ES-SADEH — A LITHIC - EARLY BRONZE - IRON II (EDOMITE) - NABATAEAN SITE IN SOUTHERN JORDAN REPORT ON THE SECOND EXPLORATORY CAMPAIGN, 1988

by
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with the results of a botanical survey
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Introduction

Es-Sadeh, 15 km south-southwest of Petra was first visited by archaeologists a few years ago when H.R.H. Crown Prince Al-Hassan, Dr. Adnan Hadidi and Dr. Fawzi Zayadine reached the valley by helicopter. The results of the first exploration by a group of the Naturhistorische Gesellschaft Nürnberg (NHG) in October 1987 are already published (Lindner, Farajat and Zeitler 1988) and will not be repeated here. The second exploration undertaken by a group of the NHG under the direction of M. Lindner was from 26 Sept. to 3 Oct. 1988, during a stay in Jordan of 18 days. New finds, discoveries and aspects of that second campaign at es-Sadeh will be reported and discussed below.

The Track to es-Sadeh

The valley of es-Sadeh can be reached by Land Rover as lately proven by an army driver who drove to within 4 km of the valley centre. Having no four-wheel-drive vehicles or helicopters at their disposal it took the exploration group, with two camels and four donkeys, one day to arrive at es-Sadeh from Petra via Ṣabra (Fig. 1). From a certain point about 6 km southwest of Ṣabra, the wadi of the same name is a very deep and impassable gorge. Of two detours, the longer one across the hills to the northwest (970 m asl) is usable for loaded camels. The shorter one, a narrow ledge above the wadi at 800 m (asl) can be used by men and unloaded donkeys only.[1]

Northeast of the above-mentioned point, the second Ionic capital of Ṣabra was found (Pl. I,1). It had been washed down through the wadi from Ṣabra proper where the first, and at that time only specimen had been found in 1984 (Lindner 1986: 162-166). Together with the Ionic capital found by Ph. Hammond in the theatre of Petra, three specimens of that kind are now known from the Petra region (Hammond 1965: Pl. 37; 3, 4).[2]

Lithic Surface Finds

Before entering the valley from the northwest, one crosses a ridge of pure white sandstone near a deep rock wadi, a tributary of Wadi es-Sadeh. Stone implements found there were analyzed by H.G. Gebel for the first preliminary report (Lindner, Farajat, and Zeitler 1988: 77).

New finds in 1988 do not seem to change the over-all picture of Middle Paleolithic and PPN surface scatters in the Lower Wadi Ṣabra region. However, since it is possible that the sites of Wadi Ḥammada and Ras Raibid at the northwest outskirts of es-Sadeh are identical to the site at Ras en-Nyazi (Schyle and Uerpmann 1988: Fig. 1; 40), their discussion has to be postponed.

1. The track on a ledge of the steep rock wadi was not known to M. Lindner when he wrote about Wadi Ṣabra in 1986 (M. Lindner 1986: 158).
2. M. Lindner 1986: 162-166, Abb. 11. It should be a special task to compare the three specimens and to find out whether they were parts of buildings or of free-standing *ex-voto* or memorial columns.

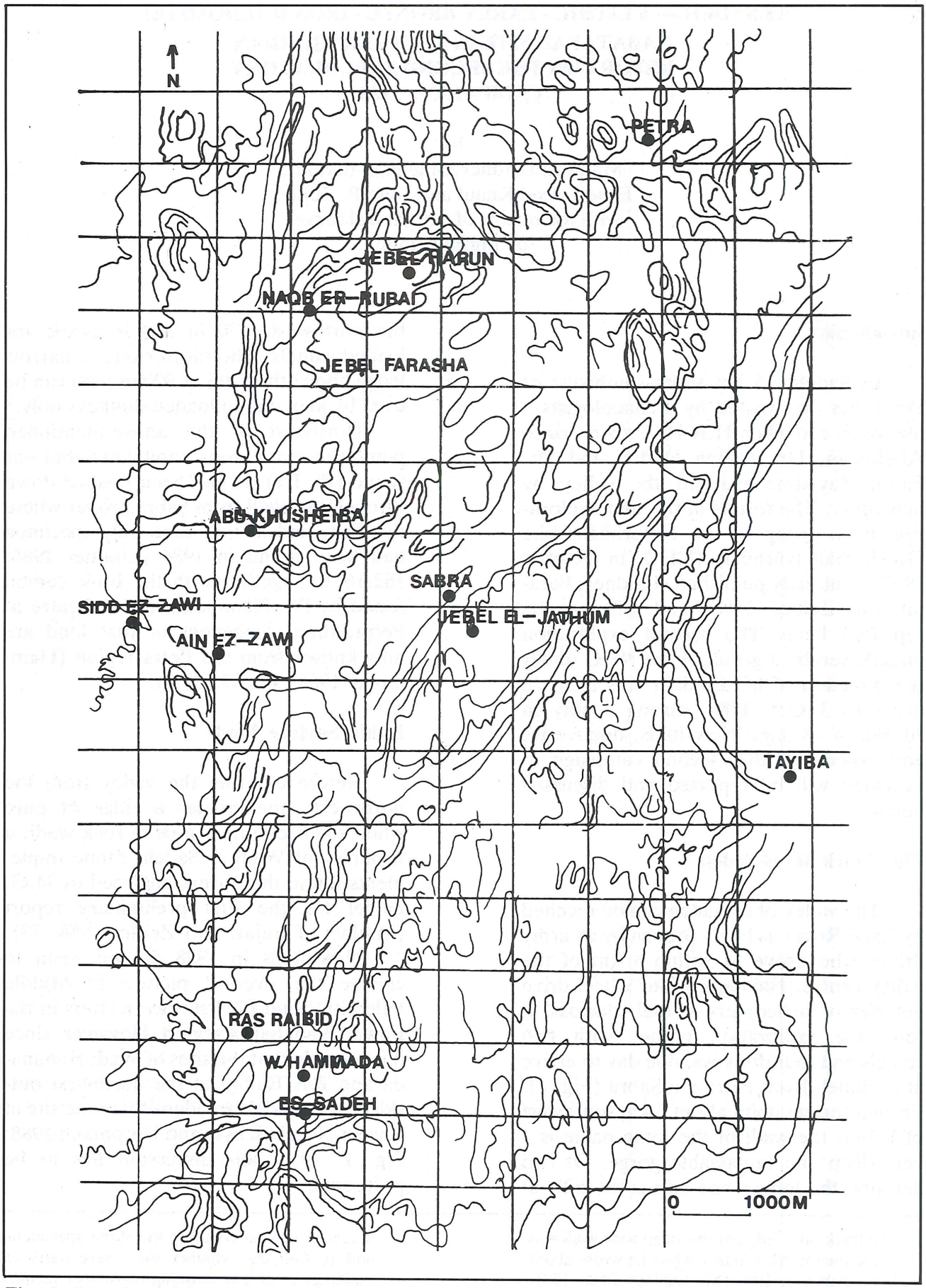


Fig. 1. Location of Petra, Ṣabra and es-Sadeh.

New Aspects of the Location of es-Sadeh

Several observations have to be added to the first preliminary report (Figs. 2, 2a). Geologically, the quartz porphyry head of the valley in the east was transformed by water into an almost perpendicular crater-like gorge, about 100 m high. Water coming from the southeast falls down over three basins (Pl. I,2). The term "waterfall" therefore is more appropriate than "spring". The porphyry in the red sandstone of the lower Cambrian extends to Wadi Umm el-'Ala with a similar head. Above the igneous rock, the sandstone massif towers up to 1200 m (asl). In front of the isolated plateau of Umm el-'Ala (820-860 m asl), the sandstone rests upon a clay-marl stratum at about 710 m asl. Water trickles out of it on both banks of the valley, allowing bushes and trees, and in the south even some grape vines, to grow (Pl. II,1).

South of the valley centre marked by an idol-niche, the water has cut deeply through the porphyry. It shaped a gorge with several kettle-holes which were certainly used as reservoirs at all times. Now they are half-filled with sand and debris, and contain only little water. Bedouins built stone shacks or caches above the waterholes. The sandstone in that place is heaved up and folded. The same is true for the following limestone strata to the west (Pl. II,2)

The north bank of the valley seems badly shaken by solifluction at least partly caused by earthquakes[3] (Pl. III,1). Remains of artificial terraces and wadi walls indicate an agricultural use at different times. In 1988 Bedouins had planted hishi *(Nicotiana rustica)* on cleared fields both on the north bank and on a plateau in the west. They had also dug holes for planting trees on the north bank and were at the point of fencing in the cleared field with barbed wire. After passing through the gorge with the kettleholes, the wadi continues in a broadening bed full of hard limestone and flint gravel. The sandstone peters out on both sides, and in the north later than in the south gives way to yellowish limestone with crystallized gypsum on the surface. The wadi exit (600 m asl) is situated between marl cliffs. In the northwest, white sandstone marks the lithic sites of Wadi Ḥammada and Ras Raibid, described with these local names in the first report on es-Sadeh. Not far from them, a wide flint outcrop offered material for the stone implements.

A Prehistoric Settlement on the South Bank of es-Sadeh

Between the valley centre (620-660 asl) marked by the gorge and two large tumbled boulders, one of them with an idol niche, and the "temple" mountain, the south bank rises above a cliff of Cretaceous limestone deposits to a height of more than 750 m (Fig. 3). About 25 rectilinear house ruins scattered over an area of 200 x 200 m indicate a small settlement (Pl. III,2). Five houses were built closer to the wadi, twenty of them higher up the slope and more to the west. There may be a difference of 50 m in altitude between the lowest and the uppermost situated houses. The main part of the settlement is arranged on both sides of a deep rut (Pl. IV,1). A strongly built wall may have contained its banks, but of course the rut may have come into being because the wall and strong house foundations held their positions (Pl. IV,2).

The sketch drawn from a point on the western ridge at 710 m asl (Fig. 3) shows the location of the house ruins and the sizes of some of them. Later inhabitants or users of the valley have re-arranged building stones by throwing them back into the houses or by making animal pens. Nowadays, the slope like the whole region is

3. Earthquakes, and that pertains to the mentioned alterations of es-Sadeh, are known from antiquity up to this century, with "great" and "powerful" quakes in the regions of Karak, Shawbak and Aqaba which would certainly have affected the es-Sadeh area (see for example Ghawanmeh n.d.).

Fig. 2. The valley of es-Sadeh. Drawing by I. Künne.

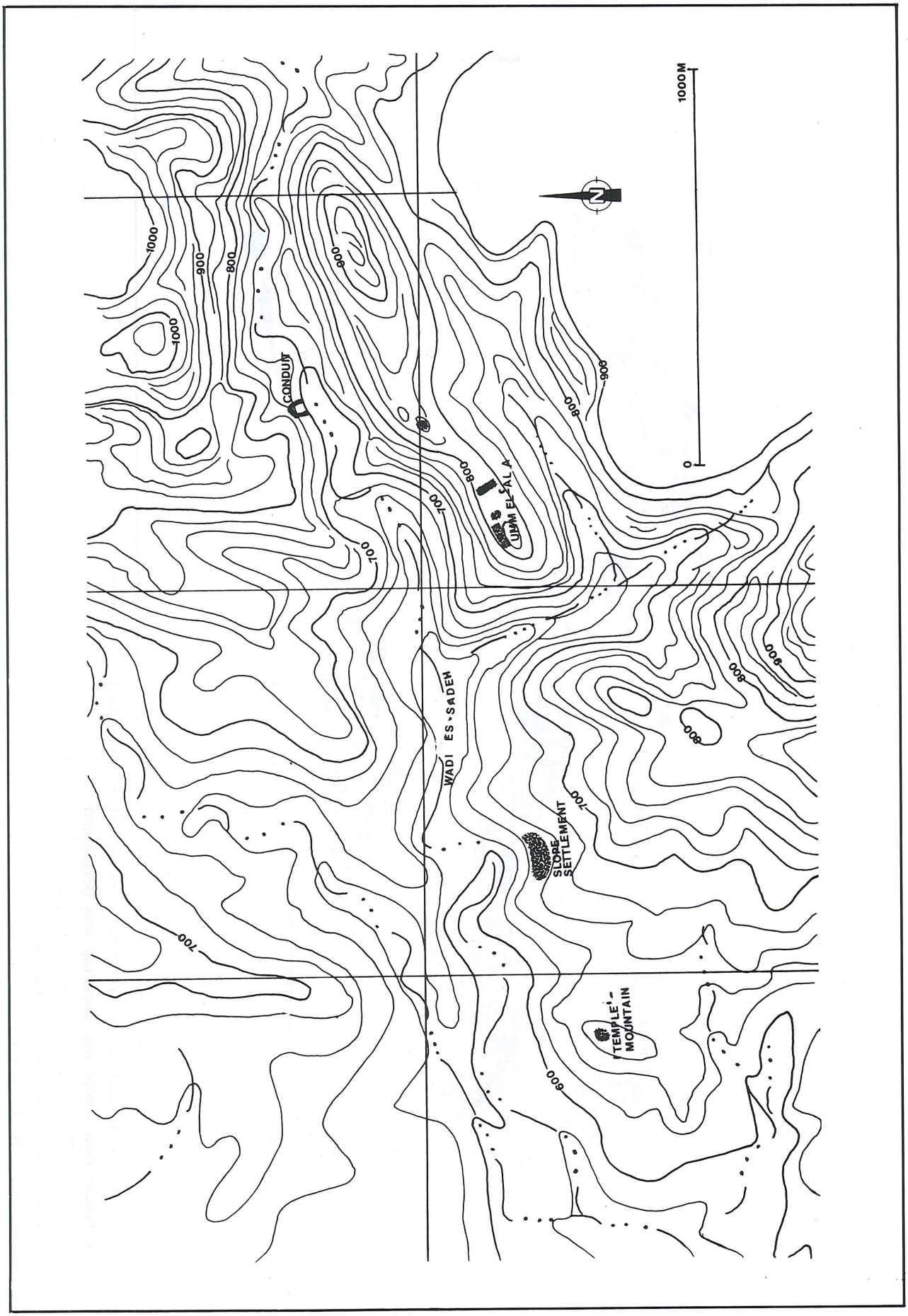


Fig. 2a. Es-Sadeh: Location of different sites. Sketch map by E. Schreyer.

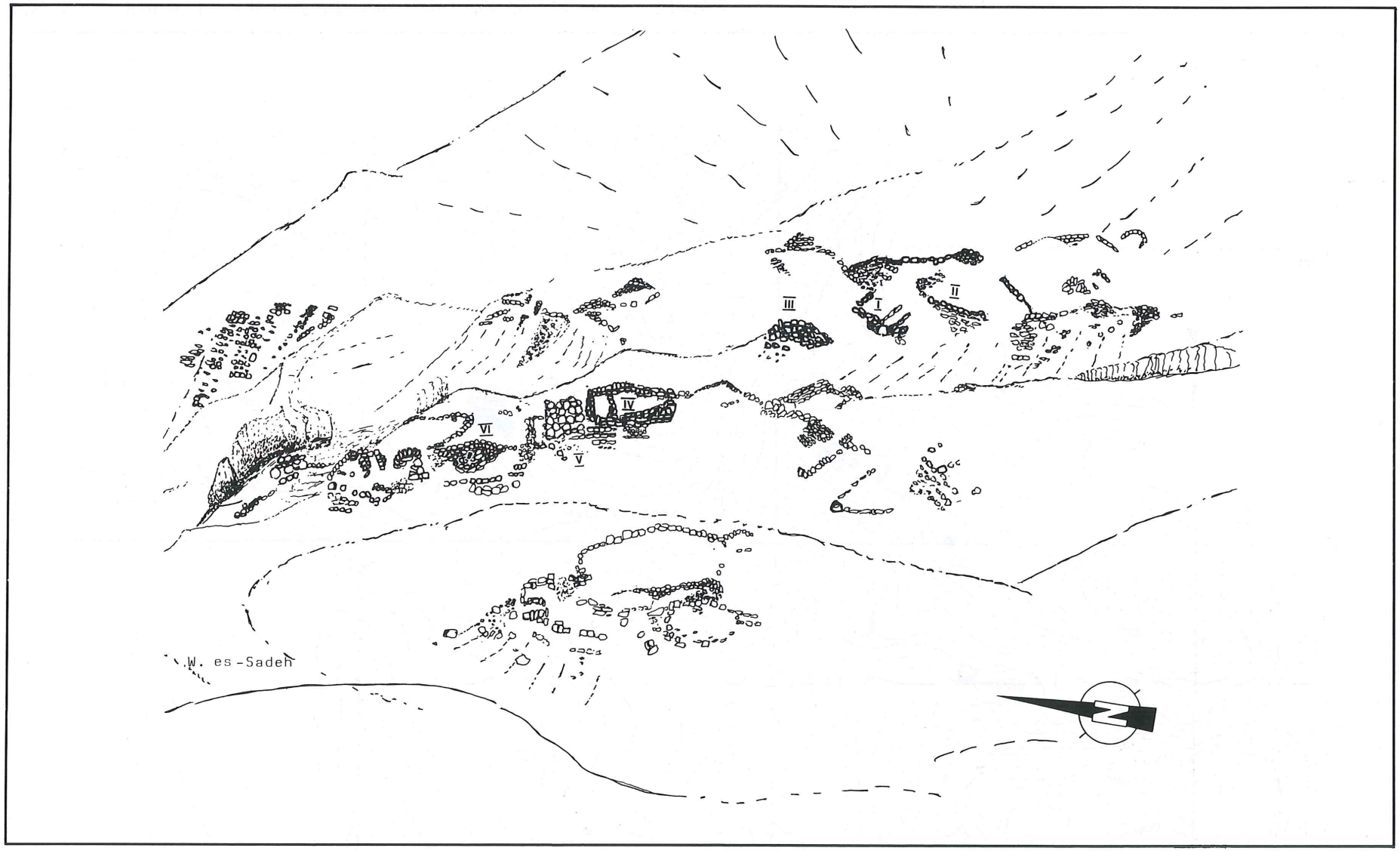


Fig. 3. The EB settlement at the south slope of es-Sadeh. Drawing by I. Künne.

I. House ruin where the sounding was performed
II. Large walled-in area with possible graves
III. Large house on top of a hillock
IV. House with all ashlars thrown inside.

used as a pasture for goats.

The surface masonry consists of apparently roughly hewn boulders of limestone (Pl. V,1). Fallen pillars of square-cut slabs supported a roof. Up to four layers of masonry can be discerned. Sometimes a double wall was seen. The building stones of a few houses are reddish, discoloured by fire. Building stones as found in a sounding were either better cut or better preserved than the material in the open.

As expected, there was only a small scatter of surface pottery (Pl. V,2). In addition to EB ceramics, Iron II (Edomite), Roman (Nabataean?) and even some Mamluk-Ottoman sherds were found. Either the slope houses were reused at some later time or the herdsmen broke their vessels when camping on the slope.

A Sounding in the Prehistoric Settlement on the South Bank[4]

The most significant finds came from a sounding in a ruin of a possibly semi-subterranean house, measuring about 9 x 15 m at about 670 m asl with seemingly undisturbed foundations. The ruin is located on an exposed spot approximately in the centre of the settlement. A square of — at first — 1.40 x 0.80 m was excavated.

Stratum I. Tumbled ashlars of 0.30 m x 0.40 m x 0.15 m were taken out of the yellowish clay-sand locus to a depth of 0.45 m. At 0.03 m an egg-shaped pecking stone 0.14 m long and at 0.20 m three quarters of a grinding plate, both of a finely grained quartzite, were found. At 0.40 m the rest of the plate (0.25 x 0.15 m) was found (Fig. 4).

