Chapter 16
Early Holocene in the Highlands: Data on the Peopling of the Eastern Yemen Plateau, with a Note on the Pleistocene Evidence

Francesco G. Fedele

Keywords Early Holocene • Pre-Neolithic • Yemen Plateau

Introduction

The uplands of the western Arabian peninsula have featured negligibly in discussions about the Pleistocene and Early Holocene occupation of Southwest Asia. Paleolithic, or presumed Paleolithic implements, have only been reported occasionally, and these are often without context. In most instances such findings have not been approached with critical scrutiny. As far as human occupation is concerned, the whole chronological period between the Last Glacial Maximum and the beginning of the Holocene is relatively unknown. Whether there is reason to think of an actual void in human presence can not be assessed. In particular, no lithic assemblage resembling an "Upper Paleolithic" industry has been reported. An attempt in the 1980s to develop a Paleolithic archaeology on the eastern and central Yemen Plateau met with limited success (Bulgarelli, 1988) and was soon discontinued. The Early Holocene itself, here defined as the period earlier than the "Mid-Holocene Pluvial", has remained archaeologically unknown. Against this background, even modest information obtained from systematic archaeological fieldwork should be of interest.

Although we focus here on a small part of Yemen, a broader geographic perspective is essential. Here we are concerned with the western Arabian uplands, the fairly extensive mountainous "backbone" of the peninsula, which originated as a cordillera by the rifting of East Africa and Arabia along the Red Sea (Fig. 1). An often used and comprehensive name for these uplands is Yemen Mountains. However, an Arabic term is strangely lacking, perhaps as a result of historical contingencies that have emphasized divisions over geographic unity. The middle sector of the Yemen Mountains is rather loosely identified with the historical region of 'Asīr, a part of "Greater Yemen" in a geographic sense; as a name, 'Asīr is presently connected with the mountainous province of southwestern Saudi Arabia whose core relief is the Sarāt massif. Steep gullies intersect the eastern border of the Yemen Mountains as the highlands fall away more or less gradually towards the Arabian interior, this latter occupied by lowlands and deserts. Reaching higher in altitude (up to 3,500–3,600 m a.s.l.) the mountain sector in present-day Yemen tends to have a more precipitous and dissected border onto the eastern interior.

In this chapter, I wish to report observations from the eastern Yemen Plateau which suggests the potential of the Yemen highlands for an understanding of the Early Holocene occupation of the southern Arabian peninsula. Additional information points to the environmental and archaeological potential of the region for the Late Pleistocene peopling as well, although on the basis of limited data. My own observations derive from excavations and surveys carried out between 1984 and 1990 in the region of Khawlān at-Tiyāl, which together with Al-Hadā to the south formed the core study area of the Italian Archaeological Mission to Yemen (cf. de Maigret, 2002). Two smaller areas will be of interest in particular (Fig. 1): the Wādī at-Tayyilah basin, primarily from the standpoint of a Neolithic excavation, and Wādī Khamar in the Jihānah district, made the object of a survey programme. These areas are located 40–60 km east-southeast of San'ā'.

The first intimation of a "pre-Neolithic" occupation of Early Holocene date was obtained in October 1984 during the initial testing at a Neolithic settlement on middle Wādī at-Tayyilah, site WTH3. An intentional search for earlier levels than the Neolithic was attempted through soundings, in the absence of any recognizable material on the surface. Further results were obtained in the two following seasons. At the same time, the environmental background to human activity in the region throughout the Holocene was established. Only research priorities and practical constraints prevented from documenting the pre-Neolithic evidence in greater detail and pursuing the investigation further. However, in 1987 and 1990, the examination of Wādī Khamar reinforced the opinion that during the earlier part of the Holocene human peopling may have been widespread, in the eastern

F.G. Fedele (✉)
Laboratory of Anthropology, University of Naples "Federico II",
via Mezzocannone, 8, 80134 Naples, Italy
e-mail: ffedele01@yahoo.it

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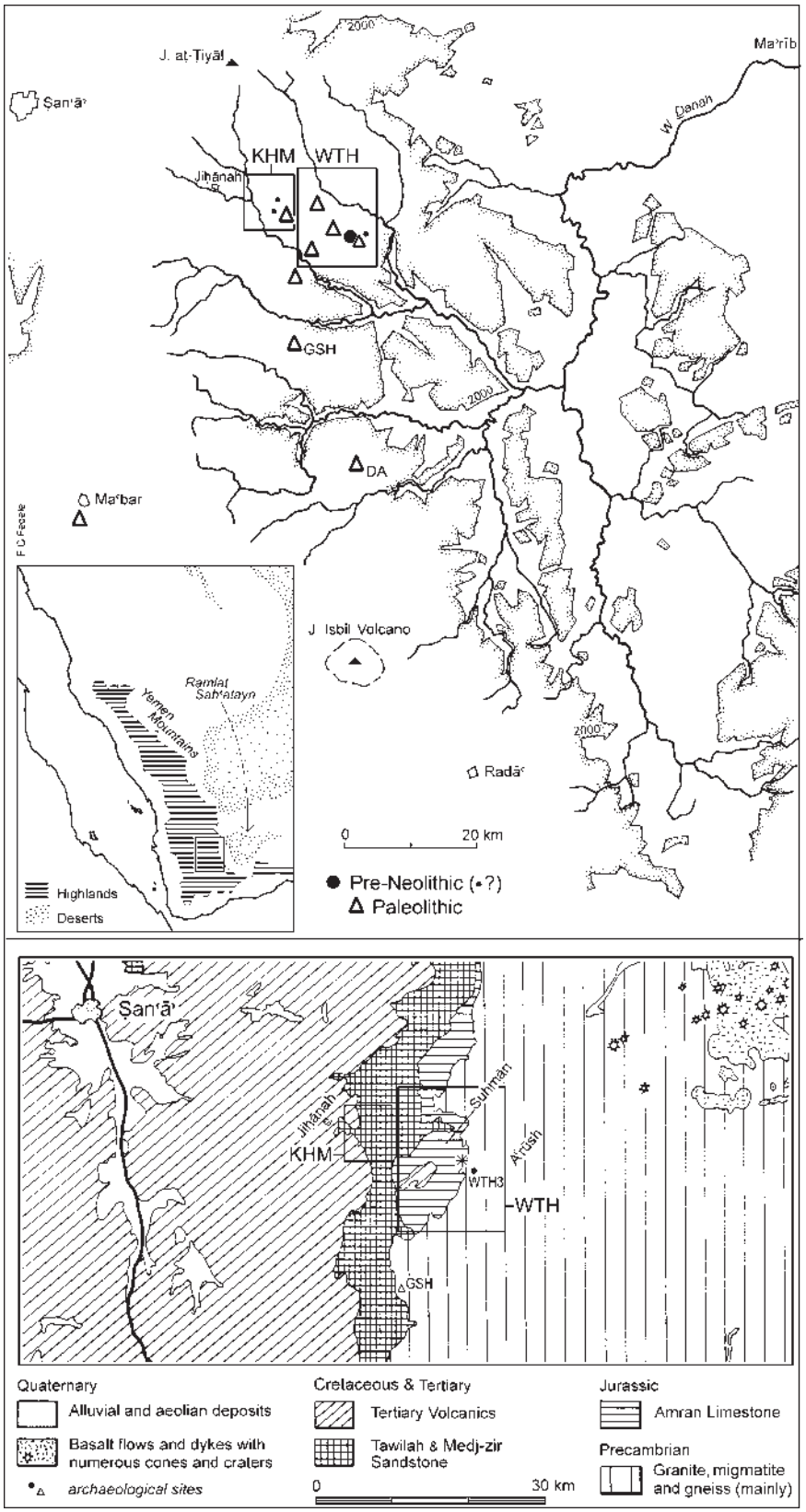

Fig. 1 Map of the eastern Yemen Plateau, central sector. *Boxed areas* include KHM, the Wādī Khamar basin (cf. Fig. 13), and WTH, the Thayyilah-NAB area (cf. Fig. 2). Other prehistoric localities: DA, Dulāʿ al-Aʿmās; GSH, Jabal Shaʿīr. *Below*: simplified geological map of Khawlān (Kohlan Sandstone and Amran Limestone unified; see Kruck et al., 1996, Sheet 5 Sanʿa', for updating and detail); the *asterisk* on the Suhmān Plateau is Jabal al-ʿUrqūb

highlands at least. The Khamar survey has remained unpublished until now. In this context, this chapter summarizes primary evidence as documented and studied at the time of fieldwork. Where appropriate, the evidence has been reconsidered in the light of subsequent experience.[1]

Admittedly, due to a lack of exploration in Yemen, it is difficult to determine to what extent our study area and sampling results in the Khawlān at-Tiyāl are representative of the highlands at large. Such windows of preservation of Early and Mid-Holocene landscapes may, in fact, best occur in the least modified parts of the eastern Yemen Plateau, and be rather rare elsewhere in the western Arabian uplands. In areas of the uplands populated more densely from early historic times to the present the landscape appears to have been highly modified by human activity (Wilkinson, 2003, chapter 9), which leaves little opportunity for intact Holocene landscapes to be preserved on the surface, with or without archaeological evidence. Concurrently, earlier Holocene surfaces may be deeply buried as a result of widespread sedimentation. However, only systematic research in the future can provide firm data on the presence and distribution of relevant occurrences throughout the highlands.

Elsewhere on the Yemen Plateau, sparse but valuable data (e.g., de Bayle des Hermens, 1976; Garcia et al., 1991; Edens and Wilkinson, 1998: 55–65) suggest that identification of the pre-Neolithic archaeological record may largely depend on the amount of research and focus. Apposite research design is obviously needed to place any occurrences within a geoarchaeological and chronological framework, particularly if pre-Neolithic (including Paleolithic) sites turn out to be rare and scattered. Recently in the Hadhramawt, a re-orientation of strategy in prehistoric survey has allowed stratified Early Holocene contexts to be revealed in a region otherwise characterized by heavy erosion and human disturbance (Crassard and Khalidi, 2004; Crassard et al., 2006). Such observations might help cast in a wider context our data, which derive from a small study area explored for a relatively short time. The subject will be taken up again in the last part of this chapter.

[1] The documentation presented in this chapter has several limits that need be explained. The excavations at WTH3 came to a halt after 1986, and that very season was curtailed, because of mounting tensions in the area, making any further exploration of the deeper horizons impossible. It is also unfortunate that well preserved charcoal was very rare at the site and, alas, several charcoal samples for radiocarbon were misplaced in Rome after preparation for shipping to the dating laboratory. The only measurement (Beta-23, 583) cannot be associated with the prehistoric occupation; a dating programme would require a return to the site. The Khamar survey was conducted at the very end of what eventually became my last season in Yemen, in February 1990, and time for post-survey work was very limited. Furthermore, because of expected continuation in the near future, artifacts from surface scatters or sections were rather observed than collected, in general, and priority was given to the Neolithic samples. The materials from Wādī Khamar and the deeper levels of WTH3, housed at the National Museum in San'ā', could not be re-examined for the present publication.

Pre-Neolithic Evidence from the Wādī at-Tayyilah Basin (Al-A'rūsh)

Area and General Stratigraphy

The region reviewed here is the Khawlān at-Tiyāl, comprising a large portion of the mountainous territory east and south-east of San'ā', between the Yemen Plateau's central basins and the outermost edge of the highlands, this latter bordering the interior lowlands and desert.

The area of particular interest is represented by the middle sector of Wādī at-Tayyilah[2] and a syncline furrow nearby, An-Najd al-Abyad (NAB) or 'white valley', which together will be called the Thayyilah-NAB area (Fig. 2). This area is located about 60 km east-southeast of San'ā'.

Overall, the Thayyilah-NAB area constitutes a well-defined, medium-sized basin of about 18 km^2, characterized by a uniform environmental record. It presents active drainage along the Tayyilah, coupled with a surrounding cluster of largely "fossil" catchment remnants, notably in the NAB furrow. To some extent the latter are relics of a mid-Holocene landscape, fossilized by widespread relief rejuvenation due to recent tectonic movements, still probably in progress (de Maigret et al., 1989; Fedele, 1990a). The name itself of An-Najd al-Abyad hints to the gray hue of fine-grained mid-Holocene sediments blanketing the valley, testimony to a milder environment than today. The interest of the Thayyilah-NAB area results from the large number of prehistoric sites associated with this peculiar, highly informative geologic framework.

