('76)

Name of Applicant: McGovern (Last) Patrick (First) Edward (Middle)

Museum Applied Science Center for Archaeology; The University Museum;
University of Pennsylvania; Philadelphia, Pa. 19104; 215-386-7400
(Address and telephone number (including area code))

Date: _____

Return to:

Committee for Research and Exploration
National Geographic Society
17th and M Streets, N.W.
Washington, D. C. 20036

Applications must be typewritten within the margins on one side of page only with heavily inked ribbon. The application must be limited to these seven pages. If additional materials are essential to a full understanding of the project, they may be attached and will be kept in the office of the Committee Secretary where they may be consulted by Committee members.

1. Project title (ten words or less):

CESIUM MAGNETOMETER AND RESISTIVITY ARCHEOLOGICAL SURVEY: UMM ED-DANĀNĪR, JORDAN

a. Under what major field of science do you classify this project? Archeology

b. Funds requested from National Geographic Society (U.S.A. currency) $ 3000

c. Expected duration of the project. (Specify dates of field and laboratory study).

September-October 1978 (one month total)

d. Location of field work Umm ed-Danānīr region, Beqaʿa Valley, Jordan

e. Abstract of Proposed Research.

The archeological results of a salvage excavation of a LB IA-IIA burial cave in the Umm ed-Danānīr region strongly suggest that LB people(s) were well-established and probably settled in this part of the Beqaʿa Valley, in contrast to the survey results and conclusions of earlier researchers. At least three more caves were discovered in what appears to be an extensive LB burial ground. "Megalithic" buildings within a kilometer of the caves, especially at Rujm el-Ḥenū, are architecturally close to the LB Amman airport "temple" and could be connected with LB occupation. In order to gain a full picture of the LB remains in the area, a thorough archeological survey using geophysical prospecting instruments will be carried out: (1) a cesium magnetometer survey to locate more LB burial caves, particularly those which are filled in and less likely to be disturbed, (2) an electrical resistivity survey near the "megalithic" buildings to locate occupational remains, and (3) a general archeological survey within a kilometer of the caves to locate all possible LB sites, which can be explored concurrently with the magnetometer and/or resistivity instrument. The results from the survey will be used to develop a well thought-out and economical excavation strategy for a major archeological expedition, which is planned for the near future.

Name of Applicant: Patrick Edward McGovern

2. Biographical information and qualifications of the applicant:
(In addition, please attach curriculum vitae for committee files)

a. Present position (institution and rank):

William Penn Foundation Research Fellow, Radiocarbon Laboratory, University of Pennsylvania

b. Place and date of birth:

Corpus Christi, Texas; December 9, 1944

c. Education and degrees with institutions and dates:

A.B., 1966, Cornell University (Arts and Sciences)
M.Div., 1969, Faith Theological Seminary, Elkins Park, Pa.
Ph.D., expected 1978, University of Pennsylvania (Oriental Studies)

d. Special qualifications of applicant for proposed research (experience, languages, etc.):

I have been a field and pottery supervisor on excavations in Lebanon and Israel, and I co-directed the 1977 Umm ed-Danānīr salvage excavation of a LB burial cave, which was was jointly funded by the Jordanian Department of Antiquities and ASOR/ACOR. I am well-versed in the theory and logistics of the magnetometer and Gossen Geohm, because of my participation in a major MASCA prospecting survey at Valley Forge National Historical Park. I have an excellent academic training, in addition to having travelled throughout the Middle East and worked in most of the major museums.

If others are to participate in this project, please give the same biographical information and qualifications for each person in the space below:

Bruce Bevan

Name of Applicant: Patrick Edward McGovern

3. Books and papers published by the applicant and others who will participate in the proposed research. (A statement such as the following is satisfactory: I have published _____ books and _____ articles (give number), but only the following are on topics directly related to the proposed research.) (Please attach complete bibliography for committee files.)

Several preliminary reports on the Beqaʿa Valley salvage excavation of the LB burial cave are scheduled to appear in the Newsletters of the American Schools of Oriental Research (ASOR) and the Museum Applied Science Center for Archaeology (MASCA). A final report on the Beqaʿa salvage excavation will be published in an ASOR publication and in the Annual of the Department of Antiquities of Jordan. I am presently completing a Ph.D. dissertation on amuletic and ornamental jewelry pendants from Late Bronze Age Palestine; a detailed study of the jewelry from levels VII and VIII at Beth Shan is forthcoming in Dr. Frances James' Late Bronze Age volume on the site.

Bruce Bevan

4. Method of publication of scientific results of proposed study: Final reports will be published in the MASCA Newsletter, in an ASOR publication, and in the Annual of Department of Antiquities of Jordan

Name of Applicant: Patrick Edward McGovern

5. Budget

a. Total budget for the project: $ 8,700

If funds have been requested from other sources, attach budgets. Contributions from investigator's home institution should be listed under Item 6.

b. Amount requested from National Geographic in U.S.A. currency: $ 3,000

c. Budget for funds requested from National Geographic Society. Please specify: e.g., equipment, assistants, field work, travel, services, supplies, etc. The Committee requires that budget items be given with precision and in detail. Two columns may be used. Include on pages 6-7 justification for any items that are not clear. (IMPORTANT: No charge for overhead is allowed. If any capital items are purchased with Society funds, the items or their salvage value are to be returned to the Society upon completion of the project.)

1. Two round-trip air fares, Philadelphia-Amman (22-45 day excursion)	$1,800
2. Insured air freight shipment of magnetometer and Gossen Geohm (110 kg.), round-trip Philadelphia-Amman	700
3. Drawing of maps and archaeological finds, photographic developing and printing, xeroxing, lay-out, mailing, telephone/telegraph, and miscellaneous supplies (film, paper, etc.)	500
TOTAL	$3,000

d. Person or institution (with address) to whom payment should be made: MASCA

e. Schedule of payments desired: $3000 a month before start of project

All funds received

Before the application is considered, the Society must be informed that all necessary permits for field work (collecting or excavating) and laboratory, museum, or library study have been obtained; and that if foreign travel is involved, the participants have valid passports and required visas.

Name of Applicant: Patrick Edward McGovern

6. Amount and nature of institutional or other contributions toward this work. (If you are receiving no aid on this project from a university or other organization, or other individual, please explain):

1. Jordanian contribution: $4,000 for expenses within Jordan, including salaries for workmen and the Department of Antiquities' representative, room and board for two MASCA personnel, car rental, insurance, and miscellaneous supplies.
2. MASCA contribution: $1,700, which will cover the salaries of two MASCA personnel and the rental fees of the magnetometer and Gossen Geohm.
3. ASOR-ACOR contribution: the two MASCA personnel will live and work out of ACOR in Amman, where they will have full use of the facilities.

7. Previous grants (date, source and amount) received for this work, grants now available, or applications to other organizations which are now pending. State whether they are alternative to your request to the Society. If another request for a grant is made after this proposal is sent to the Society, please notify the Society at once.

none

8. Previous grants from the National Geographic Society for any project. (List project title, date and amount.)

none

9. Names and addresses of at least three individuals competent to pass judgment upon your qualifications and/or your project. (Note: The Society will get in touch with your referees. In addition, the Committee has its own sources of information, and the referees you suggest may or may not be consulted.)

1. Dr. Adnan Hadidi, Director-General; Department of Antiquities of Jordan; P.O.B. 88; Amman, Jordan
2. Dr. James A. Sauer, Director; American Center of Oriental Research; P.O.B. 2470; Jebel Amman; Amman, Jordan
3. Dr. Martin J. Aitken

Elizabeth Ralph

4. Dr. Edward F. Campbell, Vice-President for Archeological Policy of ASOR; McCormick Theological Seminary; 5555 South Woodlawn Ave.; Chicago, Illinois 60637

10. If the grant requested here is approved, the applicant pledges himself to present a preliminary report on the project to the National Geographic Society on Jan 1 1979 **(give date) and a final formal report on** Sept 1 1979 **(give date). The final report is to include an abstract suitable for publication in the Society's Research Reports and a one-page summary.**

Signature: Patrick Edward McGovern

Typed name: Patrick Edward McGovern

In 1977, the applicant co-directed a salvage excavation of a Late Bronze burial cave in the Umm ed-Danānīr region of the Beqa'a Valley, Jordan, which was the first excavation ever carried out in the archaeologically rich valley. 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 LB IA-IIA local and imported pottery (e.g., Chocolate-on-Cream, Cypriote Base-Ring, and Mycenaean), along with accompanying grave goods (scarabs, cylinder seals, bone inlay, etc.), was recovered from an anciently disturbed stratum with disarticulated human skeletal remains. The high quality and quantity of locally made pottery and other artifacts strongly suggest LB settlement(s) near the cave (N.B., similar assemblages occur in LB settlements on the West Bank), although Nelson Glueck once argued that only nomads or semi-nomads had inhabited Jordan, south of the Wadi Zerqa, during LB (1940: 124-25, later modified, 1970: 141).

A limited search in the vicinity of the cave revealed at least three more LB burial caves, which are undoubtedly part of a larger series along the northwestern slopes of the valley. Many "megalithic" buildings also exist within a kilometer of the caves, and some of these may be connected with LB occupation. A prime candidate is Rujm el-Ḥenū, about 750 m. east of the line of caves, whose easternmost building is architecturally very similar to the Amman airport LB "temple." The latter building, which produced a surprisingly large number of Egyptian and Mycenaean imports, has been interpreted as a tribal shrine of nomads/semi-nomads and related to biblical traditions about the early Israelites (Campbell and Wright 1969: 104-16). The proximity of the airport, however, has hindered a full investigation, and the site has recently been covered over by a new runway. Exploration of Rujm el-Ḥenū and other possible LB settlements in the Umm ed-Danānīr region may provide another opportunity for testing such hypotheses. Beyond this, the LB burial caves and probable settlement(s) in the Umm ed-Danānīr region promise to fill in a large gap in Jordan's cultural history. To date, only a few small LB sites have been excavated on the East Bank, and most of this material is still unpublished.

As a much-needed first step towards developing a well thought-out and economical excavation strategy, a thorough archaeological survey of the Umm ed-Danānīr region using geophysical prospecting instruments will be carried out, in order to gain a full picture of the LB remains. Twenty full workdays will be spent in the field during September-October 1978, when the areas around the "megalithic" buildings will be clear of crops and the heavy rains will not yet have begun. Headed by the two MASCA personnel, three-man teams will be involved in each aspect of the survey:

1. A Precision Portable Cesium Magnetometer Model V-4920 in its differential configuration with two sensors (Ralph, Morrison, and O'Brien 1968: 109-22) will be employed to locate more LB burial caves. The discovery of completely filled-in caves, which have not been disturbed by the local people, will be a major goal, since they are more likely to produce a stratigraphic sequence of LB pottery.

