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Manayzah, early to mid-Holocene occupations in Wādī Ṣanā (Ḥaḍramawt, Yemen)

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Summary
Discovered during the 2004 campaign of the RASA Project in the province of Ḥaḍramawt, Yemen, Manayzah is an early to mid-Holocene site exceptional for its deep and well-preserved occupational stratigraphy, an unparalleled corpus of stone tools, numerous animal bones, clearly defined activity and dwelling areas, as well as elements of stone and shell jewellery. Lithic industries are widely diversified with worked obsidian, bifacial arrowheads, and numerous other tool types. The fluting technique appears in stratigraphic contexts and is now dated to the seventh millennium BP by radiocarbon assay on associated organic material.

In the 2005 winter season, RASA archaeologists initiated an open-area excavation and added much archaeological data for spatial analysis and lithic studies, which focused on debitage modalities and tool shaping. The study of features (such as hearths, pits, and post holes) promises valuable insight into the social organization of mid-Holocene populations in Ḥaḍramawt. This prehistoric occupation site is the first of its kind in Yemen in terms of quality, diversity, and quantity of artefacts, and is especially remarkable for the associations of bones and lithics. This new data set offers crucial progress towards redefining the so-called "Neolithic" period in southern Arabia, particularly in terms of economic activities. What follows is a preliminary report on the site, and current research.

Keywords: Manayzah, Holocene, Ḥaḍramawt, Yemen, lithic technology

Introduction

Prehistoric human occupations are still poorly understood in South Arabia, especially in Yemen. Because most material comes from surface scatters, the Palaeolithic period remains ill defined. Although researchers have found artefacts typologically related to the Pleistocene in several regions, there is no precise dating for any of these artefacts. The early and mid-Holocene period is better known, thanks to a few stratified sites (e.g. Fedele 1986; Garcia *et al.* 1991; Amirkhanov 1994; Kallweit 1996; McCorriston *et al.* 2000; Cattani & Bökönyi 2002; de Maigret 2002; Crassard & Bodu 2004), palaeoenvironmental studies (e.g. McClure 1971; Fedele 1990; Sanlaville 1992; Wilkinson 1997; 2003; Inizan *et al.* 1998; Lézine *et al.* 1998; Cleuziou & Tosi 1998; McCorriston *et al.* 2000), and abundant surface lithic material (e.g. Caton-Thompson 1964; Bayle des Hermens 1976; Di Mario 1986; 1989; Inizan & Ortlieb 1987; Inizan 1989; 1997; Cleuziou, Inizan & Marcolongo 1992; Amirkhanov 1994; 1997; Edens & Wilkinson 1998; Khalidi 2005; Crassard & Khalidi 2005). Yet the definition of the so-called "Neolithic" period in Yemen remains controversial. Researchers still lack any clear evidence of domestication and agriculture from a stratified site pre-dating 3500 BC (Wilkinson 1997; Ekstrom & Edens 2003; Harrower 2005). While elsewhere the term Neolithic generally implies food-producing societies, in Yemen the term "Neolithic" applies to stone tools and chipping debris, mostly found on the surface. These lithics have been typologically associated with a broader Near Eastern Neolithic cultural phase because Yemen's knappers used a pressure-flaking technique that was culturally distinctive elsewhere. Yemen lacks a precise chronological frame or typo-technological analysis for its so-called "Neolithic" lithic industries. Instead researchers refer to a few regionally distinct tool types based on a superficial typology (e.g. "Arabian bifacial tradition" or "ABT", "Rub' al-Khali Neolithic") that may lack underlying technological congruence.

Several archaeologists have therefore questioned the grouping of artefacts into cultural phases based on typological attributes alone (Inizan 2000; Charpentier 2004;

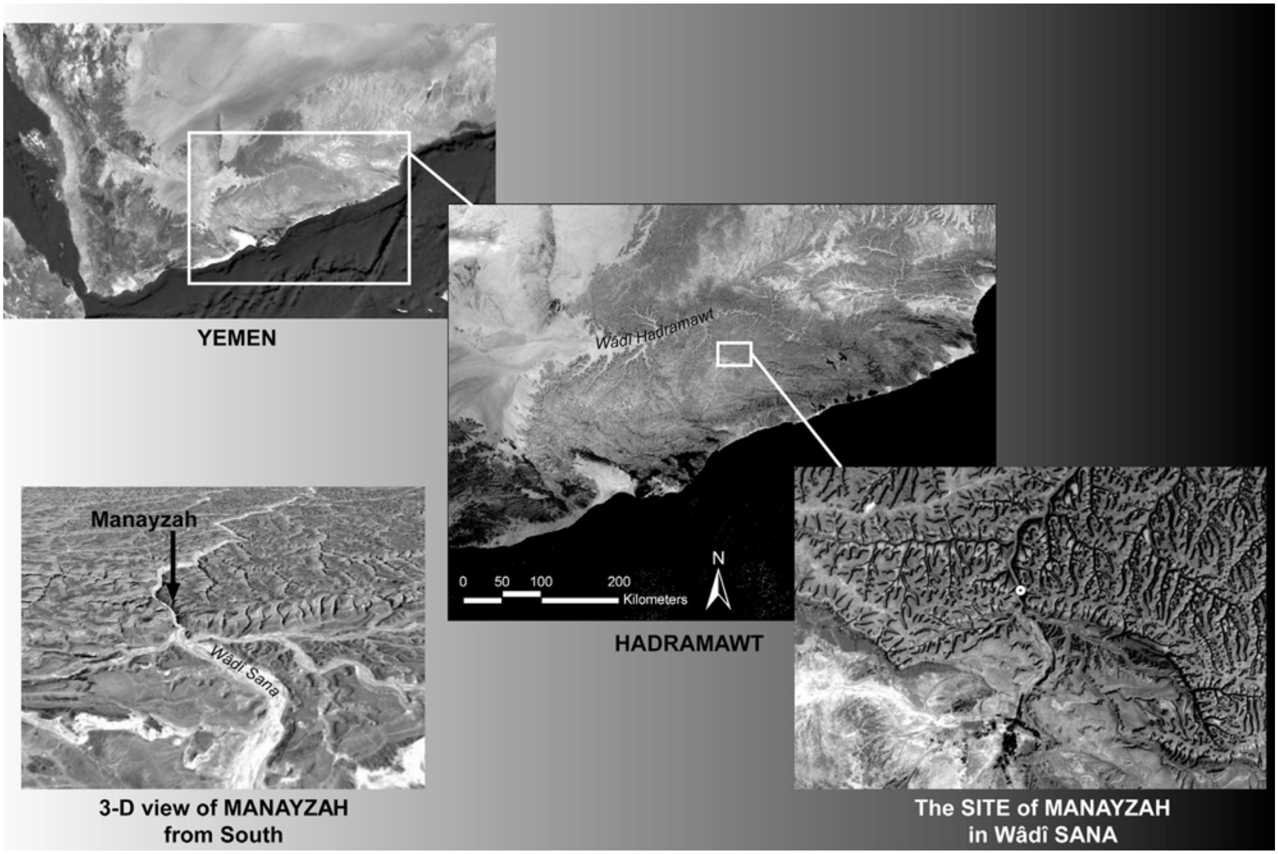

FIGURE 1. *The location of Manayzah in Ḥaḍramawt, Yemen.*

Crassard & Khalidi 2005; Cleuziou 2004). This paper introduces the site of Manayzah, which could provide key data for defining so-called "Neolithic" Holocene occupations and life-ways (socio-economic peculiarities) in Wādī Ṣanā, Ḥaḍramawt, and beyond.

In February 2004, the RASA Project[1] team discovered Manayzah (or al-Manayzah) during systematic survey of a randomly selected transect in Wādī Ṣanā (Fig. 1).[2] The surface of the site, located under a small rock shelter, was densely carpeted with lithic artefacts (flakes, arrowheads, other numerous tools made of chert, and also many obsidian flakes, bladelets, and tools), prompting researchers to map the site and establish a metre grid with alphabetical designations east to west and numerical designations north to south.

In 2004 we opened a small 1 m x 1 m test pit in K9. From the first, discoveries in K9 showed the high potential of the site. Fifteen layers appeared in the upper 50 cm profile, with a succession of occupations and numerous, diverse archaeological artefacts and features including perfectly preserved hearths. With such good data available, we decided to continue excavation in February 2005 with an open-area strategy in order to obtain a better view of the spatial distribution of artefacts and features, while also trying to reach the bottom layers in the K9 deep sounding.

Manayzah is but one of several significant sites located and tested by the RASA Project. Conceived as a survey and limited excavation strategy, the RASA Project has sought over four seasons both to define the chronology and culture history, and to examine the impact of climate change on human adaptive strategies in one of the highland drainage systems (Wādī Ṣanā) of southern Arabia (McCorriston *et al.* 2000; McCorriston *et al.* 2005; Harrower, McCorriston & Oches 2002). RASA fieldwork and subsequent analysis situate Manayzah in a broader ecological and cultural context: the site represents one of several rock shelters containing early Holocene human occupation in the upper and middle reaches of the inland-draining wadi. Subsequent to the occupations represented at Manayzah and other shelters, people herding (probably) cattle and later ca-

