

Yigal Shiloh. One of the most important discoveries made this summer was the Late Iron II structures built over the base of the stone-stepped ramp on the eastern slope of the Ophel. Kenyon's attribution to the Second Temple period must now be revised in light of the most recent evidence.

Sy Gitin  
Albright Institute of Archaeological Research  
Jerusalem, Israel

### Baq'ah Valley Project 1980

The third season of the Baq'ah Valley Project (15 May-30 June 1980) proved to be an excellent follow-up to the 1978 geophysical survey. The project was again jointly sponsored by the National Geographic Society, the Jordanian Department of Antiquities, and the Museum Applied Science Center for Archaeology (MASCA) and the University Museum of the University of Pennsylvania; it was affiliated with the American Schools of Oriental Research (ASOR) and its center in Amman, Jordan (ACOR). Four MASCA personnel (Dr. Patrick McGovern, Director; Helen Schenck, Registrar; Nicholas Hartmann, Photographer; and William Glanzman, Field Supervisor), resident Albright and NEH fellows at ACOR (Drs. Vincent Clark and David Graf, respectively), osteologist (Marilyn Saul), and architect (Susan Balderstone) comprised the core staff, and were assisted by the Departmental representatives (Ali Sa'idi and Sa'ad Hadidi) and a crew of 20 workmen.

### Summary of the 1978 Survey Results

As part of the 1978 campaign, 33 partially or fully robbed-out burial caves, 19 of which dated to various phases of the Late Bronze Age (LB), had been located on the lower slopes of Jebel al-Hawāyah and Jebel al-Qešir in the Umm ad-Danānir regions of the northwestern Baq'ah Valley, ca. 20 kms northwest of Amman, Jordan. Because of the high probability of finding more unrobbed burial caves nearby, a cesium magnetometer survey was also carried out in conjunction with the standard archeological survey.

The cesium magnetometer is the most sensitive magnetic prospecting instrument presently available, and MASCA pioneered and has continued to be in the forefront of research involving its application to archeology. Since earlier magnetometer surveys had been successful in detecting graves at Forts Louisbourg and Lennox in Canada, it appeared possible that the cesium magnetometer could be similarly employed to locate much larger, filled-in burial caves in the Umm ad-Danānir region, but this assumption needed to be tested before going into the field. The cesium magnetometer measures the total intensity of the magnetic field, including that of the earth, and a magnetic contrast must exist between the feature one wishes to detect and its immediate environment. For the Baq'ah Valley caves, what was required, then, was a contrast between the magnetization of the soil filling the caves and the

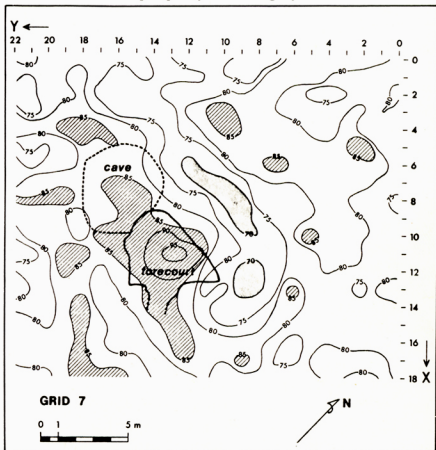
surrounding limestone and sandstone bedrock. Actual measurements indicated that the soil was indeed ten times more susceptible to magnetization than the bedrock, and it could be calculated that completely filled caves ranging in volume from 8 m<sup>3</sup> to 40 m<sup>3</sup> should show up as magnetic highs with intensities between 5 and 25 nanotesla (nT), a relatively small anomaly in contrast to the average total field of about 44,000 nT for the Baq'ah Valley.

In accordance with this projection, the magnetometer survey resulted in the location of some 25 significant (5 nT or greater) magnetic highs, close to the robbed-out caves and thus most likely representing filled-in burial caves. Six significant magnetic low spots, possibly due to nonmagnetic air voids contrasted with the slightly magnetic bedrock, were also of interest, since they might mark unrobbed-up caves, which would be easier to excavate.

