

**EXPLORATIONS IN THE UMM AD-DANĀNĪR REGION
OF THE BAQ'AH VALLEY
1977 - 1978**

by
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INTRODUCTION

Late Bronze Age pottery appeared on the antiquities market in Amman in the winter of 1975-76, and was ultimately traced back to a robbed-out burial cave (Cave A2) on Jebel al-Hawāyah in the Umm ad-Danānīr region of the northwestern Baq'ah Valley, ca. twenty kms. northwest of Amman (see Figs. 1, 2, 4, and Pls. XXXVIII, 1 and XXXIX, 1; general geographic coordinates for the region are 35°, 40', 20" E, 32°, 5', 10" N, and Cave A2 is located at 228.19E, 166.28N on the Palestinian grid). Dr. James A. Sauer, director of the American Center of Oriental Research (ACOR) in Amman, informed me of this discovery and suggested that I carry out a trial sounding in the cave, with hopes of finding an undisturbed stratigraphic sequence of LB pottery and artifacts, still badly needed for Transjordan. My interest in the project was further heightened when I learned that a nearby "megalithic" building at Rujm al-Ḥenū had a surface ground plan very similar to the Amman Airport Building (cf. Fig. 7). However, a sounding near the building might easily develop into a major project, and at the time we did not have the financial backing or personnel to attempt anything on a large scale. It was thus decided to limit the project to the cave sounding, which should at least provide us with a preliminary assessment of the potential of the region.

The cave sounding was carried out in June 1977 with the sponsorship of the Jordanian Department of Antiquities, ACOR, and the Kyle-Kelso Archaeological Fund. Robin Brown and I served as co-directors, and were assisted by Ali Sa'idi (district inspector), Jane Muhawi, local workers, and numerous volunteers. Jim Sauer, who has constantly aided the project from its inception, advised on pottery and stratigraphic matters. Dr. Adnan Hadidi, Director-General of the Department of Antiquities, and his staff are also to be greatly thanked for smoothing the way to bring the project into the field at the earliest possible date and for always being ready to aid the project as the need arose.

The cave sounding produced some remarkable results. In contrast to earlier surveys which had found no evidence for LB in the valley (Glueck 1939:191-200; de Vaux 1938: 417 - 22), a very extensive and representative collection of local and imported pottery (including Mycenaean IIIB, Cypriote Base-Ring II, Chocolate-on-white, and bichrome wares), along with accompanying grave goods (scarabs, cylinder seals, toggle-pins, many types of beads, etc.), were recovered from two disturbed strata. The high quality and quantity of the pottery and small artifacts (ca. 10,000 sherds, 52 whole vessels, and 290 small finds were registered), coming from a sounding limited to less than a quarter of the cave, strongly suggested that LB settlement(s) and other burial caves existed nearby. A limited search in the vicinity of the cave confirmed the existence of at least three more LB burial caves, which appeared to be part of a larger series along the northwestern slopes of the valley, where the strata of limestone and sandstone can easily be hollowed out. It also appeared probable that one of the many "megalithic" buildings, which exist within a kilometer of the caves, might be connected with LB occupation, a prime candidate naturally being Rujm al-Ḥenū.

Because of the high probability of finding more LB remains, it was decided that the next logical step towards developing a well thought-out and economical excavation strategy should be to carry out a thorough archaeological survey of the Umm ad-Danānīr region using geophysical prospecting instruments (cesium magnetometer and electrical resistometer), in order to gain a full picture of these remains. This survey was carried out in October-November 1978 with the financial support of the Department of Antiquities, the National Geographic Society, and the Museum Applied Science Center for Archaeology (MASCA) of the University Museum, University of Pennsylvania. The project was headed by myself (principal

investigator) and Dr. Bruce W. Bevan, who were assisted by Ibrahim Haj Hasan (Department conservationist), Susan M. Balderstone (architect), Mohammed Salem, Susan Spencer, Jenine Howard, along with local workers and volunteers. All the major goals, which had been set for the survey, were achieved, including the location of many more LB burial caves and two probable LB settlement sites.

The obvious success of both the sounding and survey in revealing the abundance of unique LB remains in the Umm ad-Danānīr region has led to a formal affiliation of the Baq'ah Valley Project with MASCA, with the goal of exploiting the full scientific potential of the archaeological materials. Besides the continued use of highly sensitive geophysical prospecting tools to inform excavation strategy, a whole battery of scientific techniques (neutron activation analysis, argon beam microprobe, thin-section analysis, thermoluminescent and radiocarbon dating, etc.) are being or will be employed to glean as much information as possible from the materials now available and those that will hopefully be recovered in future seasons.

A number of specialist reports have already been prepared on excavation and survey materials, viz., stratigraphy (Robin M. Brown), faunal and human skeletal remains (Drs. Michael Finnegan and Jack J. Husted of Kansas State University and the University of Kansas, respectively), scarabs (Dr. James M. Weinstein of Cornell University), lithics (Dr. Gary O.

