EXCAVATIONS OF THE EARLY BRONZE AGE CEMETERY AT BAB EDH-DHRA JORDAN, 1981

A Preliminary Report

by
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Introduction

The Bab edh-Dhra settlement (Figure 1) was first brought to the attention of archaeologists by Albright (Albright 1924, 1926, 1945; Glueck 1935) and the adjacent cemetery was first described by Saller (1965) and Lapp (1966, 1968a, 1968b, and 1970). Beginning with Lapp's pioneer work, the cemetery has been extensively excavated (Schaub 1973, 1981a, 1981b Rast and Schaub 1974, 1978; Ortner 1978, 1979, 1981). The recovery of well-preserved human skeletal remains from the cemetery has added signficant data to our understanding of the biological history of the Early Bronze Age population in the Bab edh-Dhra area. The data make comparisons possible between the people of Bab edh-Dhra and other contemporary and non-contemporary groups in the Middle East (Frohlich and Ortner 1981).

This preliminary report describes the work carried out at the Bab edh-Dhra Cemetery between May and August, 1981, as part of the expedition to the Southeastern Ghor led by Drs. Walter E. Rast and R. Thomas Schaub. The cultural finds, except for a few items now located at the Kerak Museum, and all of the human skeletal material have been shipped to the Smithsonian Institution and are presently being conserved and studied in the Department of Antrhopology.

Objectives

Several objectives were planned for the 1981 field season at the Bab edh-Dhra Cemetery. These include: (1) a comprehensive topographical survey of the cemetery and adjacent areas, (2) a survey of previously excavated shaft tombs to incorporate the distribution of tombs, (3) an electronic survey of the cemetery using electromagnetic terrain conductivity measurements to discover the extent of the cemetery as well as the location and density of unidentified shaft tombs and charnel houses, (4) excavation of selected shaft tombs whose location was identified by the electronic survey, and (5) excavation and recovery of human skeletal material from different Early Bronze Age subphases to increase sample sizes to levels appropriate for multivariate statistics.

Topographical Survey

The cemetery and adjoining area was surveyed during the 1981 field season to produce an accurate contour map of the area. The survey was conducted using a self-reducing theodolite (Carl Zeiss, Dahlta 010-A) which permitted us to measure relative vertical as well as horizontal distance differences between selected points. Twenty-two instrument stations were selected for an area covering 3000 meters (East to West) and 600 meters (North to South) with the virtual center in the previously excavated cemetery area. The north-south axis was limited by the construction of the town for the Arab Potash Company to the south and by the cemetery's natural boundaries to the north. All major high and low geographical points were recorded. Approximately 25 to 50 points were recorded for each of the 31 theodolite stations, which provided a data matrix for an accurate contour map. The estimate of each point's position below mean sea level (Defense Mapping Agency 1973) as well as its position in a selected

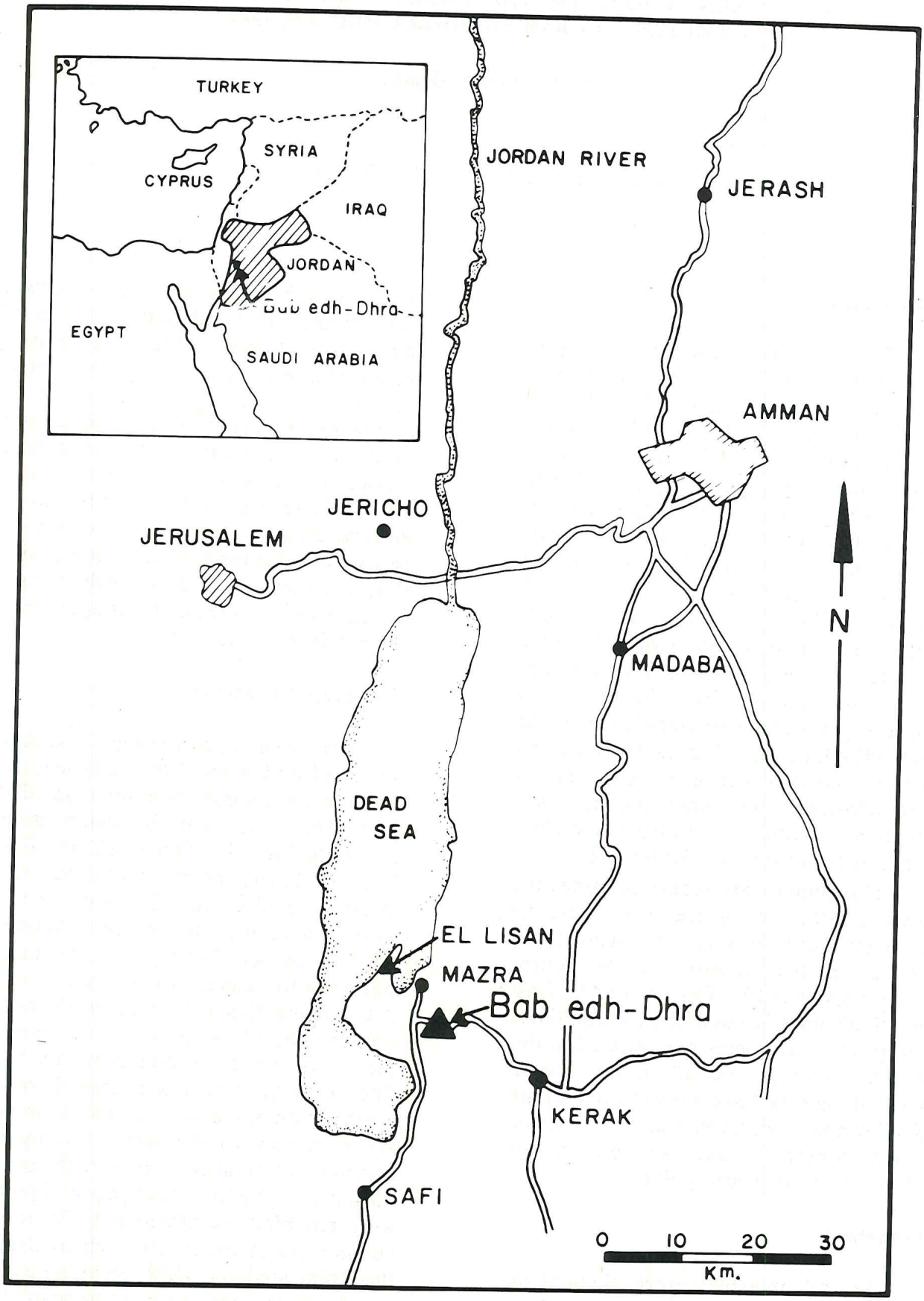

Figure 1: The Dead Sea region with the Bab edh-Dhra Cemetery indicated by the triangle.

coordinate system were computed on a LSI-11 Microcomputer based on the data obtained in the field. The final contour map was assembled from a combination of data obtained from a computer-generated contour map (Smithsonian Honeywell Series 60 (level 66)/6000) modified manually where appropriate. The employment of a computer-generated contour map allowed a much higher accuracy in determining the exact distance between the contours at any given point inside a selected area (Figure 2). In addition to the construction of contours, all known shaft tomb and charnel houses were recorded for later inclusion on the contour map.

