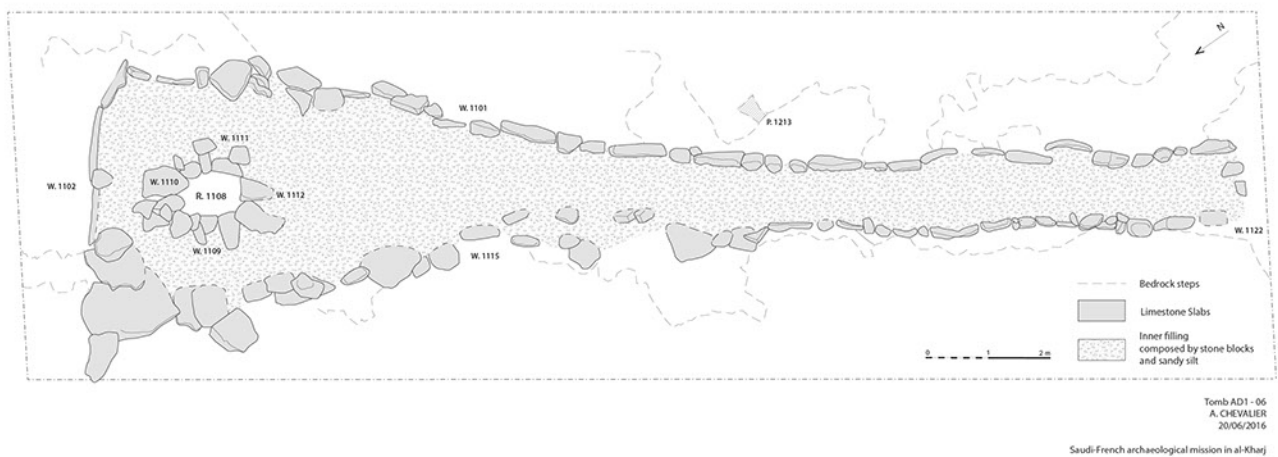
Fig_15_AD1-01 Plan



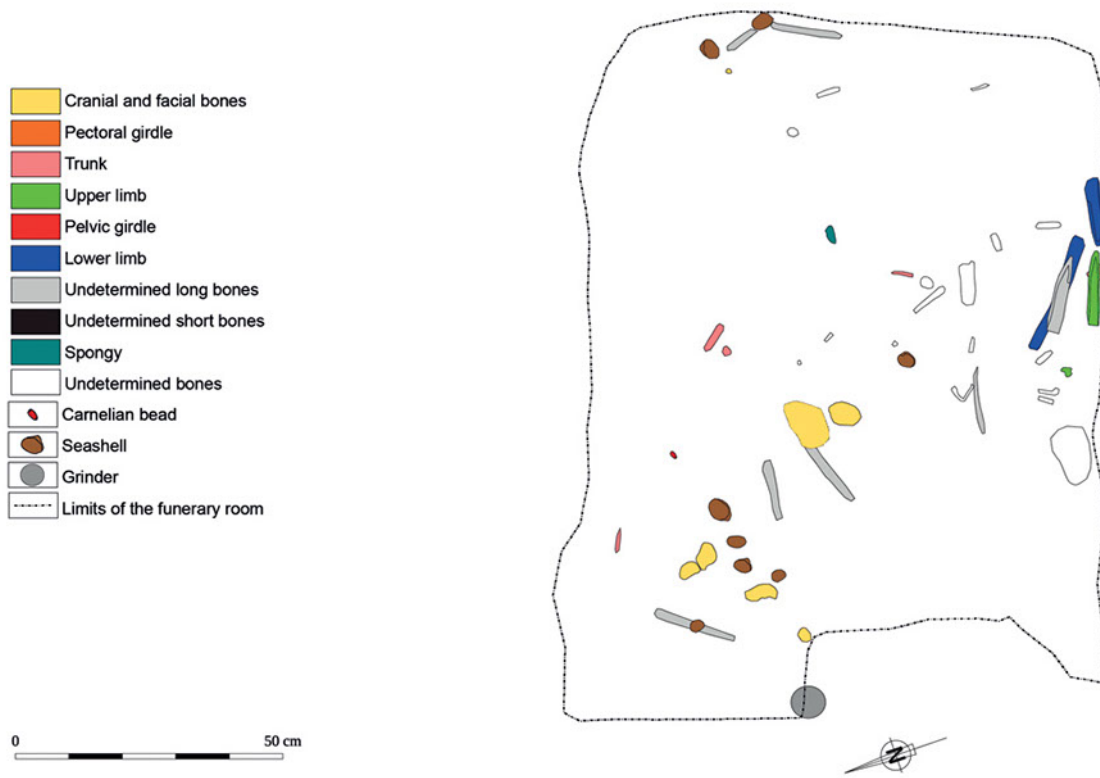
Fig_16_AD1-03 AD1-04 Plan



Fig_17_AD1-11

