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The shell-midden sites of RH5 and RH6 (Muscat, Sultanate of Oman) in their environmental setting

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The excavation of aceramic shell-middens discovered on the cape of Ra's al-Hamra and along the edges of the neighbouring Qurm mangrove-swamp (Muscat, Sultanate of Oman) allow the authors to follow the cultural and environmental changes that took place in the region between the middle of the seventh and the first centuries of the fifth millennium BP.

KEY-WORDS: shell-middens, fisher-gatherers, mangrove-swamp, Sultanate of Oman

INTRODUCTION

Many of the shell-midden sites of the Cape of Ra's al-Hamra were discovered by R. Jäckly of the Petroleum Development Oman in the early Seventies (Tosi 1975). This cape, located a few kilometres northwest of Muscat, is a limestone Tertiary terrace stretching towards the Indian Ocean in one of the most peculiar ecological zones of the northern Omani coast, at the eastern end of the flat, sandy, Batinah Beach, and the beginning of the rocky coastline that extends southeastwards as far as the cape of Ra's al-Hadd in the corner of Arabia. Twelve prehistoric shell-middens were recognized by R. Jäckly and by the Italian and German Archaeological Expeditions (Durante and Tosi 1977) (Fig. 1). Only four were partly excavated, namely RH4 (Durante and Tosi 1977: 141), RH5 (Biagi *et al.* 1984; Biagi and Salvatori 1986), RH6 (Biagi 1985; 1999; Biagi and Nisbet 1992) and RH10 (Santini 1987). They all lay on the above-mentioned cape, except RH6, in the neighbouring mangrove swamp of Qurm, on a lower terrace, partly covered with a sand dune, at the mouth of Wadi Aday (Fig. 2). Most of the sites were destroyed during the development of the Muscat capital area between the late Seventies and the Eighties, with the exception of RH6, still almost intact in the Qurm National Reserve.

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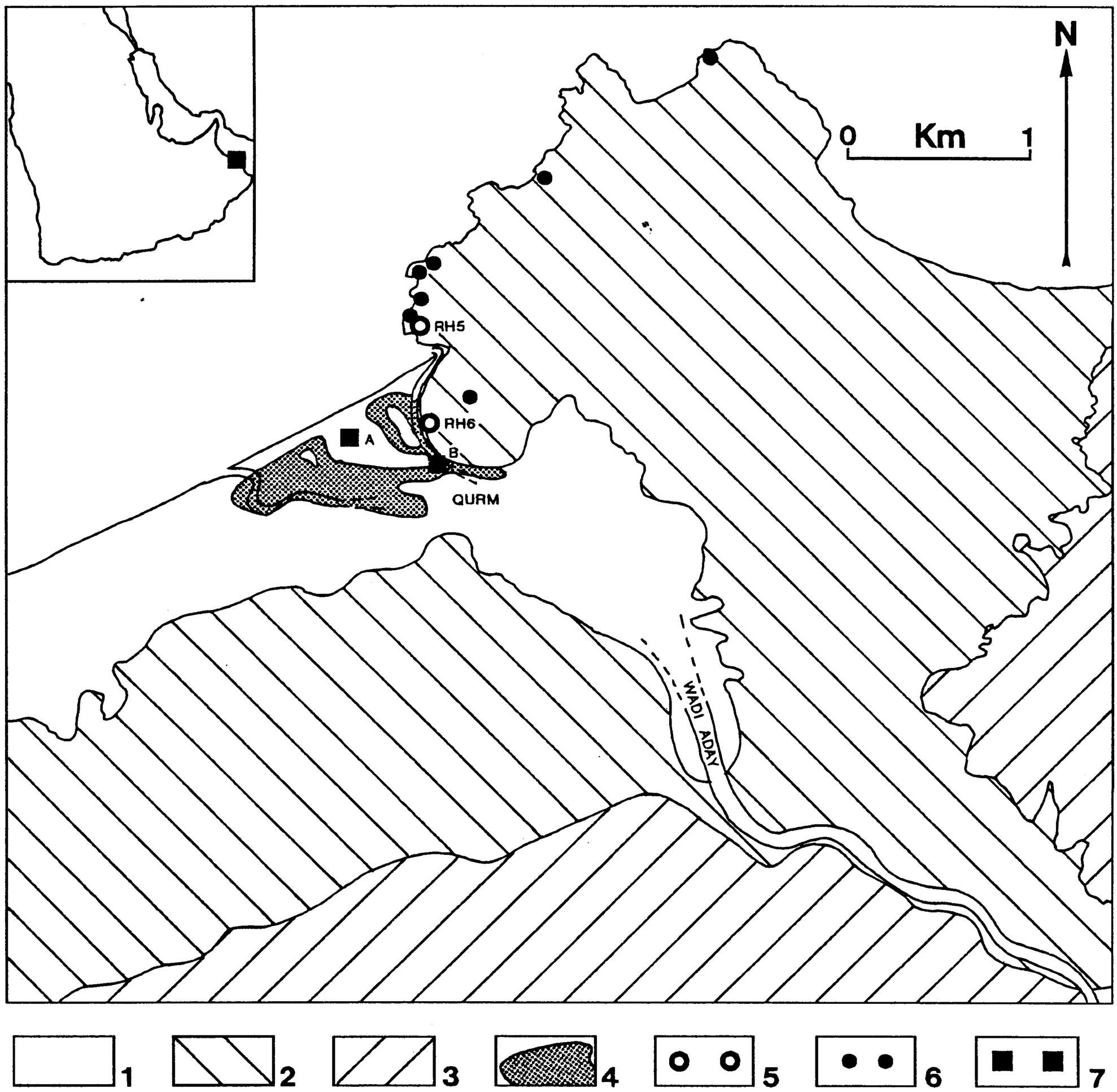

Fig. 1. Map of Ra's al-Hamra and Qurm areas. 1 – lowland zone, 2 – foothills, 3 – mountain zone, 4 – actual mangrove swamp, 5 – sites RH5 and RH6, 6 – other shell middens, 7 – cored points. Drawn by P. Biagi.

During the last fifteen years, rescue excavations were conducted at RH4, while RH5 and RH10 were extensively, but not entirely investigated between 1980 and 1985. Excavations at RH6 were carried out in 1986 and 1988 (Biagi 1999).

