TEST SOUNDINGS OF ARCHAEOLOGICAL AND RESISTIVITY SURVEY RESULTS AT RUJM AL-ḤENU

by
Patrick E. McGovern

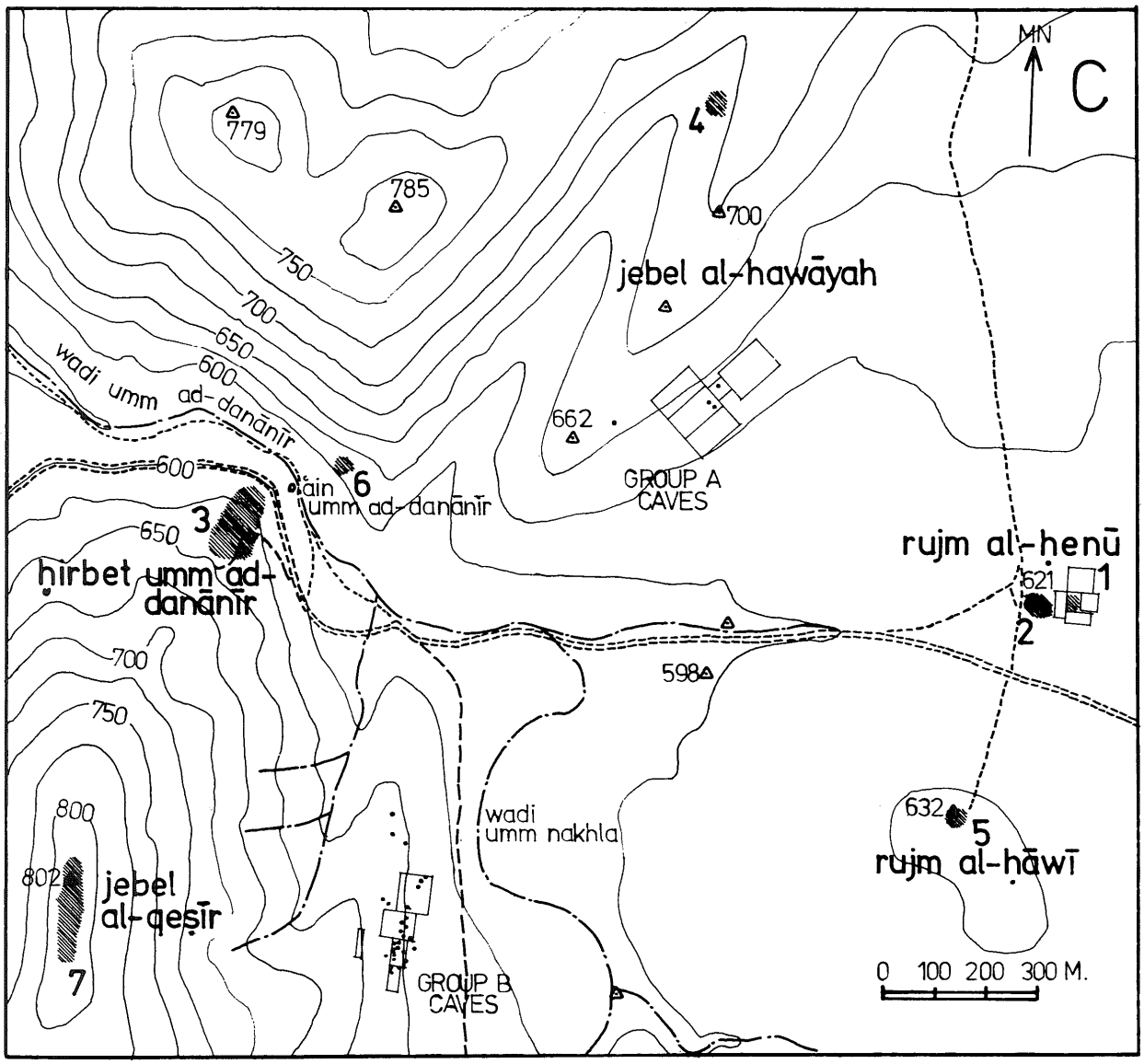
Introduction

Because of ongoing development and the destruction of ancient sites in the Baq'ah Valley, now virtually a suburb of Amman, the Baq'ah Valley Project from its inception has sought to recover the maximum amount of representative archaeological data with the least expenditure of time, manpower, and finances. Thus, there has been a very conscious effort to develop specific working hypotheses that can be tested in a relatively straight forward fashion, utilizing the full battery of techniques that modern scientific archaeology has to offer (McGovern, 1980a). Although alien to Middle Eastern archaeology in which the traditional practice has been to excavate a single major site, such an approach is desirable as much for theoretical as for strictly economic reasons (cf. Dever, 1980: 46-74).

The Baq'ah Valley is a logical geographical unit for study, since it is a fertile, well-watered plain surrounded by barren hills. Indeed, the flat, relatively self-contained valley sharply contrasts with the standard Transjordanian plateau topography of deeply cut gorges descending to the Jordan Valley (Pl. XI; Bender, 1974: 6-11, 114-15). Evidence for human occupation, reaching back to the late Middle Paleolithic (*ca.* 45,000 B.P.) and virtually continuous up to the present, is especially prominent in the northwestern Umm ad-Danānīr region of the valley where the density of perennial springs is among the highest on the plateau (Hashemite Kingdom of Jordan and the Federal Republic of Germany, 1977: 1-7, Map HG 4.2N). In addition, the Umm ad-Dananir region is strategically located along probable ancient routes running north to Syria and northwest to the Jordan Valley via the Wadi Umm ad-Dananir.

The region originally attracted our attention because of a series of over thirty Late Bronze (LB) and Iron (Ir) IA burial caves on Jebel al-Hawayah and Jebel al-Qesir. These were possibly related to one of the "megalithic" buildings nearby, specifically the eastern structure at Rujm al-Ḥenu (Fig.1: site 1), which is located 500 to 1600 m. east of the caves and an associated settlement site at Hirbet Umm ad-Dananir. The surface ground plan and construction technique of Rujm al-Henu East (Fig. 2; Pl. XII, 1) resemble that of the LB Amman Airport Building (Hennessy, 1966: figs. 1-2, pl. 33A), 15 km. to the southeast. Until it was destroyed to clear a path for a jet runway, the airport building was the prime example of the *Quadratbau* architectural type on the East Bank (Wright, 1966; 1968; 1971a; 1971b). As the name implies, *Quadratbau* structures have a square layout with a central unit ("courtyard") surrounded by outer rooms. The type also occurs west of the Jordan at Hazor (remnants only; Yadin, 1972: 98-100) and on Mt. Gerizim (Boling, 1969: 84; 1975: 33-35), which date to LB I and Middle Bronze (MB) IIC-LB I, respectively. Although the surface ground plan of Rujm al- Ḥenu (E) is only approximately a square and is not fully defined on the interior, it offered the possibility for investigating another building of this type.

The Amman Airport Building with its rich deposits, including scarabs and cylinder seals (Ward, 1964), gold jewelry, Mycenaean vessels, and antique Egyptian and Minoan stone vases (Hankey, 1974), posed a whole series of questions. It was discovered at a time when the nomadic hypothesis of N. Glueck (1934: 138; 1939:



Umm ad-Danānīr Region
Baq'ah Valley, Jordan.

Ref: 1 : 10,000 Zarqa Basin sheets 27/64 & 19/64.
Jordan Department of Lands & Surveys, 1950.

Legend
Site
Grid
Caves
Roads (main) (secondary) (track)
Wadi
Spring
Trig. Point

Fig. 1: Map of Umm ad-Danānīr region

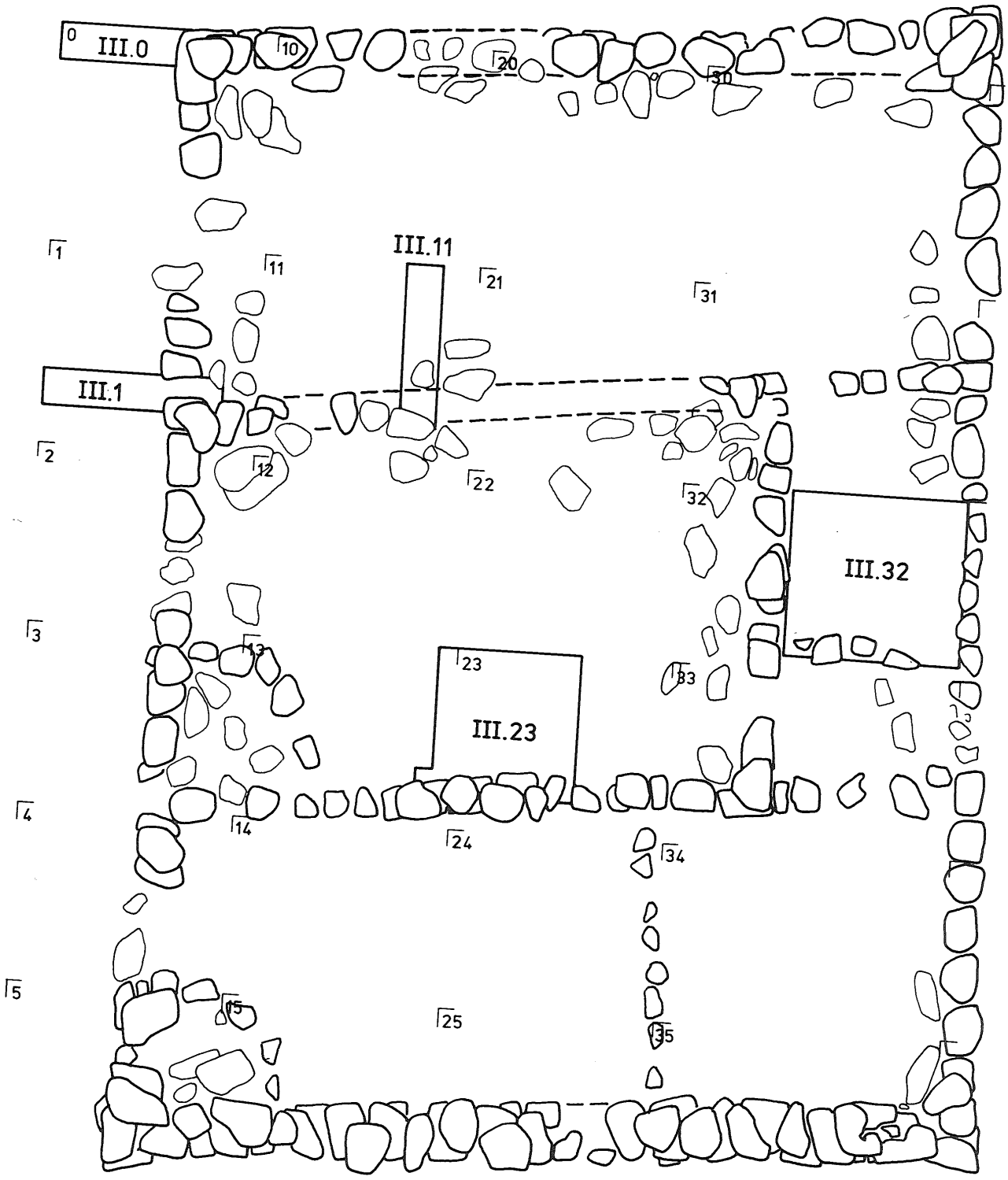


Fig. 2: Rujm al-Ḥenu (E) top plan

264-66; 1940: 124-25) held sway. Based on survey findings, Glueck maintained that all of central and southern Transjordan, south of the Wadi Zarqa, was essentially devoid of permanent settlements throughout the MB IIA-C and LB periods. Instead, nomads and/or "semi- nomads" (cf. Spooner, 1973: 3-4, 19-21, 42 [n.6] for modern anthropological distinctions) occupied the Transjordanian plateau. Since there was little evidence for a permanent settlement in the immediate vicinity of the Amman Airport Building (Hennessy, 1966, 1970; Herr, 1977), it was proposed that the building might have been a tribal shrine, possibly a temple or mortuary cult structure. and related to early biblical traditions (Campbell and Wright, 1969). By extension, other examples of the *Quadratbau* class could be similarly explained.

It should be stressed from the outset that functional interpretations based primarily on architectural analogies are often suspect. For example, Albright (1960: 36, 92-93) interpreted the Mt. Gerizim structure as a villa or patrician's house. Ground plans of later domestic structures at Beth Shan, Tell es-Sa'idiyeh, and Tell Far'ah (S) also appear to be of the *Quadratbau* type (Fritz, 1971).

The constantly accumulating evidence for an advanced culture in the MB and LB periods, especially from tombs (Dajani, 1966; Harding and Isserlin, 1953), prompted Glueck (1951: 423; 1970: 141) to modify his position by arguing for a contraction of urban life to a smaller number of major sites. While some (Albright, 1960: 82) concurred with this judgment, others still felt that it did not go far enough, particularly for the region north of Madaba (Harding and Isserlin, 1953: 14; Harding, 1967: 32-34; Ward, 1964: 47, 1973: 45-46; Ward and Martin, 1964: 19-22; Franken, 1970: 7-9; Zayadine, 1973: 19-21; Thompson, 1974a: 193-94, 1974b; Weippert, 1979: 25-26). Recent excavation of LB remains at the site of Sahab (Ibrahim, 1972; 1974; 1975a; 1975b), southeast of Amman, surveys in Moab (Miller, 1978: 51; Ibach, 1978), and evidence for MB and LB remains at the Amman Citadel (Dornemann, 1970), Tell Safut (Ma'ayeh, 1960: 114), and Ḥirbet Umm ad- Danānīr (LB level reached in the 1981 field season) support the view that there was a moderate concentration of variously sized, well-established communities on the central Transjordanian plateau (cf. Zayadine, 1973: 72, Map 6).

As a first step toward possibly elucidating these problems in the Umm ad- Dananir region, an intensive archaeological and geophysical survey was carried out in 1978 (McGovern, 1980a). An exhaustive collection of surface artefactual materials at Rujm al-Ḥenu produced three transitional MB/LB diagnostic sherds from the central room of the eastern building. Since no other MB/ LB sherds were found within 500 m. of the structure and in view of a number of architectural considerations (below), it then appeared probable that Rujm al-Ḥenu (E) belonged to the *Quadratbau* class.

Concurrently, a resistometer was used to investigate buried remains inside and in the immediate vicinity of the building. While no additional interior crosswalls were indicated, the resistivity data did suggest a wider area of occupation.

In the 1980 season, the survey was followed up by archaeological soundings to test the various hypotheses described above and others implied by the survey data. For example, to what extent did the surface sherding evidence actually reflect cultural sequences? Did specific resistivity patterns ("signatures") correlate with walls, pits, or other archaeological features?

Archaeological Survey

Methodology

Earlier surveys by Glueck (1939: 191-200) and de Vaux (1938) had successfully located many sites in the Baq'ah Valley, but their work was partly vitiated by inadequate descriptions, a then poorly understood pottery sequence for Transjordan, and a methodological approach mainly relying on native informants and obvious surface remains.

Our 1978 survey sought to recover a more truly representative sampling of cultural materials in accord with statistical models (Watson, LeBlanc, and Redman, 1971: 121-25; Ragir, 1967: 181-87; Haggett, 1966; Hodder and Orton, 1976: 20). Otherwise, less conspicuous remains (e.g., remnants of architecture, small clusters of non-descript sherds or flints) might be overlooked. Even with such precautions, a surface collection can be highly skewed in a non-representative fashion because of the relative closeness of specific cultural levels to the surface, erosional processes, modern disturbance, and other factors.

The initial phase of the Umm ad-Dananir survey involved systematically traversing the relatively small area (52.5 hectares) between Jebel al-Hawayah and Jebel al-Qesir on the west and Rujm al-Henu and Rujm al-Hawi on the east (Fig.1). Base lines were set up by theodolite readings from benchmarks of the 1:10,000 Zarqa Basin Map (Department of Lands and Surveys of Jordan, 1950). Groups of three to five individuals then traversed two meter wide strips between the base lines. They walked slowly side by side, covering half a kilometre per hour, and collected as much artefactual material as possible at this speed. The level of discrimination was adequate to locate concentrations of three or more artefacts and small isolated features.

Seven of these artefact clusters, which were associated with architectural remains, could be designated "sites." Groups of sherds were also found randomly distributed in the Umm ad-Dananir fields where they had evidently been spread by agricultural activity. In contrast, sites were isolated from fields on hills bordering the valley or on bedrock outcrops. Rujm al-Henu (W) belonged to the latter class.

In the second phase of the survey, exhaustive surface collections of artefacts were gathered at each site, which was only possible because of the limited number of small (less than 2.50 hectare) sites in the Umm ad-Dananir region. Where larger sites and survey areas are covered, systematic or random sampling techniques are required. In the case of Rujm al-Henu (E), survey units were defined by the architectural layout of interior rooms; peripheral units extended out five metres from the walls of the building. A single form, modeled after the site survey record sheet in Hester, Heizer, and Graham, 1975: 24, was used to record details of site names, location, ownership, description and sketch, vegetation, soil, nearest water, structures and possible stratification, and miscellaneous features.

Rujm al-Henu (E)

Descriptions of Rujm al-Henu (E) by Glueck (1939: 194) and de Vaux (1938: 420-21) were necessarily brief, and require some correction of detail. De Vaux's schematic drawing (1938: fig.8) of the eastern building at Rujm al-Helu *(sic)* shows a rectangular main structure whose central room is defined on the west by the exterior wall. It is oriented north- south, and lacks crosswalls and entrance(s). Although de Vaux states that the approximate outer dimensions of the building are 20.00 x 40.00 m., the ratio of width to length on the drawing (0.68) is greater than 0.5.