Stratum II. At 0.50 m a second wall appeared running parallel to the outer one (Pl. VI,1). The gap of 0.15 m was filled with small stones. There were still fragmented building stones in the unvaried matrix of clay and sand. Shells of land snails were extant to a depth of 0.80 m. When at 0.82 m a slab of red sandstone was lifted, a round hole appeared. It was the opening of a storage jar sunk or cut into the floor of the house and half-filled with fine sand. (Pl. VI,2). After enlarging the square to 2.00 x 1.80 m, at 0.60 m of the enlarged area several sherds of apparently different vessels made of a peculiar very finely grained whitish clay were noted. The exterior and most of the interior of the ware is red and polished (Pl. VII,1).

Stratum III. The floor of densely packed clay with limestone pieces was reached at 0.84 m. Four sherds directly on top of the floor by the double wall were blackened by fire. The well-fired red clay of the sherds is mixed with red ochre, mica and limestone chips (Figs. 5 and 6). When, eventually, the jar was taken out, it had a small hole in its lower body. The grey and undecorated vessel is 0.59 m high, 0.42 m wide with an opening of 0.15 m ∅, the base is 0.22 m ∅. Two tiny ledge handles strangely standing or pushed up like ears are not very practible for gripping or even holding up the jar.[5] (Fig. 7:3).

Early Bronze Age I-II Pottery of the South Bank Settlement at es-Sadeh (E.A. Knauf)

EB I-II pottery came from both surface and the sounding collections from the settlement on the south bank of es-Sadeh. The most remarkable find is, undoubtedly, the complete storage jar (#1, Fig. 7:3) from the sounding. Parallels from Arad (Amiran *et al.* 1978: Pl. 34: 1-5; 40:8) establish a close connection with Arad Stratum II which Amiran (1978:115) dates to the second half of the first dynasty's reign in Egypt, *ca.* 2860-2770 B.C. The whole range of Early Bronze domestic pottery is attested at es-Sadeh: storage jars #2 and #3 (Fig. 8:1,2; *cf.* Amiran *et al.* 1978: Pl. 15:1), holemouth jars #4 (Figs.

4. Responsible for the excavation was E. Schreyer who also performed the soundings on Umm el-'Ala and the "temple" mountain.

5. The mentioned impracticability was experienced during the transport of the vessel on donkey and camel back to Petra.

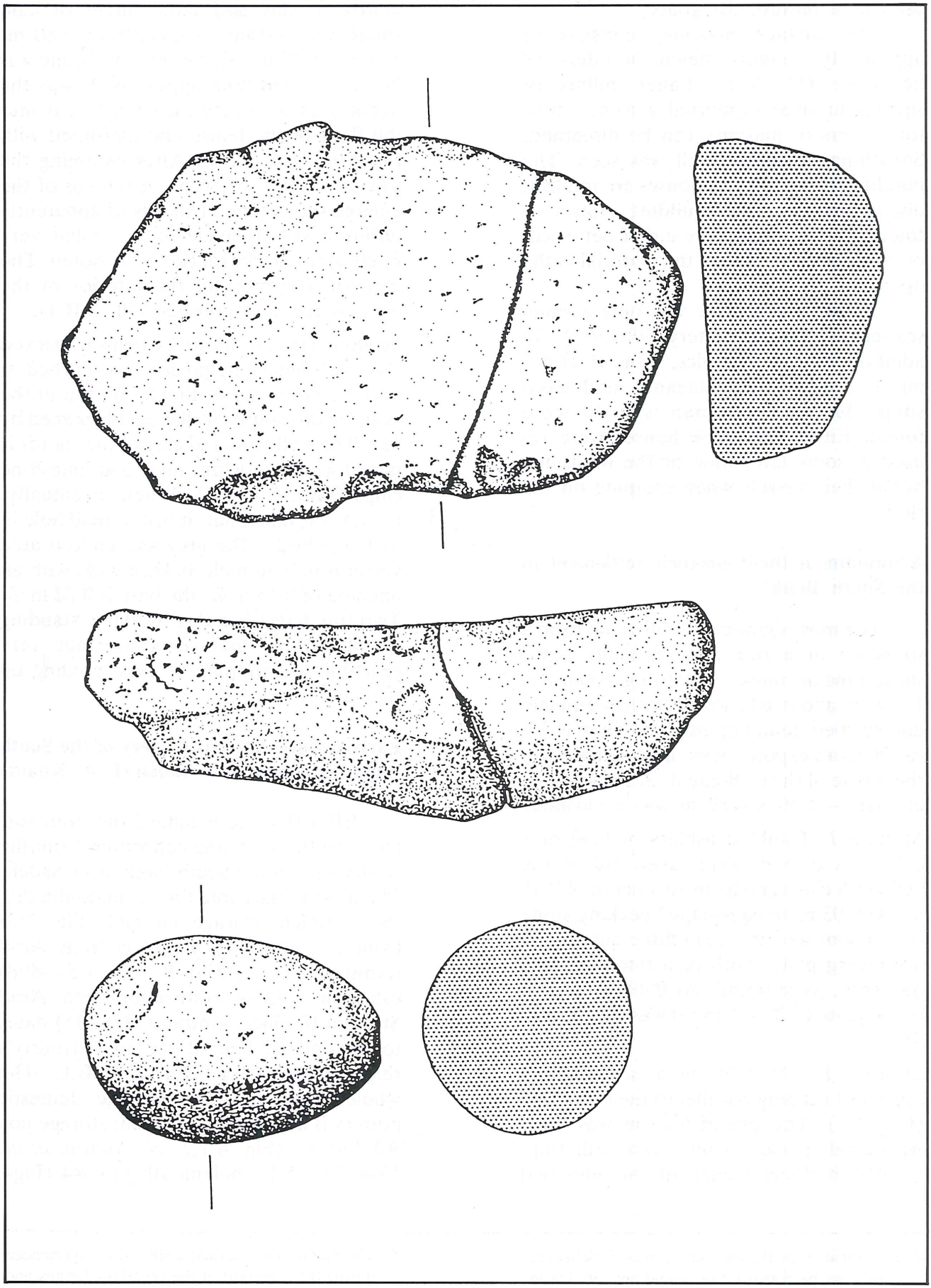


Fig. 4. Grinding plate and pecking stone from the sounding in the EB settlement of es-Sadeh.

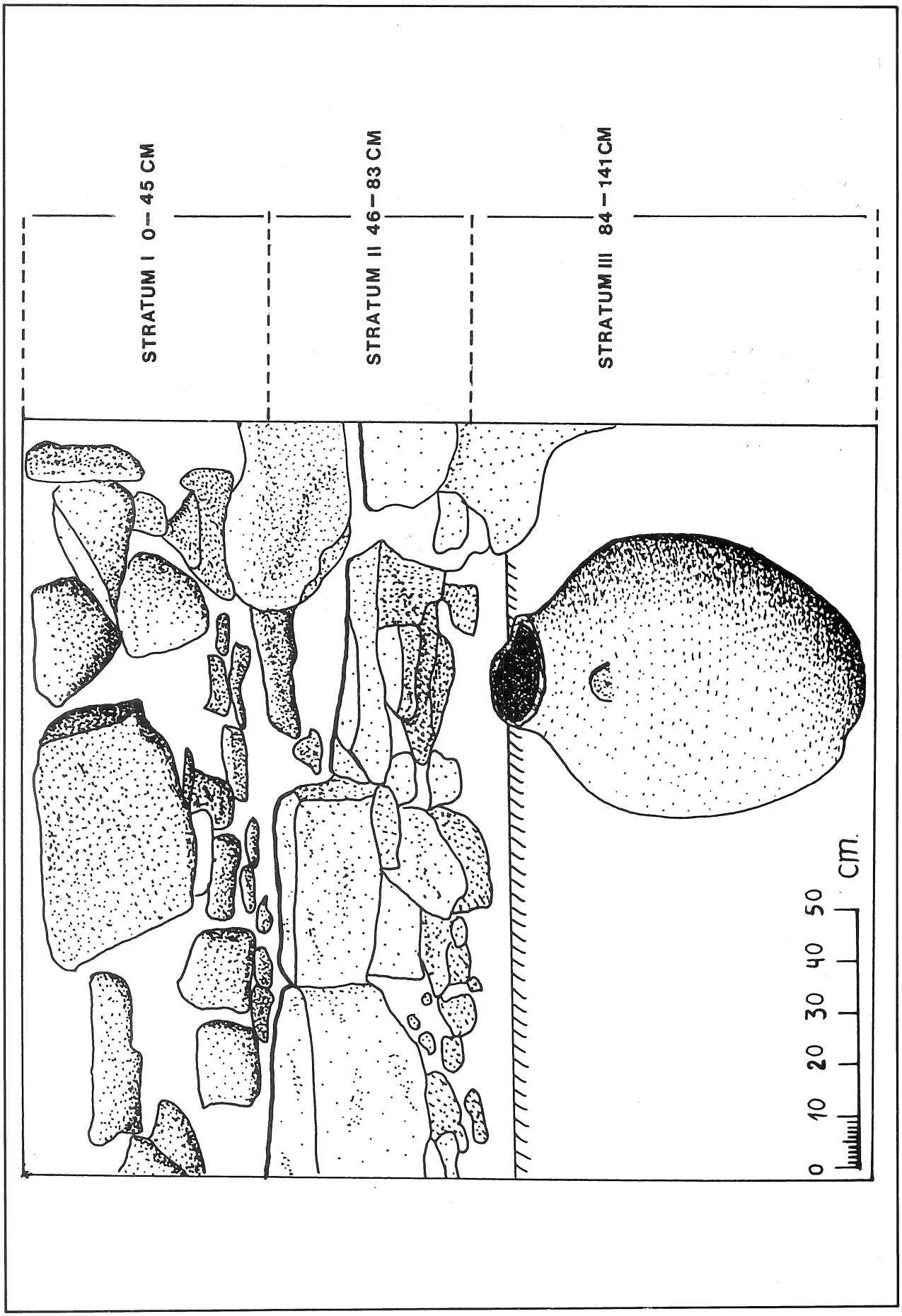


Fig. 5. Sounding in the EB settlement of es-Sadeh. (Drawing by E. Schreyer).

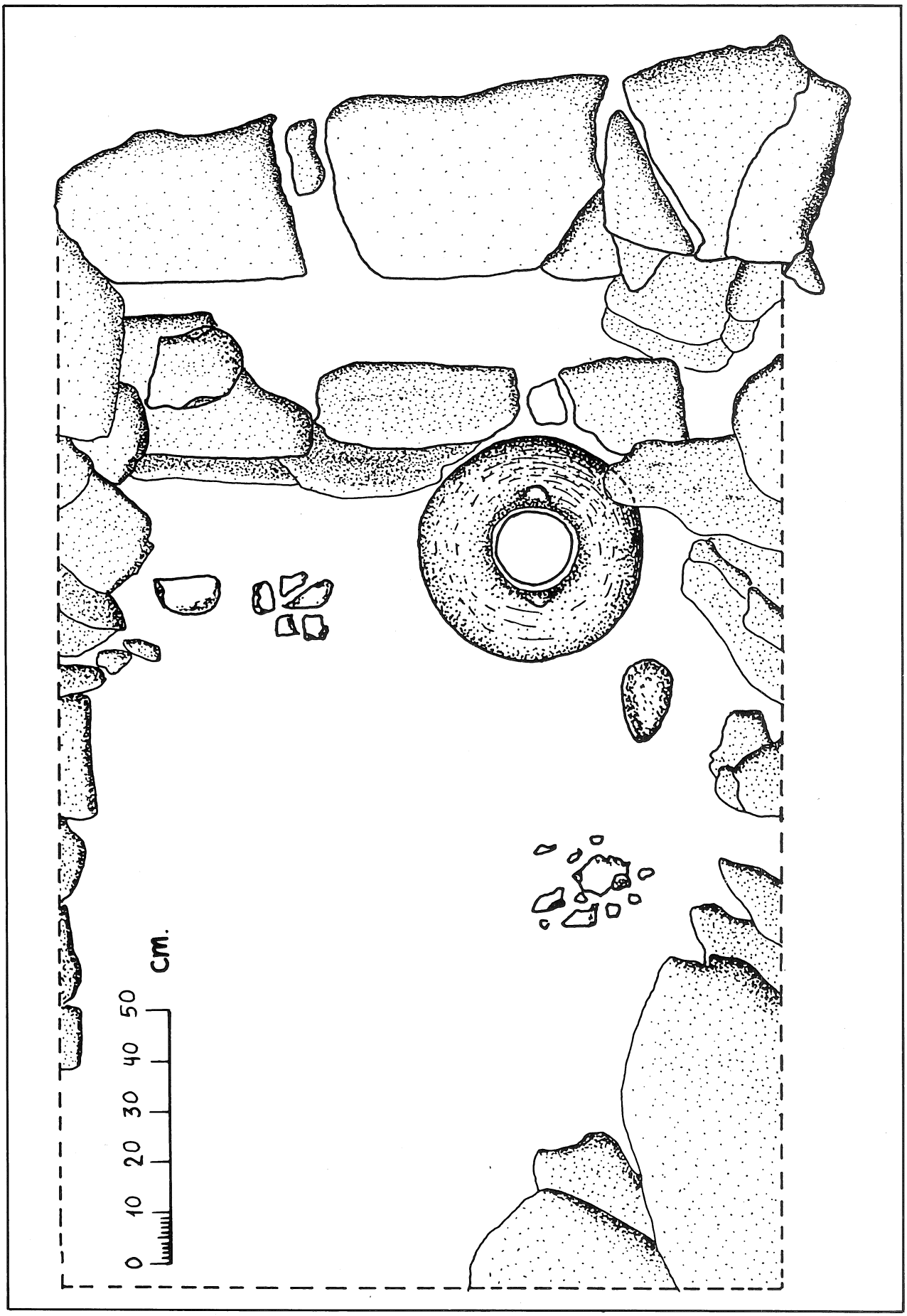


Fig. 6. Sounding in the EB settlement of es-Sadeh. (Drawing by E. Schreyer).

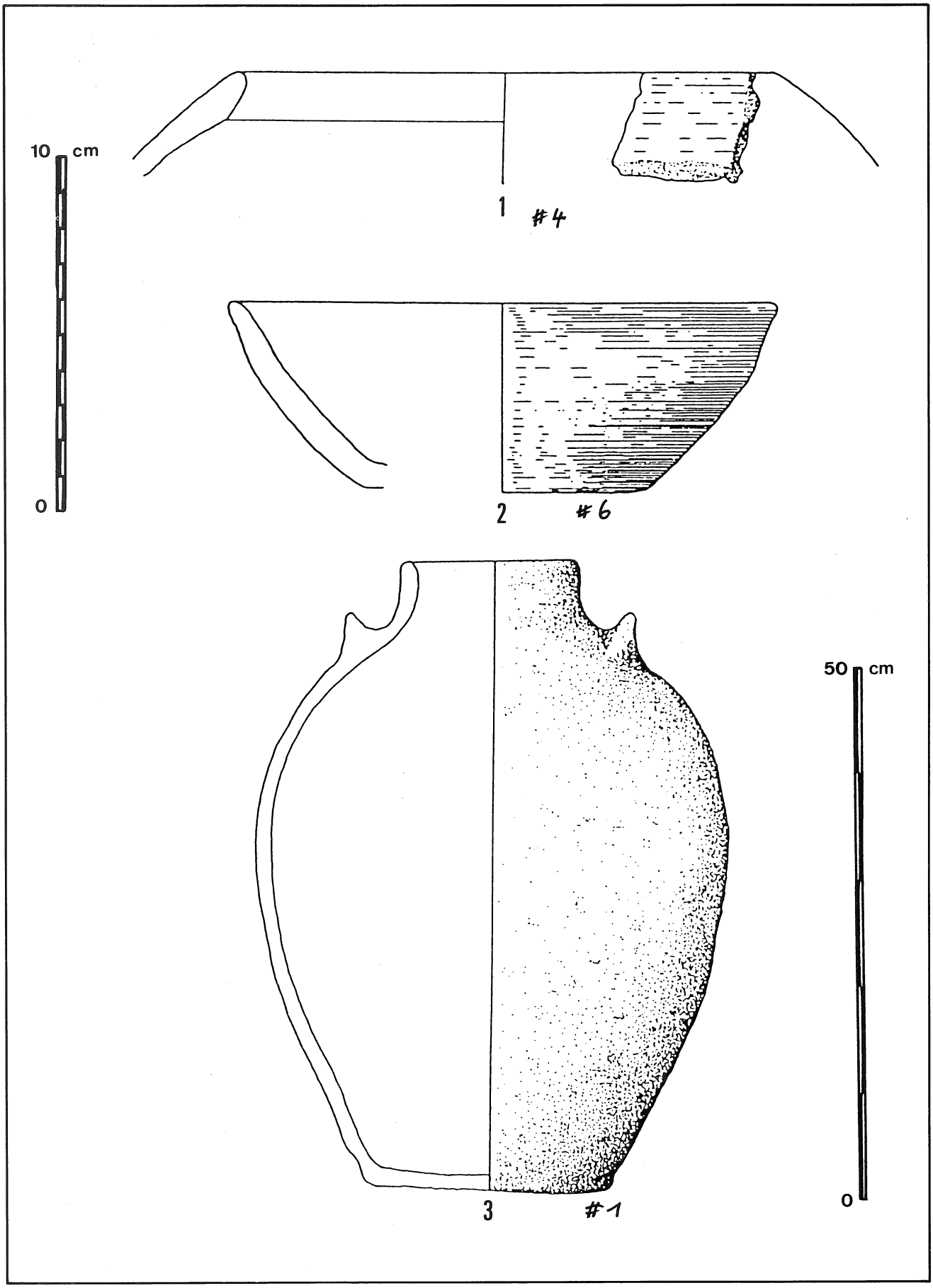


Fig. 7. EB Pottery from the sounding in the settlement at the south slope of es-Sadeh.

7:1;8:3,4; *cf.* Amiran *et al.* 1978: Pl. 18:5-14), jugs #5 (Fig. 8:7; *cf.* Amiran *et al.* 1978: Pl. 95:1) and bowls #6 (Figs. 7:2; 8:5; *cf.* Amiran *et al.* 1978: Pl. 22:52).

The distribution of pottery types demonstrates that all kinds of domestic activities were performed at es-Sadeh in the Early Bronze Age, regardless of whether the settlement was of a permanent or seasonal nature. The leg of an animal figurine #7 (Fig. 8:6; *cf.* Amiran *et al.* 1978: Pl. 117) indicates the possibility of religious activities at the site as well.

In the EB II period, the chiefdom of Arad controiled a semi-sedentary periphery that extended deep into Sinai. We may have to add the eastern escarpment of Wadi 'Arabah to this political structure in order to see the full picture. Preliminarily, a hypothesis can be formulated that the rise and decline of the Arad chiefdom was linked to its relationship with Egypt, which commenced in the EB I. In the EB II, Arad may have controlled the copper-mining areas of southeastern Palestine and of Sinai. Arad probably owed its prominence to its role at the interface between the semi-sedentary copper producers and their Egyptian market. When, at the beginning of the EB III period, Egypt shifted the centre of her Asiatic interests north to the Phoenician coast, the socio-political system of southern Palestine broke down. The position of the small farming communities at es-Sadeh within the chiefdom of Arad, and how it was affected by the latter's fate will be elaborated after more data are processed.

New Aspects of the Iron II (Edomite) Mountain Settlement on the Umm el-'Ala Plateau

After three more exploratory visits and a second sounding, several details have to be added to the description of the Umm el-'Ala plateau with its Iron II (Edomite) stronghold. The "arable plain", a catchment between Wadi Umm el-'Ala and its tributary from the southeast that was mentioned in the report on the 1987 campaign, was examined in 1988. It was recently used for agriculture, and was important if not necessary for the people living on the plateau in ancient times. With water converging from two valleys, good crops were possible in years with sufficient rainfall.