RH5 was undoubtedly the largest shell-midden in the region, measuring 90 metres in length and 45 in width. Its sequence, 1.5 metres thick, revealed seven main phases of occupation and a cemetery with the remains of some 220 individuals (Biagi and Salvatori 1986; Coppa *et al.* 1986). RH6 is a mound some 60 metres long and 75 wide (Fig. 3), the western part of which is occupied by an aceramic shell-mound the deposits of which are 1.7 metres thick (Fig. 4). A trench opened

Fig. 2. Aerial photograph of the Qurum/Ra's al-Hamra area with the location of sites RH5 (square) and RH6 (triangle). Photo: R. Salm.

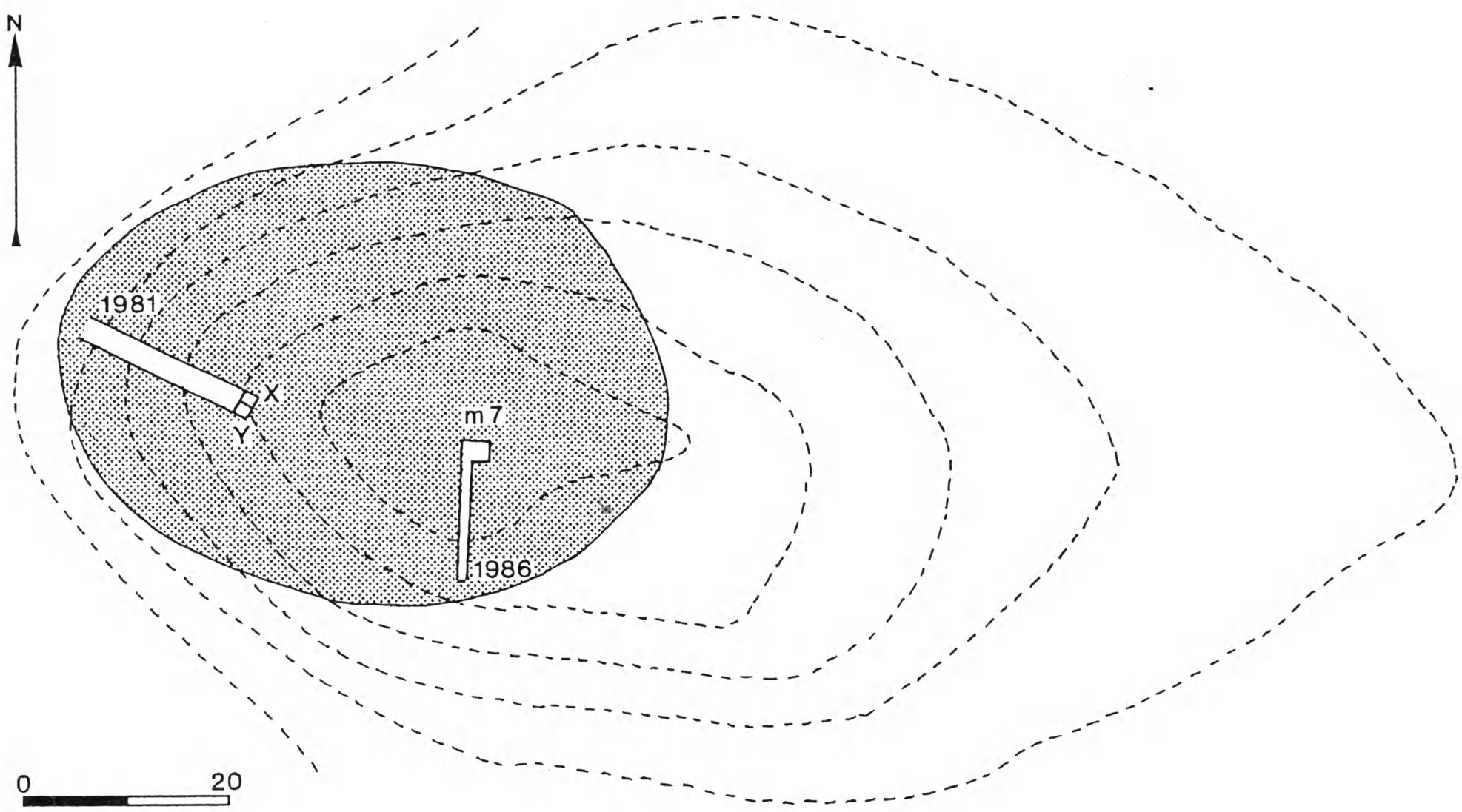

Fig. 3. RH6. Site plan with the indication of the extension of the shell-midden (shaded area) and the location of the trenches. Contour lines every 1 metre. Drawn by P. Biagi.