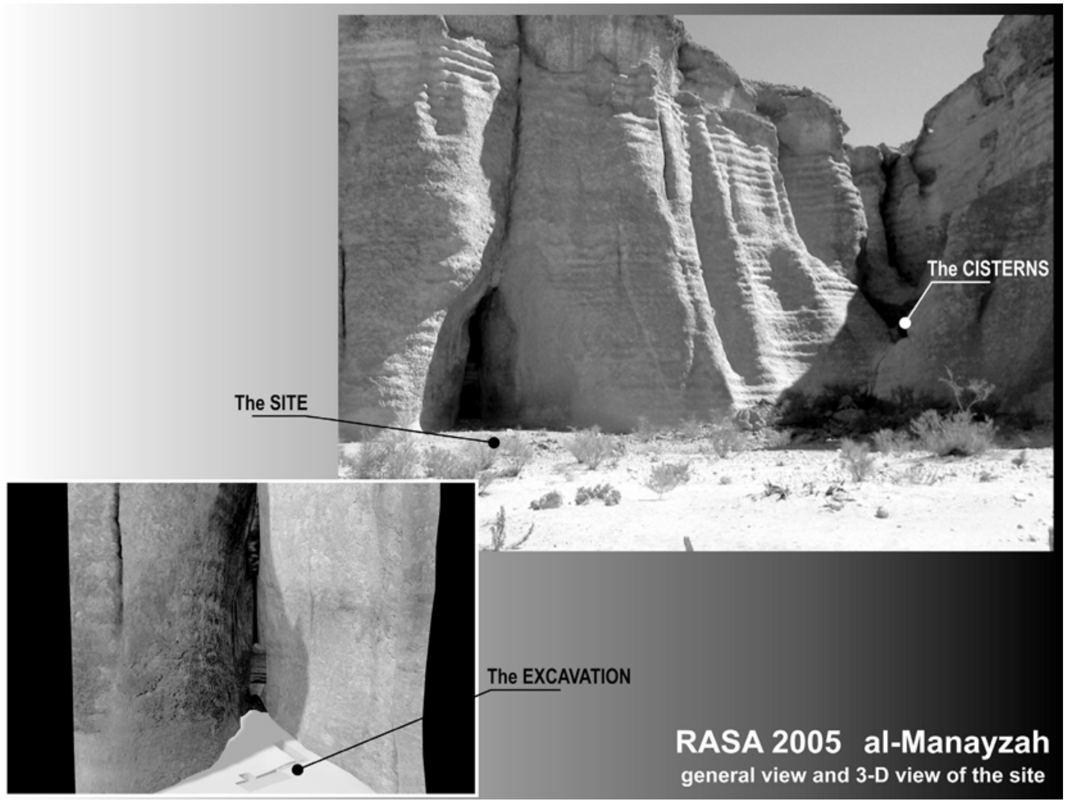

FIGURE 2. *A general view, Manayzah.*

prines depended on the forage and limited cultivable land afforded by Wādī Ṣanā. Herders continue to occupy rock shelters to the present day, but water sources have dramatically diminished since the middle Holocene, and herders no longer cultivate cereals or wild plants in Wādī Ṣanā.

Situation and strategy

General aspects of Manayzah

The site name of Manayzah comes from the name of an adjacent system of small natural cisterns that collect rainwater (Fig. 2). It is likely that a spring originally fed this system, but there is no evidence for a modern spring flow. Standing water makes this place important today in the arid climate of Ḥaḍramawt. Certainly the presence of water was a decisive one for the prehistoric population's use of the adjacent rock shelter. Located at the bottom of an abrupt cliff 40–50 m high, the site offers good protection from the sun, making it attractive for shelter. The archaeological strata in the site form a small hill sloping down from the entrance of a narrow, sleeve-shaped cave, which is not deep (about 10 m). It appears that this little cave was probably higher and larger than it is today, because of the accumulation of sediments concentrated in the back of it. The whole site is topographically higher than the Wādī Ṣanā bed, and is hidden from the main watercourse, which can have a very strong flow because the watershed of the broad Ghayl bin Yumayn basin drains through a narrow canyon at this location.

The surface of Manayzah is covered by a slightly hard surface of indurate sand due to the calcification of sediments. When it rains, rainwater drains down and through the limestone cliff, spreading out over the site and producing a limestone precipitate as it evaporates. A calcified crust could have played a significant role in the preservation of delicate archaeological strata, especially during forceful spate floods of the later Holocene, when the erosion of silts has characterized much of the Wādī Ṣanā drainage.

Strategy of the archaeological operations

After reopening K9 in 2005, we extended excavation

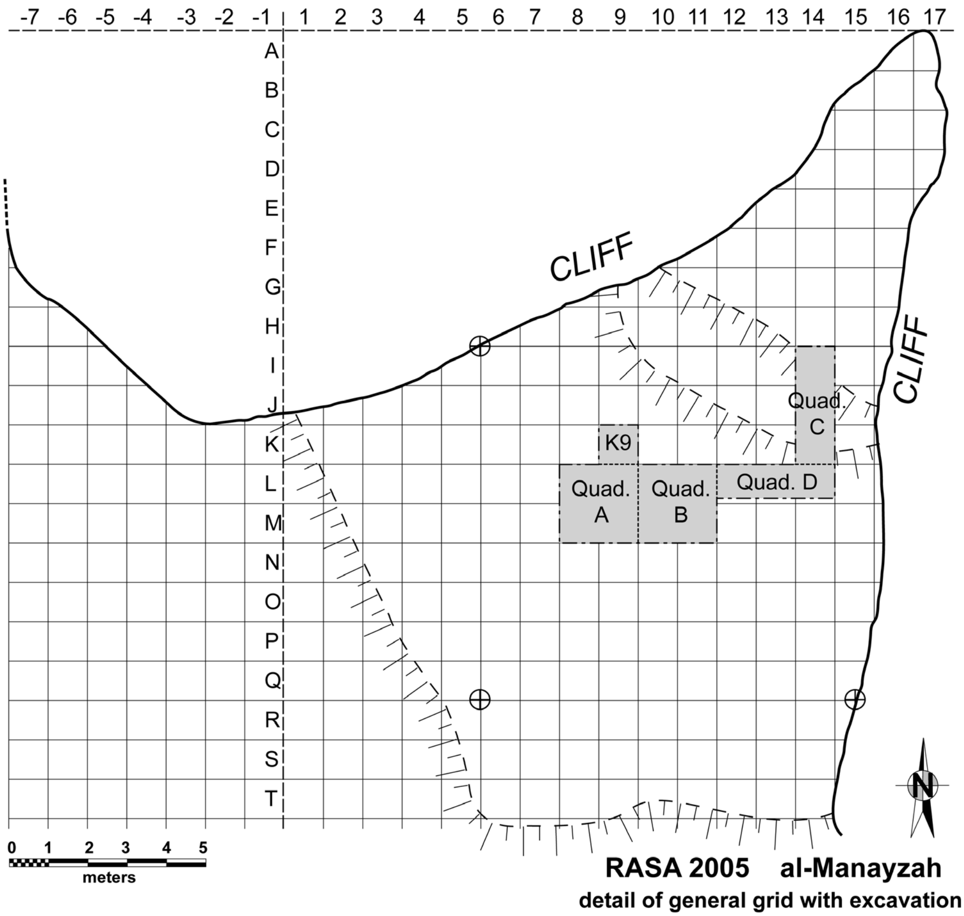

FIGURE 3. *The archaeological grid, Manayzah.*

southward to follow the stratigraphy already known from K9. We established an arbitrary 4 m^2 sector called Quadrant A (including squares L8, L9, M8, and M9). To gain a better view of the spatial variability of artefacts and features, we opened another 4 m^2, Quadrant B (including L10, L11, M10, and M11), east of Quadrant A. Two other quadrants were also opened to establish the entire stratigraphic sequence from the highest layers under the cave to the bottom of test-trench K9. Thus Quadrant C includes squares I14, J14, and K14, and Quadrant D links C and B by a 60 cm-wide trench across the northern halves of squares L12, L13, and L14 (Fig. 3). We stopped excavation in Quadrants A and B after reaching a clear surface of indurate sand, and in C and D after reaching a thin yellow layer that we could follow in both quadrants and in part of Quadrant B, making a stratigraphic connection between all areas. In K9 we have not yet reached a sterile base of the site 2.20 m below the uppermost strata in Quadrant C.

Prior to excavation we completed a systematic surface collection across the site. Every piece of knapped flint and obsidian was taken and inventoried by square metre to evaluate the spatial patterning. Even for surface material, such a study can provide useful information, such as how the site was disturbed in its most recent occupations (dung and stone placements show that Manayzah has been used as a Bedouin campsite in recent times). This study is still under way but, from the surface, it already reveals a reasonably good homogeneity of the lithic industries.

