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► **To cite this version:**

Rémy Crassard, Holger Hitgen. From Ṣāfer to Bālḥāf - rescue excavations along the Yemen LNG pipeline route. Proceedings of the Seminar for Arabian Studies, 2007, 37. hal-01828433

HAL Id: hal-01828433

<https://hal.science/hal-01828433>

Submitted on 3 Jul 2018

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From Ṣāfer to Bālḥāf — rescue excavations along the Yemen LNG pipeline route

RÉMY CRASSARD & HOLGER HITGEN

Summary

The Centre Français d'Archéologie et de Sciences Sociales de Sanaa (CEFAS) and the Deutsches Archäologisches Institut (DAI) in Ṣana'ā, in cooperation with the Yemeni General Organization of Antiquities and Museums (GOAM), carried out a preventive archaeological survey along the route of a projected pipeline that will transfer the natural gas from Ṣāfer deposits (Governorate of Mārib) to the future Yemen LNG facilities in the village of Bālḥāf (Governorate of Shabwa). This survey took place along the route in order to identify all archaeological sites in danger of partial or total destruction due to the future construction of the pipeline. Archaeological remains are from very different time periods, which stretch from the earliest prehistoric times to recent Islamic occupations. A total of 171 archaeological sites have been individualized and documented by preliminary plan drawing, photography, and material sampling. The use of a Geographic Information System (GIS) enabled a precise localization of the archaeological occupations along the studied area. This paper focuses on the first results of the excavations realized at two major sites: the previously unknown ancient Hadramitic settlement of Darbas at Wādī Jirdān (main occupation during the second half of the first millennium BC), and a widespread sample of "Bronze Age" funerary structures on the western *jawl*.

Keywords: Yemen, Shabwa, Bronze Age, Ḥaḍramawt, Rescue Archaeology

Introduction

The Centre Français d'Archéologie et de Sciences Sociales de Sanaa (CEFAS) and the Deutsches Archäologisches Institut (DAI) in Ṣana'ā, in cooperation with the Yemeni General Organization of Antiquities and Museums (GOAM), carried out a preventive archaeological survey along the route of a projected pipeline (Fig. 1) that will transfer the natural gas from Ṣāfer deposits (Governorate of Mārib) to the future Yemen LNG facilities in the village of Bālḥāf (Governorate of Shabwa). This survey took place along the route in order to identify all archaeological sites in danger of partial or total destruction due to the future construction of the pipeline (Crassard & Hitgen 2005; Arbach *et al.* 2006).

Following the initial survey, two sites — a necropolis of supposed Bronze Age tombs on the western *jawl* (plateau) and the Hadramitic site of Darbas — were selected for further studies and excavations. The fieldwork took place in the spring of 2006.

The planned pipeline crosses four major landscapes: the dune desert (southern Ramlat as-Sab'atayn), then a flat gravel desert, followed by the plateau (*jawl*) and the Hadrami coastal plain. In the desert and coastal plain

regions few archaeological sites were identified. The majority of sites documented included prehistoric sites located in the dune desert, which dated predominantly to the Pleistocene and / or Holocene period. The sites are located along the fringes of probable relict early to mid-Holocene palaeolakes, which are features previously identified in other desert regions of Yemen, such as the published palaeolakes of the northern Ramlat as-Sab'atayn (Cleuziou, Inizan & Marcolongo 1992; Lézine *et al.* 1998). Our survey established that the above-mentioned sites would not be directly endangered by the pipeline construction work.

Conversely, the situation in the region of the Wādī Jirdān and the plateau area is entirely volatile. On the one hand this region is a very rich zone for archaeological remains, and on the other the space for a possible rerouting of the pipeline is limited due to the topography of the region. Many tombs were identified in this region, and were initially attributed to the Bronze Age period (*c.* third to late second millennium BC). At the foot of the Wādī Jirdān plateau, a South Arabian site was discovered and later identified as the Hadramitic site of Darbas. It was dated from surface material present on the site to the first millennium BC.

The plateau area along the pipeline route possesses

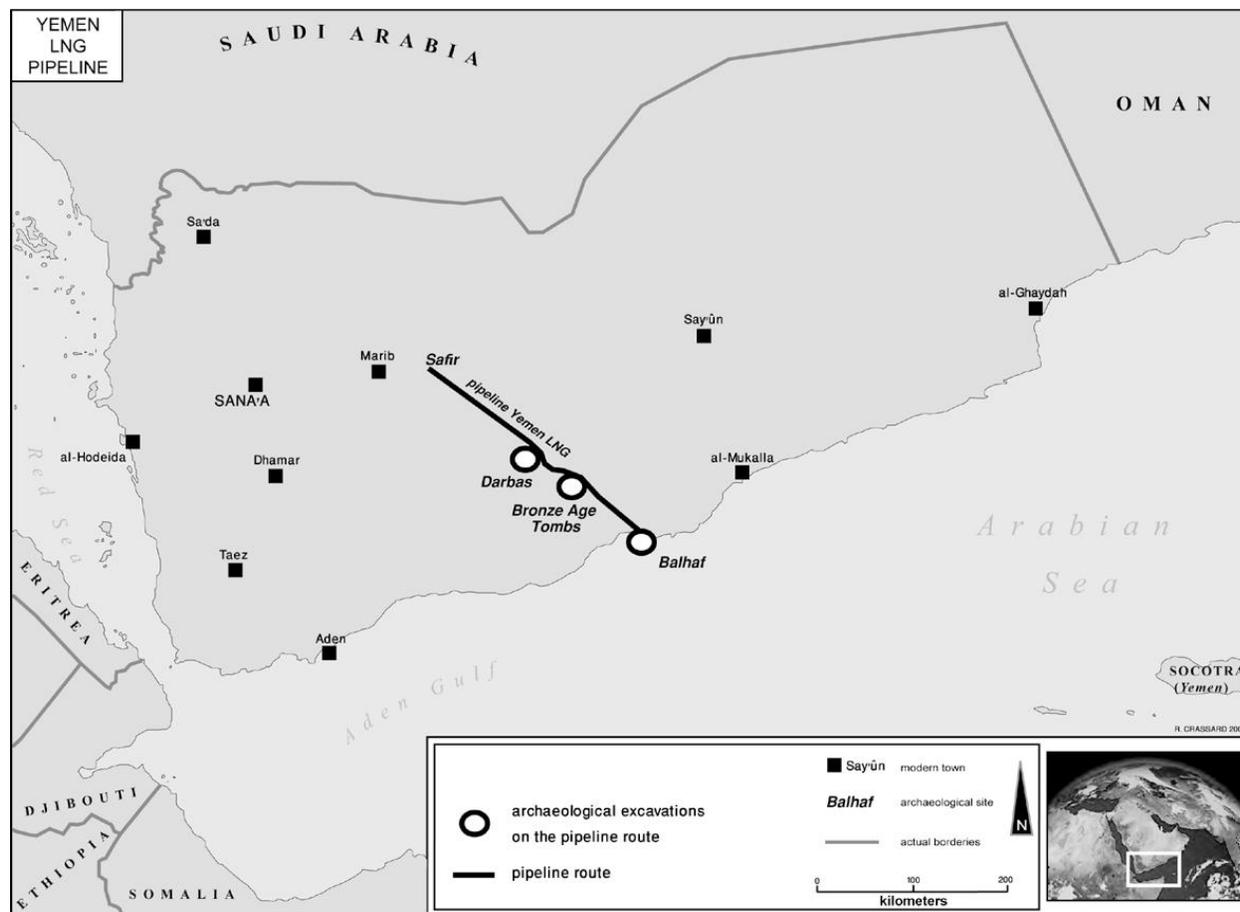


FIGURE 1. Yemen LNG pipeline route.

characteristics typical of the Ḥaḍramawt geosystem. High plateaux that reach an average height of 1300–1600 m are the remains of large Tertiary formations known as the Jizā and Umm al-Raḍūma geological formations. The plateau summits are permanently flat and consist of some remains of higher plateaux, which appear as flat pyramidal mesas. In many places, these geological formations are rich in chert sources. These chert sources attracted prehistoric populations as many prehistoric sites were within easy access of this raw material, which was commonly used to produce stone tools (Crassard & Bodu 2004: 68). This stone type is nevertheless rare in the area studied, even though sparse lithic industries are still visible on the surface.