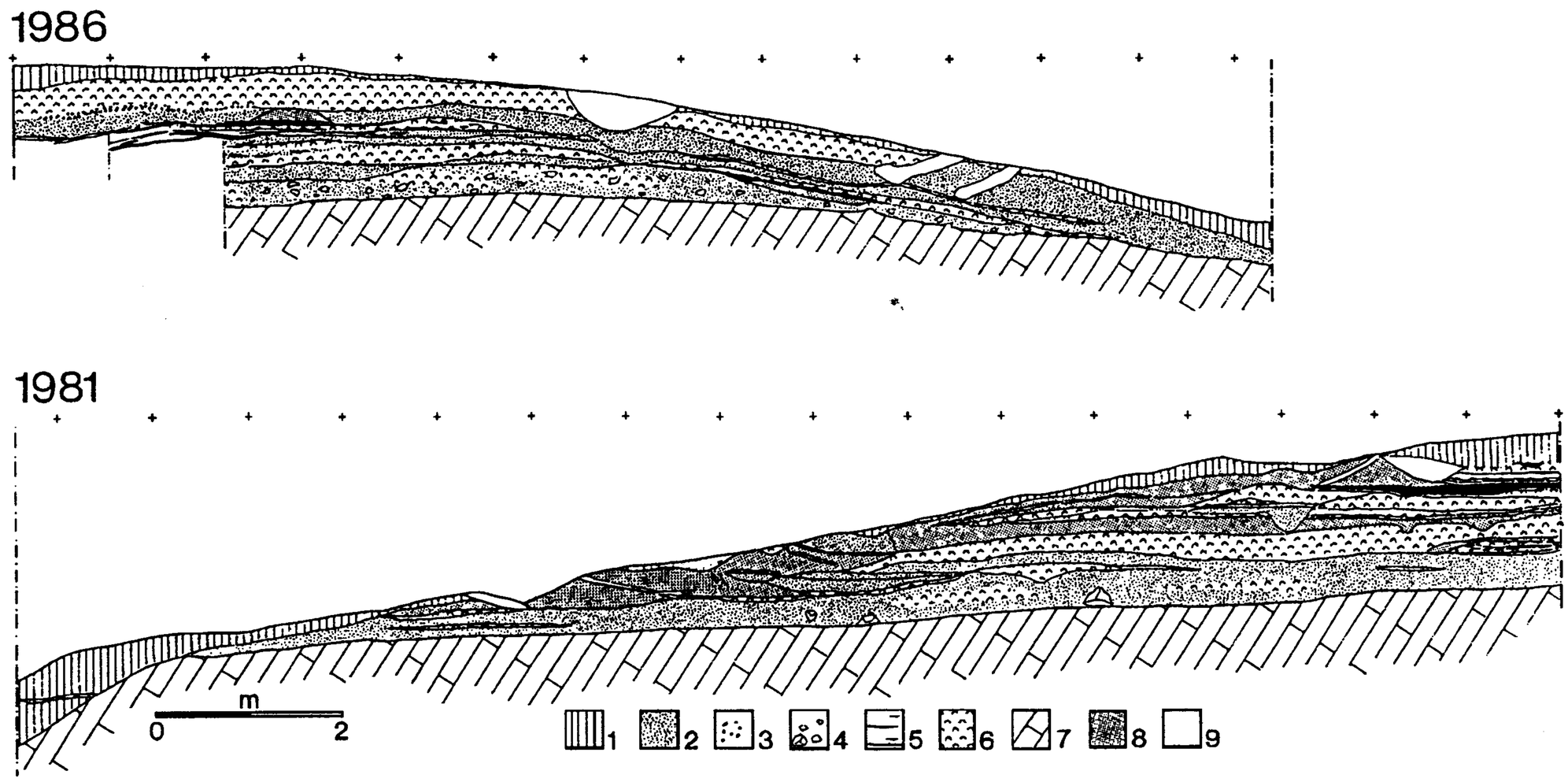

Fig. 4. RH6. Section through the deposits excavated in 1981 and in 1986. 1 – subrecent sand, 2 – sand, 3 – allochtonous pebbles, 4 – stones, 5 – charcoal lensès, 6 – marine and mangrove shells, 7 – bedrock, 8 – fish bones, 9 – disturbed deposits.
Drawn by E. Starnini from originals by M. Cattani, S. Salvatori and I. Tiscornia.

in 1986 on the top of the midden brougth to light a Bronze Age burial with three croutched skeletons one of which was dated to 3580±80 BP (OxA-2629) (Biagi 1994: 20; Hedges *et al.* 1997).

The excavations carried out at RH5 demonstrated that the site had seven main phases of occupation that produced various features including rubbish pits, postholes, fireplaces and C-shaped small canals. A small trench opened at RH6 revealed that the site was composed of fourteen layers of eolic sand, shells, fish bones, ash and charcoal the lowermost of which lay on the rubified bedrock. The excavations showed that the first inhabitants of both RH5 and RH6 settled on the limestone terrace as indicated by many features of various shape and size dug into the bedrock.

THE RADIOCARBON CHRONOLOGY

Many ^{14}C dates were obtained from the two sites (Uerpmann 1992; Biagi 1994). Most of the dates from RH5 have been obtained from *Avicennia charcoals*, while those from RH6 are mainly from marine (*Anadara uropigimelana*) and mangrove (*Terebralia palustris*) shells. The ^{14}C chronology of the sites indicates that RH5 was inhabited between the middle of the sixth and the first centuries of the fifth millennium BP; while the dates from RH6 range between the middle of the

seventh and the first centuries of the sixth millennium BP. This demonstrates that RH6 was abandoned (or had already been abandoned some decades before) when RH5 was settled for the first time.

THE MATERIAL CULTURE ASSEMBLAGE

Strong differences characterize the artefacts from the two sites. As regards the chipped stone tools, the hyaline and opaque quartz artefacts are very common to the lowermost layers of RH6, while the blonde flint ones are better represented in the upper ones. The instruments include small backed retouched perforators, front end-scrapers with side retouch, truncations on bladelets, backed bladelets and various types of splintered pieces. The blade technology is rather well represented. The polished stone tool inventory comprises one intact specimen of conglomerate adze, as well as small balls, some 1 cm in diameter, flat, circular and oval-shaped net-weights and hammerstones obtained from wadi pebbles.

The shell implements include a great number of fish hooks polished from *Pinctada radiata* and *Pinctada margaritifera* shells. All their stages of manufacture are testified from the uppermost layer 1, probably indicating the presence of a workshop. A small pit from the same layer contained many *Fasciolaria trapezium* shell vessels. Gorges and various types of perforators characterize the bone inventory.

Quite a different picture comes from site RH5. Here the most common flint and jasper tools are the so-called Hamrian chisels (Maggi and Gebel 1990) chipped with the hard hammering technique. The "conventional" instruments are rather uncommon, with the exception of some retouched blades and flakes and denticulated tools. The stone assemblage also includes dozens of wadi pebble hammerstones with traces of percussion at both edges as well as many typical anvils. No axe or adze is known from this site which produced many characteristic polished stone earrings collected both from the settlement and from the graveyard (Isetti and Biagi 1989). The fish hooks, polished from shell, are recorded from the entire sequence. The site also yielded several bone gorges and perforators and many net weights obtained from flat beach pebbles with bifacial notches on the long sides.

As already reported by Biagi *et al.* (1984:48) all the above-mentioned raw materials were easily available within a two hour radius from the sites (Uerpmann 1988).

Both RH6 and RH5 are aceramic sites. One only pot was collected from the topmost layer 0, at RH5 (Cleuziou and Tosi 1989:29) dated to 4760±100 BP (Bln-3140). The pot, that comes from Pit HXF, is considered by other authors to be a recent, submodern, intrusion (Potts 1993:180).