First campaign of extensive excavation: Manayzah 2005

Stratigraphy

Manayzah has deep stratigraphy for a site largely depos-

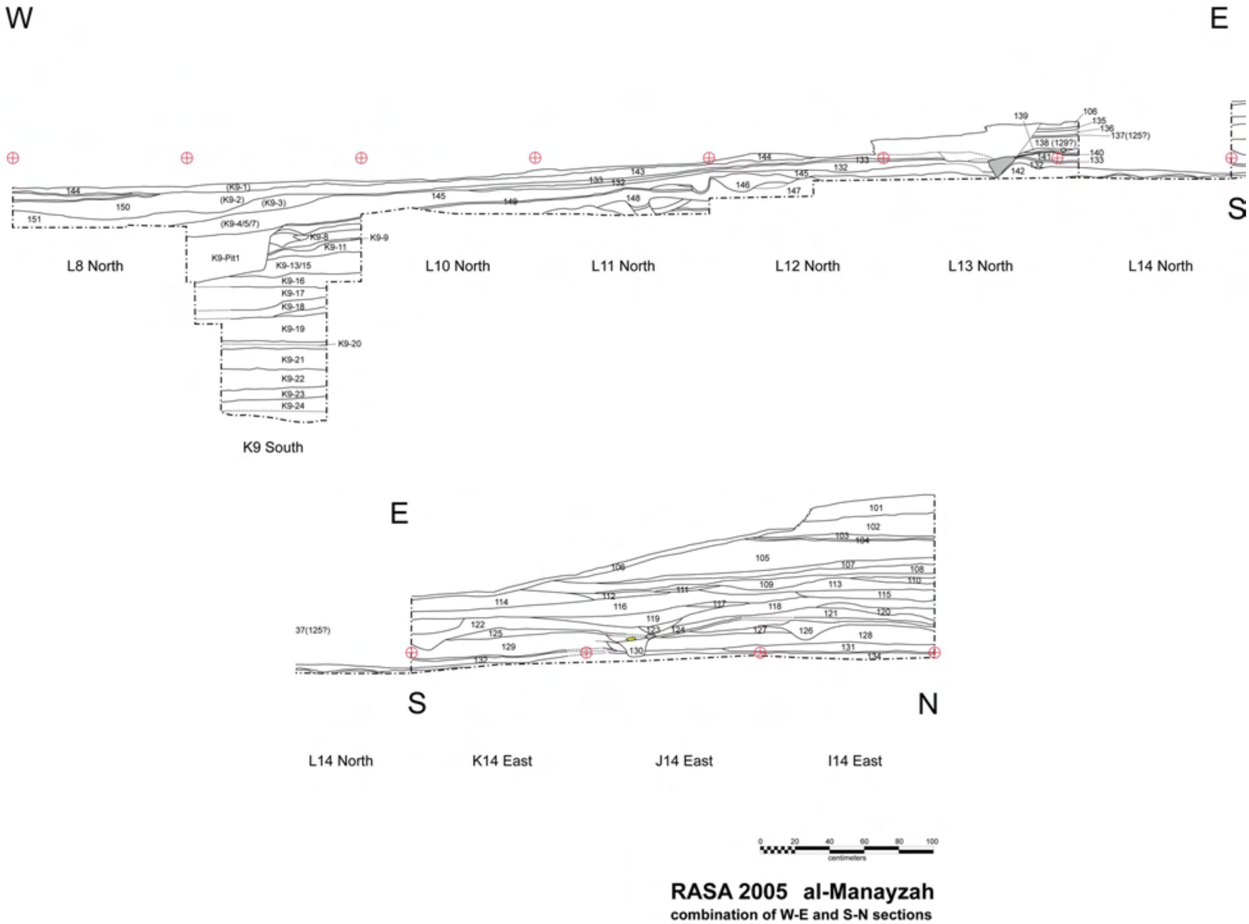

FIGURE 4. *A combination of the W–E section and S–N section, Manayzah.*

ited through aeolian and water-born sand and silt accumulation, enriched with organic materials. It is extremely rare to find well-preserved early Holocene sites in the Arabian Peninsula because taphonomic processes such as deflation and erosion remove most occupational debris. Many sites are only surface distributions of artefacts without a chrono-stratigraphic framework. At Manayzah more than 2.20 m of known stratigraphy (the bedrock has not been reached) promise an important relative chronology for the regional early to mid-Holocene (Fig. 4).

About sixty stratigraphic layers have been identified, and each of them has been sampled for phytolith analysis. The thin layer numbered 149 and found in Quadrants A and B has been partially recovered over a large area, and is clearly associated with features, such as a pit and three hearths.

Although the stratigraphy allows clear definition of depositional events, some layers are poorly preserved in very thin accumulations. These circumstances sometimes make it impossible to separate layers in excavation. Nevertheless it has been possible to identify discrete lithic workshops. For example, some remains of obsidian micro-debitage lie scattered on a flat area that we therefore suppose to have been a knapping area for retouch activity on top of layer K9–13.

Our surface collection yielded some very important diagnostic tools. The surface artefacts are typologically closely similar to those found in the upper excavated levels. Their common characteristics suggest that there has been little perturbation and erosion of the site surface, a hypothesis we hope to test with spatial statistics and the composition of surface and underlying assemblages. While the surface artefacts are very rich in obsidian and chert flakes, some tools were also found, including a knife in jasper-like chert (Fig. 5/2) with a

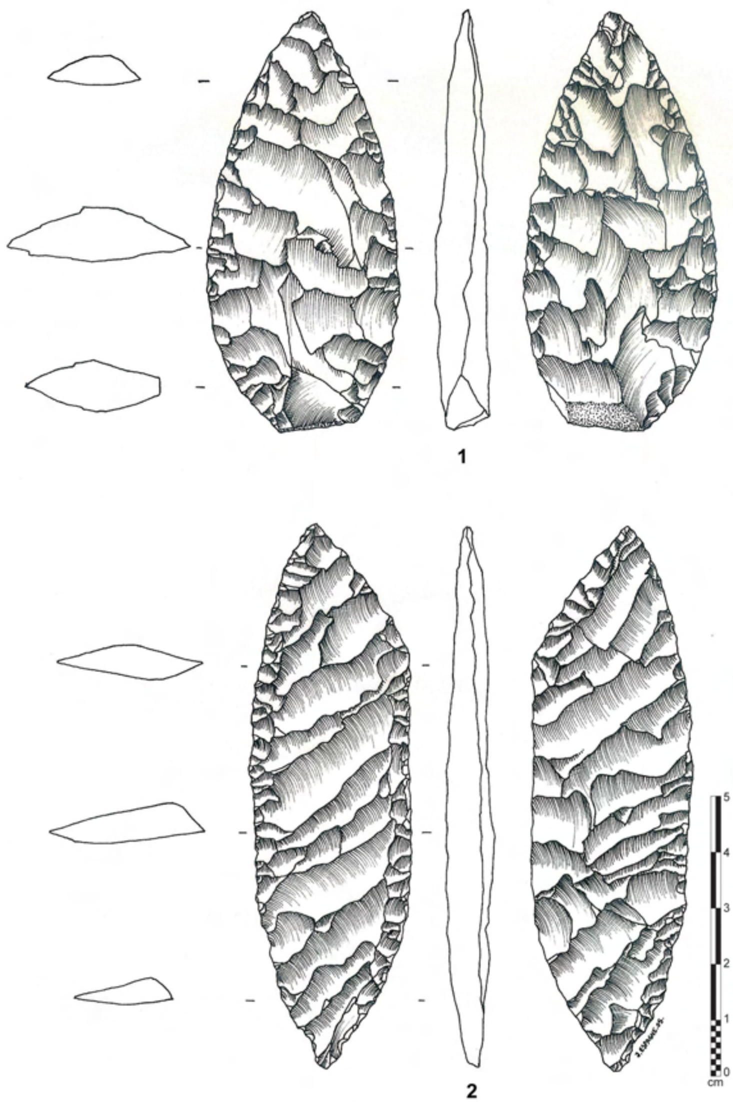

FIGURE 5. *Foliate bifacial tools:* ***1.*** *H9-loc000: a foliate bifacial piece.* ***2.*** *H9-loc000: a bifacial knife.*

very skilled pressure-flaked parallel retouch (*en écharpe*). Some arrowheads, typologically close to examples found at the Khuzmum excavation (McCorriston *et al.* 2000), belong to a "Neolithic" cultural style (Crassard & Khalidi 2005).

Features

Four hearths and numerous ashy areas (possibly ash dumps or discrete hearths) have been excavated, showing a dense occupation of the site in prehistory. Two well-constructed hearths of exactly the same type have been discovered and may prove good markers for chrono-cultural identification. These circular hearths are 50–60 cm in diameter and 20–25 cm deep. They were deliberately filled with burnt limestone clasts averaging 10–20 cm. The two hearths are only 3.5 m apart and both have been constructed by digging a pit from the same layer. They indicate deliberate spatial patterning during occupation perhaps by multiple families or subgroups. Other stratified hearths are generally slightly dug into the sandy matrix and contain charcoal. One hearth (K9-Hearth1) was constructed as a bed of flat stones in a circular shape.

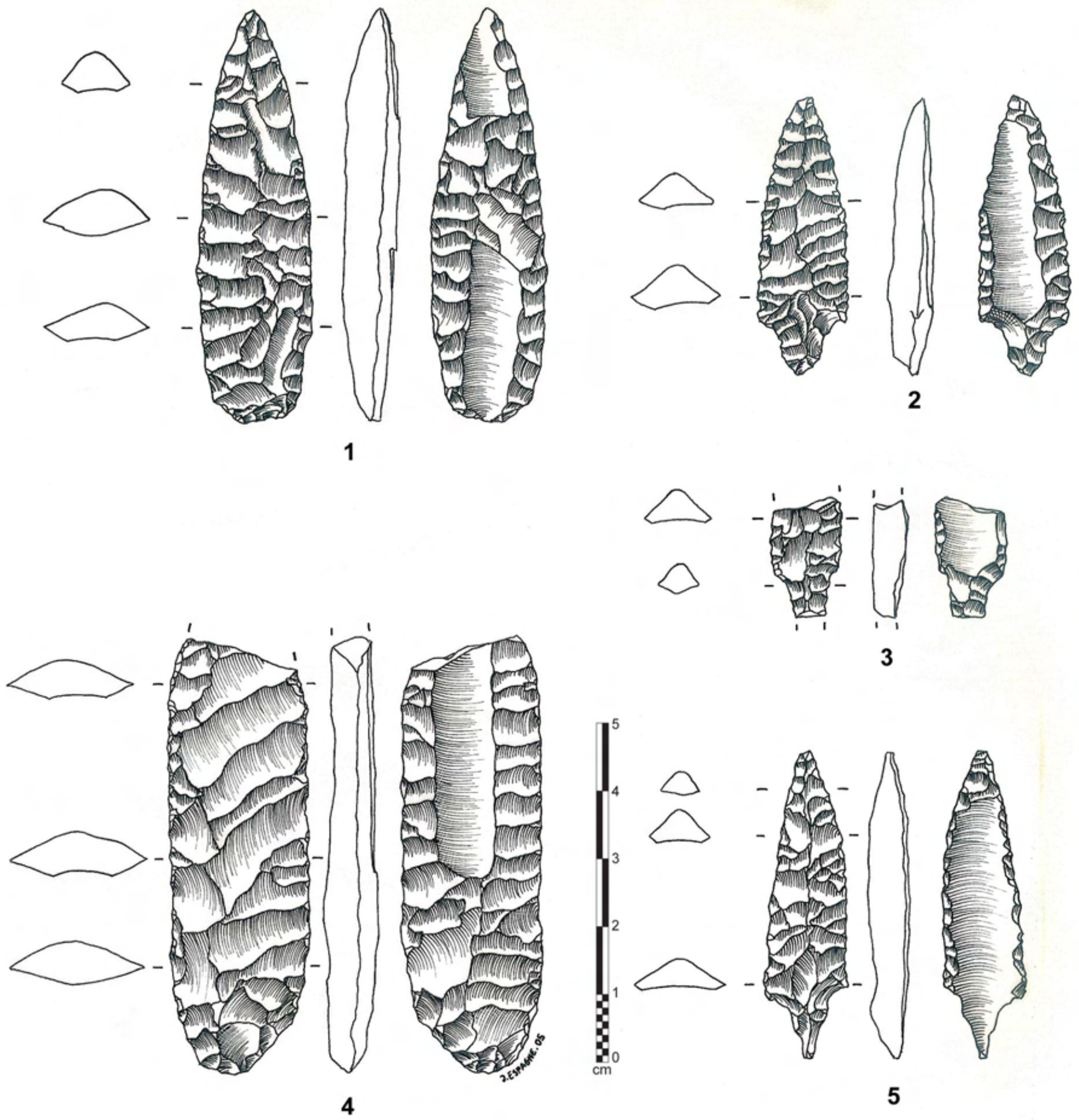

FIGURE 6. *Fluted bifacial tools:* ***1.*** *I6-loc000: the bi-fluted pre-form (?) of an arrowhead.* ***2.*** *Q5-loc000: an arrowhead fluted from the point.* ***3.*** *M8-loc001: a fragment of an arrowhead fluted from the point.* ***4.*** *Quad.C-all-loc009: the mesio-basal of a fluted bifacial piece (pre-form of arrowhead?).* ***5.*** *L9-loc002: an arrowhead fluted from the base.*

Part of a pit (K9-Pit1) had been recognized in K9 in 2004. It now appears to be about 1.5 m long and at least 30 cm deep. Although not completely excavated, the small part probed in K9 yielded a high number of animal bones and was rich in charcoal, including intact burnt branches.