Electronic Survey

One of the major obejectives during this field season was to examine methods and equipment in which a small team could identify and locate shaft tombs electronically so that time consuming test excavations could be avoided. The electronic equipment must be able to produce accurate and reproducible results with minimal training and experience. The EM-31 electronic conductivity meter, produced by Geonics Ltd., Toronto, Canada, was selected because it appeared to have the required potential: (1) it was light enough to be carried by one person (Plate LXV), (2) it did not require any physical contact with the ground, thus speeding up the actual survey, (3) the recycle time for a new reading on the meter was less than 2 to 3 seconds, (4) it was independent of large and heavy power supplies (8 D-cell batters gave approximately 20 hours of operating time), and (5) the equipment could identify conductivity variations to a depth of 6 meters in soil (McNeil 1980).

Basically, the EM-31 measures the conductivity of the soil by producing a time varying magnetic field at the transmitter end. This artificially produced magnetic field results from the induction of very small electrical currents in the ground. The electrical currents result in a secondary magnetic field which, with the primary magnetic field, is sensed by the receiver coil located at the other end of the equipment.

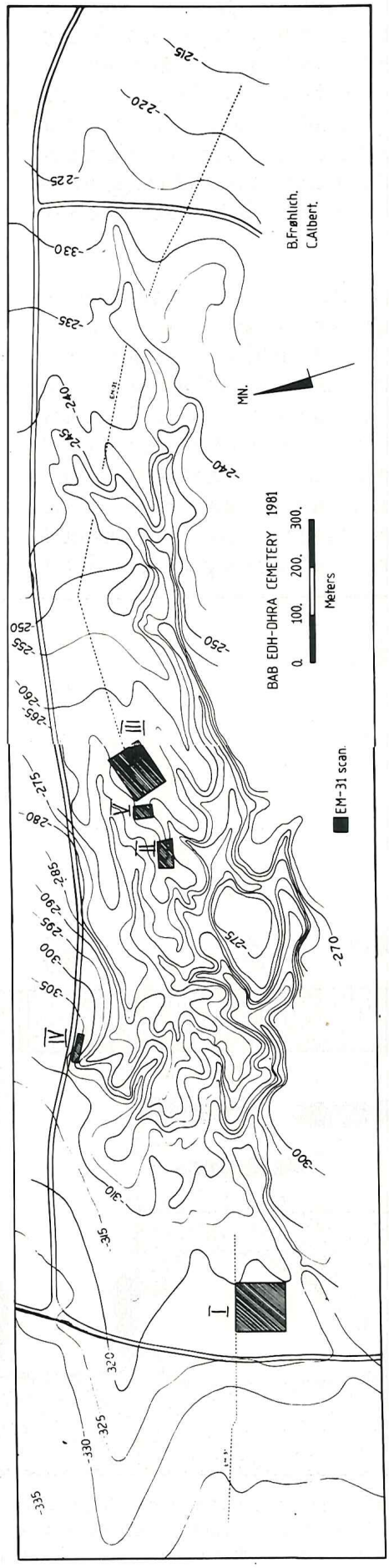

Figure 2: Topographical map of the Bab edh-Dhra Cometery. Contour intervals are 5 meters. Shaded squares indicate areas which have been scanned with the EM/31 Electronic Conductivity Meter. The dotted line indicates the path of a long EM-31 scan trail to explore East-West boundaries of the cemetery area.

The ratio between the primary magnetic field and the secondary magnetic field can be converted to yield a value in millimho. per meter (mmho/m. or Siemens) indicating the ground's conductivity. In general, different geological features yield different conductivities, thus allowing identification of varying soil features (McNeil 1980).

The specific response of the equipment to the presence of shaft tombs was not known prior to our field testing. However, we were reasonably certain that the vertical shafts, with a diameter of up to 2 meters and a depth of 1.5 to 3 meters, would yield different conductivity readings than the undisturbed adjacent areas. Further, we also expected that the presence of unsilted tomb chambers surrounding the filled shaft would increase the difference in conductivity. Identification of shaft tombs by variation in conductivity was based on the following assumptions: (1) a filled shaft would have a slightly more porous consistency than the surrounding hard packed structures, resulting in an increase of conductivity because of a higher content of moisture, and (2) an air-filled, unsilted grave chamber adjacent to the filled shaft would have lower conductivity since air is a poor electrical conductor (Figure 3).

If this hypothesis is correct the identification of significant high readings surrounded with low readings should reflect the presence of an unsilted shaft tomb, whereas significant high values in combination with adjacent reductions in the conductivity should indicate the presence of a shalf tomb system with silted tomb