The cesium magnetometer is the most sensitive magnetic prospecting instrument available, and MASCA has the only operable one in the world. Earlier MASCA surveys were successful in detecting graves at Forts Louisbourg and Lennox in Canada (Ralph 1969: 16). In order to critically tests the magnetometer's usefulness for the Umm ed-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 m^3/kg) and the sandstone and limestone bedrock, which showed no susceptibility, was statistically significant, according to the Student's t Test. Assuming an 8-50 m^3 volume range for the filled-in caves (the excavated cave had 30 m^3 of soil fill), magnetic anomalies between ten and fifty gamma can be expected The cesium magnetometer (0.05 gamma sensitivity) can detect the complete range of projected anomalies, and is the preferred instrument.

The logistics of the survey involve 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 survey (Department of Lands and Surveys of Jordan 1950: Sheet 27/64), and making measurements at two meter spacings. Magnetic intensity contour maps at ten unit intervals will be drawn as soon as possible, and promising areas will be explored with closer sensor spacings. Approximately eight hectares (twenty acres) will be surveyed.

2. A Gossen Geohm will be used for an electrical resistivity survey of the "megalithic" buildings, particularly Rujm el-Ḥemū. The major goal will be to map out the extent and particular features of buried LB occupational remains.

The specific resistivity of soil samples from the Umm ed-Danānīr was measured and found to vary between twenty and sixty ohm-meters, which is much lower than values for limestone and sandstone (5000 ohm-m.). Therefore, stones walls and structures will be detected by the Gossen Geohm, which has a 0-5000 ohm range. The magnetometer cannot be used here, because stone walls and features would not produce large enough magnetic anomalies.

The four-probe Wenner configuration with one meter probe separation should be ideal for sub-surface remains, although other probe spacings will be tried. As with the magnetometer survey, 50 x 100 m. grids will be precisely laid out, and resistivity contour maps at ten unit intervals will be plotted for possible follow-up surveys of promising areas. About four hectares (ten acres) will be surveyed.

3. A general archaeological survey within a kilometer of the caves will be directed towards locating other possible LB sites, which can be explored concurrently with the magnetometer and Gossen Geohm. Approximately four square kilometers will be surveyed using standard archaeological survey techniques (Hester, Heizer, and Graham 1975: 13-63). Constant reference will be made to earlier survey results, and all new discoveries will be precisely located.

The results of the survey will be prepared for publication at ACOR and the University Museum (Publication Section). Full analysis of the results is expected to lead to a major archaeological expedition with a broad institutional base in the near future.

Campbell, E. F., Jr., and G. Ernest Wright, 1969. Tribal League Shrines in Amman and Shechem. The Biblical Archaeologist 32:4 (December): 104-16.

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

Glueck, N. , 1939. Explorations in Eastern Palestine, III. Annual of the American Schools of Oriental Research 18-19 (1937-1939), eds. M. Burrow and E. A. Speiser. New Haven: American Schools of Oriental Research.

Glueck, N., 1940. The Other Side of Jordan. New Haven: American Schools of Oriental Research.

Glueck, N., 1970. The Other Side of Jordan. 2d ed. Cambridge, Mass.: ASOR.

Hester, T. R., Heizer, R. F., and Graham, J. A., 1975. Field Methods in Archaeology. 6th rev. ed. Palo Alto: Mayfield.

Ralph, E. K., 1969. Archaeological Prospecting. Expedition 11:2 (Winter): 14-21.

Ralph, E. K., Morrison, F., and O'Brien, D. P., 1968. Archaeological Surveying Utilizing a High-Sensitivity Difference Magnetometer. Geoexploration 6: 109-22.

Vaux, R. de, 1938. Chronique: Exploration de la région de Salt. Revue biblique 47: 417-22.

P. McGovern

PRELIMINARY REPORT

CESIUM MAGNETOMETER AND RESISTIVITY SURVEY

UMM AD-DANĀNĪR, JORDAN

The archeological survey of the Umm ad-Danānīr region of the northwestern Baqᶜah Valley, employing geophysical prospecting instruments, was carried out between October 19 and November 12, 1978. It achieved all of its major goals, which are briefly summarized below, pending the final report.

1. Thirty-three partially or fully robbed-out burial caves were located and precisely mapped on the eastern lower slopes of Jebel al-Hawāyah and Jebel al-Qeṣīr, respectively north and south of Ḫirbet Umm ad-Danānīr (see accompanying map of the Umm ad-Danānīr region). Of those caves whose robbers' dumps could be surface sherded, nineteen were Late Bronze Age in date (5 MB IIC/LB IA, 3 LB IA, 3 LB II, 7 LB, and 1 LB II/Iron IA). Three burial caves were Byzantine, and one was Mamlūk.

2. As had been predicted, the cesium magnetometer was able to detect the 10-50 gamma difference in magnetic intensity between the cave fill and the surrounding limestone/sandstone bedrock, and no less than eighteen significant anomalies were located and mapped. Since the anomalies are close to the robbed-out LB caves and in the same soft limestone/sandstone strata, they undoubtedly represent LB burial caves (some up to 10 m. in diameter), which have not been disturbed by modern digging. Based on the results of the 1977 sounding of an LB IA-IIA burial cave on Jebel al-Hawāyah, some of these caves could have as many as twenty-five burials along with rich and varied collections of associated burial goods. In support of this contention were the fragments of a Mycenaean stirrup jar and virtually intact LB vessels recovered near the robbed-out caves.

3. The discovery of two LB settlement sites fulfilled our prior expectations and fitted in with the size and richness of the LB cemetery. It also provides another challenge to Nelson Glueck's modified hypothesis that only nomads or semi-nomads inhabited Jordan, south of the Wadi Zerqa, during the Late Bronze Age.

a. Rujm al-Ḥenū (16585/22880--Palestinian grid). Located approximately one kilometer east of the line of burial caves, the site comprises two "megalithic" buildings. The eastern rectangular building (ca. 25 x 30 m.), similar in structure to the LB Amman Airport "temple," produced a very remarkable finding: MB IIC/LB IA surface sherds from its central courtyard (an exact plan of this important structure has been prepared). The western rectangular building (ca. 46 x 14 m.), with circular and rectangular towers on the western and southern sides respectively, was most likely constructed in LB II according to surface sherding. The circular tower may have been added in the Iron Age, since it appears to run over the original wall on the west side.

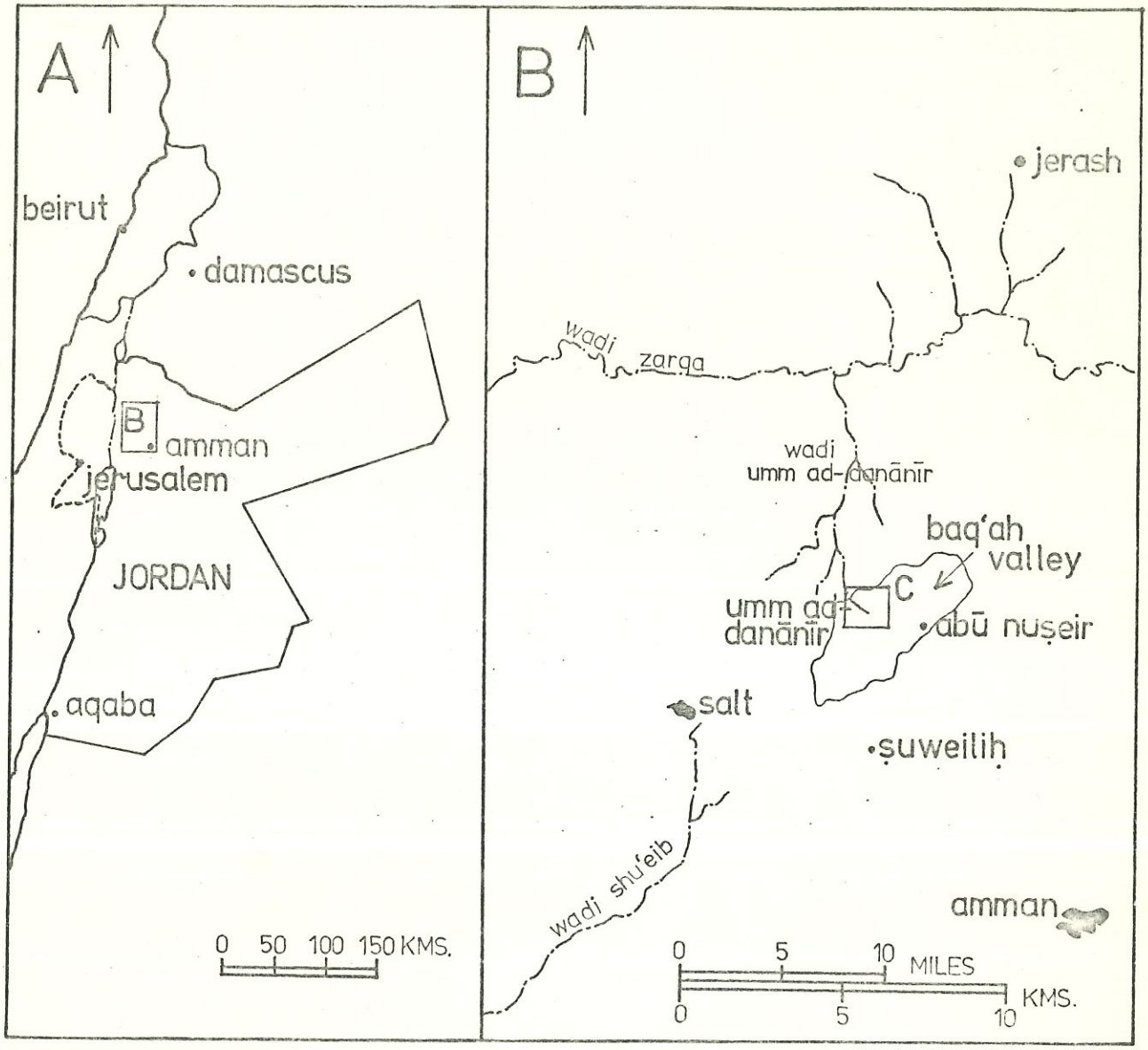
A Gossen Geohm resistivity survey in the immediate vicinity of Rujm al-Ḥenū and inside the eastern building, covering approximately one and a half acres, localized probable zones of buried architectural remains on all sides of the eastern building and between the two buildings. Thus, a more extensive LB settlement may exist here than is immediately apparent on the surface.

b. Ḫirbet Umm ad-Danānīr (16600/22725). This large (ca. 1 hectare), multi-terraced site is strategically located above the Wadi Umm ad-Danānīr, where the strong spring of ᶜain Umm ad-Danānīr provides a constant source of water throughout the year. It would have guarded the northwestern pass of the Baqᶜah Valley and the trade route between the Jordan Valley (Deir ᶜAlla) and Amman. The main periods of occupation according to surface sherding were LB II, Iron IA, Iron II, Early Roman III, and Early Byzantine. Besides being first occupied during LB II (possibly earlier), Hirbet Umm ad-Danānīr is important as a transitional site from LB to Iron IA when a major cultural change occurred with the arrival of the Israelites, Ammonites, etc.

