

# BAQ<sup>C</sup>AH VALLEY PROJECT

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As a much-needed first step towards developing a well thought-out and economical excavation strategy, a thorough archaeological survey of the northwestern Baq<sup>C</sup>ah Valley (Umm ad-Danānīr region), ca. 20 kms. northwest of Amman, was carried out in October-November 1978, employing geophysical prospecting instruments (cesium magnetometer and resistometer) as well as standard archaeological survey techniques. The principal investigator was Dr. Patrick E. McGovern, Research Specialist at the Museum Applied Science Center for Archaeology (MASCA) of the University Museum of the University of Pennsylvania, and the project was supported by the Museum/MASCA, the National Geographic Society, and the Jordanian Department of Antiquities. There were three phases to the survey, each requiring several weeks apiece.

1) A cesium magnetometer in an absolute configuration with one sensor was used to locate completely silted-up Late Bronze and Early Iron Age burial caves. Based on tests of stone and soil samples collected earlier, it could be calculated that the average magnetic susceptibility between the cave fill ( $0.0005 \text{ nT m}^3/\text{kg}$ ) and the sandstone and limestone bedrock, which showed a very slight susceptibility, was statistically significant by the Student's  $t$ -test. Assuming an 8-50  $\text{m}^3$  volume range for the filled-in caves, magnetic high anomalies between five and fifty nanotesla (nT) were anticipated. The cesium magnetometer with a 0.05 nT sensitivity was expected to detect the complete range of projected anomalies, although "soil noise," general background variations, etc. minimize the significance of anomalies of 5 nT and below.

The logistics of the survey involved laying out 50 x 100 m. grids with compass and transit in relation to the permanent bench marks of the 1 : 10,000 Zarqa Basin map, and making measurements initially at a coarse resolution of every 2 m. Magnetic intensity contour maps at fixed intervals (normally 5 nT) were drawn as soon as possible, and promising areas explored with closer sensor spacings (1 or 0.5 m.).

As had been predicted, the cesium magnetometer was able to detect the full range of anomalies, and as a result thirty-nine significant high anomalies of 10 nT and above and seventy-four minor anomalies were located and mapped. Of these, a 5 x 5 m., 20 nT high was chosen for the initial test excavation in 1980. Theory was fully borne out by excavation, and a completely undisturbed Iron Age IA (ca. 1200-1050 B.C.) burial cave was discovered exactly in the area of the magnetic anomaly. The elliptically shaped cave, ca. 5 x 4 m. in area, was totally silted-up and further sealed off by six large boulders blocking the entrance, which faced due east onto a forecourt entered by a ramp. When the groundplan of the cave and forecourt was superimposed over the high-resolution 1 m. magnetometer grid, the magnetic contour lines were seen to follow the configuration of cave and forecourt. With some allowance for geometric variations, the range of magnetic values could be shown to correspond very closely to calculated intensities for the soil volumes of the cave and forecourt. Magnetic lows to the

north matched up with large bedrock outcrops with a lower magnetic intensity, which was not offset by any surface soil, and which was further accentuated by the anti-magnetic effect of the high. More test excavations of different types of anomalies are planned for the 1981 season.

An aerial survey of the Umm ad-Danānīr region was also carried out in 1980, and timed to take full advantage of the differential drying out of winter vegetation which was the most abundant on record. Preliminary results suggest a good correlation between excessive vegetational growth and magnetic highs; where both occur together, there is a very high probability of finding a silted-up burial cave.

2) A Gossen Geohm resistometer was used for an electrical resistivity survey of a potential Late Bronze Age building of the Quadratbau type (cf. the Amman Airport Building) which might be associated with the large Late Bronze Age cemetery. An argument has been made that the latter type of structure was constructed by nomadic or transhumant peoples and not associated with a settlement site. The goal of resistometer survey in testing this hypothesis was to map out the extent and particular features of potential LBA occupational remains which would be later excavated.

The resistometer was the instrument of choice, since the specific resistivity of soil from near the building was found to vary between twenty and sixty ohm-meters, which was much lower than the values for limestone and sandstone (ca. 5000 ohm-m.) used in the construction of building and presumably at least for the foundations of any nearby structures. The four-probe Werner configuration with one meter probe separation was used, and as for the magnetometer survey, 50 x 100 m. grids were precisely laid out and contour maps (normally at 10 ohm intervals) were drawn up soon after the survey for follow-up work.

Areas of higher resistivity were located on all sides of the building, which might be explained as probable zones of buried architectural remains, rock fall, bedrock irregularities, etc. Test soundings were carried out in 1980, and the resistivity results appear to correlate with bedrock irregularities, suggesting that the building is indeed isolated from a surrounding settlement. However, the pottery dating evidence from the test soundings was ambiguous, and until further work is carried out, the exact dating and function of the building must remain unclear.

3) The general archaeological survey involved systematically traversing a 52.5 hectare area in linear strips two meters wide. Groups of three to five individuals walked slowly side by side at about 0.5 km/hr and collected as much artifactual materials as possible at this speed. Artifactual clusters of three or more artifacts were precisely mapped in, and exhaustive surface collections were then made in their vicinity. A one page form was used to record details of name, location, ownership, site description and sketch, vegetation, soil, nearest source of water, structures and possible stratification, etc.