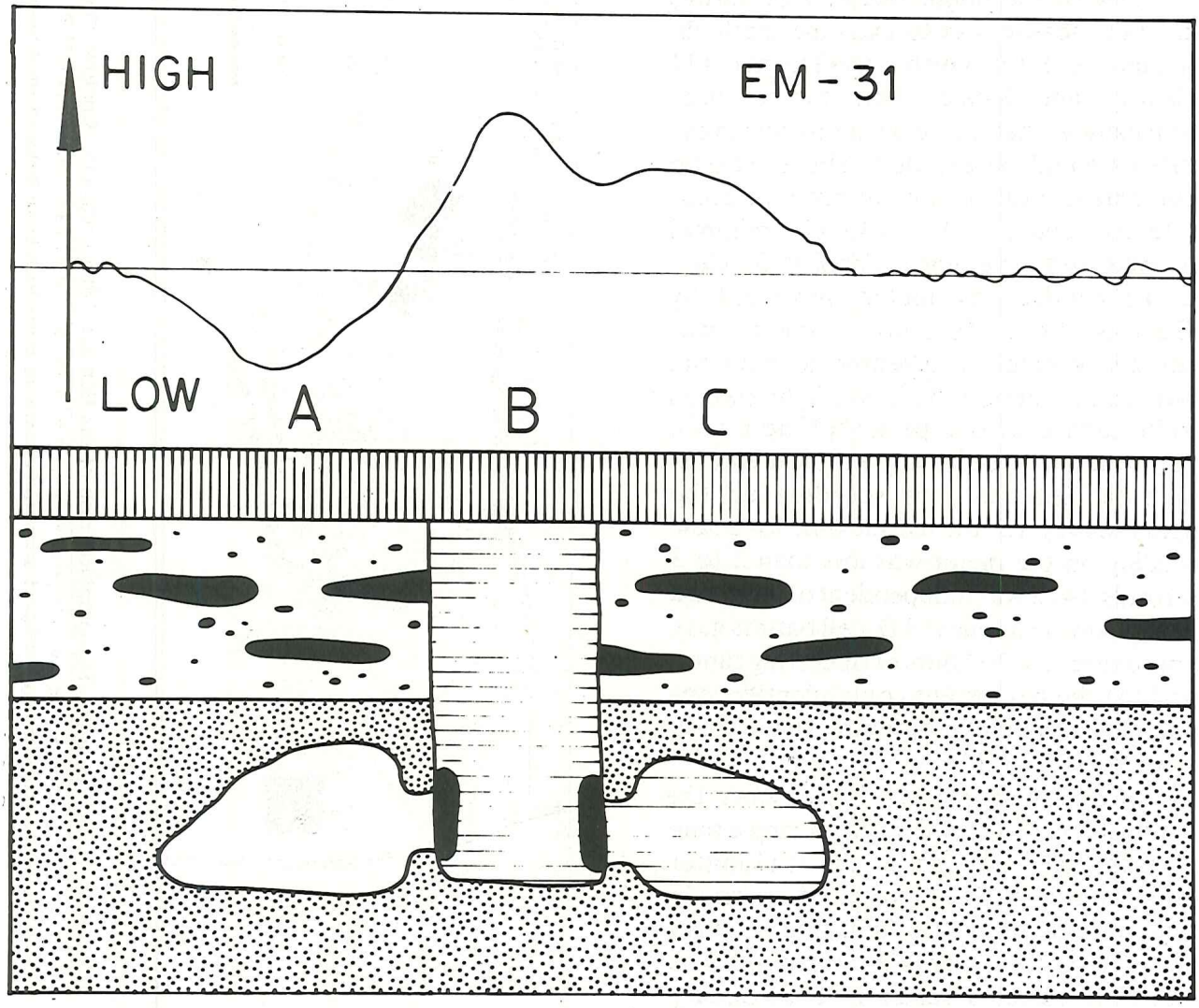

Figure 3: EM-31 response to a shaft tomb. Minimum conductivity is read when the center of the EM/31 passes an unsilted burial chamber (A). Maximum conductivity is read when scanner passes a refilled shaft (B). A higher than normal conductivity is read when scanner passes a silted burial chamber (C).

chambers.

We were also interested in evaluating several important potential problems with the equipment: (1) would the equipment be sensitive to the extremely high ambient temperatures found at the site, (2) would the equipment show sensitivity to long exposure to the sun, and (3) how sensitive the equipment would be to rough handling inevitable in a field situation? Basically, the important thing to learn was if the equipment could function in the rough environment at the Dead Sea without major repairs and recalibrations.

Our experience was very positive. During three months of field work at no time was it necessary to carry out any major recalibration on the equipment. Several test areas with known conductivity yielded the same results during any given time of the day (temperature differences) and between any given time of the week and/or month (time variation). Furthermore, at no time did we experience any major break down of the equipment.

Five squares were surveyed by the EM-31 (shaded areas in Figure 2). Two areas, 60 by 30 meters (Area II in Figure 2) and 100 by 74 meters (Area III in Figure 2) were scanned - taking conductivity readings every 2 meters, - yielding 496 data points in the first area and 1938 data points in the latter. A contour map indicating concentrations of high conductivity as well as low conductivity was produced for the field. Selected areas inside the two squares were scanned again, using one meter intervals. The resulting contour map from the latter scan yielded a higher degree of resolution for the high and low areas. These areas were selected for the test excavations, (Area II in Figure 2) which demonstrated a strong association between the conductivity readings and the presence of man-made disturbance in the soil. After several test excavations it was clear that areas with high conductivity were synonymous with the vertical shaft of the shaft tombs, whereas low readings, in most cases, indicated the presence of unsilted chambers (Figures 4 and 5). Five areas having high readings were tested by excavations. In all cases the excavations yielded a shaft within ¼ of a meter from where the predicted shaft center should be (Figures 4 and 5).

Areas with extremely high readings, when compared to the adjacent area, were in all cases equivalent to either robbed shaft tombs (the soil in the shaft has had little or less time to pack, thus resulting in a higher degree of moisture (A in Figure 6)) or geological features such as gravel deposits, limestone deposits etc. (A in Figure 4). The difference in the conductivity between undisturbed geological layers and Early Bronze Age man-made shafts was less than 10 mmho/m. and, in some cases, only 2 to 4 mmho/m. (Figures 4 and 5).

Based on the assumption that inside a small, defined area the top layer of the ground is horizontally layered, the extent of the cemetery could be established using the EM-31 scanner. This assumption is based on the hypothesis that only shaft tombs are the result of man-made structures in the area. Thus, by running three parallel traverses from the center of the cemetery in an east-west axis (Figure 2) it is possible to determine when the concentration of shaft tombs decreases, by interpretating the differences between the three parallel readings. We were able to identify the western limit of the cemetery because the electronic survey data indicated that the Early Bronze Age tombs stopped approximately 300 meters east of the modern north-south road connecting Mazra with Safi. On the Lisan Peninsula, approximately 250 meters west of the north-south road, at least one and possibly two stone wall structures were located by a significant increase in the conductivity. The wall structures may be associated with a Roman road described by Nelson Glueck, (Glueck 1959; McCreery 1981). The results of the three parallel readings to the east was less successful. However, this was due to the fact that the scanner picked up many interpretable as well as uninterpretable structures in the ground which were significantly different from the expected values. Only future test excavations can associate these conductivity differences with possible cultural remains. In some cases, however, the difference in conductivity could be associated with cle-