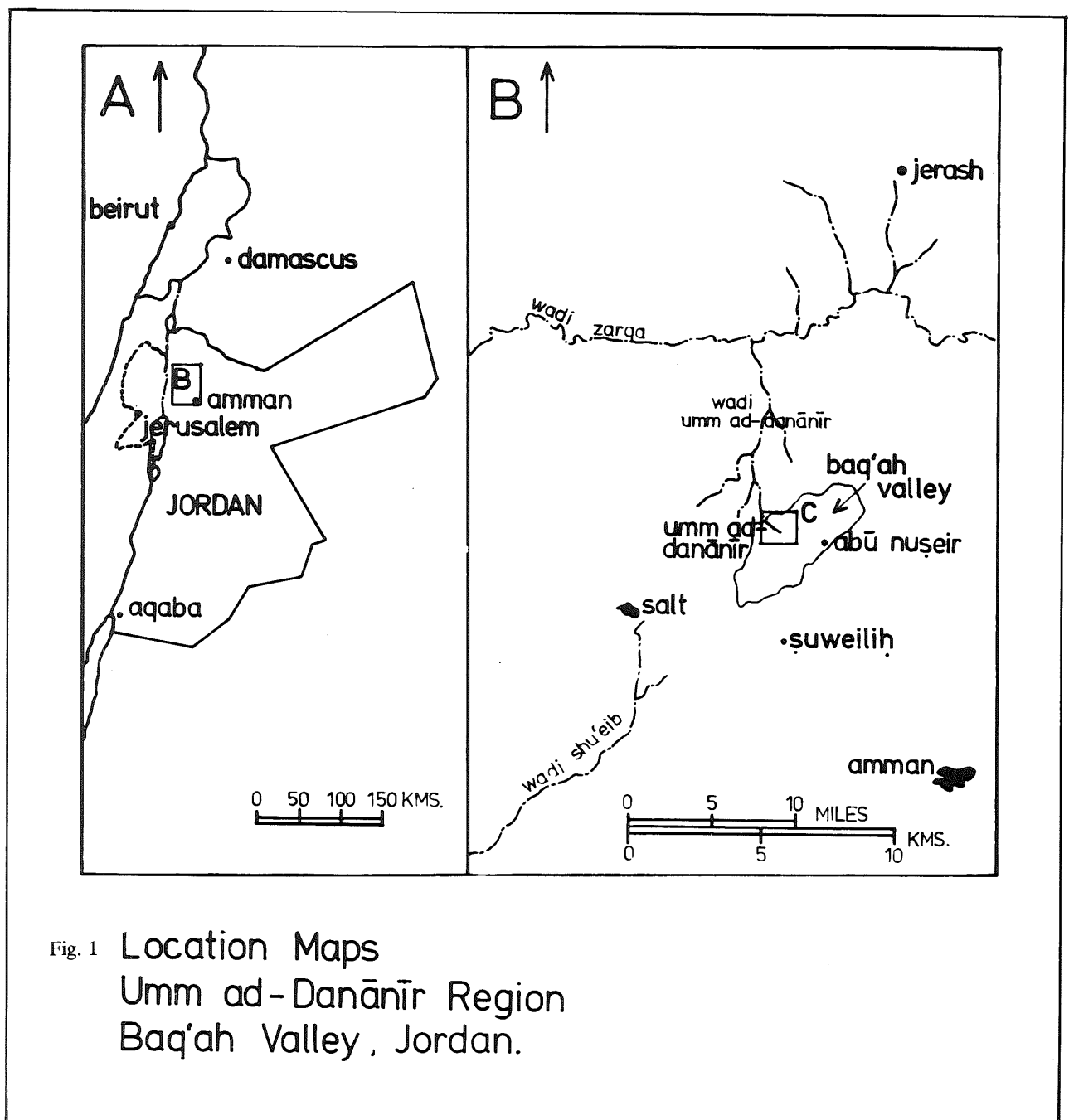


Fig. 1 Location Maps
Umm ad-Danānīr Region
Baq'ah Valley, Jordan.

Rollefson of Professional Analysts), glass and faience (Dr. Sidney M. Goldstein of the Corning Museum of Glass), and Mycenaean and Cypriote imports (Robert B. Koehl of the University of Pennsylvania). The results of these studies, which have contributed some very important and detailed insights to the overall picture, are freely drawn upon in the rest of this report, and this writer would like to express his gratitude to these scholars for their excellent reports.

BURIAL CAVE SOUNDING

As mentioned above, Cave A2 had been partially robbed-out in 1975-76, and we had no idea how much of the cave deposit had been disturbed when we began excavating. The cave is quite large and comprised of eastern and western chambers (each ca. 5 m. in diameter), and is hollowed out of soft limestone and sandstone strata on the lower slopes of Jebel al-Hawāyah. It is not clear whether the cave was naturally formed, but some man-made adaptations are at least suggested by the smoothed-off walls and the division of the cave into two chambers of roughly equal size. The robbers' entrance to the cave was through a hole in the roof, although there was probably a cave mouth further downhill, now covered over by colluvium, as is the case with another very extensively robbed-out LB burial cave (A1 -- Pl. XXXIX, 2), 15 m. to the southwest of Cave A2.

To have completely excavated Cave A2 would have taken many months, and we were forced to limit our investigation to a sounding in the northern half of the eastern chamber and in the northeastern part of the western chamber, covering an area of ca. 20 sq. m. of the estimated 80 sq. m. of the total cave. Fortunately, this was enough to give us a reasonably clear picture of the cave deposits.

In extremely difficult working conditions of high humidity and a meter high working space, we first had to isolate and dig out about a meter of recently disturbed debris (layer 1), with robbers' pits sometimes dipping down another half meter to the floor of the cave. This was a critical and time-consuming operation, since any material from this layer could easily contaminate the presumed undisturbed levels below.

Over 5000 sherds came from this layer, amounting to 56% of the total number of sherds recovered from the sounding. The overwhelming majority of the diagnostic sherds (primarily bowl, lamp, jug, and juglet types) could be dated to LB IA (63%), while another 29% were LB IB and only 8% could be dated to LB II. Several Early Roman I-II and Late Roman III-IV sherds from this layer indicated that the cave must have been used during this period for some undefined purpose.

A unique find from layer 1 was a body sherd from a Mycenaean IIIB squat, biconical stirrup jar. It is comparable in shape and decoration to stirrup jars from the Amman Airport Building, the Deir 'Alla sanctuary, and Level VIII at Beth Shan, and suggests that a trade route from the Jordan Valley passed through the Baq'ah Valley on its way to Amman.

Despite the modern disturbance, all soil from layer 1 was sifted for small artifacts, and this effort was amply rewarded. Glass, faience, copper/bronze, and semi-precious stone beads of many types were recovered, e.g., following the bead classification proposed by Beck (1927), circular oblate and barrel discs (Beck Types I.A.1.a. and I.A. 1.b.), circular oblate (Beck Type I.B.1.a), circular circular (Beck Type I.C.1.a), and fluted spheroid (Beck Type XXIII.A.2.a). Other important finds included complete and fragmented copper/bronze drop earrings, hoop earrings or bracelets, and regularly ribbed toggle-pins without heads (Henschel-Simon's Type 6a), a fragment of an ostrich egg, and two white faience cylinder seals. While one of the cylinder seals has a simple sacred tree motif and may be of local manufacture, the other is very similar to an unpublished LB example from Nuzi and is almost certainly an import from northern Mesopotamia (Pl. XLIII, 1).

A large quantity of faunal and human skeletal material came from layer 1, none of which was from articulated skeletons. The highly alkaline and moist soil conditions of the cave had also left many of the bones in extremely poor condition. Nevertheless, careful analysis of the bones revealed that at least three human adults, three sub-adults, and one infant are represented in layer 1. Although it was difficult to assign genus and species because of the lack of comparative material, it could be determined that frog, turtle, bird, rat, sheep, goat, dog or jackal, donkey, and four varieties of snails were present.

After carefully excavating layer 1, our hope had been to find undisturbed LB levels below. This hope was frustrated by a clear disturbance in antiquity. Layer 2 showed signs of this

disturbance in every locus dug. Whereas the modern debris so prevalent in layer 1 was noticeably lacking here, small artifacts, sherds, whole vessels, and disarticulated bones were found in jumbled heaps under and around many cobbles and boulders.

Some measure of the extent of the disturbance could be gleaned by drawing up distribution charts of artifact types. For example, beads of the same type, which would presumably be found together on the same necklace, were an especially good indicator of how once discrete burials must have been mixed up some time after they were laid out. An extensive pottery reconstruction program provided added confirmation, since some reconstructed whole vessels were comprised of sherds coming from loci which covered the entire area of the sounding and from both layers 1 and 2.

Layer 2 could be divided up into sub-layer 2a, a thin (ca. 25 cm.) multi-coloured sandy layer, and sub-layer 2b, which was thicker (up to a half meter) and made up of a granular brown soil. Sub-layers 2a and 2b are most likely the result of disturbances associated with the laying out of multiple burials, since it was generally the practice to push aside and pile up the bones and goods from earlier burials to make way for the new.