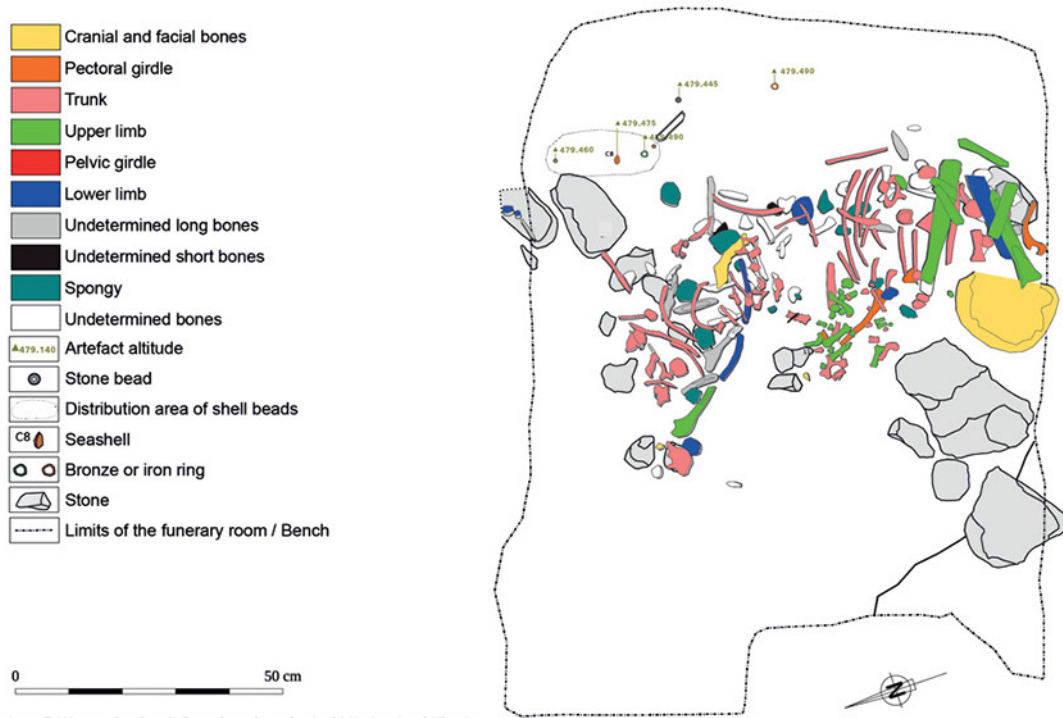


Fig_18_AD1-06



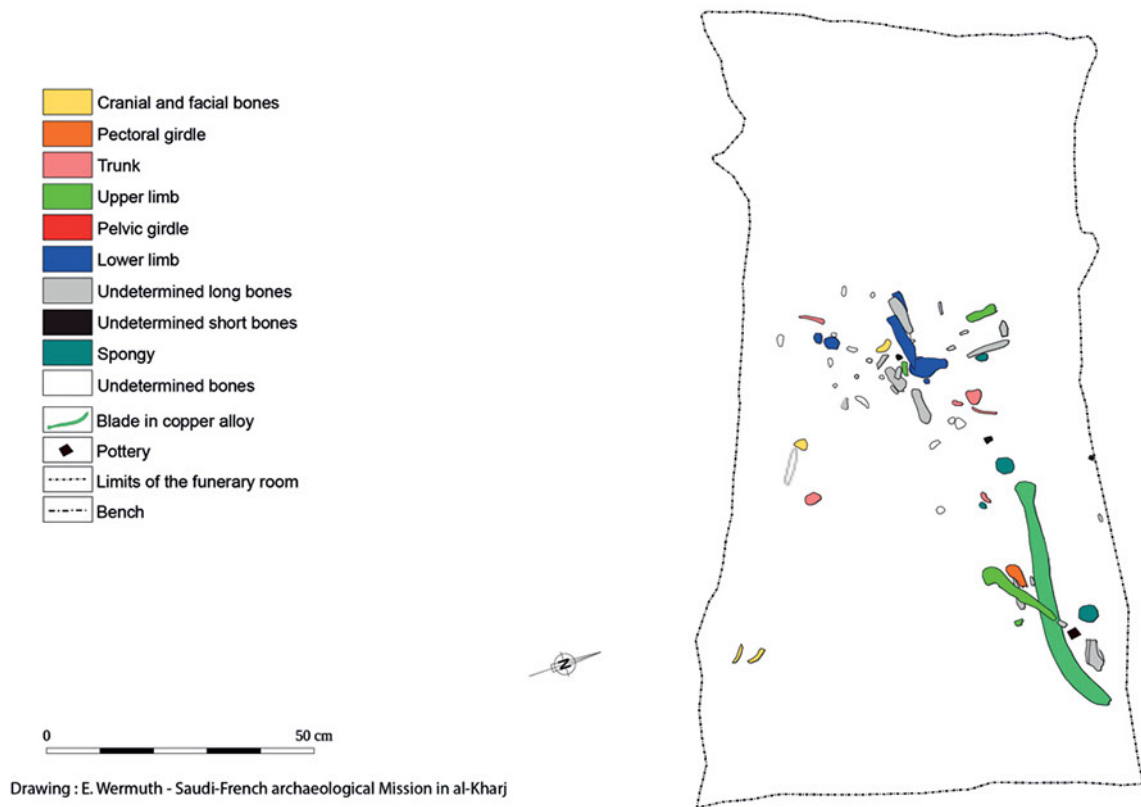
Drawing : E. Wermuth - Saudi-French