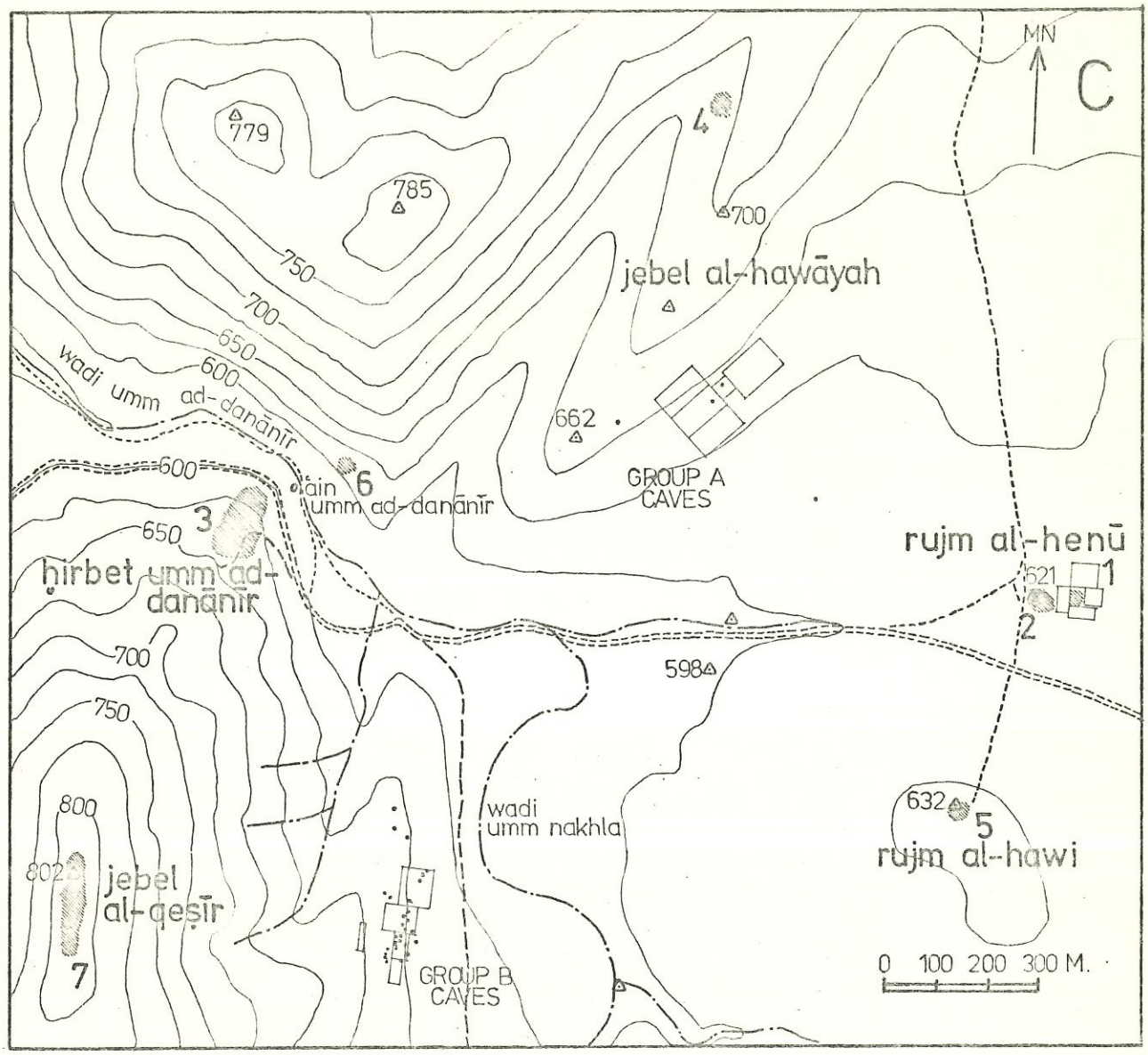
4. Sites of other periods were located and explored. The most impressive is the large Early Bronze II-IV site of al-Qeṣīr (16506-47/22693), which covers the entire top of Jebel al-Qeṣīr (about a quarter hectare) and has an encircling defensive wall. Three Iron II sites were discovered, two virtually obliterated by modern earthmoving. A large number of flints, discovered in confined areas on Jebel al-Hawāyah and Jebel al-Qeṣīr, ranged in date from the Middle Palaeolithic to the Chalcolithic period, thus greatly pushing back man's earliest presence in the valley.

5. A preliminary survey in other areas of the valley outside of the Umm ad-Danānīr region gave evidence of numerous "megalithic" Iron Age structures (some with intact walls fifteen feet high), two tells (one of which was occupied in the Late Bronze Age), a major Mamlūk site, and various Roman and Byzantine remains.

6. Another building with a ground plan similar to the Amman Airport "temple" was located only a half kilometer southeast of the latter. Surface sherding indicates an LB dating for its construction with a reuse during the Iron Age. The Jordanian Department of Antiquities provided funds to have the very well-preserved ground plan drawn by our architect.



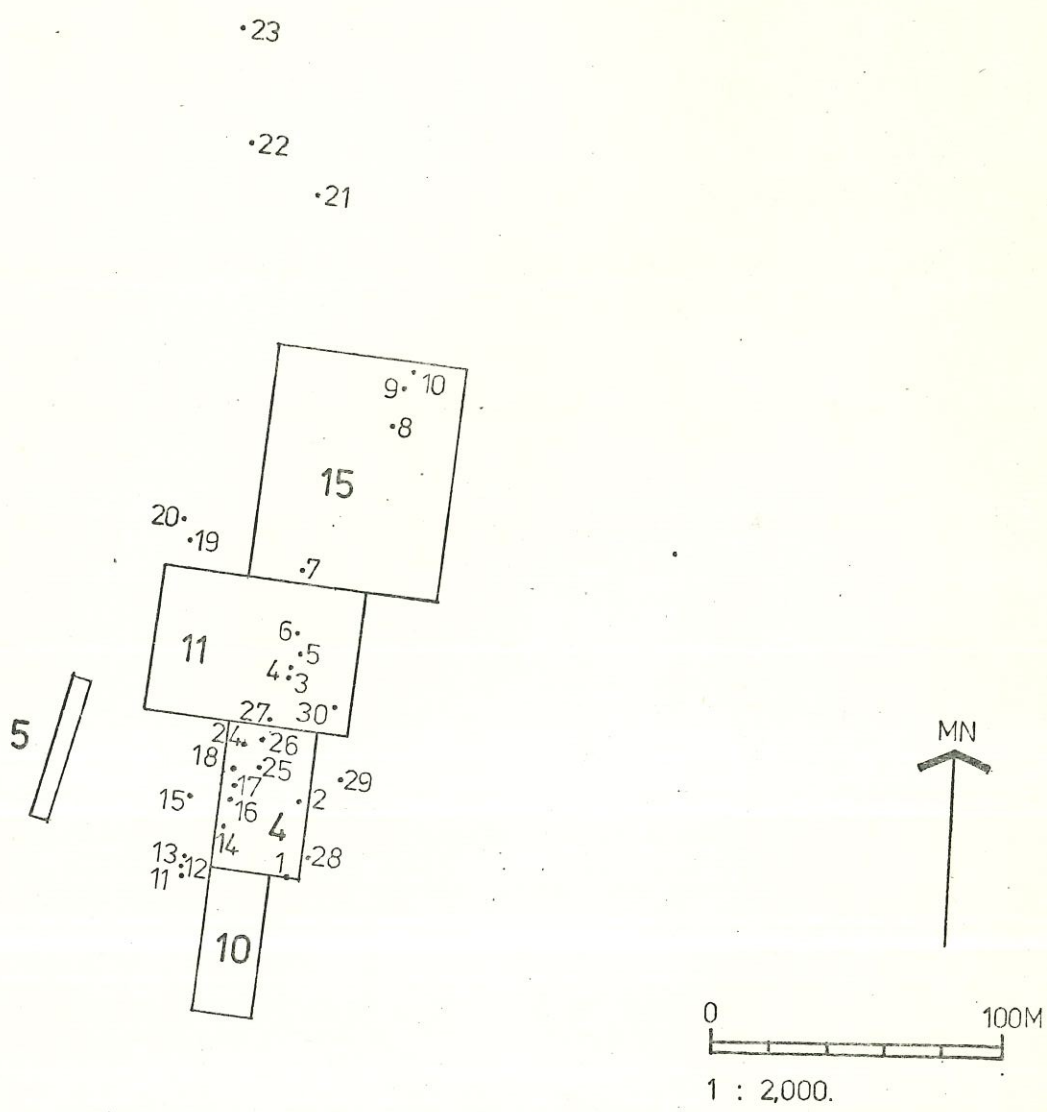
Location Maps
Umm ad-Danānīr Region
Baq'ah Valley, Jordan.



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

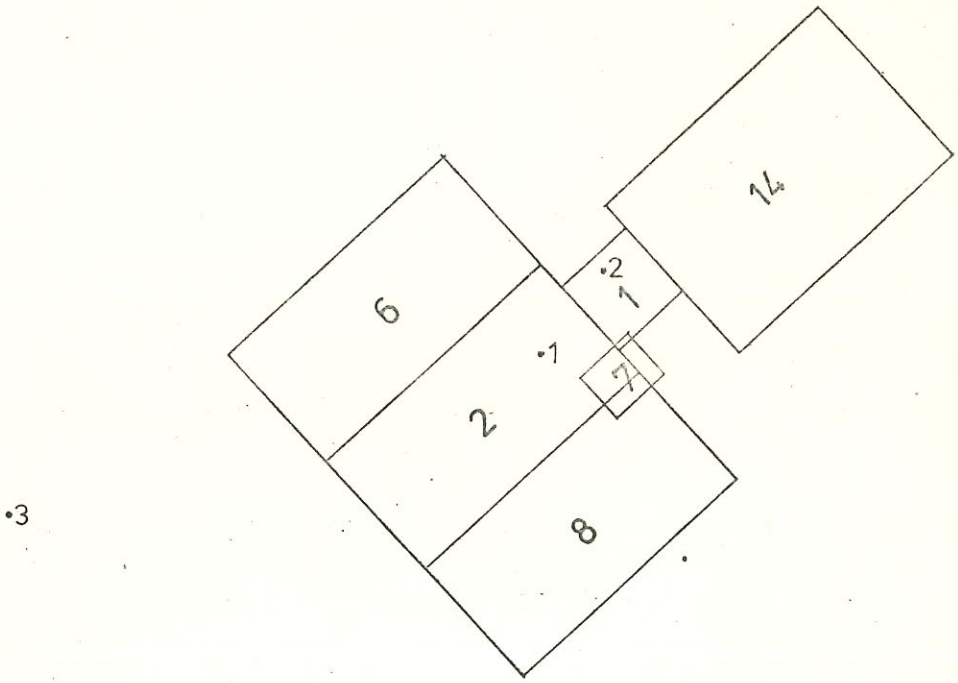
Ref: 1 : 10,000 Zarqa Basin sheets 27/64 & 19/64.
Jordan Department of Lands & Surveys, 1950.