Two very clear post holes have been identified, excavated from different surfaces. Post holes (10 cm wide and 10 cm deep) included small vertical stones in their fill, probably as chocks to stabilize slender posts. Post holes suggest the presence of wooden structures, and it may be possible to define more than one of these in future excavations.

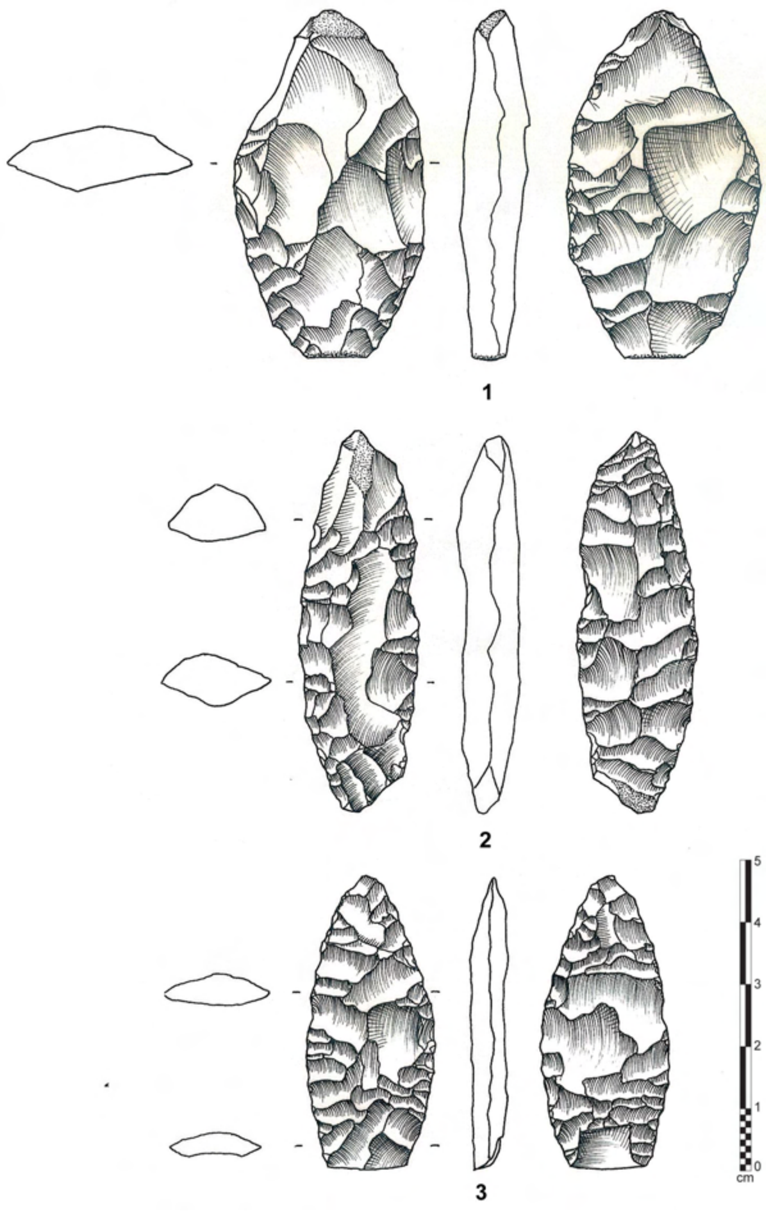

FIGURE 7. *Bifacial tools (pre-forms?):* ***1.*** *Quad.A-all-loc004: an irregular biface.* ***2.*** *L10/L11-loc009: an irregular biface.* ***3.*** *Quad.B-all-loc008: a biface with the remains of a missed fluting operation at one extremity.*

Lithic technological analysis

The tools and debris of flaking activities using chert and obsidian are dense in most of the layers and always present in every strata, including the surface and the lowest excavated layer in square K9.

Fluting technique

The fluting technique was common at Manayzah. This technique, first described and extensively experimented by D. Crabtree (1966), is well known and associated with a long period of time in the Americas, from the Arctic area with Palaeo-Eskimo points, to Patagonia, via

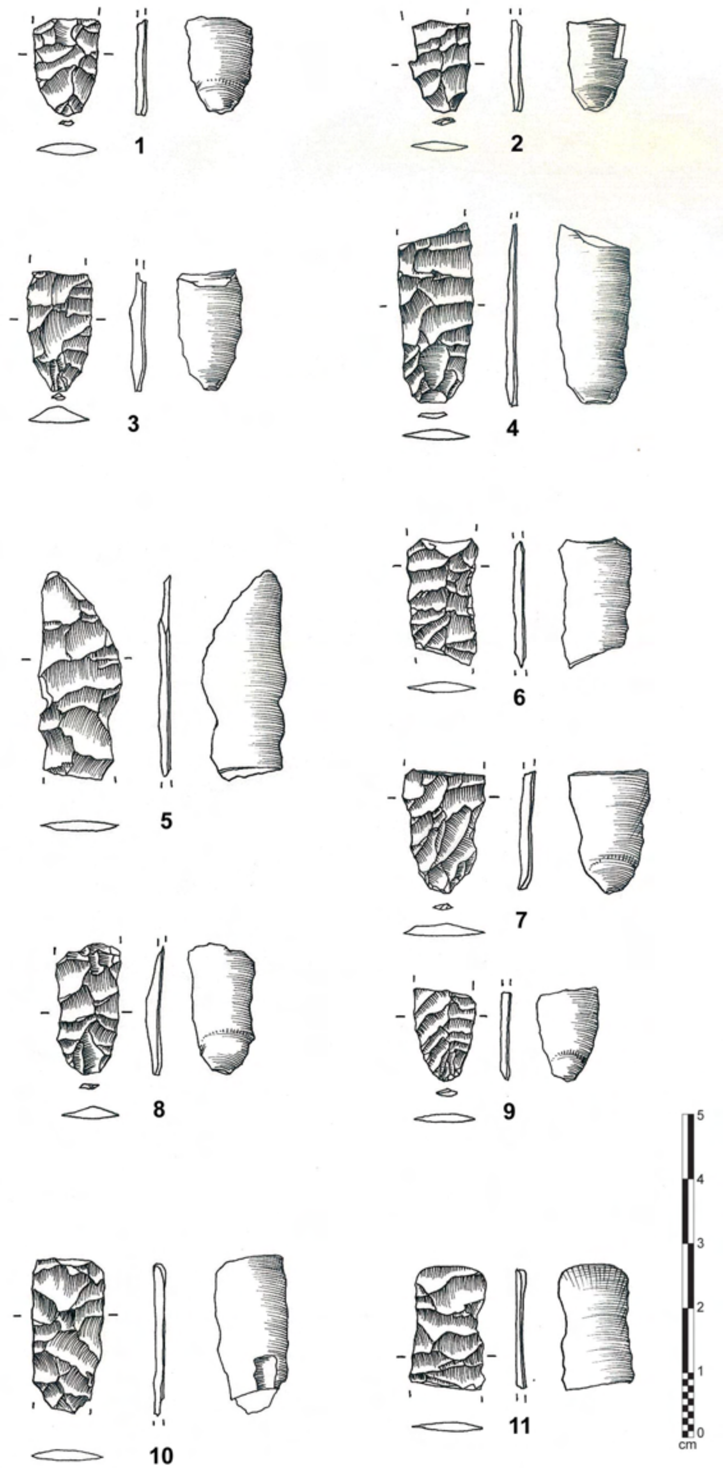

FIGURE 8. *Channel flakes:* ***1.*** *proximal;* ***2.*** *proximal;* ***3.*** *proximal;* ***4.*** *proximo-mesial;* ***5.*** *mesio-distal;* ***6.*** *mesial;* ***7.*** *proximal;* ***8.*** *proximal;* ***9.*** *proximal;* ***10.*** *mesial;* ***11.*** *distal.*

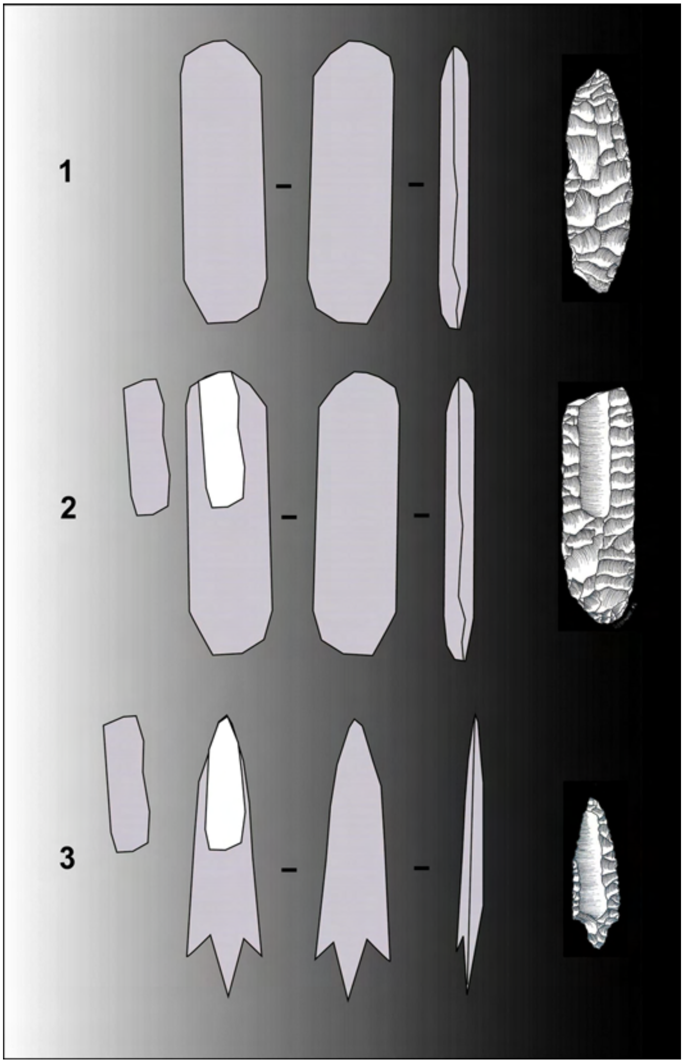

Figure 9. *The schematic operating system of fluting at Manayzah.*

North America, with Palaeo-Indian points such as Folsom and Clovis points dated to 11500–10500 BP. Fluting entails thinning a bifacial piece by removing a long, flat flake along the central axis of the biface. Fluted tools and channel flakes (or fluting flakes), the diagnostic waste after a fluting removal, are easy to recognize and associate with this technique. The possibility that these pieces could have been obtained in an accidental way or by chance is not viable.