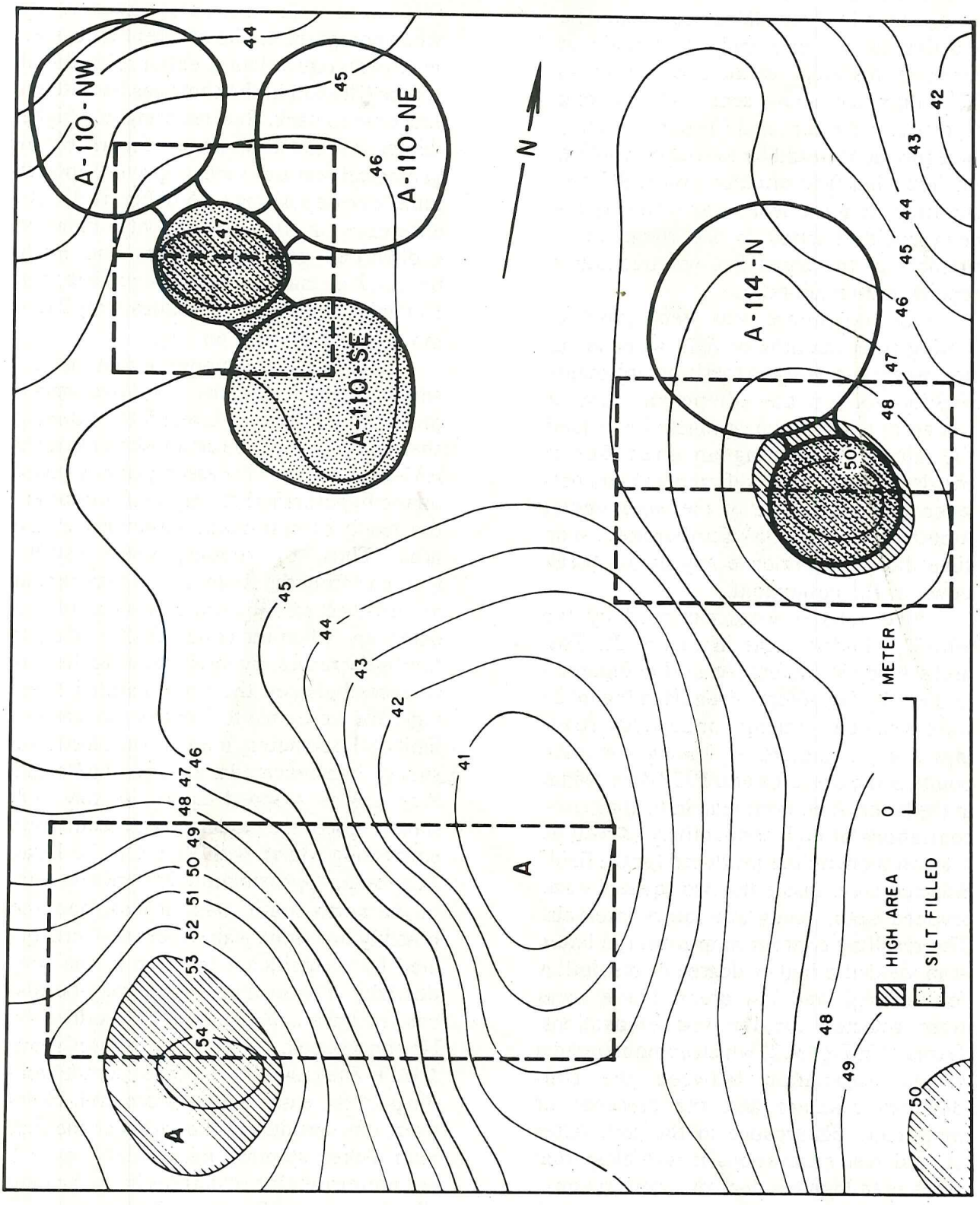

Figure 4: Contour map showing differences in conductivity in association with the shaft tombs. Conductivity intervals are 1 meter. Measurement spacing is 1 meter. Dotted lines are excavated areas. High conductivity areas are shaded. Refilled shafts and silted tombs are stippled. Shafts A-110 and A-114 are found in the center of high conductivities. Possible shaft tomb in lower left corner. Extreme high and low areas are pockets of Lisan marl and gravel deposits (A).

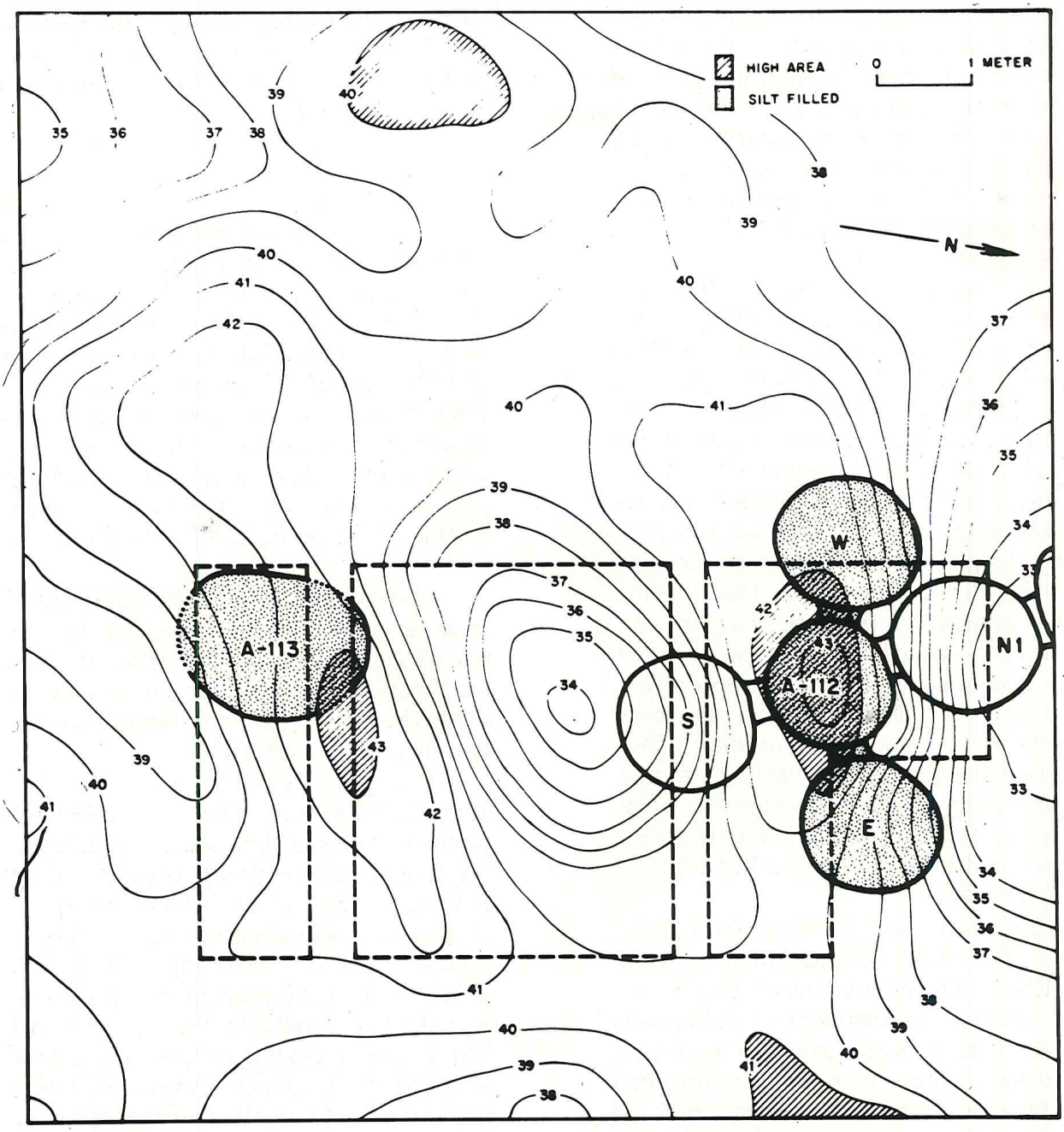

Figure 5: Contour map showing differences in conductivity. Contour intervals are 1 meter. Measurement spacing is 1 meter. Dotted lines are excavated areas, High conductivity areas are shaded. Refilled shafts and silted tombs are stippled. Shaft tomb A-112 shows two partly unsilted chambers (A-112-N1 & A-112-S) in low conductivity areas and two silted chambers (A-112-W& A-112 E) in normal conductivity areas. Collapsed or robbed shaft tomb A-113 is centered in a high conductivity area; however less significant. possible shaft tomb in upper center.

arly visable stone walls running perpendicular to the scan axis. It was clear that the scanner picked up even small differences in the conductivity and that most of these inconsistencies could be associated with man-made features.

The presence of EB IB-III charnel houses (3050-2300 B.C.) built in the area which was utilized earlier by the EB IA tombs (3150 - 3050 B.C.) is known (Lapp 1970; Rast and Schaub 1978, Schaub 1981a; Ortner 1981) and it was one of our objectives to test the equipment's ability to pick up these structures, which are made of mudbricks. Aerial photos and topography suggested the presence of charnel house structures around our central theodolite reference point at the center of the cemetery (Rast and Schaub 1978). The conductivity contour map of the area suggested a presence of the charnel house in two ways: (1) by not yielding any significant

high areas associated with shaft tombs, and (2) by a decreasing pattern of conductivity toward the center of the presumed position of the charnel house (Figure6). The second evidence (a significant lowering of the conductivity toward the center of the charnel house) is the most promising, but must await further clarification in the form of test excavations.