Excavations of funerary structures on the plateau

Approximately 140 funerary structures were docu-

mented along the pipeline route. Given that these funerary structures were only partly endangered by the construction work of the pipeline, it was not necessary to excavate all of them. Instead excavation and a detailed study of a representative selection of sites were carried out, which allowed us the opportunity to compare the results with similar structures further along the pipeline route.

Another main objective in the plateau area was to excavate a range of tomb types and especially those that were different from the prevailing tomb type in the region: the circular tomb with a chamber made of vertical flat limestone slabs (orthostats). Two other types of tombs were documented: circular tombs with a small quadrangular chamber and wall-tombs. Two tombs of each of these types were excavated in order to ascertain whether any variability existed.

Most of the circular tombs were found in a poor state of preservation. They more or less resembled large

YLNG Site Number	Structure Number	East	North	Altitude	Type
009	T1	720559	1641226	1366	1
009	T2	720558	1641177	1369	1
010	T5	721474	1638181	1408	1
010	T6	721511	1638120	1408	1
010	T7	721561	1638132	1411	1
010	T9	721572	1637754	1422	1
010	T144	721500	1638181	1408	3
017	T49	745934	1631012	1618	1
017	T50	745944	1631008	1619	2
017	T54	747186	1630728	1604	2
017	T56	746276	1630624	1611	1
019	S4	749305	1628017	1630	3
019	T87	749075	1627782	1622	1
026	T113	752074	1622140	1647	1

FIGURE 2: Excavated Tombs (coordinates in UTM 38 WGS 84).

S: Structure; T: Tomb; YLNG: Archaeological Site

mounds formed as a result of the stone elements of the structure collapsing. The rubble and collapse occurred after the looting(s) of the funerary chambers over the past centuries and as a result of natural erosion and the progressive fragility of the dry-stone architecture.

Types of tombs and architecture

"Bronze Age" tombs were the predominant registered sites on the plateau (YLNG 009 to YLNG 033). Several single tombs and three large necropolises were documented. The funerary structures discovered along the pipeline route are of three different types. These include one main tomb type characterized by a *circular tomb structure with an orthostat-lined funerary chamber* (Type 1). The second type of circular tomb discovered is characterized by a *circular tomb with a quadrangular funerary chamber* (Type 2). A last type was isolated: the *wall-tomb* (Type 3). As demonstrated in Figure 2, a total of fourteen funerary structures were excavated (Crassard & Hitgen 2006).

Site YLNG 010

One major necropolis site, YLNG 010, was chosen for excavation because of the particularly good preservation

of its many funerary structures (Fig. 3). The site is situated about 100 m from the main pipeline. Due to its distance from the pipeline itself, this site was not in danger of being destroyed through direct impact. Nevertheless, it appeared to be the best and most promising example of the main type of tombs documented along the pipeline route. Some of the tombs situated within the direct impact of the pipeline were excavated in order to ascertain whether their intra-site architectural organization was comparable, and whether they could provide enough archaeological material to produce a preliminary chronology and typology for these site types.

Type 1: circular tombs with an orthostat-lined funerary chamber

These tombs differed only slightly from each other, typologically speaking, and represented examples of the "circular tower tomb" variety, also called "turret tombs" (De Maigret & Antonini 2005: 11) or "pill-box tombs" (Philby 1939: 371). These have a circular plan that ranges from c. 3–10 m in diameter. A funerary chamber made of orthostats is situated within these structures. These chambers, which contain buried corpses, are enclosed by a circular wall. Some of the tombs have one or more tails, which consist of alignments of small stone