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



Jebel al-Qeṣīr

Geophysical survey grids & Group B Caves.



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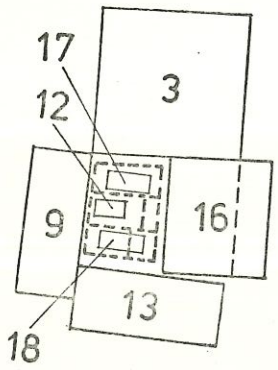
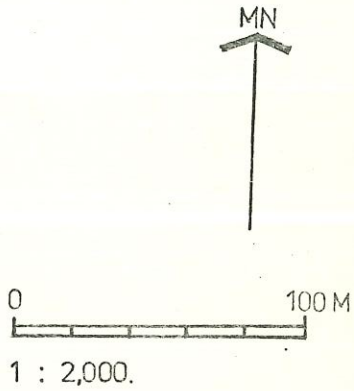
Jebel al-Hawāyah

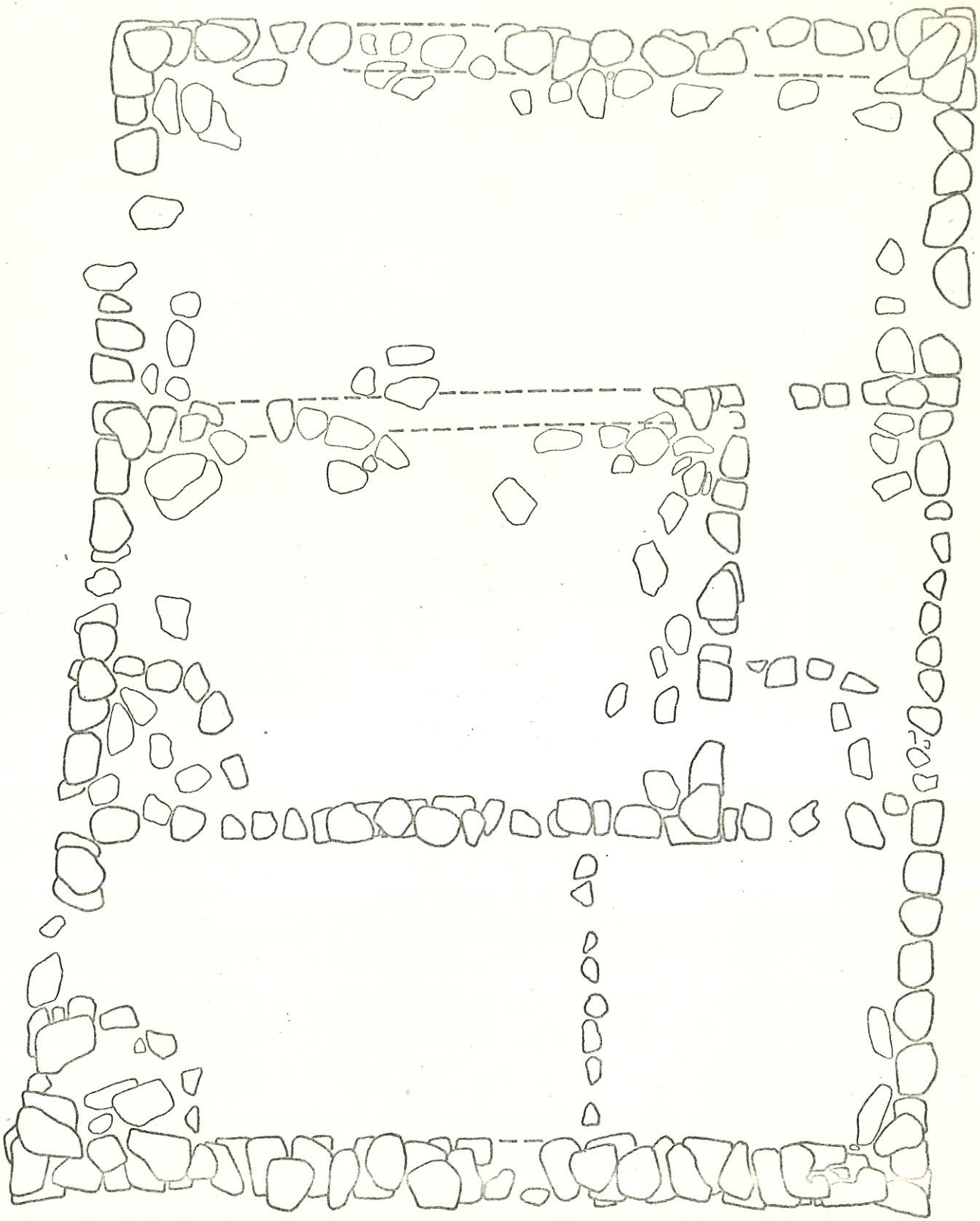
Geophysical survey grids & Group A Caves.





Rujm al-Henū, Site no. 1.

Geophysical survey grids & East building.



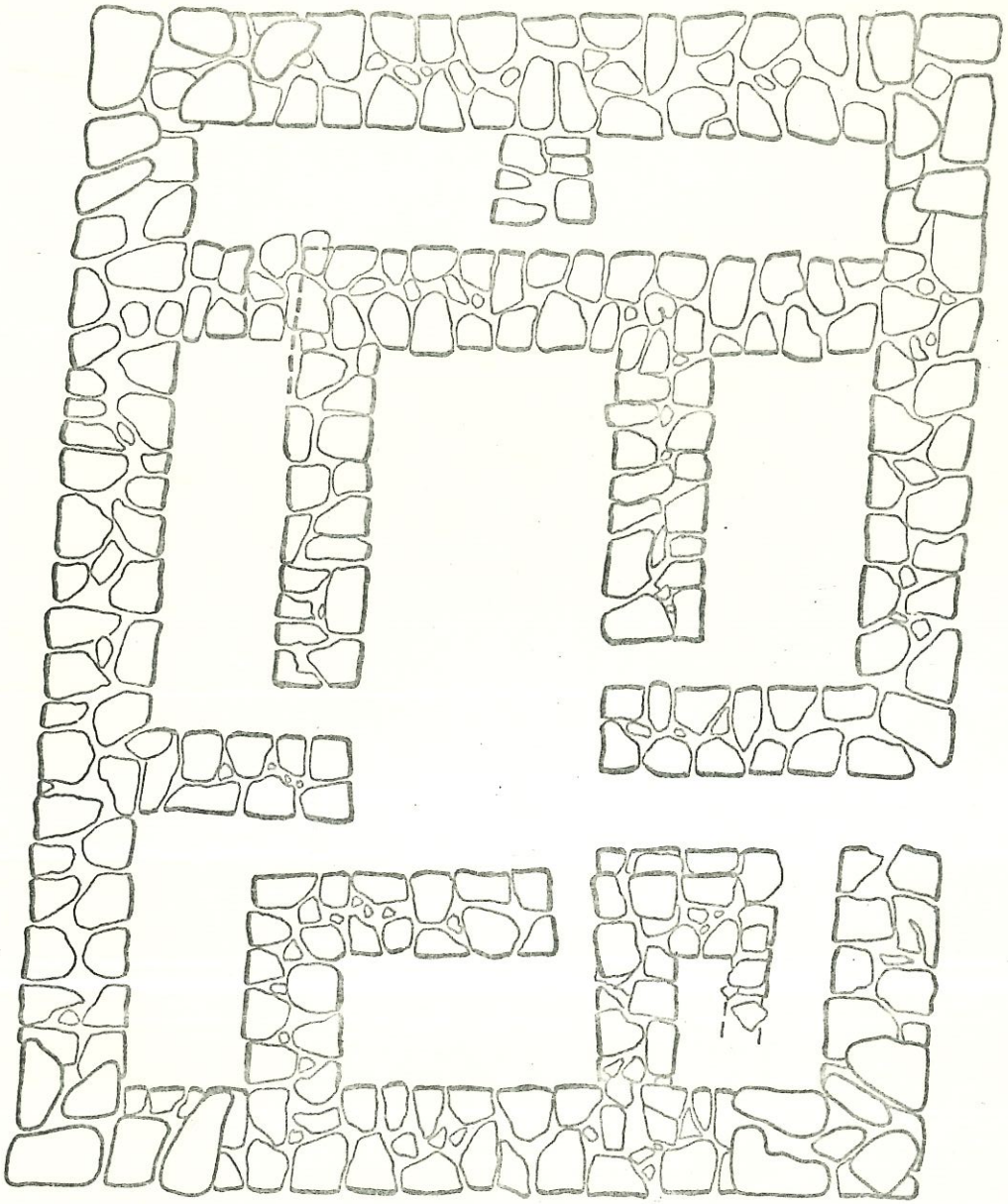
Rujm al-Henū
Plan of East Building.
Scale - 1 : 100

0 1 2 3 4 5M

MN

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

6.11.1979.



Amman Airport Temple No. 2.

Scale - 1 : 100 0 1 2 3 4 5M

MN

Susan M. Balderstone A.R.A.I.A. Architect. 30.11.1978.

June 7, 1979

Dear Beth:

Here is a copy of the preliminary report for the Baq^{c}ah Valley, Jordan cesium magnetometer and resistivity survey. Our plans for the future (assuming we can get adequate financial backing and put together a good team) are to test some of the magnetic anomalies which promise to be LB burial caves and to carry out a major sounding at Rujm al-Henu (eastern building--see plan); we hope to be able to go into the field in the spring of 1980. Burial caves normally do not have much in the way of charred organic remains or charcoal, and I think most of non-charred organic remains will have disintegrated, based on the results of our previous cave sounding. Rujm al-Henu may be more promising, since it part of an LB settlement site. Of course, the burial caves do have enormous quantities of bones, but I assume that you wouldn't want to have only that! Jordan, to be sure, is an area that could use more radiocarbon dates. You already have some good sequences from the Jordan Valley and the West Bank (Tell es-Sa^{c}idiyeh, Deir ^{c}Alla, etc.), but the Transjordian plateau is not well-represented. It would certainly help to have more dates from the plateau in particular and Palestine generally, in order to test the pottery chronology which is based on Egyptian correlations.