In 1988, rock-shelter ("abri") dwellings not noted before were found and dated by a remarkable amount of pottery below the rim of the plateau at 770 m (asl) in the north, south and southeast. Walls of coarse boulders were built in front of shallow recesses with natural or quarried terraces towards wadi Umm el-'Ala. In one case, two layers of stones are still preserved (Pl. VII,2; VIII,1).

In order to establish the occupation of the longhouses on the plateau and to find possible differences between that habitation and the rock-shelters, a sounding was performed in Building I (see sketch drawing Fig. 9) on the plateau (Pl. VIII,2). Whereas a first sounding in 1987 had only revealed a featureless and findless floor of tamped chalk, pottery fragments on a floor covered with sherds were excavated in 1988 which can be compared with the ceramic material collected on the surface and in front and below the rock-shelters (Pl. IX,1; 2).

Concerning the defence structures of Umm el-'Ala, the existence of now collapsed walls at almost all possible accesses to the plateau could be verified. The rockshelters overlooked those accesses and may have been additional defence structures. A third type of defence structure was the "tower", so-called by us because in the exposed, prominent place, only a tower-like building would have made sense, and because the amount of well-hewn ashlars speaks clearly for a building that by its height dominated the valley, the plateau and the pass leading to the upper Wadi es-Sadeh and farther east. A correction is necessary as far as the material of the tower is concerned. The building stones are not of Cretaceous limestone but of a finely grained, hard, whitish sandstone separated from the red sandstone above by blue and red marl strata and quarried directly below the structure itself. Thus a glacis was formed which certainly im-

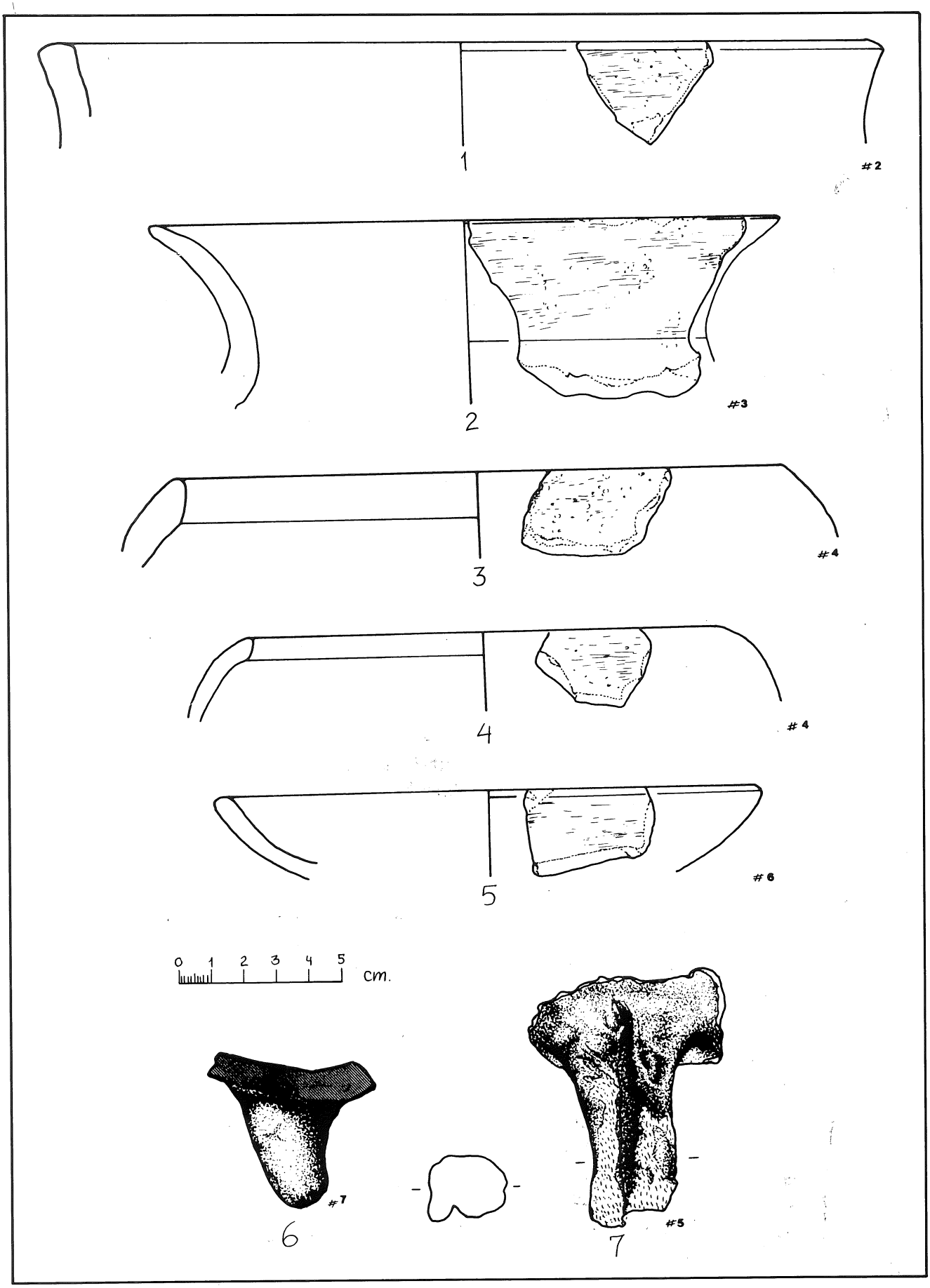


Fig. 8. EB Pottery from the sounding in the settlement at the south slope of es-Sadeh.

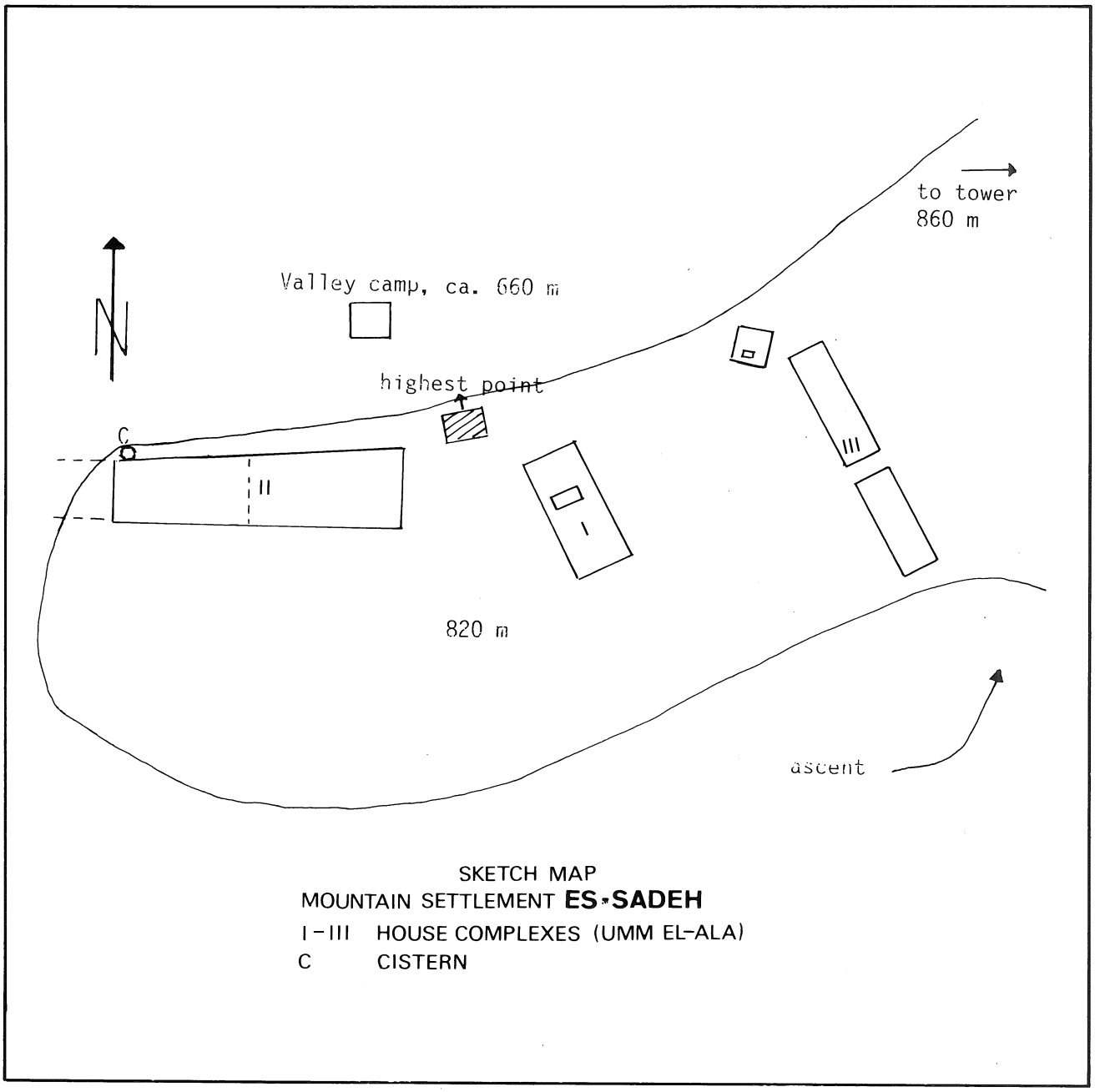


Fig. 9. Sketch map of the mountain settlement on Umm el-'Ala (es-Sadeh). (I. Künne).

proved the defence of the tower. A staircase of big ashlar steps leads up to its foot. The other accesses were barred by walls. Moreover, at the southwest corner of the platform, the ruin of a building of about 6 x 6 m and another one at the southeast corner could have been used either for defence or as dwellings. The formerly described longhouses on the spur of the plateau were arranged in a way that they formed another defence feature with a cistern north of Building II, which together with the highest point was a kind of rallying point in case of attack (Fig. 9).

The Iron II (Edomite) Pottery of Umm el-'Ala (S. Farajat and J.P. Zeitler)

The 1988 survey of es-Sadeh revealed a large amount of Iron II ware from all parts of the site. In general, the following groups may be presented.

Group 1: Jugs with high necks and handle. Mostly light reddish ware with small grits, some with

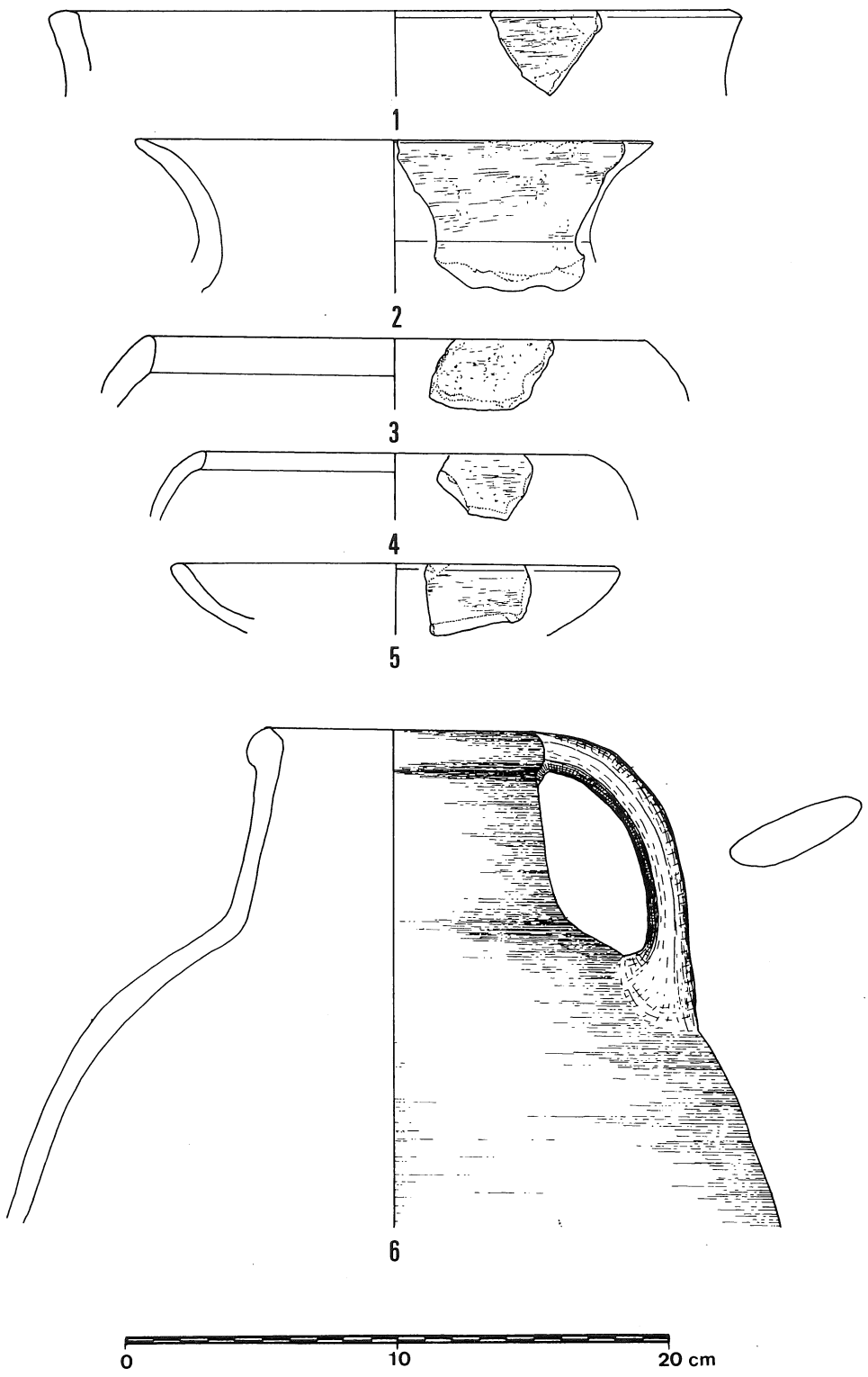


Fig. 10. Iron II (Edomite) pottery from Umm el-'Ala plateau at es-Sadeh. No. 6: A jug with high neck and handle.

grey core. Coarse surface (Fig. 10:6).

Group 2: Cooking pots with profiled rims and handles. Light reddish to reddish-brown ware with small grits, some with grey core. Coarse surface (Fig. 11:1).

Group 2a: Similar to Group 2, but larger (Fig. 11:2).

Group 3: Large jars with everted rims, thick and medium coarse, some with grey core, dark grits (Fig. 11:3,4)

Group 4: Deep bowls and craters. Light brown ware, sometimes with dark brown core. Smooth surface, some grits (Fig. 11:5, 6).

Group 5: Bowls with thickened rims, sometimes with flat rims. Light brown ware with light grey core, few small grits (Fig. 11:7).

Group 6: Jars with collared rims. Light pinkish ware, thick grey core, small grits, medium fine ware (Fig. 11:8).

Group 7: Jars with rilled rims. Pink ware. Large black grits, no core. Coarse texture and surface. Some pieces with cream brown surface (Fig. 12:1).

Group 7a: Similar to Group 7, but smaller (Fig. 12:2).

Group 8: Bowls with high profiled rims. Light reddish ware, smooth with light grey core, small grits. Probably imitations of Assyrian bowls (Fig. 12:4).

Group 9: Bowls with high, slightly outturned rims. Light reddish, buff ware with few grits (Fig. 12:3).

Group 10: Bowls with profiled rims, large diameter. Light brown ware, smooth to medium fine ware with small grits (Fig. 12:5).

Group 11: Flat bowls with high, outturned rims, one piece was found with two horizontal bands of dark brown paint on the shoulder. Fine ware, very small grits (Fig. 12:6, 7).

Group 12: Flat bowls with wide flanged rims, usually parts of oil lamps. One piece was found with wide horizontal band of dark brown paint. Light brown ware, grey core, small grits (Figs. 11:9; 13).

The chronology of the Iron II ware of es-Sadeh is, although without difficulties, somewhat disappointing. All except one of the groups are well represented in the assemblage of Umm el-Biyara. Some groups have parallels in the pottery of Ṭawilan and Buṣeirah (Table 1) (Oakeshott 1983 with the bibliography of previous studies, e.g. Bennett 1984). Difficulties appear when trying to establish an inner chronology of "Edomite" pottery. In none of the excavated Edomite sites could a sequence of different types be observed. Although Ṭawilan shows four main phases of Edomite occupation, the pottery seems to be typologically the same in all those phases (Bennett 1984: 4; Bienkowski: pers. comm.) The final occupation, followed by a destruction level, seems to date in the fifth century B.C. (Bennett 1984:4). At Umm el-Biyara, the occupation is usually dated by a find of a seal impression of king Qos-Gabr in the seventh century B.C. (Bennett 1966: 399). Thereby, at least a *terminus post quem* for the occupation of the building is offered, but by no means a chronology for the whole site. At Buṣeirah, the end of the occupation is usually dated to the seventh century B.C.

Generally, the end of the known Edomite settlements seems to be constructable between the seventh and fifth centuries B.C. That time span is conveniently accepted due to the fact that the destruction of the Edomite kingdom is fairly well secured by Mal. 1,2-5 to the fifth century B.C. (Weippert 1982: 296). As J. Bartlett has pointed out (1979: 53), that source offers only a date for the end of a

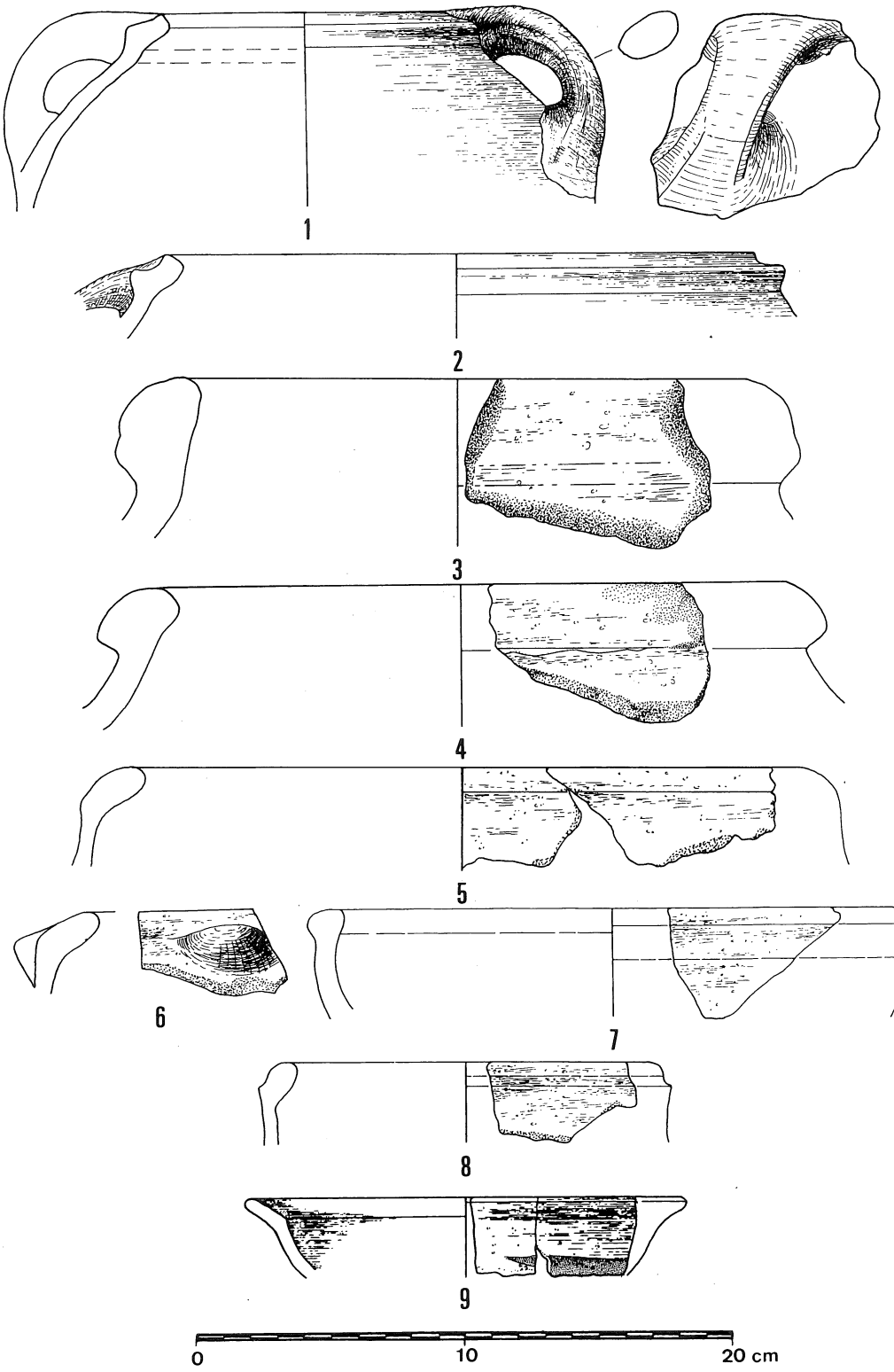


Fig. 11. Pottery from Umm el-'Ala: Cooking pots, jars, bowls, craters, oil lamps.