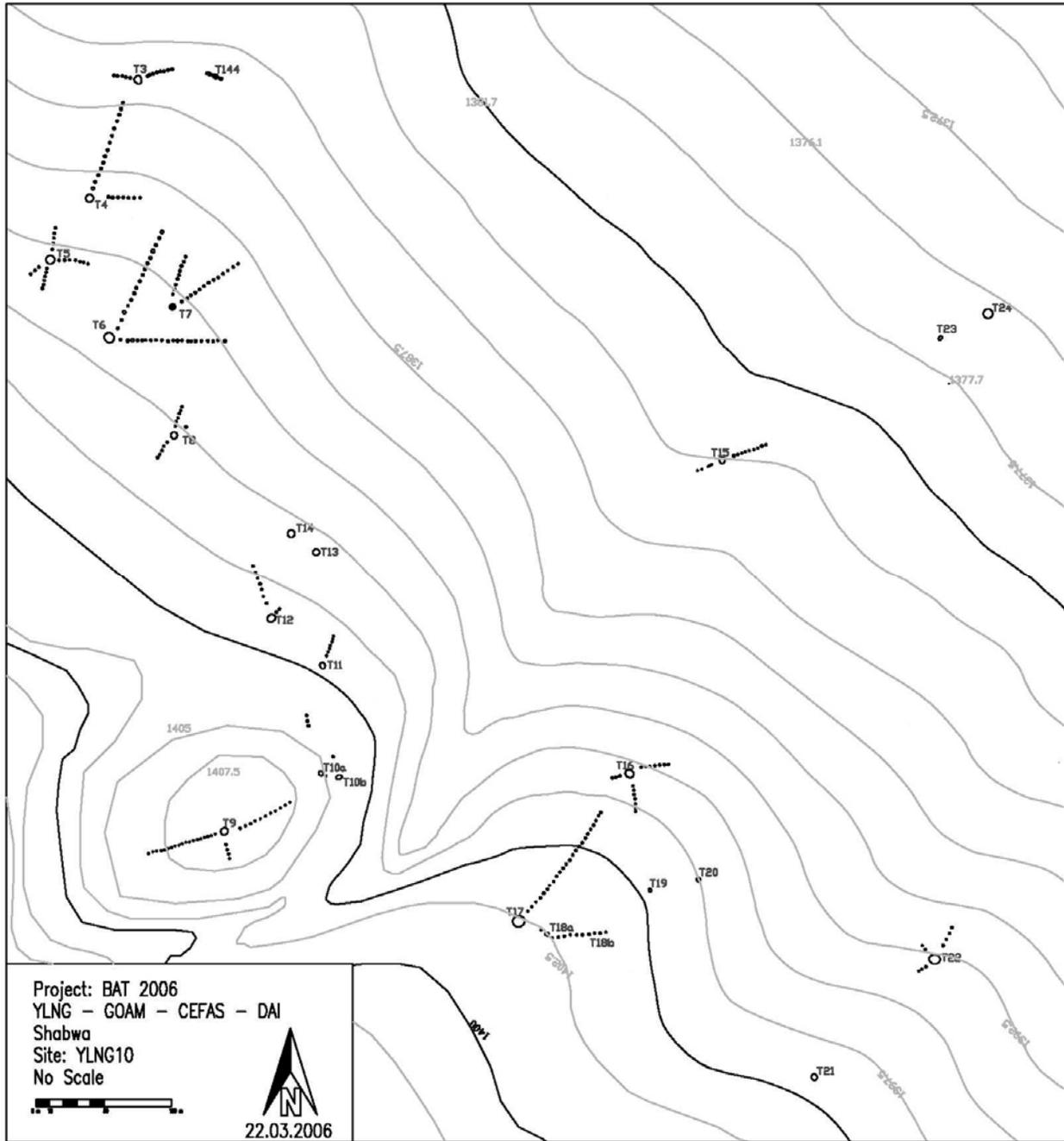


FIGURE 3. *Map of YLNG 010 site.*

structures or sparse stone piles (called sections) that can reach up to 100 m in length. The circular tower tombs excavated and inventoried along the pipeline route never have doors.

At site YLNG 010, four Type 1 tombs (Figs 4–5) were excavated (T5, T6, T7, T9). T6 and T7 were the most interesting of these structures and will be discussed in more detail below.

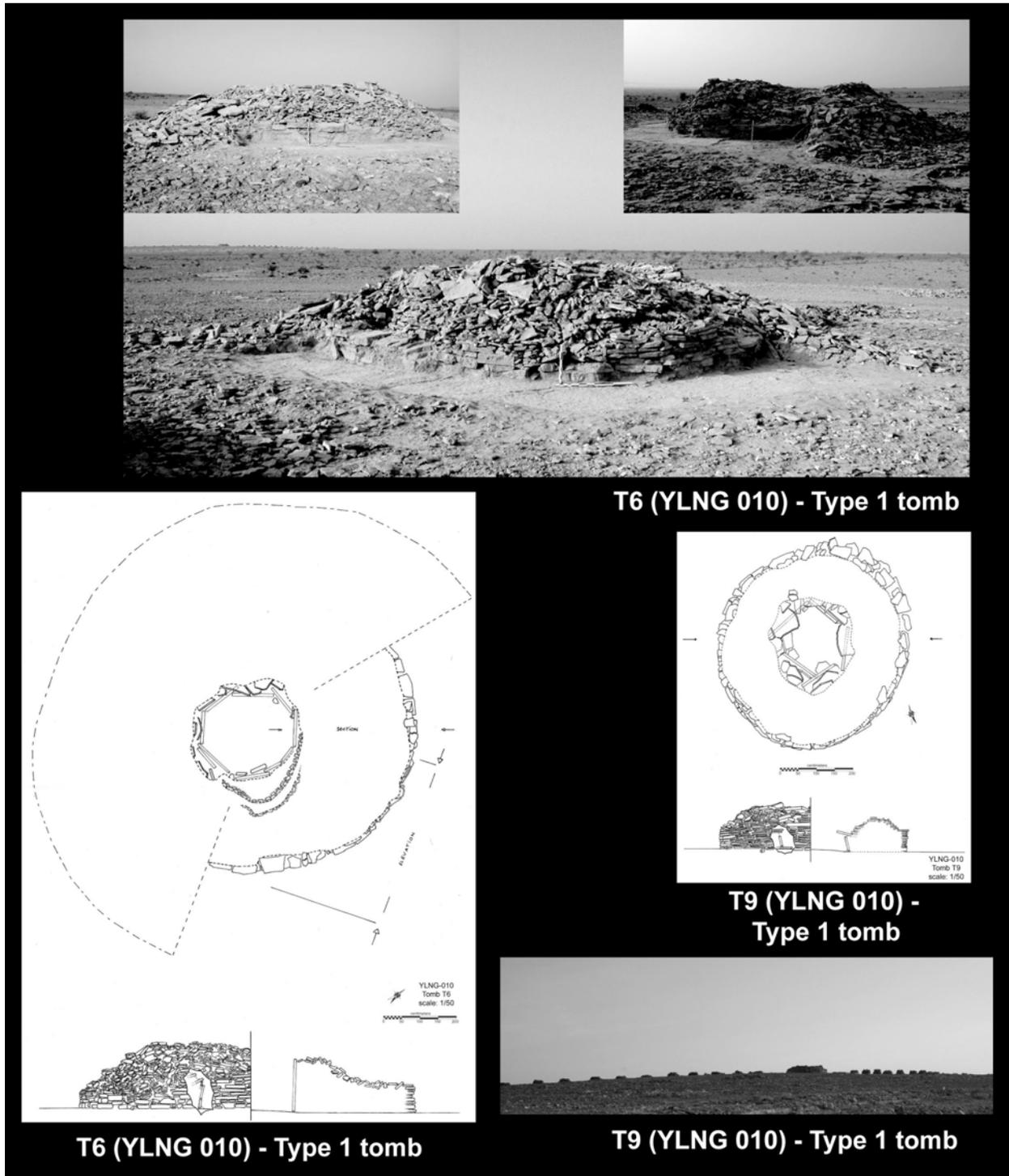


FIGURE 4. Type 1 tombs: T6 and T9.