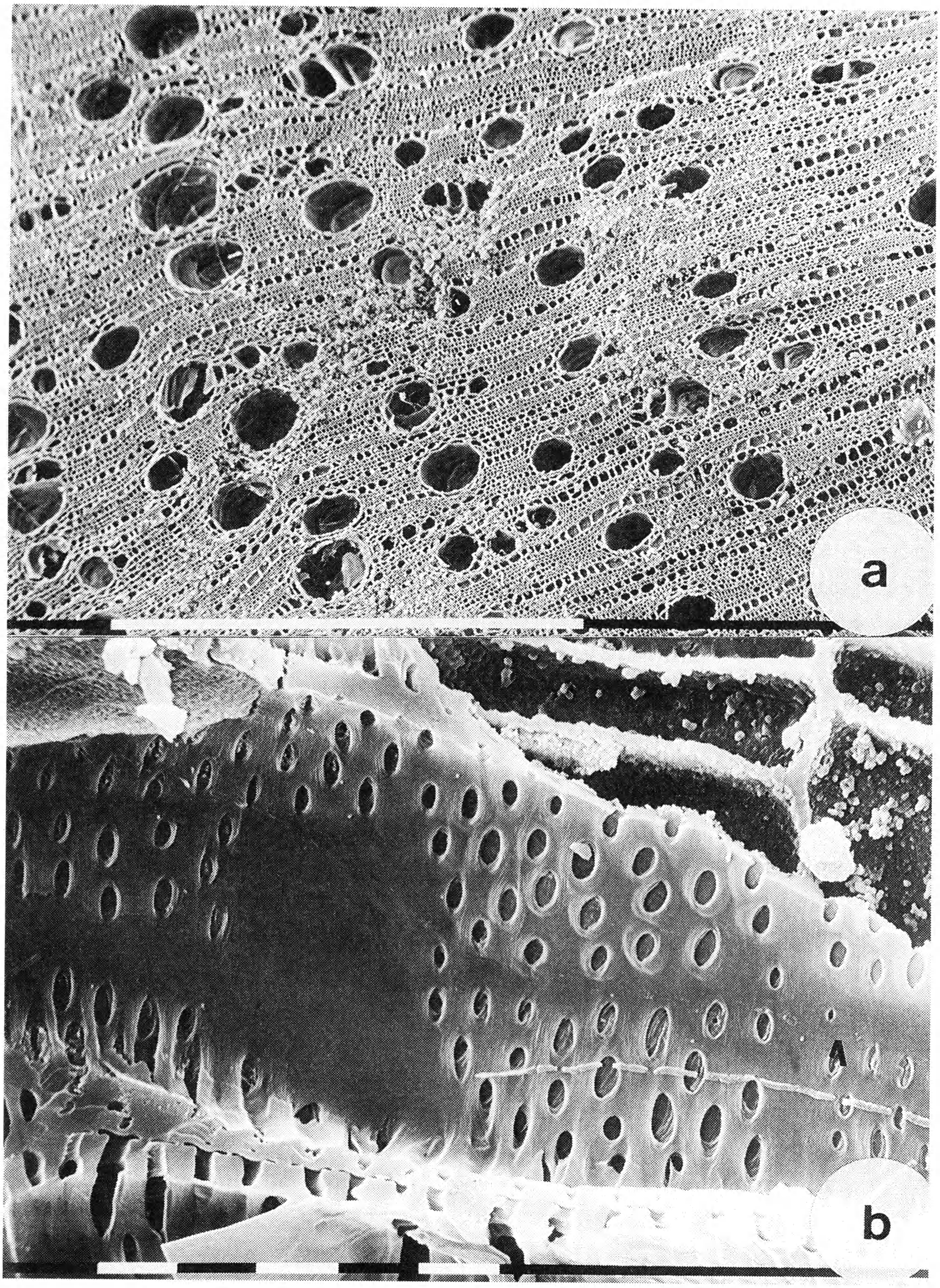

Fig. 5. *Ziziphus sp.*, cross plane (5a). *Ziziphus sp.*, radial plane, with ray-vessel pits, distinct borders (5b). Bar = 10 μm. Photo: R. Nisbet.

OBSERVATIONS ON RECENT WOOD GATHERING

The territory stretching from the limestone terraces to the sea between RH5 and RH6 is characterized by four different areas where wood can actually be collected:

1. The belt between 20 and 40 metres of sandy beach and salt marshes, with driftwood, most of which comes from the coastal building yards. The scarcity of wood belonging to the natural vegetation surrounding this zone, which is subject to periodic flooding, has to be emphasized. The phanerogamic communities include herbs or small bushes, like the spiny *Cornulaca monacantha*, *Crotalaria aegyptiaca*, *Cyperus conglomeratus*, *Sogrobolus spicatus*, *etc.*

2. The small dune environment which, at least along the eastern branch of Wadi Aday, extends inland for 70–100 metres, and contains *Chenopodiaceae* shrubs. Far from the coast, this environment changes into a flat area with a wider variety of species. Here it is easy to gather dry bushes like *Suaeda*, *Anabasis*, *Halopeplis*, *Arthrocnemum*, *etc.*

3. The edges of the mangrove swamp that are very thick and almost impenetrable because of the abundance of *Avicennia* branches and pneumatophores.

4. Still active channels inside the mangrove swamp with *Avicennia*, locally very thick. *Avicennia* wood is commonly described from layers of included concentric phloem with intercellular spaces, frequently alterned by sclerenchymatous cells, which gives the stem a characteristic alternation of zones. The pores are fairly large, round and in small clusters or in short radial files (Fig. 6b).

At present, dead wood can be easily collected along the dry channels draining the mouth of Wadi Aday along the edges of the mangrove swamp. In some areas heaps of wood accumulate producing more than 100 kgs of dry wood. Even taking into account the movement of the water table, this is the most suitable zone for gathering wood. Its identification showed a very limited number of tree species, *i.e.*, *Avicennia* (97%), *Acacia* (1.5%), *Calotropis* (0.5%) and *Palmae* (1%).

Avicennia marina the most common wood of the area, can be broken manually when alive, but with some difficulties because of the elastic and pliable nature of the wood. On the other hand, driftwood of this species, splits easily and even large branches (4–5 cms in diameter) can be broken manually. The wood burns without any smell or smoke.

CHARCOAL ANALYSIS

The analysis of 2,480 charcoal fragments from RH5 gives the opportunity to outline the essential aspects of the utilization of the territory near the site during the sixth and the fifth millennium BP. Less is known for RH6 where the excavations gave a complete sequence only along a narrow, vertical, section of the shell-midden.