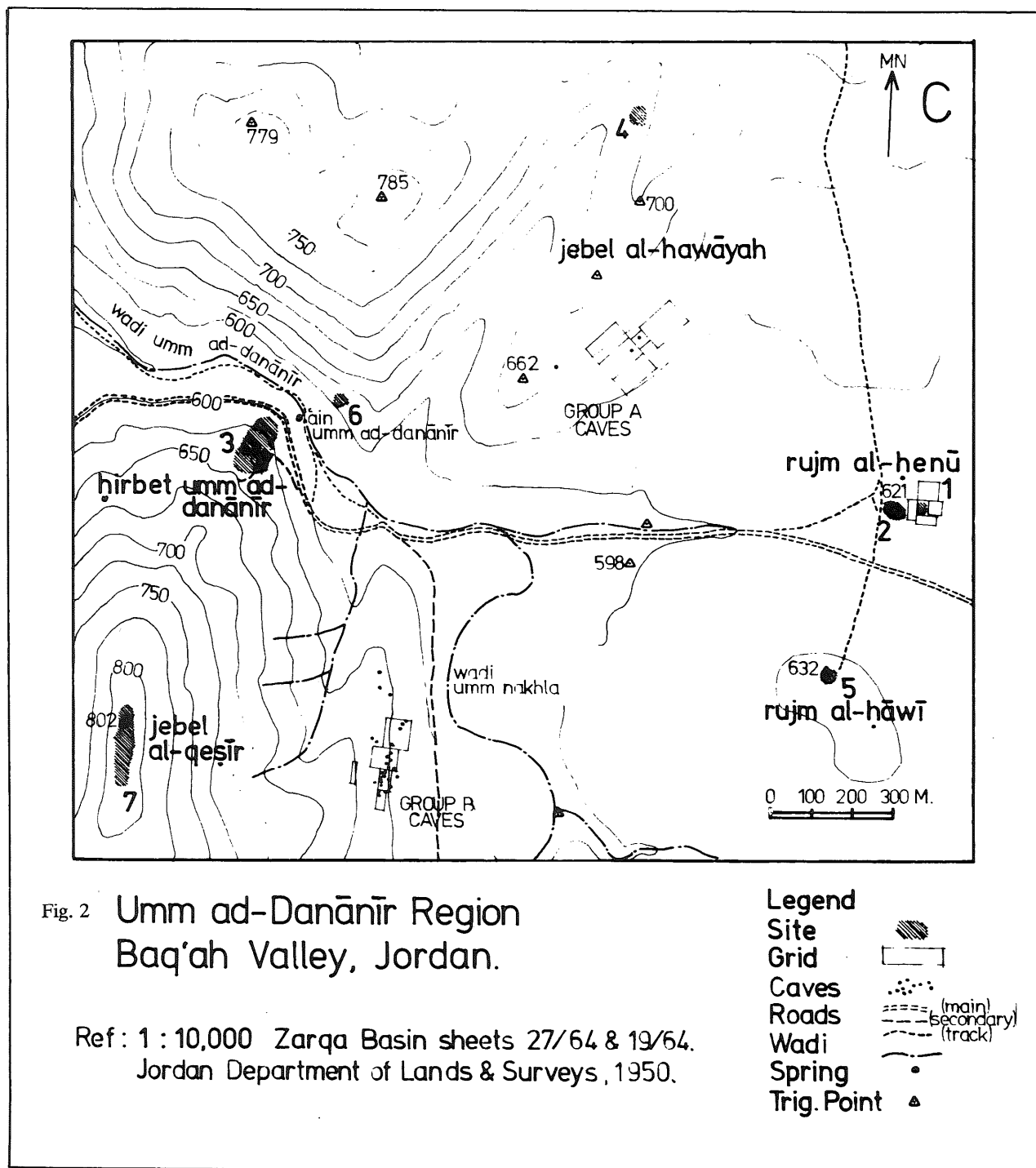
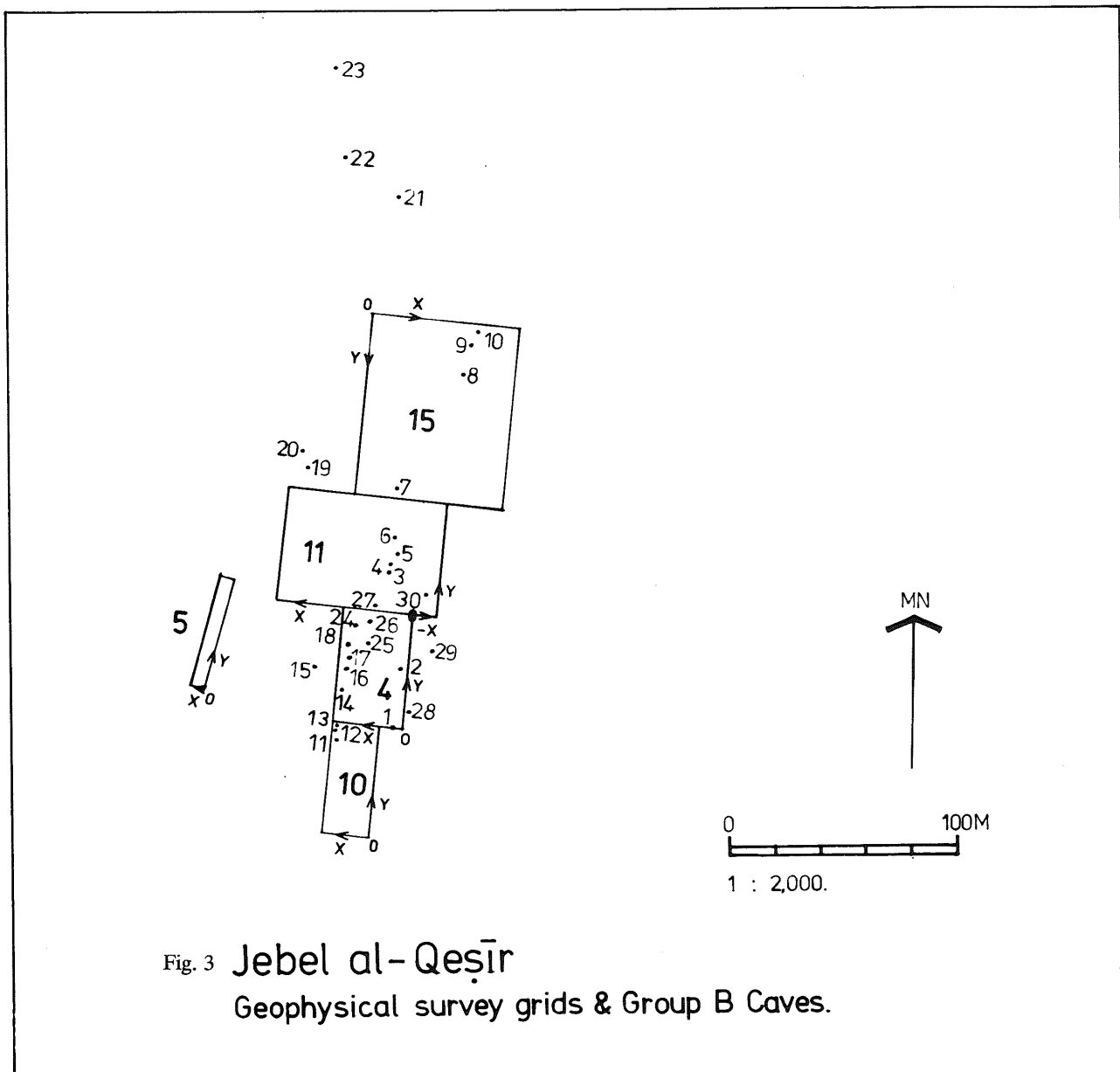


Fig. 2 Umm ad-Danānīr Region
Baq'ah Valley, Jordan.