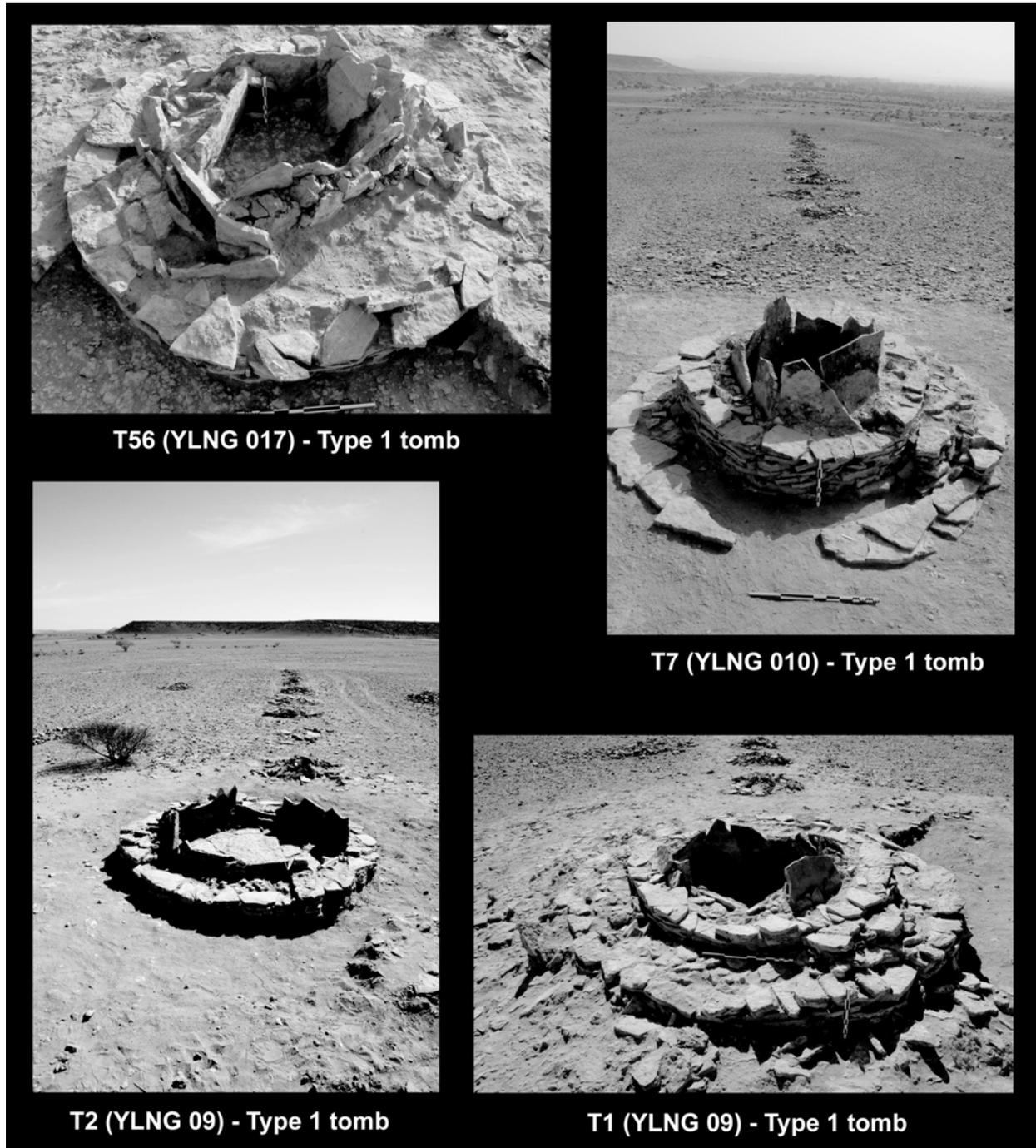


FIGURE 5. *Type 1 tombs: T1, T2, T7 and T56.*

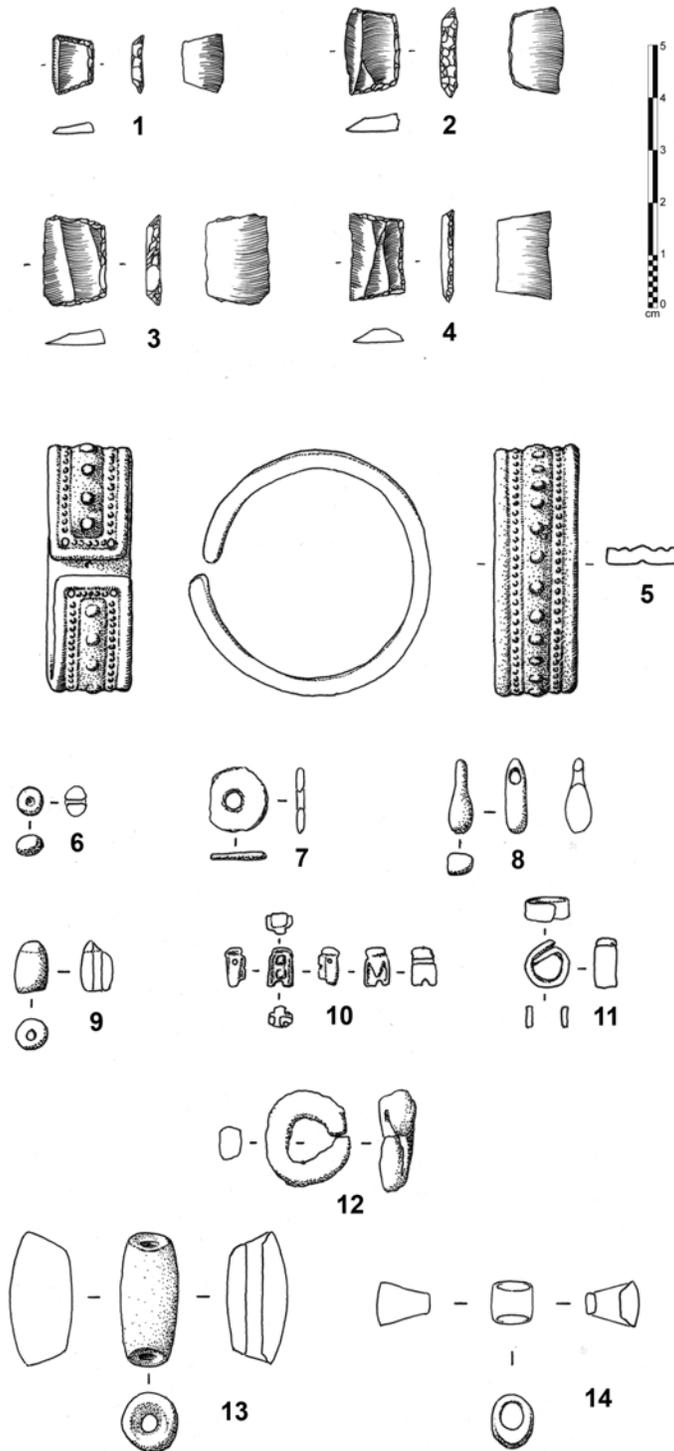


FIGURE 6. Objects from stone-made tombs: 1-4. Obsidian geometric microliths from the tomb T6 (YLANG 010 site). 5. Bronze bracelet from the tomb T6 (YLANG 010 site). 6. Bead from the tomb T6 (YLANG 010 site). 7-14. Various beads from the tomb T7 (YLANG 010 site). Drawings J. Espagne.

Tomb T6 at YLNG 010

The structure is located atop the limestone plateau and lies within the YLNG 010 necropolis in proximity to tombs T5 and T7. The tomb is preserved to a height of 1.80 m and its top plan is apparent.

The dimensions of T6 are most impressive, especially in relation to the whole corpus of tombs discovered during the preliminary survey: the diameter of the external wall is 8 m, while the funerary chamber measures 2.50 m in diameter. Two very long tails are oriented towards the north-north-east and to the east (length of tail 1 (NNE): 84.89 m, composed of sixteen sections; length of tail 2 (E): 82.84 m, composed of twenty-one sections).

The tomb is surrounded by one (possibly two) partially collapsed external wall(s). The wall lies directly on bedrock composed of a large limestone shelf made up of superimposed strata approximately 15–20 cm in thickness, which provided the construction material (stone) for the outer walls of the tomb. The space between this peripheral wall (or walls) and the orthostats of the funerary chamber is packed with limestone rubble mixed with aeolian sediment. The exterior wall was partially removed.

The funerary chamber is circular and bounded by a dozen orthostats. At the top of these slabs is a second course of inclined orthostats, which appear to have provided the support for the capping stones of the chamber. The funerary chamber of this tomb has a rather complex stratigraphy in relation to the other structures in this necropolis. The stratigraphic complexity appears to be a consequence of the tomb's size and explains the difficulty tomb raiders encountered during their forceful attempts to enter the tomb. From the foundations of the tomb, which lie on bedrock, up to the summit of the tomb, the fill was composed of a 15 cm-deep undisturbed layer of aeolian sediment. The north-east part of this layer was covered by flat-lying limestone slabs which formed a built-up arrangement. The other part appears to have been a victim of pillaging. The layer above the limestone slabs consisted of aeolian silt within which the majority of the human and faunal bones as well as other artefacts were recovered. This level had been clearly disturbed after having been deposited. As a result, no connection could be discerned between the bones recovered and the stratigraphy of the structure.