A careful plan of the building (Fig.2) revealed that the eastern and western walls of Rujm al-Henu (E) are actually bowed inward, so that the northern and southern walls measure 23.00 and 24.50 m., respectively. The approximate north-south external length of the structure is 31.00 m., (cf.Glueck's measurements — 23.00 x 33.00 m.).

At least three crosswalls are visible on the eastern and southern interior, and arcs of stones delimit areas in the southwestern corners of three rooms. The structure may have been entered from the west where boulders are lacking at three uniformly spaced points (Pl. XIII, 1).

The main walls (exterior and central unit) are composed of huge boulders, the majority over a metre in length and weighing as much as a ton. They are of native limestone, reddish Nubian sandstone, and flint, which may have been hauled from *wadi* beds or possibly quarried from hillsides (Pl. XVIII, 2).

Although now badly weathered, the stones may have been roughly hewn to size and shape. Single lines of the boulders were dry-laid one on top of another with a packing of cobbles. Only one or two courses are visible, except in several corners where three courses are built up in a crude header and stretcher fashion. In contrast to the main walls, smaller stones (less than a metre in length) had been used for inner crosswalls and the corner arc-shaped enclosures, which suggested that they were secondary. The depth of soil accumulation inside and outside the building could not be ascertained, so that visible boulders might either be upper courses of buried walls or parts of the foundation.

Glueck (1939: 194) broadly dated Rujm al-Ḥenu (E) to Early Iron I-II (*ca.* 1300-600 B.C.; for a pre-1200 B.C. beginning of the Transjordanian Iron Age, see Glueck, 1939: 240 and Weippert, 1979). The surface sherding evidence from the 1978 survey considerably expanded this dating, according to the following diagnostic counts: 3 MB/LB (*ca.* 1650-1480 B.C.), 2 LB/Ir (*ca.* 1400-1100 B.C.), 6 Ir IIC/ Persian (P) (*ca.* 700-500 B.C.), 7 Late Roman (LR)/Early Byzantine (EByz) (A.D. 135-491), 11 EByz (A.D. 324-491), 1 Umayyad (Umay) (A.D. 661-750), 2 Mamlūk (Mam) A.D. 1250-1516), and 2 Modern (Mod) (after A.D. 1918). The post-Iron Age chronology follows Sauer, 1973: 3-5.

Rujm al-Ḥenu (W)

The western building at Rujm al-Ḥenu has a ground plan (Fig. 3; Pl. XII, 1) which is very different from that of the eastern building. Its layout conforms to the *qasr* architectural type (Glueck, 1939: 153-55) of which there are numerous examples distributed over a 20 km. radius of the Amman Citadel (Glueck, 1939: *passim,* 1970: 180-81; Landes, 1964: 72-76; Gese, 1958; Hentschke, 1960; Fohrer, 1961; Reventlow, 1963; Boraas, 1971; Thompson, 1972, 1973, 1977).

The main features of these buildings are large, rectangular or square enclosures and circular towers *(rujūm malfufah),* which are either incorporated into walls or separated by short distances from the main structures (completely isolated towers also occur-Glueck, 1937: 159). Like Rujm al-Ḥenu (E), *qasr* type buildings are normally constructed of dry-laid boulders of limestone, sandstone, and flint with a rubble chinking.

Glueck (1939: 194) and de Vaux (1938: 421) argued for the contemporaneity of the two Rujm al-Ḥenu structures. A closer examination, however, reveals dissimilarities that may reflect different constructional and occupational histories.

It is true that the eastern and western buildings at Rujm al-Ḥenu (Pl. XII, 1-2) have much in common. Separated by only thirty metres, both buildings are almost exactly oriented to the cardinal points of the compass. Their northern walls are offset by only five metres from a coincident east-west line. Rujm al-Ḥenu (W) also has a layout that is comparable to that of the eastern building, but on a much larger scale. An open central area (courtyard) is surrounded by a corridor, which is possibly divided up into casemate units (cf. the crosswalls in the northeastern and southwestern corners). Three equally spaced gaps in the eastern wall (Pl. XVII, 1) may have been entrances, which would have faced three possible entrances to the eastern building.

De Vaux's sketch (1938: fig. 8) of Rujm al-Henu (W), in addition to the misplacement and omission of walls and entrances, is too elongated north-south. The true dimensions of the building, including the southeast bastion, are *ca.* 46.00 m. north-south and 44.00 m. east-west.

Significantly, the boulders used for the western building are generally smaller (less than a metre long) than those of the main walls of the eastern building, and more closely resemble those employed for the presumed secondary constructions of the latter. Only the circular tower, the southeastern bastion, and several exterior corners of Rujm al-Henu (W) have concentrations of the larger boulders. Moreover, every exposed wall of the western structure is comprised of two lines of stones.

The sherding evidence from the western building also differed from that of

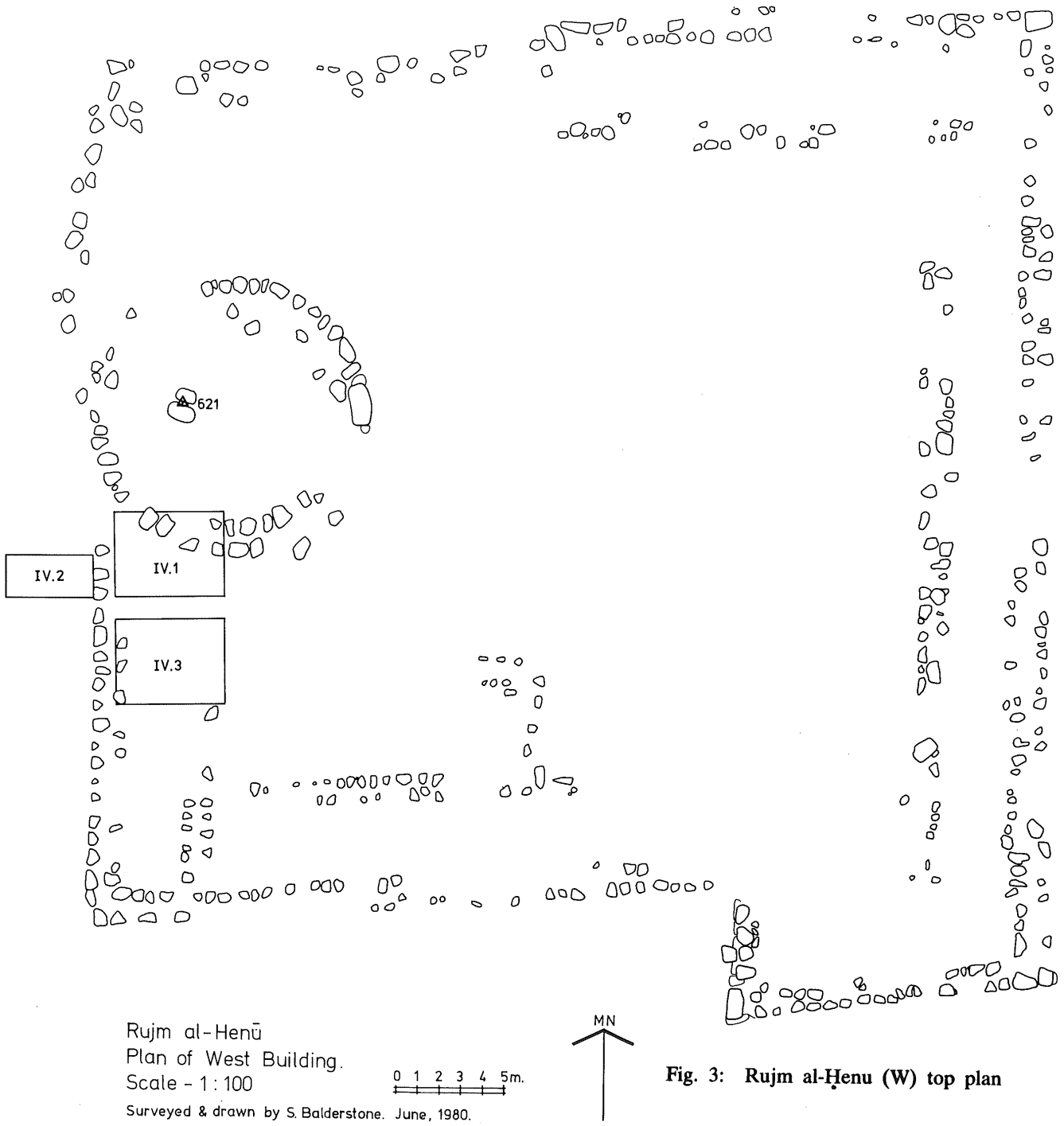


Fig. 3: Rujm al-Ḥenu (W) top plan

the eastern building. Apart from a single LB II (*ca.* 1400-1200 B.C.) diagnostic, the only pre-modern period represented was Iron II C/P (72 diagnostics). The interior positioning of the circular tower with a very limited exposure to the west suggested architectural phasing in which the elaborate *qasr* layout was preceded by an isolated *Rujm malfuf.*

The soil accumulation in and around the western building appeared to be greater than that of the eastern building. The visible structure completely covers the top of a mound, which rises more than three metres above the valley floor and is bordered on the west by large areas of denuded bedrock.

Pre-Excavation Interpretation

Early explorers were understandably intrigued by "megalithic" structures such as those at Rujm al-Ḥenu, which are unique to the southern Gilead region, and dated them to a prehistoric period (Mackenzie, 1911: 39; Watzinger, 1933: 23-24) or Roman times (Conder, 1899: 193). More recent investigation of *rujm malfuf* and *qasr* type structures has pointed to an Iron I (*ca.* 1300-900 B.C.; Glueck, 1937: 19, 1939: 157, 165-66; Landes, 1964: 72 [eleventh century]; Gese, 1958: 56-57) or Iron II (seventh-sixth century B.C.]; Thompson, 1972, 1973, 1977) construction date, although other periods (e.g., Roman—Boraas 1971) have not been ruled out. The Iron I dating, in particular, has not been accepted by those who question Glueck's pottery dating criteria (Franken, 1970; Franken and Power, 1971; Mittmann 1971: 1-4; Weippert, 1979: 28-30). There is general agreement that the *Quadratbau* buildings were constructed in the late MB or early LB period, although they may have continued in use to the end of the Late Bronze Age (e.g., Amman Airport Building).

Functionally, the *qasr* and *rujm malfuf* type buildings have usually been interpreted as fortresses or watchtowers, which protected approaches to Amman (Conder, 1899: 193; Mackenzie, 1911: 25-26; Gese, 1958: 57; Landes, 1964: 72-74; Glueck, 1939: 163, 165-67, 1970: 183). An alternative hypothesis, not necessarily mutually exclusive from the watchtower hypothesis, is that such buildings served as habitation quarters for the rural Ammonite population (Glueck, 1939: 163). Their spatial distribution suggests a settlement pattern for maximally exploiting the arable agricultural land in the Amman area. Ḥirbet Muḍmar (Pl. XIX,2), which is located less than a kilometre southwest of Rujm al-Ḥenu in the middle of the Baq'ah, exemplifies the complementary relationship of agricultural, and domestic functions. The large complex of massive, bastioned buildings was erected on bedrock outcrops, surrounded by fertile fields, and could have housed a considerable population.

In the case of the two buildings at Rujm al-Ḥenu, differences in architectural details and overall layouts, as well as surface sherding evidence, suggest divergent constructional and occupational sequences. Assuming the eastern buildings were constructed sometime in the late MB or early LB period, Iron II C/P inhabitants of the region might have sited another building to the west, in order to obtain more easily large boulders for important structural elements (corners and towers). At the same time, the eastern building was not completely dismantled, but might have continued to be used (e.g., as an animal enclosure); easy access back and forth between the structures would be provided by facing entrances.

Rujm al-Ḥawi (Fig. 1: Site 5). which is situated about 350 m. southwest of Rujm al-Ḥenu on the other side of the modern road, bears importantly on the question of the temporal relationship of the Rujm al-Ḥenu buildings. Its main structure is virtually the mirror-image of Rujm al-Ḥenu (W), yet there is no building on the surface that matches Rujm al-Ḥenu (E). Double lines of limestone, sandstone, and flint boulders (less than a meter long for the most part) make up its outer walls. The rectangular building, which measures *ca.* 50 m. north-south and 30 m. east-west and is aligned to the points of the compass, has a circular tower

incorporated into its western wall (Pl. XX, 1) and a square bastion on the north (Pl. XX, 2). Surface pottery was equally divided between the Iron II C/P and Byzantine periods.

Rujm al-Henu (W) and Rujm al-Hawi may have been contemporaneous border posts. If an ancient route followed the line of the modern road, their circular towers would look west along the route toward a northwestern pass (Wadi Umm ad-Dananir) while their bastions would face one another and be approximately equidistant from the route. This proposal stresses the defensive nature of the towers, but need not exclude a concomitant domestic function. The first line of defenses was probably at Ḫirbet Umm ad-Danānir where Iron II C/P structures have recently been excavated (P1. XIX, 1).

Only Rujm al-Ḫenu (E) produced sherding evidence for activity in the Late Roman, Early Byzantine, Umayyad, and Mamlūk periods, which may have included the rebuilding of walls and adding secondary installations. Today, both structures at Rujm al-Henu are used primarily as dumping grounds.

The Resistivity Survey at Rujm al-Ḫenu East

Logistics

Based on the pre-excavation interpretation of Rujm al-Ḫenu (E) possibly belonging to the *Quadratbau* class, was it an isolated shrine used by nomads/ "semi-nomads" (see Introduction) or was it part of a larger settlement? While the nomadic shrine hypothesis might only be resolved by excavating identifiable cultic remains (altars, distinctive artefacts), the question of the building's isolation from an associated settlement could be approached by a combination of geophysical prospecting and archaeological techniques.

Since the land surrounding Rujm al-Henu (E) is today used exclusively for agriculture, any near-surface occupational remains would be disturbed by plowing. Accordingly, an aerial survey (Pl. XII, 1), often the ideal complement to a geophysical survey, did not reveal any unusual crop or soil marks near the structure.

Trial soundings might be sunk at random points around the building to investigate deeper lying remains, but this would entail considerable labor and expense (workmen and farmer compensation) with no guarantee of positive results. Alternatively, a suitable geophysical detecting device could be used to map probable areas of buried walls and structures, which could then be excavated in a systematic fashion.

There were compelling arguments against expanding a concurrent magnetometer survey, which successfully located silted-up caves (McGovern, 1979, 1981a). Limestone and sandstone, the preferred building materials in the Umm ad-Danānir region, have low specific magnetization values compared to the more magnetic soil. Even very large accumulations of stones, such as collapsed walls, would produce negligible anomalies, which would be totally indistinguishable from background fluctuations. Modern surface iron debris in and around Rujm al-Ḫenu (E) was an added deterrent to a magnetic survey.

Electrical resistivity techniques, on the other hand, have been shown to be excellent in detecting stone linear features and even in obtaining the top plans of entire structures (Ralph, 1969; Tite, 1972: 25). Since its first application to archaeology in 1946 by Atkinson (1952), a wide range of inexpensive, extremely portable commercial instruments have been developed, and theoretical principles are now well understood although sometimes difficult to apply in practice (Atkinson, 1963; Aitken, 1974: 267-86; Clark, 1970; Tagg, 1964). As with magnetic surveying, which depends on the magnetic contrast

between the archaeological feature sought and the surrounding medium, resistivity surveying takes advantage of another contrastive physical property of materials, *viz.* specific resistivity, which is a function of water retention and dissolved ionic salts and humic acids capable of conducting an electrical current. A sufficient resistivity contrast must exist between limestone/sandstone boulders at Rujm al-Ḥenu (E) and the surrounding soil, in order to detect significant anomalies.

Samples of soil from near the building, which had been finely sifted and mixed with various quantities of distilled water, were first tested in MASCA using a Gossen Geohm resistometer (108 Hz; 4.5V) and a standard linear array of four equally spaced probes (the Wenner configuration—Aitken, 1974: 270-71). In this arrangement, an alternating current (I) is applied to the outer probes, and the resultant voltage difference (V) is simultaneously measured across the inner probes. Assuming minimal contact resistance, the resistance (R) of the soil is then simply the quotient, V/I (by Ohm's law). By applying a simplified formula for specific resistivity ($\rho = 2\pi$ dR), where d is the probe spacing, it could be calculated that the soil samples from Rujm al-Ḥenu (E) varied between 20 and 60 ohm-m. In contrast, the specific resistivity of limestone/sandstone was much higher—*ca.* 500 ohm-m. The intrusion of limestone/sandstone boulders between the probes should then result in detectible high anomalies. Where there is a relative absence of limestone and sandstone, R would diminish and produce low anomalies. Actual measurements in the field will be modified by many factors, including soil stratigraphy and inhomogeneities, nearness of the bedrock and water table, the spacing between the probes and their placement in the soil, the relationship of the probes to the archaeological feature, etc. (Aitken, 1974: 268-71, 273-85; Tite, 1972: 25-32). Our survey was carried out in late Fall when several days of rain assured good contact conditions.

A crucial logistical problem is establishing the most ideal probe distance for detecting archaeological features. For the Wenner configuration, the resistance measured is actually a rough average at the array midpoint of soils from the surface down to a depth of about one and a half times d (Aitken, 1974: 271). After experimenting with various probe distances, a one metre separation was selected for detecting presumably near subsurface remains. With a smaller separation, not enough current would reach the sought-after feature, while a wider separation would reduce locational precision.