As regards the archaeomagnetic study, I enclose copies of Derek Walton's work at Oxford. He now plans to set up another squid magnetometer at McMaster and would like to have samples from other areas to check the double peak at 650 and 433 B.C. on the Greek curve (see Fig. 1 in the Nature article). If it is true that the rotation of the core leads to a westward drift of approximately $0.2^{\circ}\,yr^{-1}$, then the peaks should appear at 750 and 533 B.C. in Iran and at 700 and 483 B.C. in Palestine. Although Hasanlu has fairly well-dated material to pick up the early part of the first peak, the trough, and the early part of the second peak, we need to use a Palestinian site (Tell es-Sa^{c}idiyeh) to pick up the first peak more adequately. It is interesting that there seems to be a relationship between the Greek archaeomagnetic curve and the MASCA bristlecone pine curve, but I'm not sure how much this should be pushed, if there really is a westward drift (see Bucha's article in Dating Techniques for the Archaeologist). Another possibility, assuming again that the project actually materializes, is to take archaeological material from areas more distant (Southeast Asia, for example); the Greek curve should also be replicated.

Pat

FIELD RECORDING AND PLAYBACK INFORMATION

PROSPECT ______ COUNTY OR PARISH ______ STATE OR PROVINCE ______ COUNTRY ______ CLIENT ______ SHEET NO. ______

LEFT STORAGE ______ ARRIVED FIELD ______ LEFT FIELD ______ ARRIVED STORAGE ______ DATE ______ OBSERVER ______ PARTY NO. ______

IDENTIFICATION OF RECORDING												CHARGE (E)								SEISMOMETERS AND SPREAD (F)			WATER DEPTH MEASURED AT ______	AMPLIFIER SYSTEM TYPE: ______								MAGNETIC RECORDER -REPRODUCER TYPE: ______				REMARKS
LINE NUMBER	PROFILE NUMBER	SHOT NO.	RECORD NUMBER (A)	MAGNETIC DISC OR TAPE: SERIAL NUMBER	MAGNETIC DISC OR TAPE: HEAD GROUP NO.	TIME	PROFILE DIRECTION (B): GRP.	PROFILE DIRECTION (B): BEARING	DIRECTION(C) OF GRP. TAPPED	SHOT POINT OFFSET (D): DIST.	SHOT POINT OFFSET (D): DIR.	NUMBER OF CHARGES	TOTAL CHARGE	CODE (E)	DEPTH: TOP	DEPTH: BOT.	PRIMACORD: FROM	PRIMACORD: TO	CAPS USED	CODE (F)	SEIS. DEPTH	S. P. SEIS. OFFSET		FILTERS: HIGH CUT	FILTERS: LOW CUT	INITIAL ATTENUATION: SETTING	INITIAL ATTENUATION: RESET OR TRIP	A.G.C.	ULTIMATE SENSITIVITY	PER CENT OUTPUT	CIRCUIT TYPE (H)	PER CENT MODULATION	MOVEOUT CAM NO.	SPREAD LENGTH ADJUSTMENT (I): 1-12	SPREAD LENGTH ADJUSTMENT (I): 13-24	

ADDITIONAL REMARKS AND DIAGRAMS

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INSTRUCTIONS:

(A) Use M-1, M-2, etc., for monitor or direct records and P-1, P-2, etc., for playback records. (B) Give bearings of end groups with reference to spread centers. Use recording boat as reference for water work. (C) Give direction for group tapped on each split spread with reference to spread center. Tap group in direction shooting is progressing. (D) Surveyor's sheets give exact data. Give any changes made by drillers, etc. (E) Draw charge patterns on lower right part of sheet and identify with code. Surveyor's sheets give exact dimensions of regular patterns. (F) Give seis. patterns of groups and group layouts on lower center part of sheet. Identify with code. Surveyor's sheets give complete dimensions of regular group layouts. (G) Split, single-end, etc. (H) Straight, composite type, etc. Draw diagrams of special types and special group to amplifier channel to magnetic track connections. (I) When making moveout corrections with Techno, give head dial readings for 1 and 24 when velocity cam follower on maximum radius.

G.S.I FORM NO. 730 MADE IN U.S.A. NOTE: CLIP BOARDS AND BINDERS ARE AVAILABLE FOR THESE SHEETS

SEISMOMETER AND SPREAD TYPES (F)

CODE	SEIS. TYPE	NO. PER GROUP	SEIS. INT.	SEIS. PATTERN OF GROUP	NO. GROUPS	GROUP INTERVAL	TYPE OF GROUP LAYOUT (G)