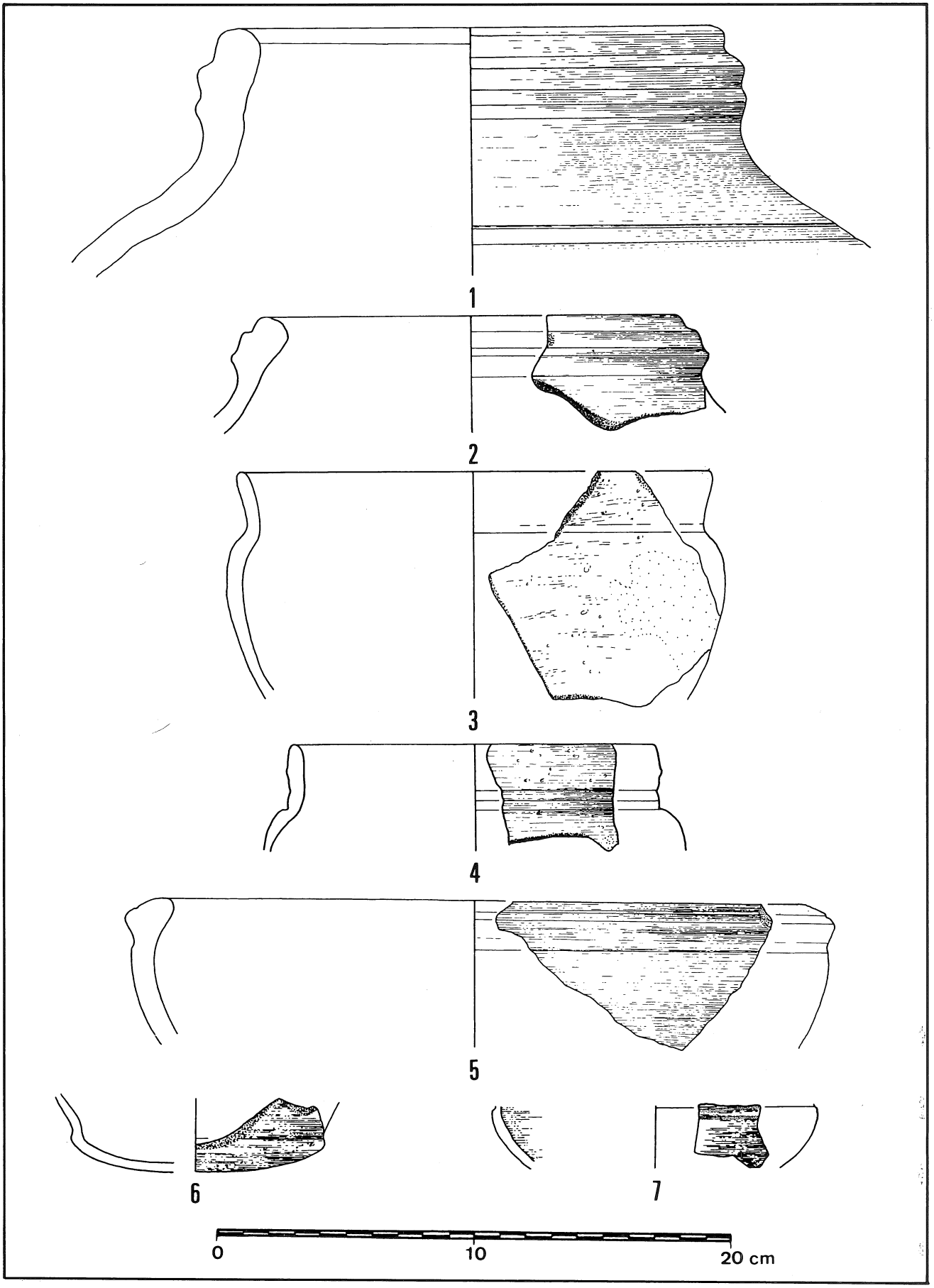


Fig. 12. Pottery from Umm el-'Ala: Jars with rilled rims, bowls with profiled rims.

Table 1: Camparison of the es-Sadeh finds with other Edomite sites.

TYPE / SITE	Group 1	Group 2	Group 2a	Group 3	Group 4	Group 5	Group 6	Group 7	Group 7 a	Group 8	Group 9	Group 10	Group 11	Group 12
Umm el-Biyara	●	●	●	●	●	●		●	●	●	●	●	●	●
Ṭawilan		●					○			●			●	
Buṣeirah				●							●		●	●

political system, but not a *terminus post quem* for the production of Late Iron II ware. Connecting both occurences would be a methodical mistake. At the moment, it seems best to rely on the antiquarian method of dating the finds into the Late Iron II Age and to avoid an absolute date for their production.

The comparison of the finds from different locations at es-Sadeh does not show the expected chronological variations. Most of the pottery types can be found in all sub-sites, e.g. rock-shelter dwellings, plateau settlement, slopes and cliffs of Umm el-'Ala. From the sounding on the plateau, a larger number of pottery group 12 is present. Whether this was due to a better selection in the course of the excavation compared with the random collection from the surface or to other factors remains uncertain. The same applies to comparisons of the amount of painted pottery with other Edomite sites. Only a few painted pieces, produced in fine ware, are present from es-Sadeh. Compared with the coarse ware they must seem insignificant or in the bright daylight even invisible to the surveyor. Only a larger-scale excavation could make sure that the es-Sadeh pottery is more linked to the Umm el-Biyara finds, with little painted pottery, than to the assemblages from Ṭawilan and Buṣeirah where painted pottery was abundant.

The Nabataean Occupation of es-Sadeh

Where the Nabataeans lived in es-Sadeh can only be outlined provisionally.[6] From the surface sherding, three Nabataean building complexes were identified. One is located close to the valley exit on the lower north bank. The ruins are of the astounding size of about 10 x 10 m. A second complex was found and described in 1987 as a "village" of about 20 houses between the EB settlement and the "temple" mountain, as a matter of fact situated directly below and in some way connected with the building on top. A single structure, set apart but also beside the recent (and certainly also ancient) path leading up to the summit was examined in 1988. A third building complex was found, but only superficially examined, outside and northwest of the valley proper. It is located in a flat depression close to a small wadi that sends winterly spates into wadi es-Sadeh.

The "Temple" Mountain (Pl. X,1)

Nothing really new was learned about the structure that has been tentatively called "temple" or sanctuary because of the exclusively fine Nabataean pottery both on the surface and in a sounding

6. No soundings were performed at any of the Nabataean dwellings.

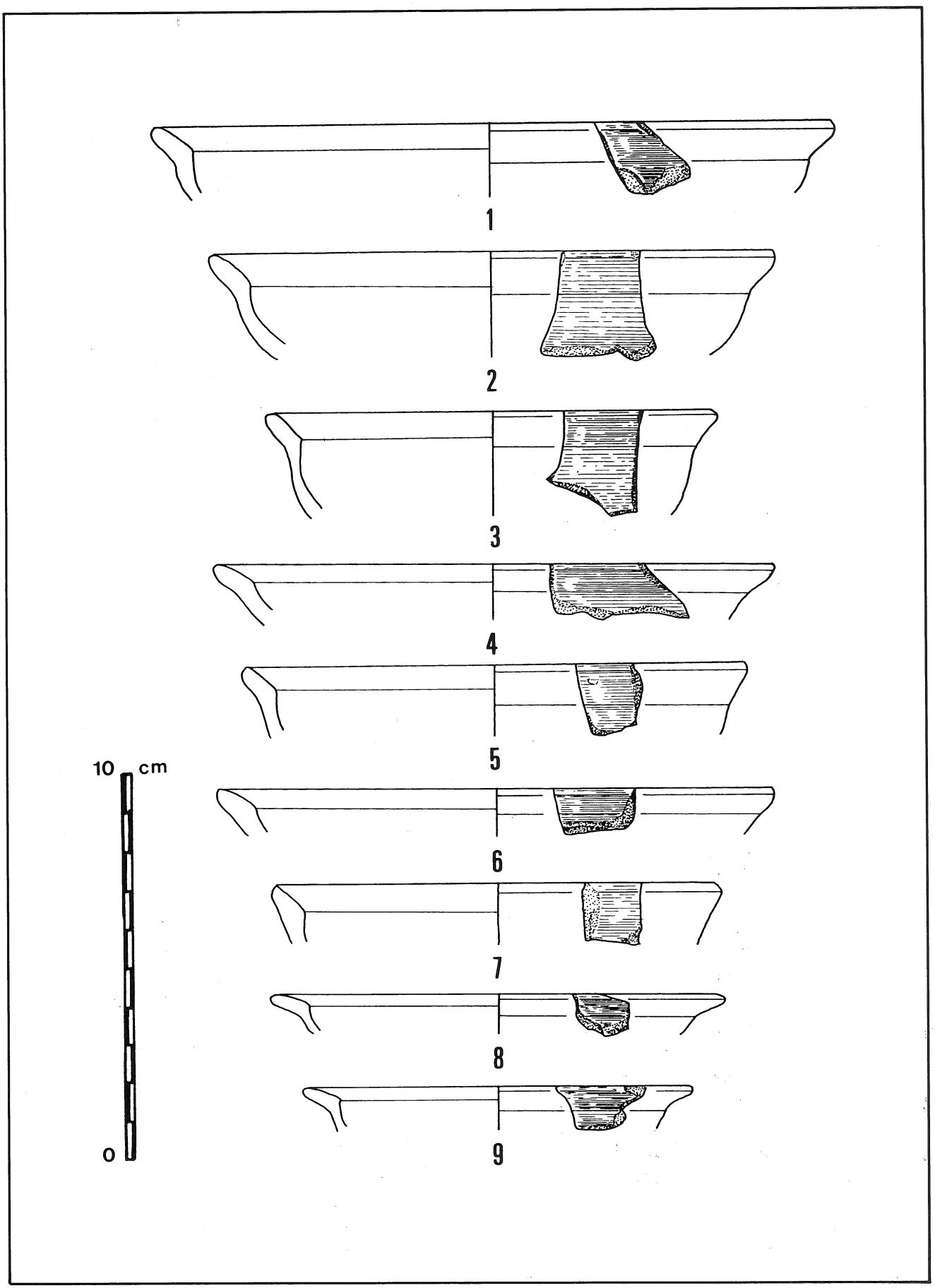


Fig. 13. Pottery from Umm el-'Ala found in a sounding in Building I of the plateau settlement.

(1987), all of which belongs to the period from the first century B.C. to at least the first/second century A.D. (Pl. X,2). Besides, its longer axis is directed towards Jabal Harun whose summit is visible at a distance of 13 km between other nearer mountain tops. A sounding at the outside of the east wall that seems eroded and scattered like the whole structure showed well-preserved foundations of well-cut ashlars more than 0.45 m long and 0.27 m high. The direction of the longer axis is reminiscent of Petraean sanctuaries looking or being directed towards the "holy mountain", such as the High Place on Zibb 'Aṭuf, the block idol ("Pfeileridol") of the Khubtha plateau, the supposed podium of the ruined temple (Lindner *et al.* 1984: 174-177; Pl. 23:2) on the Deir plateau and the rock temple of ed-Deir itself. St. Crawford (1930:296) suggested that borrowed sanctity could be secured by an unobstructed view of the sacred mountain shrine. If the block-like structure projecting from the northern wall of the building at es-Sadeh was an altar, a person ascending its steps would have looked straight at the summit of Jabal Harun.

Some Further Observations on the Nabataean Pottery from Es-Sadeh (J.P. Zeitler)

The Nabataean pottery from es-Sadeh has already been described and dated on the basis of the 1987 survey (Lindner, Farajat and Zeitler 1988). During the 1988 survey, more pottery was added to the assemblage. Most of the fragments are similar to the types already outlined in the previous report. However, more pieces of cooking pots and bowls, mainly bowls with straight rims, were gathered. Some new types appeared during the survey (Fig. 14).

Some sherds of painted bowls with a leaf-wreath and groups of lanceolated leaf patterns (Fig. 14:4, 6) are noted. They are similar to types known from various sites at Petra (Horsfield and Horsfield 1942: Fig. 44; Murray and Ellis 1940: Pl. 13, 40; Parr 1970: Pl. 44,6, Fig. 5, 58, 64; Zeitler 1989: Abb. 14,2) and elsewhere (e.g. Negev 1974: Pl. 4; Negev 1986: 37, No. 265). According to Parr's stratigraphy and to a new sequence of pottery excavated by a team of the Naturhistorische Gesellschaft Nürnberg (NHG) under the author's direction near the Urn Tomb, that type of decoration dates to the period between the first quarter and the last half of the first century A.D. (Zeitler 1989: 317). The finds from the potter's workshop at Oboda confirm the chronology (Negev 1974: 44 ff.)

A larger amount of pottery painted with brown and black palmette motives was found in 1988 (Fig. 14: 14-18). In both of the above-mentioned sequences from Petra, that type of decoration does not appear before the middle of the first century A.D. (Parr 1970: Fig. 6, 87, 7, 197, 113; Zeitler 1989:317). Finds from a Nabataean cemetery at Mampsis confirm the chronology (Negev and Sivan 1977). According to the excavation near the Urn Tomb at Petra, the decoration remained "in fashion" there for a long time after the Roman annexation. The large variety of Nabataean ware with palmette decoration from the excavation belongs stratigraphically to occupation phases from the late first to at least the third century A.D. A sequence of oil lamps secures this chronology of more than 20 layers.

The abundance of this type of Nabataean painted pottery goes hand in hand with a total absence of typical Roman ware, both at Petra and es-Sadeh. Considering the chronology of the finds from Petra, the usual explanation that the site was abandoned after the Roman annexation, seems to miss the point. Until now, no differences in the Nabataean painted ware from the first to the third century A.D. are apparent. Perhaps better results will be derived from the analysis of the excavation finds at Petra. Until then, the end of the occupation of the different Nabataean sites at es-Sadeh is uncertain and has to fit between the end of the first century A.D. and the third century A.D.

Together with the finds from the 1987 survey of es-Sadeh, a continuous land use from the first century B.C. up to some time between the end of the first and the third

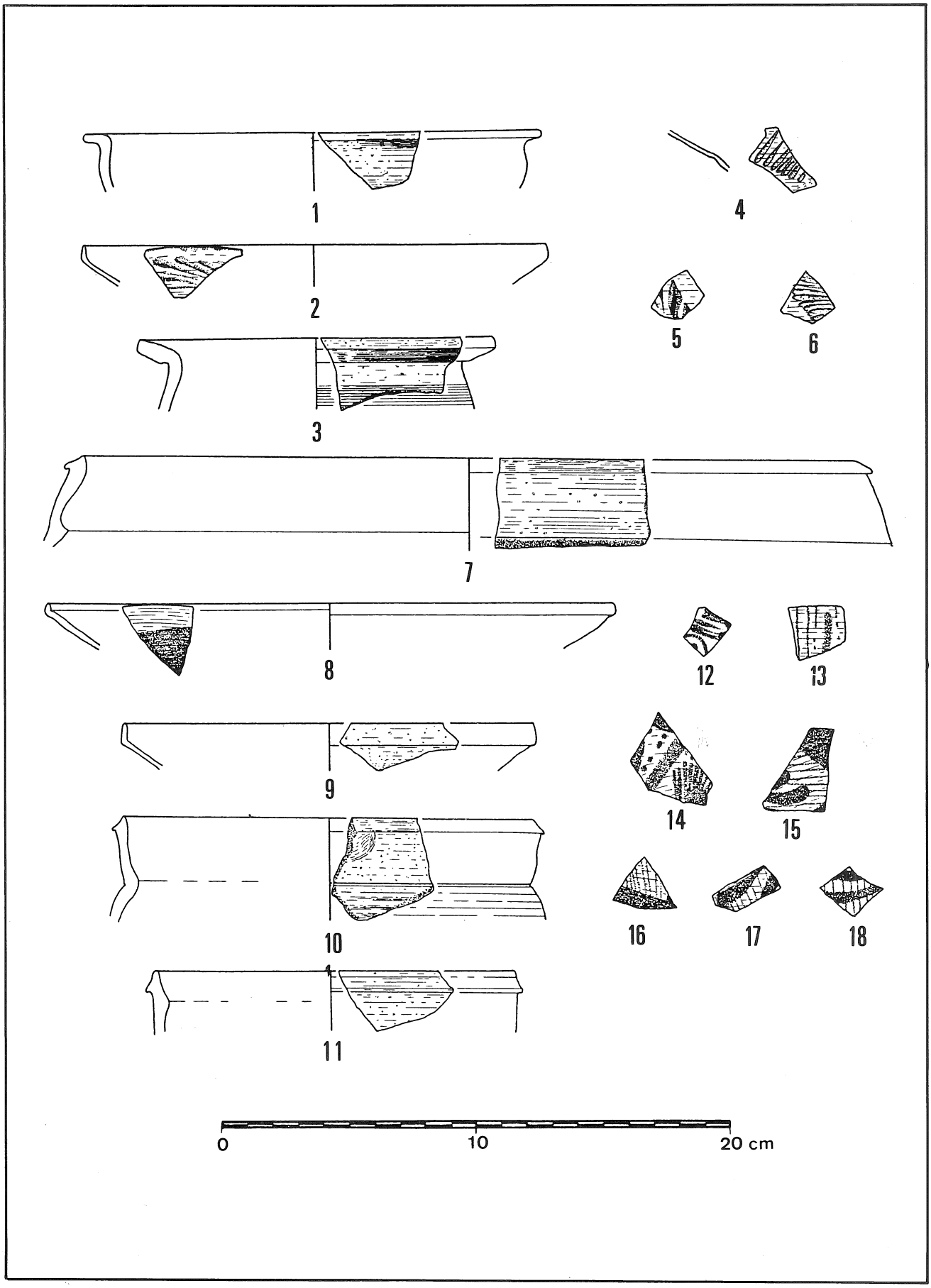


Fig. 14. Nabataean pottery from es-Sadeh.

century A.D. could be secured from the surface finds and the finds from the small sounding in the building supposed to be a sanctuary or even a "temple". If the interpretation of the latter building should prove correct, some pottery with traces of smoke and ash might indicate the use of fire during the religious ceremonies.