As for the archaeological survey, resistivity grids were precisely laid out with theodolite, optical square, prismatic compass, and metric tapes. Four grids were set up surrounding Rujm al-Ḥenu (E) and three on its interior (Fig.4), covering 0.62 hectares and representing 6181 data points. On average, about 900 measurements/day could be made with the resistometer (sometimes operating two instruments simultaneously) compared with 1300 measurements/day for the magnetometer.

Traversing a resistivity grid is very straight-forward for the Wenner configuration Pl. XXI, 1). The linear array of four probes is moved one probe at a time along a line parallel to the Y-axis; to start a new line, the array is moved one metre in a positive direction of the X-axis. Plastic or linen tapes (not metallic because of conductivity effects) are laid along the X-axis and the side opposite. Another tape can then be exactly positioned along the measurement line, in order to ensure accurate probe placement. The probes are 1.50 m. long, mild steel rods. Their sharpened points were driven about ten centimetres below the dry surface.

A team of at least three people is needed to carry out the survey efficiently. The person with the resistometer takes and calls out readings to a second person, who records them on centimetre graph paper at the midpoint of the array (thus, initial and final measurements for each line are indented 1.50 m.), usually at a scale of 1:200. A third person moves the end probe to the front of the array in preparation for the next reading. As one line is finished,

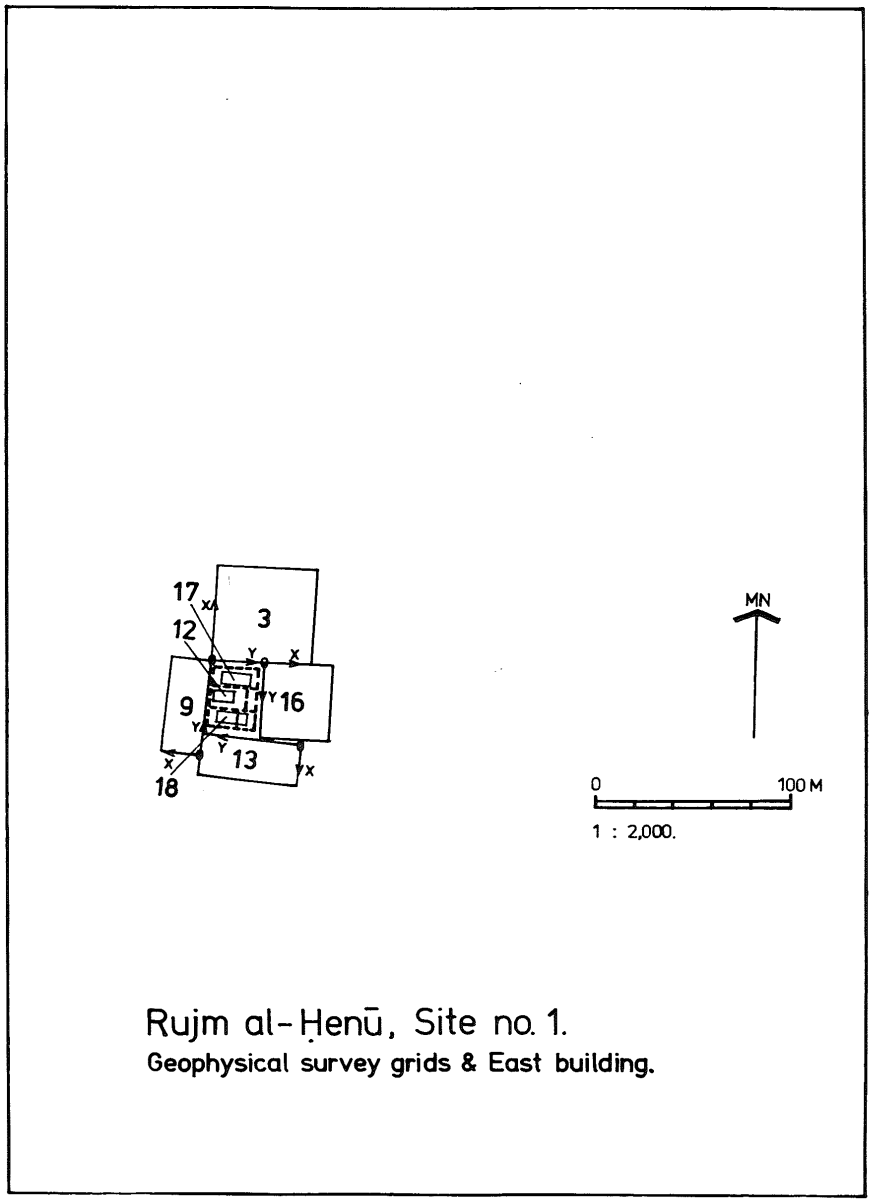


Fig. 4: Rujm al-Ḥenu (E) resistivity grid map

the tape parallel to the Y-axis is moved over a metre, and the same process is repeated, continuing in this fashion until the grid is completed.

The resistivity data is usually contoured up as soon as possible, so that significant anomalies can be further tested with different probe separations and/or arrangements. The choice of an appropriate contour interval, which will reveal significant highs and lows but does not clutter up the map, is often determined by inspection (Clark 1970: 703 suggests several theoretical procedures). A 10 ohm interval is used for all the grids at Rujm al-Ḥenu (E). High anomalies (more than 10 ohms above the background field) are indicated by diagonal hatching, low anomalies (at least 10 ohms below the background field) by stippling, and boulders by less fine stippling.

Pre-Excavation Interpretation of Resistivity Data

A number of fairly large, diffuse areas of higher resistivity were located on all sides of Rujm al-Ḥenu (E), which pointed to a wider area of settlement. For example, Grid 9 (Fig.9), which covered the area between the eastern and western building, has generally higher resistivity values in the region between X0-18 and Y17-47 in contrast to surrounding areas of the same grid. Another diffuse high begins in Grid 13 (Fig.10) between X3-22 and YO-24, and extends into Grids 16 (Fig.11; X10-35 to YO-39) and 3 (Fig.8; XO-35 to Y31-50). Possibly connected with the latter is a region of higher resistivity that approximately bisects Grid 3 between X21-40 and YO-31.

Before follow-up test excavations (below), it was uncertain whether these regions of higher resistivity represented foundations of outlying buildings, room additions to Rujm al-Ḥenu (E), wall collapse, bedrock irregularities, or miscellaneous stone accumulations. Although possible "M" patterns, which typically result from running a linear array of electrodes perpendicularly to a wall (Clark, 1970: 704-705) were noted (e.g., Grid 9: X8-9.5, Y30-33; Grid 13: X19.5 5-21, Y5-9), there was no consistent overall pattern. Isolated highs of various areal dimensions are interspersed with many low anomalies of the same type in all the grids. However, on the assumption of a simplified two-phase system, measurements at the same midpoint (Grid 16: X10, Y38) using various probe separations fit best a theoretical model of a thin (*ca.* 0.05 m.) soil layer directly over bedrock.

Resistivity results from Grids 12, 17, and 18 (Fig. 12: 1-3) inside Rujm al-Henu (E) suggested that there were no additional crosswalls than those visible on the surface. High and low anomalies again appear as irregular, diffuse regions. Some highs spread out from corners and along walls (Grid 17: X0-1, YO-8; XO.5-6, Y9-14; Grid 18: X22. 5-26, YO-6), perhaps resulting from rock tumbles, but other highs meander in the centres of rooms (e.g., Grid 12: X1-4, YO-6) in an unexplainable fashion or appear to correspond to secondary walls (Grid 18: X23-25, Y10-11).

Test Soundings at Rujm al-Ḥenu East

Excavation Strategy

A grid system was employed at the eastern building of Rujm al-Ḥenu (designated Field III during the excavation phase) that took advantage of its rectangular layout (Fig. 2). An arbitrary base point was established near the northwestern corner of the building, and a datum line laid out parallel to its exterior western wall. An array of grid points, which were arranged perpendicularly to the datum line and spaced five, six, or eight metres apart, then defined logical excavation units that were not intersected by crosscutting walls and allowed for one metre baulks. The numbering of the squares runs from north to south, and can be indefinitely extended eastward. By adding grid quadrants to the northeast, northwest, and the southwest, starting from the same base point which would now be at the midpoint of the expanded array, all areas surrounding the building could be investigated using a consistent grid system (cf. Albright, 1938: 8-9, pl.

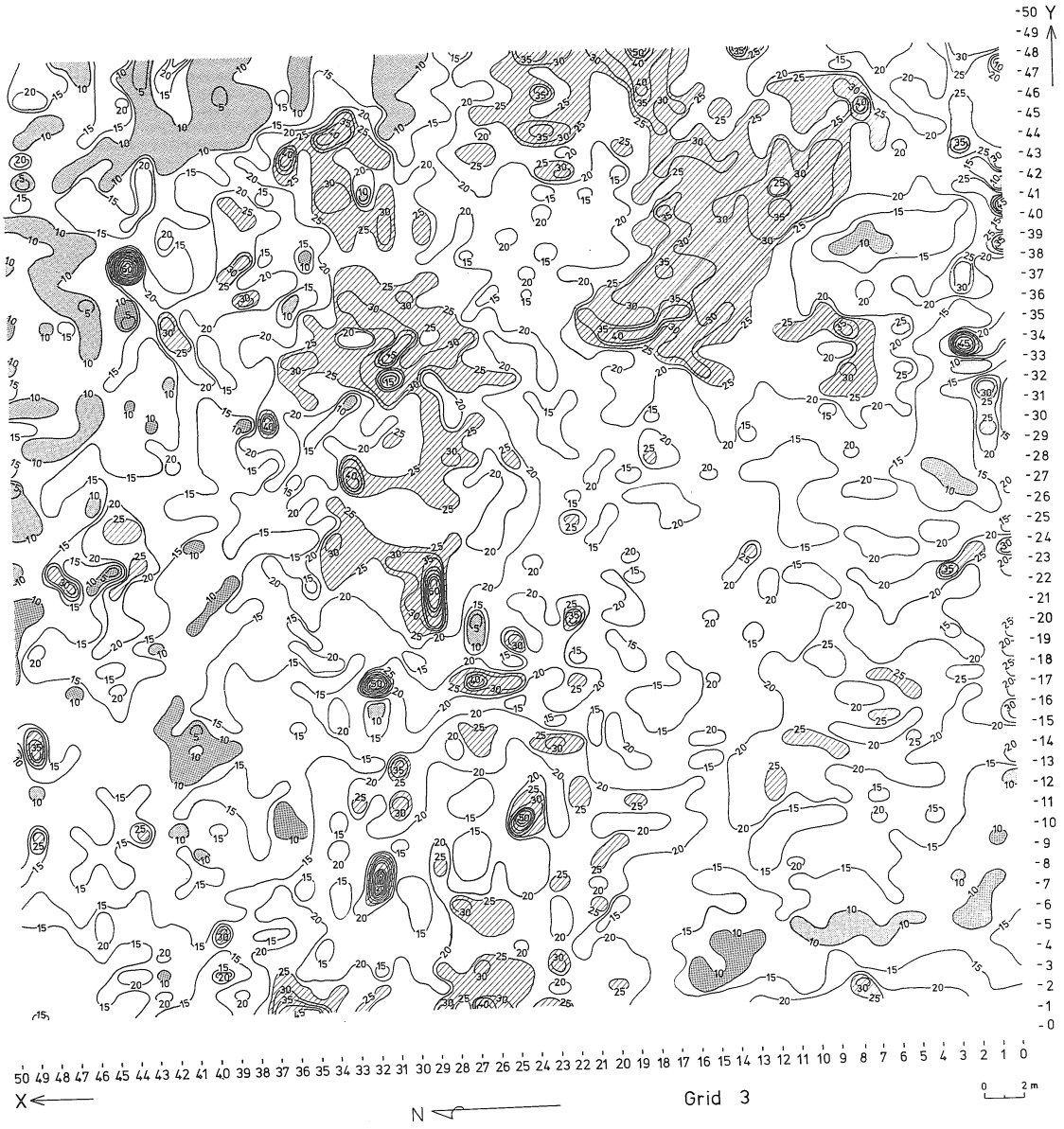

-50 Y
-49
-48
-47
-46
-45
-44
-43
-42
-41
-40
-39
-38
-37
-36
-35
-34
-33
-32
-31
-30
-29
-28
-27
-26
-25
-24
-23
-22
-21
-20
-19
-18
-17
-16
-15
-14
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
-0
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
X
N
Grid 3
0 2 m

Fig. 8: Grid 3

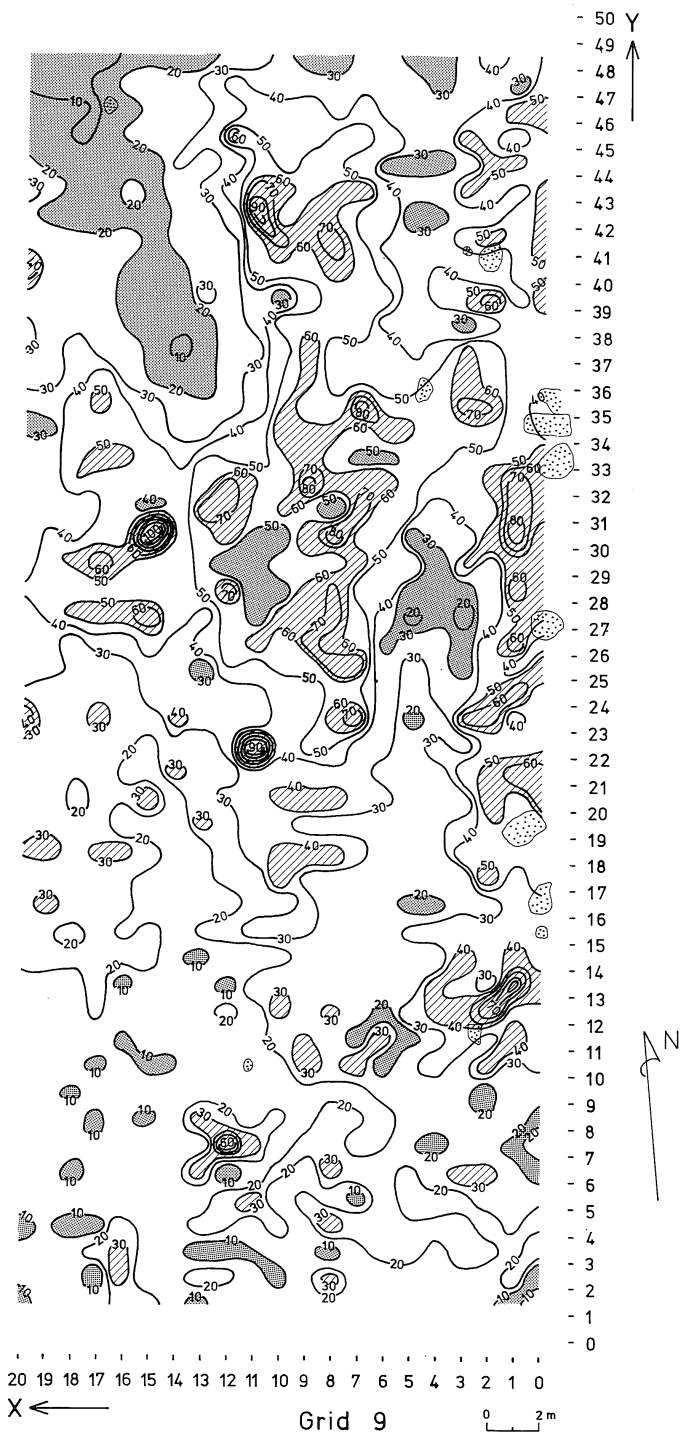

Y
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
N
20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
X
Grid 9
0 2m