The Khawlān at-Tiyāl includes a mosaic of mountains and small intermontane plains, with average annual precipitation of about 200 mm, as well as more dissected and barren fringes nearer to the edge of the Yemen Plateau, above 2,000 m in altitude. These uplands are scarred by seasonal streams or wadis (*widiān*) which eventually cut through the margin of the highlands and disappear from escarpments into the vast stretches of semidesert and desert to the east. The Thayyilah-NAB area belongs to the Wādī Danah drainage, the largest wadi system of inland northern Yemen. This is the rivercourse that flows down from the eastern highlands to Mārib and was responsible for the florescence of this ancient Sabaean capital.

In 1984–1985 a generalized sedimentary sequence spanning the terminal Pleistocene and Holocene was recognized over the entire mountainous part of Khawlān. Some of the most complete occurrences were studied in the Thayyilah-NAB area. The sequence may in fact be common throughout the eastern Yemen Plateau, at least within the 1,800–2,000-m altitude belt, although with slightly different local variants. The standard litho- and pedostratigraphy is summarized in Fig. 3, where relevant details are included. In the Thayyilah-

[2] Thayyilah is an anglicized spelling of the original name, at-Tayyilah; several Arabic placenames in this chapter will be written in a simplified transliteration with diacritic signs omitted.

Fig. 2 Map of Suhmān and the Thayyilah-NAB area, this latter comprising the Wādī at-Tayyilah and Wādī an-Najd al-Abyad basins (center-east). Prehistoric sites of interest are indicated. Geology based on Marcolongo and Palmieri (1990), with updating from Kruck et al. (1996): PreC, Precambrian basement; Ja (*shaded*), Jurassic Amran Limestone and underlying Kohlan Sandstone; Kt, Cretaceous Tawilah Sandstone; β, Tertiary Volcanics, basalt

NAB area, the Holocene deposits on the lower slopes are mainly composed of redeposited aeolian silts, intergrading with alluvial or sometimes lacustrine sediments towards valley bottoms. The typical, widespread Holocene sequence forms wadi terraces varying in thickness from 2 to 6 m, but it can often be found upslope on the gentler sides of depressions and valleys. From the migmatite or granite bedrock to the top the succession is the following (numbering begins with "Stratum 2" in the light of the subsequent discovery of an earlier unit in Wādī Khamar, see below):

Stratum 2 ("Early gravels"): more or less cemented alluvial gravels, often a conglomerate, indicating high-energy transport of a torrential type; intercalated, indurated sandy units may be locally common;

Stratum 3 ("Light lower silts"): a complex of horizontally deposited silty-clayey sands, alluvial in origin but more colluvial towards the top, sometimes intercalated to gravel lenses; locally these units include, or show lateral variation to, laminated lacustrine sediments (3λ) or evaporitic deposits near former springs (calcareous sinter or travertine, 3t); they seem to indicate an alternating wet-dry regime and can be attributed to the earlier half of the Holocene;

Stratum 4 ("Gray paleosol"): a thick silty-clayey layer, sandier towards the top; it typically includes a gray to dark

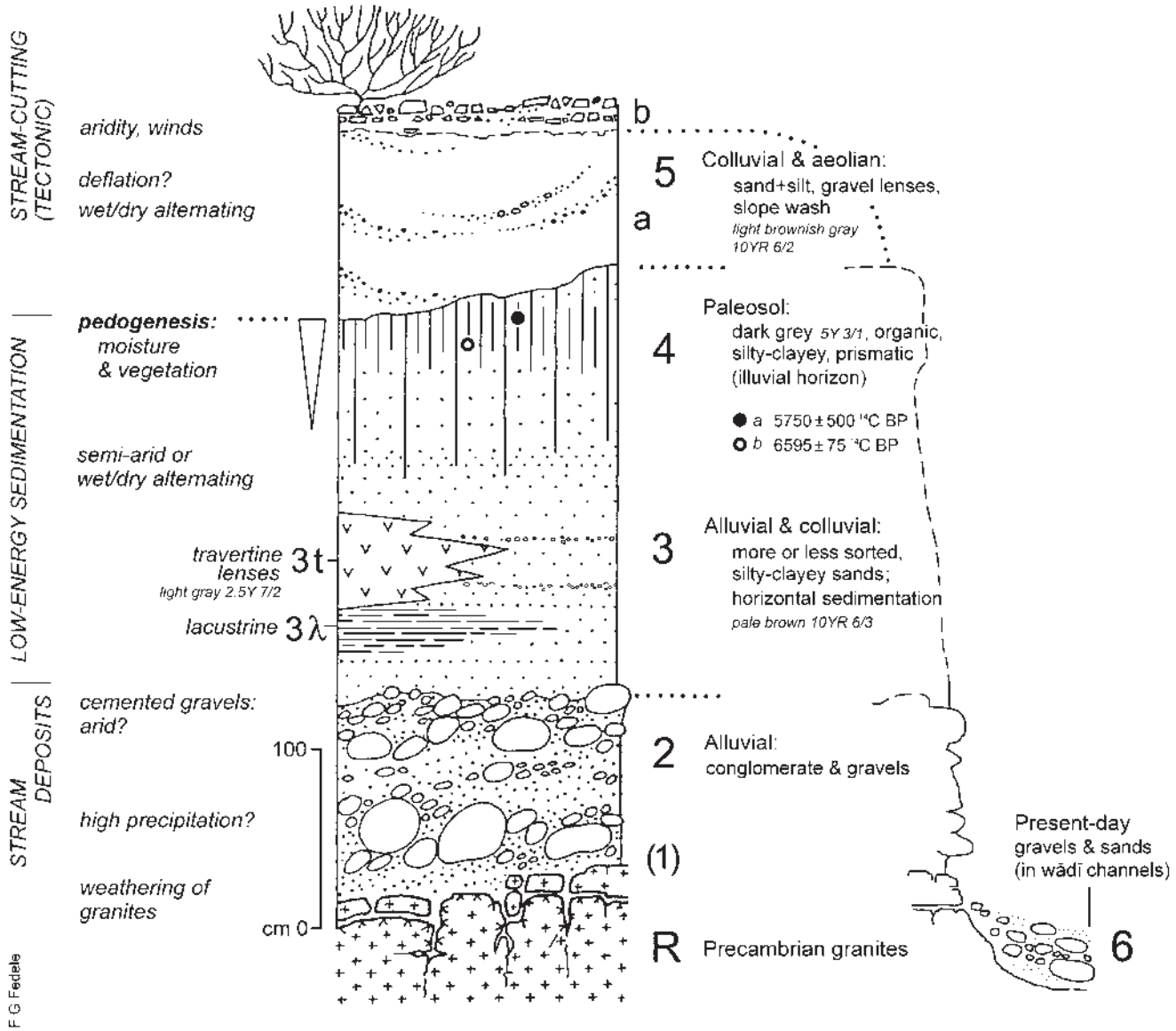

Fig. 3 Holocene–Pleistocene depositional series on the eastern Yemen Plateau, Thayyilah-NAB area: a generalized lithostratigraphy and paleoenvironmental sequence (based on de Maigret et al., 1989, and personal observations). R, granite/migmatite bedrock. Radiocarbon dates on soil's organic fraction by the Rome laboratory, unpublished (**a**, Middle Wādī at-Tayyilah; **b**, Wādī Swayhāt; as reported in Marcolongo and Palmieri, 1986; de Maigret et al., 1989)

gray band, rich in organic matter and accumulated calcium carbonate, usually bounded by a well-defined upper limit due to truncation (by deflation or erosion); the gray band is a humic-accumulation horizon of a paleosol clearly to be correlated with mid-Holocene conditions, as explained below;

Stratum 5 ("Light upper silts"): aeolian silt and colluvial lenses of sand and gravel, largely affected by aeolian deflation and normally topped (5b) by *hammada* stony surfaces with angular clasts, linked to recent aridity; upwards these units are increasingly associated with exfoliation of desert varnish from rock faces, a process that is at least partly coeval with Stratum 6;

Stratum 6 ("Modern gravels"), only to be found in furrows with active discharge: present-day wadi gravels and sands, regularly associated with stream or river channels cut not only into the pre-existing Strata 2–5, or 1–5 elsewhere, but often also the bedrock (examples in Fig. 6).

The Early gravels may be related to a supposed phase of massive discharge around the Pleistocene-Holocene transition, and therefore have an age of ca. 12 to 9 ka (cal. BP); further comments are given in the section on Wādī Khamar below. Stratum 3 represents the rapid establishment of mild, moist, soil-forming conditions during the earlier part of the Holocene in the northern tropics, equally known across the Red Sea (e.g., Barnett, 1999, chapter 4, with references). The best instance of a limnic series in our area was observed at the bend of Wādī at-Tayyilah between site WTH1 and the hamlet of Al-Hindiyya, where two suites of laminated units

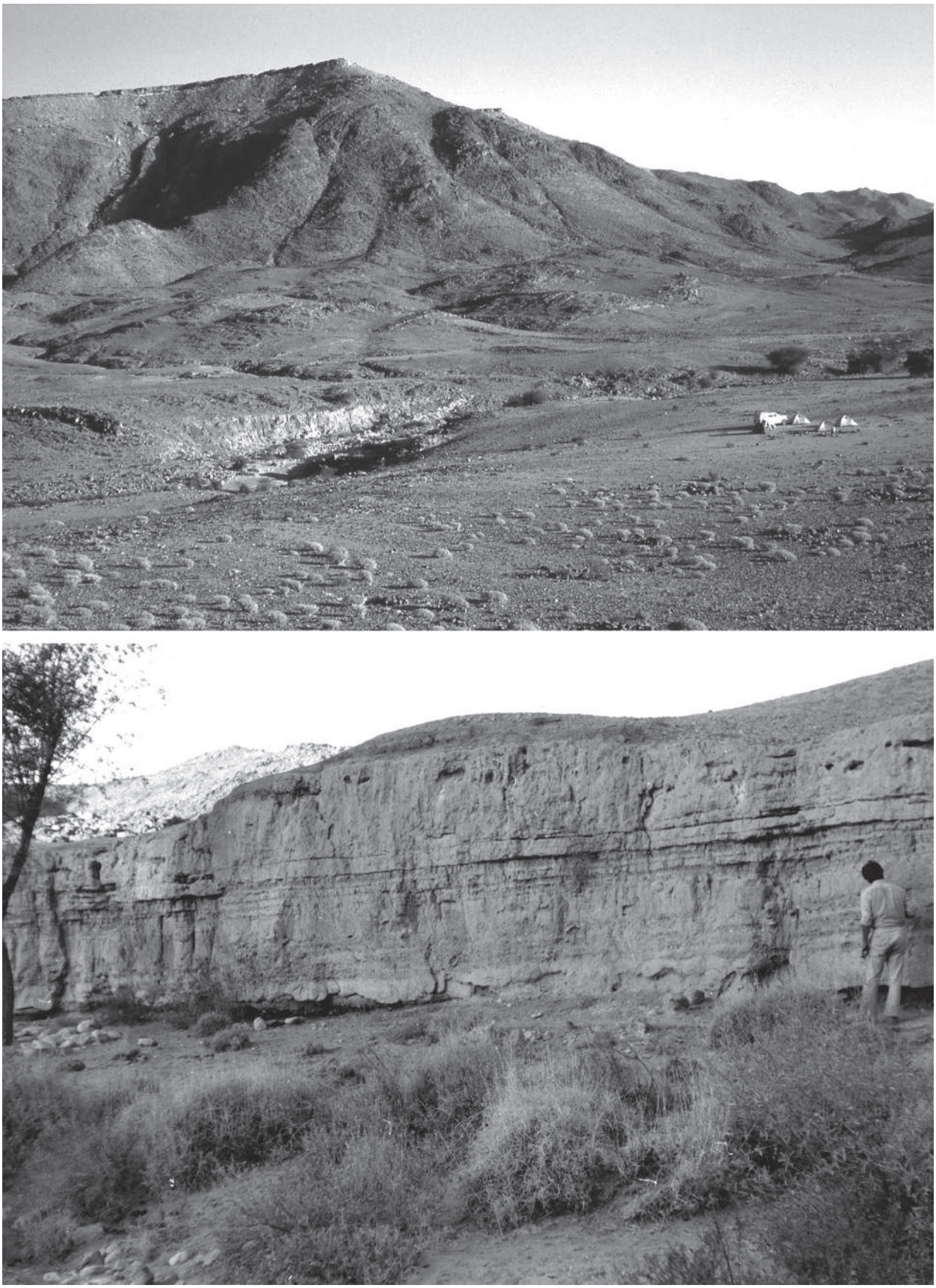

Fig. 4 *Above*: middle Wādī at-Tayyilah and overlooking Jabal al-'Urqūb; part of prehistoric site WTH3 in the foreground. *Below*: exposure of an Early Holocene sequence at WTH1/I

are present and contain gastropods and charcoal (site WTH1/I; Figs. 4, below, and 6). They are separated by several thin lenses of alluvial sands and gravels. Where present, travertines show plant remains and poorly developed vacuolar structure. At WTH1/I the exposures of Stratum 3 are no less than 4.5 m thick.