In general, the use of the electromagnetic terrain conductivity meter proved to be successful. In all, five areas with high conductivity and thought to be shaft tombs were tested by excavations. In each case, the conductivity measurements indicating the shaft corresponded with the actual location of the shaft. More field tests are necessary to understand the influence of natural geological variation on the conductivity for the cemetery. The positive results obtained at Bab edh-Dhra are not, however, necesarrily transferable to other sites. If used at another site the equipment must be recalibrated for the new soil conditions and geological variation. Our experience suggests considerable promise for achieving much more effective excavation procedures by first identifying areas of potential interest with the EM-31.

Shaft Tombs

Six shaft tomb systems were excavated. Five shafts were identified by using the EM-31 and the sixth was found by Mr. Sami Rabadi, Department of Antiquities Inspector at the Kerak Museum. Of the six excavated tombs, four were undisturbed tombs, one tomb had been disturbed (by robbers?) and one was a collapsed tomb. Human skeletal remains were found in all but the collapsed tomb. Of the four undisturbed tombs, one had four chambers, only three of which had been used for burials. One tomb had three chambers and two tombs had one chamber each. Of the total of nine undisturbed chambers, seven were unsilted, and two were partly silted (Table 1). The disturbed tomb had four silted chambers (50% to 90% silted) none of which had blocking stones. An additional partly silted chamber (10% silted) belonging to an adjacent shaft tomb system had been broken into, presumably by thieves, from one of the partly silted chambers. The collapsed tomb may have been the result of construction which reached an earlier and unknown tomb or of a shaft dug during a robbery attempt.

A 110

Three burial chambers are associated with this tomb. Shaft and chamber dimensions are given in Table 1. Two chambers, A 110 NE and A 110 NW, were unsilted and yielded undisturbed burials. One chamber, A 110 SE was partly silted, with approximately 40 cm. of silt (Figure 4). All chambers were cut into a matrix consisting of a mixture of hard-packed clay, sand and gravel. Several signs of tool marks were visable on the ceiling in all three chambers.

Chamber A 110 NE The single burial chamber was sealed from the shaft by one blocking stone and mud mortar between the blocking stone and the entryway covering the entire external surface of the blocking stone (Table 1).

The grave yielded two articulated adult skeletons (one male and one female) placed so that the skull was to the left and the postcranial skeleton to the right of the entryway. One child (approximately 7 years old) was located between the female skeleton and the entryway (Pls. LXVI, LXVII). The male skeleton was placed on its right side parallel to the backwall. All bones were in anatomical position, except for parts of the upper extremities, which were found between the lower extremities, and the eight lowest vertebrae, which were disarticulated from the skeleton and placed in correct anatomical order next to the child's skeleton (Pls. LXVI, LXVII). The lower extremities were slightly bent with the left leg flexed more than the right leg.

Based on measurements from upper and lower extremities the estimated living stature of the male skeleton was approximately 165 cm. Except for an abnormal bone growth found on the distal end of the left humerus, no pathological changes were identified. The adult female skeleton was placed on its back with the lower extremities slightly bent. The upper extremities were placed with the left arm

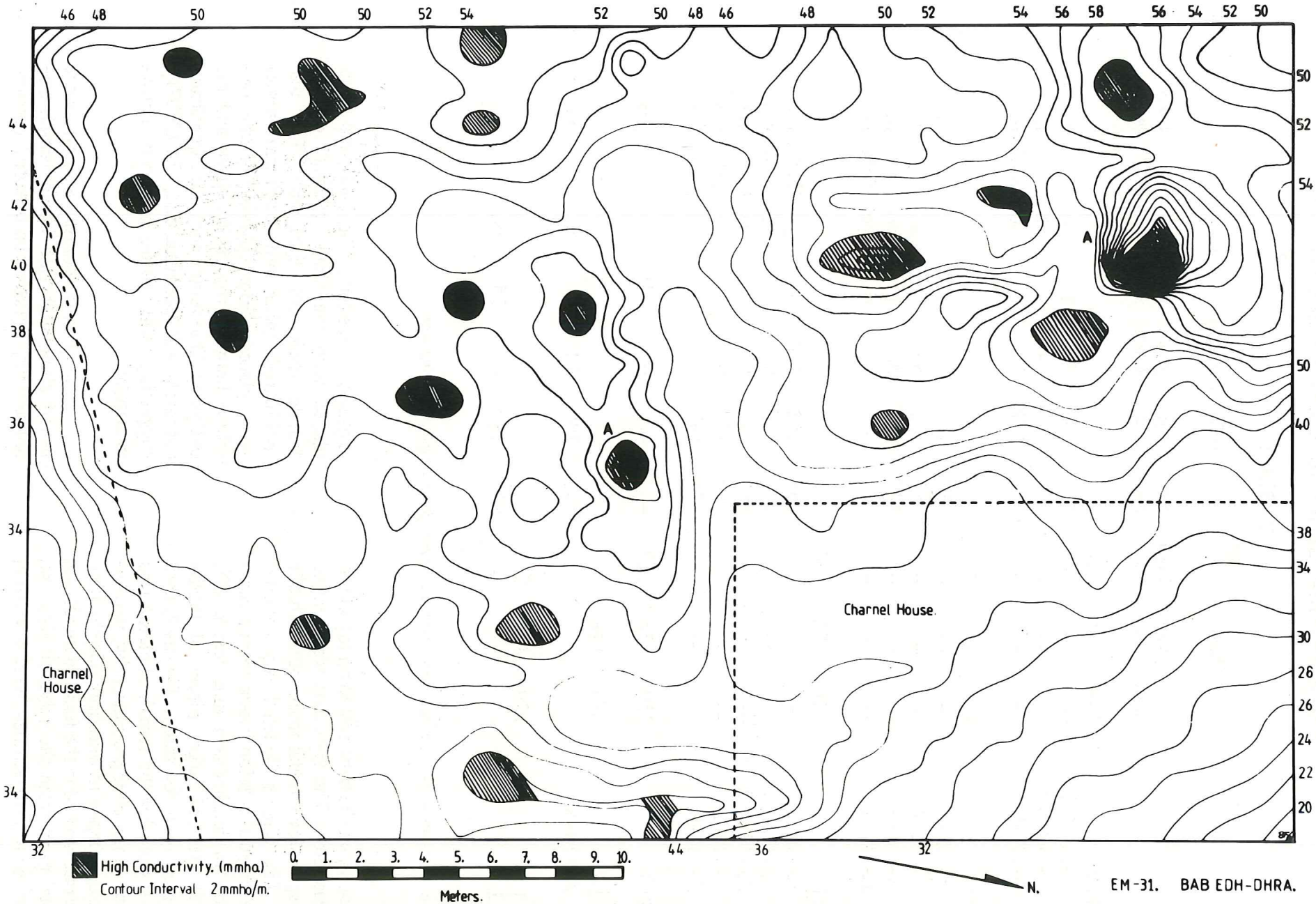

Figure 6: Contour map showing differences in conductivity in area with known charnel houses. Conductivity intervals are 2 meters. Measurement spacing is 1 meter. Shaded areas are concentrations of high conductivities and thus are possible shafts. Differences in conductivity more than 5 to 10 mmho/m. are robbed or excavated tombs (A). Charnel houses are significant in having no high condutivity concentrations (Shafts) and a significant lowering of the conductivity toward the center of the charnel house.