Fig. 9: Grid 9

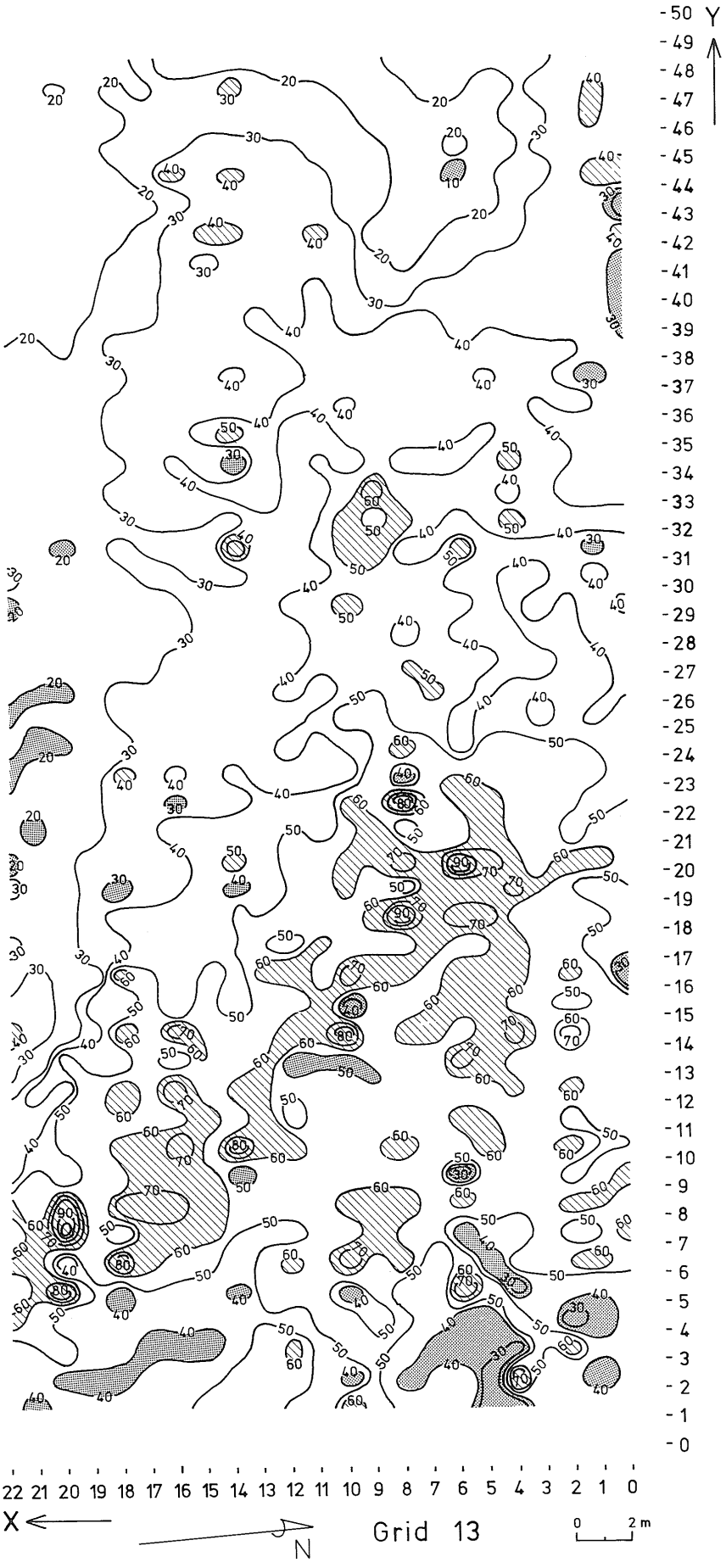


Fig. 10: Grid 13

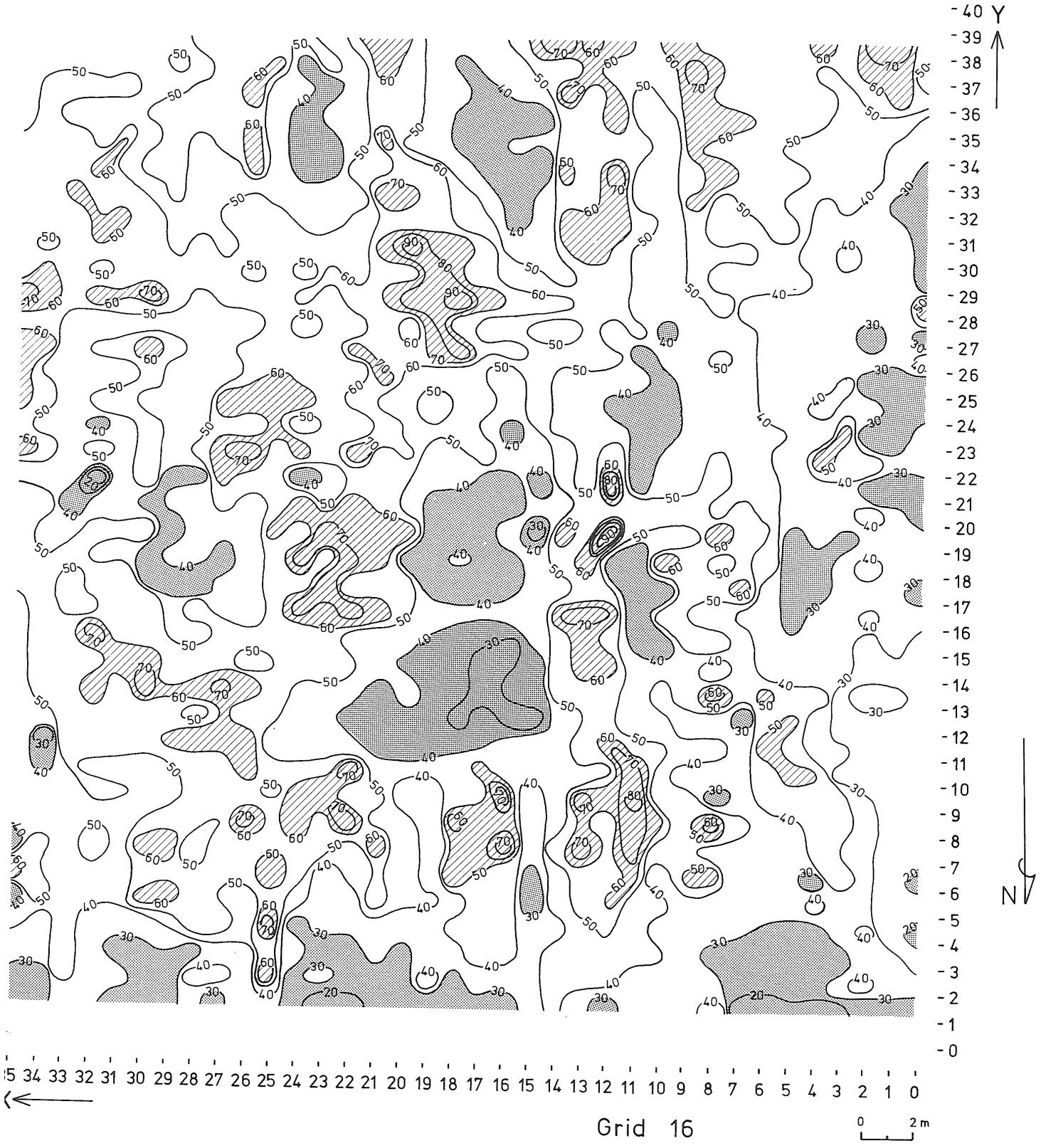
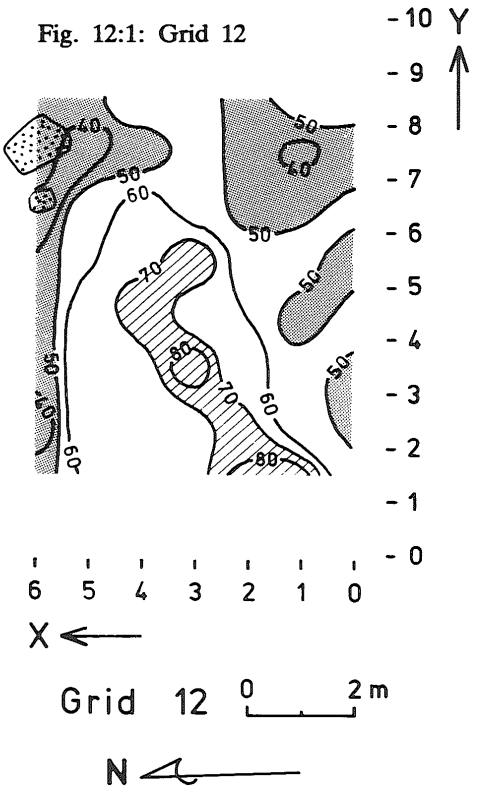


Fig. 11: Grid 16

Fig. 12:1: Grid 12



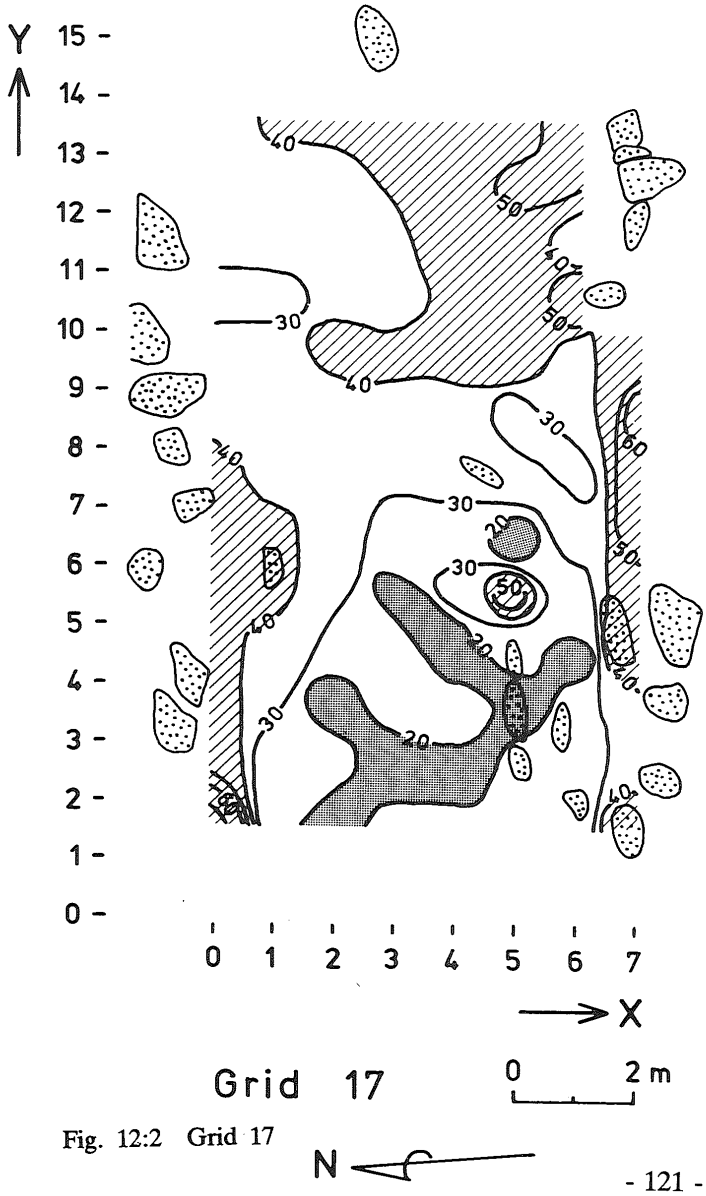
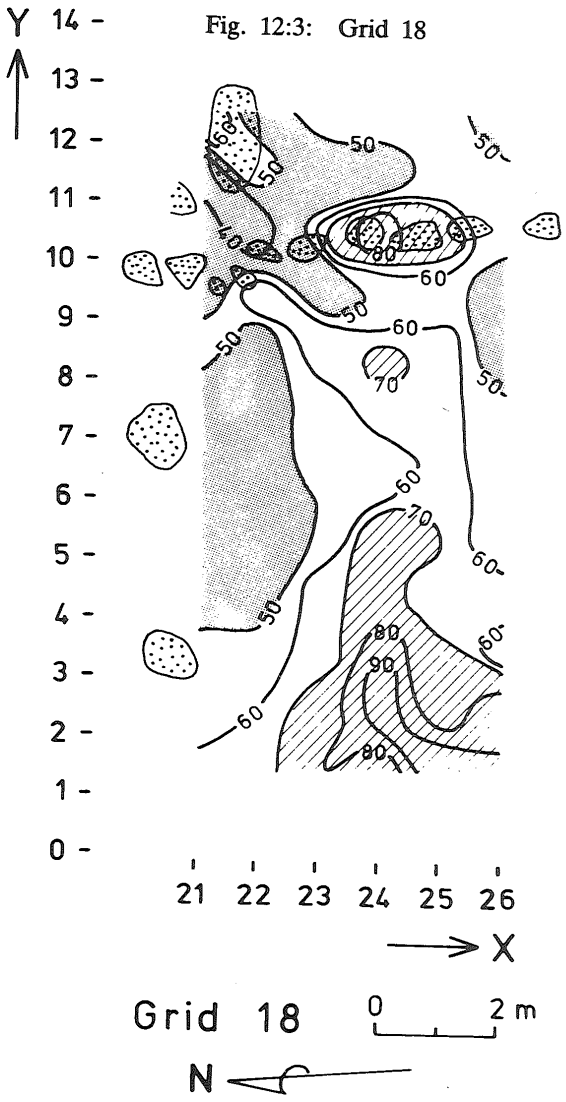


Fig. 12:2 Grid 17

Fig. 12:3: Grid 18



47).

The main objectives of the soundings were: 1) to date the building's construction and any occupational phases, 2) to determine the significance and relationship of surface interior and exterior walls, and 3) to test the resistivity data, particularly where there was the likelihood of a crosswall or outlying structure.

Test soundings in 1980 were limited to five squares, covering an area of 53 m² of which 43 m² were on the interior of the building (total area of *ca.* 750 m²). Two 1.00 x 5.00 m. trial soundings (Areas III.0 and III.1), perpendicular to the western wall and separated by 8.50 m., were intended to reveal foundation trenches and buried architecture between the two Rujm al- Ḥenu buildings. Excavation units inside the eastern building were located in different rooms and were variously sized (III.11—1.00 x 4.50 m.; III.23—4.00 x 4.00 m.; III.32—4.50 x 5.00 m.), but shared similar objectives: clarification of the interior room layout by exposing crosswalls, and the investigation of occupational phasing in three sectors of the building.

Stratigraphy and Finds

Before the start of excavation, a thick cover of vegetation had to be burned off to expose a silty, reddish gray (Munsell 5YR 5/2) topsoil (Loci III.0.1-2 = III.1.1, 3 = III.11.1,2,4 = III.23.1-2 = III.32.1-2), *ca.* 0.15 m. in depth. It contained large quantities of modern debris (plastic, aluminum foil, glass, etc.) and vegetal matter, intermixed with pebbles and sherds (total of 601; 2LB, 1 LB/Ir, 47 Ir II, 30 Ir IIC/P, 8/LR, 42 R/BYz, 18 EByz, 6 Byz, 3 Mam, and 18 Mod diagnostics).

Small objects[1] recovered from the topsoil included a glass bead (Fig. 13: 1) and a probable pipe bowl fragment (Fig. 13: 2; Pl. XXI, 2). The later is unparalleled, and may be of quite recent date. The bead has a long pear shape (Beck, 1973: type I.D.1.g), and an impressed thread decoration, which is common in the Roman period.

Just beneath the topsoil, a reddish yellow (Munsell 5YR 6/6) subsoil (Loci III.0.5 = III.1.2 = III.11.3 = III.23.4), similar to that at the western building (below) but more clayey, was usually encountered. Occasionaly, one or more other layers might intervene or displace it all together.

In Area III.32, a very fine, dark gray ashy layer (Locus III.32.2), 0.05-0.10 m. deep, extended across the entire square (Fig. 5). It appeared to be associated with a crude fireplace (Locus III.32.6-7) of four cobbles, which was set into a space between two boulders of the eastern interior wall of the central room (Locus III.32.4) and was filled with a pile of burned brush. Plastic and glass fragments attested to its recent origin, despite the presence of exclusively premodern sherds (total of 90; 5 Byz and 5 R/Byz diagnostics).

An ashy layer (Locus III.1.4) was also excavated in the eastern third of Area III.1 (Fig. 5) where a *ca.* 0.30 m. deep accumulation of fine ash, four blackened cobbles (fireplace?), and ten sherds (1 Ir I, 7 Ir II, and 2 LR diagnostics) rested against the exterior wall (Locus III.1.9). Beneath this, two thin (*ca.* 0.10 m.) layers may represent early stages in subsoil formation: Locus III.1.5, a brown silty soil with decomposed limestone nodules, and Locus III.1.6, a well-compacted, yellowish red silty soil with numerous clay chunks. Plastic, glass, and aluminum fragments date their deposition/formation to the post- war period; 15 sherds (9 Ir II, 2 LR, and 1 Byz diagnostics) were recovered. Loci III.1.5 and III.1.6 abruptly terminate to the west where the plow zone infringes on the excavation area (Fig.5). Here there were no intervening layers between the topsoil and the subsoil (Locus III.1.2).

The subsoil averaged 0.30 m. in depth outside the building, whereas it was between 0.10 and 0.15 m. thick on the interior. Disturbance by plowing very close to the exterior walls probably

[1] In the legends to the small object and stone artefacts (Pls. XXV,2-XXVII,1; Figs. 13-14), musem provenience with accession number is denoted by A.-Jordanian National Museum, Amman, and P. University Museum, University of Pennsylvania, Philadelphia, PA. Other abbreviations include: I=interior, E=exterior, L=length, W= width, H= height, and D=diameter.