Stratum 4 is only of interest here as an easily recognizable marker and the upper limit of the Early Holocene as defined in this paper. In connection with this stratum, the depositional history was punctuated by one major phase of soil formation, simultaneously identified at WTH3 (de Maigret et al., 1984: 431–437; Fedele, 1985) and by the Italian geologists in the Thayyilah-NAB area (Marcolongo and Palmieri, 1986). On qualitative data this fossil soil was designated the "Thayyilah Paleosol" (Fedele, 1986, 1987, 1988, 1990a); quantitative analyses have subsequently improved its identification (Marcolongo et al., 1988; de Maigret et al., 1989; Marcolongo and Palmieri, 1990) while our brief survey of Wādī Khamar allowed to trace its presence further north and west. The Thayyilah Paleosol can be dated to the sixth–fifth millennia cal. BC on the basis of two radiocarbon determinations (Fig. 3). It is a local expression of a mid-Holocene soil which represents a useful pedostratigraphic marker over a wide area of southwestern Arabia, given that similar pedogenetic bodies of the same general age have been reported from a number of locations at different altitudes (e.g., Overstreet et al., 1988; Overstreet and Grolier, 1996; Wilkinson, 1997; Lézine et al., 1998; McCorriston, 2000; French, 2003: 224–234; , Parker et al., 2006).

The connection of widespread soil formation with a period of milder and moister oscillations, plausibly resulting from higher rainfall (e.g., Wilkinson, 2005), is generally accepted, hence the frequent designation of Mid-Holocene Pluvial (see Fleitmann et al., 2007, for a detailed climatic framework). The period is also well documented in tropical eastern Africa including the Ethiopian highlands (e.g., Barnett, 1999). In Khawlān this soil's environmental significance is clear: pedo-sedimentary evidence, topography and a palynological test (Marcolongo et al., 1988, palynology by A. Lentini; Fedele, 1990a, Fig. 4) (Fig. 5) suggest the presence of high watertable, scattered ponds and some tree cover in upland basins. Well watered conditions can equally be inferred from the incidence of bovine husbandry in the Neolithic (Fedele, 2008) and by

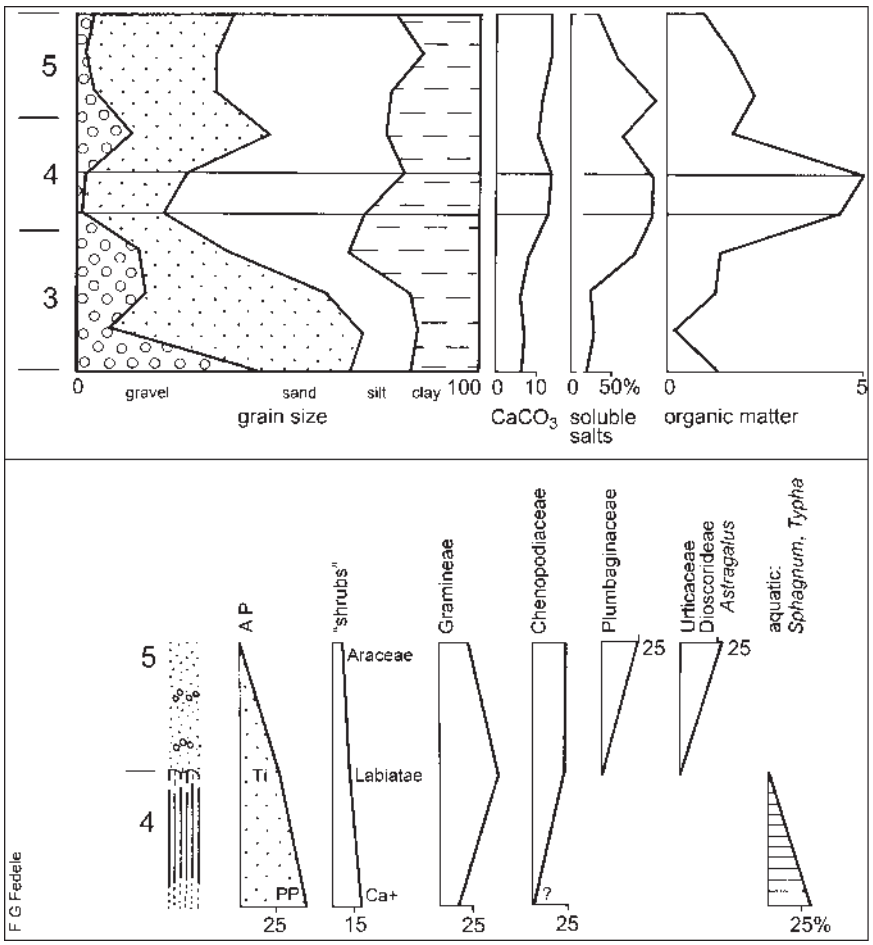

Fig. 5 Sediment and pollen analyses of a Holocene series from middle Wādī at-Tayyilah (after Fedele, 1990a, revised; data from Marcolongo et al., 1988). Strata as in Fig. 3

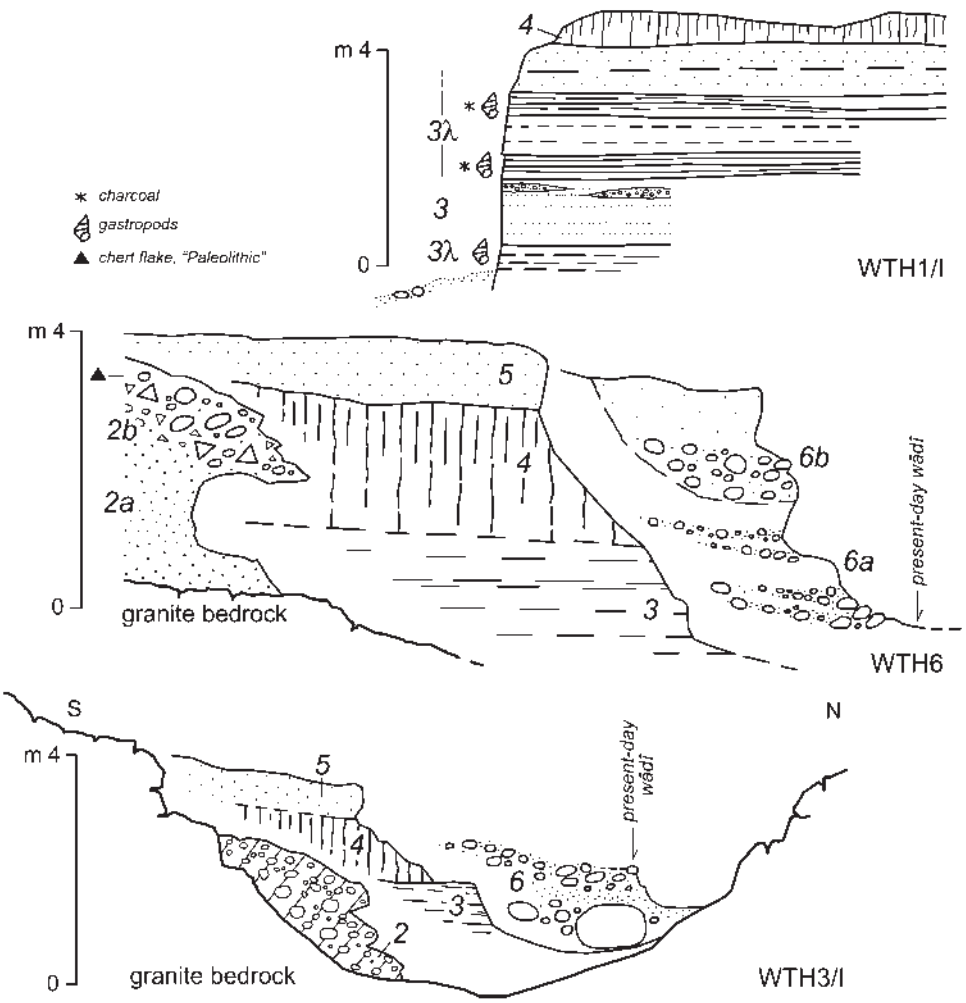

Fig. 6 Simplified stratigraphic sequences from middle Wādī at-Tayyilah and Wādī Swayhāt. WTH3/I and WTH6 are cumulative profiles

analogy from attributes of similar buried soils on the Plateau (e.g., French, 2003: 224–234). Widespread geomorphic stability contributed to this kind of landscape in the eastern highlands, before being rather abruptly ended by regional tectonic uplift and a concurrent new cycle of severe desiccation (Fedele, 1990a).

Site WTH3: Setting, Local Sequence, and Pre-Neolithic Components

Stratified pre-Neolithic evidence on the eastern Yemen Plateau was first obtained through soundings during the excavations of the Neolithic settlement at WTH3 between 1984 and 1986. These earlier components will be labelled "pre-Neolithic"for the sake of a noncommittal designation. As mentioned, no hint of earlier human activity could be perceived on the surface. Site WTH3 (44° 39′ 58″ E, 15° 10′ 00″ N) lies in a semi-desert landscape at an altitude of 2,025 m in the middle Wādī at-Tayyilah drainage, which is almost completely set within the Precambrian basement migmatite at the foothills of the limestone tableland of Jabal al-'Urqūb. The bedrock and surrounding rocks at WTH3 have a distinct granite facies. Half-buried on the rock-strewn hillside and covering an estimated 70 by 90 m, the site coincides with a mildly sloping terrace in proximity of a watercourse, a standard Neolithic location in the region of Khawlān. The present-day wadi runs eastwards about a hundred meters north of the site and is flanked by a series of alluvial terraces; the third and topmost can possibly indicate the margin of the mid-Holocene riverbed (Fig. 4).