Observing the settlement pattern in southern Jordan for the first centuries A.D., there appears little evidence of a large number of sites with Nabataean *and* Roman occupation. Excepting the succession of a Nabataean settlement and a Roman fortress at Udhruḥ (Killick 1986: 51 ff.), most Roman sites show only a small amount of Nabataean ware. That fact becomes obvious at the sites along the *Via Nova Traiana* where most finds in its southern part date between the third and sixth centuries A.D. According to fabric and type, they seem to be Roman rather than Nabataean products. The latter are only present in a few examples (Parker 1987:535). Although the basis for an hypothesis is still small, the discussed observations may argue for two different types of settlements in southern Jordan:

— Settlements with a Nabataean tradition, often dating back to the first century B.C. with houses, temples and industrial areas (oil press at Khirbet edh-Dhariḥ — pers. comm. F. Villeneuve; wine press at Beidha — pers. comm. Z. al-Muheisen).
— Settlements with a Roman tradition, aligned to the Roman road layout and usually in context with military installations.

If those differences could be proved in future, they may indicate a coexistence of an oriental, Nabataean way of life like at es-Sadeh, and an occidental, Roman way of life until the dawn of the Byzantine period.

The Nabataean Aqueduct with the Aqueduct Arch and the Origin of its Water-Supply

In 1987 it could not be ascertained where the water at the valley head came from. It falls, flows or trickles down to the wadi-bed perhaps all year long, certainly during October 1987 and 1988. It shot down like a turbin-drive after only 15 minutes light rain in October 1987. After a 5 hours hike through Wadi Umm el-'Ala behind the plateau of the same name and after climbing a steep pass (810 m asl), a gravel-filled upper section of Wadi es-Sadeh was reached. Not far from a fallen rock that the Bedouins had tried to detonate, the spring was found in an artificially altered basin at 710 m (asl). From there, its water streams in a westerly direction through a humid gorge full of plants and trees. Eventually, together with possibly more effluxes, it reaches the upper section of the porphyry gorge with its basins and cataracts. It cascades about 130 m down to Wadi es-Sadeh (640 asl) where it disappears immediately in the gravel of the wadi-bed, unless there is a torrent after a rainfall.

The hydraulic engineers of antiquity caught the water from the uppermost basin, perhaps with the help of a wooden construction — an incision in the cliff is visible — and conducted it around the inside of the perpendicular gorge and the ensuing cliff to the valley centre. The hard and brittle igneous rock, smooth only where polished by streaming water over a long time, could not be worked like the sandstone at other Nabataean sites. Therefore, layers of gravel stones were mortared against the rock wall. Such quantities of mortar mixed with limestone and chipped porphyry pieces were used that the dissolving mortar, after almost 2000 years, makes the cliff in some places look like a limestone wall. On top of the stone layers, a channel about 5 cm wide and 10 cm deep was hollowed out of the same mortar. Because no substructures could be fastened around the bend of the gorge, two aqueduct arches had to support the channel. Instead of the mortar gutter, however, from there on prefabricated guttering stones of well-cut, plastered ashlars were laid upon substructures of regular ashlars. No traces of covering stones were noted (Pl. XI,1; 2).

The same use of guttering stones or "aqueduct or conduit blocks" as Oleson calls them (Oleson 1986:257; 1988:117), in Wadi el-Ḥasa, Wadi Ramm, Ṣabra, Petra and Ḥumayma[7] supports the hypothesis that the Nabataean water-supply systems using them did not originate randomly but by plan and order of the Nabataean king before the beginning of the Christian era. Obviously, arable land was taken over to further the economy of the country (Alt 1935:49).

The aqueduct arch, undoubtedly the most spectacular sight not only of es-Sadeh but of southern Jordan (originally there were two of them) was measured in 1988 with a certain degree of danger and inaccuracy. It is 5.00 m high, 3.50 m in width and 0.80 m deep with the abutment 2.25 m above the foundation. The bossed ashlars are of an average size of 0.60 x 0.25 m. The load capacity of the exposed right pillar is strengthened by stepped opposites. That interesting detail should make comparisons with other arches, and therefore the chronology, easier. There are, of course, other possibilities for dating the arch. As the Nabataean pottery all over es-Sadeh dates back to the first century B.C. and reaches its quantitative and qualitative hiatus in the first century A.D., the arch, along with the whole aqueduct, should be dated to the first half of the first century A.D. The Nabataeans would not have postponed the matter of their water-supply until the end of their occupation, but would have provided it from the beginning. Greek or Roman influence is possible as well as the hiring of foreign architects. But so far, there is no indication that aqueduct(s) and arch(es) were built only after the annexation of Nabataea by the Romans. On the contrary, as D. Graf pointed out recently, the occcupation of outlying Nabataean settlements tends to cease under Roman rule either by withdrawal or shifting of the population (Graf n.d.).

The aqueduct is interrupted twice by severe solifluction at least partly caused by earthquakes. But its end is well preserved. After some 300 m the water was conducted by plastered guttering stones still *in situ* 50 m east of the valley centre into a reservoir of 18 x 9 m (Pl. XII,1). It is (partly?) built of heavy, excellently cut ashlars with two supporting walls towards the wadi. A 2 x 1 m trench revealed only fine sand to a depth of 1 m. No covering arches as in other Nabataean cisterns were found. The flowing water may have made covering unnecessary. An overflow would have reached the kettle-holes of the gorge.

There are traces of a second aqueduct in Wadi Umm el-'Ala behind the plateau. Substructures as described for the upper section of the main aquedect are attached to a porphyry cliff close to a cataract of quartz porphyry about 5 m high. Either a hydraulic experiment failed or a once functioning aqueduct was destroyed in the course of time (Pl. XII,2). The origin of the water-supply would have been both Wadi Umm el-'Ala and the head of its southern tributary with another porphyry "crater". In October 1988 no water reached the gravel-filled bottom at 700 m asl, but birds calling in the heights signalled the existence of water in basins about 100 m higher up.

Past and Present of es-Sadeh

The hike around the plateau of Umm el-'Ala was informative for more than one reason. Es-Sadeh was no cul-de-sac. When inhabited or not, it was situated on a track between Wadi 'Arabah and the east, and it certainly connected settlements and/or pastures. The Bedouins lately repaired the ancient track from the valley centre to the entrance of the upper Wadi es-Sadeh. The equally important continuation towards the east is yet to be explored. For the local Sa'idiyin Bedouins, es-Sadeh is still an important place. They started an agricultural project as others had done before them.

7. About "prefabricated guttering stones" see: M. Lindner *et al.* 1988: 75-99. Not mentioned there is the find of similar conduit elements at en-Nu'eirah north of Petra (Lindner 1986: 103; Pl. 7).

Not far away, in the southwest, a Bedouin had already built a reservoir filled with water in October 1988. He plants tomatoes, beans and other vegetables and reaches his garden by a roughly made road. The Bedouin's enterprise proves that es-Sadeh, in spite of its deficiencies, could have a future — as it had several times in the past.

A Botanical Survey of the Wadi es-Sadeh Region (I. Künne)

A botanical survey of Wadi es-Sadeh and its surroundings, at elevations between 600 and 850 m asl, was carried out in conjunction with the archaeological survey in 1987 and 1988.

The western lower area is of limestones and marls of the Upper Cretaceous, while the eastern upper area is of massive Cambrian brownish weathered sandstones with veins of Quartzporphyry (Bender 1968). The wadi bed consists of alluvial material. The annual rainfall is about 100-200 mm (Gebel and Starck 1985). This places the wadi in the arid zone. The mean annual temperature ranges between that of Ma'an (1080 m asl., 17°C) and Aqaba (5 m asl, 24.2°C) (Zohary 1973).

During the two campaigns 99 species were collected in the es-Sadeh area (Table 2). Because the collecting was done in autumn, the plant list is not complete. The species grow in different habitats and in the plant communities shown in the vegetation map (Fig. 15). (Syntaxonomy is according to Zohary 1973 and 1982. The legend and symbols follow Frey and Probst 1977 with some variations):

1. The main unit of the examined region is a moderate desert vegetation with *Anabasis articulata, Zygophyllum dumosum, Agathophora alopecuroides, Retama raetam, Gymnocarpos decander, Reaumuria hirtella, Fagonia mollis, Blepharis attenuata, Colchicum tunicatum.* This unit covers the lower hills west of Umm el-'Ala and north of Wadi es-Sadeh on Upper Cretaceous material and belongs to ***Anabasetea articulatae, Zygophylletalia dumosi.***

The occurence of species depends on altitude, direction and soil vegetation changes in nuances. I have noted:

2. A mixed vegetation of moderate desert similar to 1. with a greater number of steppe plants (*Artemisia sieberi, Noaea mucronata, Astragalus spinosus, Chiliadenus iphionoides*): ***Artemisietea herbae-albae mesopotamica*** on the plateau of Umm el-'Ala on sandstone.
3. Desert vegetation with typical Saharo-Arabian plants, but almost no participation of Sudano-Sindian species *(Retama raetam, Anabasis articulata, Zilla spinosa, Lycium shawii, Fagonia glutinosa)*: ***Anabasetea articulatae, Anabasetalia articulatae*** on more sandy soil in Upper Cretaceous material. This unit covers the broad plain west of Wadi es-Sadeh.
4. Desert wadi vegetation with members of hot deserts *(Hammada salicornica, Acacia raddiana* — only one in a trench) on flat terraces of Wadi es-Sadeh, on lower slopes west and south of Umm el-'Ala and in Wadi Umm el-'Ala: *Anabasetea articulatae* with elements of ***Hammadetea salicornicae*** on Upper Cretaceous material and in the sandstone area.
5. Desert wadi vegetation with *Retama raetam, Tamarix nilotica, Hammada salicornica, Daphne linearifolia, Anabasis articulata, Pituranthos triradiatus, Fagonia mollis, Artemisia sieberi, Caylusea hexagyna,* but also with high bushes of *Nerium oleander* on dry wadi ground in the eastern part of Wadi es-Sadeh, in Wadi Umm el-'Ala and in the wadi southwest of Umm el-'Ala: ***Retamo-Tamaricetea fluviatilis*** on alluvial material.
6. Hydrophytic vegetation with *Nerium oleander, Phragmites australis, Arundo donax, A. plinii, Juncus arabicus, Inula viscosa* in the western part of Wadi es-Sadeh, where waterholes were still seen in October: ***Phragmitetea*** on alluvial material.
7. Halophytic vegetation on spring hori-

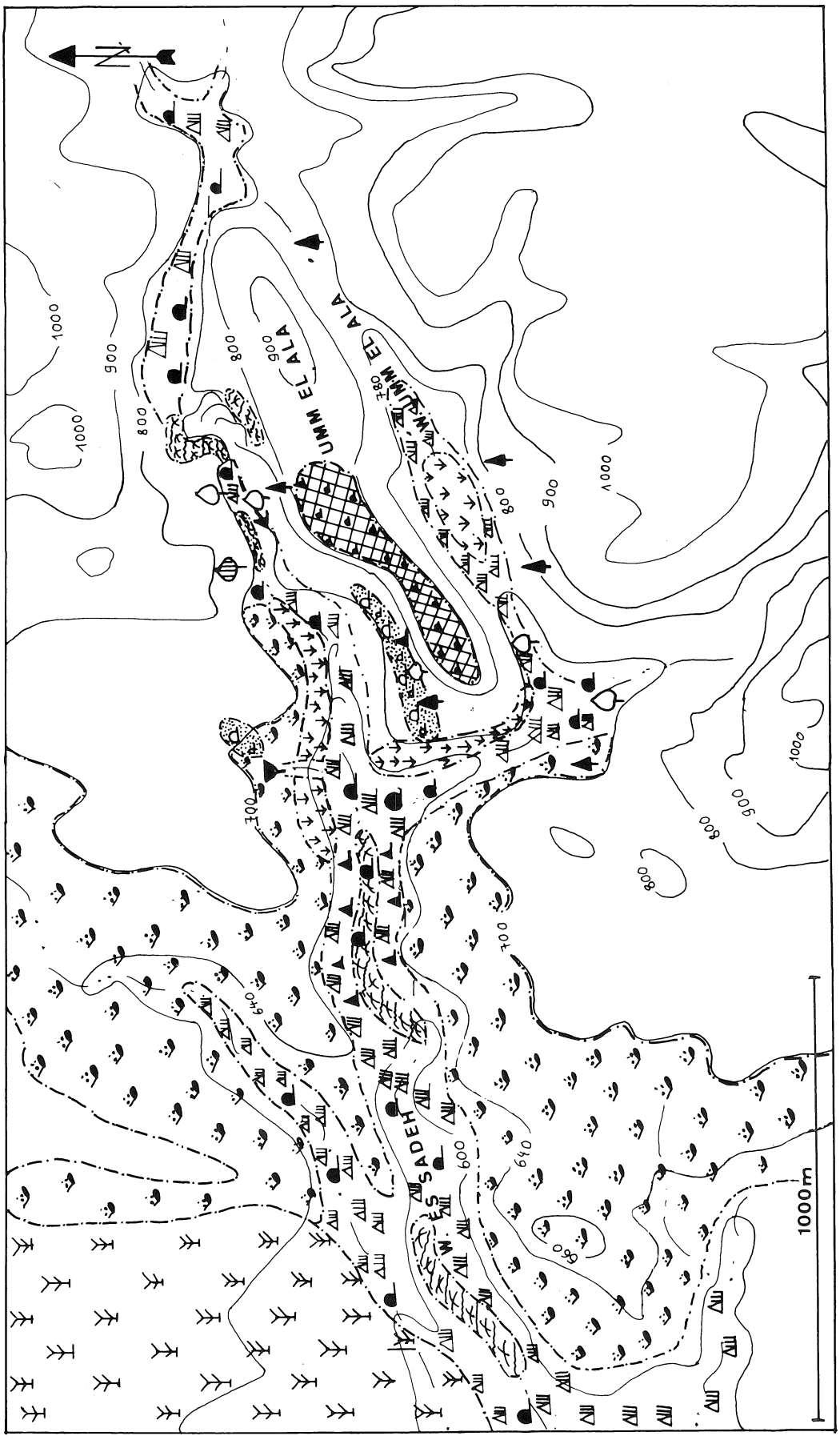
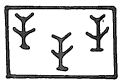


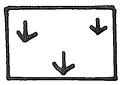
Fig. 15. Vegetation map of the Wadi es-Sadeh area.

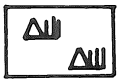
Legend of the Vegetation Map of the Wadi es-Sadeh Area

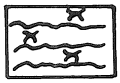
1  Moderate desert flora: Anabasetea articulatae, Zygophylletalia dumosi

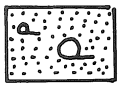
2  Mixed vegetation of desert/steppe: Anabasetea articulatae/ Artemisietea herbae-albae mesopotamica

3  Desert vegetation with typical Saharo-Arabian plants of Anabasetea articulatae, Anabasetalia articulatae

4  Desert vegetation of Anabasetea articulatae with elements of Hammadetea salicornicae

5  Desert wadi vegetation: etamo-Tamaricetea fluviatilis

6  Hydrophytic wadi vegetation: Phragmitetea

7  Halophytic vegetation at spring horizons: Suaedetea fruticosae (deserti)

 Decidious tree: *Pistacia palaestina, P. khinjuk*

 Evergreen needle-leaved tree: *Juniperus phoenicea*

 Desert tree: *Acacia raddiana*

 Tree with rod-like twigs: *Moringa peregrina*

 Evergreen needle-leaved shrub: *Tamarix nilotica*

 Shrub with rod-like twigs: *Retama raetam*

 Evergreen broad-leaved shrub: *Nerium oleander*

 Decidious sub-shrub: *Zygophyllum dumosum*

 Sub-shrub with reduced scale-like leaves: *Anabasis articulata*

 Sub-shrub with reduced scale-like leaves: *Hammada salicornica*

 Dwarf shrub: *Artemisia sieberi*

Table 2: Plants collected in the es-Sadeh area (nomenclature after Zohary and Feinbrun 1966-1986; Greuter *et al.* 1984, 1986, 1989).

ACANTHACEAE
Blepharis attenuata, W.IT, E.SA

ADIANTACEAE
Adiantum capillus-veneris, M, IT, EuSib (Trop)

AIZOACEAE
Aizoon hispanicum, SA

ANACARDIACEAE
Pistacia khinjuk, IT
Pistacia palaestina, E.M

APIACEAE
Eryngium glomeratum, E.M, W.IT
Pituranthos tortuosus, E.SA
Pituranthos triradiatus, E.SA

APOCYNACEAE
Nerium oleander, M (W.IT, SA)

ARACEAE
Arum cf. elongatum, E.M, W.IT

ASCLEPIADACEAE
Caralluma spec.

ASTERACEAE
Achillea fragrantissima, E.SA, W.IT
Artemisia sieberi (= A. herba-alba p.p.), IT
Asteriscus pygmaeus, SA (W.IT)
Centaurea eryngioides, IT
Chiliadenus iphionoides, E.M
Chiliadenus montanus, E.SA
Filago desertorum, E.SA, W.IT
Gymnarrhena micrantha, SA (W.IT)
Ifloga spicata, SA
Inula viscosa (= Dittrichia v.), M
Iphiona mucronata, E.SA
Lactuca orientalis, IT
Onopordum ambiguum, E.SA, W.IT
Tripteris vaillantii, E.SA, Sud

BORAGINACEAE
Alkanna orientalis, E.M, W.IT
Anchusa strigosa, E.M, W.IT
Heliotropium spec.

BRASSICACEAE
Moricandia nitens, SA

CAPPARACEAE
Capparis aegyptia, E.M (W.IT)

CARYOPHYLLACEAE
Gymnocarpus decander, SA
Gypsophila arabica, W.IT
Silene linearis, E.Sud, SA

CHENOPODIACEAE
Agathophora alopecuroides (= Halogeton a.), SA
Anabasis articulata, SA (IT)
Atriplex halimus, M, SA
Halothamnus lancifolius (= Aellenia l.), W.IT
Hammada salicornica, E.Sud
Noaea mucronata, IT
Salsola baryosma, Sud (SA)
Salsola volkensii, E.SA
Suaeda aegyptiaca, E.SA

CISTACEAE
Helianthemum lippii, E.SA, Sud
Helianthemum sancti-antonii, SA

CUCURBITACEAE
Cucumis prophetarum, E.SA (Sud)

CUPRESSACEAE
Juniperus phoenicea, M (N.W.Arabia)

EPHEDRACEAE
Ephedra aphylla (= E. alte), E.SA

FABACEAE
Astragalus spinosus, IT
Colutea istria, SA, IT
Ononis natrix, M (SA)
Retama raetam (= Lygos r.), SA (IT, M/coasts)

GENTIANACEAE
Centaurium cf. spicatum, M, IT

GERANIACEAE
Erodium crassifolium (= E. hirtum), SA

GLOBULARIACEAE
Globularia arabica, SA

JUNCACEAE
Juncus arabicus, SA, W.IT

LAMIACEAE
Ballota undulata, E.M, E.SA, W.IT
Lavandula pubescens, E.SA, E.Sud
Origanum petraeum Danin sp.n.
Salvia lanigera, S.M, SA
Salvia palaestina, E.SA, W.IT
Satureja cf. thymbrifolia, W.IT, E.SA
Teucrium cf. leucocladum, E.SA
Teucrium polium, M, W.IT

LILIACEAE
Asparagus stipularis, M
Colchicum tunicatum, W.IT
Drimia maritima (= Urginea m.), M

MALVACEAE
Malvella sherardiana, E.M, W.It

MIMOSACEAE
Acacia raddiana, Sud

MORACEAE
Ficus pseudo-sycomorus, E.Sud

MORINGACEAE
Moringa peregrina (= M. aptera), E.Sud

OROBANCHACEAE
Cistanche salsa, IT

POACEAE
Arundo donax, M, IT, EuSib
Arundo plinii, M
Pennisetum asperifolium, S.M, Trop
Pennisetum divisum, SA (trop.afr.)
Phragmites australis, M, IT, SA (Trop)
Piptatherum miliaceum, M (SA, W.IT)
Stipagrostis ciliata, SA, S.Afr

POLYGONACEAE
Rumex cyprius, SA, IT (E.M)

RESEDACEAE
Caylusea hexagyna, E.Sud (SA)
Ochradenus baccatus, Sud (SA)

RHAMNACEAE
Rhamnus dispermus, E.SA

RUBIACEAE
Galium sinaicum, E.SA

RUTACEAE
Haplophyllum tuberculatum, SA

SALICACEAE
Salix acmophylla, E.M, IT
Salix cf. pseudo-safsaf, IT

SCROPHULARIACEAE
Kickxia acerbiana, E.SA

SOLANACEAE
Hyoscyamus aureus, E.SA, W.IT
Lycium shawii, E.SA, E.Sud
Nicotiana rustica (cult.)