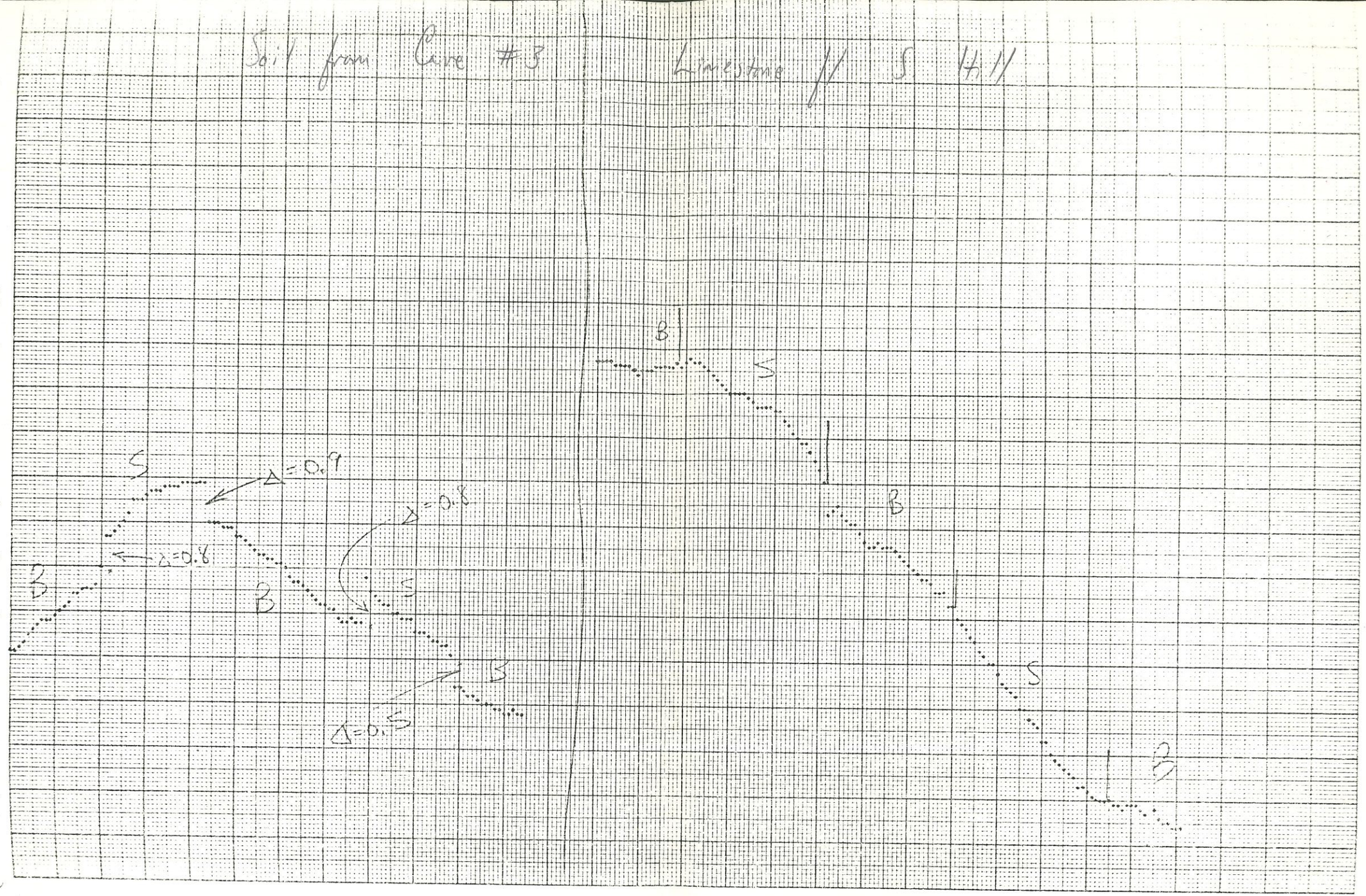
LOG LEVEL INDICATOR CALIBRATION

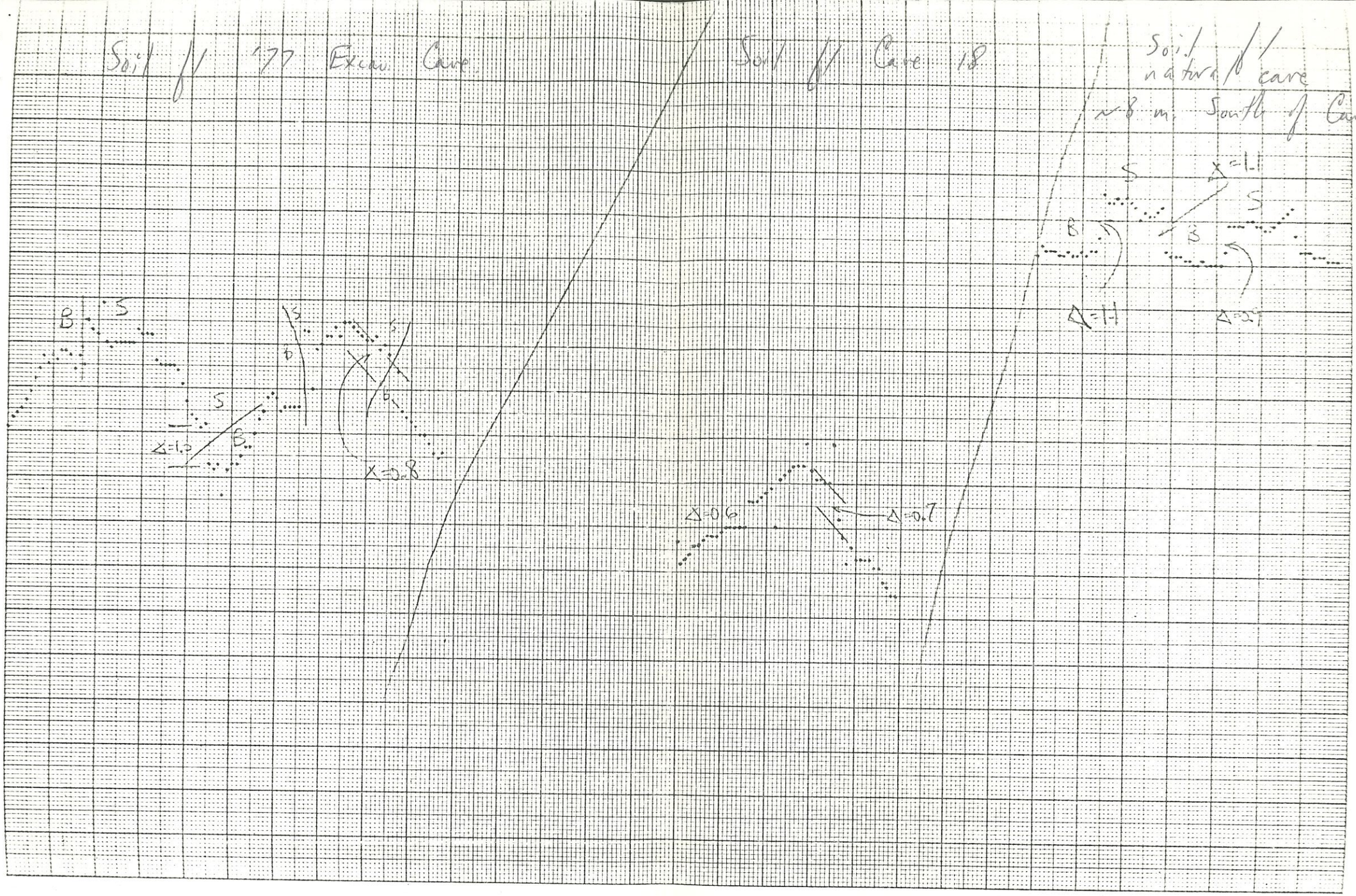
OSCILLATOR SIGNAL RANGE ______ mv. TO ______ μv.

CALIB. RECORD NUMBER	UNIT NUMBER	FED BY GROUP NUMBER	FILTERS: HIGH	FILTERS: LOW	SENS.	TIME CONSTANT	DEFL.	COMP. RANGE (db)

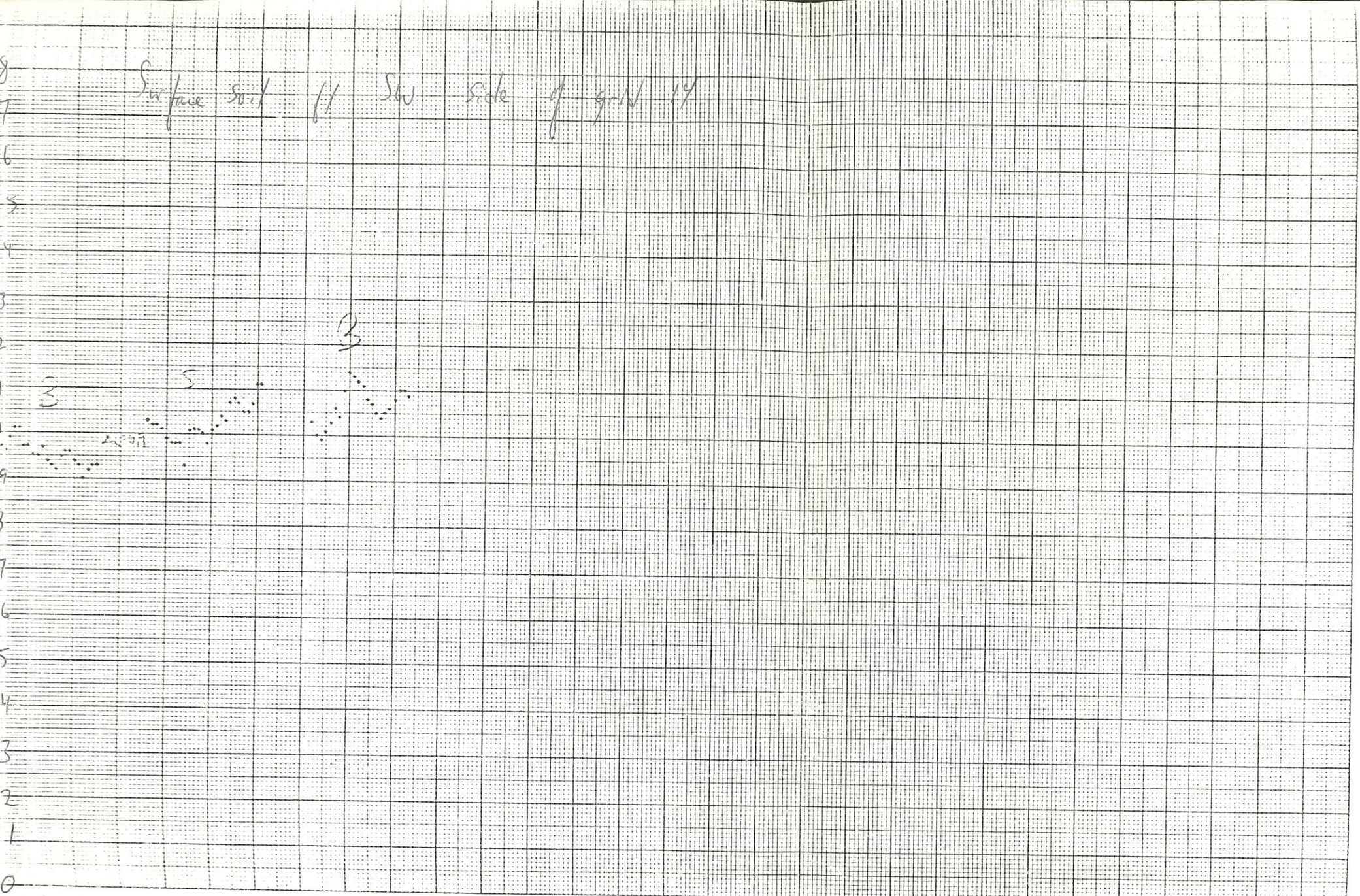
CHARGE ARRANGEMENT (E)

CODE: A	CODE: B	CODE: C

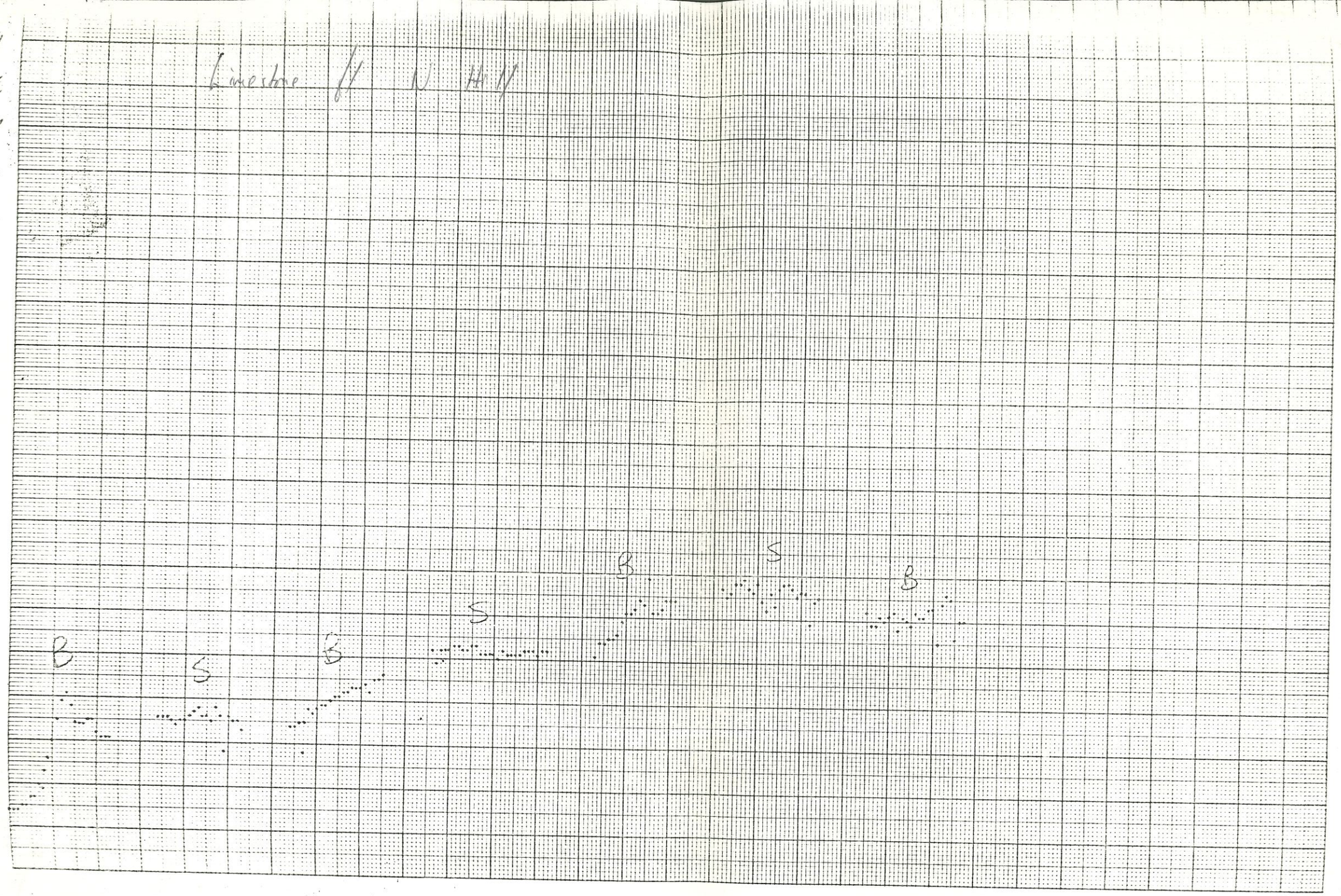

Soil from Cave #3
Limestone
S
B
Δ=0.9
Δ=0.8
Δ=0.8
Δ=0.5


Soil profile 177 Excav. Cave
B
S
Δ=1.5
X=0.8
Δ=0.6
Δ=0.7
Soil profile Cave 18
Soil profile natural cave ~8 m. South of Cave 8
Δ=1.1
Δ=1.1
Δ=2.5