Overlying the disturbed sediment was a layer coinciding with the collapse of some of the orthostats, which resulted in the breakage and fragmentation of their upper halves. To the south, above one of the first of the

capping stones, three infant skeletons were recovered. The fact that they were partially intact and that they were located on one of the large capping stones which lay above a partially intact orthostat, implies that these burials were not affected by pillaging and that they came from a blocked-off area between the interior wall of the tomb and the large slabs which border the chamber (the exterior of the chamber). The artefacts recovered with the child burial included obsidian geometric microliths and oyster shells.

T6 is one of the richest tombs and contained a variety of objects including oyster shells, obsidian cores, flakes and microliths, shell, bronze and carnelian beads, stone tools (spherical and flat polishers), two bronze bracelets, and various bronze fragments.

Tomb T7 at YLNG 010

The dimensions of T7 are much smaller than those of T6: the diameter of the external wall is 4.90 m. The funerary chamber measures 2 x 1.70 m and is circular. Two tails are oriented towards the north-north-east and the north-east (length of tail 1 (NNE): 37.50 m, composed of nine sections; length of tail 2 (NE): 56.30 m, composed of thirteen sections). T7 lies in proximity to T6 and is preserved to a height of 0.90 m. Its top plan is entirely visible on the surface.

The external architecture of the tomb is similar to that of T6. The funerary chamber is lined with overlapping orthostats that form a herringbone design, both decorative as well as a supporting structural configuration. In certain instances small upright slabs were placed at the base of the orthostats to stabilize them further.

The first visit to the tomb revealed a recent looting event that was confirmed by the local villagers. The funerary chamber had been partially looted and pillaged to half of its original depth (approximately 35 cm). The aeolian sediment removed during the activity covered the sides of the mound and included fragments of bone and other artefacts (various beads, iron fragments). Several limestone slabs and disarticulated human bone fragments were excavated below 30 cm of aeolian sediment inside the chamber.

Abundant material culture was recovered from this tomb (Fig. 6). The reconstruction of the looting debris enabled us to determine the nature of these deposits. The excavation revealed numerous ornaments, which included 235 beads (made of agate, bronze, clay, carnelian, glass, green stone, mother-of-pearl, seashell, tooth/shell, and a variety of other stones), one clay pendant, bronze ring fragments, an iron bead, an earring, and a bracelet. Furthermore, numerous unidentifiable oxidized

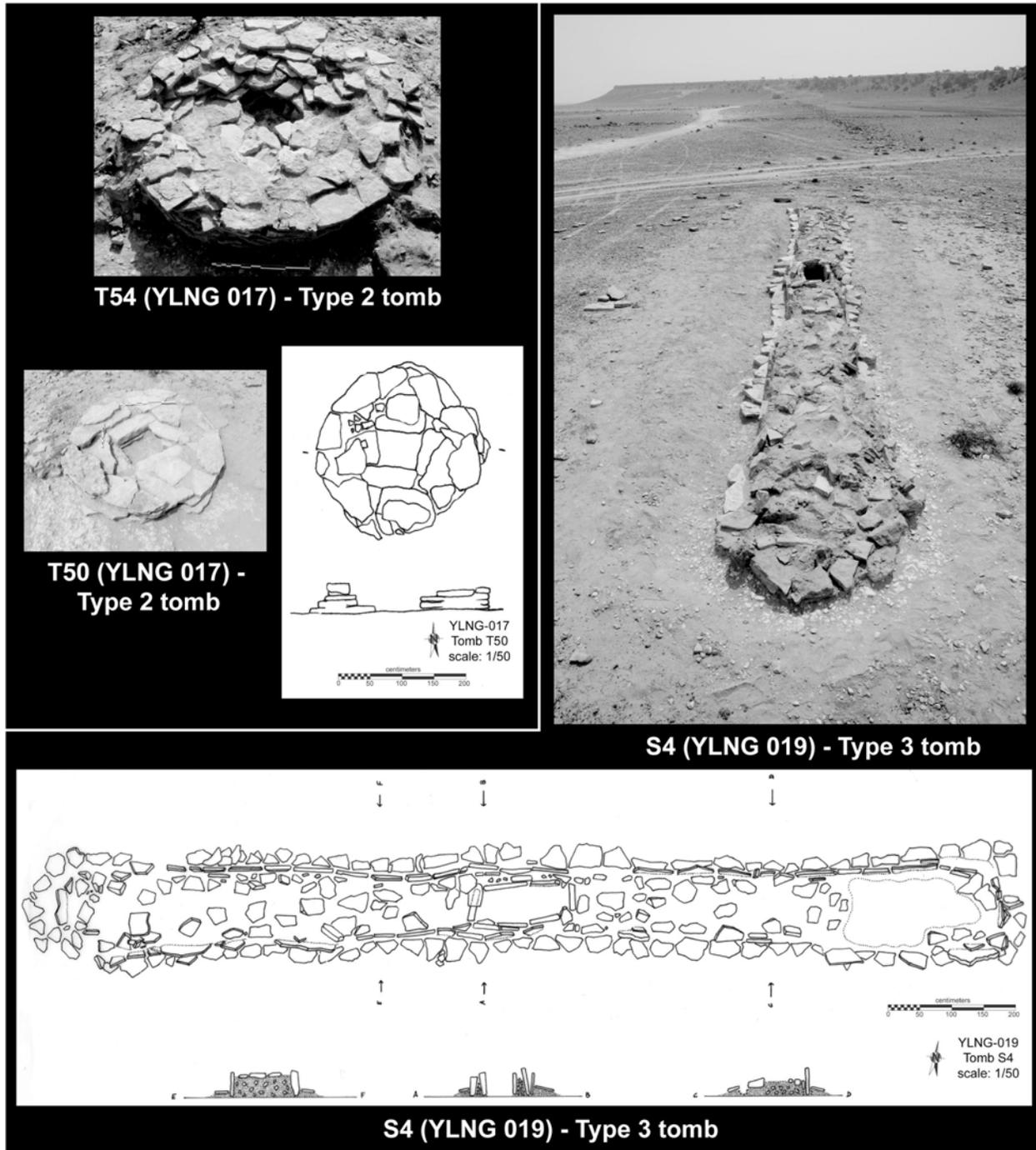


FIGURE 7. Type 2 tombs: T50 and T54; Type 3 tombs: S4.

and corroded iron and bronze fragments were recovered, as well as a fragment of an iron blade and one possible iron arrowhead. Obsidian is also present with many geometric microliths, flakes, and an obsidian core.

T7 is thus a collective burial, which has one phase that can be dated to the late Bronze Age period (geometric microliths) and / or the Iron Age (iron, glass beads, glazed pendant, and also geometric microliths).

Type 2: circular tombs with a quadrangular funerary chamber

Type 2 is very similar in size and shape to Type 1 although it includes a vertical stone-made chamber. Only two Type 2 tombs (Fig. 7) were excavated (T50 and T54 at YLNG 017).

Tomb T54 at YLNG 017

T54 is 3.60 m in diameter, while the funerary chamber measures only 0.90 m x 0.60 m. The structure is located along the limestone plateau, about 30 m west of T56 (circular tomb composed of orthostats). It is perfectly clear in plan and is preserved to a height of approximately 55 cm. The ground plan of the structure is circular and built of large limestone slabs. A small central space left vacant in the centre of the circle formed the funerary chamber (approximately 90 x 60 cm).