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

Sub-layer 2a was much poorer in cultural and material remains than 2b, mainly owing to its smaller dimensions. While ca. 3000 sherds (35% of the total) were recovered from 2b, only about 500 (5%) came from 2a. The relative percentages of LB IA, IB, and II sherds were roughly the same in each sub-layer (2a -- LB IA 60%, IB 35%, II 3%; 2b -- LB IA 69%, IB 22%, II 8%), and closely matched the percentages for layer 1. However, only one whole vessel (an LB IB lamp type) was found in sub-layer 2a in contrast to 2b which produced no less than 37 jugs (Pl. XLII,5), juglets (Pl. XLII,3-4), lamps, (Pl. XLII,2), and bowls (Pl. XLII,1), of which 27 could be assigned to LB IA, 6 to IB, and only 1 to LB II (a chalice), another three vessels being transitional LB types. Included among the sherds and whole vessels of layer 2 are some particularly fine examples of Chocolate-on-White (Pl. XLII,6), burnished white slip (Pl. XLII,1), and local bichrome pottery (Pl. XLII,5), in addition to rim, base, and body sherds from three Cypriote Base-Ring II jugs.

The small finds from sub-layer 2a numbered only 7 (4 beads, a drop earring, a toggle-pin fragment, and a green stone drop pendant) as opposed to 196 objects from 2b. Beads from the latter sub-layer accounted for most of this difference, which included another 17 types not represented elsewhere in the sounding. Of special interest were the glass crumb (Beck Type XLVI.A.2.d), spot (Beck Type XLVI.A.2.b.1), and multiple stratified eye (Beck Type XLVI.A.7.a.) beads (Pl. XLIV,1). Since glass was probably invented ca. 1600 B.C. in northern Mesopotamia, the glass beads from our cave sounding, which are most likely from LB I contexts, are very near the beginning of glass-making in the Near East and are some of the earliest glass artifacts recovered to date from a Transjordanian site. It is not impossible that the



glass and faience beads were produced locally, as molds found in other Palestinian excavations suggest.

Copper-bronze finds were also plentiful, including 2 complete drop earrings and 3 toggle-pins of Henschel-Simon's Type 6a (most often found in MB IIC-LB IA contexts). One toggle-pin has a ring passing through its eyelet, which is uncommon for Palestinian toggle-pins but known to occur in Cyprus and at Ras Shamra in the Late Bronze Age.

Two more white faience cylinder seals of probable local type (showing sacred tree and joined standing figure motifs) were found in sub-layer 2b. A green stone scaraboid and 4 glazed steatite scarabs (Pl. XLIII, 2), with close Egyptian and Palestinian parallels from MB IIB-C and LB I contexts, clearly point to Egyptian contacts whether by trade or through a tradition of manufacturing technique. Five wood inlay fragments again most likely suggest an MB IIC or LB I context, as does a hollow pottery bull figurine of crude type (Pl. XLIV, 2), which is very similar to an example from the MB IIC-LB IA burial tomb on Jebel Jofeh el-Gharbi in Amman (Harding 1953: Fig. 9, 105).

The faunal and human skeletal material from layer 2 does not differ greatly from the layer 1 material, but did provide some important new information. The minimum number of humans represented is 6 adults, 3 sub-adults, 2 children, and 3 infants. Arthritic lipping on vertebrae and limb bones, coupled with carious lesions and the degeneration of a considerable number of teeth, follows the pattern in pathology of other agricultural groups, and is a definite indicator that the LB peoples in the Baq'ah Valley were engaged in some type of agricultural activity (unfortunately, pollen and flora, which are poorly preserved in an alkaline environment, were absent in the soil samples examined). Except for the possible presence of cattle and no rodent bones, the fauna represented in layer 2 is identical to that in layer 1. Apart from the snails, over 50% of faunal material was from sheep and goat for both layers, clearly pointing to animal husbandry as another part of LB Baq'ah Valley economy.

Although it would have been more desirable to have recovered intact burials from the various sub-phases of the Late Bronze Age, our limited cave sounding did provide detailed evidence for an extensive LB I presence in the valley, which to a lesser extent continued on through the rest of LB. Moreover, the great quantity of exceptionally well-made local pottery and artifacts and good evidence of contacts to the north, south, and west are virtually impossible to reconcile with Glueck's hypothesis that only nomads and/or "semi-nomads" inhabited Jordan, south of the Wadi Zarqa, in the Late Bronze Age (Glueck 1940:124-25, later modified 1970:141). Evidence for animal husbandry and agriculture, which should not be unexpected for such a highly fertile and well-watered valley as the Baq'ah is today, are additional strong arguments for fully sedentary LB occupation in the region.

* Pl. V Pl. XLII

CESIUM MAGNETOMETER AND RESISTIVITY SURVEY

Assuming the excavated cave to be representative, it appeared likely that other burial caves in the region would be silted up and their mouths covered over by soil eroded away and washed down from the hill above. Obviously, surface exploration would then be of little use. Even where a cave entrance might be partially visible, there would be a high probability of modern disturbance. Completely filled-in caves, on the other hand, could be expected to have intact burials, and might produce the much-needed stratigraphic sequence of Transjordanian LB pottery and artifacts.

Earlier MASCA cesium magnetometer surveys had been successful in detecting graves (Ralph 1969). In order to test the magnetometer's usefulness for the Umm ad-Danānīr region, the magnetic susceptibilities of stone and soil samples from the 1977 cave excavation were measured using a single sensor, with frequent checks on the background field intensity. The difference in average magnetic susceptibility between the cave fill (0.005 nT m³/kg) and the sandstone and limestone bedrock, which showed a slight susceptibility, was statistically significant. Assuming an 8-50 m³ volume range for the filled-in caves, magnetic anomalies between 10 and 50 nanotesla (nT) could be expected. The cesium magnetometer (with its 0.1 nT sensitivity) would detect the complete range of projected anomalies.

Our expectations appear to have been completely justified. Another 32 partially or fully robbed-out burial caves were located on Jebel al-Hawāyah and Jebel al-Qeṣīr (Figs. 2-4). Of