WTH3 has remained one of the very few Neolithic sites investigated on the Yemen Plateau (see Kallweit, 1996, for a further example). The site was excavated and recorded with geoarchaeological criteria and exacting procedures, unprecedented on the Plateau (e.g., Fedele, 1995). All sediments were dry screened with 4-mm mesh and expertly hand-picked for artifacts and ecofacts. Deposits from particular

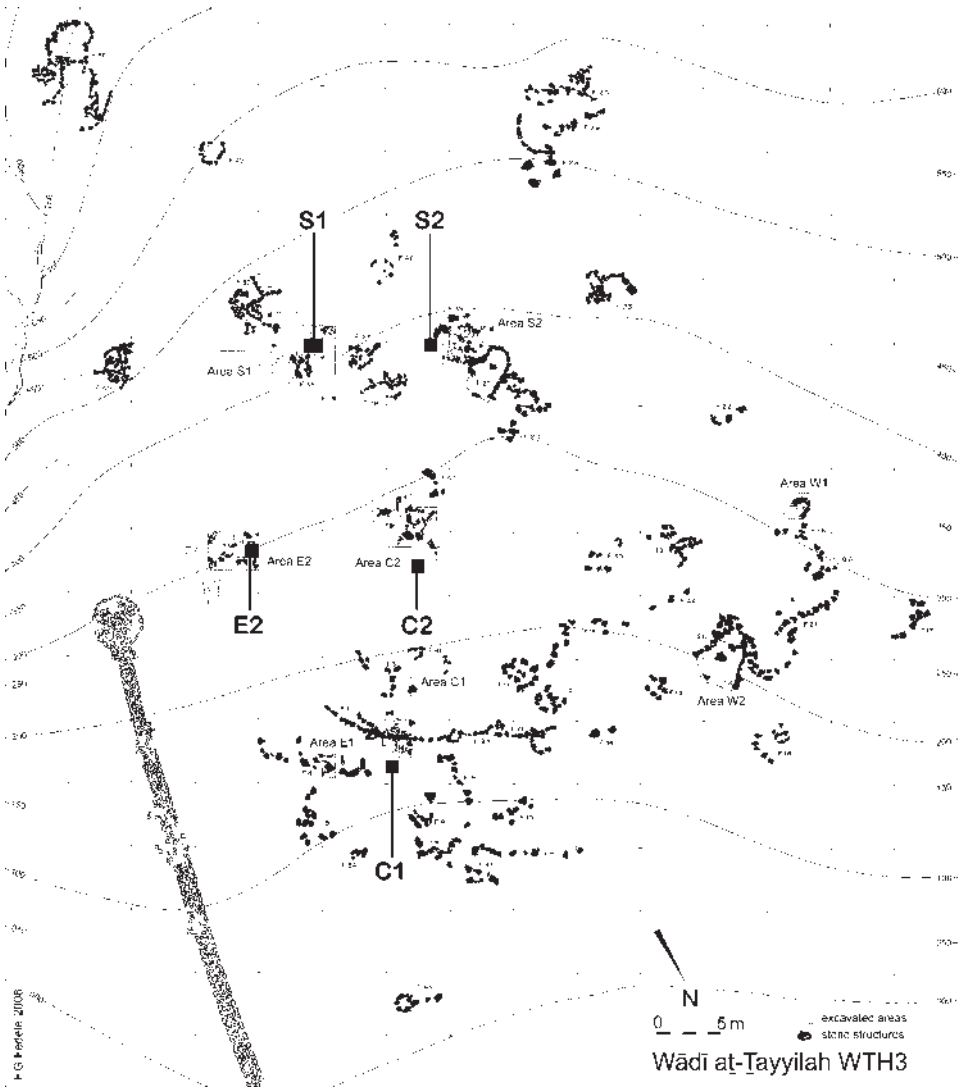

Fig. 7 Plan of Wādī at-Tayyilah site WTH3, showing above-ground features and position of the excavated pre-Neolithic levels (redrawn from V. Labianca and D. Picchi/Mairay, plan A16, 1986). The large structure to the east is a later tomb, unrelated to the Pre-Neolithic and Neolithic occupations

contexts were bagged for water sieving in San'ā'. Badly preserved faunal finds were block-lifted within their matrix for laboratory processing after consolidation in the field. As a consequence, WTH3 generated a controlled, very large collection of lithic finds and a valuable sample of archeofaunal material (Fedele, 2008, with references).

The most conspicuous feature of the site is its Neolithic occupation, apart from a later tomb (Fig. 7), and the excavation program was primarily aimed at revealing and understanding the Neolithic component. The attendant culture can be confidently labelled Neolithic from the well-documented presence of domestic animals (Fedele, 1988, 2008; a different opinion in Crassard and Khalidi, 2004). A total of about 120 m^2 were excavated, amounting – in spite of the effort – to perhaps 5% of the site. In order to sample spatial variation eight excavation areas were opened, and small soundings for the detection of earlier deposits and cultural horizons – if any – were made in five of them: north to south, Areas C1, C2, E2, S2 and S1 (black squares in Fig. 7).

The existence of pre-Neolithic levels would not have been revealed without intentional sounding. Already during the initial testing in 1984 the site turned out to be stratified, up to 1-m-thick in Area C1, and to possess some evidence of earlier material than the Neolithic. It was subsequently found that the deposits reached a similar thickness in other parts of the site. The discovery of pre-Neolithic evidence opened up an entirely new subject within the program, which would have been developed in future field seasons. In fact, the earlier levels could only be explored on about six square meters in total.

The soundings below the main occupation had to be kept to a minimum considering not only research aspects, but

time constraints, limited staff, and generally difficult fieldwork conditions. Under the circumstances, the exploration of the pre-Neolithic levels implied a vertical excavation strategy which could not be easily scheduled within the essentially horizontal strategy (open-area stripping or *décapage*) demanded by work on the Neolithic, our research priority. In addition, it became clear from the outset that a correct evaluation of pre-Neolithic evidence embedded within sandy arkosic sediments, characterized by rather weak unit boundaries, would have required the most analytical and patient reading of lithostratigraphy, a task that we could only pursue on a small number of soundings. Given suitable conditions, however, I would urge researchers to take up the task of deep testing below Neolithic or Bronze Age occupations wherever possible, without stopping at presumed culturally sterile soil.

The detailed stratigraphic profiles from WTH3 can be correlated to the standard depositional sequence of the Thayyilah-NAB area (Fig. 3). Above the decayed migmatite/granite bedrock and related arkosic sand (A) there are 40–80 cm of colluvial and aeolian sediments, predominantly silty-sandy in texture, due to prolonged but discontinuous slope deposition. And here again this trend was punctuated by the formation of the Thayyilah Paleosol, which blankets the site and is indicated as stratum G (for gray) in the site's general profile (Fig. 8). The pre-Neolithic levels are associated with strata M and Y. Stratum M (for Italian *marrone*, brown) is possibly to be equated with poorly developed, slightly argillic brown-earth type soils of the earlier half of the Holocene such as those studied in the Damār plains (French, 2003: 228–232). Stratum Y is a yellowish layer, sandy-silty in texture with variable amounts of grit, separated from overlying M by a generally weak upper boundary.

There appear to be more than one pre-Neolithic level. A particularly precise horizon is documented in all five test pits in the upper part of stratum M and will be provisionally called "Pre-Neolithic", with a capital P. In Areas E2 and S1 it is characterized by stone clusters and pits, associated with heavily weathered, leached burnt features that look like hearths (simple campfires?). Stone-filled hollows to be attributed to the same horizon, or the very base of the Neolithic, were recorded in Area C2 (de Maigret et al., 1988: 23).

A potential dating object was found within a pit in Area S1, a feature of mixed cultural-erosional origin that contained a pocket of dark ashy silts and piled stones, perhaps from a nearby hearth (Fig. 9). The finding is a partial figurine made of hardened, unfired clay (Fig. 11a), which may represent a female torso or two closely facing figures; it is at the moment the oldest piece of portable "art" in Yemen (Fedele, 1986, Fig. 28; Fedele, 2008, Fig. 8). The nearest parallels are probably to be found in the Pre-Pottery Neolithic B of the Levant (e.g., Jordan; Kuijt and Chesson, 2005, Figs. 8.2 and 8.4), and according to this hypothesis a date in the seventh millennium BC is tentatively proposed. Such an artifact might be of some relevance for Drechsler's (2007) model of the dispersal of the Neolithic into southern Arabia (see the last section of chapter).

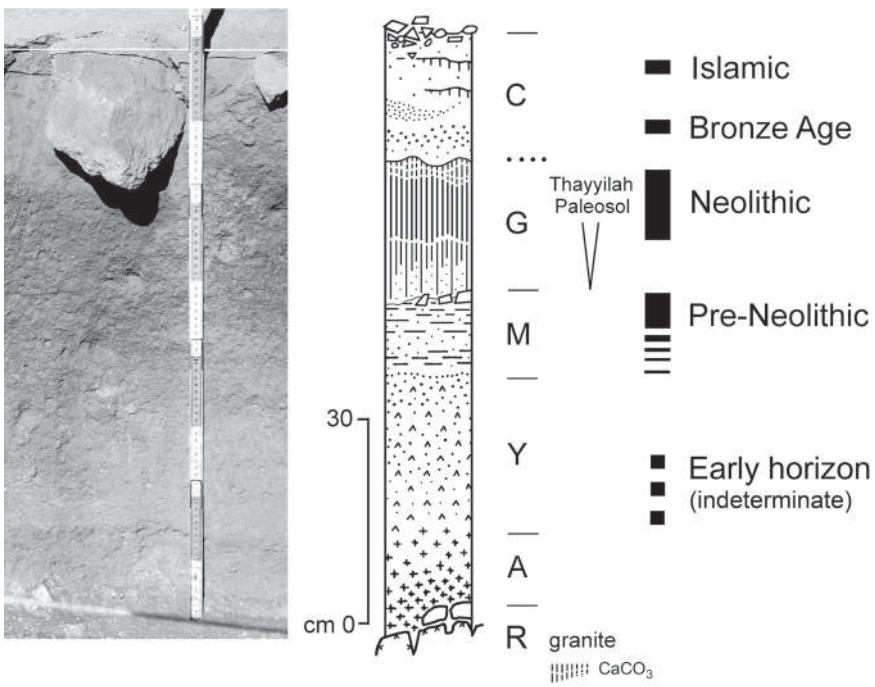

Fig. 8 General stratigraphy of site WTH3: litho-pedostratigraphic units and cultural stratigraphy. On the *left*: view of a representative section from the test pit in Area C1 (1984)

Archeofaunal samples, totalling about 140 pieces, come from deep contexts in Areas S1 and E2 (Table 1); a bone from E2 bears cut-marks. Preservation was mildly favored by rapid burial and slight charring, as in the locus of the clay figurine in Area S1, which gave bone remains from large bovids. An adult radius is metrically intermediate between wild and domestic cattle (Fig. 11b; Table 2): its estimated proximal width gives a logarithmic difference from a female European aurochs assumed as standard of c. −0.030, which means that although large the WTH3 *Bos* could be either wild or domestic (Fedele, 2008, with references; for a relevant diagram see Grigson, 1989, Fig. 5).

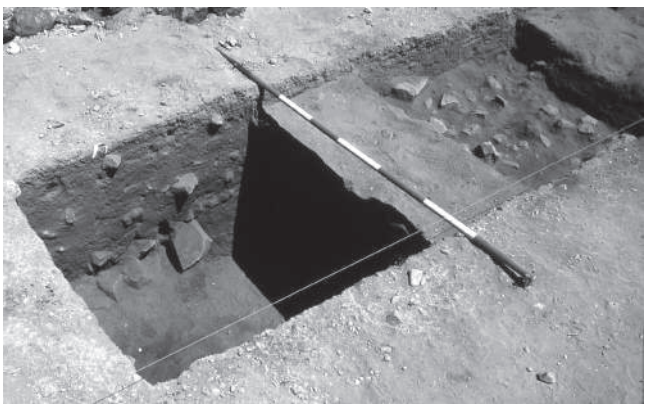

Fig. 9 Site WTH3: view of sounding in Area S1 (1985 excavations). The base of the test pit on the left shows the locus of the unfired clay figurine of Fig. 11; the Neolithic layer is exposed within the square on the *right*

Table 1 Archeofauna from the Pre-Neolithic horizon of site WTH3, Wādī at-Tayyilah: species composition and number of identified specimens (after Fedele, 2008)

	WTH3: Pre-Neolithic
Total number of specimens:	c. 140 (identified 6)
Wild or indeterminate status	
Bos sp., possibly wild	4
cf. *Gazella*, possibly gazelle	2
Only identified to size group	
Cattle-equid size group	c. 45
Caprine-gazelle size group	c. 20

Table 2 WTH3, Bos sp., adult radius no. 165.1. Coded measurements follow von den Driesch (1976)

	Measurements (mm)
Width of the proximal end, Bp	94 ± 1
Width of facies proximalis, BFp	~85
Depth of facies proximalis	38
Maximum depth of the proximal end	43

Since all the materials from the Pre-Neolithic appear to derive from large bovids and gazelle-sized animals, with domesticates not clearly present, I would suggest a wild fauna in which the aurochs may be dominant. Another wild species, buffalo, was reported from a mid-Holocene occupation at Sa'dah, next to a rock surface with depictions interpreted as the same species ("*Pelorovis antiquus* = *Bubalus arnee*"; Garcia et al., 1991; Garcia and Rachad, 1997). At WTH3, like at Sa'dah, we may be dealing with campsites where forager groups would bring butchered game, in the context of seasonal occupation by essentially mobile populations. It is unfortunate that such glimpses of mid-Holocene campsites as those provided by Sa'dah and WTH3 has remained until now isolated, and inevitably under-explored.