TAMARICACEAE
Reaumuria hirtella var. palaestina, E.SA, W.IT
Tamarix nilotica, SA

THYMELAEACEAE
Daphne linearifolia, E.M

URTICACEAE
Forsckaolea tenacissima, E.Sud (Nubo-Sind), SA

VITACEAE
Vitis vinifera

ZYGOPHYLLACEAE
Fagonia bruguieri, SA (IT)
Fagonia mollis var. mollis, E.SA
Peganum harmala, IT, SA (M, S.EuSib)
Zygophyllum dumosum, E.SA

zons with *Tamarix nilotica, Atriplex halimus, Suaeda aegyptiaca, Salsola volkensii, S. baryosma, Phragmites australis* and *Juncus arabicus* on north- and south-facing slopes of Wadi es-Sadeh: ***Suaedetea fruticosae deserti.*** Near the north-facing spring horizon rich vegetation appears: *Salix acmophylla, Pistacia palaestina, Juniperus phoenicea, Daphne linearifolia, Colutea istria, Ochradenus baccatus, Ephedra aphylla, Asparagus stipularis, Inula viscosa, Cistanche salsa,* even *Vitis vinifera* are growing there. On the south-facing slope plants had been burned in 1987. In 1988 *Phragmites australis, Juncus arabicus, Suaeda aegyptiaca* (many individuals, pioneer?), *Aizoon hispanicum* appeared.

The following units with small extension are not shown in the map:

8a. Vegetation on rocky sandstone areas with *Juniperus phoenicea, Pistacia palaestina* and *P. khinjuk* in shady creeks (upper part of Wadi es-Sadeh, Wadi Umm el-'Ala and wadi south-west of Umm el-'Ala). This unit resembles the ***Juniperus phoenicea-Pistacia atlantica-Ass.*** of Zohary 1973. Zohary wrote in a footnote to *P. atlantica:* "mostly *P. khinjuk*". Zohary put his association to ***Quercetea calliprini.***

8b. Together with these trees at the feet of slopes and on rock faces grow *Rhamnus dispermus, Eryngium glomeratum, Centaurea eryngioides, Chiliadenus montanus, Iphiona mucronata, Onopordum ambiguum, Globularia arabica, Galium sinaicum, Alkanna orientalis, Teucrium polium, Helianthemum sanctiantonii, H. lippii.* In the eastern part of Wadi Umm el-'Ala at the feet of shady sandstone rocks the holotype of *Origanum petraeum Danin sp. n.* (Danin 1990) was discovered in 1988. This species differs from *O. dayi* and *O. ramonense* in its bilabiate calyx and its multicellulate hairs.

This unit resembles the ***Varthemietea iphionoidis deserta*** (Danin, Orshan and Zohary 1975), which is the richest plant community in the desert.

9. In Wadi es-Sadeh opposite of the Umm el-'Ala massif on a sunny Quartzporphyry slope *Moringa peregrina,* a little tree with rod-like twigs, grows together with *Hammada salicornica* and *Forscaolea tenacissima.* 200 m to the east, also on a gravelly Quartzporphyry slope, *Ochradenus baccatus, Lavandula pubescens, Cucumis prophetarum* and *Forscaolea tenacissima* appear: they belong to ***Acacietea tortilis subsudanica.***

10. In the neighbourhood of the probably perennial waterfall in the eastern part of Wadi es-Sadeh and above a large water reservoir in the upper part a unit consisting of *Adiantum capillus-veneris* and mosses grows: ***Adiantetea capilli-veneris.***

Phytogeographical analysis

The collected species can be related to the phytogeographical territories in Table 3.

Mediterranean species were found in shady wadis and on north-facing slopes of rocks, mainly in the sandstone area, excepting *Drimia maritima.* This species was seen in all parts of the region.

Irano-Turanian species were seen on sandy wadi ground, on high elevations in sandstone areas and on rocky tops and upper parts of slopes in Upper Cretaceous material.

Saharo-Arabian species grow over the whole examined area, with less participation in the sandstone area.

Most of the Sudanian species settle in regions with Quartzporphyry underground excepting *Ochradenus baccatus* and *Acacia raddiana. Ochradenus* also grows on wadi ground in the sandstone area and near the north-facing spring horizon.

Most of the collected species belong to Saharo-Arabian territory. That demonstrates that most parts of the examined region belong to the "moderate desert". Because of the neighbourhood of the

Table 3: Phytogeographical analysis of the collected species.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of ssp.	32	11	12	9	3	9	4	1	8	1	1	1
Percentages	35	12	13	10	3	10	4	1	9	1	1	1

I = Saharo-Arabian (SA), II = Irano-Turanian (IT), III = Mediterranean (M), IV = Sudanian (Sud), V = M/SA, VI = IT/SA, VII = SA/Sud, VIII = Sud/African, IX = M/IT, X = Oro-M, XI = Pluriregional, XII = Eurosibirian/M/IT

Edomite mountains in the east and Wadi 'Arabah in the west, a greater number of Irano-Turanian and respectively Sudanian species are mixed with the dominating desert plants.

Conclusion

The result of the survey is that, according to its flora, the region belongs to the "moderate desert". Regular agriculture without irrigation seems hardly feasible. Due to the advantageous water supply, however, human communities were able to survive over long periods in ancient times.

A species "new to science" was discovered during the survey: *Origanum petraeum Danin.* It was seen later also in the Jabal ej-Jathum massif.

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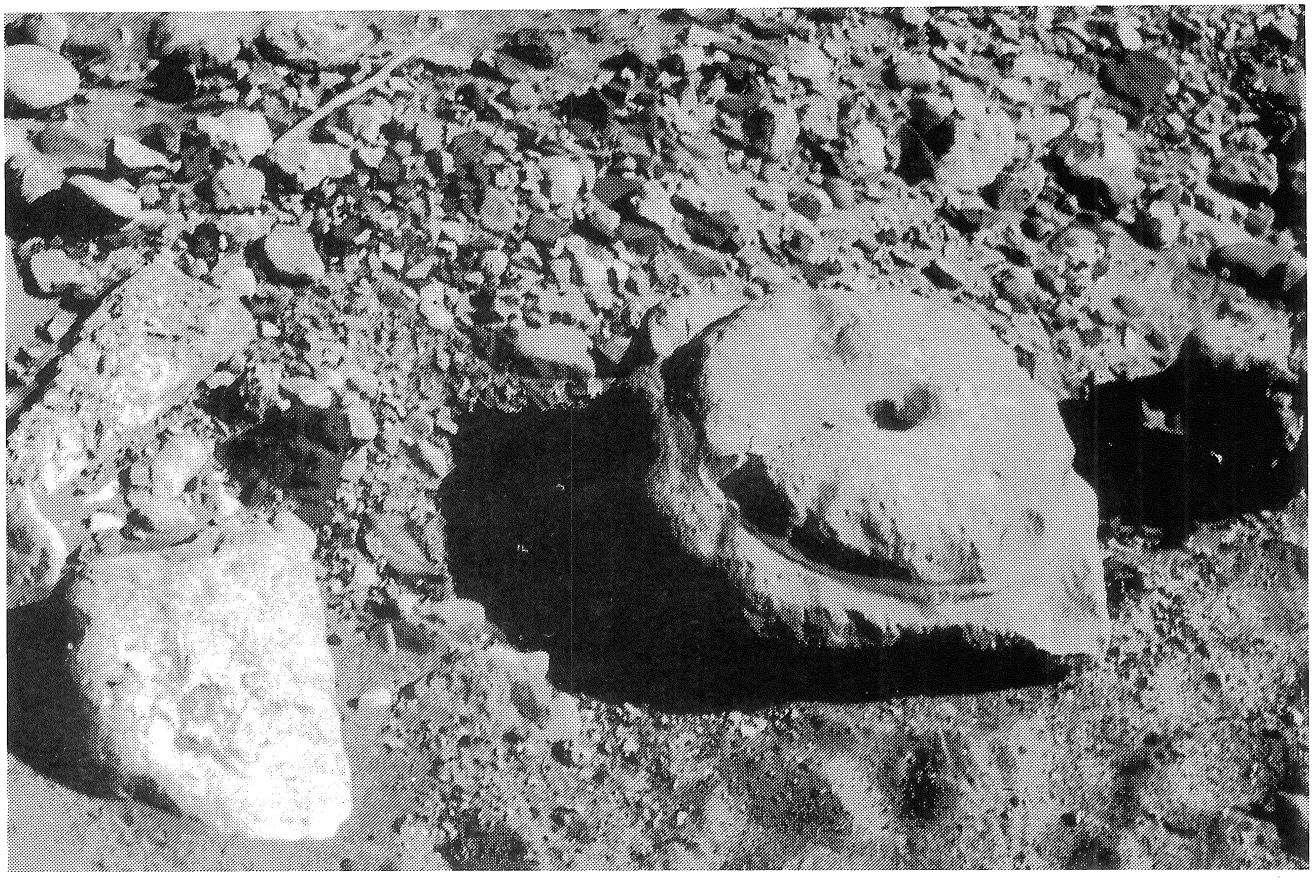
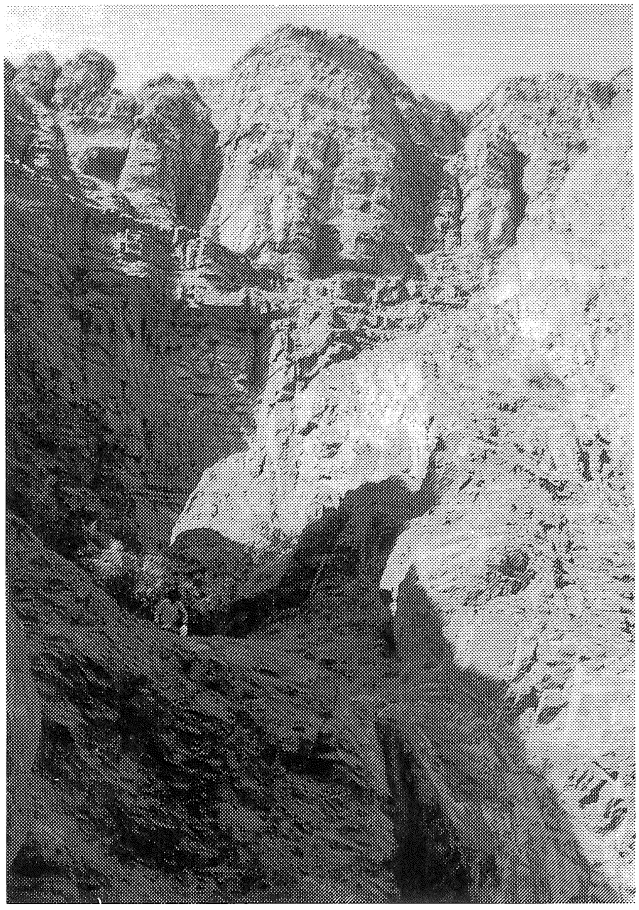
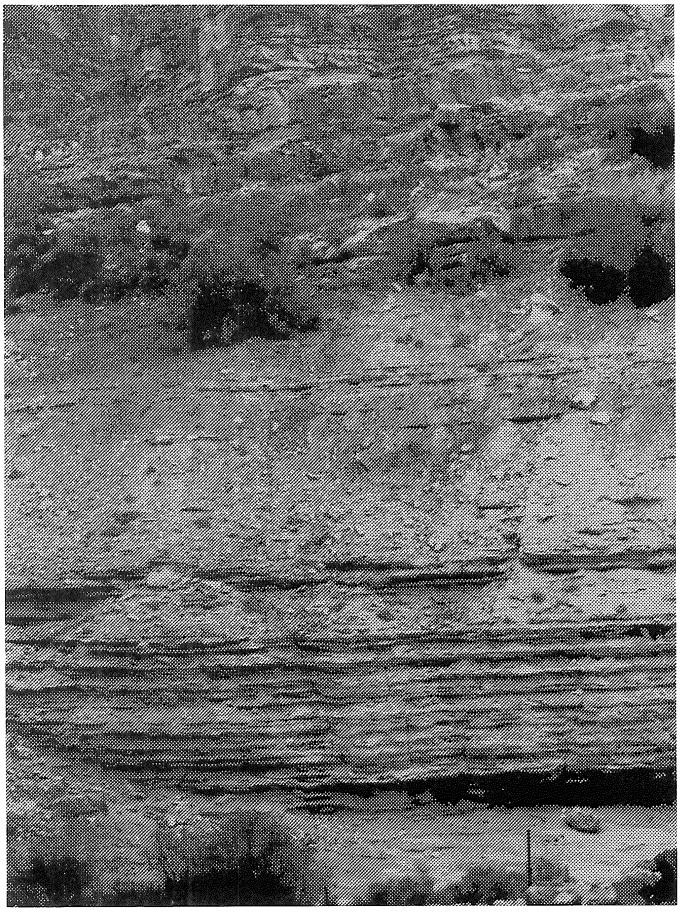


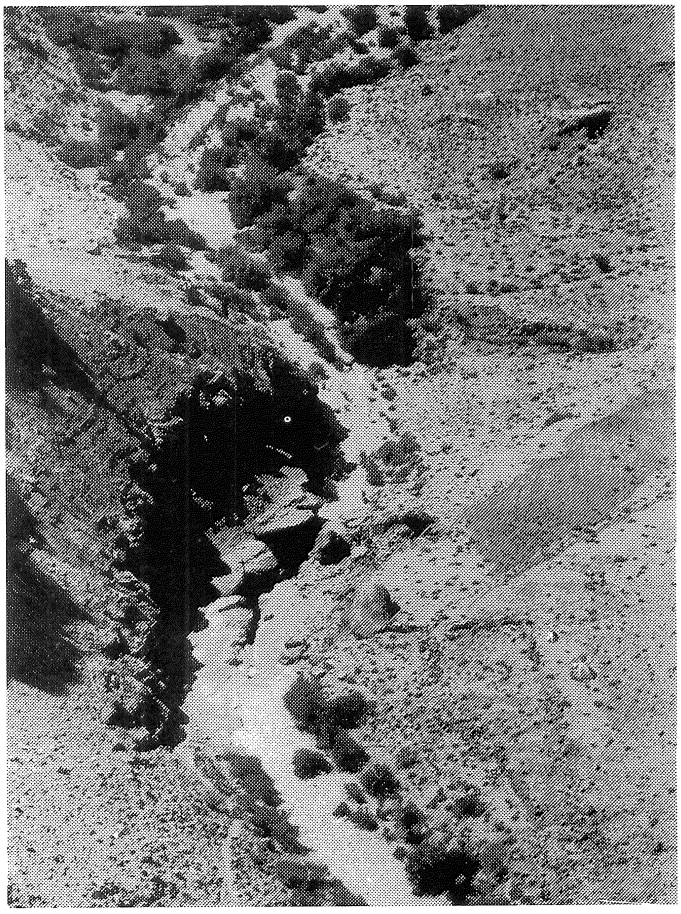
1. Ionic capital found 5-6 km down the wadi from Ṣabra.



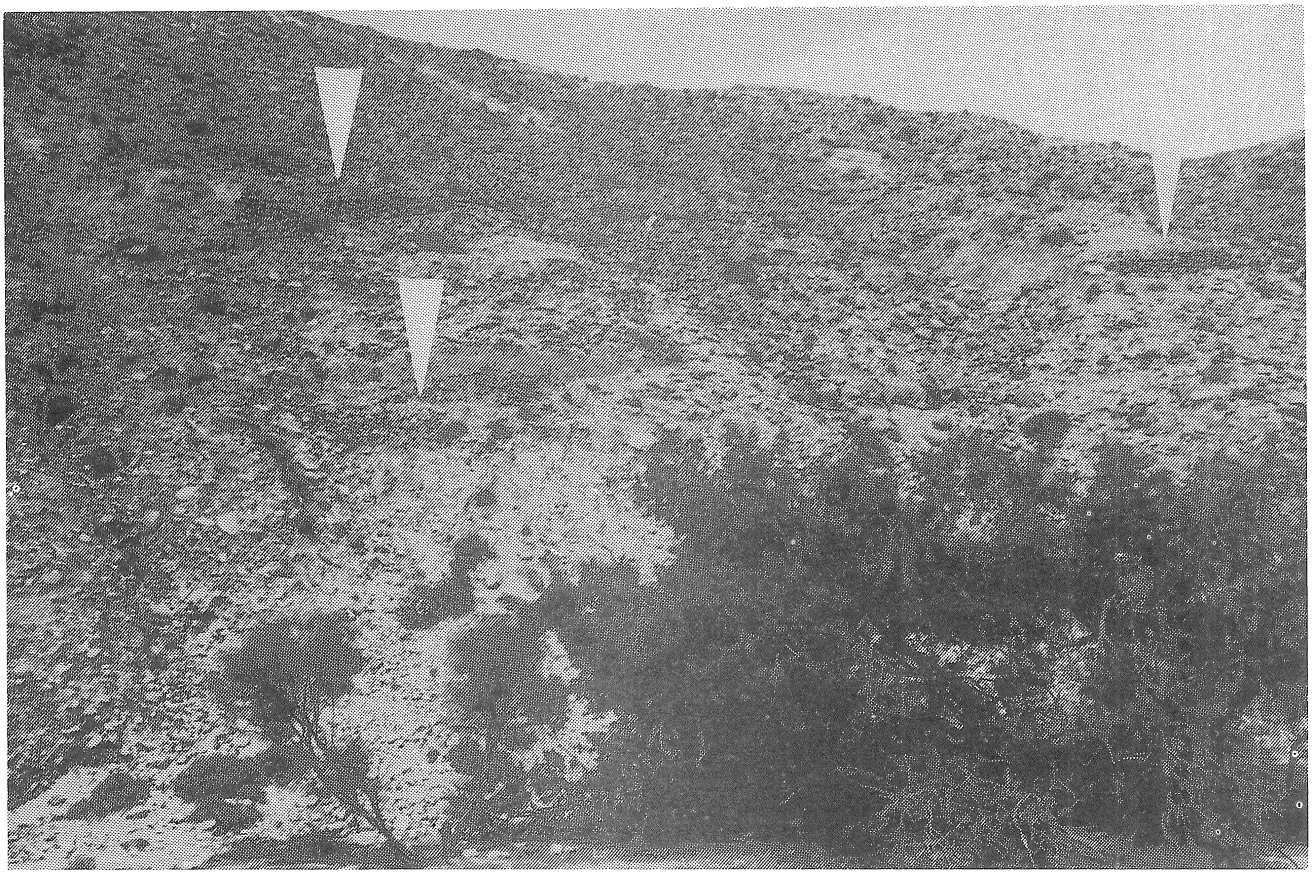
2. Crater-like gorge between upper and lower Wadi es-Sadeh with basins and cascades.