archaeological Mission in al-Kharj

Fig_19_S.R1023.2

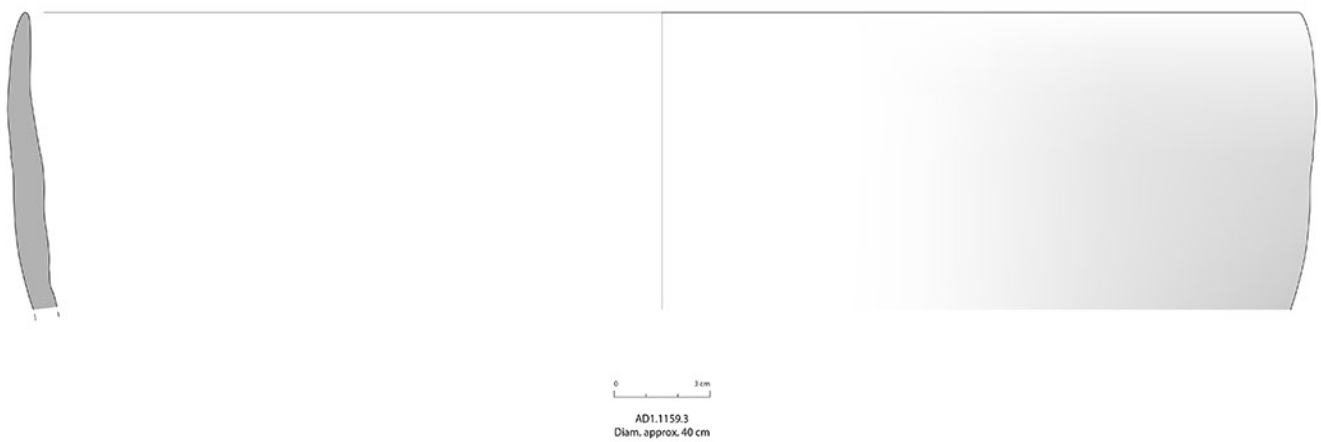
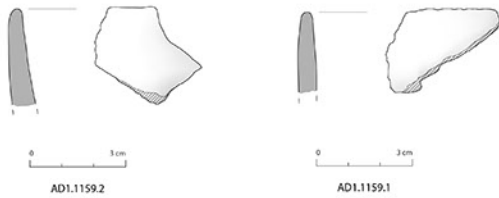