The funerary chamber is not bound by a single architectural element (neither orthostats nor paving). The walls were built of limestone slabs that demarcate the structure's perimeter. Given these small dimensions, a simple slab would have sufficed as a capstone.

The inhumation methods used in this type of grave, characterized by a small funerary chamber, are not entirely clear as there is an absence of identifiable or associated bone remains. Artefacts were collected from the collapse layers of the structure, and these included a perforated shell brooch (*Pinctada margaritifera*), carnelian and shell beads, obsidian geometric microliths, a bronze pin, and two shell bracelets.

The circular Type 2 tombs revealed very similar objects to those found in Type 1 tombs and can be dated to at least one single period of use.

Type 3: the wall-tombs

A few other funerary structures that are long and rectangular in plan ("wall-tombs") were found close to tombs of Types 1 and 2. Unfortunately, due to the absence of bone remains and other archaeological artefacts, the wall-tombs had no chronological indicators.

Two wall-tombs (Fig. 7) were excavated (T144 at YLNG 010 and S4 at YLNG 019).

Tomb S4 at YLNG 019

The structure is located on the limestone plateau within a necropolis consisting of a number of circular funerary structures. The tomb is preserved up to a minimal height and its top plan is clear. The structure is made up of a long rectangular exterior wall that is oriented east–west and is approximately 16 m in length by 1.2 m in width. This wall is constructed of orthostats that are preserved up to a height of c. 30 to 40 cm. The orthostats are held by a double facing of flat-lying limestone slabs placed directly on the bedrock and preserved up to a height of one to three courses. Where the orthostats are absent, the troughs where they once lay are visible between two flat paving stones. With the exception of the funerary chamber, the interior of the rectangular structure is packed with a fill composed of limestone blocks (20–40 cm in length) and aeolian sediment.

A rectangular funerary chamber is located in the centre of the rectangular outer structure following an identical orientation (east–west). The chamber is lined with orthostats made of large upright slabs and has a dimension of 1.55 m x 0.55 m. The outer walls and the capping stones (large limestone slabs longer than 1 m) of the chamber were discarded along the edges of the room during one looting phase. This discard event produced a semi-circular mound at the level of the tomb chamber, which was preliminarily considered to be a voluntary enlargement of the structure at the time of construction. The chamber was excavated in its totality and contained no material or bone remains.

The chronological framework

The Bronze Age period (c. third to late second millennium BC) is mostly known thanks to the discoveries of numerous tombs and necropolises characterized by megalithic architectural elements (de Maigret 2002). A strong symbolism also appears in the funerary architecture of this period (Braemer *et al.* 2001; Braemer, Cleuziou & Steimer-Herbet 2003; Steimer-Herbet 2004) bearing elements that remain poorly understood (e.g. tomb tails and drawings inside dolmen-like structures). Associated domestic architecture is scarcely found and is best represented in the Yemeni highlands (de Maigret 2002).

The presence of a large number of trapezoidal geometric microliths in T5, T6, T7, T54, and T56 suggests that Types 1 and 2 tombs are more recent than the pro-

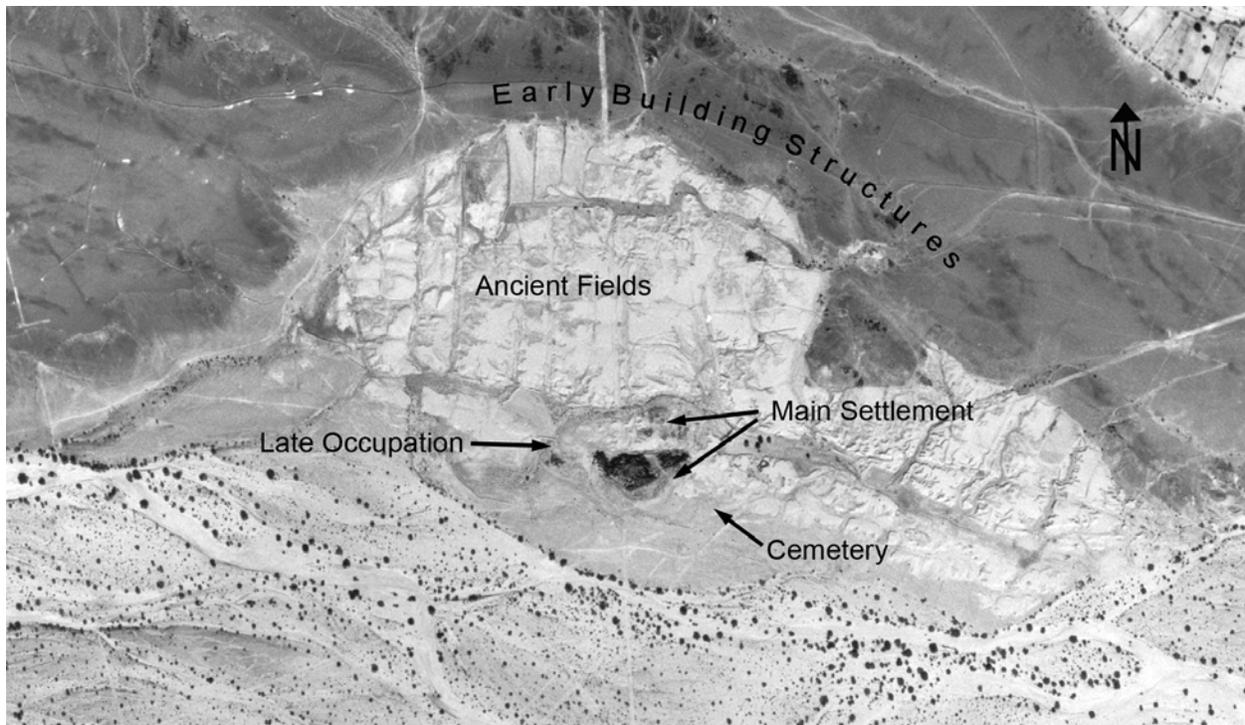


FIGURE 8. *Darbas. Aerial photo of the ancient oasis.*

jected Bronze Age period. These elements are in fact quite typical of the period dating from the end of the second millennium BC to the first centuries AD (Crassard, forthcoming). The presence of these stone tools in a funerary context is also quite surprising given that their function has generally been associated with agricultural activities (Inizan & Francaviglia 2002). Given their funerary context, such tools may be interpreted not only as the elements of a tool such as a scythe, but might also be interpreted as non-agricultural tools or weapons. The presence of numerous stone tools mainly made from sandstone implies that they were used for polishing activities. They can perhaps be associated with the polishing of steatite given that an abundance of vessels made from this material is present during the above-mentioned period. Some iron object fragments were also found in T7, which further demonstrates the later date suggested for the burials. Nevertheless, prior to excavation, this particular tomb was found in a very poor state of preservation, which could indicate an intrusive context for these iron elements. In the findings of the archaeological project in al-Makhdarah (de Maigret & Antonini 2005), only one tomb can be associated to Type 1: MKDiii / T44. All the other tombs excavated in this project have one door and a different architectural

structure. These are more related to the "turret tomb" type.

The precise chronological frame for Types 1, 2, and 3 tombs remains difficult to ascertain. We preliminarily propose a period of construction and occupation from the second to the first millennium BC, but the results of radiocarbon dates are awaited.