BAB EDH-DHRA, GENERAL SHAFT TOMB DATA

TABLE 1

	Shaft:			Burial Chamber				Entrance	
	Depth	Upper Diam.	Lower Diam.	Max. Length	Max. Width	Max. Height	Blocking Stone(s)	Silting	Disturbed (Robbed)
A-110	148	125	114						
A-110-NE	—	—	—	175	184	88	1	no	no
A-110-NW	—	—	—	156	175	84	1	no	no
A-110-SE	—	—	—	172	172	72	3	yes(20%)	no
A-111	197	129	76						
A-111-E	—	—	—	163	190	89	9	no	no
A-111-W	—	—	—	153	152	83	7	no	no
A-111-N	—	—	—	149	164	86	1	no	no
A-111-S	—	—	—	—	—	—	0	yes (95%)	no
A-112	151	172	166						
A-112-S	—	—	—	168	152	114	0	yes (50%)	yes
A-112-N/1	—	—	—	174	183	95	0	yes (50%)	yes
A-112-N/2*	—	—	—	151	—	80	(1)	yes (10%)	yes
A-112-E	—	—	—	180	168	94	0	yes (90%)	yes
A-112-W	—	—	—	174	147	86	0	yes (90%)	yes
A-113	250	136	110	—	—	—	(3)	—	yes
A-114	139	126	96						
A-114-N	—	—	—	192	208	74	1	no	no
C-11	129	105	57						
C-11	—	—	—	83	119	67	15	no	no

**Adjacent tomb accesed by the thieves through a breakdown of the separating wall.*

bent such that the hand rested on top of the male skeleton. The right arm was bent to make space for the placement of the child's body. The female skeleton was covered with a shroud, possibly made from a combination of leather/skin and textile (Pl. LXVII). Several larger pieces of textile were recovered for study. The estimated living stature for the female skeleton was 153 cm. Bone changes caused by osteoarthritic development were found in the lumbar vertebrae and in the femoral heads. All skeletal parts from the subadult skeleton, except for the extremities, were in correct anatomical position. The child had been placed with the skull "resting" on the female skeleton's right arm. The disarticulated upper and lower extremities were placed almost parallel to the vertebrae between the child's trunk and the entryway. One femur showed a significant cut mark on its proximal end, (Pl. LXVII), suggesting soft tissue removal before interment.

Twenty-four complete pots were found along with one basalt vessel, one unfired clay figurine, and several decom-

posed wood objects. Most pots were located to the right of the entryway and between the child's skeleton and the entryway (Table 2). The figurine was located below the pots just adjacent to the entryway. Preliminary readings of the pottery by Dr. Thomas Schaub indicate an EB IA association (Schaub 1980). Wood samples for carbon dating were also collected..

BAB EDH-DHRA, CULTURAL FINDS
TABLE 2

	Pots	Basalt Vessel(s)	Mace Head(s)	Un-fired Clay Figurine(s)	Wood Objects	Wood Tools	Beads	Wood selected For Carbon Dating	Textile
A-110-NE	24	1	0	1	yes	no	no	yes	yes
A-110-NW	22	1	0	2	no	no	no	yes	no
A-110-SE	30	2	2	0	no	no	yes	yes	no
A-111-E	15	1	0	2	no	no	no	no	no
A-111-W	14	1	0	0	yes	no	no	no	no
A-111-N	49	1	1	0	yes	no	no	yes	no
A-111-S	0	0	0	0	no	no	no	no	no
A-112 (all)	no	0	0	0	no	no	no	no	no
A-113	3	0	0	0	no	no	no	no	no
A-114-N	23	1	1	0	yes	yes	no	yes	yes
C-11	8	1	1	0	no	no	no	no	no
Total:	188	9	5	5	—	—	—	—	—

Chamber A 110 NW Tomb dimensions are given in Table 1. The chamber was sealed from the shaft by a single blocking stone and mortar. The chamber was unsilted and contained only disarticulated skeletons. All adult and most sub-adult skulls were placed to the left of the entryway and the postcranial and remaining infant cranial material was placed in the center of the chamber floor (Pl. LXVIII). The preliminary analysis of the skeletal remains revealed the presence of two adult males and a minimum of four infants ranging from newborn to approximately one year of age at death. One of the adult skulls was found with the cranial bones articulated. In the other adult skull, all the individual cranial bones had separated and were nested in each other before the final placement toward the back of the chamber. Between the two adult skulls was one partly disarticulated infant skull and two stacks of infant skull fragments. Although three discrete piles of infant skull fragments were found between the two adult skulls, the three groups contained four infant crania with the youngest either prenatal or newborn, one was approximately 6 months of age, and two were about 1 year of age (Table 3). The adult bones in the bone pile are from exactly two individuals. Although the placement of the skeletal material indicates a secondary burial, the location and articulation of one pair of lower extremities suggest that they were placed in the grave while they were still connected by soft tissue. This suggests a relatively short time for the primary burial period (probably not more than a few weeks). No articulation, however, was found between the femora and the innominate bones. The estimated living stature of the two adult males was 164 cm. and 166 cm.

Twenty-two complete pots and one basalt vessel were found to the right of the entryway. Two unfired clay figurines were placed between the infant cranial frag-

TABLE 3
BAB EDH-DHRA, 1981
SKELETAL MATERIAL

Burial Chamber:	Adults Males	Adults Females	Total	Children (1-18 yrs.)	Infants (0-1 yr)	Pre-natal (-9 mth.-0 yr.)	Total
A-110-NE	1	1	2	1	0	0	3
A-110-NW	2	0	2	0	4	0	6
A-110-SE	2	2	4	2	3	1	10
A-11-E	1	1	2	0	2	1	5
A-111-W	3	1	4	0	2	0	6
A-111-N	2*	1*	3*	3	4	0	10*
A-11-S	0	0	0	0	0	0	0
A-112	—	—	—	—	—	—	—
A-113	0	0	0	0	0	0	0
A-114-N	1	2	3	2	2	0	7
C-11	1	1	2	1	2	0	5
Total	13	9	22	9	19	2	52

**More than or equal to.*

ments and the nested adult skull bones closest to the backwall (Pl. LXVIII). One bone needle and several extremely fragmentary wood objects were found inside the pots and on the floor to the left of the entryway. No textiles and/or skins have been identified with this tomb (Table 2). The preliminary identification of the cultural material suggests an EB IA association (Schaub 1982). Wood samples for carbon dating have been collected.

Chamber A 110 SE Tomb dimensions are given in Table 1. Three blocking stones and mortar formed a seal between the shaft and the tomb. Approximately 40 cm. of silt covered the chamber floor. The silt consisted of a fine-grained, light brown clay forming a horizontal layering sequence in the entire tomb. The silt is the result of water and silt leaking through the blocking stones, offering support for the hypothesis that multiple, small blocking stones in connection with the lack of good packing material form a less perfect seal between the tomb and shaft (Ortner 1981). Silt was found inside all the articulated crania and all the pots except for three smaller juglets which floated on the top of the silt (Pl. LXIX).