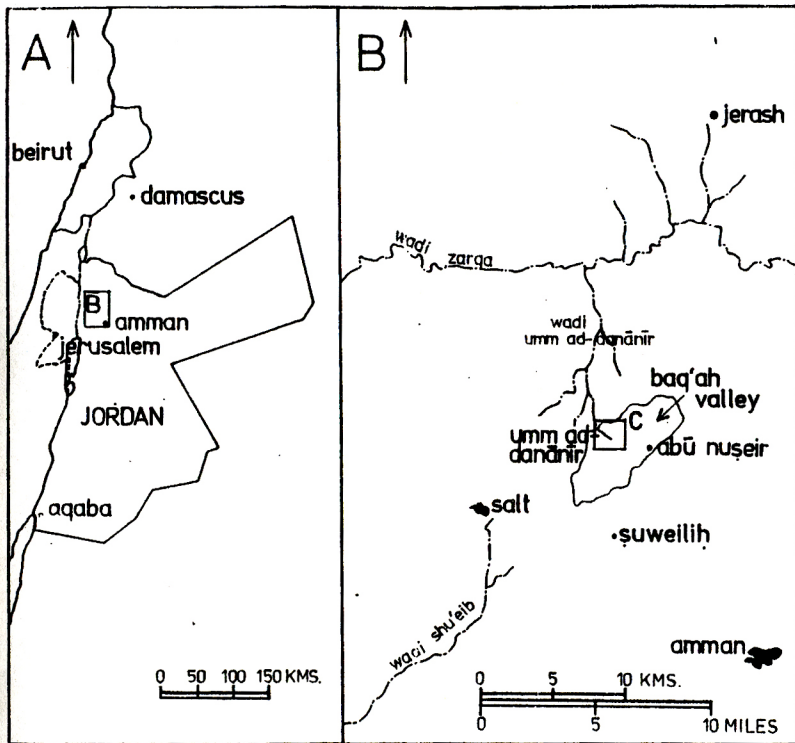
As a result of this phase of the survey, seven sites (several of which were newly discovered and two of which were probable Late Bronze Age settlement sites) were located. They ranged in date from Early

Bronze II to the Byzantine period. Thirty-three partially or fully robbed-out burial caves were also found, primarily dating to the LBA but including Late Roman/Byzantine and Mamlūk periods as well. Test soundings at three of the sites has clarified details of date of construction and later reuses. A large number of flints were concentrated in several areas on the lower slopes of two hills, and dated to the Middle Palaeolithic through the Chalcolithic period.

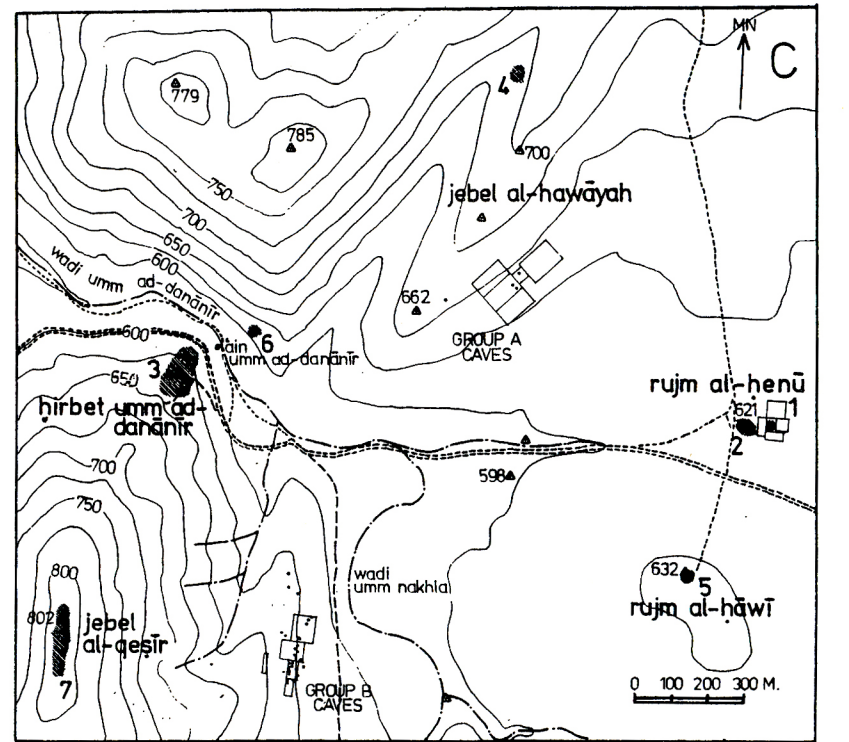
In 1981 twelve additional magnetic anomalies of various areal dimensions and generally high readings were tested by archaeological soundings. In accord with theory, all the highs were due to excess soil deposition. However, since the magnetometer readings would be the same for both filled-in natural caves and those used for human burials, the majority of the highs in this instance represented various geological features, viz. sinkholes, solution pits, caves, and other natural depressions, which had not been used for burials. A 15 nT high, 4 x 6 m. in area, proved to be an undisturbed extension of a Late Bronze II burial cave, which produced an extremely rich collection of material.

#### References:

- McGovern, P., 1982. Exploring the Burial Caves of the Bag'ah Valley in Jordan. Archaeology 35: 46-52.
- McGovern, P., 1981. The Bag'ah Valley, Jordan: Test Soundings of Cesium Magnetometer Anomalies. MASCA Journal 1:214-217.
- McGovern, P., 1979a. The Bag'ah Valley: A Cesium Magnetometer Survey. MASCA Journal 1:39-41.
- McGovern, P., 1979b. Explorations in the Umm ad-Danānīr Region of the Bag'ah Valley, 1977-1978. Journal of the Department of Antiquities of Jordan 24:55-67.



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



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  
Wadi  
Spring  
Trig. Point

Fig. 1 A. Map of Jordan showing the location of Insert B.  
B. Detail of the general area around the Baq'ah valley and the location of the Umm ad-Danānīr Region (Inset C Fig. 2)

Fig. 2 Detailed map of the Umm ad-Danānīr Region study zone in the Baq'ah Valley, Jordan, indicating location of sites.