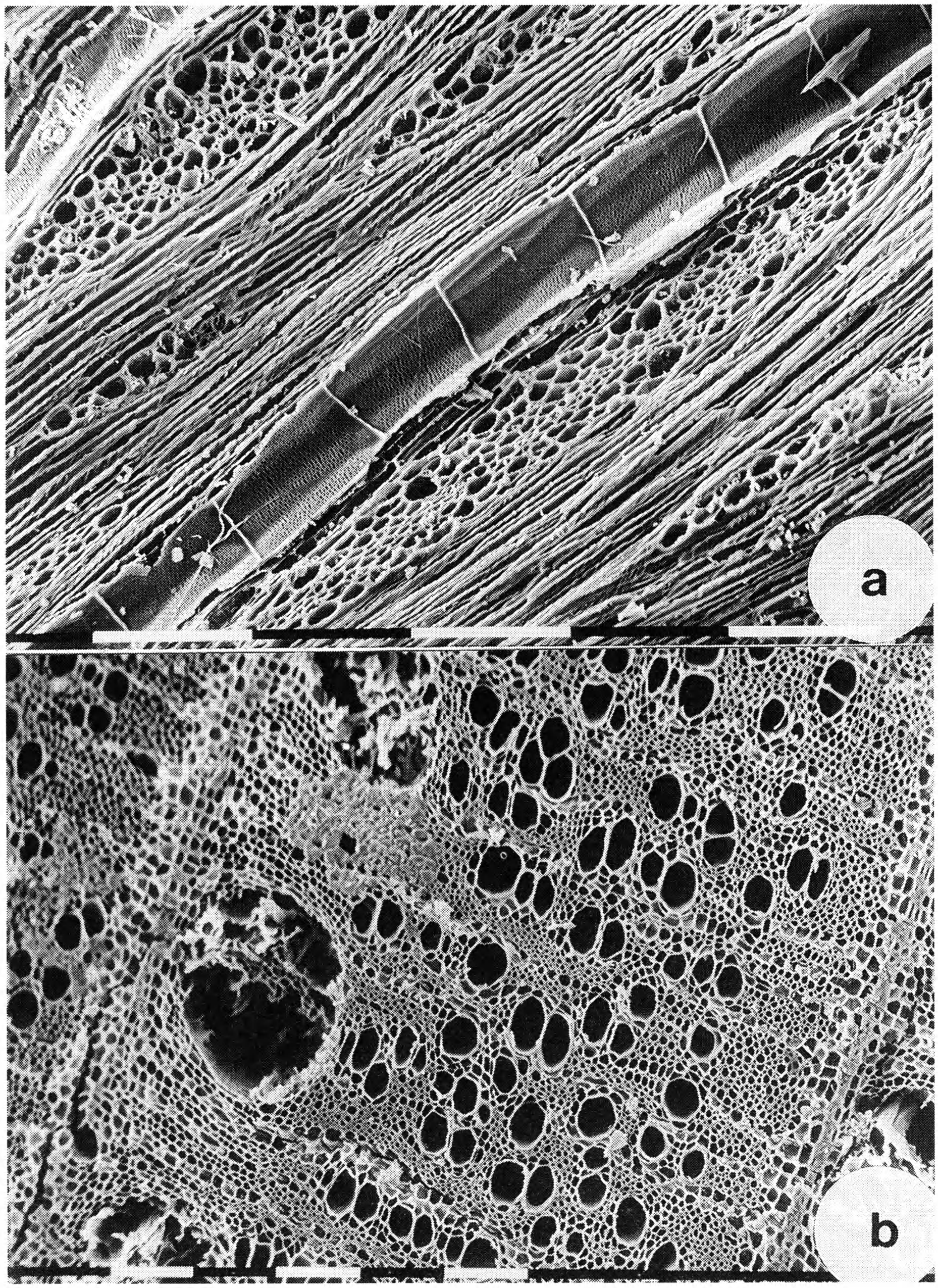

Fig. 6. *Tamarix sp.*, tangential plane (6a). Large rays up to 10 seriate, with sheath cells. Bar=0.1 mm. *Avicennia marina* (Forrsk.) Vierh., cross plane (6b). Large pores are phloem strands included in the secondary xylem. Layers of sclerenchymatous cells are visible in tangential lines. Bar=0.1 mm. Photo: R. Nisbet.

Table 1. Distribution of charred wood through RH5 sequence

Layers	0	1	2	3	4	5a	5b
Avicennia	+	+	+	+	+	+	+
Tamarix		+		+		+	+
Chenopodiaceae		+	+	+		+	+
Ziziphus		+		+	+	+	+
Acacia		+	+	+		+	
cf Salvadora			+				
Unidentified		+		+			

RH5. As shown in Table 1, the only species represented through the whole sequence, since the oldest settlement phase, is *Avicennia marina*.

Moreover, *Avicennia* is the most common tree documented from the fireplaces. In particular, two hearths discovered in layers 1 and 5, produced charcoal of this wood. Besides the mangrove plant association, the sandy dunes were suitable catchment areas providing small shrubs of the *Chenopodiaceae* family (it has been impossible to identify this wood even to a genus level; the wood includes concentric phloem, and the rays are absent. In the totality, the fragments belong to small branches), as well as the limestone terraces and the wadi banks inland, with their scattered vegetation of *Acacia* Desert Parkland (however, no attempt was made to identify this wood at a species-level; the pores are usally small, the growth-ring boundaries are not evident, the parenchyma is largely vasicentric, sometimes almost confluent; the pores are solitary or in short radial files, <80 μm – Fig. 7a, in tangential plane, rays 2–4 seriate – Fig. 7b; these characters might indicate *A. ehrenbergiana* Hayne – Rolando 1992), *Ziziphus* (Fig. 5a and 5b), *Tamarix* (Fig. 6a) and *cf. Salvadora*.

RH6. Small samples were taken from the section excavated in 1986 and 1988 (Fig. 3, X and Y). Here *Avicennia* is well represented again throughout the whole series, with only a few exceptions, probably due to the small size of the sample. However, *Acacia* wood is also common at this site both in term of presence for layer and of number of pieces (Table 2).

Table 2. Charcoal distribution through the sequence of RH6

Layers	2	5	6	7	9	10	12	13
Avicennia		+	+	+	+	+	+	+
Tamarix	+	+	+					
Ziziphus		+		+				+
Acacia	+	+	+	+	+		+	
Unidentified								+