The Hadramitic settlement of Darbas in Wādī Jirdān

In the lower course of Wādī Jirdān to the north-east of ‘Ataq, the capital of the province of Shabwa, a small ancient oasis dating to the Hadramitic period (second half of the first millennium BC to the first century AD) was discovered during the survey in the immediate vicinity of the pipeline alignment. The site, called Darbas by the locals, was previously unknown.

Until this survey was carried out Wādī Jirdān had never been a site of intensive archaeological research. Because the region belonged, both culturally and politically, to the South Arabian kingdom of Shabwa, it only played a role as a possible transit route in the incense trade between Qāni^c and Shabwa (Bowen Jr 1958: 37). Only a few summary reports cite this region, including



FIGURE 9. *Darbas. Section of the main channel of the irrigation system east of the oasis.*

the ones written by van der Meulen (1947: 107–18) in the 1930s and by Brian Doe (1971: 190–214) in the 1960s. Herrmann von Wissmann's study of aerial photographs in the 1960s led to the first detailed cartographic publications, which contained a large number of ancient sites in Wādī Jirdān (1962). In the 1980s, high-resolution satellite images and more advanced evaluation methods enabled Ueli Brunner and Harold Haefner to produce a first comprehensive analysis of the ancient irrigation systems of the wadi (1990: 143). Thus far, however, this has not been followed up by further intensive field research for this particular region.

The most important sites of Wādī Jirdān are represented by the two city complexes of al-Binā' and al-Barīra (von Wissmann 1962; Doe 1971: 190–214; Schiettecatte 2006: 283–86), lying about 12 km apart, on the lower course of this wadi. Both cities, which are protected by fortifications, are surrounded by large lay-

ers of sediment that indicate an artificial irrigation system. About midway between these two sites, in the middle of a large gravel mound more than 30 m high, is a small tributary wadi, Wādī Ṣa'ḍa. In this area, a Hadramitic settlement, which was also described by D. van der Meulen and A.J. Drewes (von Wissmann 1962: 185), was identified during the survey. Apart from a few ceramic finds and some graffiti, the site was totally destroyed by modern settlement activity.

Because Wādī Ṣa'ḍa lies in the immediate vicinity of the Darbas settlement (Fig. 8) and will be crossed by the planned pipeline, this tributary wadi was also intensively surveyed. Compared to the ancient settlement, the agriculturally arable land in the wadi has recently been affected by modern agriculture and building activity. Apart from some minor irrigation elements, only a wall made of rubble and built to a height of 1 m is preserved, although its function is not yet clear. The wall encloses



FIGURE 10. *Darbas. General view on the main settlement of the oasis from the north.*

the whole wadi, but most certainly had no protective or irrigational function. Rather it may have had a symbolic significance as a boundary between the settlement and its adjacent agricultural land, and the hinterland beyond.

Irrigation¹

Originally Wādī Ṣaʿda did not have any natural inlet or outlet. In order to be able to use the wadi for agricultural purposes, water had to be obtained from Wādī Jirdān along artificial channels. The arrangement of the two (not isochronous) preserved channels that were partly hewn in the rock to a depth of 20 m and had a length of more than 350 and 700 m respectively, shows that during the first millennium BC Wādī Jirdān changed its course at least once. The ancient oasis area of Darbas lies right on the edge of the main wadi (Wādī Jirdān), at the foot of a Pleistocene fan plateau and is, at the same time, protected from the wadi by another rock formation. The preserved state of the ancient irrigation sediments and the existence of numerous ancient settlements and irrigation constructions made a comprehensive examination of all structures necessary. The scientific methodology, including a detailed mapping of all the structures, contributed towards the pipeline being relocated several hundred metres away from the area. The site is therefore no longer immediately threatened by building activities.

The aim of the archaeological project in Darbas was to carry out a comprehensive exploration of the oasis with its irrigation system and its respective settlement structures. The oasis area, only 120 ha in size, has sediment heights of *c.* 8 m. Based on an average annual sedimentation of *c.* 1 cm, this indicates a period of usage of at least 800 years (Brunner 1983: 74). Altogether two different, temporally uninterrupted irrigation systems have been identified (Brunner, in preparation). Whereas there are only a few traces of the older, deeper-lying irrigation system, the second system and its function can be reconstructed in detail: the water was fed in from the wadi via a *c.* 2 km-long channel (Fig. 9) in order to overcome the height differences of the higher-lying oasis area. Here the channel ran parallel to and along the wadi, from the foot of the Pleistocene fan plateau to the oasis. It was partially cut into the layers of rock, but one part consisted of a channel bed that had been built for it and lined with stones. The water was then distributed to the field through small outlets made of wadi gravel stones. Other tributary channels are missing in this system compared to that of Mārib (Brunner 1983). After flooding a field section, the water could be led through other outlets to lower-lying fields. Only in a few areas of the oasis where it had been recultivated during the last few months before the survey, signs of ancient agriculture could be found. These included ploughed furrows and traces of tree plantations. The examination of botanical samples is still in process.



FIGURE 11. *Darbas. Domestic dwelling of the late occupation phase.*

Settlement activities

The small agriculturally developed settlements of Darbas changed their position several times in the course of the occupation of the oasis. The earliest settlement, dating from the first half of the first millennium BC, can be found on the slopes of the Pleistocene fan plateau to the north of the oasis area. These take the form of simple rectangular building units, the foundations of which are made up of carefully placed wadi gravel stones. The masonry rising up from these foundations was presumably constructed by the loam or mud-brick method. Most buildings appear to have one main room with a courtyard in front of it. Some buildings have small side rooms or annexes. The buildings are often grouped together to form small farms with directly adjoining threshing floors.

After the abandonment of these early settlement areas a new settlement unit arose on the edge of the wadi bed (Fig. 10) in the area of a protective rock formation (second half of the first millennium BC). This can be divided into two areas. The first is located at the south-

ern foot of the rocks, where large rectangular buildings were built with foundations of huge quarry stones. The buildings were destroyed right down to these foundation layers and the archaeological material consists almost exclusively of ceramics that do not allow allocation of function to this architecture. They were possibly residential buildings, but they also gave an indication of being public buildings such as temples, administration headquarters, etc. Such functions are possible because of their monumental character.

Contemporaneously, smaller building constructions arose to the north of the rock formation with quarry-stone foundations and mud-brick walls. These small room units served as working and storage areas, as is demonstrated by the storage vessels and work tools. Likewise, many grinding and milling stones made from local stone provide evidence of an agricultural way of life. Indications of the local production of these tools are provided by numerous half-finished products and unused rubbing stones.

In the latest phase, dating up until the first century AD, the settlement was moved to the western section of



FIGURE 12. Darbas. Burial 26 dating to the 1st century BC with remains of leather and textiles.

the protective rock formation (Fig. 11). The building method corresponds to the older phases of the mud-brick houses built on quarry-stone foundations. The rectangular room units were often altered, and individual buildings connected with each other by new wall arrangements and combined to form larger building units. Individual buildings were demolished or burned down repeatedly. After being levelled off new houses were built in their place, but these no longer corresponded to the layout of the previous buildings.

The settlement and the oasis were finally abandoned around the first century AD. Only a few ceramic fragments provide evidence of an Islamic period occupation. These must have been mainly nomads as all traces of settlement are missing. However, the settlement areas of the latest phase, dating to *c.* 100 years ago, were used as a burial place, indicated by several Islamic burials.