### Test Sounding of a Magnetic Anomaly

Archeological test soundings were obviously required to define the distinctive magnetic pattern(s) of the hypothesized undisturbed burial caves. From a priority list of 31 significant magnetic anomalies of various intensities and areal dimensions, a ca. 7 × 11 m, 5-15 nT high on Jebel al-Hawāyah was chosen for the initial test excavation. Theory was borne out by excavation, and an undisturbed Iron IA burial cave (A4), completely silted up and further sealed off by six large boulders (ca. 1.5 m in length) blocking the entrance, was discovered exactly in the area of the magnetic anomaly.

**Superimposition of ground plan of Cave A4 over magnetic high.** The 85 (= 43,885 nT) contour line follows the general external configuration of the cave to the northwest, the forecourt, and ramp to the southeast. The area of the greatest colluvial build-up in the forecourt and the midpoint of the anomaly show up as a 15 nT high at X = 11, Y = 13, which drops off to 5 nT on the periphery. Drawing by H. Schenck.





**Left: Forecourt and entrance** to Cave A4 on Jebel Al-Hawāyah. Before excavation only a small outcrop of bedrock was visible; cave and forecourt were completely silted up. **Right: Cave A4.** Chalice, lamp, and mild steel anklet *in situ*. All photos courtesy of Nicholas Hartmann/MASCA.



When the ground plan of the cave and forecourt is superimposed over the magnetometer contour map of data points spaced 1 m apart, the fit between the two is seen to be extremely close. With some allowance for geometric variations, the range of magnetic values can be shown to correspond very closely to the calculated intensities of the soil volumes of the cave and forecourt. The lows to the north, rather than resulting from air voids, match up with large bedrock outcrops with a lower magnetic intensity, which is not offset by the usual cover of more-magnetic soil. Although groundwater percolation may have eroded away some of the soft limestone/sandstone bedding planes in the initial stages of cave formation, the final form of the relatively symmetrical cave and forecourt with a ramp leading down to the latter is man-made.

Compared with nearby LB burial caves, which are ca. 10 m in diameter, Cave A4 is quite small. However, into its ca. 20-m<sup>2</sup> area, over 225 burials had been deposited, the majority in the secondary heaps—women and children to the south and men to the north. With the burials was an excellent and unique assemblage of Iron IA whole vessels (total of 78, including bowls, lamps, jugs, juglets, kraters, beer-strainers, chalices, and basalt mortars), together with carburized iron (mild steel) and bronze anklets and bracelets, earrings and rings, beads in a wide assortment of types and materials (glass faience, semiprecious stones and bone), toggle-pins, buttons, and one example each of a pendant, scarab, stamp seal, and cylinder seal.

The steel anklets/bracelets, which retained substantial amounts of uncorroded metal, are among the earliest such artifacts from the Transjordan plateau and will be thoroughly examined in MASCA to elucidate the important transition from bronze to iron metallurgy during this period. However, in general, this tightly dated burial group promises to illuminate a critical time when the relatively advanced LB culture was ending, and new peoples, such as the Ammonites and Israelites, were

emerging. Besides metallographic studies, MASCA will also be involved in radiocarbon and thermoluminescence (TL) dating to test the traditional pottery chronology, thin-section and neutron activation studies of the pottery wares, which will be compared against compositional analysis of the LB wares and the rich clay deposits of the Baq'ah Valley to determine local or foreign manufacture and possible continuity between LB and Iron IA cultures, and paleobotanical and malacological examination.

The study of the human skeletal and faunal remains is being carried out in three stages. First, the gross quantitative and nonquantitative attributes of the collection are presently being studied by Marilyn Saul at ACOR. Following this, the material will be shipped to Washington for permanent storage in the Smithsonian Institution, where Dr. Donald Ortner will make a more detailed study of the paleopathology and genetic characteristics of the bones. Finally, Drs. Francis Johnston and Irving Shapiro of the University of Pennsylvania will look at the metal levels in the bones, especially as contrasted with concentrations in LB bones. Preliminary results already indicate that all ages are represented, various diseases are in evidence (e.g., arthritis, dental caries, etc.), and a number of individuals exhibit similar genetic traits of the patella and cranium. It appears from the partial articulation of some of the skeletons that bodies may have been shoved aside relatively soon after being primarily deposited in the tomb, perhaps suggestive of an epidemic, war, or other natural or human catastrophe often hypothesized for this period.