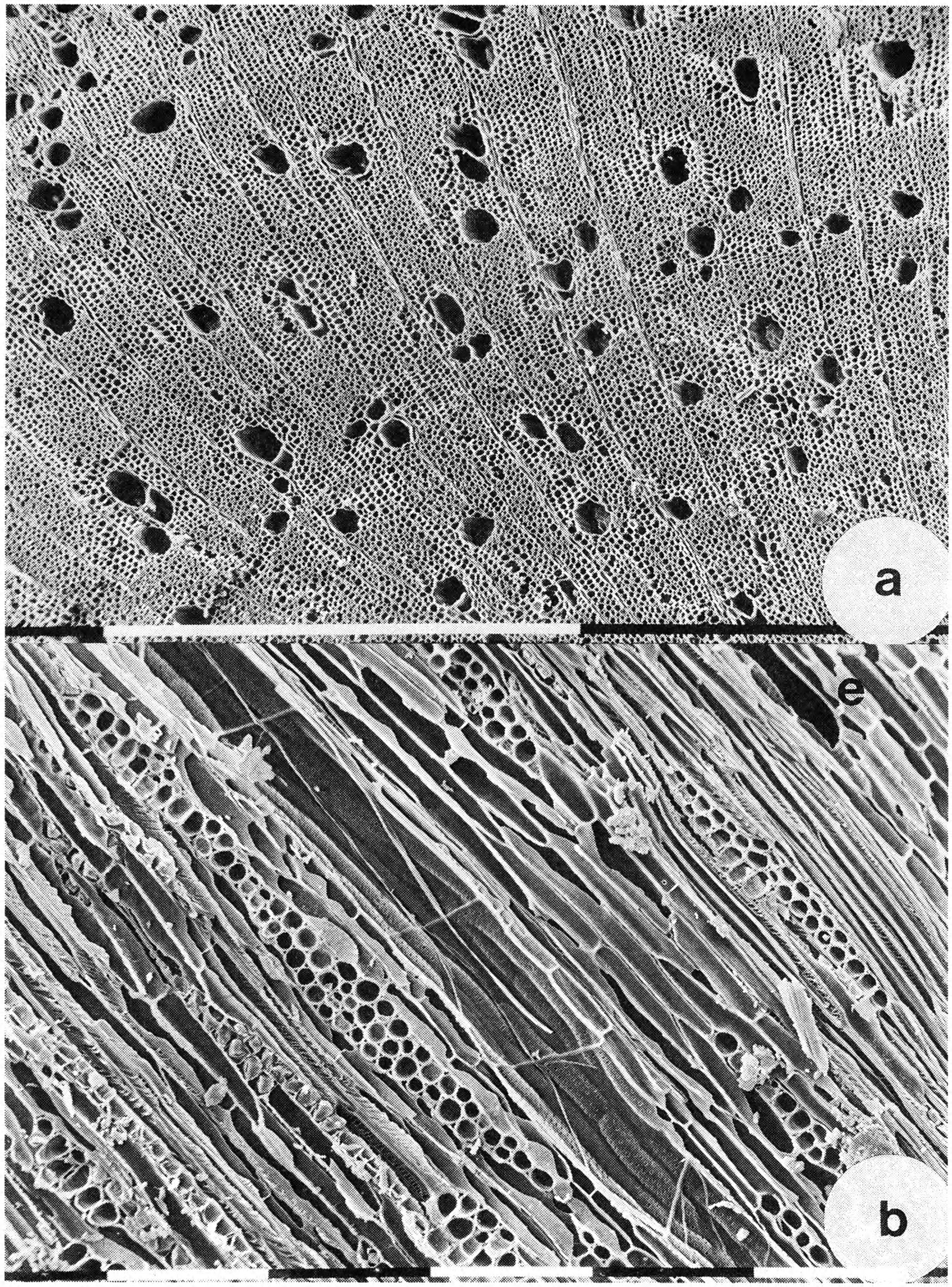

Fig. 7. *Acacia sp.*, cross plane (7a). Bar = 1 mm. *Acacia sp.*, tangential plane (7b). Bar = 0.1 mm. Photo: R. Nisbet.

These data indicate that the mangrove environment was already established at least by the middle of the seventh millennium BP. The oldest ^{14}C date so far available from the RH6 layers containing *Avicennia marina* is Bln-3632/II (6310±60 BP) on *Terebralia palustris* (Biagi 1994: 20). At least since this early date, therefore, this part of the coast has been sheltered, as mangrove swamps require a low shore gradient and shorelines with a large tidal range (Woodroffe 1983).

THE HEARTHS OF SITE RH5

The charcoal collected by flotation or by hand, frequently belongs to well-defined fireplaces, many of which were visible along the sections. A number of micro-stratigraphies of these hearths were drawn during the 1985 season (Fig. 8).