Drawing : E. Wermuth - Saudi-French archaeological Mission in al-Kharj

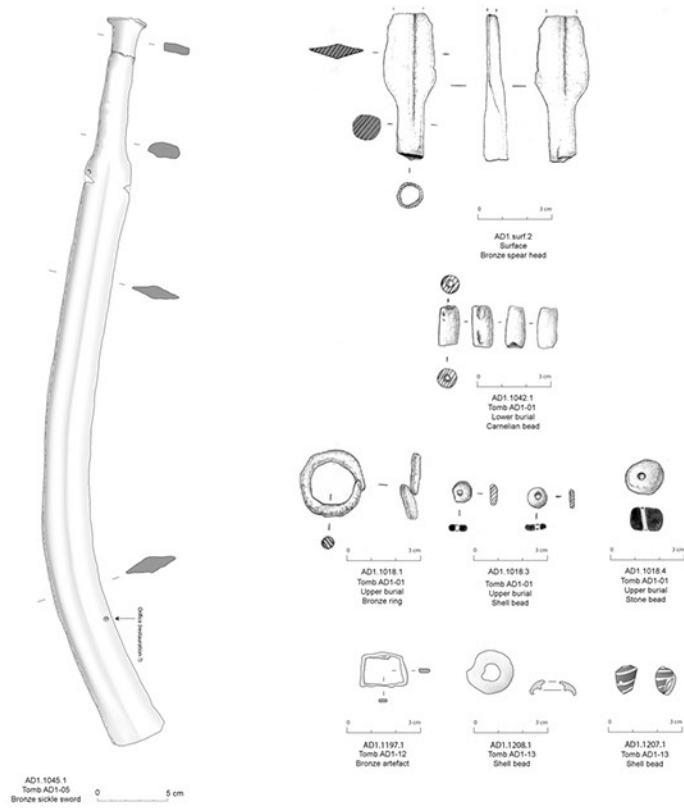