Burials

The ancient cemetery was situated only a few metres to the east of the rock formation. Altogether twenty-six ground burials were recorded of which eight were excavated. All burials lie uniformly in an east–west direction whereby the head of the deceased is oriented to the east. However, the tombs are very different in their shape. Whereas some are simple pits, in which the dead were buried in a crouching position, others have a niche in the lower section in which the deceased was laid stretched out on his back with the head turned to one side. The niche was covered with large quarry stones so that a kind of burial tomb was formed, which was then covered over with sediment. In general the tombs of Darbas are comparable to some single graves in Wādī Daw‘an that date to the late phase of ancient occupation in that region (Sedov 1997: 41).

In Tomb 26 (Fig. 12) at the foot end of the deceased, there was an iron knife that lay next to its leather sheath. The state of preservation of this burial, falling in the first century BC, is extremely good. In some parts of the body organic materials are still preserved. It can therefore be ascertained that the deceased, whose hands lay folded beneath the face that was turned to one side, was wrapped or sewn up in leather. In the area of the chest there were still remains of a red-dyed fabric, probably clothing. In the remaining tombs burial gifts or costume accessories are missing except for the presence of individual beads.

Acknowledgements

The archaeological operations were financed by Yemen LNG Co Ltd. We would like to thank the staff of Yemen LNG, especially Robert Hirst, James Firebrace, Sylvie Ledoirant, and Mohammad Sinnah; the President of the General Organization of Antiquities and Museums, Dr. ‘Abd-‘Allah Bawazir; the director of GOAM, Shabwa branch, Khairan Mohseen al-Zubaidi; the directors of the German Archaeological Institute (DAI Sana’a), Iris Gerlach, and of the French Centre for Archaeology and Social Science in Sana’a (CEFAS), Jean Lambert, for their support and assistance during the fieldwork. The excavations were carried out by ‘Issa ‘Alī Ibn ‘Alī, Mohammad ‘Amin, ‘Abd al-Karīm al-Barakani, Rabia’ ‘Abd-‘Allah al-Batful, Sylvain Bauvais, Ueli Brunner, Julien Espagne, Hervé Guy, Sarah Japp, Olivier Lavigne, Jürgen Malsch, Jamāl Mukrit, Jérémie Schiettecatte, and Mike Schnelle. We would also like to thank Lamya Khalidi for editing the English.

Notes

- ¹ We owe the information about the ancient irrigation in Darbas to the fieldwork of Ueli Brunner who, dur-

ing the project, was responsible for the research on irrigation. The results of his work will be published soon.

References

- Arbach M., Crassard R., Hitgen H. & Khalidi L.
2006. Vers une archéologie préventive au Yémen. *Chroniques Yéménites* 13: 1–12.
- Bowen Jr R.L.
1958. Ancient Trade Routes in South Arabia. Pages 35–42 in R.L. Bowen Jr & F.P. Albright (eds), *Archaeological Discoveries in South Arabia*. (Publications of the American Foundation for the Study of Man, 2). Baltimore, MD: Johns Hopkins Press.
- Braemer F., Cleuziou S. & Steimer-Herbet T.
2003. Dolmen-like structures: some unusual funerary monuments in Yemen. *Proceedings of the Seminar for Arabian Studies* 33: 169–182.
- Braemer F., Steimer-Herbet T., Buchet L., Saliège J.F. & Guy H.
2001. Le Bronze Ancien du Ramlat As-Sabatayn (Yémen). Deux Nécropoles de la première moitié du III^e millénaire à la bordure du désert: Jebel Jidran et Jebel Ruwaiq. *Paléorient* 27: 21–44.
- Brunner U.
1983. *Die Erforschung der antiken Oase von Marib mit Hilfe geomorphologischer Untersuchungsmethoden*. (Archäologische Berichte aus dem Yemen, 2). Mainz: Philip von Zabern.
(in preparation). *The Irrigation System in Darbas, Wādī Jirdān*.
- Brunner U. & Haefner H.
1990. Altsüdarabische Bewässerungsoasen. *Die Erde* 121: 135–153.
- Cleuziou S., Inizan M-L. & Marcolongo B.
1992. Le peuplement pré- et protohistorique du système fluviatile fossile du Jawf-Hadramawt au Yémen (d'après l'interprétation d'images satellite, de photographies aériennes et de prospections). *Paléorient* 18 / 2: 5–28.
- Crassard R.
(forthcoming). Obsidian lithic industries from al-Midamman (Tihama coast, Yemen). In E.J. Keall (ed.), *Pots, Rocks and Megaliths*. (British Archaeological Reports, International Series) Oxford. Archaeopress.
- Crassard R. & Bodu P.
2004. Préhistoire du Ḥaḍramawt (Yémen): nouvelles perspectives. *Proceedings of the Seminar for Arabian Studies* 34: 67–84.
- Crassard R. & Hitgen H.
2005. *Final report: Pipeline archaeological survey, Archaeological Management Plan*. [Unpublished report for Yemen LNG, CEFAS / DAI, Sana'a, English and Arabic versions].
2006. *Final report: "Bronze Age Tombs" Project (YLNG BAT-2006), Archaeological excavations*. [Unpublished report for Yemen LNG, CEFAS / DAI, Sana'a].
- de Maigret A.
2002. *Arabia Felix: An Exploration of the Archaeological History of Yemen*. London: Stacey International.
- de Maigret A. & Antonini S.
2005. *South Arabian Necropolises — Italian Excavations at Al-Makhdarah and Kharibat al-Ahjur (Republic of Yemen)*. Rome: Istituto Italiano per l'Africa e l'Oriente — Centro Scavi e Ricerche Archeologiche.
- Doe B.
1971. *Southern Arabia*. London: Thames and Hudson.

- Inizan M-L. & Francaviglia V.M.
2002. Les périples de l'obsidienne à travers la mer Rouge. *Journal des Africanistes: Afrique-Arabie, d'une rive à l'autre en mer d'Erythrée* 72 / 2: 11–19.
- Lézine A-M., Saliège J-F., Robert C., Werth F. & Inizan M-L.
1998. Holocene lakes from Ramlat as-Sab'atayn (Yemen) illustrate the impact of monsoon activity in Southern Arabia. *Quaternary Research* 50: 290–299.
- Philby H.St.J.
1939. *Sheba's daughters: being a record of travel in Southern Arabia*. London: Methuen.
- Schiettecatte J.
2006. *Villes et urbanisation de l'Arabie du Sud à l'époque préislamique. Formation, fonctions et territorialités urbaines dans la dynamique de peuplement régionale*. PhD thesis, Université de Paris 1 Panthéon-Sorbonne. [Unpublished].
- Sedov A.W.
1997. Die archäologischen Denkmäler von Raybūn im unteren Wādī Dau'an (Hadramaut). *Mare Erythraeum* 1: 31–106.
- Steimer-Herbet T.
2004. *Classification des sépultures à superstructure lithique dans le Levant et l'Arabie occidentale (IV^e et III^e millénaires avant J.-C.)*. (British Archaeological Reports, International Series, 1246). Oxford: Archaeopress.
- van der Meulen D.
1947. *Aden to the Hadhramaut. A Journey in South Arabia*. London: John Murray.
- von Wissman H.
1962. Al-Barīra in Ġirdān im Vergleich mit anderen Stadtfestungen Alt-Südarabiens. *Le Muséon* 75: 177–209.

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