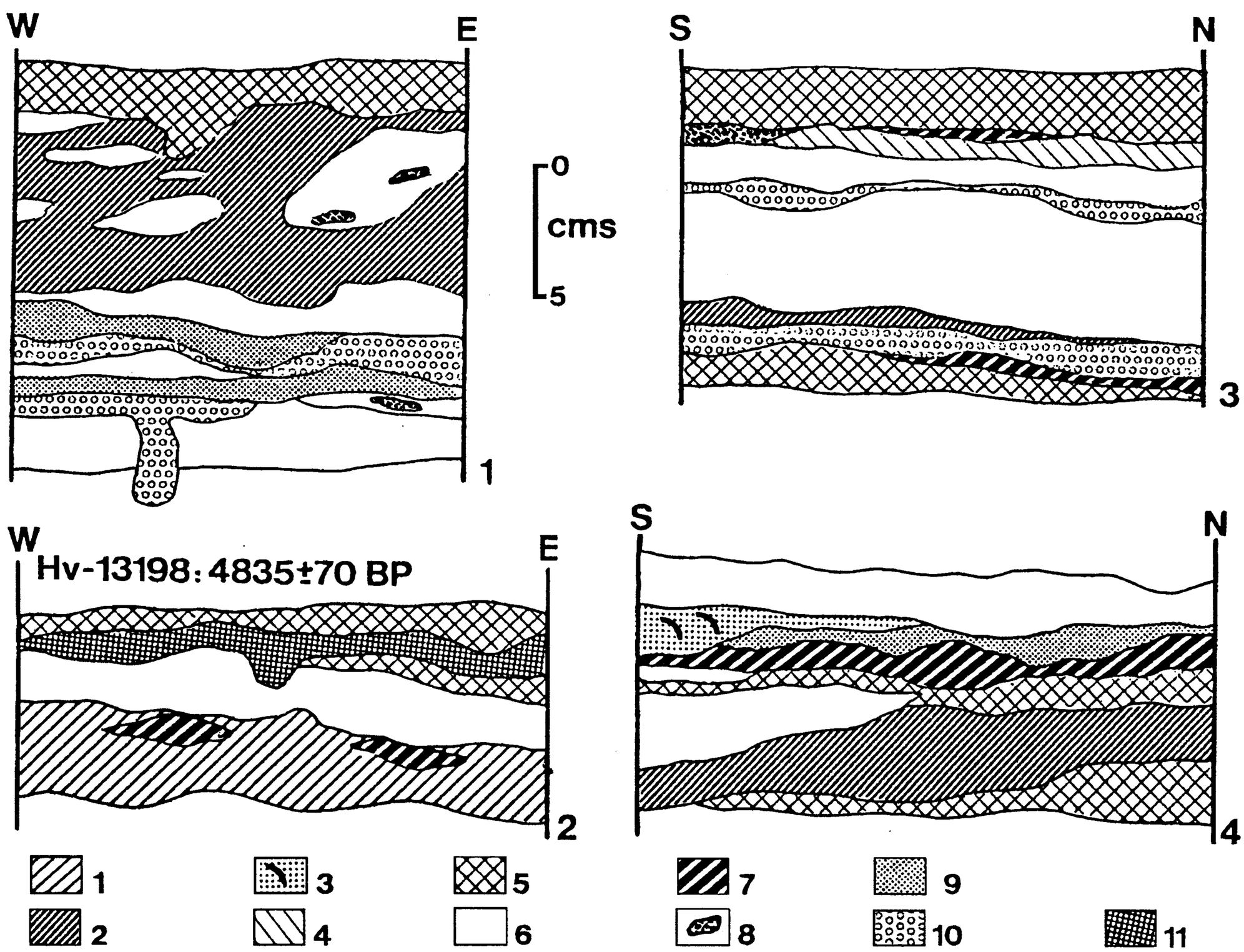

Fig. 8. RH5. Micro-stratigraphy through four hearths. 1 – unburnt fish bones and grey sand, 2 – grey sand, 3 – grey ash with molluscs, 4 – brown ash with fish bones, 5 – unburnt fish bones, 6 – white ash, 7 – charcoal, 8 – ash in reddish nodules, 9 – brown ash, 10 – burnt fish bones, 11 – black sand with charcoal. Drawn by R. Nisbet.

In general, they are mainly composed of white or grey ash, in lenses or in continuous layers, 4–5 cms thick. In many cases, the top of the ashy layers is sharp and the bottom is gradual, merging to a blackish sandy sediment rich in minute charcoal fragments. Very frequently (83% of the cases) a layer of unburnt fish lies above the ashes. Thin layers of black, burnt, fish bones are usually mixed with small fragments of charcoal. True concentrations of charcoal without minerogenic sediment are scattered or isolated in small patches.

CORING IN THE MANGROVE AREA

A preliminary survey was carried out in 1986 in order to test the presence of layers suitable for palynological analysis in the surroundings of the mangrove swamp (Figs 1 and 9). A 250 cm soil auger was employed for taking 10 cores in two well-defined areas. Zone A is located in the wide flat area west of the Northern Channel, some 300 metres from RH6. This area cannot be reached directly from the shell-midden site for the presence of channels and of a thick mangrove vegetation, but an easy access is by the seashore. Zone B is close to RH6, in the dunes around the midden, *i.e.*, along the right side of the Northern Channel of Wadi Aday.

Zone A. Of seven cores (185, 217, 232, 88, 142, 178, 224 cms deep, respectively), five produced thick layers with charcoals and/or waterlogged leaves, fibres and small pieces of wood at different depths. Usually these materials are inbedded in blue/black clays which might indicate that their deposition took place in slow running water suggesting the existence of old channel beds of the mangrove swamp (Fig. 9A). A preliminary work carried out on some of the samples (R. Scaife pers. comm. 1988) confirmed the presence of pollen in these layers, and therefore the reliability of this zone for environmental studies and for the reconstruction of the history of the swamp in relationship with the sea-level fluctuations.

The organic material obtained from one of the cores (A3) at the depth of –160 cms from the surface, produced a ^{14}C assay of 3000±70 BP (Bln-3688). It is obvious from this date and from the stratigraphy obtained from the cores extracted from the whole area, that there is a vertical zonation that would depend, more than on eustatic change, on the tectonic movements (subsidence) of the Wadi Aday mouth, changes in channel circulation and siltation as a consequence of variations in upland drainage and accumulation of organic material from locally growing *Avicennia* and halophytic bushes.

Zone B. Three cores from this area, reaching the depth of 104, 240 and 247 cms respectively, gave no macroscopic evidence of buried vegetation. Sediments undoubtedely attributable to mangrove clays were not detected (Fig. 9B).