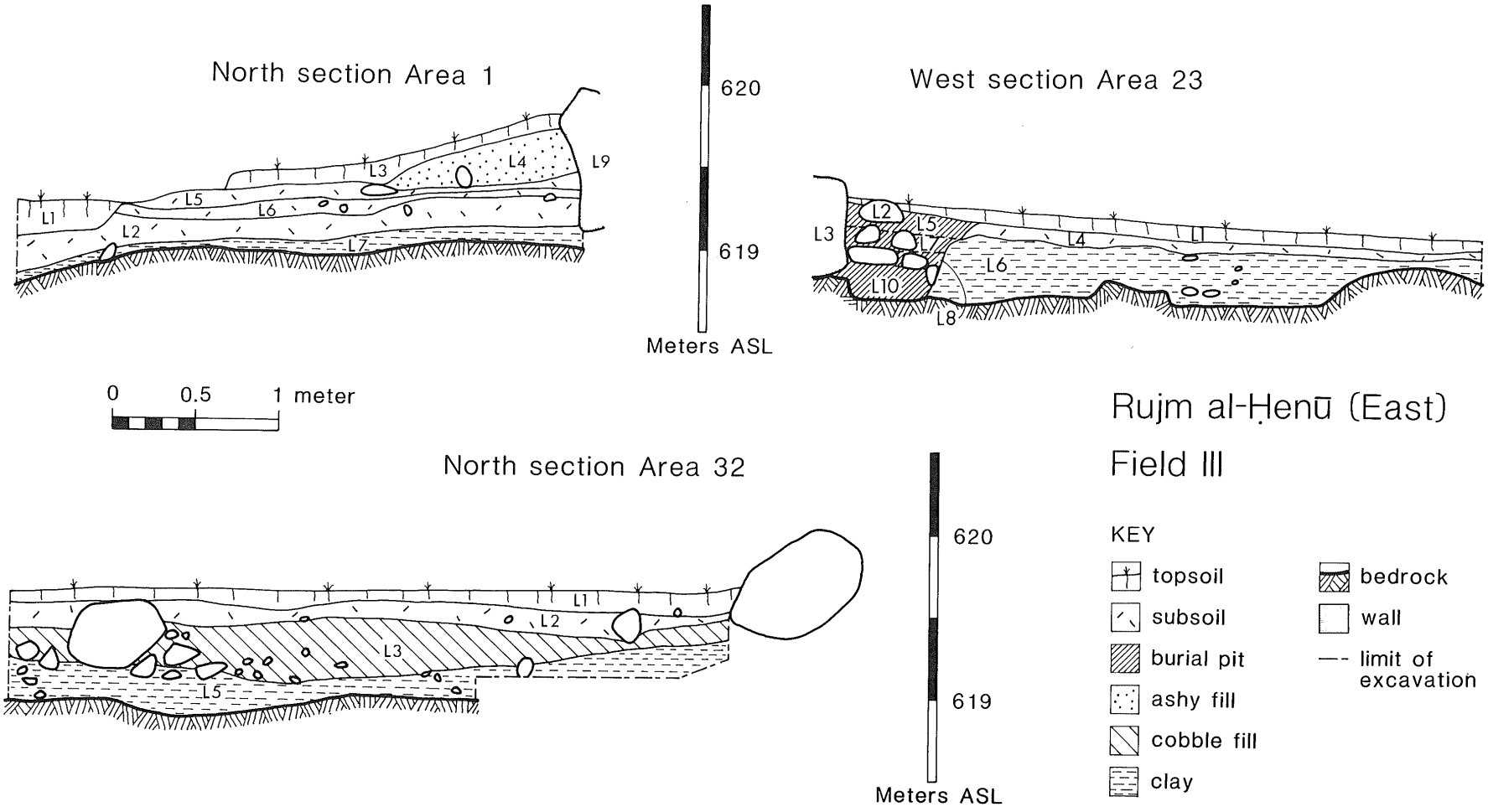


Fig. 5: Rujm al-Ḥenu (E) sections

accounts for the disparity. Consequently, modern debris (leather and pottery) was found in the subsoil layers (Loci III. 0.5 and III. 1.2) of Areas III.0 and III.1, together with 109 sherds (4 possible LB, 30 Ir II, 2 Ir IIC/P, 3 R/Byz, and 7 Byz diagnostics).

Natural sedimentation processes contribute to the formation of dense clay layers above bedrock (Limbrey, 1975: 79-80, 205). Where there is frequent plowing, however, this layer is either destroyed or not allowed to reform. This was observed on the western side of Area III.0; approaching the exterior wall, a *ca.* 0.10 m. thick, dark brown clay layer with cobbles (Locus III.0.6) was encountered. Forty-six sherds (3 possible LB, 29 Ir II, and 2 Byz diagnostics) from this locus may have been originally churned up by plowing, and then incorporated into a reconsolidated clay layer. The latter overlay modern Locus III.0.7, a half metre diametre hollow in the bedrock (Pl. XIII, 2) which yielded pieces of modern asbestos sheeting.

It is perhaps significant that the yellowish red clay layer (Locus III.1.7) in Area III.1 was completely sterile. While Locus III.0.6 ran up to the exterior wall (Locus III. 0.3), Locus III.1.7 appeared to run under this wall (Locus III.1.9) and a possible east-west wall (Locus III.1.8) which was exposed in the southern baulk (Fig. 5; Pl. XIV, 1). The latter wall, unless merely rockfall, is comprised of a single course of four small boulders. It abuts the exterior wall, and is in line with the northern interior wall of the central room.

The thinner subsoil layers inside the building (Loci III.11.3 = III.23.4 = III.32.3) produced 215 sherds (2 possible LB, 8 LB/Ir, 5 Ir II, 17 Ir IIC/P, 10 R/Byz, 12 EByz, 4 Umay, and 2 Mam diagnostics). The absence of modern sherds and debris is noteworthy, since it suggests a longer undisturbed period which would account for a better-developed soil profile inside the building. In Area III.11, in particular, a very hard-packed, yellowish brown clay layer (Loci III.11.5-7), over 0.60 m. thick, had apparently formed at the expense of subsoil layer thickness. It probably fills a depression in the bedrock, which is closer to the surface in the other excavated areas. Interspersed throughout the dense clay, except in the final 0.10 m. cut above bedrock (Locus III.11.7), were 281 sherds (19 Ir II, 13 Ir IIC/P, 18 R/ Byz, and 1 Mam diagnostics). A looser, yellowish red clay (Locus III.23.6), *ca.* 0.10-0.50 m. thick, covered bedrock in Area III.23 (Fig.5), which yielded 532 sherds (29 Ir II, 29 Ir IIC/P, 15 R/ Byz, and 1 Byz diagnostics).

Area III.32 had a comparable yellowish brown clay layer (Loci III.32.5,8), which formed the matrix for piles of cobbles concentrated on the periphery and thinning out toward the center of the square (Pl. XVI, 1; Fig. 5). Again, only premodern sherds were recovered from this layer (total of 1022; 45 Ir II, 66 Ir IIC/P, 30 R/Byz and 2 Byz diagnostics), along with a basalt bowl fragment. Locus III.32.5 appears to be the foundation for a subsidiary wall (Locus III.32.9) in the southern baulk (Pl. XVI, 2). This wall does not abut with the exterior wall (Locus III.32.10), and may curve south to form an arc-shaped enclosure, comparable to two better-defined examples in the southwestern corners of the central and southern rooms. Only a thin line of clay runs under the exterior wall. A cobble build-up, possibly separate form Locus III.32.5, was observed under the interior eastern wall of the central room (Locus III.32.4).

The subsoil (Locus III.23.4) and clay (Locus III.23.6) layers in Area III.23 were cut by a pit (Loci III.23.5, 7-10) along the southern end of the square (Fig. 5), adjacent to the interior wall (Locus III. 23.3). Here, a pile of small boulders (*ca.* 0.20-0.50 m. long) and cobbles (Locus III.23.2) emerged, which extended out from the wall 0.75 to 0.90 m. (Pl. 7). Between the stones was a yellowish red, clayey soil (Locus III. 23.5) with patches of ash, which included 16 sherds (1 possible LB, 1 Ir IIC/P, and 1 EByz diagnostics).

When one of the stones on the west was removed, the partial remains of an articulated neonate were exposed (Pl. XV, 1), only 0.20-0.25 m. below the surface. With its head to the southwest, the

skeleton was poorly preserved and lacked lower limbs. It lay on its back in a matrix of brownish gray, clayey soil (Locus IH.23.7), about 0.10 m. thick, which constituted the uppermost fill of the pit and produced a total of 59 sherds (4 Ir II, 1 Byz, and 1 Umay diagnostics). Another thin (*ca.* 0.10 m.) layer (Locus III.23.8) followed, which was similar in colour and texture to Locus III.23.5, and yielded 45 sherds (2 Ir II and 1 Umay diagnostics). Again, a neonate (Locus III.23.9), almost completely intact but in extremely fragile condition, had been buried in this layer, about 1.50 m. east of the previous burial. The body was semi-flexed, lying on its right side, head to the west, and face to the south. Several non-descript Iron Age body sherds were closeby.

Below Locus III.23.8 in an area defined by two small boulders on the west and interior wall Locus III.23.3, a fully articulated adult male burial (Locus III.23.10) was discovered in a bedrock hollow (Pl. XV, 2; Fig. 5), approximately 0.50 m. below the surface. The body was fully extended on its right side, head to the west, and face to the south. Since the cranium was in the western baulk, the area was enlarged, in order to excavate the complete skeleton. The bedrock concavity, the lowest portion of the burial pit, undercuts wall Locus III.23.3, but, since the pit was dug from the subsoil level, it probably does not predate the wall. A total of 57 sherds (5 Ir II and 3 Ir IIC/P diagnostics) and a patinated glass fragment were recovered from the soil matrix of the grave.

Little need be added to the survey description of walls and architectural layout. Only one or two courses of single line walls were preserved in the excavated area.

According to the preliminary faunal analysis, several species of terrestrial mollusks and mammals (primarily sheep/ goat, some donkey) were randomly distributed in the topsoil, subsoil, and clay layers.

Interpretation

The siting of Rujm al-Ḥenu (E) was partly determined by an open area of exposed bedrock. Natural soil and clay may have filled hollows in the bedrock (Loci III.1.7, III.11.7) or was brought in intentionally to create a level platform. Clay accumulation over bedrock occurs naturally, and, except where it had been later disturbed by plowing (Loci III.0.6-7) or pitting and dumping operations (Loci III.23.6, III.32.5,8), it was sterile. The eastern building's location on bedrock was largely unanticipated, because it is now surrounded by rich agricultural land and the neatest outcropping of bedrock is west of Rujm al-Ḥenu (W).

Like the western building (below), the main exterior and interior walls of Rujm al-Ḥenu (E) were founded on bedrock and/or the built-up clay layer, sometimes consolidated with cobbles (Locus III.1.7. and beneath wall Locus III.32.4.) Secondary walls (Locus III.1.9 and III.32.9) of smaller boulders (less than a metre long) were also built over cobble fills, whether purposely or accidentally. Wall Locus III.1.9 may be a room addition or the border for a pathway between the eastern and western buildings (the latter occur at Hirbet Mudmar).

Further similarities with the western building end here. Rather than the intact statigraphic sequence (foundation, occupation floor, destruction debris) recovered there, efforts to date the eastern building's construction and period(s) of occupation were largely frustrated by later disturbance. Although trial soundings were distributed in various sectors inside and outside the building and covered a larger relative area than for Rujm al-Henu (W), only mixed fills, *ca.* 0.20-0.65 m. deep, were found directly over bedrock and/or clay deposits. Although Iron II C/P pottery predominated (see the article by Vincent Clark), it was always mixed with Roman, Byzantine, and occasionally Islamic materials. The lack of stratigraphy, particularly the absence of foundation trenches and floors, meant that absolute dating was out of the question, and only the relative sequence of one secondary wall (Locus III.32.9) could be established.

Nevertheless, excavation results from Rujm al-Ḥenu (E) did provide confirmatory evidence for the survey hypothesis that the eastern building had a different

constructional and occupational history than the western building. While no LB pottery was found in the excavation of the western building, Rujm al-Ḥenu (E) yielded 1 LB, 10 possible LB, and 9 transitional LB/Ir diagnostics, besides the 3 MB/LB sherds from the survey. Additionally, excavation down to bedrock clearly demonstrated that very little remained of the eastern building, which would fit with an earlier construction date and the subsequent clearance of boulders from its upper wall courses for the construction of the western building. Mixed loci, however, are hardly definitive, and may only evidence robbing and dumping activity sometime between the Roman period and the present.

The three burials (two neonates and one adult male), which had been deposited in a pit in Area III.23 (Loci III.23.5, 7-10) that was demarcated and covered by a pile of small boulders and cobbles, had no associated burial goods for dating purposes. The glass fragment and over fifty sherds, belonging exclusively to the Iron II period, cannot provide an assured date for the pit and its contents as a whole, since a Byzantine and an Umayyad sherd came from the topmost layer of the pit fill (Locus III.23.7). The east-west orientation of the bodies, heads to the west and faces to the south (toward Mecca), argues for their deposition sometime during the Islamic period (A.D. 630-1918). The burials must predate the modern period, because local inhabitants, whose ancestors have lived in the region for at least the last hundred years, had no knowledge of these burials and comparable ones at Rujm al-Ḥenu (W) prior to excavation. Both buildings would have been ideal for cemeteries, since they are unsuitable for agriculture but close to human settlement.

Following its use as a cemetery, the eastern building was abandoned for an undetermined period of time. Modern debris is confined to the topsoil, except where plowing and pitting has disturbed soil layers outside the building. Crude fireplaces and piles of burned brush and ash were excavated in Areas III.1 (Locus III.1.4) and III.32 (Locus III.32.4), which had been laid down since 1948.

Interpretation of Resistivity Data

The trial soundings at Rujm al-Ḥenu (E) partly resolved the ambiguity of the resistivity results. In the four areas (III.0, III.1, III.11, and III.23) which overlapped with resistivity grids (total of 20 m²), the correspondence between rises and dips in the bedrock and highs and lows in resistivity, respectively, was evident. Thus, the bedrock hollows in Areas III.11 (Loci III.11.5-7) and III.0 (Locus III.0.7) coincide with lows in Grids 17 (X5, Y3.5) and 9 (X1.5, Y45.5). The possible east-west wall (Locus III.1.7) in Area III.1 may correlate with a high at X3, Y35.5 in Grid 9.

Generalizing these results, which represent less than 0.5% of the total area surveyed with the resistometer, may seem presumptuous without additional test soundings. Still, the results obtained thus far are quite uniform, and bedrock irregularities could well explain the diffuse highs and lows dominating each grid. Occasional small areas of very high resistivity can probably be attributed to isolated outcrops of bedrock. On the west in the area between the two buildings (Grid 9), high anomalies may represent wall lines of room additions, pathway boundaries, or even separate structures.

The combined resistivity and excavation results shed light on the question of whether Rujm al-Henu (E) should be classified as a *Quadratbau* type structure. No additional buried crosswalls, belonging to the main structure, were uncovered where one might expect to find them (e.g., in Area III.23 to delineate a fully centralized room, or in Area III.11 to form two northern rooms). The surface crosswall in Area III.32 is definitely secondary. Thus, it is possible that the original layout completely lacked crosswalls, which would represent a major departure from the classical *Quadratbau* type. On the other hand, there might well be variant architectural traditions of the same general type, especially in the Amman area where "megalithic" construction was common and possibly the primary form of rural settlement. *Qasr* type structures do not adhere to a fixed architectural layout.

Because the occupational and con-

structional history of Rujm al- Ḥenu (E) is still uncertain, its possible isolation from a permanent settlement, according to the nomadic hypothesis, is of less importance. Still, if the above interpretation is correct, the building is isolated on all but the western side where later construction is well attested.

Test Soundings at Rujm al-Ḥenu West

Excavation Strategy

On the western side of the western building (designated Field IV), three areas (IV.1-3) were laid out (Fig. 3). Area IV.1, 5.00 x 4.00 m. in area, was set up in the corner formed by the outer southern face of the circular tower and the interior face of the enclosure wall. Area IV.2 was a 4.00 x 2.00 m. trench aligned perpendicularly to the outer face of the western enclosure wall and separated from Area IV.1 by a 1.00 m. baulk. Another 1.00 m. baulk divided Areas IV.1 and IV.3, the latter a 5.00 x 4.00 m. square located south of Area IV.1 along the interior of the western enclosure wall.

Apart from testing resistivity data, the same basic objectives were in view as at the eastern structure: 1) the period(s) of construction and use of the building, 2) the nature of the exterior surface walls, particularly the structural and temporal relationship between the circular tower and the enclosure wall, and 3) the internal layout of rooms and other installations, whether original or secondary. Although bedrock was reached in only a 20 m² area, representing about 1% of the total area of the building (*ca.* 1900 m²), the first objective was achieved and the other two partially resolved.

Stratigraphy and Finds

The appearance of Rujm al-Ḥenu (W) prior to excavation corresponded to that of the eastern building. Beneath a thick growth of vegetation, which had to be burned off, a silty, dark gray topsoil (Loci IV.1.1 = IV.2.1-IV.3.1) was exposed. It was intermixed throughout with variously sized pebbles, cobbles, and boulders, modern debris, vegetal matter, and 617 sherds (48 Ir IIC/P, 34 Ir II, 5 ER, 5 LR, 1 R/Byz, 2 Byz, 1 Mam, and 11 Mod diagnostics). The topsoil depth was generally 0.20-0.30 m. except in the vicinity of the enclosure wall (Locus IV.1.2) and the circular tower (Locus IV.1.3) where it was a maximum of 0.10 m.

Small finds from the topsoil included a glass bracelet fragment (Fig. 13:3), a probable pipe bowl (Pl. XXIV, 1; Fig. 13:7), a stone ring fragment (Pl. XXVI, 2) and a sling stone or weight (Pl. XXVI, 1) from Locus IV.1.1, and a sea urchin fossil (Pl. XXV, 1; Fig. 13:8) from Locus IV.3.1. Unpublished examples of the latter have also been found at Umm el-Biyara, Buseirah, and Timna (D. S. Reese, personal communications, 1981 and 1982).

Immediately below the topsoil, a massive rock tumble (Loci IV.1.4-6, 9, 11, 13, 14, 16, IV.2.3-4 = IV.3.2,4,7), 1.50-1.90 m. deep, was encountered (Figs. 6-7). A sandier variety of the topsoil, which had patches of a granular, reddish yellow (Munsell 5YR 6/6) soil, filled the spaces between rocks in the upper part of the rockfall (Loci IV.1. 4-6 = IV. 2.3-4 IV.3.2). The stones ranged in size from pebbles to boulders over a metre in length. Out of a total of 1494 sherds in the upper rockfall, there were 258 Ir IIC/P, 28 LR, 1 R/Byz, and 3 Mod diagnostics.