Fig_20_S.R1023.1



Fig_21_S.R1028.1

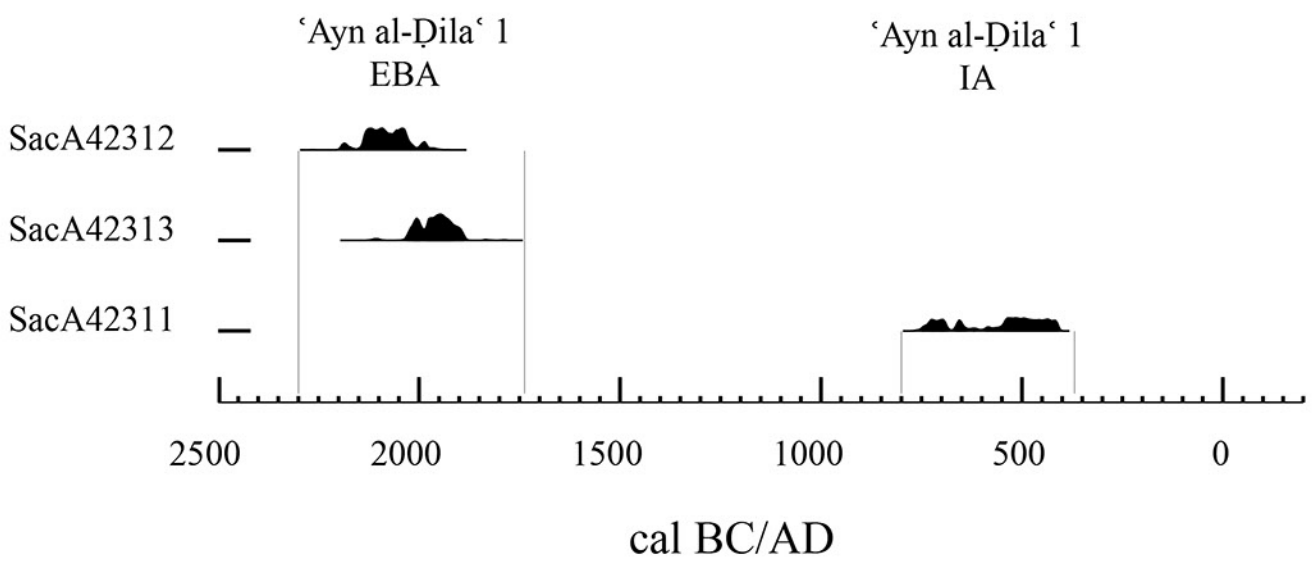


Fig_22_AD1_Pottery

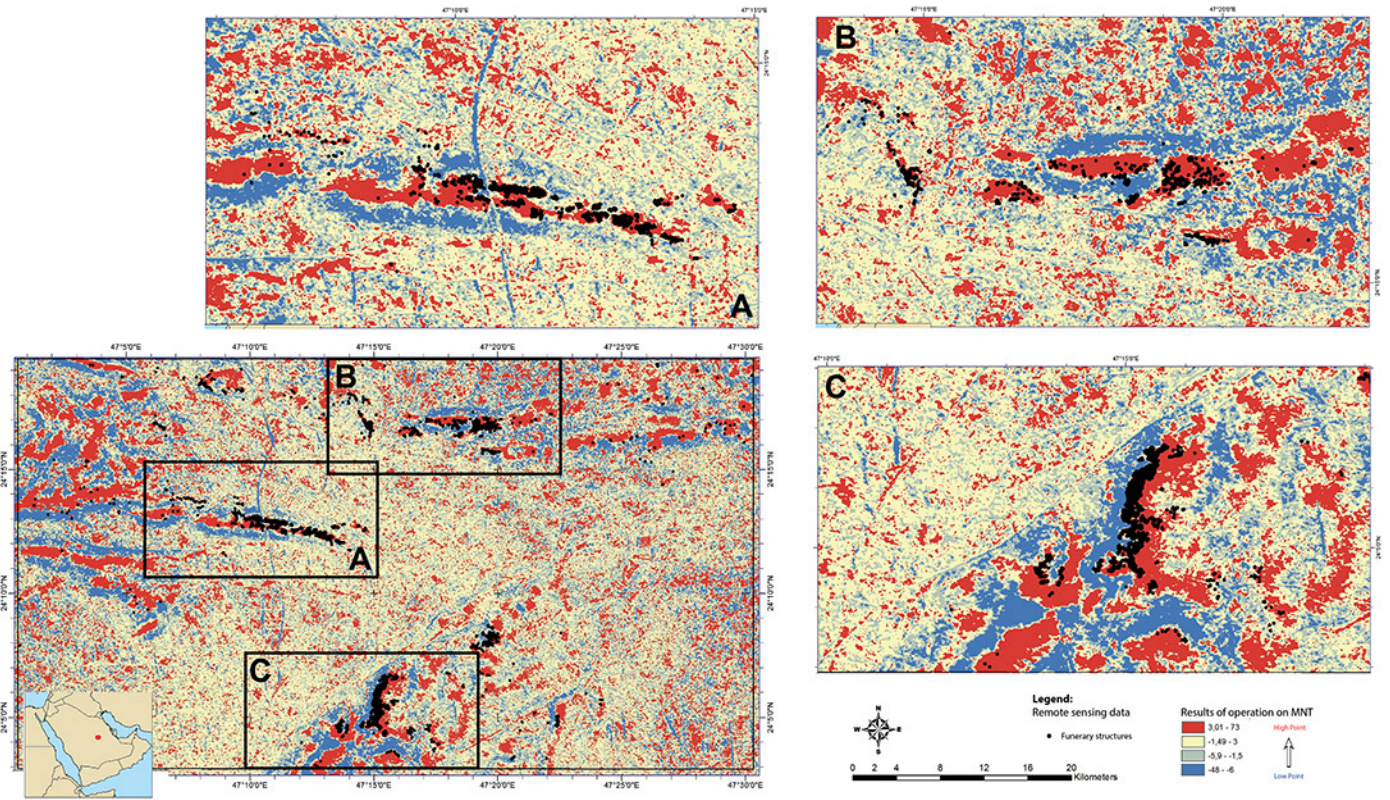