1. Verdant site at the cliff of the plateau of Umm el-ʿAla.

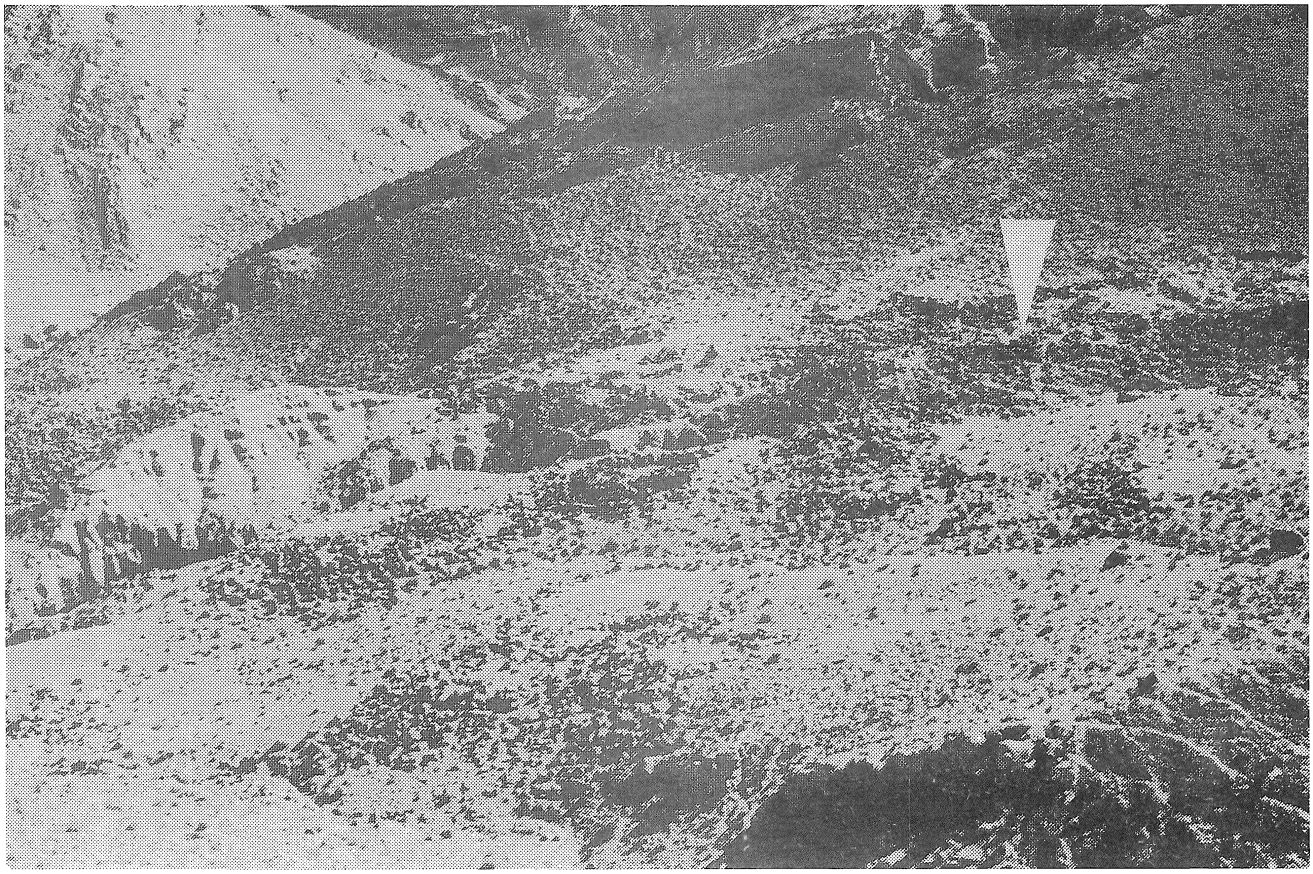


2. Centre of the es-Sadeh valley with the camp-site, the gorge the big hishi field and the track to the upper Wadi es-Sadeh (left lower corner).

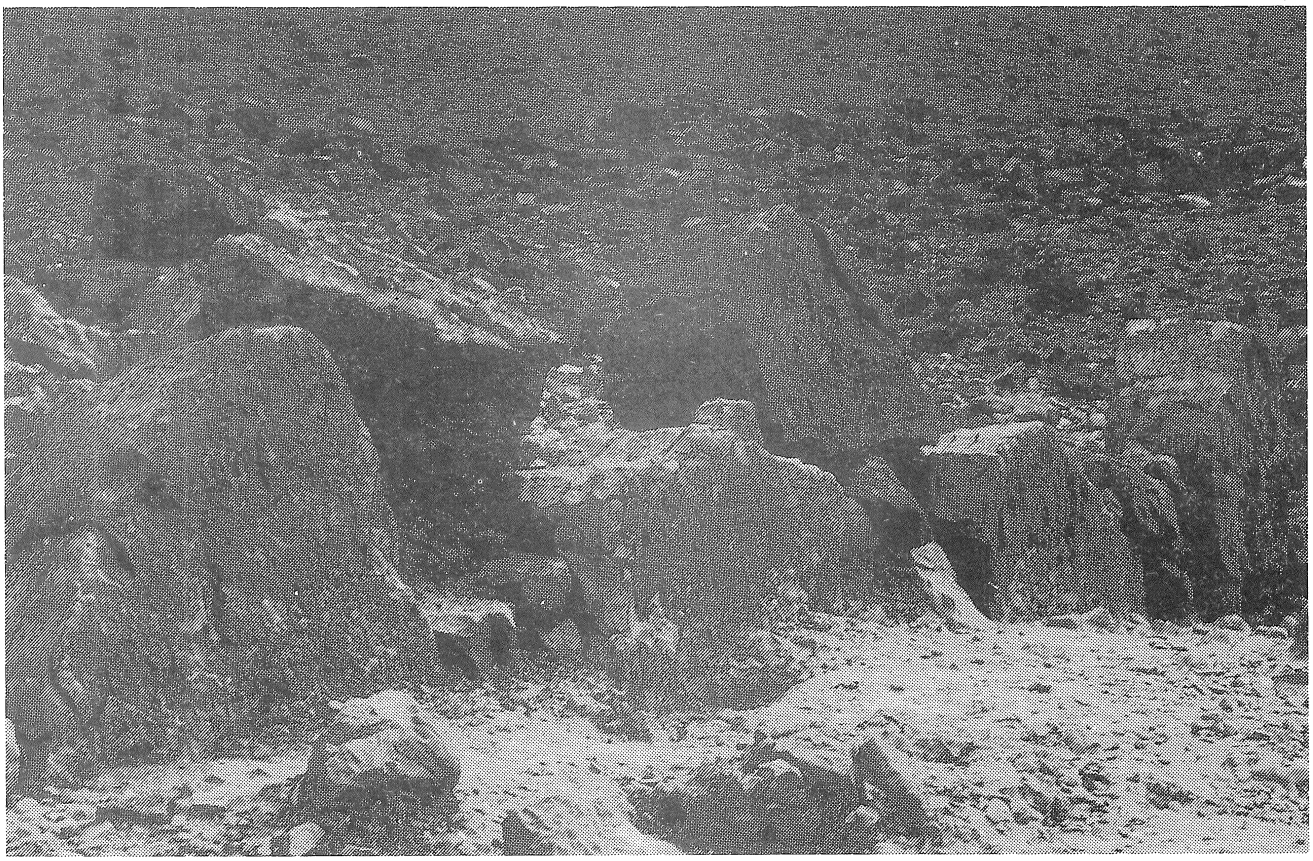


1. Slope walls at the north bank of Wadi es-Sadeh.

2. Location of the EB settlement of es-Sadeh above the cliff of alluvial deposits; looking from NW.



1. Early Bronze Age settlement on the south bank of es-Sadeh with the location of the sounding marked by an arrow.



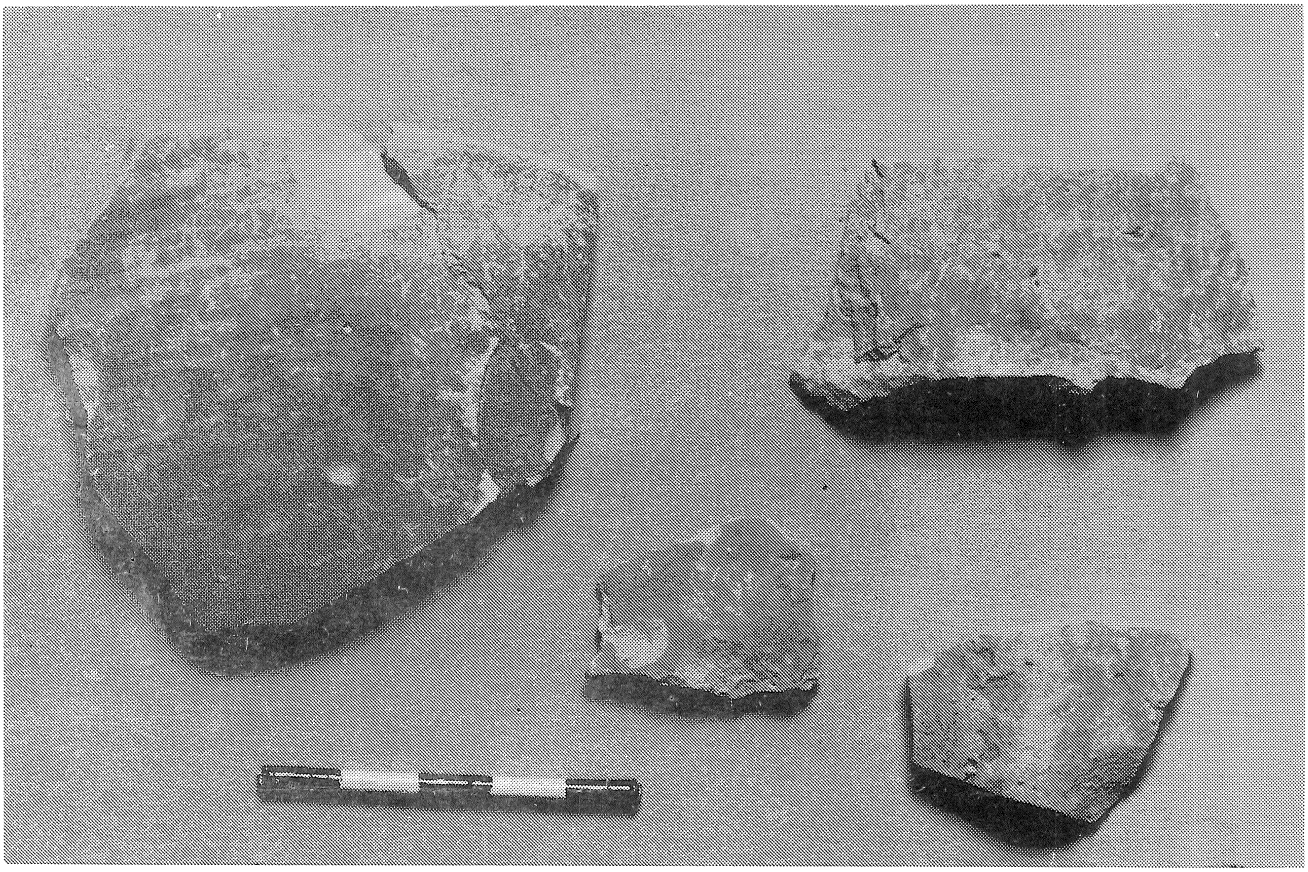
2. Wall near the present rut through the EB settlement of es-Sadeh.

1. Tumbled wall of a house in the EB settlement of es-Sadeh.

2. Surface pottery of the EB settlement of es-Sadeh.

1. Sounding at the EB settlement of es-Sadeh. Stratum II with the double wall.

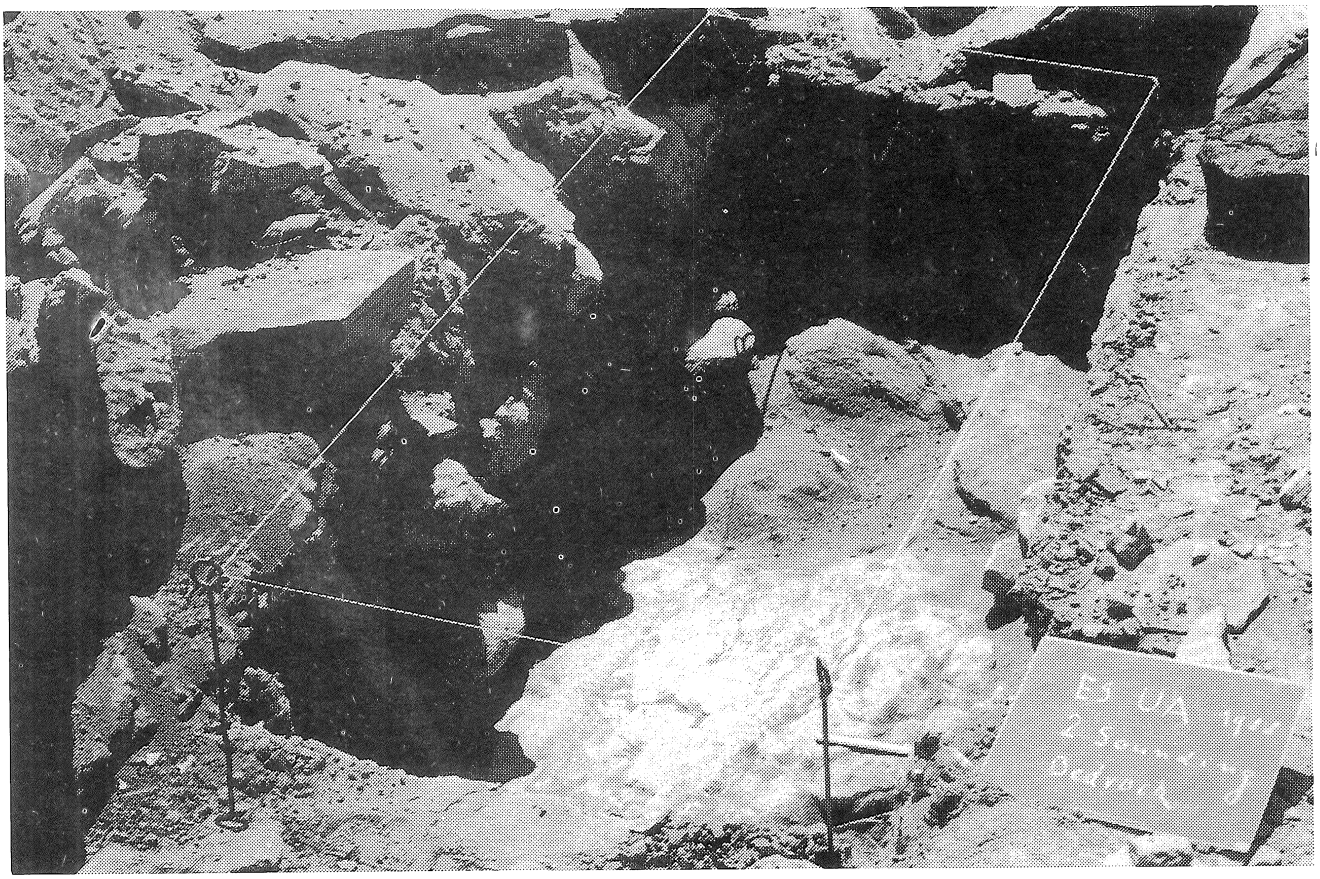
2. Sounding at the EB settlement of es-Sadeh. Stratum III with the storage jar being taken out.



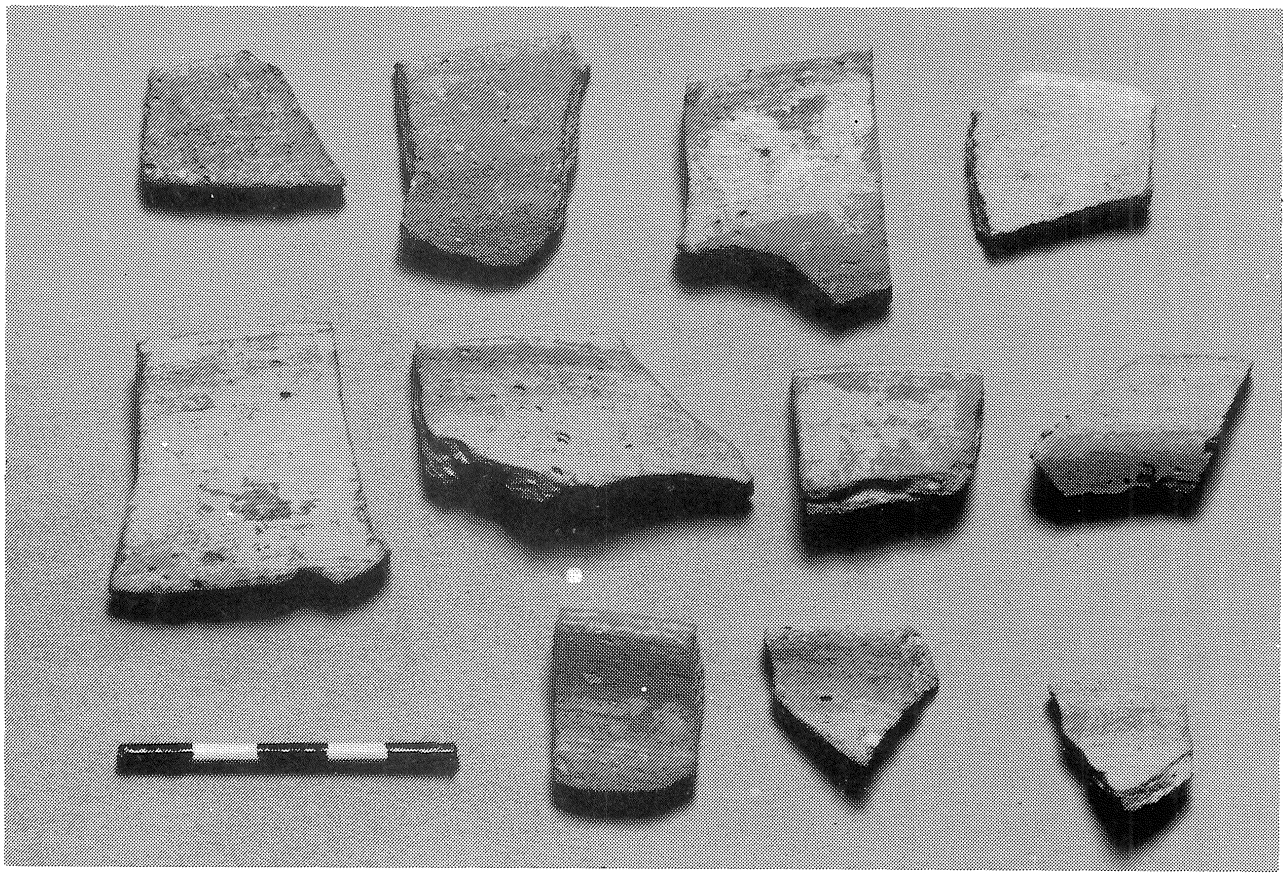
1. Pottery from the sounding in the EB settlement of es-Sadeh.