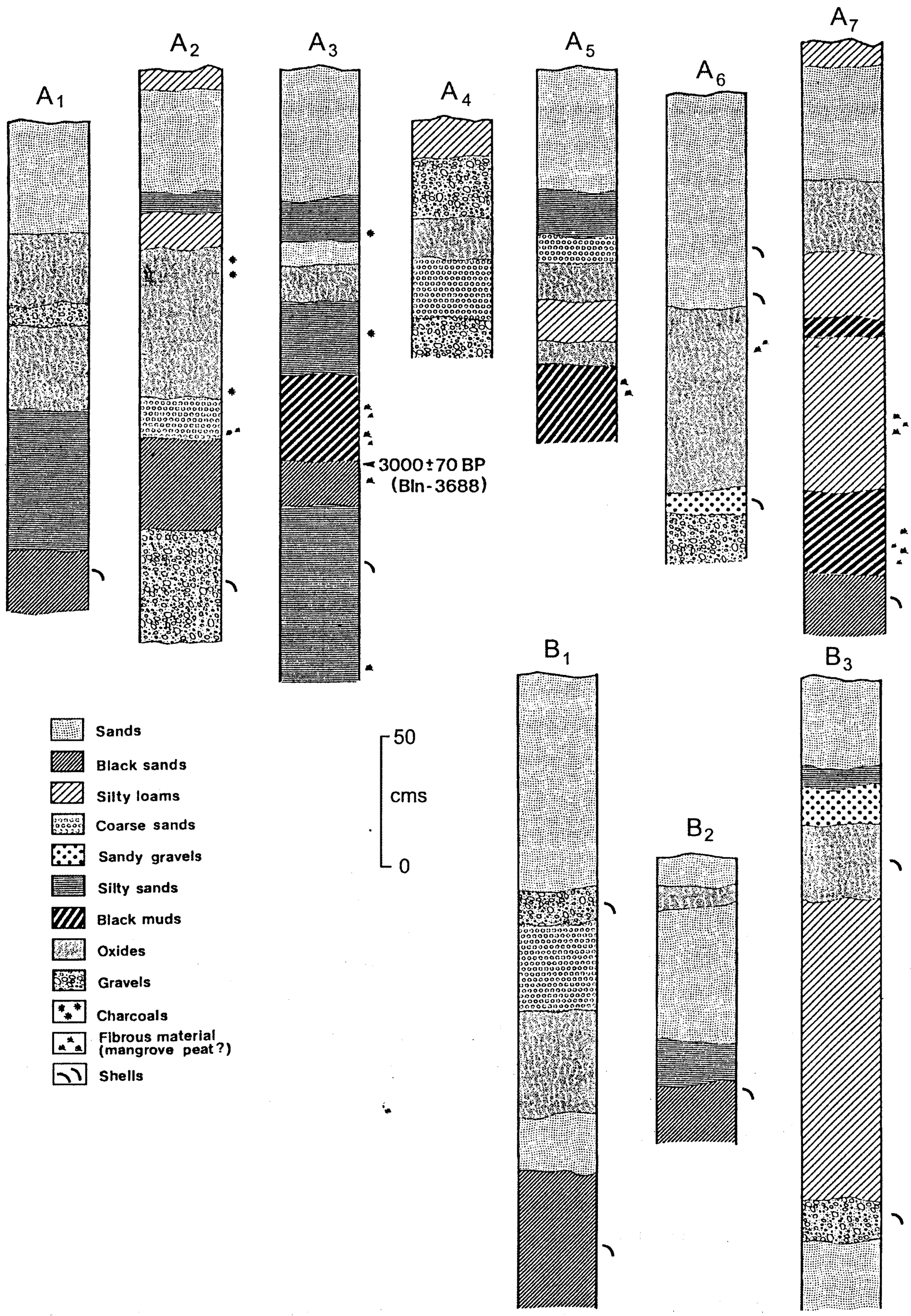

Fig. 9. Section through the dune-mangrove ecosystems surrounding RH6 from zones A and B of Fig. 1. Drawn by R. Nisbet.

FRUITS AND SEEDS

A small collection of some 300 stones and charred fruits of *Ziziphus sp.* was made throughout the whole sequence of RH5 (Table 3). Some of the stones have thin bite marks (probably made by small rodents), suggesting that at least part of the pit structures were used for storing these fruits. In addition, an earlier use for food consumption of these fruits is documented from layers 4, 5 and 7 of RH6, for a total of 21 stones. *Ziziphus* was widely exploited for its edible fruits in Arabia in prehistoric times, as indicated, for instance, by the finds from Hili in the U.A.E., dated to the fifth millennium BP (Cleuziou and Costantini 1980).

Table 3. Distribution of *Ziziphus* stones and fruits at RH5

Layer	Stones	Fruits
0	5	
1	37	2
1b	12	3
2	54	2
3	41	
3a	29	
3ab	2	
3b	17	5
4	9	14
5	8	
5a	34	6
5b	11	9

The extensive use of flotation produced two carbonized seeds from layer 4 of site RH5 (Biagi and Nisbet 1992 : 575) one of which, from square HXQ/CD, has been dated to 5160±90 BP (Biagi 1994 : 18). These grains, partly preserved, have been identified as *Setaria sp.* on the basis of the presence of fine punctuations on the husk.

In the floras of Saudi Arabia, Qatar and Oman, *Setaria* is today restricted to a limited number of species (*S. glauca*, *S. verticillata*, *S. viridis*), even though no identification of this genus has been so far made in the archaeological record of the whole Arabian Peninsula.

THE FAUNAL REMAINS

The first evidence for domesticated animals comes from site RH6 where dog bones have been recovered in the lowermost layers, even though goat is documented only from layer 6 upwards (Biagi 1999); as regards the wild species,

Thar has been identified from layer 11, dated between 6270±60 BP (Bln-3633/II) and 6130±60 BP (Bln-3634/I) (Uerpmann H-P. pers. comm. 1988). The exploitation of the marine environment is documented by scarce bones of *Chelonia mydas* as well as by many catfish and sea-snake bones (Biagi and Travers 1984). A large amount of shellfish is attested by the presence of both marine and mangrove species in varying percentages, throughout the entire RH6 sequence. *Terebralia palustris* is common since the lowermost layer 14, ^{14}C dated to the mid seventh millennium BP (Biagi 1994: 20), which indicates that the mangrove environment already existed by that period. Other interesting observations are provided by the finds from layer 11. In fact, here, the commonest shell species is Ostrea cucullata, introduced into the site in groups still attached to rounded pebbles. This should indicate the exploitation of a rocky coastline by the earliest RH6 settlers. The above-lying layer 10 is composed of a thin level of beach silt and *Umbonium vestiarium* shells, just above a level of almost pure sand containing a great number of chipped stone artefacts, most probably indicating the presence of a man-made living floor.

A preliminary analysis of the mammal bones from RH5 shows that cattle and sheep/goats are present throughout the entire duration of the settlement, giving quite a low contribution to the diet of the prehistoric community. *Gazella gazella* and thar bones are also present as well as a few remains of marine mammals. Bird bones are represented too. The remains of *Chelonia mydas* green turtle are very common both in the settlement and in the graveyard. Only a small sample of the extremely rich assemblage of fish bones from this shell-middden has been identified so far. The evidence to date shows that both large fishes, such as tunny and shark, and small ones, mainly herrings and sardines, were the main contributors to the diet of the RH5 villagers (Biagi *et al.* 1984).

CONCLUSIONS

The availability of natural resources from the ocean, coastal and inland environments made the cape of Ra's al-Ḥamra particularly attractive for settling in the Early Holocene. Fishing offshore and along the coast is widely documented from both archaeological and faunal remains (Uerpmann 1989). The coasts could supply resources in terms of food consumption (turtle eggs, crustaceans, molluscs) or provide shrubs and herbs as fuel, and raw materials, like shells, for making instruments.

Changes in the coastal landscape and environment, from rocky (RH6, lower layers) to sandy (RH5), seems to be indicated both by the fishing implements recovered from the shell-middens and by the faunal remains namely shells, turtle

and fish bones, from the two sites. The abundance of Ostrea cucullata gathered by the inhabitants of layer 11 at RH6, together with the low number of turtle bones and the high percentage of catfish remains (Biagi and Travers 1984: 409), indicates the presence and exploitation of at least a partly rocky coastline. On the contrary, a sandy beach already existed around 5000 BP, when RH5 was settled. The bones of *Chelonia mydas* from this latter site are very abundant indicating the nesting of green turtles along the beach below the cape of Ra's al-Hamra.

The mangroves were exploited for their high productivity in wood and meat. The economic importance of a mangrove ecosystem has been pointed out by many authors such as, for instance, Lugo and Snedaker (1974) and Bailey and Parkington (1988). It mainly consists in providing timber and fuel, as well as tannin. *Avicennia*, the only mangrove tree documented in RH5 and RH6 subfossil associations, is easy to collect along the channels; in addition, mangroves shelter in their intertidal zone (today the highest tides can reach +3.1 m above 0 level) a rich though specialised association of *Terebralia palustris*, largely gathered by the prehistoric aceramic communities.

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