A variety of small artefacts came from the upper rockfall. A flint arrowhead (Fig. 13:10), half of a limestone "cosmetic" dish (Pl. XXII, 2; Fig. 14:2) a basalt tripod (?) table fragment (Pl. XXVII, 1), a pestle (Pl. XXV, 2), and a possible carved pipe bowl (Pl. XXIV, 2; Fig 14:4), in addition to thick plaster fragments, were found in Locus IV.1.4 along the outer face of the circular tower (Locus IV.1.3). Locus IV.3.2 produced a badly damaged limestone "cosmetic" dish (Pl. XXIII, 1; Fig. 14:1) a carnelian drop pendant (Pl. XXII, 1; Fig: 13:4) a possible potter's tool (Fig. 14:3) a cowrie shell (Fig: 13:5) with its dorsal side shaved off,[2] a ceramic male

[2] This writer would like to express his gratitude to D. S. Reese for species identification of the cowrie shell.

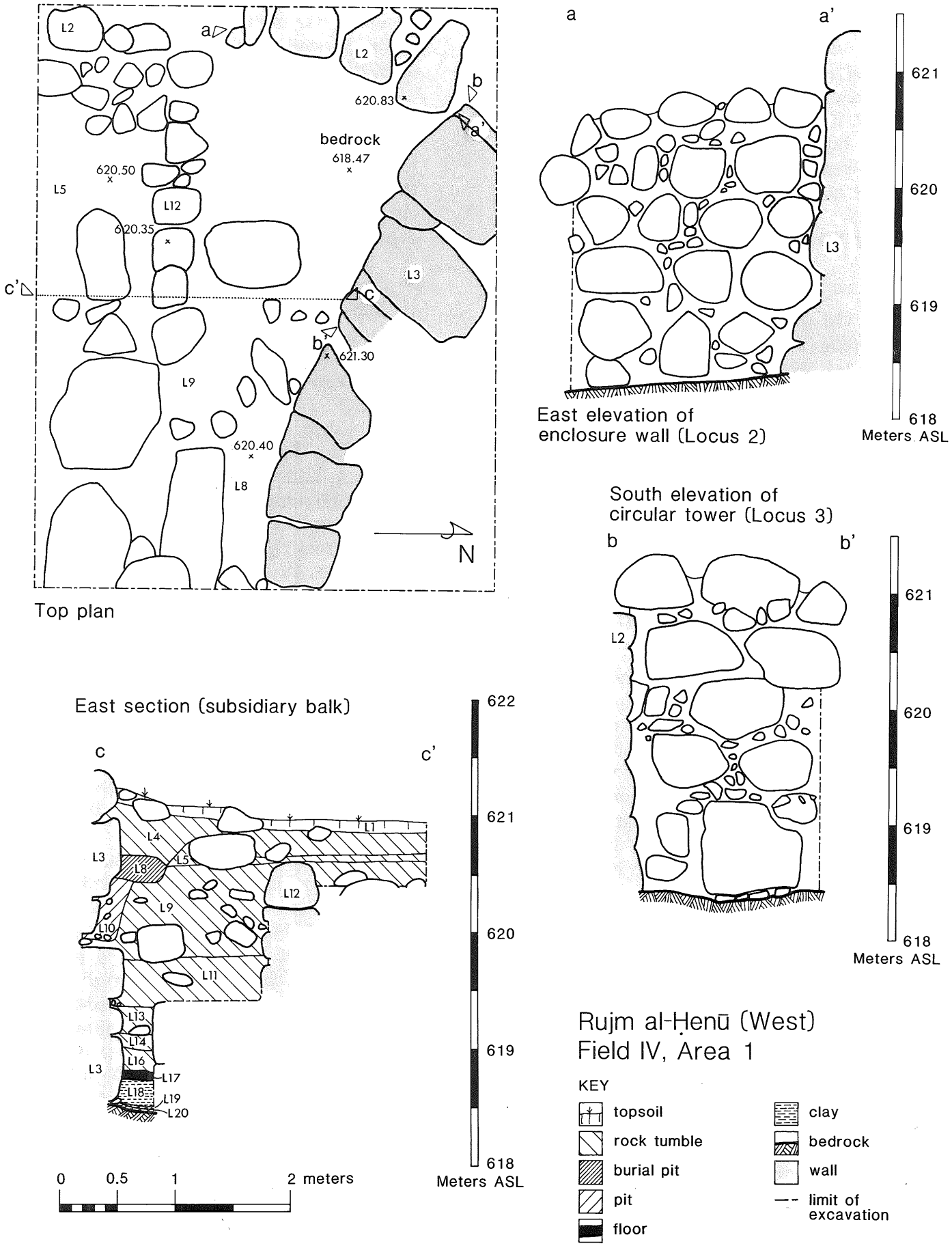


Fig. 6: Rujm al-Ḥenu (W) top plan of Area IV.1 with sections and elevations.

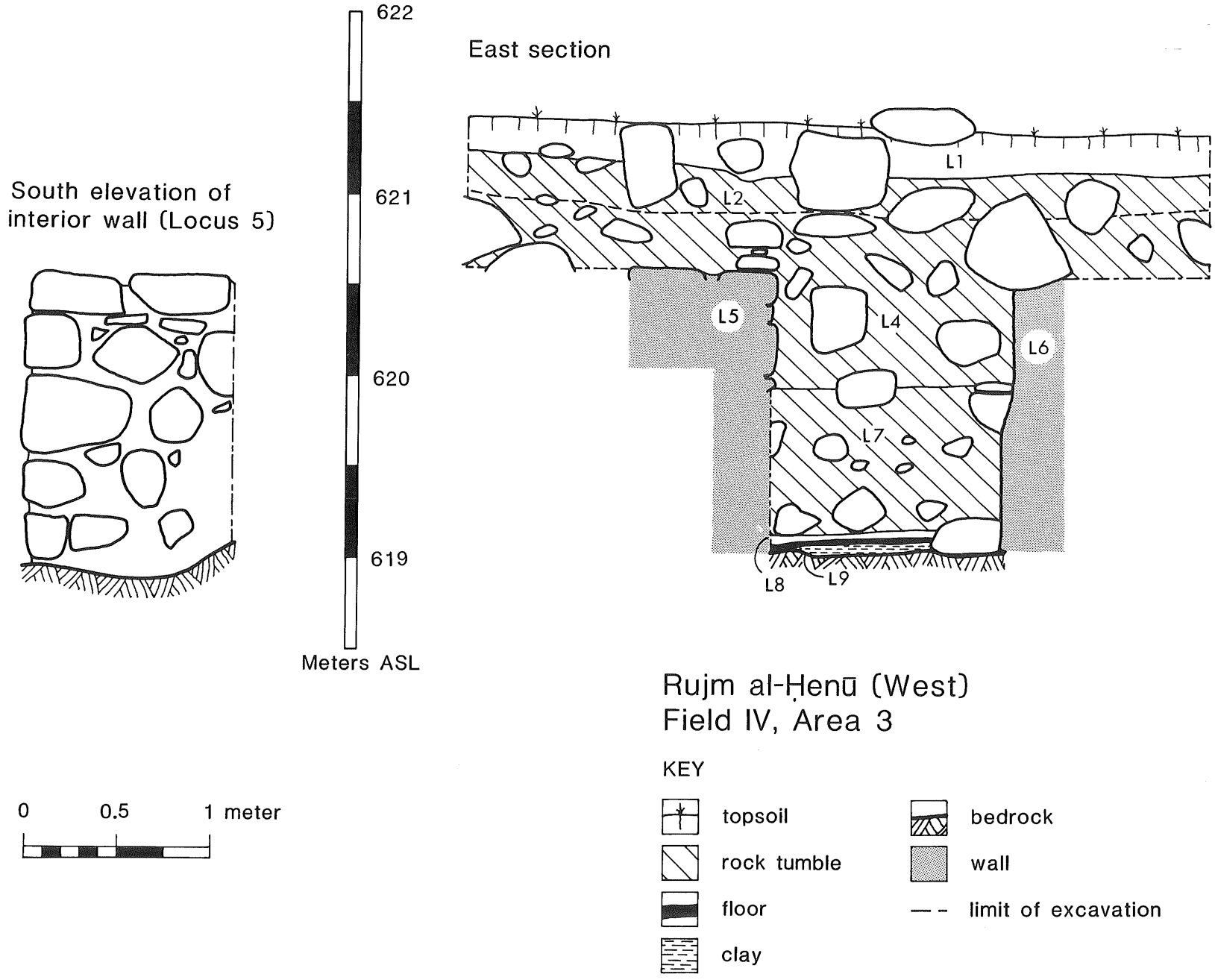


Fig. 7: Rujm al-Henu (W), Area IV.3 section and elevation

	Object	*Field No.*	*Basket*	*Locus*	*Description*
Fig. 13:1	Bead	III.1	III.0.2	III.0.1	Beck type I.D.1.g (circular long pear-shape) IV. Impressed reddish orange threads on a blue glass matrix. A.
Fig. 13:2	Pipe Bowl? Fragment	III.2	III.0.1	Surface	E impressed decoration. I unblackened. Fired clay (Munsell 10YR 6/2 [light brownish gray]). P. 81-6-204.
	Glass Fragment	III.3	III.23.25	III.23.10	Patinated; transparent and somewhat bubbly matrix. Light green. P. 81-6-205.
	Stone Bowl Fragment	III.4	III.32.13	III.32.5	Internally bevelled rim. D: 20 cm.; H: 4 cm. Basalt. P. 81-6-206.
Fig. 13:3	Bracelet Fragment	IV.2	IV.1.1.	IV.1.1	Blue glass. P. 81-6-207.
Fig. 13:4	Pendant	IV.14	IV.3.7	IV.3.2	McGovern type VI.F.2 (elongated drop). Carnelian. P. 81-6-215.
Fig. 13:5	Cowrie Shell	IV.18	IV.3.8	IV.3.2	Back shaved off. *Cypraea (Monetaria) moneta* (Red Sea species). p. 81-6-209.
Fig. 13:6	Nail?	IV.11	IV.3.5	IV.3.2	Flattened "head," narrowing to point at tip L: 3.1 cm.; W: 1.4 cm. Iron. P. 81-6-214.
Fig. 13:7	Pipe Bowl? Fragment	IV.3	IV.1.2	IV.1.1	E incised decoration. I unblackened. Fired clay (Munsell 5YR 6/4 [light reddish brown with hand-burnished slip (2.5YR 3/6 dark red]). P. 81-6-216.
Fig. 13:8	Fossil	IV.10	IV.3.3	IV.3.1	Sea urchin (Echinoidea). Perforated. P. 81-6-211.
Fig. 13:9	Male Figurine Fragment	IV.17	IV.3.8	IV.3.2	Only torso and upper legs preserved; genitals, buttocks, and belt(?) indicated. Fired clay (Munsell 10R 6/6 [(light red]). A.
Fig. 13:10	Arrowhead	IV.23	IV.1.7	IV.1.4	Pre-Pottery Neolithic B type. Flint. P. 81-6-252.
Fig. 14:1	"Cosmetic" Palette	IV.13	IV.3.7	IV.3.2	Probably undecorated except for E groove below rim. Limestone. P. 81-6-208.
Fig. 14:2	"Cosmetic" Palette Fragment	IV.8	IV.1.7	IV.1.4	Limestone. A.
Fig. 14:3	Potter's Tool?	IV.16	IV.3.7	IV.3.2	Probably reused potsherd. P. 81-6-218
Fig. 14:4	Pipe?	IV.7	IV.1.7	IV.1.4	Numerous E scratches and incisions probably from manufacture. E blackened; I unblackened. Bone (femur). P. 81-6-217.
	Coin	IV.9	IV.3.4	IV.3.2	After restoration, only slight indications of a head on obverse; reverse completely worn away. D: 2.2 cm.; T: 0.3 cm. Copper or bronze. P. 81-6-251.

Iron Strip	IV.19b	IV.3.15	IV.3.5	Corrosion obscures any detail. L: 4.5 cm.; W: 2 cm.; T: 0.4 cm. P. 81-6-252.

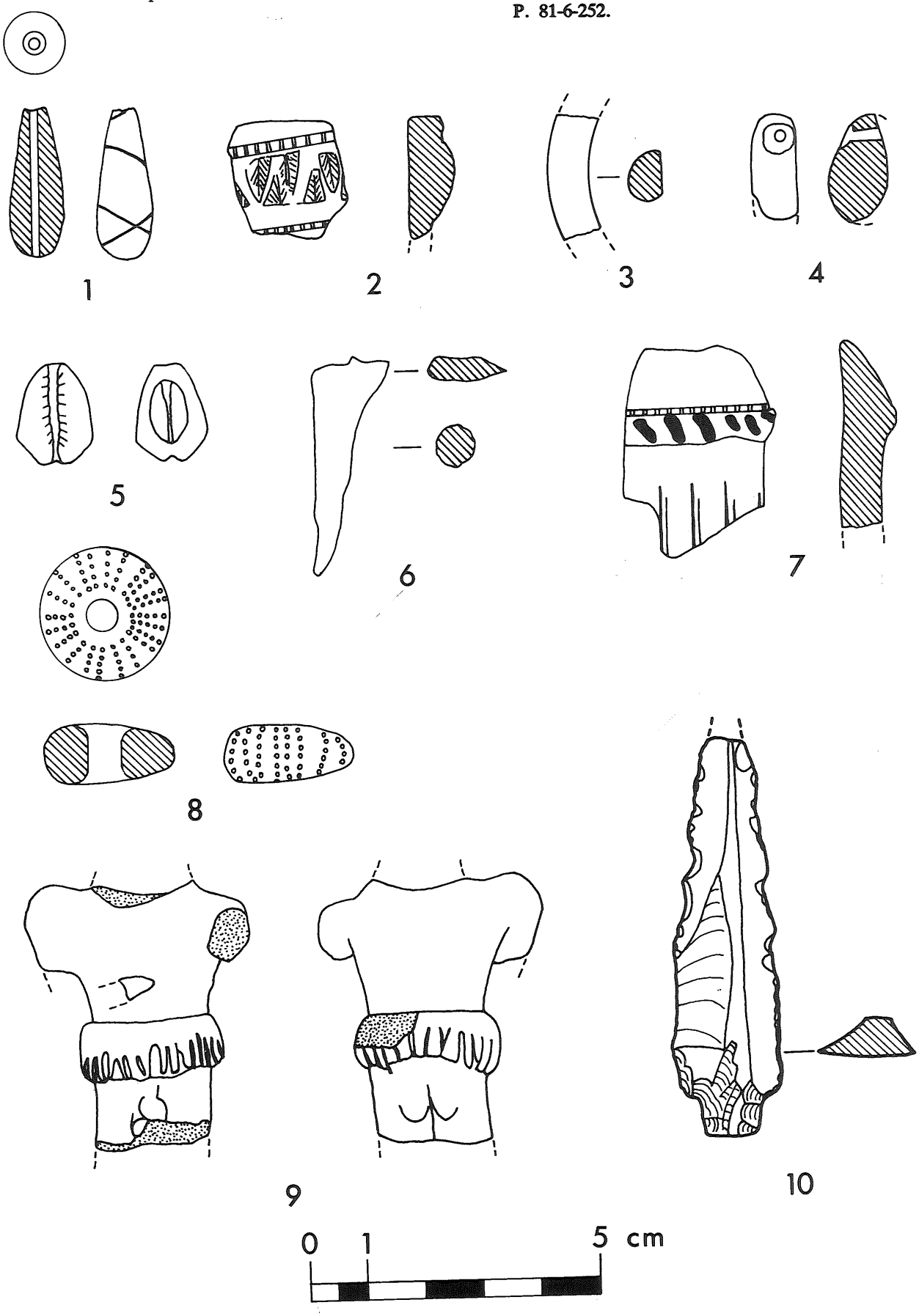


Fig. 13

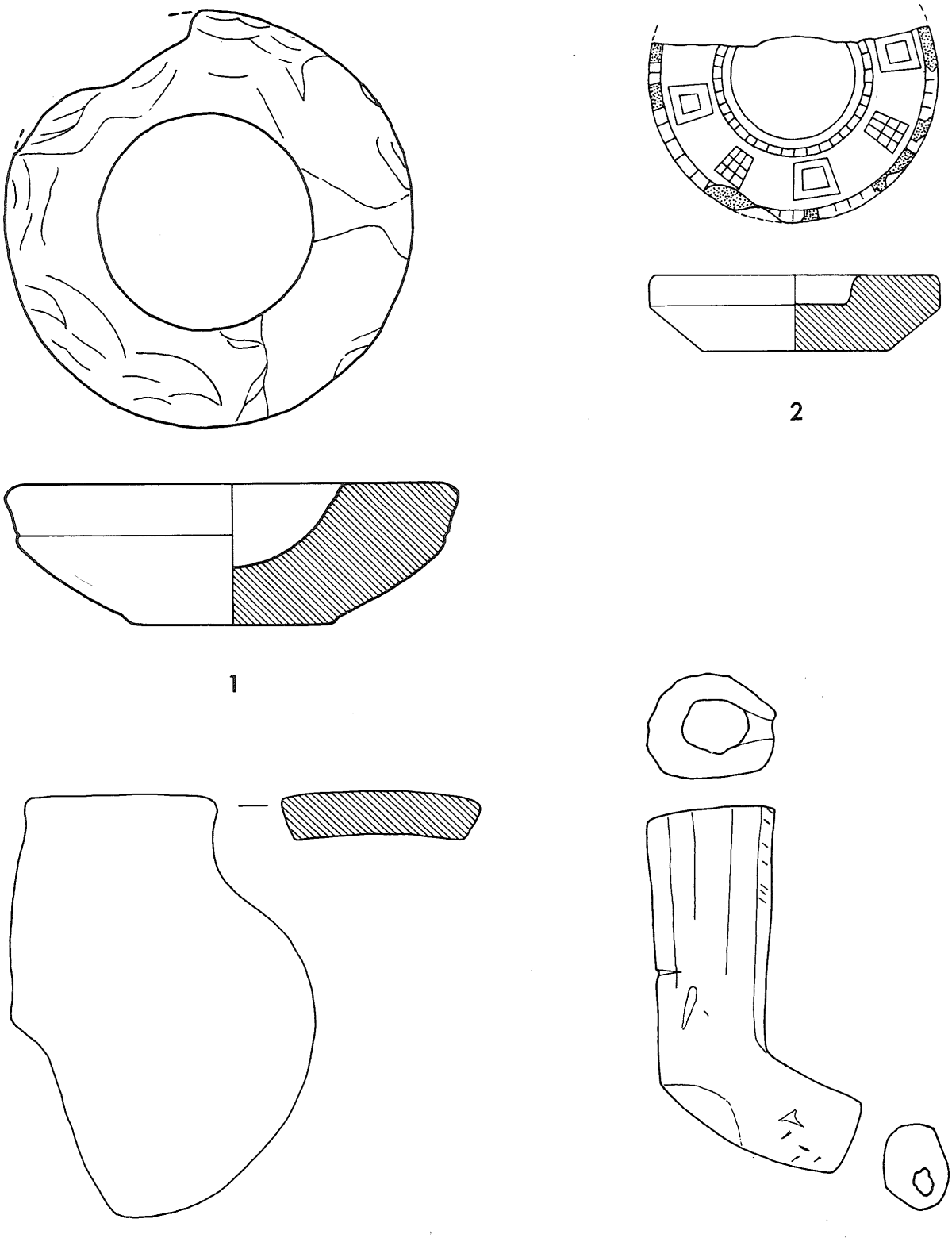


Fig. 14

figurine fragment (Pl. XXIII, 2; Fig. 13:9), a probable nail (Fig. 13:6) a completely worn/corroded coin, a basalt grinding stone, and basalt quern and table fragments.