This technique has been previously identified in Yemen at several surface sites (Charpentier & Inizan 2002; Charpentier 2003). The fluting technique has also been discerned on lithic assemblages from Oman and the United Arab Emirates. Manayzah marks the first discovery in South Arabia of a knapping technique that removes a channel flake from the base of the point: all previous finds of fluted points, interpreted as arrowheads, show removal of a channel flake from the apical-end (the point). At Manayzah, many non-pointed chert bifacial tools and arrowheads were found with the scar of a channel flake that had been removed from the basal or proximal end of the tool (Fig. 6/2–5), or sometimes from both ends (Fig. 6/1). Some of the fluted products may be pre-forms for arrowheads (Figs 6/4 & 7/3) abandoned after a knapping accident (such as breakage due to poor percussion), or a personal or cultural choice

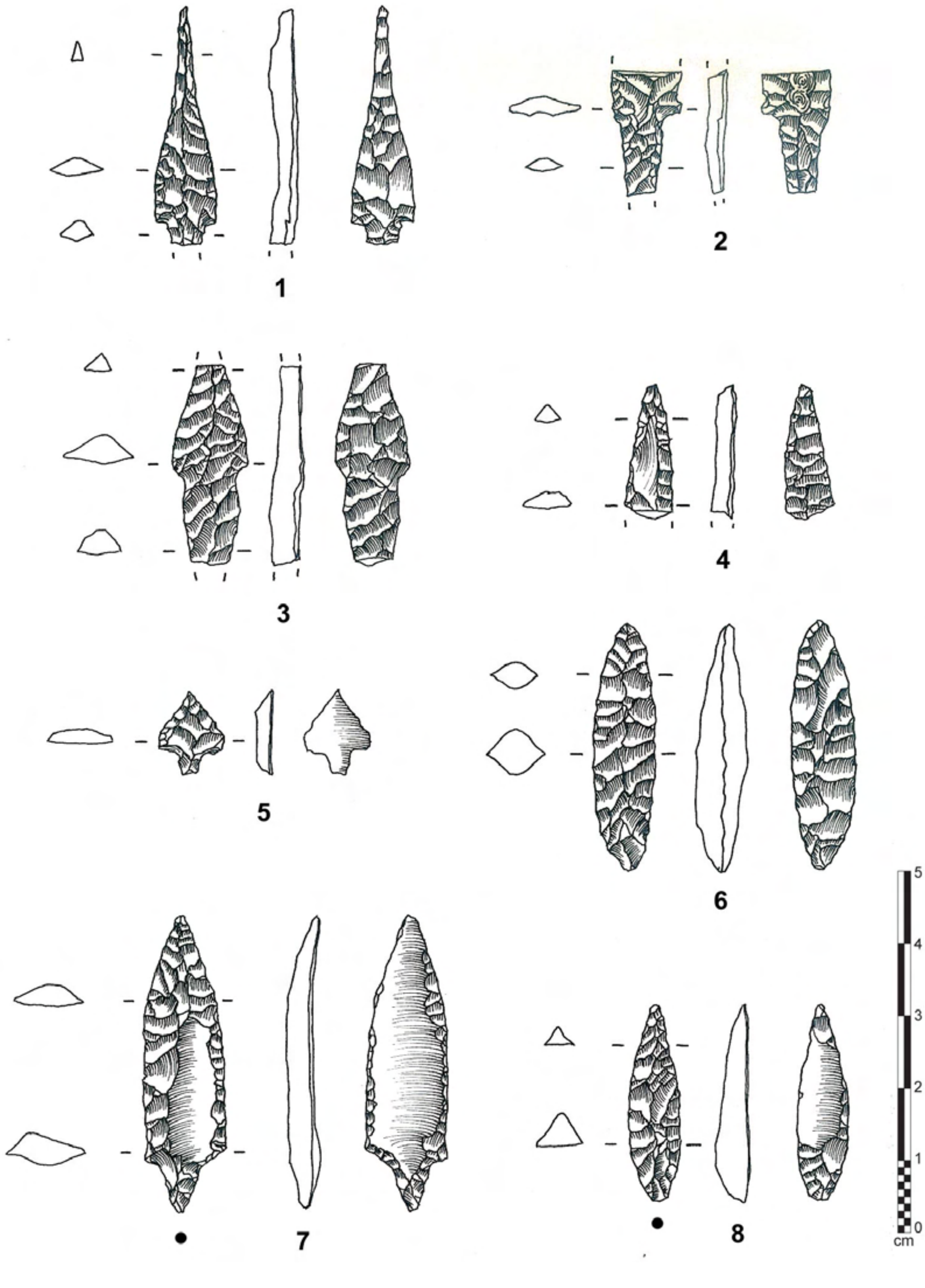

FIGURE 10. *Arrowheads:* ***1.*** *a plano-convex/trihedral arrowhead;* ***2.*** *a fragment of a bi-convex bifacial arrowhead;* ***3.*** *a fragment of an asymmetrical bi-convex/trihedral arrowhead;* ***4.*** *a fragment of a trihedral arrowhead;* ***5.*** *a small arrowhead on a flake with tang and wings;* ***6.*** *a symmetrical bi-convex bifacial arrowhead (?);* ***7.*** *an arrowhead on a blade (obsidian);* ***8.*** *an arrowhead on a thick flake (obsidian).*

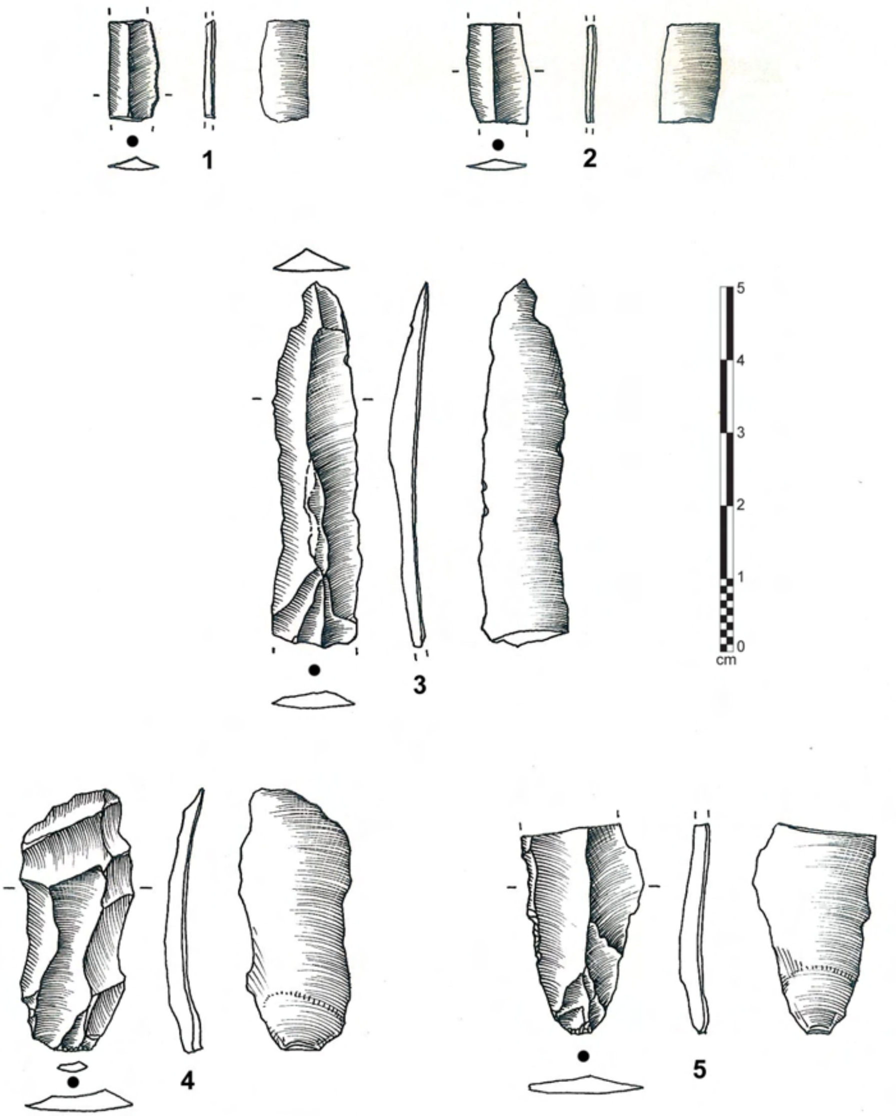

FIGURE 11. ***1–5.*** *Obsidian bladelets.*

(unsatisfactory bifacial shape). The discovery of a high number of fragmentary channel flakes (proximals, mesials, and distals[3]) indicates *in situ* point production (Fig. 8). Channel flakes also indicate the presence of expert knappers, for a successful fluted point is very difficult to produce. The technique for fluting used at Manayzah remains unclear; it could have been a pressure or indirect percussion technique. The heat treatment of some bifaces before fluting is possible. It has been detected on fragmentary channel flakes by the presence of a bright surface, but cannot be clearly confirmed until use-wear analyses are done.