The test pit in Area C1 has produced a tiny amount of lithic finds from deeper levels than the Pre-Neolithic: provisionally these levels will be referred to as the WTH3 "Early horizon" (Fig. 8). Even allowing for short vertical migration in fine-grained sediments, the existence of a distinct earlier horizon well within stratum Y and at the A/Y contact was considered real, according to a reiterated, critical check of lithostratigraphy (Fig. 10). The collection only numbers four chert artifacts – three waste flakes and a blade – which on the basis of physical freshness suggest chipping in situ. Bone material was absent or not preserved. Unfortunately, no date can be offered for this deeper horizon.

The A/Y stratigraphic contact also gave a large, mildly worn denticulate scraper made of quartzite, wich is highly suggestive of redeposited Paleolithic material. This is a distinct possibility, since Area C1 likely lay very close to the riverbank at the time of the Pleistocene-Holocene transition, and elsewhere this kind of location corresponds to a frequent Paleolithic choice (for instance on the Yemen Tihāmah; Bulgarelli, 1985). Indeed in proximity, at findspot WTH3/III in October 1984, a fossilized fragment of long-bone diaphysis from a *Bos*-sized animal was found (Fig. 11c), recently eroded from cemented sands of this former riverbed of Wādī at-Tayyilah, Stratum 2 of the standard sequence. The bone fragment is relatively unworn, thus ruling out river transport, and shows splintering marks at one extremity which suggest human percussion rather than incidental breakage. Its correlation to the "early horizon" is only inferential, but not implausible.

The lithic artifacts from the Pre-Neolithic are nondiagnostic as well, unfortunately, and sample size is once again very small, a few dozen pieces (Fig. 12). Micro-waste from onsite working is common, with evidence of microblade technology, and there is a frequency of expediently utilized blanks as well as chert and granite macroliths. Obsidian was used, including a gray variety that is rare in the Neolithic, and whose source is unknown. Pending detailed re-analysis of the material (cf. Note 1) it is not possible to provide more

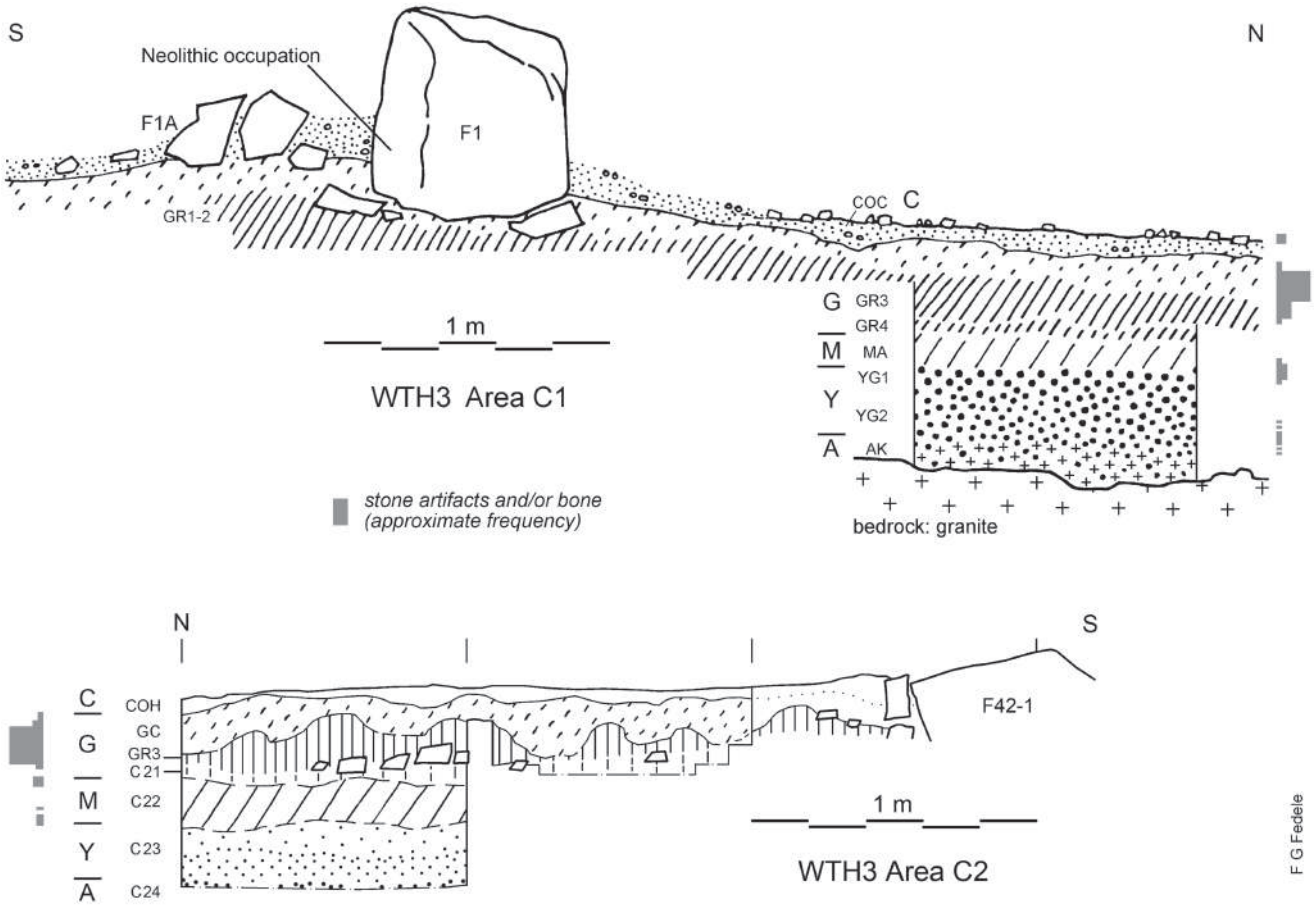

Fig. 10 Site WTH3: selected profiles from Areas C1 and C2 to show the pre-Neolithic cultural horizons. *Shaded histograms* on the side of profiles suggest the vertical distribution and frequency of cultural material

specific information, or evaluate the finds in the light of the current upsurge of innovative lithic technology studies. With suitable artifact samples, the analytic framework now constructed by Crassard (2007 and see also Crassard et al., 2006) should be borne in mind.

The impression on present evidence is that the Pre-Neolithic and Neolithic manifestations may be phases of a single continuum, an idea primarily supported by the apparent continuity of occupation at site WTH3. From the artifactual point of view, such a continuum might hint to similarities with the East African sequence rather than the Fertile Crescent, which would incline towards adopting an East African terminology (Fedele and Zaccara, 2005). The lack of pottery contributes to this impression. If so, the above lithic phases could be grouped under a "Late Stone Age" of the Yemen Plateau, a terminology already proposed for south-eastern Arabia by M. Uerpmann (1992). Further exploration of this issue is clearly necessary.

Other Pleistocene/Holocene Sites in the Thayyilah-NAB Area

Near WTH1, where the Early Holocene limnic series was observed (WTH1/I), the paleo-wadi had the character of a wide, meandering rivercourse with a tendency for overflowing. Our survey suggests the plausible existence of several associated sites, but actual reconnaissance was not possible. However, there is a hint of early human activity at WTH6, a thick terrace section on a small right tributary of the Tayyilah called Wādī Swayhāt (Fig. 6). Another exposure on this wadi had been sampled by Marcolongo and Palmieri (1990; de Maigret et al., 1989) during their initial reconstruction of recent geologic history. At WTH6, a chert flake was found in the exposed section within the breccia-conglomerate unit or Stratum 2. These gravels are especially rich in limestone and siliceous clasts from the wadi's headwaters, and prehistoric groups might have

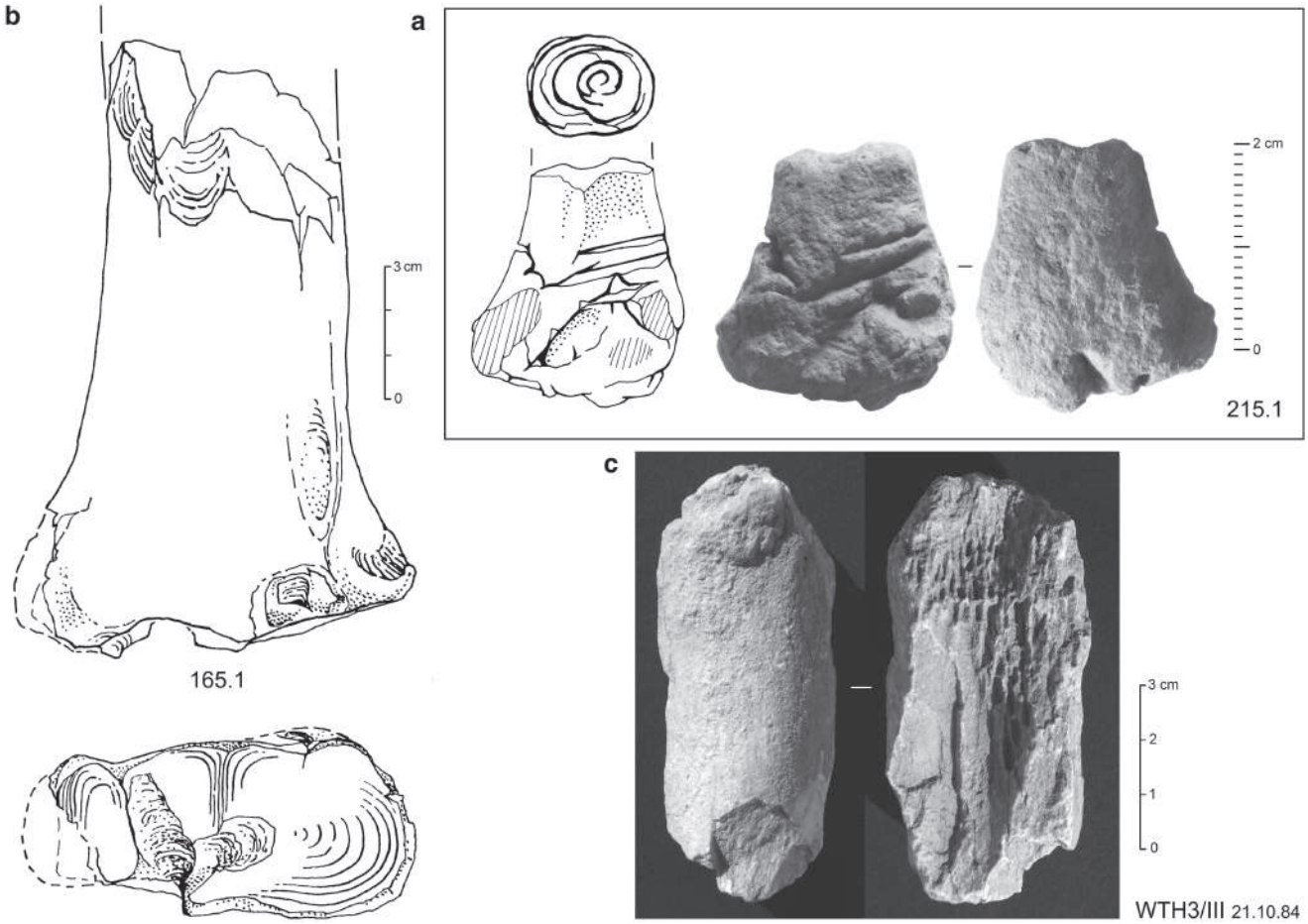

Fig. 11 Site WTH3, Pre-Neolithic: (**a**) part of figurine made of unfired clay; (**b**) *Bos* sp., proximal radius intermediate between wild and domestic; both from area S1. Site WTH3/III: (**c**) *Bos* sp., fragment of fossil bone from the cemented alluvial gravels (Stratum 2)

exploited chert cobbles as a resource. A Paleolithic site indeed exists on the limestone plateau overlooking the area from the west, Jabal al-ʻUrqūb. A flake alone is hardly diagnostic, but its origin from a discoid core as well as size correlate well with its Paleolithic appearance and stratigraphic date. To our knowledge this stratified find is still unique in the region.