Fig_23_AD1_artefacts

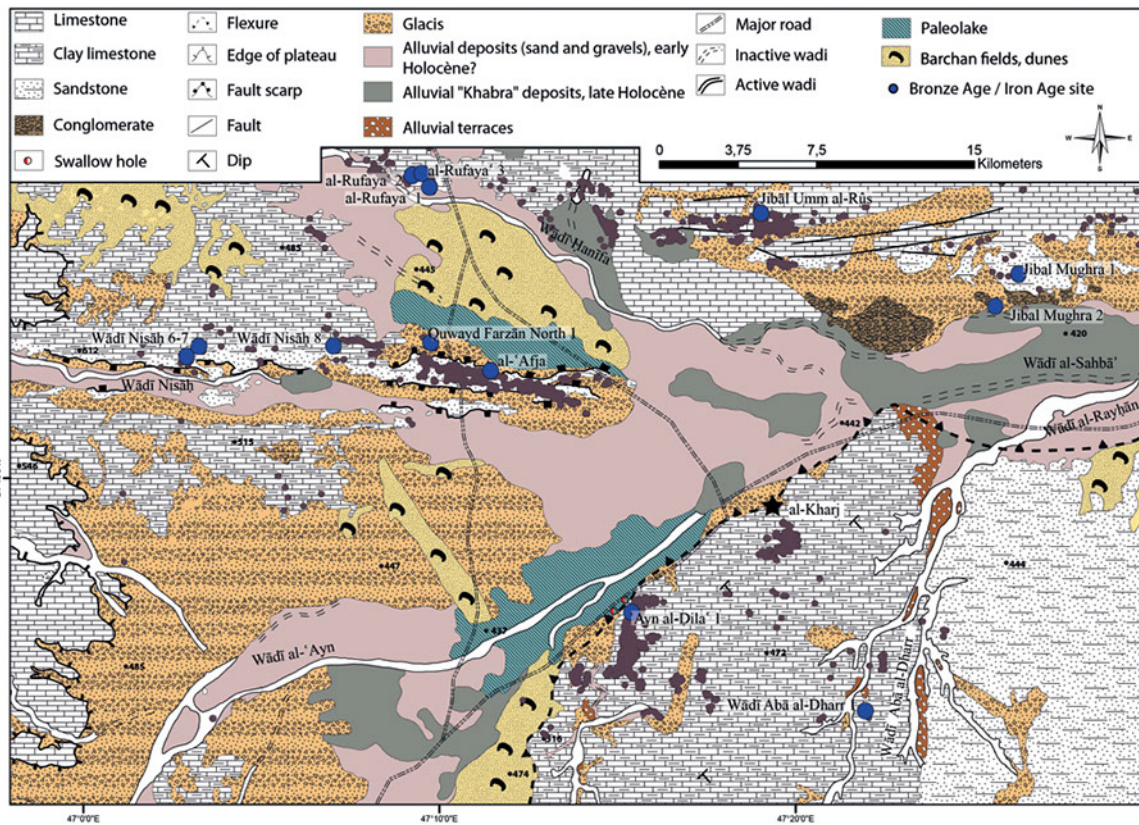
Calibrated Age Ranges (2 sigma)