One fluted bifacial point (Fig. 6/1) discovered on the surface (square I6) provides good information on the *chaîne opératoire*, or technical sequence, of fluted Arabian tools. The piece was fluted at both extremities and seems to be a pre-form of a fluted point. First the knapper prepared a small almond-shaped biface with an asymmetric biconvex cross section. The shaping was made by semi-abrupt retouch on the first face, and low angle retouch on the other one, all by pressure flaking.[4] Next the knapper removed a fluting flake on the less convex face by using a punch (indirect percussion) or pressure technique at the point (apical end). This first

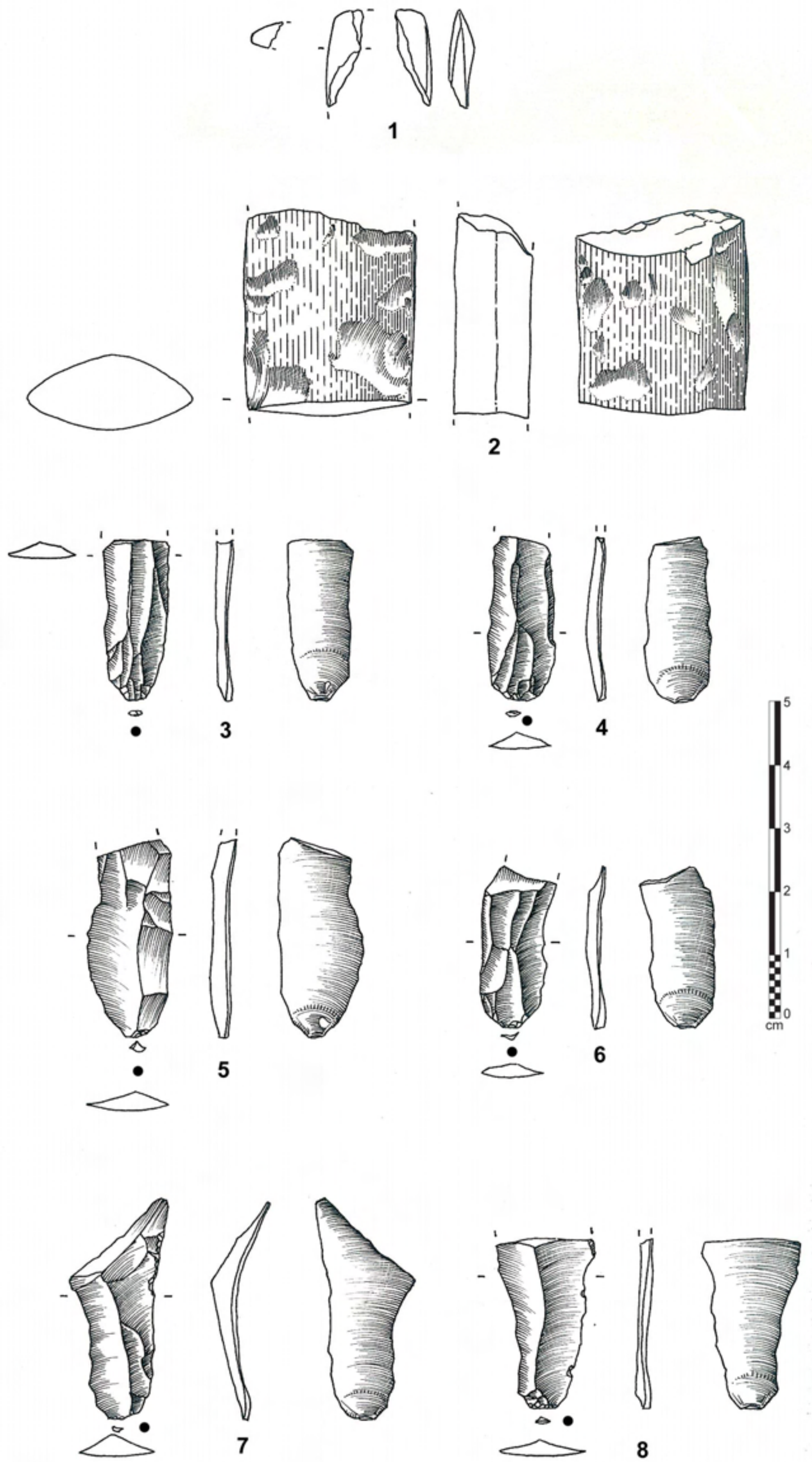

FIGURE 12. *Polished axes and obsidian bladelets:*
***1.** the edge of a polished axe in green stone;*
***2.** the mid-part of an axe in grey stone; **3–8.** obsidian bladelets.*

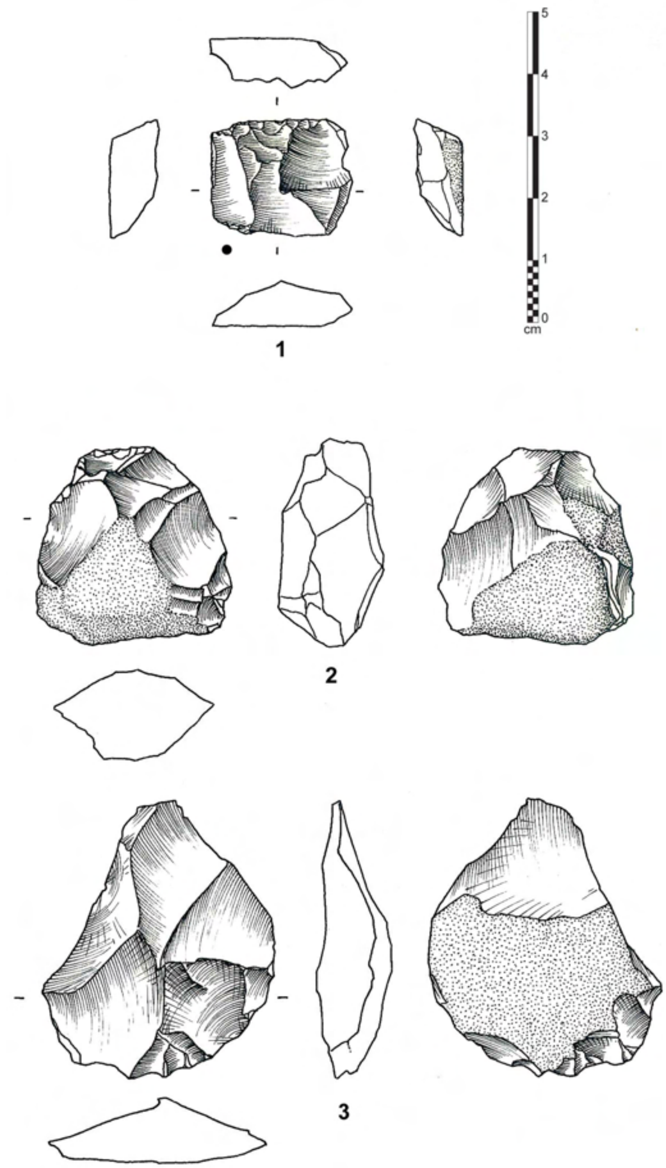

FIGURE 13. *Cores:* ***1.*** *an obsidian core with one unipolar striking platform;* ***2.*** *a core for flakes ("Levalloisian intention"?);* ***3.*** *a "Levalloisian" core.*

fluting effort did not work: this can be seen from the scar of a hinged channel flake. Because the apparent final goal of the knapper was to have a complete flute along the full length of the piece, he or she decided to do a fluting removal from the bottom (basal end) of the bifacial tool. Alas for the knapper: the same knapping accident occurred, and he or she abandoned what we consider as a pre-form of a fluted planoconvex arrowhead. Thus it is possible to reconstruct the story of this abortive tool, and then to restructure in theory a complete technological sequence of fluting at Manayzah (Fig. 9). One conclusion can be proposed: the knapper envisioned fluting along the entire length of the arrowhead, intending to produce a sufficient fluting length. This goal could be explained by the functionality of the tool, or by a techno-cultural stress peculiar to a single prehistoric human group.

Just how or whether fluting enhanced the function of fluted points remains unknown. It is clear that such points were used as projectile points, but the fluting itself does not make a better weapon. Nevertheless, it makes the arrowhead slightly lighter. It is also now evident that knappers worked to make a fluting scar removal of sufficient length and would abandon an unfinished tool, even if the pre-form could still be finished as a serviceable point (albeit lacking a fully long flute scar). Most of the time, the fluting operation appears from the upper part of the points, and cannot be directly interpreted as a hafting element. Because of the difficulty and knowledge required to flute, and because of the risk of wasting meticulous preliminary work during the shaping of a complex bifacial piece, it is possible to see in the fluting action a display of skill by highly specialized "masters". The removals of one or two final flakes could destroy the carefully fashioned piece, while they are not absolutely necessary to the hafting process or to considerations of weight. Fluting may therefore be a culturally and stylistically determined choice, one that may have significant chronological implications.

The fluted points, entire or fragmentary, were found stratified, which now allows us a precise date for the technique, both relative and absolute. Fluted elements occurred in layers overlying and later than a hearth (K9–9) radiocarbon dated (on wood charcoal) to 6902+/-41 BP (5835 BC–5733 BC Cal 1δ — laboratory ref. AA59570). In the stratigraphy, channel flakes are present in slightly older layers, up to K9–10/K9–11.

Raw materials

The basic raw materials used for flint knapping are numerous. Two main local sources have been identified. One source is pebbles from wadi beds, which provided a common and widely used opportunity for the knappers at Manayzah. The material from wadi beds is varied, with a majority of cherts, but also chalcedonies and jaspers. They were all used because of their high quality for knapping, especially for pressure technique work, which requires very fine siliceous stones. Moreover, the quality of used stones could be ameliorated by heat treatment. Another probable source is on the top of the plateau. Very good quality chert and flint are known from outcrops in Ḥaḍramawt (Wādī Waᶜshah). It is likely that such sources are present on the Wādī Ṣanā plateaus, since fragments of thin tabular chert blocks, similar to those already known from Wādī Waᶜshah, have been found in the excavation. Finally, obsidian, an extrinsic material, is also widely used throughout a large part of the currently known stratigraphy.