Pre-Neolithic Evidence from the Wādī Khamar Basin (Jihānah)

The Area and Its Depositional–Environmental Sequences

Three sub-regions can be distinguished in the Khawlān at-Tiyāl, as historically defined by tribal territories. However, as indicated by de Maigret (1990: 3–4, 11), they also largely correspond to the three main geologic and lithologic zones (Figs. 1 and 2). East to west they are: Al-Aʻrūsh, in the Precambrian basement dominated by migmatite and granite; As-Suhmān, closely identified with the tableland made of Jurassic limestone, dolomite and calcarenite (Kohlan Sandstone and Amran Limestone formations, this latter in its shelf facies); and Jihānah, linked to Cretaceous-Paleocene sandstone (Tawilah and Medj-zir Sandstone formations) and Tertiary volcanics. Detailed geology can be seen in Kruck et al. (1996, Sheet 5 Sanʻa', initially published 1991). It should be noted that the Jihānah designation is here taken in its geographic rather than administrative sense.

Wādī Khamar is a branching valley located in the sandstone country of the easternmost Jihānah district along the border with Suhmān, about 40 km east-southeast of Sanʻā' (Fig. 13). It corresponds to a small and rather secluded basin, about 11 km^2 in area, and is composed of a north-to-south valley discharging south. Two smaller, tributary catchments

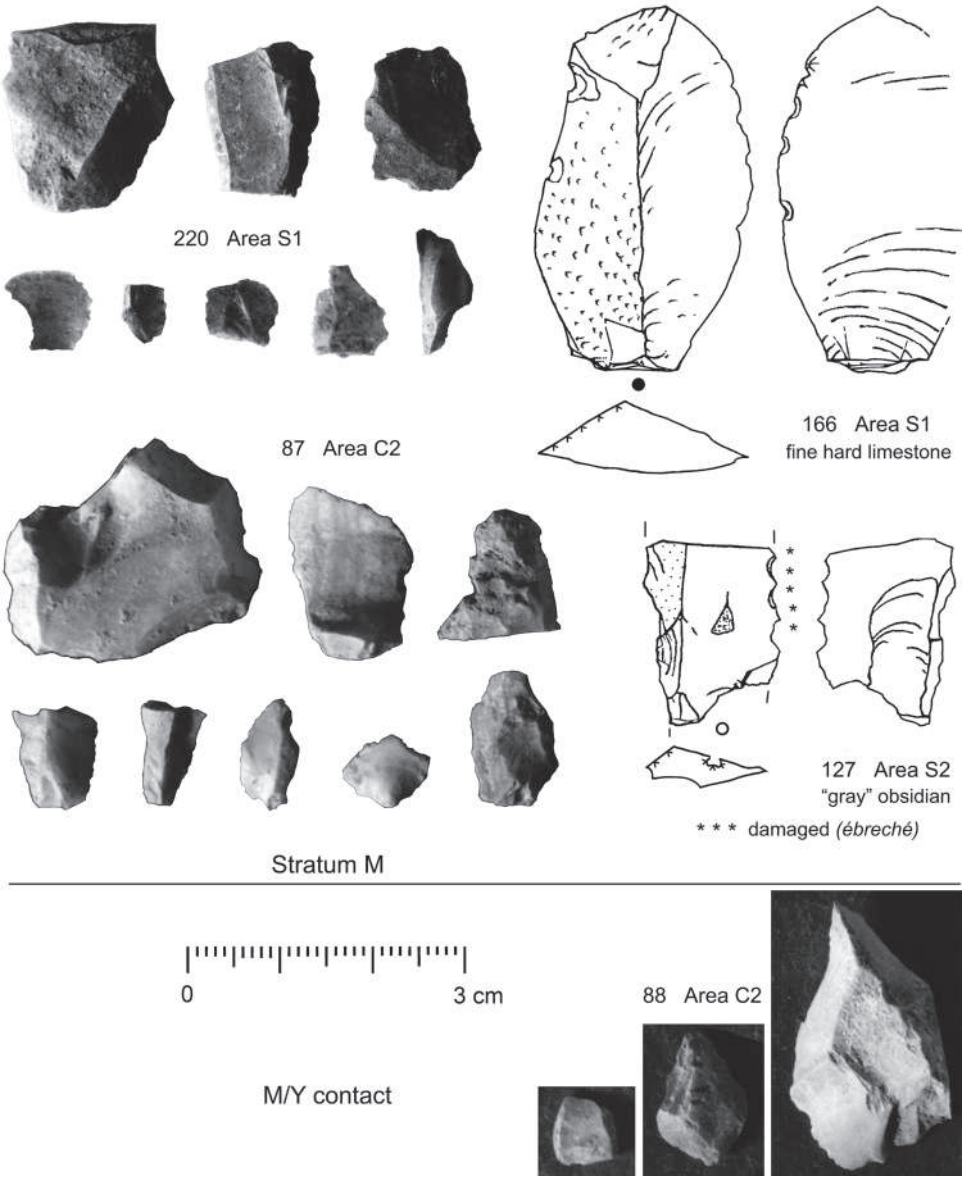

Fig. 12 Site WTH3: selection of lithic artifacts from levels of the Pre-Neolithic horizon. All chert, unless indicated otherwise

are situated on the right side of the valley, Wādī al-Far‘ and Wādī al-Akhdād, slightly suspended above the main valley axis, at elevations of 2,160 m and 2,180–2,190 m, respectively. The lower sector of the valley is centred on the floodplain and hamlets of Bayt Abū Jaydā‘, 2,110 m, and is separated from the upper sector, where the *qaryat* (village) of Khamar is located, 2,150 m, by a constriction of the valley and some rocky steps in the longitudinal profile.

A project was devised in 1987 to sample the archaeological occurrences within the sandstone belt of Khawlān (Kruck et al., 1996: 41–44), which had remained underexplored, and Wādī Khamar was selected for survey on the basis of air photo study. The attempt represented an extension of the initial research area of the Italian mission. Prospectively, a particular emphasis was put on the probable existence of caves and stratified cave deposits, a search for the earlier prehistory, and the presumed presence of early rock depictions (“rock art”). A single engraved rock had been previously recorded at the nearby sandstone-belt village of Al-Hisf, although without clues to its dating. All the theoretical expectations of the survey were indeed met with success, and several Neolithic and Bronze Age sites were recognized. However, it was not possible to set up camp at Khamar and spend more time in the field, and thus pursue our investigation beyond basic field reconnaissance. The survey took a net total of six days, one in November 1987 and five in February 1990; this latter phase coincided with an unusually rainy period, which provided insights about

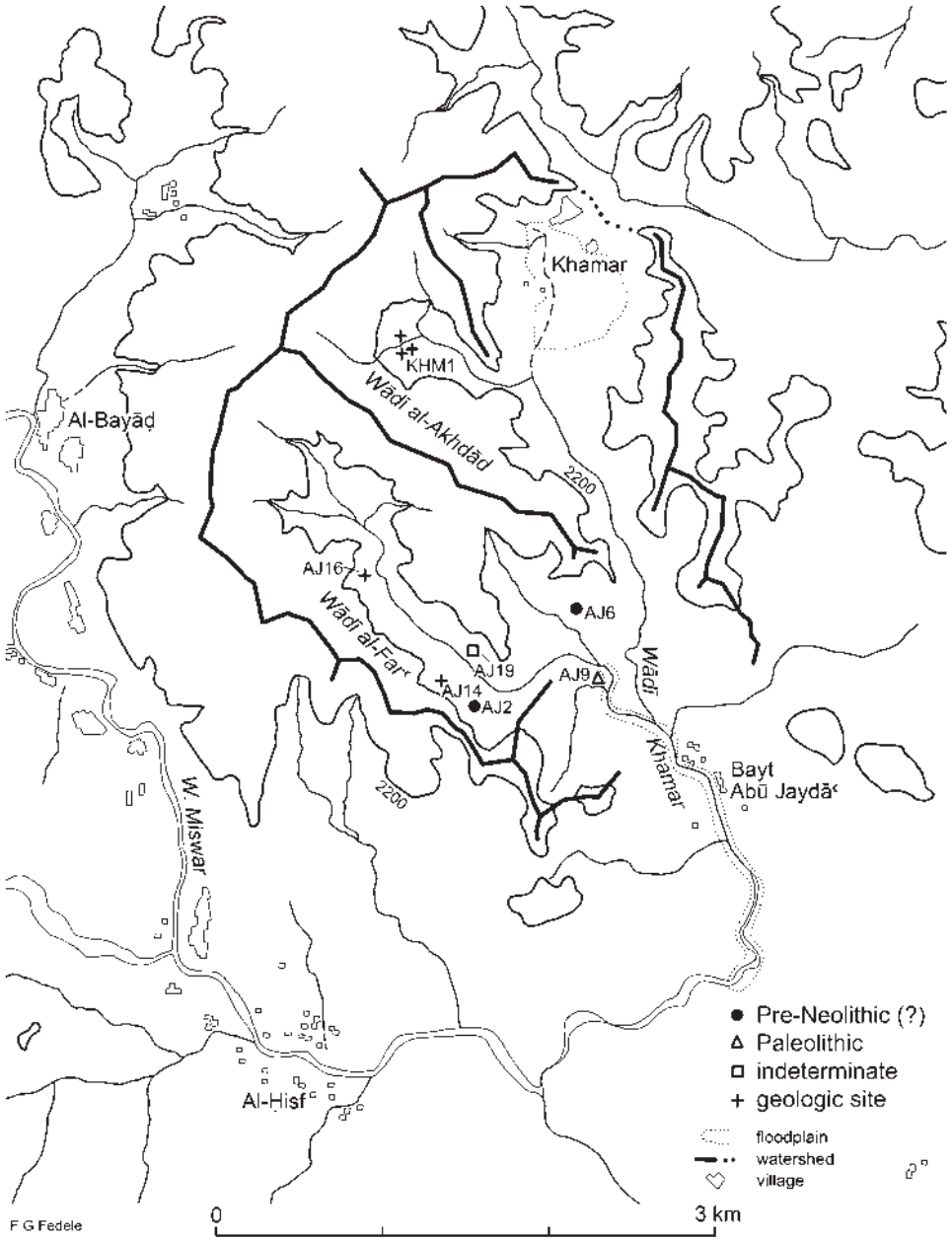

Fig. 13 Map of the Wādī Khamar basin. Prehistoric and geologic sites of interest are indicated

current processes of runoff and erosion. The survey's results have only been mentioned in a privately circulated report (Fedele, 1990b).

Among the acquisitions of interest here was the observation of numerous open-air, alluvial-colluvial stratified deposits in the Al-Farʿ and Al-Akhdād hanging basins, which almost perfectly replicate the typical stratigraphic succession of the Thayyilah-NAB area. Compared to that area, however, the Khamar sequences revealed an earlier unit below the alluvial conglomerate or gravels, thus expanding the environmental record back in time: this unit is here designated Stratum 1. These sequences obviously span the Holocene and in some cases the Late Pleistocene periods: the main occurrences are plotted in Fig. 13. No less than a dozen individual outcrops were listed and partly recorded, the most notable in terms of extent, preservation and cultural potential being KHM1, AJ16, AJ14, and AJ2. This information confirms that the Thayyilah-NAB type-sequence has regional significance and reflects widespread environmental conditions, including controls at both regional and super-regional scales (e.g., climate).