#### *Test Soundings at Potential Settlement Site(s)*

In an attempt to locate the settlement site(s) to go with the LB and Iron IA cemetery, soundings were made at Rujm al-Henū (Sites 1 and 2) and Khirbet Umm ad-Danānir (Site 3). The eastern building of Rujm al-Henū (Site 1), which has a ground plan similar to the Amman Airport Building, unfortunately had only 30 cm of a mixed Byzantine and Iron Age fill above bedrock. However, the presence of some LB sherds still suggests that it may have been constructed in this period and cleared and used by later peoples. The resistivity results from the vicinity and inside this building correlated very well with bedrock irregularities and indicate that the building is isolated from other settlement on three sides.





**Aerial view** of Rujm al-Henū. Smaller eastern building (Site 1) in foreground; larger structure (Site 2) dates to Iron IIC.

To the west, soundings were carried out at another "megalithic" building with a clear surface ground plan (Site 2, Rujm al-Henū [W]). This building had a single Iron IIC (600-400 B.C.) destruction level which sealed smashed whole storage jars under massive stones from upper courses of the wall, of which five buried courses remained. In the small area of the sounding, covering ca. 5% of the total area of the building, it could be shown that the circular tower on the west side was part of the overall rectangular structure.

The main LB-Iron IA settlement site now appears to be located at Khirbet Umm ad-Danānīr, which is strategically placed at the head of the Wadi Umm ad-Danānīr and above the perennial spring of the same name. The small sounding opened here produced mixed deposits definitely dating to the LB II, Iron IA, Iron IIC, and Early Roman III periods, as well as a 2.5-m-high outer wall of a house probably dating to the Early Roman III period. It is hoped that the remains of the structures of the LB-Iron Age settlement will be found here in future seasons.

This would provide yet another challenge to the hypothesis that only nomads and/or "seminomads" inhabited Jordan, south of the Wadi Zarqa, in the Late Bronze Age. Indeed, the Iron IA people(s) who are often viewed as intrusive elements on their way to becoming fully sedentary might better be understood in the context of continuity of a fully settled population in the Umm ad-Danānīr region. While the Iron IA cultural level is below that of the LB, particularly evident in the poorly fired, coarser pottery (but contrast the technical sophistication of the steel jewelry) and the number of imported artifacts drops off markedly after 1200 B.C., it should be noted that burial caves for the two periods are found close together, pottery and small-object types are shared or very similar, and, finally, considerable archeological material from both periods occurs together at Khirbet Umm ad-Danānīr.

A number of interesting finds were made at the Rujm al-Henū buildings and at Khirbet Umm ad-Danānīr, including Ottoman pipes, limestone measuring cups, basalt vessels and mortars, weights, a coin, pendants, figurines, a gaming piece, glass fragments, sling stones, and two cosmetic palettes.

#### *Aerial Survey of the Umm ad-Danānīr Region*

An intensive survey of the region was also carried out this season and timed to take full advantage of the differential drying out of the abundant winter/spring vegetation. Preliminary results suggest that there is good correlation between the larger magnetic highs and excessive growth.

#### *1981 Rescue Operation*

Recent constructing and robbing activity in the area of the magnetometer survey on Jebel al-Hawāyah make it imperative that a rescue operation be mounted as soon as possible. Bulldozing along the natural terraces of the hill has revealed as many as 14 potential caves, 4 of which fall within the area of the survey and in fact coincide with magnetic highs. Fortunately, the latter anomalies are quite representative of variations in intensity and areal dimensions for the range of anomalies. Beside providing additional tests of magnetic data interpretation, the archeological returns from these excavations should be high, with new LB and/or Iron IA materials incorporated into ongoing MASCA research programs.

Patrick McGovern  
University of Pennsylvania