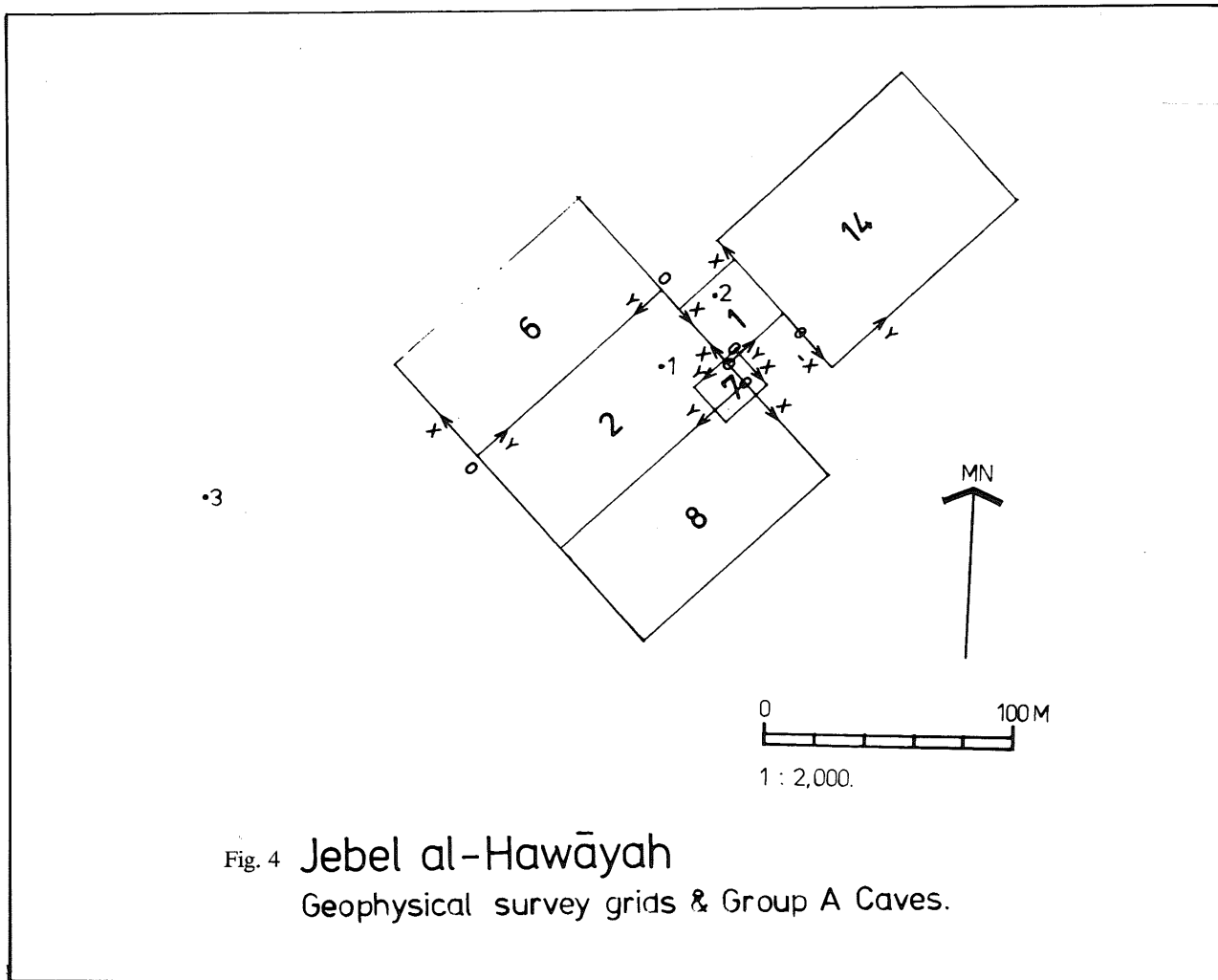


Fig. 4 **Jebel al-Hawāyah**
Geophysical survey grids & Group A Caves.

those caves whose robbers' dumps could be surface sherded (total of 23), 19 were LB in date (5 MB IIC/LB IA, 3 LB 1A, 3 LB II, 7 LB, and 1 LB II/iron IA). Three burial caves were Byzantine, and one was Mamluk. In between these robbed-out caves, no less than 18 significant anomalies in the 10-50 nT range were located and mapped. Since these anomalies are near the robbed-out caves and in the same soft limestone-sandstone strata, some of them undoubtedly represent filled-in LB burial caves.

On Jebel al-Qeṣīr, the robbed-out burial caves and the anomalies run in lines along several tiers (Pl. XL,1), which may be naturally formed or possibly cut by man as roads or terraces since large boulders appear to have been intentionally placed along the tiers in places. Although natural processes could easily have hollowed out the soft limestone, smoothed-off cave walls, one two-chambered cave, and well-cut elliptical, square, or rectangular entrances (occasionally recessed, perhaps to hold a blocking stone) argue for human agency or at least adaptation in the formation of the caves.

Two-thirds of the caves had been extensively robbed out (cf. Pls. XLI,1 and XLI,2), so that a good idea could be gained of the sizes and shapes of caves from the various periods represented. LB caves varied in size from a maximum dimension of ca. 10 m. down to 1 m., and were circular, elliptical (both horizontally along the hill and vertically into the hill), or two-chambered in shape. Many of the robbers' dumps associated with these caves had large quantities of pottery and bones, probably attesting to multiple burials over several generations. From the more than 270 diagnostic sherds collected from the robbers' dumps came some unique finds, including complete profiles of LB I and II vessels, an MB IIC black cylindrical juglet, and 3 sherds of at least two more Mycenaean IIIB stirrup jars, similar in type to that found in excavated cave A2.

The three Byzantine caves and one Mamlūk cave, in contrast to the LB caves, produced only 18 diagnostic sherds, and only one of these caves (Byzantine) had a considerable number of bones in its robbers' dump. While the Mamlūk cave was large (maximum dimension of 4.5 m.) and irregularly shaped, the Byzantine caves varied in shape (circular and irregular ellip-

tical) and were quite small (average dimension of ca. 2 m.), which suggested their use for only a single burial.

Since Early Bronze Age, Iron Age, and Roman remains are also known to exist in the region, cemeteries for these periods should be close by. However, nothing to date has been found of them.

The cesium magnetometer was used to survey 3.4 hectares of ground in the immediate vicinity of the robbed-out caves on Jebel al-Hawāyah and Jebel al-Qeṣīr (Figs. 2-4). Grid 11 (Fig. 5) on Jebel al-Qeṣīr provides a good example of the type of data we obtained. As is readily apparent, there is a great deal more magnetic activity near the robbed-out caves on the lower part of the hill in contrast to further up the hill where there is virtually no activity. Each of the robbed-out caves had an associated robbers' dump downhill from the cave entrance, and predictably these show up as magnetic highs (X14, Y0; X10, Y16; X8, Y24; X9, Y32; X - 9, Y10). The robbed-out caves themselves show up either as lows (B3 and B30) or blend in with the background intensity (B27, B5, and B6), depending upon the amount of magnetic soil fill which has been removed and the size of the air cavity (with no magnetic susceptibility) thus created. When the air void is large enough, it is possible to have a low anomaly relative to the slightly magnetic bedrock.

A number of magnetic highs on the grid, which are not due to robbers' dumps, are very likely filled-in burial caves. Anomalies of 15 nT (X14, Y7) and 10 nT (X14, Y40), both 2 m. x 4 m. in area, are equivalent in size and located on the same line as robbed-out caves B27, B5, and B6, so that they are probably best explained as burial caves, missed by the robbers.

A 15 nT high (X17, Y22), 4 m. x 6 m. in area, with a 10 nT reverse anomaly to the north, may represent an extension of Cave B3, since this cave appears to have been only partially robbed-out. Other highs occur further downhill along another line of robbed-out burial caves, which includes Cave B30, e.g., a 15 nT anomaly at X1, Y27, and a 10 nT one at X-6, Y32.

Magnetic lows are also of potential importance, since they could in fact turn out to be caves or parts of caves that have large air voids, which would naturally be much easier to excavate than filled-in caves. For example, a 10 nT anomaly at X22, Y20, 2 m. x 2 m. in area, could be a further extension of Cave B3. The 20 nT low at X-5, Y16 may be a large unfilled cave with only its mouth covered over, although the high gradient dipole, which showed up even more clearly in a high resolution grid with a 1 m. spacing of measurement, suggests surface iron.

The same pattern of magnetic highs and lows near robbed-out burial caves repeats itself in the other grids on the lower slopes of the two hills. However, only future excavation of various types of magnetic anomalies can enable one to interpret the results more exactly.

The average intensity of the Earth's magnetic field for the Umm ad-Danānīr region was about 43,850 nT, which normally decreased slightly during the morning hours. Since the variation was always quite slow and did not show any disturbances, a single sensor in its absolute mode was used for the survey. This speeded up operation over difficult terrain, even though two sensors in the differential mode would have eliminated all variations, including the diurnal one.