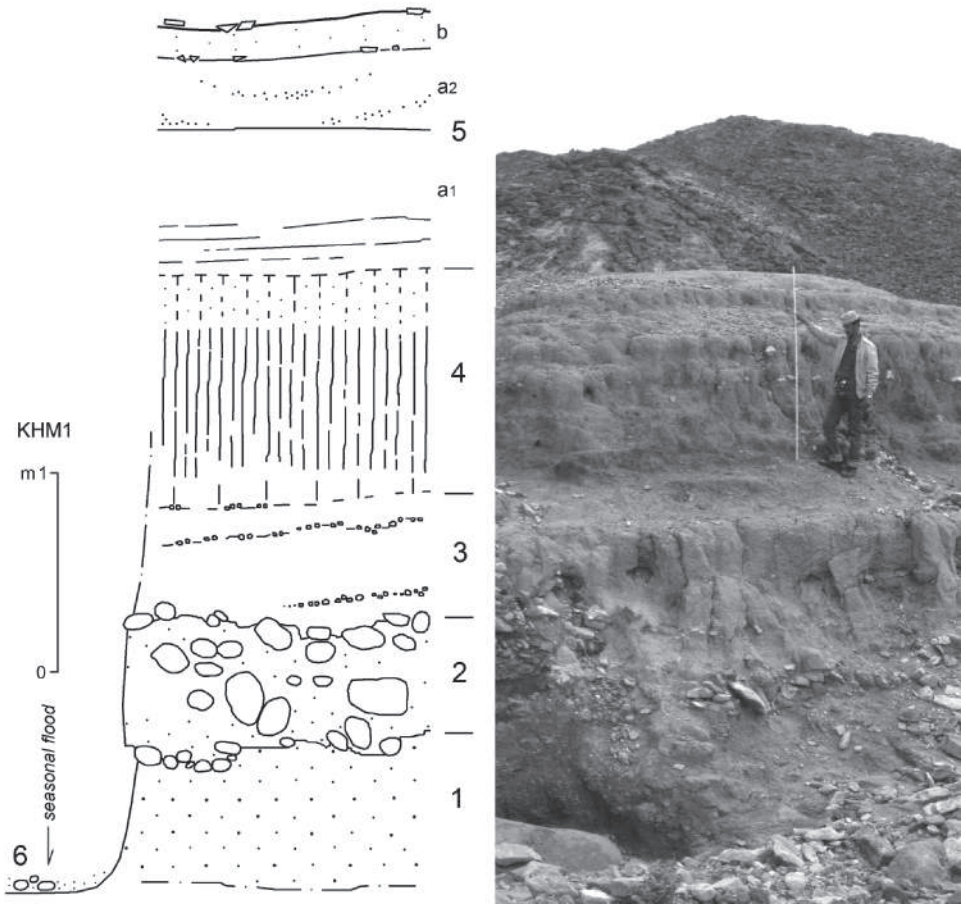

Fig. 14 Holocene–Pleistocene depositional sequences of Wādī Khamar: different exposures at KHM1 (*left*, 1987 profile; *right*, 1990)

The Early and Middle Holocene sedimentation tends to blanket the valley bottom and lower slopes in both suspended basins, except where erosion was more active. The series is regularly and conspicuously dominated by a pedogenetic unit which I would equate with the Thayyilah Paleosol, the pedogenesis being superimposed on a band of often indurated, carbonate-rich, gray and dark gray silts (Stratum 4 in Figs. 14 and 15). These mid-Holocene units are normally sandwiched between a cover of yellow sands and silts, largely aeolian in origin (Stratum 5), associated with the topographic surface, and an underlying suite of pale silty-clayey units, gray to brown in color and varying locally in texture and structure (Stratum 3).

The above sequence is separated by the lower and earlier deposits by a marked discontinuity (2/3), usually the only significant lithostratigraphic break to be seen in the exposures. This discontinuity and the underlying deposits can only be inspected in wadi bottoms, where recent stream erosion has been cutting through the sediment cover, down to an earlier floodplain and/or its bedrock. One of the best examples of the whole series, and possibly the most comprehensive in the Khamar basin, can be observed at KHM1, a cluster of dissected terraces nested upvalley in Al-Akhdād (Fig. 14). Like elsewhere, the 2/3 discontinuity is clearly erosional in nature and may also entail a significant hiatus. Stratum 2 is the usual layer of alluvial gravels, often cemented, indicating a former stream-bed. Below this layer and unique to KHM1, the top of a thick unit of yellow cemented sands can be observed ("Early sands", Stratum 1), which disappears beneath the active level of the present-day wadi. These sands are not necessarily alluvial in origin. They could be traced laterally for a short distance and turned out to interdigit with pale blue-greyish silts, lacustrine in all probability, a heteropic relationship; no detailed study was possible.

Together, Strata 1 and 2 can be interpreted as representing an interval within the Late Pleistocene. They might approximately date anywhere from between the later Pleniglacial and the end of the Pleistocene, before about 11 ka cal. BP; a date at the Pleistocene-Holocene limit for the heavy discharge associated with the gravels appears plausible. In principle, Strata 1 and 2 might be attributed to a period of alternating pluvial and arid regimes, with the Early sands marking a particularly arid phase within it such as – again in principle – the Late Glacial hyperaridity of about 20–12 ka cal. BP. Only investigations aimed at the specific conditions of Khawlān could bring precision, particularly because tectonic history may have locally modulated the action of climate,

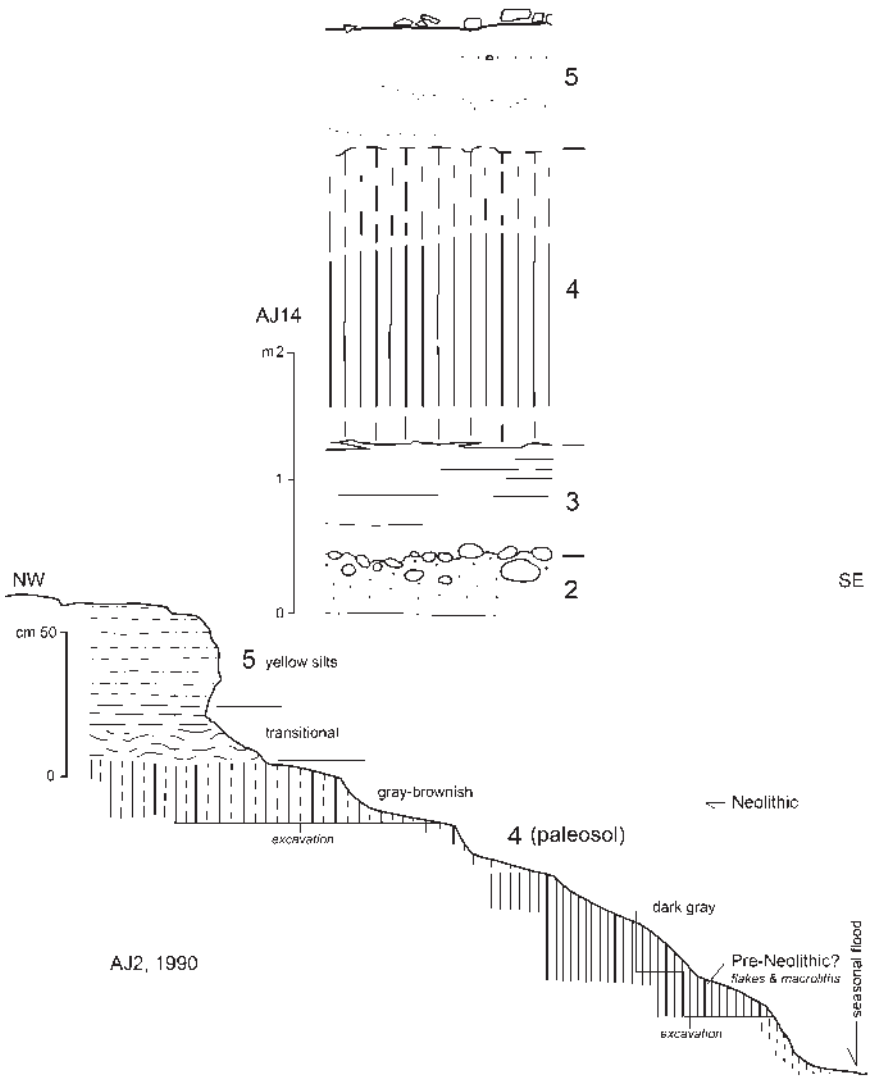

Fig. 15 Holocene–Pleistocene depositional sequences of Wādī Khamar: Wādī al-Far‘ basin, sites AJ14 (*above*) and AJ2 (*below*, with 1990 test excavations)

in depositional terms, as it did in the Holocene. Unfortunately, no artifacts were found in these lowermost units. Elements of lithic industry were only observed in the mid-Holocene sequence, where they were eroding from the “gray” paleosol of Stratum 4.

Early Holocene and Putative Late Pleistocene Sites

The sites of interest are all open-air. Two cave deposits of some significance were inferred from visible morphology and erosional windows in the sediment fills, which gave hints of deep sequences, but could not be tested. The open-air occurrences will be discussed according to their presumed chronological order starting with the most recent.

AJ6, AJ2. Site AJ6, near the flat or *hanaka* of Bayt Abū Jaydā‘, is a small quarry and workshop site connected with an outcrop of poor-quality chert. Chert appears to be rare or nonexistent in the Khamar basin and possibly in the sandstone belt in general, which explains why inferior but easily obtained material would be valued. Although obviously impossible to date on the basis of two brief inspections, the surface material is partly compatible with the Neolithic, this attribution being based on the Thayyilah and Qutrān “industries” already recognized on the eastern Plateau (Fedele, 1988; Fedele and Zaccara, 2005). However, some lithic clusters appear to be the product of a “Neolithic”-looking but less definite chipping tradition. This, and the type of site itself, make it possible that an Early Holocene component is also present. The possibility is strengthened by the stratified occurrence of some artifacts, including macroliths, at the base of the Thayyilah Paleosol dark-gray band at AJ2, one of the principal terrace exposures in Wādī al-Far‘ (1990 test excavation; Fig. 15).

AJ19. Also in Wādī al-Far‘, this site is an exceptional spread of lithic artifacts located on an isolated rise (a terrace

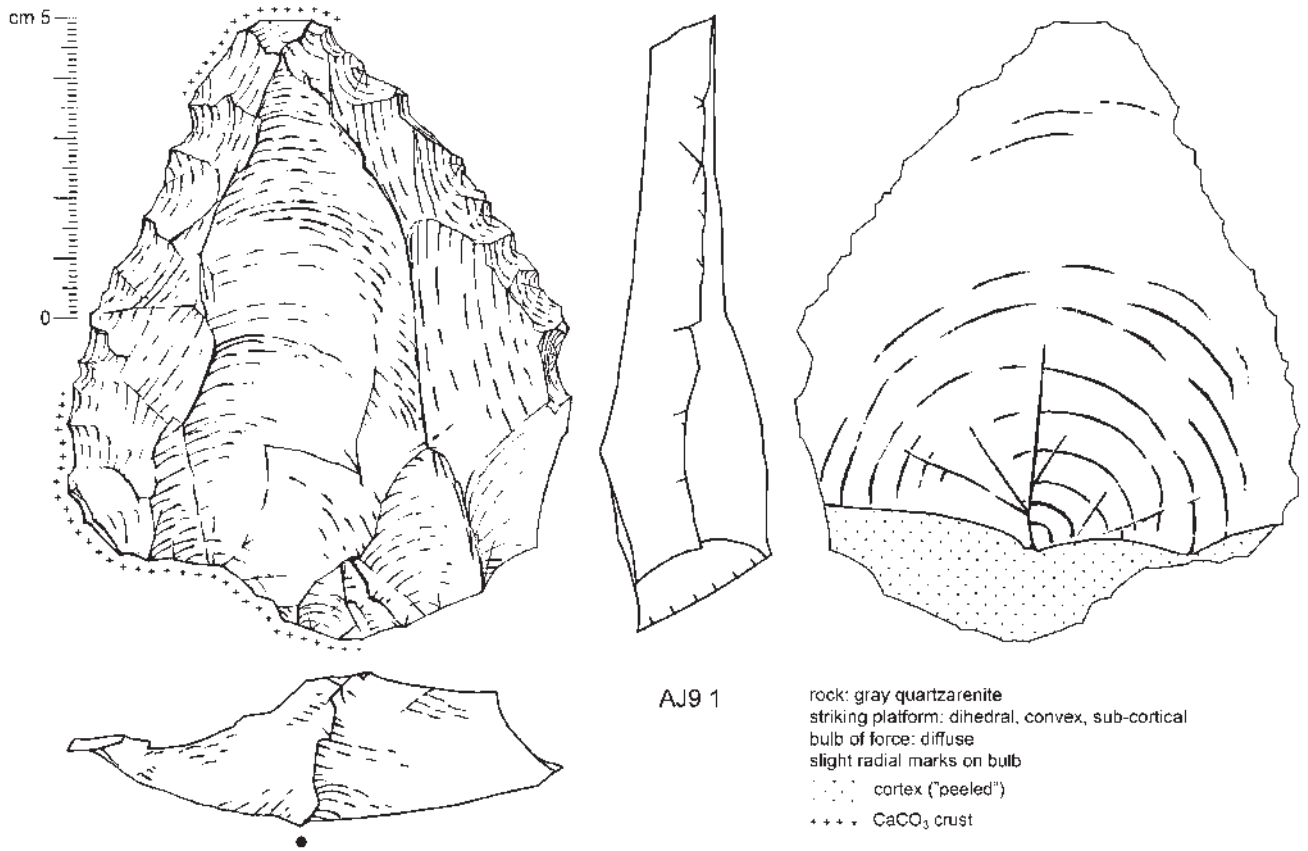

Fig. 16 Wādī Khamar: Paleolithic tool from site AJ9

remnant?) upslope from a protruding rock. This lithic scatter is highly unusual relative to similar sites in Khawlān in terms of composition, artifact density, and to some extent size. Three varieties of red-brown contact-metamorphic rocks were imported and worked, but alongside workshop waste there is about 30% of utilized blanks and finished tools. It was not possible to resolve whether the site is a palimpsest – a mixing of various ages – or contains instead an essentially synchronous component. A distinct perception was gained during the survey that the site was different from what was already known in Khawlān. There is at least a component whose technology and typology do not match the Neolithic and Bronze Age lithic inventories of the region (for the Bronze Age see Di Mario, 1987, 1990). From a purely theoretical standpoint, a core and some large prismatic blades are formally compatible with an "Upper Paleolithic" affiliation. The condition and context of the site do not contradict this possibility.