Surface soil of Sw side of grid 1



Soft 177 Gee


Limestone
B
S
B
S
B
S
B

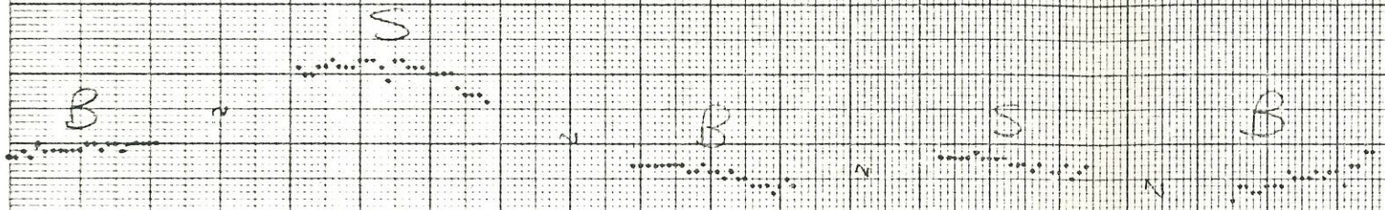
H, at

Sunshine // N hill

assume min sample time ~10 counts

S = sample

B = background



use adjacent 6 measurements for average

12 Nov 78 magnetic tests on soil & rock on N hill at Sega'a; use single sensor

read sequence of numbers: every one displayed

delay between sample & background on this series

sandstone sample – background readings

10:40 : 8.8, 8.8, 8.9, 8.8, 9.0, 8.9, 8.9, 8.9, 8.9, 8.9, 8.9, 9.0,

9.0, 8.9, 9.0, 9.0, 8.9, 9.0, 9.0, 9.0, 9.0, 9.0

wt: 13.9 kg

Vol: $6\frac{1}{4} \times 2\frac{1}{4} \times 4$ cu in

6.563 cu in

$6.22(10^{-3})\ m^3$

$\rho = \frac{13.9}{6.22(10^{-3})} = 2.23(10^3)\ \frac{kg}{m^3}$

sandstone sample in place:

0.1, 0.0, 0.0, 0.1, 0.1, 0.2, 0.1, 0.1,

0.1, 0.2, 0.2, 0.2, 0.1, 9.9, 0.2, 0.2

0.1, 0.1, 0.1, 0.0, 0.0, 0.0, 0.0, 9.8

9.7, 9.7, 9.7, 9.7, 9.6

background w/o sample

8.7, 8.7, 8.7, 8.7, 8.7, 8.7, 8.7, 8.7, 8.6

8.6, 8.7, 8.6, 8.6, 8.5, 8.6, 8.5, 8.5, 8.4

8.4, 8.4, 8.4, 8.4, 8.5, 8.4

B_1 $\quad \overline{B_1} = 8.40$

sandstone sample back in place:

8.8, 8.8, 8.8, 8.8, 8.8, 8.9, 8.8, 8.8, 8.8

S_1 $\quad \overline{S_1} = 8.82$

8.8, 8.7, 8.7, 8.7, 8.6, 8.7, 7.9, 8.6, 8.6

8.7, 8.5, 8.6, 8.7

S_2 $\quad \overline{S_2} = 8.62$

background w/o sample

B_2 $\quad \overline{B_2} = 8.33$

8.2, 8.4, 8.4, 8.3, 8.3, 8.4, 8.4, 8.4

8.6, 8.5, 8.5, 8.5, 8.6, 8.4, 8.4, 8.5

8.4, 8.7, 8.7, 8.9, 8.9

Conversions:

1) pints $\times 4.732(10^{-4}) = m^3$

1 U.K. gal. $= 1.6(10^{-3})\ m^3 = 0.2642$ U.S. gallon

1 U.S. gal. $= 3.79(10^{-3})\ m^3$

(2) lbs $\times 0.948(10^{-3}) = m^3$

$\overline{S_1} - \overline{B_1} = 0.42$

$\overline{S_2} - \overline{B_2} = 0.29$

$\Big\}$ avg $= 0.36$

12 N-116, p.9

* without sandstone sample in place = sample distance

0.30 meters

10:47 Test w limestone block

background w/o sample

1.4 1.4 1.4 1.6 1.5 1.7 1.7 2.0 1.9 2.3

2.6 3.0 3.5 3.9 4.1 3.8 3.4 3.4 3.4 3.5 3.5

3.2 3.1 3.1 3.1

[delay w 10 measurements]

limestone sample in place

3.6 3.6 3.6 3.5 3.4 3.5 3.5 3.6 3.7

3.8 3.6 3.6 3.5 3.8 3.6 2.8 3.6 3.5

3.5 3.5 3.3

w/o limest sample

3.4 3.4 3.5 2.8 3.5 3.8 3.7 3.8

3.9 3.9 4.0 4.1 4.1 4.2 4.2 4.3

4.3 4.3 4.4 4.2 4.5 4.5 4.6

limestone sample in place

5.2 4.9 5.2 5.2 5.2 5.3 5.3 5.2 5.2

5.3 5.3 5.1 5.1 5.1 5.1 5.0 5.2 5.1

5.1 5.1 5.1 5.2 5.2 5.2 5.1 5.2 5.2

w/o limestone sample

5.1 5.4 5.4 5.5 5.5 5.6 5.9 6.1 6.1

6.2 6.4 6.3 6.9 6.1 6.1 6.2 6.4 6.4

6.4 $B_1, \overline{B}_1 = 6.4$

Wt: 8.9kg

Vol: qt: |||

qt $2\frac{1}{2}$ cup

4qt

$4.639\,qt$

$V = 4.39(10^{-3})\,m^3$

$\rho = 2.03(10^3)\,\frac{kg}{m^3}$

with limest. samples

6.7 6.5 6.6 6.8 6.8 6.9 6.7 6.6 6.8 S_1

6.4 6.2 6.6 6.3 6.7 6.8 6.8 6.7 6.5

6.6 6.6 ~~5.9~~ 6.4 6.5 S_2

w/o limest. samples

B_2 6.2 5.9 5.9 6.1 6.0 6.1 6.2 5.8 6.1

6.0 5.9 6.2 6.1 6.1 6.3 6.3 5.5 6.4

6.6 6.5 5.6 6.0 6.0

* sample distance – limestone

0.30 meters

Soil samples = from cave excavated in 1977

time
10:58

background reading – sample removed

8.1 8.0 7.9 8.1 8.5 7.9 8.8 8.5 8.2

8.1 8.2 8.2 8.1 7.7 7.4 7.6 7.7 7.8

7.6 7.8 7.8 7.9 8.0 8.1 8.0 8.0 8.2

8.1 8.4 8.3 8.4 8.3 8.1 8.3 8.4

w soil samples in place

9.6 9.7 9.6 9.5 9.4 9.4 9.5 9.5

9.5 9.4 9.3 9.4 9.1 9.2 9.2 9.1

9.0 8.9 8.9 7.6 9.1 8.9 9.0 9.0

9.0 9.0 8.9 9.0 9.1 8.9

background - sample removed

8.2 8.0 8.0 8.0 8.2 8.3 8.1 8.5 8.5
8.5 8.6 8.4 8.3 8.4 8.1 7.1 8.0 8.2
8.3 8.3 8.1 8.2 8.1 8.2 7.9 8.4 8.4
8.6 8.6 8.6 8.5 8.4 8.4 7.7 8.5 8.4

W sample in place

0.8, 1.0 0.5 0.9 1.2 1.1 0.6 0.8 0.9 1.1
1.1 1.3 1.4 1.4 1.5 1.3 1.4 1.3 1.1 1.4
1.4 1.5 1.4 1.4 1.4 1.2

sample removed

9.7 9.8 9.6 9.7 9.4 9.9 9.6 9.6 9.2 9.4
9.0 9.5 9.3 9.3 9.2 9.1 9.1 9.2 9.1
9.1 9.1 9.0

* sample distance: 0.38 meters

Soil sample - surface soil from SW side
Time 11:20 of grid #14

Wt: 8.9kg
Vol: qt: ////
~ 3/4 cup
7qt
$V = 7.19\,qt \approx 6.81(10^{-3})\,m^3$
$\rho = 1.31(10^3)$

background - sample removed

0.0 9.9 9.9 9.8 9.7 9.6 9.9 0.1 0.1 9.7
9.7 9.5 9.5 9.7 9.4 9.3 9.2 9.5 9.6 9.6
9.4 9.3 9.0 9.2 9.3 9.3

W sample

0.3 0.2 0.2 0.1 9.9 9.8 9.8 9.8 9.3
0.1 0.2 0.2 0.1 9.8 0.1 0.2 0.4 0.3
0.7 0.8 0.7 0.5 0.5 0.7 1.1 1.1

background

0.3 0.0 9.9 0.1 0.3 0.6 0.4 1.0 1.4 1.3 1.2
1.1 0.8 0.7 0.5 0.4 0.5 0.6 0.8 1.0 1.0
0.9

* sample distance = 0.38 meters

Soil sample from '77 excav: this is repeat of save sample
time: 11:17 Recording every reading;
- no stop for sample change between readings
- sample distance = 0.38 m.

wt 10.2kg

B: (Background)
0.1 0.3 0.4 0.5 0.7 0.9 1.2 1.4
1.7 1.5 1.7 1.6 1.8 1.8 1.7 1.4
1.7

Vol: qt ||||
7 qt 3 1/4 cup
$V = 7.81\ qt = 7.41 (10^{-3})\ m^3$
$\rho = 1.38 (10^3)$

S (Sample)
1.5 2.5 2.3 2.2 2.9 2.0
1.9 2.0 2.0 2.0 2.0 2.0 2.3
2.2 2.2 2 2 1.6 1.6 1.5 1.5
1.5 1.5 1.4 1.1 0.7 0.4 0.3 0.1 0.2

B (Background)
9.3 9.2 9.3 8.6 9.2 9.3
9.5 9.5 9.7 9.7 0.0 0.3 0.5
0.8 0.9 0.8 0.5 0.6 0.6 0.6
0.6

S (Sample)
2.3 2.3 1.0 1.9 2.0 2.2 2.2
2.4 2.2 2.5 2.5 2.4 2.3 2.2 2.1
2.1 2.2 1.9 2.0 1.8

B. 1.4 0.5 0.4 0.3 0.2 0.0 0.0 9.8 9.6
9.5 9.6

Sample measurements from south hill in Bega'a Valley

Time 12:25 ; soil Sample from Cave 18
(in-situ soil fills ~ 3/3 of cave height, leaving ~2.5cm gap on top)