We were also successful in locating two Late Bronze Age settlement sites, again fulfilling our prior expectations and matching the size and richness of the LB cemetery.

Ḥirbet Umm ad-Danānīr (Site 3--Fig. 2) is a large (ca. 1 hectare), multi-terraced site, strategically located above the strong, perennial spring of 'ain Umm ad-Danānīr (Pl. XL,2). It is situated on the northern side of Jebel al-Qeṣīr, and would have guarded the northwestern pass of the Baq'ah Valley, where a trade route between the Jordan Valley and Amman may have run. The site had previously been explored by Glueck (1939:197 - 98) and de Vaux (1938:421), who noted the ancient walls and structures still visible on the surface and assigned them largely to the Iron Age (some Early Roman and Byzantine sherds were also found). According to our systematic surface sherding (total of 306 diagnostics), however, LB II turned out to be a main period of occupation, along with Iron IA and IC, Iron IIA-C, Early Roman III, Early Byzantine, and Mamlūk. Thus, besides having been occupied during LB II, Ḥirbet Umm ad-Danānīr is important as a transitional site from LB II to Iron IA, when a major cultural change occurred in Transjordan with the arrival of the Israelites, Ammonites, etc.

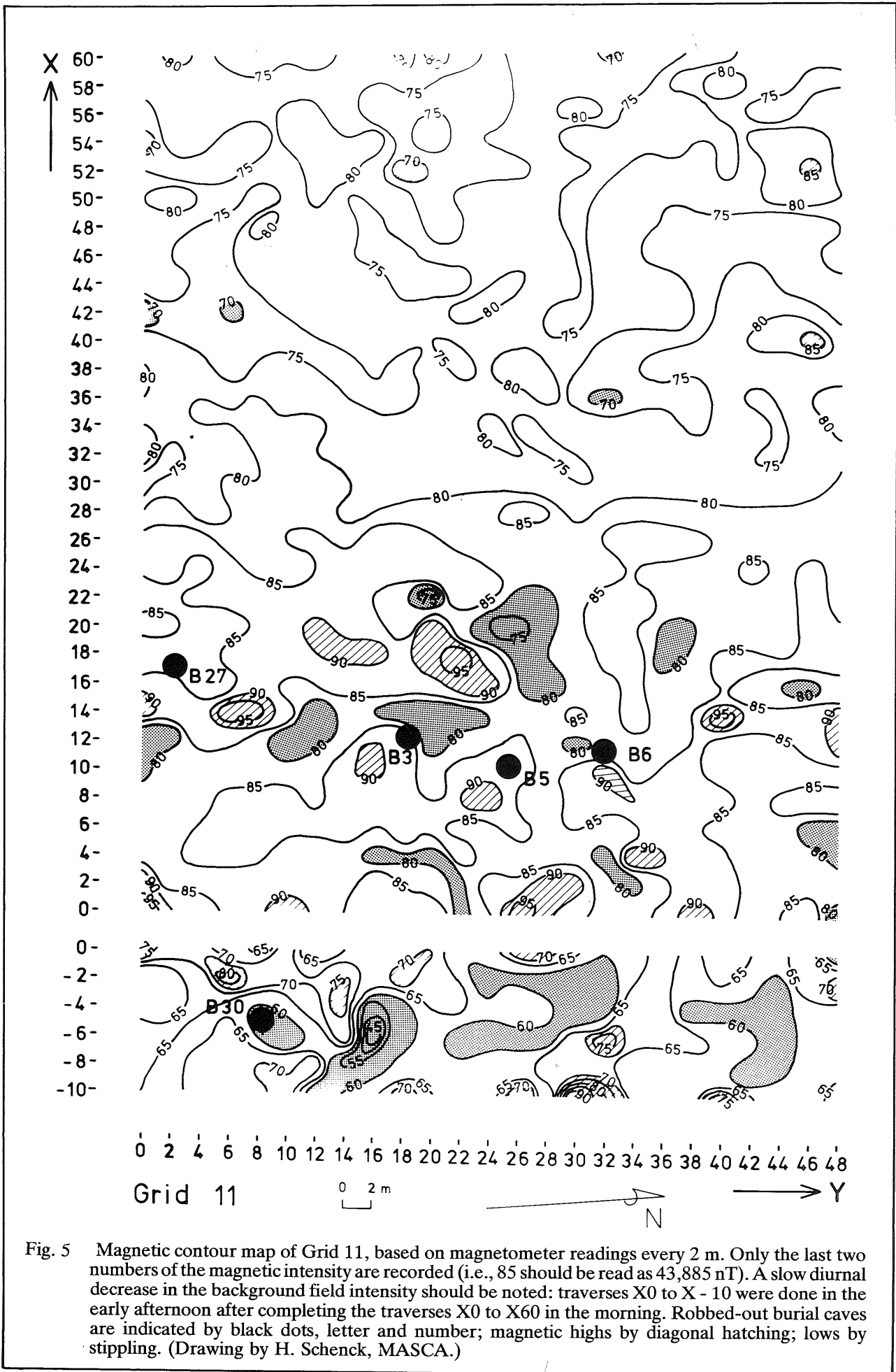


Fig. 5 Magnetic contour map of Grid 11, based on magnetometer readings every 2 m. Only the last two numbers of the magnetic intensity are recorded (i.e., 85 should be read as 43,885 nT). A slow diurnal decrease in the background field intensity should be noted: traverses X0 to X - 10 were done in the early afternoon after completing the traverses X0 to X60 in the morning. Robbed-out burial caves are indicated by black dots, letter and number; magnetic highs by diagonal hatching; lows by stippling. (Drawing by H. Schenck, MASCA.)

The other LB site, Rujm al-Ḥenū, located ca. 650 m. southeast of the line of Jebel al-Hawāyah burial caves in the middle of the valley (Sites 1 and 2--Fig. 2 and Pl. XXXVIII,2), is comprised of two "megalithic" buildings with very clear surface ground plans (dated by Glueck [1939:194] to the Iron Age). The eastern rectangular building (ca. 25 m. x 30 m.), with a central courtyard surrounded by other rooms, is similar in structure to the LB Amman Airport Building (cp. Fig. 7). Besides Iron IIC, Late Roman/Early Byzantine, Umayyad, Mamlūk, and modern sherds from the various rooms, MB IIC/LB IA sherds were discovered in the central courtyard of the building. Since no MB IIC/LB IA sherds were found within 500 m. of the structure after systematic traverses of the region, it now appears highly probable that we have located another example of a characteristic MB-LB architectural type, which also occurs west of the Jordan River. Secondary constructions in the corners of several rooms indicate that the building was used by later inhabitants of the region. Although no exact determination was possible, the soil accumulation within the building appears to be considerable.

Surface sherding of the western "megalithic" building of Rujm al-Ḥenū (Site 2), which is actually situated on a small tell ca. 3 m. high, suggests that it may have been constructed during LB II, although most of the evidence points to Iron IIC as the main period of occupation. The main rectangular structure (46 m. x 14 m.) has a rectangular tower on the south and a circular tower, which appears to run over an earlier wall, on the west.