AJ9. Rare artifacts, some of them apparently reflecting Paleolithic flaking technology, are eroding at AJ9 from yellowish, silty-sandy, non-organic sediments that look very different from the recent deposits. A polyhedral core, a denticulate, and an unusual flake tool were collected. This last artifact (Fig. 16) is a convergent scraper made on a large flake of gray quartzarenite partly covered with a calcium carbonate crust; it has a convex, dihedral platform and a simple, slightly denticulate retouch. These surface finds come from eroded, gently rolling remnants of the highest terrace in the Abū Jaydā' area. The sediments from which they appear to derive resemble the Stratum 1 sands of the general sequence. Until further research this possible association must remain hypothetical.

A Note on the Paleolithic Evidence from Other Areas of Khawlān

To add perspective, the archaeological occurrences from other areas of Khawlān that have been attributed to the Paleolithic will be summarized. Lacking stratigraphy, the attribution was always based on patination and techno-morphological traits alone, with the indeterminacy and inherent limits of this procedure. All sites are open-air, and most correspond to rich lithic scatters. Several such sites were initially reported by de Maigret (1982, 1983) and Bulgarelli (1988; cf. de Maigret et al., 1984: 437–439), and additional observations and findings were made by the author during

field operations that were principally concerned with Neolithic archaeology (unpublished records). The sites will be listed south to north (Figs. 1 and 2).

Sites of Al-A'māS, on the southern fringe of Khawlān (FGF, October 1984). On the tabular limestone plateau of Dulā' (or Zlā') al-A'māS, at least one site presents abundant *débitage* and retouched tools made of chert, coated with heavy patinas and aeolian lustre or "desert varnish" (site DA1). The particular setting is a surface mosaic of subangular to rounded clasts resembling a deflation pavement. Levallois characteristics are clear enough to indicate a probable Mousterian, in terms of the tool-making traditions of the Near East; this description, however, is not meant to imply cultural affiliation (see Petraglia and Alsharekh, 2003, for an overview of alternatives). Another similar site with a predominantly "Mousterian" composition, GSH3, is located on the flanks of the Jabal al-Watadah inselberg, facing the Jabal Sha'īr relief from the north, where long-stabilized semi-desert surfaces meet the basal slopes of the relief.

Sites of Suhmān. Several surface scatters including lithic artifacts of "Middle" Paleolithic appearance have been observed in 1982–1984 on the limestone tablelands comprising As-Suhmān (Fig. 2). Some have been interpreted as workshops by Bulgarelli (1988). The southernmost is HGN4 at Hammāt Ghawl an-Numayrī and was identified on the basis of a few tools made of nodular flint (Bulgarelli, 1984). Three similar sites, MAS2-MAS4, lie on the tableland of Al-Masannah, an area sloping towards the scenic "loop" of Wādī Habābid, or Habābiz, whose riverbed here is deeply entrenched in a canyon (plan in de Maigret, 1990, Fig. 4). Four more, HA1-HA4, lie to the southwest of the previous cluster on the tabular calcarenites of Humayd al-'Ayn, again bordering the wadi's canyon and loop (de Maigret, 1982; Bulgarelli, 1988). To the north, a site indicated by a few finds was recognized at Jabal al-Humaymah, GHU1 (Bulgarelli, 1984). Finally, a concentration exists on Jabal al-'Urqūb, GUR1, near the edge of the spectacular *mesa* overlooking the Thayyilah-NAB rift, where a tabular chert was exploited (FGF, October 1984 and subsequent visits). The scatters of lithic material suggest a mix of various technological complexes, including heavily patinated, "Middle" Paleolithic artifacts. In addition to manufacture from the local chert, exogenous flints are represented.

Dayq Qā' Jahrān. One Paleolithic locality of potential interest outside the region of Khawlān deserves to be mentioned, as it adds to the significant prehistoric evidence from the Qā' Jahrān plain, a flat *enclave* stretching north and south of Ma'bar in the central Plateau (e.g., Wilkinson, 1997; Wilkinson and Edens, 1999; French, 2003). Two findspots were located in 1983–1984 at the foothills of the Hayd Ahmad extinct volcano (QG1) and near Jabal Ghawl ar-Rā'i (QG2) a few kilometers south of Ma'bar (de Maigret et al., 1984: 439). A total sample of a hundred flake tools and choppers were recovered, in addition to two ovoid handaxes, made of rhyolite and volcanic tuff, which together suggested an attribution to the "Late Acheulean" (Bulgarelli, 1988; a handaxe is pictured on p. 41).

Bulgarelli (1985: 360) comments: "Although all these discoveries prove interesting, lithic tools have been gathered on the surface, out of their original stratigraphical context. This situation makes their cultural and chronological attribution less easy and certain." It is also unfortunate that the above findings were neither documented nor formally published, and the apparent assemblages were never defined; the collections are housed at the National Museum in San'ā'. Similar remarks were made in the same period by Toplyn (1988: 84), who calls for extreme caution in attributing surface artifacts to "heretofore undefined Yemeni Acheulean and Mousterian lithic industries". In fact, such archaeological circumstances are not restricted to Yemen: the recovery of Paleolithic material from surface situations has been common practice throughout the Arabian peninsula up to this day.

Conclusions and Inferences

The above information is preliminary. However, as it has a bearing on the peopling of a region in the Yemen highlands, it represents a first step in investigation, and the evidence suggests viable strategies for possible future research. Early Holocene and terminal Pleistocene archaeology should be identified as a specific research goal and approached accordingly. What is needed to further our limited knowledge is additional material from controlled in situ proveniences. This would include artifacts or ecofactual elements from stratified occurrences, if not whole occupation layers; or surface finds for which some kind of evidence might suggest their primary context. Such obvious requirements have just only begun to be met in other parts of Yemen, away from the western mountains, for instance in the Hadhramawt (Crassard and Khalidi, 2004; Crassard et al., 2006). Admittedly, suitable working conditions and research arrangements to accomplish that task may not yet be available in parts of the highlands.

If anything, the information here presented shows how much there is still to record and understand in the highlands. Territorial surveying is badly needed, and Wādī Khamar provides an example. On a few days' inspection, a small territory can produce tangible sites and enough background data about paleoenvironmental conditions as to allow more penetrating archaeological discovery. Insights from circumstantial evidence should not be discounted, as there can be little doubt that such a remarkable sample of wadi terrace exposures as those in Wādī Khamar will bring out pre-Neolithic evidence when adequately explored. In the same per-

spective, the case of Neolithic site WTH3 should serve as a reminder of what can be revealed by careful testing below later prehistoric occupations, or even blind-testing in stratified Holocene deposits. In this chapter a brief mention was also made of the preceding, Late Pleistocene information, which in spite of its extreme paucity can be of promise for future research.

At the moment, two levels of inference can be envisaged from the primary evidence reported. At the regional level, i.e. Khawlān at-Tiyāl, a working hypothesis can be advanced that the Early Holocene peopling of the eastern highlands might have foreshadowed in importance that of mid-Holocene times. At least in the numerous Tayyilah-like or Khamar-like basins the environmental preconditions for population infiltration and sedentarisation were all in place. Such conditions reflected locally what is now becoming known about the Early Holocene climate of southern Arabia, as reconstructed in terms of changes in monsoon precipitation and the tropical rainfall belt in general (Fleitmann et al., 2007).

At the super-regional level, it is worth asking whether the limited data from the headwaters' basins of eastern Yemen can perhaps be generalized to the whole of the eastern Yemen Mountains, again as a working proposition. Elsewhere I speculated (Fedele, 1988, 2008; cf. Edens and Wilkinson, 1998: 63–71) that most of the eastern Plateau Neolithic might represent a regional tradition specific to the highlands and distinct from both desert (e.g., Di Mario et al., 1989) and coastal cultures (Durrani, 2005). This "upland Neolithic tradition" would have taken full shape with early cattle herders who co-adapted to the severe landscape and settled the highlands widely by use of pastoralism and particular toolkit inventories. An expanded model could now be suggested whereby the emergence of an upland tradition had roots in the Early Holocene – the "Pre-Neolithic" – if not slightly earlier.

In effect, the uplands may have served as a refuge area during the periods of more severe desiccation in the lowlands, and have thus contributed to a distinct population history already under Late Glacial conditions. That is an entirely hypothetical construct. However, if the idea is correct, the Yemen Mountains and perhaps Yemen at large ought to be viewed as the southern periphery of a deep-rooted cultural continuum specific to the western Arabian uplands. This continuum would have entailed adaptive invention and original developments, hence a degree of cultural autonomy from the rest of Southwest Asia. Furthermore, an upland-adapted tradition in Yemen might have more in common with the parallel and broadly coeval developments in the Ethiopian Highlands, or elsewhere round the Horn of Africa (e.g., Barnett, 1999, with references), than with the terminal Pleistocene and earlier Holocene of the northern Near East. How to accord such a scenario – a fundamental independence from the northern Near East – with the apparently indisputable fact that several domestic animals and other cultural elements were of Near Eastern origin, is a problem for future research.

On the basis of simulation work, Drechsler (2007) has recently suggested that one of the two putative dispersal pathways of the Neolithic out of the Levant and into the Arabian peninsula was along the Red Sea coast. This wave or "branch" may have advanced rather rapidly, because of inferred higher human mobility in less favorable environmental conditions; south of about 20° latitude it apparently dispersed away from the coast and over the uplands, i.e. in Greater Yemen. A potential, distinct role for the western Arabian uplands in the spread of the Neolithic lifeways would thus emerge. The same study would support the view of an environmentally dependent process of dispersal, with rapid climatic change fostering the appearance of original Neolithic developments in southern Arabia after about 6 ka cal. BC. This conclusion suggests once again that the peopling of the Yemen Mountains during the Pleistocene-Holocene transition and immediately afterwards deserves close scrutiny, hence appropriate investigation.

The above problems evoke a wider context for our data, and at the same time, inevitably, point to the intrinsic limits of the evidence from the eastern Yemen Plateau. However, it should be obvious from the preceding account that such limits are contingent on the present state of research. There is potential for our work to be replicated and indeed expanded throughout the eastern highlands, or at least, predictably, in a broad south–north belt of local landscapes along the Precambrian and Jurassic-Cretaceous formations. The peculiar tectonic history that has led to a "fossilization" of the upper Wādī Danah drainage, and thus to a widespread preservation of Early Holocene geologic landscapes, certainly is not confined to central northern Yemen (see for instance Garcia et al., 1991, for an area further north). Future research is needed to clarify such possibilities, and eventually define areas of greater research potential. Given that our understanding of the Late Pleistocene and Early Holocene occupation of southern and western Arabia is still rudimentary, the proposition that the Yemen Mountains have the potential to contribute to this goal in their own distinctive way – as *mountains* – should be tested.

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