The majority of these finds are either very non-specific cultural/chronological indicators or unparalleled. Belonging to the former category, together with the miscellaneous stone pieces, iron nail, potter's tool (?), and coin, is the pendant, which is damaged on one side. It apparently belongs to the elongated drop type (VI.F. 2—McGovern, 1980b: 224-28), which occurs in a greater variety of materials (semi-precious stones, gold, faience, and bone) than any other Palestinian pendant type, and has a long time span and a wide geographical distribution. Aldred (1971: 144) traces the origins of Egyptian bead jewelry in its multifarious forms to the simple drop pendant, strung on a necklace, and this simple geometric shape continues to be popular throughout the Middle East today. Similarly the worked cowerie shell (a Red Sea import) was a very common jewelry element, usually on necklaces, in antiquity, and is still esteemed by modern Bedouin women. By contrast, no parallels could be found for the pipe bowls(?) and the male figurine.

The mixed nature of the upper rockfall was substantiated by the more closely dated small artefacts. The flint arrowhead is a standard Pre-pottery Neolithic B type. The two limestone "cosmetic" dishes belong to a class of such artefacts, which occur in various materials (limestone, basalt, sandstone, calcite, glass, faience, etc.) and are generally Iron II in date (Thompson, 1971). The badly damaged example (Pl. XXIII, 1; Fig. 14:1) appears to have a plain rim (Thompson's first type) in the few remaining areas that are unmarred; it has an exterior groove and ridge about a third of the way down the side, and a slight disc base. The second example, made of the same fine-grained limestone as the first example, is much finer in other respects. It has a unique rim decoration of "rope" designs which enclose a central band of alternating "checkerboards" and concentric trapezoids (cf. parallels cited under Thompson's third type). The palette is about half the size of the damaged specimen, sharply carinated, and has a flat base. Very likely, the two palettes derive from the Iron II C/P occupational phase of the western building. If they belonged to upper class Ammonite society (Thompson, 1971: 70), then Rujm al-Ḥenu (W) would seem to have been more than a border post.

During the removal of Locus IV. 1.4, a primary human burial was uncovered *ca.* 0.65-0.85 m. below the surface, lying in a burial pit (Locus IV.1.8) between wall Locus IV.1.3 and a large boulder on the east side of Area IV.1 (Pl. XVIII, 1). In a filling of pale reddish brown, silty soil, a fully extended and articulated adult body had been laid in a supine position, oriented east-west, head to the west and face to the south. Unexplainably, the lower portions of the right radius and ulna as well as the right hand were missing. The left femur near the hipjoint had also been broken and had not fully mended in antiquity. Because the lower legs and feet extended into the eastern baulk, these were left unexcavated.

In the process of clearing this burial, a skull, arm bones, ribs, vertebrae, and pelvis, in apparent disarticulation, were exposed on the western end of the same burial pit. These remains belonged to a second, stratigraphically earlier adult burial. The head was again oriented west, facing south, and the articulated left arm lay across the top of the head. Other bones in articulation included seven vertebrae attached to the skull, the left and right clavicles, scapulae, and arms, the bones of the right leg with the right hand lying beneath the right femur, and the left tibia and fibula. The lower body had probably been pushed aside to accommodate the upper burial in the pit, and its considerable articulation may imply that it was still partially carnated when this occurred. Although 64 Iron Age sherds, including 14 Iron II C/P diagnostics, were found in the pit, the location and orientation of the skeletons support an Islamic date. No burial goods accompanied the bodies.

At the same level and to the west,

another pit (Locus IV.1.7) was discovered in the corner formed by the enclosure wall (Locus IV.1.2) and the circular tower wall (Locus IV.1.3). Instead of a burial, it contained only a reddish brown soil interspersed with cobbles and 77 sherds (12 Ir IIC/P and 4 LR diagnostics).

Below Locus IV.1.7, yet another pit (Locus IV.1.10), 0.50 m. deep and quite narrow (*ca.* 0.30 m.), ran alongside the circular tower (Fig. 6). Several plaster fragments and 39 sherds (8 Ir IIC/P, 1 LR, and 1 Byz diagnostics) were randomly scattered in the dark gray soil matrix.

A completely articulated sub-adult was excavated in the upper rock tumble (Locus IV.3.2) of Area IV.3. The body, 0.10-0.20 m. below the surface, was fully extended on its back east-west, head to the west and face to the south. Only Iron Age body sherds were found in its vicinity.

When the large boulders of the rockfall ouside the structure began emerging in Area IV.2, it was decided to discontinue excavation at a depth of *ca.* 0.50 m., mainly because of lack of manpower. For the same reason, work in Areas IV.1 and IV.3 was restricted to the western halves of these squares at a similar depth. The stratigraphic profiles down to bedrock in Areas IV.1 and IV.3 are virtually identical (Figs. 6-7), and will be discussed here in turn.

While clearing the uppermost layer of the upper rockfall (Locus IV.1.9) in Area IV.1, a single line of boulders comprising an east-west wall (Locus IV.1.12) was discovered along the southern baulk. A 0.70 m. wide doorway, subsequently filled in with stones, existed between this wall and the enclosure wall (Locus IV.1.2). The removal of the remainder of Locus IV.1.9 and the other loci (IV.1.11, 13, 14, 16) of the lower rockfall was then constricted to a *ca.* 1.50 x 2.00 m. area between wall Loci IV.1.2, IV.1.3, and IV.1.12, and a subsidiary eastern baulk.

The five layers (Loci IV. 1.9, 11, 13, 14, 16) which made up the lower rockfall differed primarily in soil texture and color: IV.1.9 (silty, dark gray), IV.1.11 (silty, grayish yellow with clay clumps), IV.1.13 (silty, reddish yellow intermixed with decomposed sandstone and limestone), IV.1.14 (clayey, yellow), and IV.1.16 (silty, reddish yellow with many clay nodules and ash pockets). Otherwise, various sized cobbles and boulders and pure Iron II C/P sherds (total of 990; 105 diagnostics) were randomly distributed throughout the layers.

Along the face of wall Locus IV.1.12, a trench (Locus IV.1.15) was traced, extending 0.30 m. north of the wall and cutting through Loci IV.1.11 and IV.1.13. It was filled with a silty, gray soil, together with 22 Iron II sherds (2 Ir IIC/P diagnostics). Possibly this is a foundation trench associated with a rebuilding of wall Locus IV.1.12, which might explain the three rough boulders of its upper three courses bordering the doorway which sharply contrast with the well-cut ashlars of the lowest two courses.[3] However, Locus IV.1.15 is more likely a pit comparable to Loci IV.1.7 and IV.1.10. Unfinished stones may have been used intentionally (cf. the construction of the circular tower, enclosure, and Locus IV.3.6 walls, below) or the upper courses of wall Locus IV.1.12 may have been exposed to more extensive weathering after the building was abandoned.

Large quantities of smashed pottery vessels, particularly storage jars, first appeared in the lower part of Locus IV.1.14, and were heavily concentrated in Locus IV.1.16 (total of 582 sherds; 32 Ir IIC/P diagnostics). The sherds lay upon or were embedded in a beaten, multicolored (yellow and pink) clay surface (Locus IV.1.17).

The foundational make-up for the clay surface and the walls comprised three differently coloured clay layers: Loci IV.1.18 (*ca.* 0.25 m. thick, brown, intermixed with cobbles, charcoal fragments, and 37 late Iron Age sherds [7 Ir II C/P

[3] Vincent Clark, who supervised work at Rujm al-Ḥenu (W), favors this interpretation. Dr. Clark kindly drew up an overall stratigraphic report of this building, details of which have been incorporated here. Mr. William D. Glanzman's report on Area III.1 at Rujm al-Ḥenu (E) should also be mentioned in this regard. This writer is solely responsible for the stratigraphic interpretations of both buildings presented here.

diagnostics]), IV.1.19 (0.01-0.02 m. thick, pink, well-compacted), and IV.1.20 (0.01-0.02 m. thick, dark brown, 10 sherds 4 Ir IIC/P diagostics]) were found near the upper margin with Locus IV.1.19. Beneath Locus IV.1.20, bedrock was reached at *ca.* 618.4 ASL (Fig. 6).

As in Area IV.1, excavation of the lower rock tumble (Locus IV. 3.4) in Area IV.3 revealed interior wall construction. Two interior walls ran perpendicularly to the enclosure wall and parallel with each other; *ca.* 1.25 m. apart, they defined an east-west corridor. Further excavation in the square was limited to the area (*ca.* 1.25 x 2.50 m.) of the corridor. The northern corridor wall (Locus IV.3.5) extends from the eastern baulk toward the enclosure wall (Locus IV.3.3), and a 0.90 m. wide doorway separates it from the latter. The southern corridor wall (Locus IV. 3.6) meets the enclosure wall. Where it enters the eastern baulk, a probable door jamb was exposed.

The lower rockfall in Area IV.3 continued down alongside wall Loci IV.3.5-6 as Locus IV.3.4,7 (Fig. 7). Numerous cobbles and boulders (including several dressed stones) and 300 late Iron Age sherds (50 Ir IIC/P diagnostics) were randomly mixed in the compact layer of reddish brown, granular soil.

The rockfall was again directly over a surface (Locus IV.3.8), which ran up to wall Loci IV.3.3, 5, 6 and had 207 sherds (17 Ir IIC/P diagnostics) and a grinding stone fragment embedded in it. In contrast to surface Locus IV.1.17, IV.3.8 was a *ca.* 0.10 m. thick layer of gray, granular soil. The bottom 0.01-0.02 m. was most likely the original surface (Locus IV.1.17); it was well compacted, interspersed with ash, but devoid of pottery. The overlying 0.08-0.09 m. may represent either occupational build-up or destruction debris.

The foundation for surface Locus IV.3.8 and wall Loci IV.3.3, 5, 6 was a 0.05-0.20 m. thick, dark brown clay layer (Locus IV.3.9 = IV.1.18-20) above bedrock. Seventeen late Iron Age sherds (2 Ir IIC/P diagnostics) were found along its upper margin, immediately below the surface. In the corner formed by the enclosure wall (Locus IV.3.3) and the southern corridor wall (Locus IV.3.6), a pit (Locus IV.3.10) was excavated, which cut the clay layer but was sealed off by surface Locus IV.3.8. The pit coincided with a 0.30 m. diameter, 0.40 m. deep hollow in the bedrock, and was filled with a loose sandy, brown soil with 6 sherds (3 Ir IIC/P diagnostics).

The enclosure wall (Loci IV.1.2 = IV.2.2 = IV.3.3) where it had been fully exposed in Areas IV.1 (Fig. 6) and IV.3 had five standing courses, *ca.* 2.50 m. high. The wall was constructed of a double line of roughly shaped boulders, most of the which were of limestone (some sandstone and flint) and less than a metre long.

The circular tower wall (Locus IV.1.3) also had five courses, *ca.* 3.00 m. high, preserved (Fig. 6), but double lines of more massive boulders (over a metre long) had been employed.

Single lines of smaller boulders had been used to construct all the interior walls (Loci IV.1.12, IV.3.5, 6). Five courses of wall Loci IV.1.12 and IV.3.5 (Fig. 7) stood *ca.* 2.20 m. and 1.60 m. high, respectively; Locus IV.3.6, the southern corridor wall, had four courses, *ca.* 1.90 m. high. While rough stones made up the baulk of these walls, well-cut ashlars with squared-off corners and dressed faces had been used for the end stones of wall Loci IV.1.12 (lowest two courses) and IV.3.5 (Fig. 7; Pl. XVII, 2), which bordered doorways.

The enclosure, circular tower, and interior walls were founded on bedrock and/or the lowest clay layer (IV.1.20, IV. 3.9). Walls that meet are not bonded to one another, *viz.* the enclosure wall (Locus IV.3.3) and the southern corridor wall (Locus IV.3.6), and the circular tower (Locus IV.1.3) and the enclosure wall (Locus IV.1.2), which curves inward to meet the former (Fig. 6; Pl. XVII, 2).

A preliminary faunal analysis indicated that bird and mammal (mainly sheep/goat, some rodent, possible donkey) remains were randomly distributed in the topsoil and rockfall.

Interpretation

Test soundings near the circular tower and on the interior and exterior of the southwestern enclosure wall of Rujm al-

Henu (W), despite the limited exposure (less than 1% of the total area of the building), produced some extremely important results.

Before the building was constructed, large areas of bedrock with soil and clay filling crevices and hollows (Loci IV.1.19, 20 and lower IV.3.9) were probably visible. Remaining irregularities n the bedrock may have been intentionally leveled out by laying down more clay (Loci IV.1.18 = upper IV.3.9 contemporaneous with pit Locus IV.3.10). The bedrocked/or clay then served as the foundation for the interior and exterior walls and the single surface (Loci IV.1.17 = IV.3.8.) uncovered in the excavation. Judging from the number of smashed storage jars and other vessels, which were on or embedded in this surface and which dated exclusively to the Iron II C/P period (see Vincent Clark's article on the pottery), this must have been an Iron II C/P occupational floor. The fact that the floor runs up to the various interior and exterior walls exposed in Areas IV.1 and IV.3 and is directly over the built-up clay layer implies that it was associated with the construction and earliest use of the building.

Above the floor, almost the entire accumulation inside the structure, over one and a half metres thick, was destruction debris (cobbles and boulders) from the collapse of upper courses of walls. Thus, the building appears to have been built, occupied, and then destroyed, possibly as the result of an earthquake, within a relatively short time. The sealed Iron II C/P floor provides one of the most precise datings for a *qasr* type building (cf. the seventh-sixth century B.C. date for Khirbet al-Ḥajjar and Rujm al-Malfuf South—Thompson 1973: 50; 1977: 29), which are often stripped down to bedrock or disturbed by Roman and Byzantine occupation. Rujm al-Ḥawi, the companion building to Rujm al-Ḥenu (W), may have a comparable archaeological sequence.

South of the circular tower at Rujm al-Ḥenu (W), a number of small rooms had evidently been laid out. The room in Area IV. 1, defined by wall Loci IV.1.2, 3, 12 and of unknown eastern extent, had been filled with storage jars. The doorway between the enclosure wall and interior wall Locus IV.1.12 must have led to an uncleared room which was bordered on the south by corridor wall Locus IV.3.5. The so-called east-west corridor is entered by a doorway between the enclosure wall and wall Locus IV.3.5. A probable door jamb at the eastern end of the southern corridor wall (Locus IV.3.6) suggests that another doorway, perhaps one of a series, opened onto rooms in the southwestern sector of the building (cf. surface wall lines on Fig. 3).

Different wall construction techniques were observed at the western building: 1) larger boulders (over a metre long) were used for the circular tower than for the enclosure and interior walls (less than a metre), 2) boulders were generally very rough, except for the well-cut ashlars of wall Loci IV.1.12 (lowest two courses) and IV.3.5, which border doorways, and 3) presumably contemporaneous walls (e.g., the southern corridor wall and the enclosure wall) are unbonded. These incongruities may be the result of architectural phasing or simply reflect divergent contemporary building practices.