In order to determine whether occupation at Rujm al-Ḥenū was more extensive, a Gossen Geohm resistometer was used in an attempt to locate buried walls and structures. The specific resistivity of soil samples from the valley, collected in 1977, had previously been found to vary between 20 and 60 ohm-m., which was much lower than the values for limestone and sandstone (about 5000 ohm-m.), used in the construction of the "megalithic" buildings. Therefore, stones of buried structures should be detectible. A four-probe Wenner configuration with a 1 m. probe separation was used and found to be quite suitable for our purposes. Grids were run on each side of the eastern building and between the two buildings of Rujm al-Ḥenū, covering a total area of 0.62 hectares (Fig. 6). A number of fairly large, diffuse areas of higher resistivity were located, which are very suggestive of a larger area of settlement. However, as with the magnetometer results, the various types of resistivity patterns will have to be tested by excavation.

Sites of other periods were located and explored in the Umm ad-Danānīr region. The most impressive of these is the large Early Bronze II-IV site of al-Qeṣīr (Site 7--Fig. 2), which Glueck (1939:198-200) dates to the same period. It covers the entire top of Jebel al-Qeṣīr, and has many structures and an encircling defensive wall still visible on the surface.

Three Iron II sites were investigated. Two of these were newly discovered, but had been almost totally destroyed by modern earth-moving. Rujm 'ain Umm ad-Danānīr (Site 6--Fig. 2), located about 100 m. northeast of the spring, may have been a "megalithic" building, since sherds were found within a 20 m. diameter area and a 5 m. line of limestone and sandstone boulders within this area could be an ancient wall. Only Iron IIB-C sherds were found, suggesting that the site was an offshoot of Ḥirbet Umm ad-Danānīr in prosperous times. Rujm al-Hawāyah (Site 4--Fig. 2), located up a side valley behind Jebel al-Hawāyah, also appeared to be a "megalithic" building and another offshoot of Ḥirbet Umm ad-Danānīr. Its main period of occupation was Iron IIC.

The third Iron II site, Rujm al-Hāwī (Site 5--Fig. 2) had been previously explored by Glueck (1939:194) and de Vaux (1938:420), who also assigned dates within the Iron Age. A large (ca. 50 m. x 30 m.) "megalithic" building is situated on a small tell 5 m. high, and two circular towers (*rujm malfūf*) are located to the south and one to the west of the main structure and separated from it. Surface sherding indicates an Iron IIC date for construction with later uses in Early Byzantine and modern periods. It is very plausible to view Rujm al-Hāwī and the western building of Rujm al-Ḥenū (Site 2), which are ca. 350 m. apart, as examples of Iron Age forts which were advanced positions guarding routes to Amman. Many other Iron Age forts of the same type exist in the Amman area, and indeed there are several more scattered in other parts of the Baq'ah Valley, which we were not able to fully explore during the 1978 survey. Ḥirbet al-Mudmār (Glueck 1939:192-94), located a half kilometer south of Rujmal-Ḥenū, is one of the largest and best preserved of these, with standing walls up to 5.5 m. in places.

A very important addition to our knowledge about the Baq'ah Valley, totally missed by earlier explorers, comes from a collection of 250 lithic artifacts concentrated in nine of the magnetometer grids on Jebel al-Hawāyah and Jebel al-Qeṣīr. Seventeen implement and five

core types, dating to the later Middle Palaeolithic (ca. 45,000 B.C.), Upper Palaeolithic, Epi-palaeolithic, and Neolithic periods, greatly push back man's earliest presence in the valley. The flints may have been deposited on the lower slopes as colluvium. Alternatively, the flints may mark the sites of encampments along the shore of a lake which filled the valley in the Pleistocene and immediately post-Pleistocene periods.

SCIENTIFIC STUDIES

The LB burial caves and probable settlement(s) in the Umm ad-Danānīr region promise to fill in a large gap in Jordan's cultural history, since to date only a few small LB sites have been excavated on the Transjordanian plateau and much of this material is still unpublished. With the Department of Antiquities' encouragement, MASCA has launched an ambitious program of scientific analyses, which will take full advantage of the many tools that modern science has made available to archaeology. The uniqueness and importance of the archaeological materials already available for study, as well as what can reasonably be expected to be recovered in future seasons, make it imperative that as much information as possible be derived from these materials. MASCA is an ideal home base from which to develop and coordinate such a programme.

Pottery, the main evidence for chronology and the most abundant cultural material, needs to be studied utilizing every available resource. Beyond the standard typological distinctions of shape, decoration, ware description, etc., mineralogical and chemical composition analyses are needed to fully characterize the pottery. Thin-section mineralogical studies (for the identification of inclusions, precise determination of the presence or absence of a slip, etc.) are a *sine qua non* and a basic starting-point for the use of more sophisticated methods of chemical analysis. Fourteen pottery sherds from the 1977 cave sounding, representing the spectrum of LB ware types (from fine Mycenaean, Cypriote, and Chocolate-on-White to the coarser local wares), have been thin-sectioned and are now being studied. Concurrently, 200 mg. samples from the same sherds have been submitted to Brookhaven National Laboratory for neutron activation analysis. The chemical "fingerprints" of the wares will be statistically compared with the results from other analyses stored in a computer data bank and the best matches found for determining the origin of the pottery. The thin-section and neutron activation studies may eventually be complemented by other types of analyses (e.g., electron microscopic and x-ray studies), which could shed light on the provenience and technological aspects of the pottery.

Despite their chemical complexity, the glass and faience beads also warrant analyses, in order to elucidate the provenience and technology required for some of Jordan's earliest glass. A new technique, an argon-beam microprobe, will be tried for a start.

Similarly, for elucidating Jordan's early metallurgical history, the copper/bronze artifacts are presently being analyzed by two basic techniques: proton-induced x-ray emission spectroscopy (PIXE) at the Atomic Energy Research Establishment in Harwell, England, and

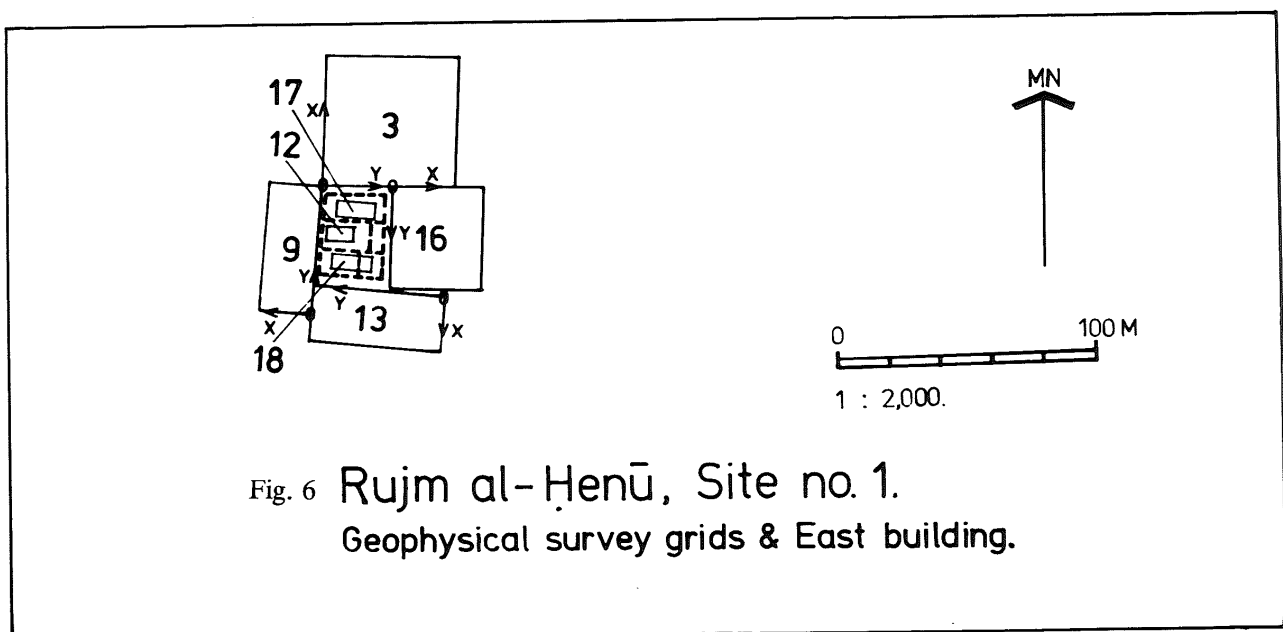


Fig. 6 Rujm al-Henū, Site no. 1.
Geophysical survey grids & East building.