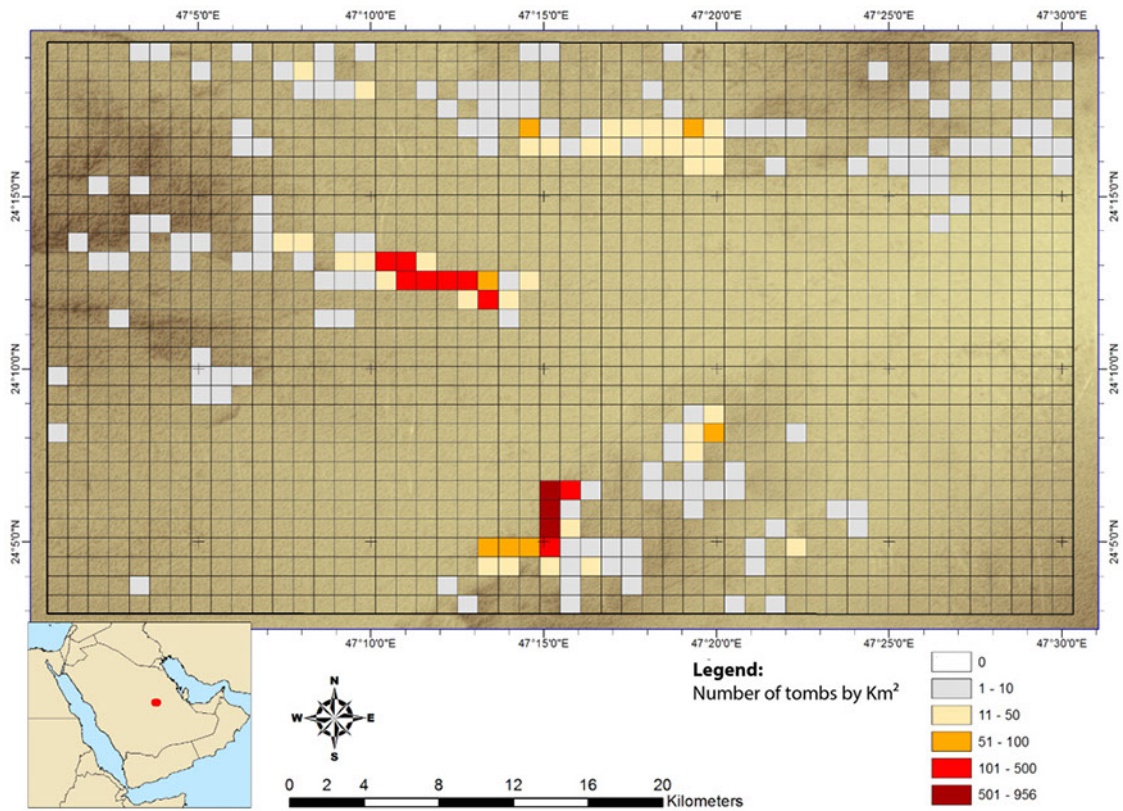
Fig_24_C14_AD1



Fig_25_TPI map



Fig_26_Kharj geomorpho_sites_Bz



Fig_27_Map_Density