Obsidian use

Obsidian is omnipresent in every stratified layer above a change of lithic artefacts evident at the stratigraphic interface K9–20/K9–21. This volcanic glass, which is black, grey-black, or green-black at Manayzah, was worked like chert. Knappers used percussion or pressure with a hammer or pressure-tool of stone, hard wood, or animal material such as bone, horn, or antler. The few examples of arrowheads in obsidian were all produced using a laminar support or a flake (Fig. 10/7–8). We found no example of fluting (either an arrowhead or channel flakes) on obsidian.

Obsidian was primarily worked for bladelets and flaking debitage (Figs 11, 12/3–8). There is no clear evidence of debitage using the pressure technique, but the shapes of butts and bulbs on many bladelets suggest the use of this method, which may be confirmed through statistical and experimental analysis. Furthermore, we have found no obsidian cores showing a clear bladelet debitage strategy. One core (Fig. 13/1) may have yielded such bladelets, but this example lacks the regular and standardized scars associated with "classic" bladelet cores.[5] It shows an expedient unipolar debitage of non-standardized elongated flakes.

Some obsidian flakes show clear flake scars indicating a shaping modality, which means that not only debitage systems were used on obsidian at Manayzah. There may have been some bifacial shaping strategies used on obsidian, without chance discard or deliberate discard, and without the archaeological recovery of any bifacially worked obsidian tools.

Obsidian artefacts are not merely abundant, but the stratigraphic superposition of assemblages suggests a shift in procurement and manufacture over time. Most tools are small and show technical similarities in manufacture throughout the chrono-stratigraphic sequence. Surface and upper assemblages suggest bladelet production because the debitage is thin, long, and required knapping expertise and perhaps the pressure technique. Furthermore, the butts of obsidian flakes and bladelets always bear the marks of deliberate and intense abrasion, generated as platform preparation during a predetermined debitage sequence. In earlier levels, the flakes appear to be closer to a shaping sequence such as occurs in the manufacture of bifacial arrowheads and retouching of a blunt tool. This approach to tool production differs sharply from the less predetermined technical systems that characterized obsidian knapping during the second and first millennia BC on the Tihama coast and on some pre-Islamic (South Arabian) sites (Caton-

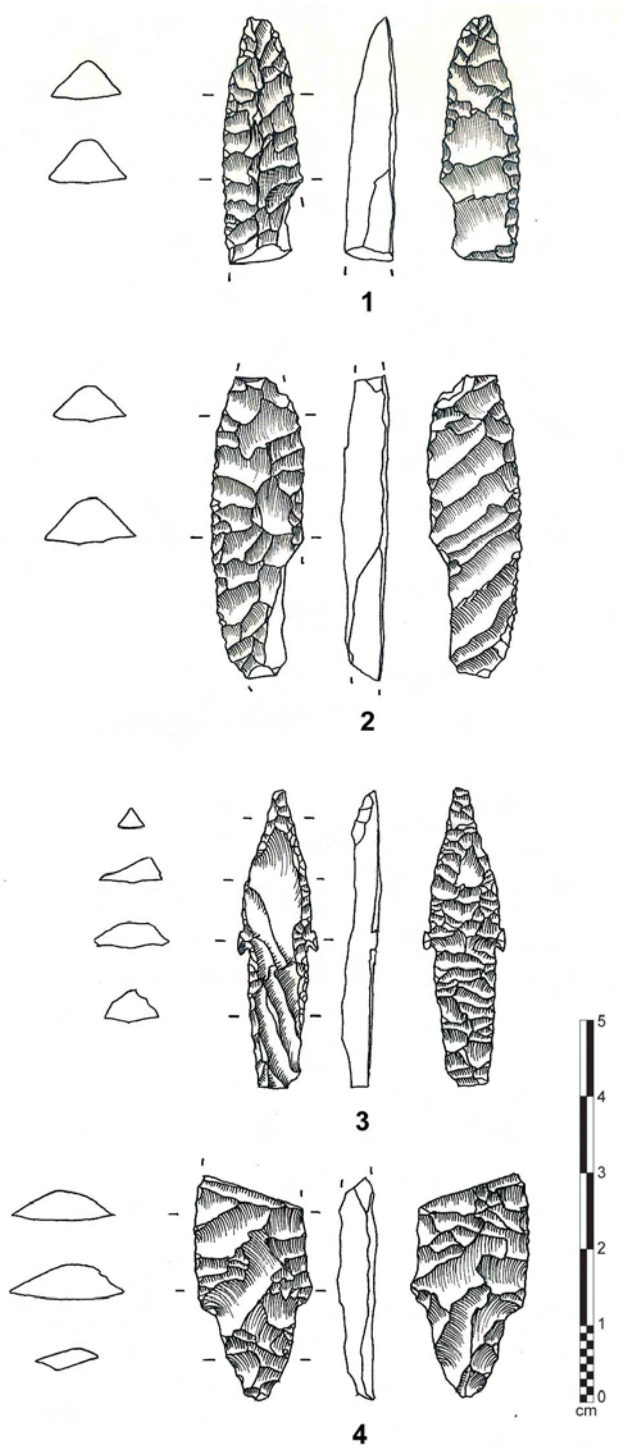

FIGURE 14. *Arrowheads:* ***1.*** *a fragment of a plano-convex arrowhead;* ***2.*** *a fragment of a plano-convex arrowhead;* ***3.*** *a bifacial arrowhead with small wings;* ***4.*** *a fragment of a bifacial arrowhead with a curved tang in cross section.*

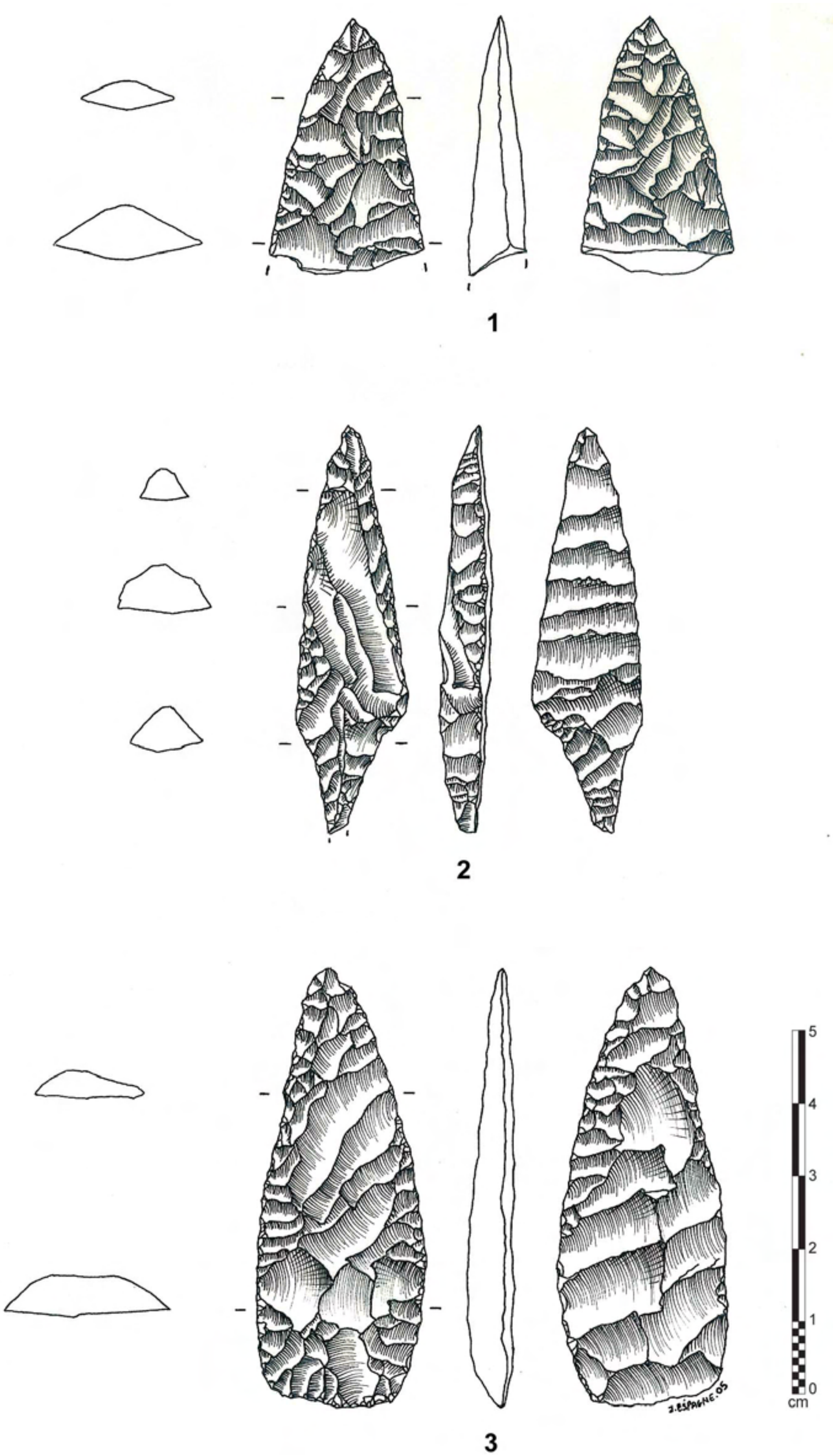

FIGURE 15. *Bifacial pieces: **1.** a fragment of a bifacial piece; **2.** an arrowhead; **3.** a plano-convex bifacial piece.*