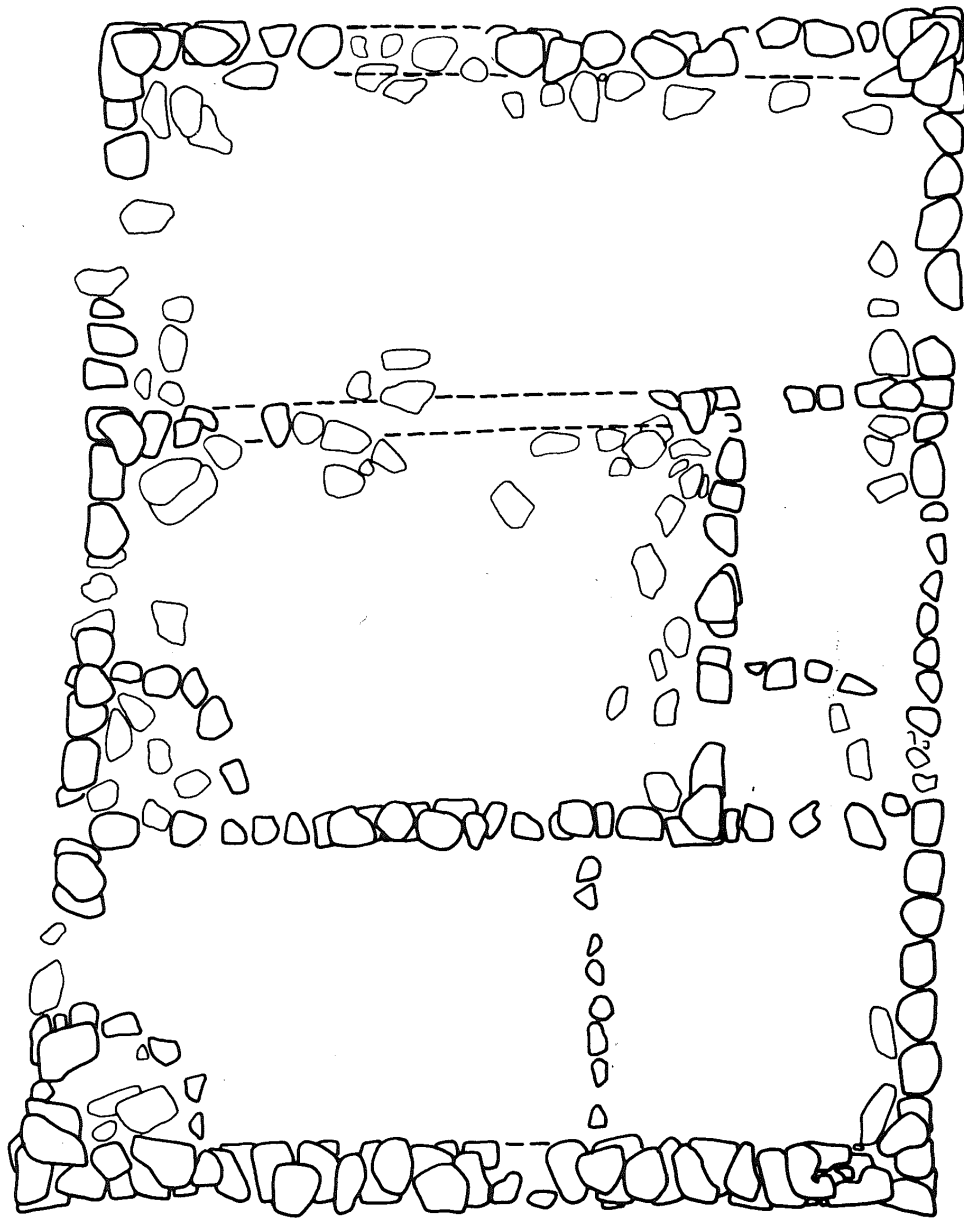
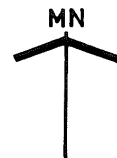
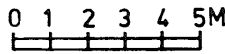


Fig. 7 Rujm al-Henū
Plan of East Building.
Scale - 1 : 100

Susan M. Balderstone A.R.A.I.A. Architect.



6.11.1979.

electron microscopic studies at the Laboratory for Research on the Structure of Matter, University of Pennsylvania.

This is only the tip of the scientific "iceberg," and other types of analyses will be employed as the occasion demands. Thermo-luminescent and radio-carbon dating, an important part of MASCA's research thrust, can help in establishing and testing the LB pottery chronology for Transjordan, where one should expect the pottery traditions to be different from sites west of the Jordan River and where Egyptian synchronisms may be more difficult to establish.

MASCA has also been a pioneer in the fields of geophysical prospecting and aerial photography as applied to archaeology, and these will continue to be important adjuncts to any future excavation or survey in the Baq'ah Valley. Experiments with new equipment could

prove them to be even more productive than equipment used in the past. For example, ground-penetrating radar could probably detect burial caves in the Umm ad-Danānīr region more precisely than the cesium magnetometer, and hang-gliders and kites are possible inexpensive alternatives to planes for aerial photography.

Virtually nothing is known about the vegetational, agricultural, and related environmental conditions of LB Transjordan. Since it is not unreasonable to assume that the Baq'ah was as fertile and well-watered in antiquity as it is today, we plan to continue to collect soil samples in future seasons for pollen and palaeobotanical analysis. MASCA's earth auger will also be used to take corings in various parts of the valley.

With the projected recovery of more faunal and human skeletal material, hopefully articulated, a fuller picture of LB animal and human population should emerge. Together with the palaeobotanical data and the judicious use of ethnographic parallels and historical sources, LB environmental and ecological conditions in the valley and man's adaptations to such can be reconstructed.

CONCLUSION AND FUTURE PLANS

Excavation at the earliest possible date is now of top priority, before more robbing and development in the area occurs. Various types of magnetic anomalies should be tested to exactly define the magnetic "signatures" of LB burial caves, and undisturbed burial caves will need to be fully excavated to recover more artifactual material for scientific analysis and study.

Soundings must also be made at Ḥirbet Umm ad-Danānīr and Rujm al-Ḥenū, particularly the latter, in order to verify the LB surface sherding evidence and to move one step closer to a more extensive excavation of these potentially important settlement sites.

Landowner approval has already been obtained for excavating the burial caves and the settlement sites. It is hoped that the same institutional support and affiliation will continue, since this will expedite getting back into the field soon.

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