Human skeletal material from 10 people was found. Two adult articulated skeletons were placed on their right side just inside the entryway. The skull was positioned to the left and the postcranial skeleton was laid to the right of the entryway. In both cases, the lower extremities were slightly bent toward the entryway and the upper extremities were bent in front of the face. One skeleton was male, the other female. A postcranial bone pile and associated skulls were placed between the two articulated skeletons and the backwall. There is no indication that the bone pile was pushed toward the back, thus making space for a later placement of the two articulated skeletons. This placement suggests that all the skeletal remains were interred at the same time. The bone pile yielded skeletal remains from two adults (one male and one female) in addition to the remains of five sub-adult individuals (Pl. LXIX). The sub-adults range in age from newborn to 0.5 yr (n = 3), 3.5 yrs (n = 1), and 2.5 yrs (n = 1). In addition one fetal humerus (approximately 1 to 2 month prenatal) was found between the two articulated skeletons (Table 3). The estimated living stature for the females was 155 cm. and 154 cm. and for the males 165 cm. and 168 cm. Estimates were based on measurements from the lower extremities (Tro-

tter and Glesser, 1952). Tomb chamber A 110 SE yielded a total of 30 pots, including a Kernoi vessel with four cups, two alabaster artifacts (mace heads or loom weights), two basalt vessels, and several perforated beads (found inside one pot). No textile fragments were found (Table 2). The preliminary identification of the pottery suggests an EB IA association (Schaub 1982). A few fragmentary wood samples were collected for carbon dating.

A 111

The tomb contained four burial chambers of which only three were used for burials. Three unsilted burial chambers (A 111 N, A 111 E, and A 111 W) were sealed from the shaft with blocking stones and mud mortar. One chamber (A 111 S) with no blocking stone was 95% silted (Figure 5). The burial chambers were cut into a matrix of clay, gravel, hard packed sand, and a few pockets of lime stone (Lisan marl).

Chamber A 111 E Nine stones packed in mortar sealed the chamber from the shaft. The dimensions of the unsilted burial chamber are given in Table 1. Two articulated adult skeletons and three disarticulated sub-adult skeletons were placed with the adults at the center of the burial chamber and the sub-adults in a bone pile between the adults and the entryway (Pl. LXX). The articulated skeletons (one female and one male) were placed on their right side with the skulls to the left and the postcranial skeletons laid to the right of the entryway with the lower extremities bent toward the entryway and the upper extremities flexed in front of the face. The upper right extremity of the female (humerus, ulna, and radius) was disconnected from the otherwise fully articulated skeleton and placed just southwest of the lumbar region (Pl. LXX). The subadult bone pile contained complete skeletons of two infants (both newborn to 0.5 yr. of age at death) and a single innominate bone suggesting the presence of a fetus (7th to 8th fetal month) (Table 3).

The location of the skeletons in chamber A 111 E with with parts of the articulated female skeleton covering the male skeleton and two of the disarticulated infant innominate bones overlapping the articulated female skeleton suggests that the articulated male skeleton was placed first along the backwall of the tomb, the female skeleton was then placed second, and finally the bones of the subadults were placed last.

Fifteen pots, one basalt vessel, and two unfired clay figurines were found in chamber A 111 E (Table 2). The figurines were located between the disarticulated bone pile containing the infant skeletal remains and the entryway. The pottery was evenly distributed to the left, right and along the backwall of the tomb with the larger items to the right. A preliminary analysis of the pottery indicates a late EB 1A association containing transition elements to EB 1B (Schaub 1982). No textiles and no wood objects or wood tools were found.

Chamber A 111 W Seven stones imbedded in mud mortar sealed the A 111 W chamber from the shaft. The chamber was free of silting but had a little roof fall along the sides of the chamber. Table 1 gives the dimensions of the chamber. Four adults (three males and one female) and a minimum of two infants were recovered (Table 3). One adult male was placed just inside the entryway with the skull to the left and the postcranial skeleton in front and to the right of the entryway. The body had been placed on its right side with the face toward the entryway. The location of the upper and lower extremities suggest a partial disarticulation of the longbones from the articulated trunk. The remaining skeletal remains were located between the partly articulated male skeleton and the backwall. In contrast to tombs previously excavated this season, the content of the bone pile was arranged with the long axis of most of the longbones placed parallel to the backwall, and the rest of the postcranial skeleton placed between the stacked longbones and the partially articulated male skeleton. All skulls assocaited with the bone pile were placed to the left of the entryway (Pl. LXXI). The estimated living stature based on measurements of the

lower extremities for the partly articulated male was 160 cm. Estimated stature for the males in the bone pile were 165 cm. and 163 cm. and for the female in the bone pile: 158 cm.

One extra longbone (radius) was included in the bone pile. It was not possible to associate this radius with any of the four adult skeletons and the radius must have been misplaced during the reburial process.

Fourteen pots, one basalt vessel, one pointed bone tool and several wood objects were found mostly located to the right of the entryway (Table 2). Preliminary analysis of the pottery indicates an EB IA association (Schaub 1982).

Chamber A 111 N The chamber had one blocking stone extensively packed with mortar to seal the chamber from the shaft. All dimensions are given in Table 1. No silting was found but there was a little roof fall along the walls.

One bone pile with disarticulated bones was located in the center of the chamber (Pl. LXXII). Complete skulls and cranial bones were found to the left of the entryway. The tentative sorting and cataloging of the postcranial skeletons suggests the presence of bones from a minimum of three adults and seven sub-adults. The total amount of single bones, however, does not add up to an exact number of individuals. Three adult innominate bones suggest the presence of at least two males. The skulls indicate the presence of one male and one female, thus a minimum of two males and one female were buried in this chamber. Skeletal material from a minimum of seven sub-adults were found in the bone pile, ages at death: 5-6 years (n = 1), 3 years (n = 1), 1.5-2 years (n = 1), and newborn to 0.5 yr (n = 4). Only in the case of the 5 to 6 year child did we identify more than 50 percent of the skeletal remains.

Forty nine pots, one basalt vessel, one artifact (mace head or loom weight), and several wood objects were found in A 111 N. Most of the cultural finds were located to the right of the entryway and along the backwall with most of the smaller pots stacked inside the larger ones (Table 2). The number of pots in this grave was the highest found during the 1981 season. A preliminary analysis of the pottery indicates a late EB 1A association containing some transition elements to EB 1B (Schaub 1982).

CHAMBER A 111S The chamber was empty. It had no blocking stone and contained no human remains or cultural items. The chamber was silted almost to the top of the ceiling leaving only a few centimeters unsilted. The non-layered stratigraphy of the shaft and the silted chamber suggests that it was filled at one time.

A 112

Four chambers associated with this tomb and one chamber belonging to an adjacent shaft tomb were found during the excavation (Figure 2). All chambers were cut into a matrix of Lisan marl. The stratigraphy of the shaft suggests multiple episodes of soil deposit during refill. At least two different shaft diameters could be identified. No blocking stones were found for any of the four chambers and the chambers were filled up to 90 per cent with material originating from the latest refill episode of the shaft. Fragmentary human skeletal material was found in all of the chambers. So far none of the material has been restored or analysed. The amount of skeletal material suggests that all the chambers contained at least one skeleton. No pottery or other cultural artifacts were present (Table2).