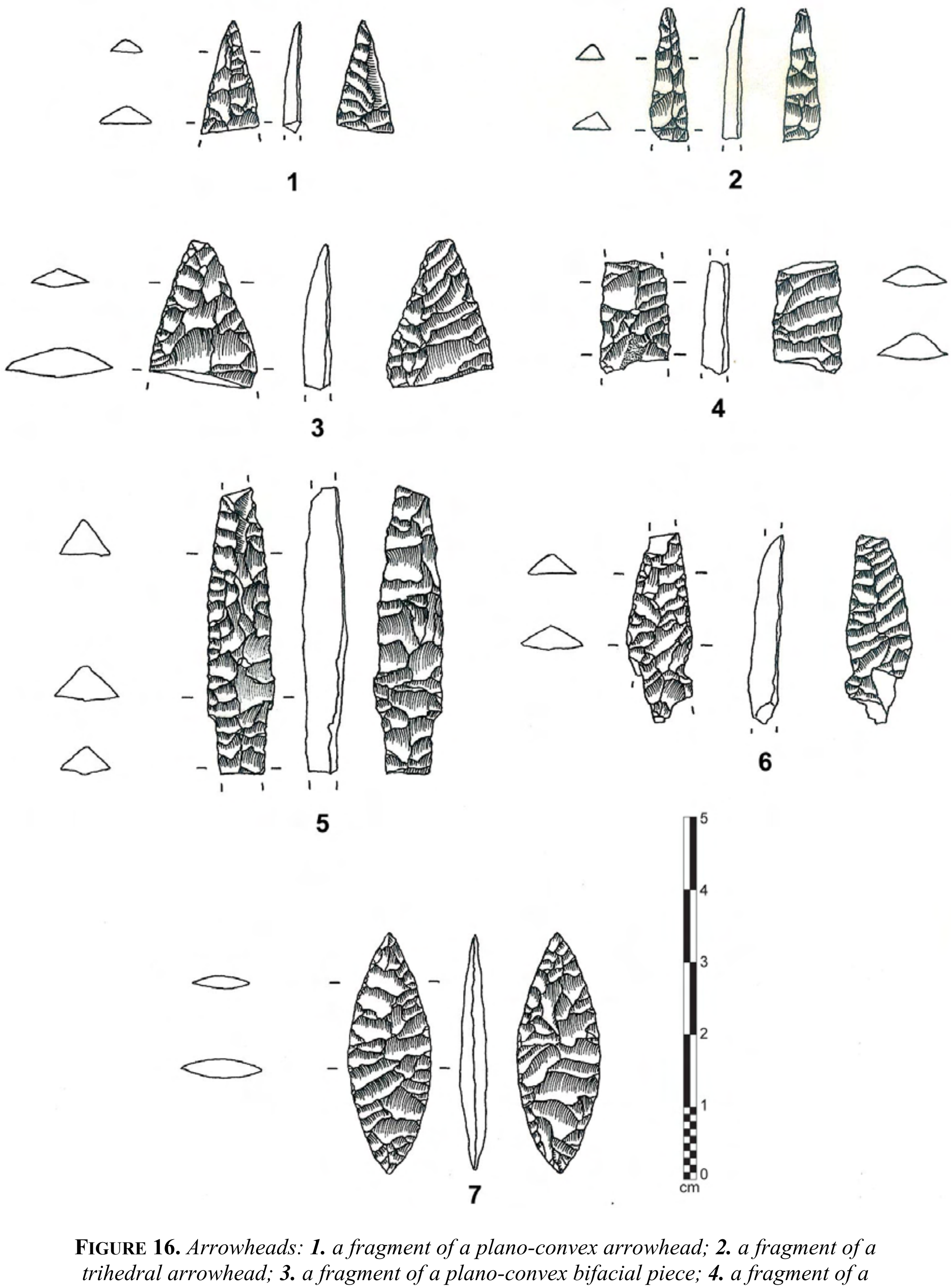

FIGURE 16. *Arrowheads:* ***1.*** *a fragment of a plano-convex arrowhead;* ***2.*** *a fragment of a trihedral arrowhead;* ***3.*** *a fragment of a plano-convex bifacial piece;* ***4.*** *a fragment of a plano-convex arrowhead;* ***5.*** *an almost entire trihedral arrowhead;* ***6.*** *a plano-convex/trihedral arrowhead with the remains of one small wing;* ***7.*** *a symmetrical foliate bifacial arrowhead.*

Thompson 1944; Inizan & Francaviglia 2002; Khalidi 2005; Crassard, forthcoming). Manayzah provides one of the only archaeologically known examples of *in situ* "Neolithic" obsidian knapping in Arabia.[6]

Arrowheads and other lithic tools

Arrowheads in chert and obsidian occurred in a large variety of shapes (Figs 10, 14, 15/2, 16), but it will ultimately be possible to see general developments of the main types in the chronological sequence, thanks to the relatively deep stratigraphy and the abundance of tools. Although typological studies are ongoing, several preliminary observations can be made.

Fluting is now well dated, and the tools produced according to this technological concept, such as the probable bifacial pre-forms of fluted points and the techno-typologically associated points, belong to the same time frame. Trihedral arrowhead points are closely related to the fluted points. They seem to be contemporary and older than those using the fluting technique. They can be related to the seventh-sixth millennium BC. Some bifacial arrowheads have a tang, slightly curved in section. This typological peculiarity may be typical of the seventh millennium BC, since they are found with trihedral points in the same layers, older than the use of the fluting technique. These two types of arrowheads have been observed in surface material found by the RASA team during previous campaigns of work in Ḥaḍramawt, especially on the GBS site (Walter*,* McCorriston & Oches 2000) and also stratified at the Khuzmum site (McCorriston *et al.* 2000). Other arrowheads have very different forms and types and we need to find more examples of each to present a serious preliminary typology.

Two fragments of polished stone axes are also present on the surface of the site. It is not yet possible to confirm whether these fragmentary tools are contemporary with other surface finds, such as fluted points. The first fragment is a piece of the edge of an axe, which was made in a green stone (Fig. 12/1). The second is a mesial fragment in a grey stone, possibly chert (Fig. 12/2). Small end-scrapers seem also to be typical of a particular style. They always consist of an end-scraper front, finely retouched by abrupt and tiny removals.

Shell and stone jewellery

Some beads have been found, mostly on the surface of the site. Stones and shells were used in the fabrication of these beads. Some of the very small shell beads were made by drilling and polishing. One fragmentary seashell provides evidence of jewellery from an older layer, K9–20. A fragment of a stone pendant has also been found, in level K9–8. It is a polished yellowish stone cylinder measuring 2.5 cm, broken on both extremities. One of them reveals half of a remaining hole.

The stratigraphic interface K9–19/K9–20 and associated lithic industries

Because we observed a clear change in technical variation and in the choice of material between layers 19 and 20 in K9, this stratigraphically deep interface represents a crucial transition or break in the site history. The earlier occupants used very different knapping techniques from those of their successors at Manayzah. In layer K9–20, a very different lithic industry underlies the upper strata. Most of the lithics are longer, probably because the knappers worked within a general debitage concept geared towards producing blades as blanks (laminar conceptualization). Furthermore a Levallois tendency in debitage modality has been identified, with the presence of at least one core with recurrent centripetal flake debitage (Fig. 13/3). The raw materials used also differ significantly from the upper layers. In the lower layers, the chert is desilicified, and is thus very light in weight with a slightly white or grey patina, which reveals the erosive action of percolated water. The lower assemblages lack obsidian, although the excavated area is 0.5 m^2. We must make it clear that we do not associate these Levalloisian artefacts with the Middle Palaeolithic, since we do not have any dating evidence for the layers they come from. The use of the Levallois method is known in other parts of the world during the Holocene, and this debitage method is not exclusively associated with Mousterian industries.

Organic remains

During excavation, Manayzah appeared to be very rich in organic materials, including bone, charcoal, charred dung, and some visible seeds of *Zizyphus* sp. Accordingly, charcoal fragments were both hand-picked and recovered through water flotation. A researcher extracted sediment for phytolith and sphericule analysis from each clearly defined occupation layer and feature. Bone assemblages, dominated by remains of animals, occur in almost every layer above layer K9–20, and some specimens appear to be human. Other bone specimens were worked. While the plant and faunal remains await conclusive analysis, a few preliminary remarks are justified here.

First, the majority of plant remains appear to be charcoal fragments, many readily identifiable to genera — *Acacia*, *Zizyphus*, *Tamarix* — still able to grow in the vicinity of Manayzah, where the grazing pressures of modern Bedu goats is less pronounced. Also contributing to the light fraction from flotation is ancient charred dung, some still in small pellets consistent in size and shape with goat and sheep pellets. One layer (Quad.B Loc.006 Lot 7) overlying a well-defined surface is particularly rich in dung. No seeds from domesticated or exogenous plants have been identified.

The animal bones (under analysis by Dr. Louise Martin, Institute of Archaeology, London), may constitute one of the richest early to mid-Holocene assemblages in southern Arabia and should provide critical socio-economic evidence through their association with lithics and hearths, towards a better definition of Yemen's "Neolithic".

Conclusions

Manayzah offers rich potential for socio-economic studies of the so-called "Neolithic" lifestyles in southern Arabia. The site contains intact stratigraphy with typologically and technically rich lithic assemblages clearly associated with plant remains and bones. There appear to have been substantial occupations with multiple contemporaneous hearths, structures, and at least one excavated pit for rubbish disposal, rake-out, human burial, or food storage, possibly used successively for several of these functions. The site's location adjacent to a permanent water source would surely have attracted foragers and herders, both of whom may be represented (hunting tools, animal dung), and may have served as a preferred locale for specialized stone knappers, perhaps sought there by other group members eager to acquire their products. Future work at the site will expand excavation, probe the deepest layers, and conclude ongoing analyses of lithic, faunal, and plant materials.

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Notes

1 RASA stands for Roots of Agriculture in Southern Arabia and includes a multinational, multidisciplinary team of archaeologists, geologists, palaeoecologists, and ethnographers directed by Dr. Joy McCorriston, Dr. Eric Oches, and Dr. ‘Abd al-‘Aziz bin ‘Aqil.

2 Manayzah was initially named RASA 2004–SU (survey unit) 155–2.

3 Distal is the furthest part of a flake from the impact point of percussion, mesial is the middle part of a flake, and proximal is the upper part of a flake, the closest to the impact point, which usually includes a butt and a bulb.

4 For lithic technology terminology, see Inizan, Roche & Tixier 1992.

5 Such as Mesoamerican "bullet cores".

6 The site HDOR 419 provided a few stratified obsidian artefacts: Crassard & Bodu 2004; see also Amirkhanov 1994.

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