Following its destruction, Rujm al-Ḥenu (W) lay abandoned for an extended period of time. Deterioration of the structure is evidenced by the soil and rock accumulation around walls (e.g., Locus IV.1.12) which may have stood above ground for a time and were consequently more weathered.

The upper archaeological fills at the western building are quite comparable to the mixed loci of the eastern building. Both have Late Roman and Byzantine materials (also Umayyad and Mamlūk at the eastern building) mixed with predominantly Iron II C/P pottery. No activity surfaces from these periods were found, so that the fills could have resulted from dumping after the Byzantine period.

Like Rujm al-Henu (E), the western structure was used as a cemetery probably sometime in the Islamic period. Two adults (Locus IV.1.8) and one sub-adult (Locus IV.3.2) were excavated, each laid out east-west in a supine position, head to the west and face to the south (toward Mecca). Since they were found in upper

rockfall fills and were unaccompanied by burial goods, closure dating is impossible. Several pits (Loci IV.1.7, 10, 15) probably belong to the same period.

After the cemetery phase, Rujm al-Ḥenu (W) was again abandoned up until the present. Modern debris and pottery, including Ottoman types of the last several hundred years, were interspersed in the topsoil.

Conclusions

The interpretations presented above are necessarily tentative, since only a small fraction of the total areas of the two buildings at Rujm al-Ḥenu have been excavated thus far. Nevertheless, by combining standard archaeological, geophysical, and aerial survey techniques, a very deliberate excavation strategy was developed, in order to test specific working hypotheses. Consequently, the archaeological returns from the soundings were considerable and are probably quite representative. Further excavation at Rujm al-Ḥenu (W) could well yield a largely undistrubed Iron II C/P occupational level, at least in areas near collapsed walls. Just the opposite can be anticipated from the eastern building. However, the discovery and excavation of any remaining intact loci (e.g., in corners) will have been worth the effort if the building's history is further elucidated.

Acknowledgements

The 1978 survey and the 1980 season of test excavations were directed by the writer, and co-sponsored by the Department of Antiquities of Jordan, the National Geographic Society, and the University Museum and its Applied Science Center (MASCA) of the University of Pennsylvania. Mssrs. Bruce W. Bevan, Ibrahim Haj Hassan (Department Representative), Ms. Susan Spencer, Ms. Jenine Howard, and Mr. Mohamed Salem comprised the core staff in 1978. Area supervisors at Rujm al-Ḥenu East (Field III) and West (Field IV) in 1980 included Mssrs. Vincent A. Clark (Areas III.0, III.23, and IV.1-3), Wiliam D. Glanzman (Areas III.1 and III.32), and Nicholas Hartmann (Area III.11). During the latter season, Mssrs. Ali Sa'idi and Sa'ad Hadidi served as Departmental representatives, Ms. Marilyn B. Saul as osteologists, and Mr. Nicholas Hartmann as photographer. Ms. Helen R. Schenck, the registrar/draftsman, drew the small objects and laid out the plates, including those of the sections and top plans for Fields III and IV. Mrs. Susan M. Balderstone, the architect during both seasons, surveyed and prepared the architectural and regional plans. Ms. Jean Bray and Mr. Neil Gallagher, volunteers from the active amateur archaeological community in Amman, assisted in the excavation and registration process. Workers were hired from the Umm ad-Danānīr region, the Palestinian refugee camp in the valley, and the towns of Salt and Suweilih.

As an afiliated project of the American Schools of Oriental Research, Dr. James A. Sauer, the director of the center in Amman, generously made available the institute's facilities, which served as the expedition's base of operations in both seasons. Additional accommodations for staff members were also kindly provided by Mrs. Crystal-M. Bennett, Director of the British Institute for Archaeology and History in Amman, and Herr Kruger of the Deutsches Evangelisches Institut für Altertums Wissenschaft des Heiligen Landes.

The writer would also like to express his sincere appreciation to Dr. Adnan Hadidi, Director-General of the Department of Antiquities of Jordan and his staff for their ready assistance and ongoing support of the project.

Patrick E. McGovern
MASCA University Museum
University of Pennsylvania

Bibliography

M. J. Aitken, *Physics and Archaeology,* Oxford, 1974.

W. F. Albright, *The Excavation of Tell Beit Mirsim,* Vol. 2: *The Bronze Age, AASOR,* 17, New Haven, 1938.

The Archaeology of Palestine, England, 1960.

C. Aldred, *Jewels of the Pharaohs: Egyptian Jewelry of the Dynastic Period,* New York, 1971.

R. J. C. Atkinson, Méthods électriques de prospection en archéologie, p. 59-70 in *La Découverte* du Passé, Paris, 1952.

Resistivity Surveying in Archaeology, p. 1-30 in *The Scientist and Archaeology,* New York, 1963.

H. Beck, Classification and Nomenclature of Beads and Pendants, *Archaeologia,* 77 (1973) p. 1-76.

F. Bender Geologie von Jordanien, Beiträge zur Regionalen Geologie der Erde, Vol. 7, Berlin, 1968.

Geology of Jordan, trans. M. K. Khdeir, Contributions to the Regional Geology of the Earth, supplementary ed. of vol. 7, Berlin, 1974.

R. G. Boling, Bronze Age Buildings at the Shechem High Place: American Schools of Oriental Research Excavations at Tananir, *BA,* 32 (1969) p. 81-103.

Excavations at Tananir, 1968, p. 24-85 in *Report on Archaeological Work at Ṣuwwanet eth-Thaniya, Tananir, and Khirbet Minha (Munhata),* Missoula, MT, 1975.

R. S. Boraas, A Preliminary Sounding at Rujm El-Malfuf, 1969, *ADAJ,* 16 (1971) p. 31-45.

E. F. Campbell, Jr., and G. E. Wright, Tribal League Shrines in Amman and Shechem, *BA,* 32 (1969) p. 104-116.

A. J. Clark, A Square Array for Resistivity Surveying, *Prospezioni Archeologiche,* 3 (1968) p. 111-114.

Resistivity Surveying, p. 695-707 in *Science in Archaeology: A Survey of Progress and Research,* New York, 1970.

C. R. Conder, *The Survey of Eastern Palestine,* Vol. 1, London, 1899.

R. W. Dajani, Jebel Nuzha Tomb at Amman, *ADAJ,* 11 (1966) p. 48-49.

A Late Bronze-Iron Age Tomb Excavated at Sahab, *ADAJ,* 15 (1970) p. 29-36.

Department of Lands and Surveys of Jordan, 1: 10,000 Zarqa Basin Maps, Air photography survey, Compiled, drawn, and printed by Air Survey Co., London, 1950.

W. G. Dever, Archaeological Method in Israel: A Continuing Revolution, *BA,* 43 (1980) p. 40-48.

R. H. Dornemann, *The Cultural and Archaeological History of Transjordan in the Bronze and Iron Ages,* 2 Vols. Ph.D. dissertation, University of Chicago, Chicago, 1970.

G. Fohrer, Eisenzeitliche Anlagen im Räume südlich von nasur und die Südwestgrenze von Ammon, *ZDPV,* 77 (1961) p. 56-71.

H. J. Franken, The Other Side of Jordan, *ADAJ,* 15 (1970) p. 5-10.

H. J. Franken, and W. J. A. Power, Reviews: Glueck's *Explorations in Eastern Palestine* in the Light of Recent Evidence, *VT,* 21 (1971) p. 119-123.

V. Fritz, Erwägungen zu dem spätbronzezeitliche Quadratbau bei Amman, *ZDPV,* 87 (1971) 140-52.

H. Gese, Ammonitische Grezfestungen zwischen wadi es-sir und na'ur, *ZDPV,* 74 (1958) p. 55-64.

N. Glueck, N. *Explorations in Eastern Palestine, I, AASOR,* 14, Philadelphia: 1934.

Explorations in the Land of Ammon, *BASOR,* 68 (1937), p. 13-21.

Explorations in Eastern Palestine, III, AASOR, 18-19, New Haven, 1939.

The Other Side of Jordan, New Haven 1940.

Explorations in Eastern Palestine, IV. AASOR, 25-28, New Haven, 1951.

The Other Side of Jordan, 2d ed, Cambridge, MA, 1970.

P. Haggett, *Locational Analysis in Human Geography,* New York, 1966.
G. L. Harding, *The Antiquities of Jordan,* 2d ed., rev, New York, 1967.
Four Tomb Groups from Jordan: An Early Iron Age Tomb at Madeba, *Palestine Exploration Fund Annual,* 6 (1953) p. 27-41.
G. L. Harding, and B. S. J. Isserlin, Four Tomb Groups from Jordan: A Middle Bronze Age Tomb at Amman, *Palestine Exploration Fund Annual,* 6 (1953) p. 14-26.
Hashemite Kingdom of Jordan, Natural Resources Authority, and Federal Republic of Germany, Agency for Technical Cooperation, Tentative Work Program for the Assessment of the Groundwater Resources in the Baq'a Area, Appendix VI-I (p. 1-7) in Vol. 4 of the *National Water Master Plan of Jordan,* Amman: Hashemite Kingdom of Jordan, Natural Resources Authority and Federal Republic of Germany, Agency for Technical Cooperation, 1977.
J. B. Hennessy, Excavations of a Late Bronze Age Temple, *PEQ,* (1966) p. 155-62.
A temple of Human Sacrifice at Amman, *The Gazette* (University of Sydney), 2 (20) (1970) p. 307-309.
R. Hentschke, Ammonitische Grenzfestungen Südwestlich von 'Amman, *ZDPV,* 76 (1960) p. 101-123.
L. Herr, The Amman Airport "Temple"-1976, *American Schools of Oriental Research Newsletter,* 2 (1977) p. 1-4.
T. R. Hester, R. F. Heizer, and J. A. Graham, *Field Methods in Archaeology,* 6th ed, Palo Alto, CA, 1975.
I. Hodder, and C. Orten, *Spatial Analysis in Archaeology,* New Studies in Archaeology 1, Cambridge, 1976.
R. Ibach, Jr., Expanded Archaeological Survey of the Hesban Region, p. 201-213 in *Heshbon 1976: The Fifth Campaign at Tell Hesban, A Preliminary Report* by R. S. Boraas and L. T. Geraty, Andrews University Monographs, Studies in Religion, vol. 10. Berrien Springs, MI, 1978.
M. Ibrahim, Archaeological Excavation at Sahab, 1972, *ADAJ,* 17 (1972) p. 23-36.
Excavations at Sahab, *Jordan,* 6(3) (1975)[a]) p. 14-23.
Second Season of Excavation at Sahab, 1973, *ADAJ,* 19 (1974) p. 55-61.
Third Season of Excavations at Sahab, 1975 (Preliminary Report), *ADAJ,* 20 (1975 [b]) p. 69-82.
M. Ibrahim, J. A. Sauer, and K. Yassine, The East Jordan Valley Survey, 1975, *BASOR,* 222 (1976) p. 41-66.
G. M. Landes, The Material Civilization of The Ammonites, p. 69-88 in vol. 2 of *The Bibilical Archaeologist Reader,* eds. E.F. Campbell, Jr., and D.N. Freedman. Garden City, NY, 1964.
S. Limbrey, *Soil Science and Archaeology,* Studies in Archaeological Science, ed. G.W. Dimbleby. London, 1975.
F. S. Ma'ayeh, Recent Archaeological Discoveries in Jordan: Quailba (Irbid District), *ADAJ,* 4-5 (1960) p. 116.
P. E. McGovern, TheBaq'ah Valley, Jordan: A Cesium Magnetometer Survey, *MASCA Journal,* 1 (1979) p. 39-41.
Explorations in the Umm ad-Dananir Region of the Baq'ah Valley, 1977-1978, *ADAJ,* 24 (1980)[a]) p. 55-67.
Ornamental and Amuletic Jewelry Pendants of Late Bronze Age Palestine: An Archaeological Study, Ph.D. Dissertation, University of Pennsylvania, Philadelphia. Ann Arbor, MI: University Microfilms, (1980 [b]).
The Baq'ah Valley, Jordan: Test Soundings of Cesium Magnetometer Anomalies, *MASCA Journal,* 1(7) (1981[b]) p. 214-17.
Baq'ah Valley Project 1980, *BA,* 44 (1981[b]) p. 126-28.
Baq'ah Valley Project 1980, *ADAJ,* 25 (1981[c]) p. 356-357.
Exploring the Burial Caves of the Baq'ah Valley in Jordan, *Archaeology,* 35 (1982 b) p. 46-57.

Baq'ah Valley Project 1981, *BA* 45 (1982[b]) p. 122-124.
D. Mackenzie, The Megalithic Monuments of Rabbath Ammon at Amman, *Palestine Exploration Fund Annual,* 1 (1911) p. 1-40.
J. M. Miller Archaeological Survey of Central Moab: 1978, *BASOR,* 234 (1979) p. 43-52.
S. Mittmann, *Beiträge Zur Siedlungs- und Territorialgeschichte des nördlichen Ostjordanlandes,* Abhandlungen des Deutschen Palästinavereins, Wiesbaden, 1970.
M. Ottosson, *Temples and Cult Places in Palestine,* Boreas: Uppsala Studies in Ancient Mediterranean and Near Eastern Civilizations 12, Uppsala, 1980.
S. Ragir, A Review of Techniques for Archaeological Sampling, p. 181-197 in *A Guide to Field Methods in Archaeology: Approaches to the Anthropology of the Dead* by R.F. Heizer and J.A. Graham, Palo Alto, CA, 1967.
E. K. Ralph, Archaeological Prospecting, *Expedition,* 11(2) (1969) p. 14-21.
H. G. Reventlow, Das Ende der ammonitischen Grenzfestigungskette?, *ZDPV,* 79 (1963) p. 127-137.
J. A. Sauer, *Heshbon Pottery 1971: A Preliminary Report on the Pottery from the 1971 Excavations at Tell Hesban,* Andrews University Monographs, vol. 7, Berrien Springs, MI, 1973.
G. Schumacher, *Across the Jordan; An Exploration and Survey of Hauran and Jaulan.* London, 1886.
B. Spooner, The Cultural Ecology of Pastoral Nomads, Addisson-Wesley Module in *Anthropology,* 45, Reading, MA, 1973.
G. F. Tagg, *Earth Resistances,* New York, 1964.
H. O. Thompson, Iron Age Cosmetic Palettes, *ADAJ,* 16 (1971) p. 61-70.
The 1972 Excavation of Khirbet al-Hajjar, *ADAJ,* 17 (1972) p. 47-64.
Rujm Al-Malfuf South, *ADAJ,* 18 (1973) p. 47-50.
The Ammonite Remains at Khirbet al-Hajjar, *BASOR,* 227 (1977) p. 27-34.
T. L. Thompson, *Historicity of the Patriarchal Narrative: The Quest for the Historic Abraham,* Beiträge zur zeitschrift der alttestamentlichen Wissenschaft 133, Berlin, 1974 [a].
Observations on the Bronze Age in Jordan, *ADAJ,* 19 (1974[b]) p. 63-70.
Historical Notes on Israel's conquest of Palestine, *Journal for the Study of the Old Testament,* 7 (1978) p. 20-27.
M. S. Tite, *Methods of Physical Examination in Archeology,* Studies in Archaeological Science, ed. G. W. Dimbleby, London, 1972.
R. de Vaux, Chronique: Exploration de la région de Salt, *RB,* 47 (1938) p. 417-22.
W. A. Ward, Cylinders and Scarabs from a Late Bronze Age Temple at 'Amman, *ADAJ,* 8-9 (1964) p. 47-55.
Scarabs, Seals and Cylinders from Two Tombs at Amman, *ADAJ,* 11 (1966) p. 5-18.
A Possible New Link between Egypt and Jordan during the Reign of Amenhotep III, *ADAJ,* 18 (1973) p. 45-46.
W. A. Ward, and M. F. Martin, The Balu'a Stele: A New Transcription with Paleographical and Historical Notes, *ADAJ,* 8-9 (1964) p. 5-29.
P. J. Watson, S. A. LeBlanc and C.L. Redman, *Explanation in Archaeology: An Explicitly Scientific Approach,* New York, 1971.
C. Watzinger, *Denkmäler Palästinas: Eine Einführung in die Archäeologie des Heiligen Landes,* 2 vols, Leipzig, 1935.
M. Weippert, The Israelite "Conquest" and the Evidence from Transjordan, p. 15-34 in *Symposia: Celebrating the Seventy-Fifth Anniversary of the Founding of the American Schools of Oriental Research* (1900-1975), ed. F.M. Cross. Zion Research Foundation Occasional Publications, ed. D.N. Freedman. Cambridge, MA, American Schools of Orietnal Research, 1979.

G. R. H. Wright, Mitteilungen: The Bronze Age Temple at Amman, with a Supplementary Note by J.B. Hennessy, *ZAW,* 78 (1966) p. 351-59.
Temples of Shechem, *ZAW,* 80 (1968) p. 1-35.
Pre-Israelite Temples in the Land of Cannan, *PEQ,* (1971 [a]) p. 17-32.
Schechem and League Shrines, *VT* 21(1971[b]) p. 572-603.
Y. Yadin, *Hazor,* Schweich Lectures, 1970, London, 1972.
Y. Yadin, et al. *Hazor* I.III/IV, 3 Vols. Jerusalem, 1958-61.
F. Zayadine, Late Bronze Age, p. 19-21 in *The Archaeological Heritage of Jordan: The Archaeological Periods and Sites (East Bank), Part 1, Amman, 1973.*