The results from the excavation of this shaft tomb strongly suggested that the tomb had been robbed before recent time (the same conductivity difference as in undisturbed shaft tombs). One scenario for the procedure the thieves used is as follows. (1) A shaft allowing entrance to the tombs was excavated inside the original shaft. (2) The blocking stones were removed from the shaft. (3) In the process of obtaining all the desirable gravegoods the thieves broke up the fragile human skeletal material. None of the skeletal material seems to have been removed, however. Similar procedures have been observed in robbed Early

Bronze Age tumuli on Bahrain Island (Frohilch 1980). (4) In order to locate burial chambers from an adjacent shaft tomb, a hard pointed instrument was forcefully thrown into the side walls of the chamber. Several cuts were found in strategically located places. One such search yielded one adjacent burial chamber. The fifth burial chamber (A 112 N2), was partly silted, yielded one undisturbed entryway with the blocking stone in situ allowing us to observe the original silting process through the entryway.

A 113

No burial chambers were found in connection with this shaft. A few blocking stones were found at the bottom of the shaft. However, no stratigraphic evidences indicating burial chambers could be identified. No skeletal remains were found, Three almost complete pots were found at the bottom of the shaft (Table 2). The dimensions of the shaft are given in Table 1. We suggest that this shaft is either the result of a shaft tomb construction which accidentally cut into an already existing burial chamber with the contents of the chamber moved to another shaft tomb, or the shaft is the result of thieves' digging to find a burial chamber. The last option is less likely than the first, since no human skeletal remains were found in shaft A 113.

A 114

One burial chamber is associated with tomb A 114. The single chamber was cut into a matrix of sand, gravel and clay. Dimensions for the shaft and for the grave chamber are given in Table 1.

CHAMBER A 114 N One blocking stone sealed with mud mortar isolated the chamber from the shaft (Table 1). The chamber was unsilted and contained disarticulated human bones, pottery, wood tools and other wood objects. All adult skulls were placed to the left of the entryway, and the postcranial skeletons were placed in a bone pile in the center of the chamber. Cultural items (pottery and wood-tools) were primarily placed to the right of the entryway (Pls. LXXIII, LXXIV). Three adults (two females and one male) and four sub-adults have been identified. The ages of the four sub-adults are, 11-12 years, 3 years, 1 year, and newborn. Two articulated vertebral columns were found in the bone pile. One was fully articulated and placed in the lower center of the bone pile with the cervical end toward the skulls. A partly articulated vertebral column was placed in the southern part of the bone pile closest to the entryway (Pl. LXXIII). The cranial bones from at least one subadult were stacked and placed in line with the skulls. The estimates of living stature for the adults are: (1) male 165 cm., (2) first female 157 cm, and (3) second female about 151 cm. Estimates are derived from maximum length of the longbones (Trotter and Glesser 1952). Severe osteoarthritis was found in one vertebral column suggesting hard work and/or old age.

Chamber A 114 N had exceptionally well-preserved wood objects. One wood stick, 137 cm. long, was located to the right of the entryway balancing on two pots (Pls. LXXIII, LXXIV).Three well-preserved wood tools and two wood bowls were conserved and removed from the grave chamber. Other wood objects, badly decomposed, were placed to the right and left of the entryway. Two wood samples were collected for carbon dating before any attempt to conserve the tomb content was carried out. Twenty-three pots ranging from large bowls to small juglets were placed to the right of the entryway. One basalt vesel and one alabaster artifact (mace head or loom weight) were found to the left of the cranial bones (Table 2). A preliminary analysis of the pottery suggests an EB IA association (Schaub 1982).

Several fragments of well preserved textiles were found on the longbones and on some of the scapulae. The distribution of these textile fragments suggests that the entire bone pile had been covered by a shroud after the interment, thus the textile fragments were found only on the upper part of the bones facing the top of the bone pile.

The human skeletal remains had been placed on two separate pieces of reed matting; one was a rectangular mat for the skulls and one rectangular mat was for the post cranial material. The location and placement of the two mats resulted in a closer location of the skulls to the entryway than the postcranial bones, which may be due to of the architecture of the tomb (Pls. LXXIII, LXXIV).

C 11

Shaft tomb C 11 was found approximately 500 meters northwest of the area in which all other 1981 excavated tombs were found (Area IV in figure2). The shaft leading to the tomb was cut into Lisan marl in an angle of about 60° (compared to the other EB IA tombs vertical shafts (90° to the horizontal surface). A single unsilted burial chamber was cut into the Lisan marl as an extension of the shaft and sealed from the shaft by a wall of small rocks held together by extensive use of mortar. The tomb dimensions are given in Table 1. No silt was found in the chamber.

Disarticulated human skeletons with the skulls to the left of the entryway and the postcranial skeletons in a bone pile in the center of the chamber were found. Two adults (one female and one male) and three subadult skeletons were found (Table 3). The sub-adult's age at death were new born to 0.5 year (n = 2), and 4 to 6 years (n = 1). Osteoarthritis was found on one set of vertebrae possibly belonging to the male skull. The estimated stature for the male was 162 cm. and for the female 155cm.

Eight pots were found. Six pots were located to the right of the entryway. One basalt vessel, one alabaster artifact (mace head or loom weight), and two pots were located to the left of the entryway (Table 2). Preliminary analysis of the pottery suggests an EB IA association (Schaub 1982). No organic material was found in C11 (Table 2).

Conclusions

The major objectives for the 1981 field work in the Bad edh-Dhra cemetery were as follows.

1. Field test the EM-31 electrical conductivity meter to determine if the equipment is sufficiently sensitive to detect slight variations in soil conductivity.

2. Determine the association between variation in soil conductivity and the presence of various man-made structures (shaft tombs and charnel houses).

3. Identify the eastern and western boundries of the Early Bronze Age cemetery at Bab edh-Dhra.

4. Obtain better estimates of the density of the shaft tombs in the cemetery area.

5. Conduct a topographical survey of the cemetery to provide data for a better map of the area.

6. Plot the location of excavated and unexcavated shaft tombs and charnel houses on the new topographic map.

7. Obtain additional skeletons from the EB IA phase (shaft tombs) to improve the sample size of existing materials.

As indicated in the above text, all of these objectives have at least partially been met. Undoubtedly additional data collection and analysis will permit us to clarify these objectives even further in future publications. In addition, the presence of partially articulated skeletons in some of the shaft tombs throws new evidence on the time framework for the primary burial phase of some of the secondary burials typical of the shaft tombs. Partially articulated skeletons suggest as little as a few weeks time for the primary burial phase, while broken skulls and postcranial bones often recovered from undisturbed shaft tombs suggest that the primary burial phase for others may have been several years or at least long enough for the bone to become relatively fragile. This evidence will support the present hypothesis of the Expedition that EB IA burials are the result of periodical returns to the site before the establishment of the permanent settlement in EB IA (Rast and Schaub 1981; Schaub 1981).

Our work on the skeletal biology of other more or less contemporary sites in the Near East begins to allow us to place the Bab edh-Dhra people in the context of the broader human biological history of the region. We also are beginning to obtain

data on how the shaft tomb people at Bab edh-Dhra are related to the people associated with subsequent occupation of the site through the Early Bronze Age. Certainly a better understanding of the human biological history of the Near East has much to add to our understanding of the human biological history of this area which provided the roots for Western Civilization.

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