2. Rock-shelter ("abri") house below the southeast rim of the Umm el-'Ala plateau.

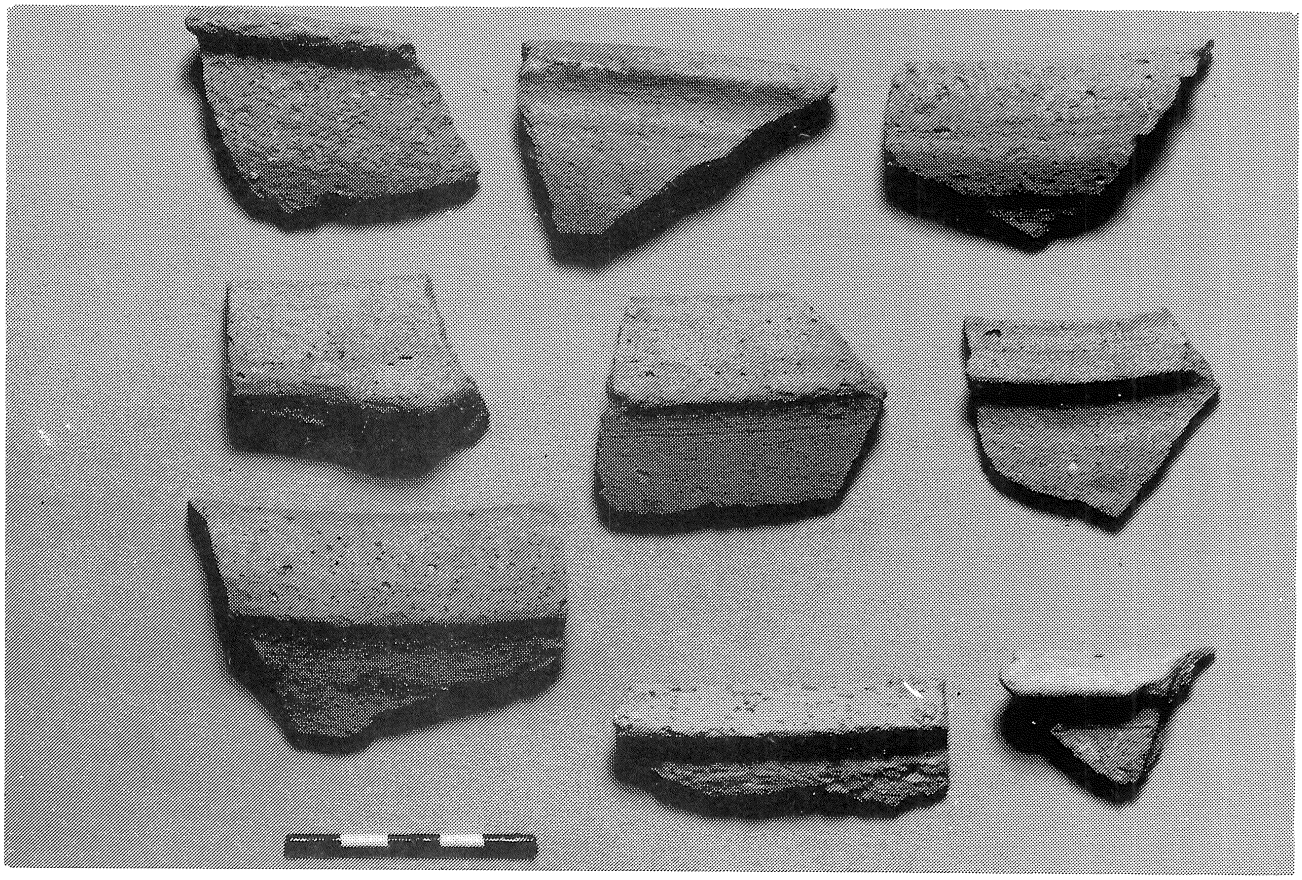
1. Rock-shelter dwelling below the rim of the Umm el-'Ala plateau.



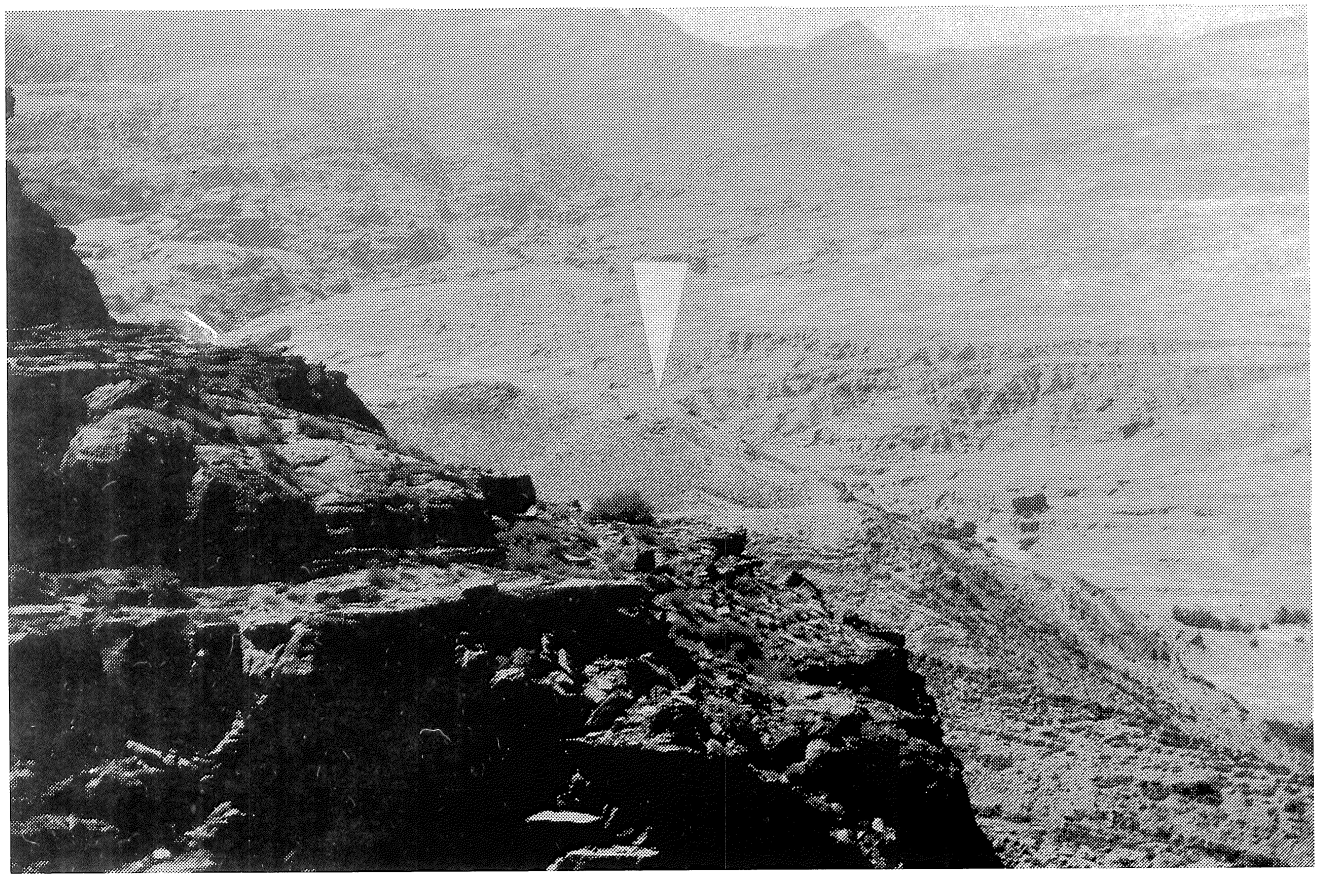
2. Sounding down to bedrock in Building I of the longhouses on the Umm el-'Ala plateau.



1. Iron II (Edomite) pottery from a sounding on the Umm el-'Ala plateau.

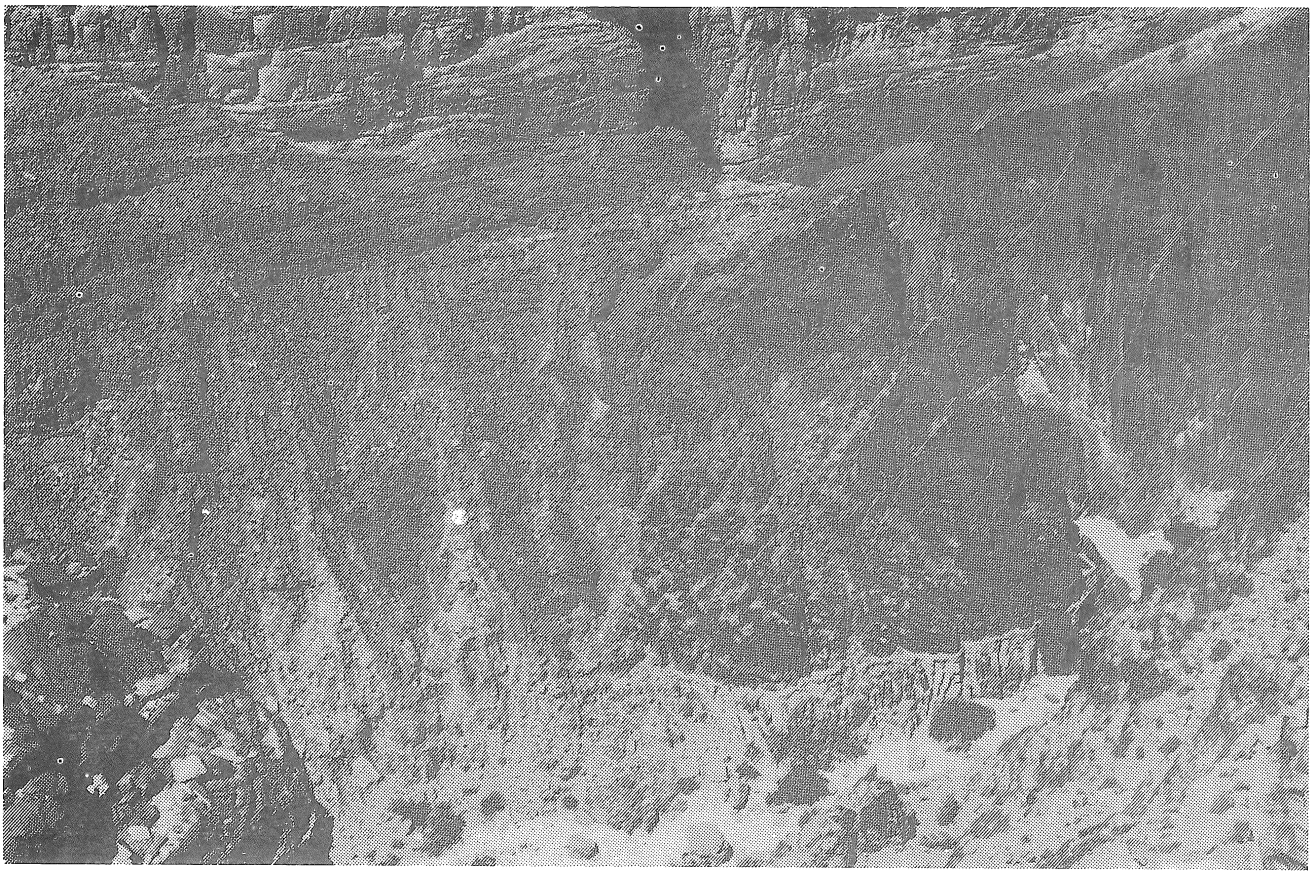


2. Iron II (Edomite) surface pottery from the Umm el-'Ala plateau.

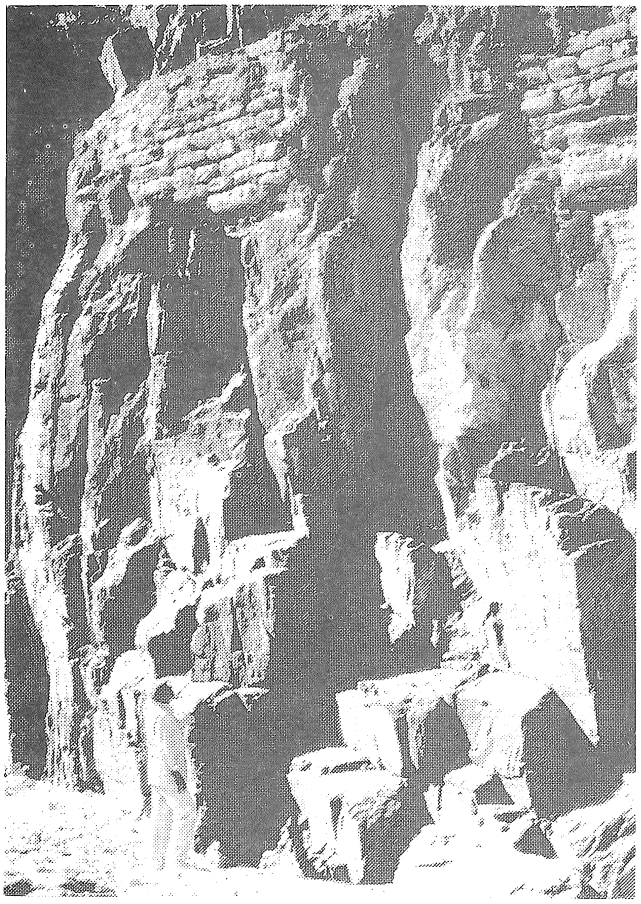


1. Location of the "temple" mountain seen from the Umm el-'Ala plateau.

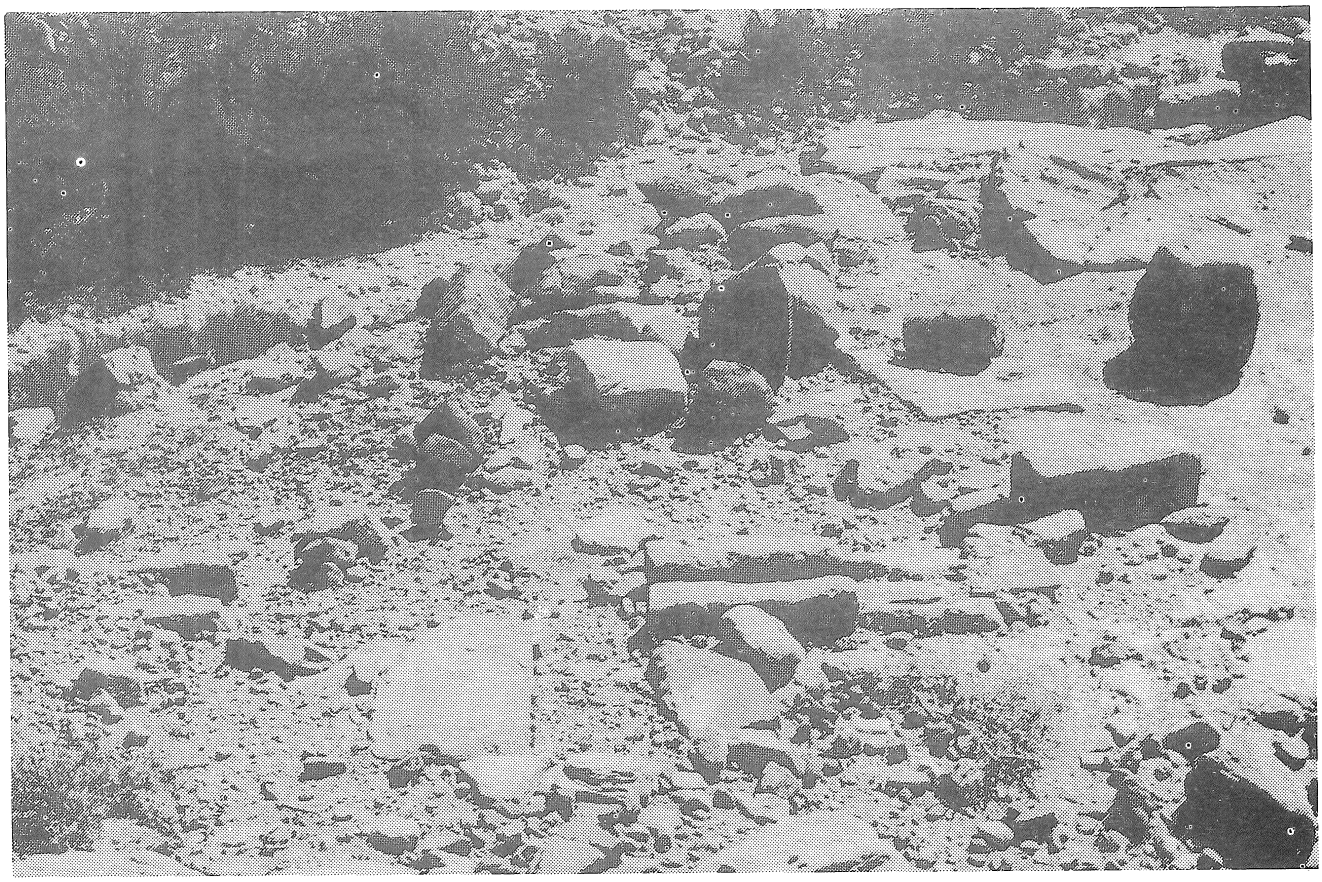
2. Nabataean pottery from the "temple" mountain.



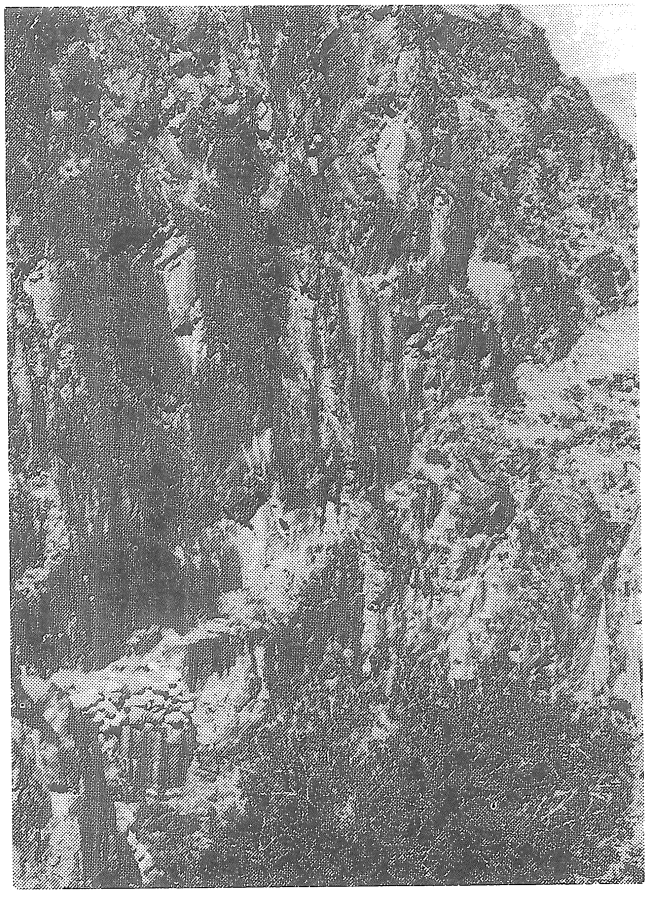
1. Conduit of es-Sadeh from the arch to the destroyed section at the sandstone slope.



2. Section of the conduit of es-Sadeh with massive substructures at the porphyry cliff.



1. End of conduit with the last guttering stones still *in situ*. Large ashlars to the right mark the front wall of the cistern or reservoir.



2. Remains of a conduit at Wadi Umm el-'Ala, which was either not finished or later destroyed.