Background : 7.2 7.2 7.3 7.4 7.6 7.6
7.7 7.8 7.8 7.8 7.9 8.0 8.0 8.0 8.0
8.0

Wt: 4.2 kg
Vol: ℓt: ////
4 ℓt 1 3/4 cup
V = 4.44 ℓt = 4.21 (10^-3) m^3
ρ = 0.998 (10^3)

S : 8.6 8.6 8.6 8.7 8.8
8.9 8.0 9.1 9.2 9.3 9.4 9.4 9.4 9.9 9.3
9.1 9.1 9.0 9.0 9.9

B. 8.2 7.8 7.2 7.6 7.3 7.3 7.3 7.3
7.1 7.1 6.8 6.7 6.5 6.5

Sample from natural cave approx. 8m. south of cave # 8

B; 4.2 4.4 4.3 4.3 4.3 4.2 4.2 4.3
4.2 4.2 4.3 4.2 4.3 4.3 4.6

Wt: 6.0 kg
Vol: ℓt ////
5 ℓt 2 1/2 cups
V = 5.33 ℓt = 5.33 (10^-3) m^3
ρ = 1.12 (10^3)

S 5.6 5.4 5.4 5.5 5.4 5.5 5.4 5.3
5.0 5.2 5.1 5.1 5.2 5.2 5.3

B 4.3 4.2 4.2 4.2 4.1 4.1 4.0 4.0 4.1
4.0 4.0 4.0 4.0

S 4.3 4.9 4.9 4.9 4.9 5.0 5.0 4.9
4.9 4.8 4.8 4.9 5.0 5.1 5.2 5.3

B. 4.7 4.3 4.3 4.3 4.2 4.2 4.2 4.1 4.1 4.1

Soil sample from Cave # 2:

time 12:30

wt 10.1 kg

Vol: qt ||||| ||||

$V = 9$ qts $= 8.53(10^{-3})m^3$

$\rho = 1.18(10^3)$

B= 5.1 5.1 5.2 5.3 5.5 5.6 5.7 5.8 5.8
5.8 5.9 6.0 6.1 6.2 6.4 6.4 6.5
6.5 6.5 6.6

7.0 7.7 7.7 7.8 7.9 8.0 8.2 8.5 8.5
8.5 8.6 8.7 8.7 8.7 8.8 8.8 8.8 8.8 8.9
8.9 8.9 8.9 8.9 8.9

B 8.0 8.0 8.0 7.9 7.9 7.9 7.7 7.7 7.6
7.5 7.4 7.3 7.3 7.2 7.2 7.1 7.1 7.0
6.8 6.7 6.7 6.6 6.5 6.4 6.3 6.2
6.2 6.1 6.1 5.9 5.8 5.8 5.9
5.8 5.8

S. 6.8 6.5 6.4 6.3 6.2 6.2 6.0 6.0
5.9 5.9 5.9 5.6 5.6 5.6 5.5 5.4
5.4 5.3 5.3

B. 5.1 4.4 4.4 4.3 4.2 4.2 4.1 4.0
4.0 4.0 3.9 3.9 3.8 3.8 3.9 3.8
3.8

Limestone rock from Smith Hill.

12:32 B. ~~1~~ = ~~1~~7 ~~1~~ = ~~1~~7 1.6 1.6 1.6 1.6 1.5 1.4
1.5 1.5 1.5 1.6 1.6 1.6 1.6 1.6 1.7

wt: 14.3 kg

vol (less ...)

qt ||||| |

6 qt $3\frac{1}{4}$ cup

$V = 6.81$ qt $= 6.46(10^{-3})m^3$

$\rho = 2.21(10^3)$

S. 1.6 1.7 1.8 1.7 1.7 1.6 1.5 1.4 1.3
1.2 1.1 1.0 1.0 1.0 1.0 0.9 0.8
0.7 0.7 0.7 0.7 0.6 0.6 0.4
0.3 0.1 0.0 9.9 9.9 9.7 9.5
9.3 9.0

B 8.3 8.4 8.5 8.3 8.2 8.1 8.1 7.9 7.7
7.6 76 7.7 7.6 7.6 7.6 7.5 7.4
7.3 7.2 7.1 7.0 6.9 6.9 6.8 6.6 6.6
6.6 6.3 6.3

5. 6.0 ~~5.9~~ 5.8 5.6 5.5 5.3 5.2 5.0
5.0 4.8 4.6 4.5 4.4 4.3 4.0 4.0 3.8
3.7 3.6 3.3 3.3 3.0 2.9 2.8 2.7
2.6 2.5 2.3 2.3 2.2 2.1 2.0 2.0
2.0

B. 2.0 1.9 1.9 1.8 1.9 1.9 1.9 1.8 1.7
1.0 1.8 1.6 1.5 1.5 1.4 1.4 1.4

* sample distance same for all above: 0.30 meters.

quitting time: 12:41

20.07.78

excavated (77) cave

get shape & total volume

volume of soil in bottom & depth to its uppersurface

volume (&height) and location of excavated dirt

H = anomaly m = mag moment on basis of volume V = volume R = distance

$$H = \frac{\Sigma(m V)}{R^3}$$

robbed cave

get volume & depth to center

$$H = \frac{m_s V_s - m_a V_a}{R^3} = \frac{V_s}{R^3}\left(m_s - m_a \frac{V_a}{V_s}\right)$$

subscripts: s = soil, a = air

note: $V_s + V_a$ = cave volume

assume R for both soil & air are same & const. $\rightarrow$ m_s & m_a are const

$\rightarrow$ then H depends on V_s & $\frac{V_a}{V_s}$

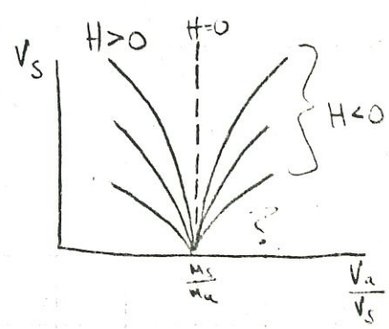
estimate magnetic properties (as function of volume) of soil & rock

evidence is that:

air is nonmagnetic

rock is slightly magnetic

soil is more magnetic than rock



H = const $\rightarrow$ $\frac{R^3 H}{V_s} = m_s - m_a \frac{V_a}{V_s}$

& $V_s = \frac{R^3 H}{m_s - m_a \frac{V_a}{V_s}}$

$H = 0 \rightarrow m_s V_s = m_a V_a$ & $\frac{V_a}{V_s} = \frac{m_s}{m_a}$

Oct. 19, 1978 Thurs.

Bruce, Sue, Susan, Adriana, Janine, Ibrahim, Pat (Mohammed d.t.g. get to site)

1) set up 50 m. grid (#1) encompassing ~~the~~ cave x
2) run magnetometer for complete grid, only partial for resistivity Adriana, Janine + Bruce Ibrahim
3) Sue, Susan + Pat went to Geographic office in Jerga - letter needed on Sat, 10 A/

Oct. 21, 1978 Sat.

Bruce, Susan, Adriana, Janine, Ibrahim, Pat, Mohammed

1) set up 50 x 100 m. (Grid 2) grid next to 30 m. grid, encompassing completely wished out cave. Complete grid done. To Jerga for map info. (Pat)

Oct. 22 1978 Sun.

Bruce, Sue, Susan Janine Ibrahim Pat Mohammed

1) set up 50 x 100' m. (Grid 9) grid north of Oct 21 grid. Magnetometer had switch + oscillator problems.

Point 0,0

REF PT COMMON END OF FIRST 3 SQUARES = 00

00 —	LINE NO. 1	30.50M	N. 173°
00 -	LINE NO. 2.	22.34M	N, 94°
00 -	SINO	100.00M	N. 226°

3) land at base Inc (A-B) talked + had ok w/ land owners

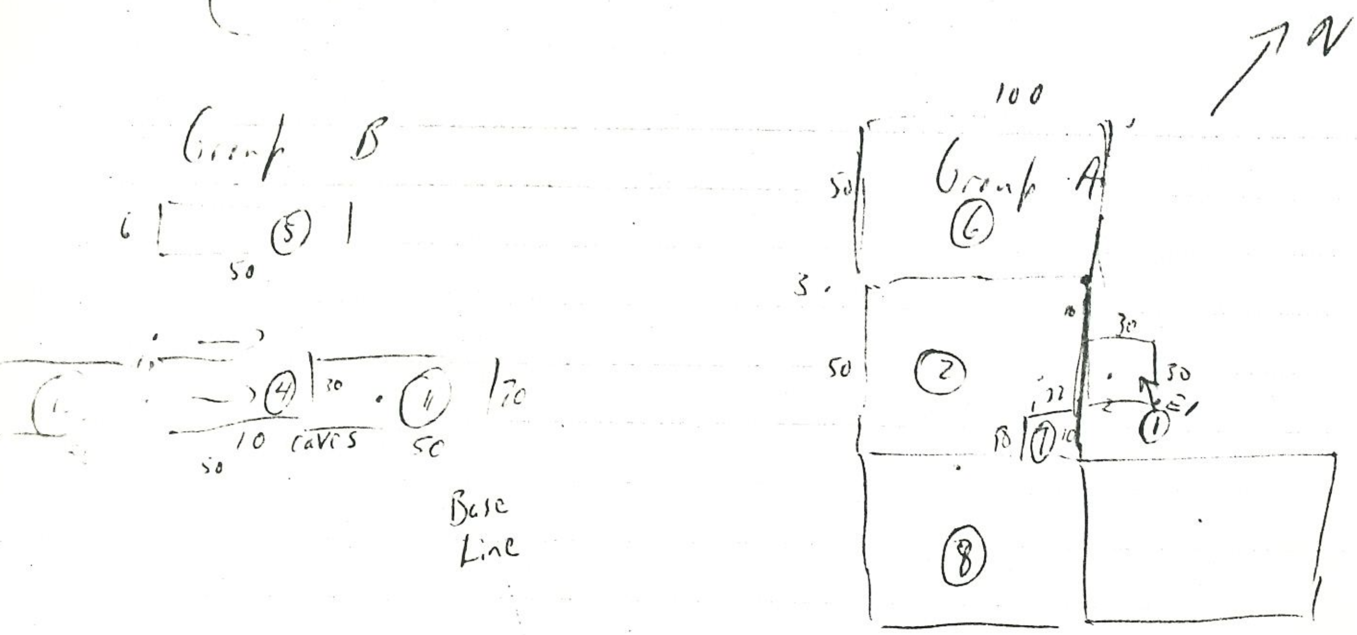
Oct. 23 Mon.
Mohammed Susan Sue Adriana, Bruce, Ibrahim, Pat, Janine
1) found 3 benchmarks on western hill and took sightings on Rujm el-Hemr, Hami, corner of School, and northerly (Grid 3) corner of square building
2) 50 x 50 m. grid begun

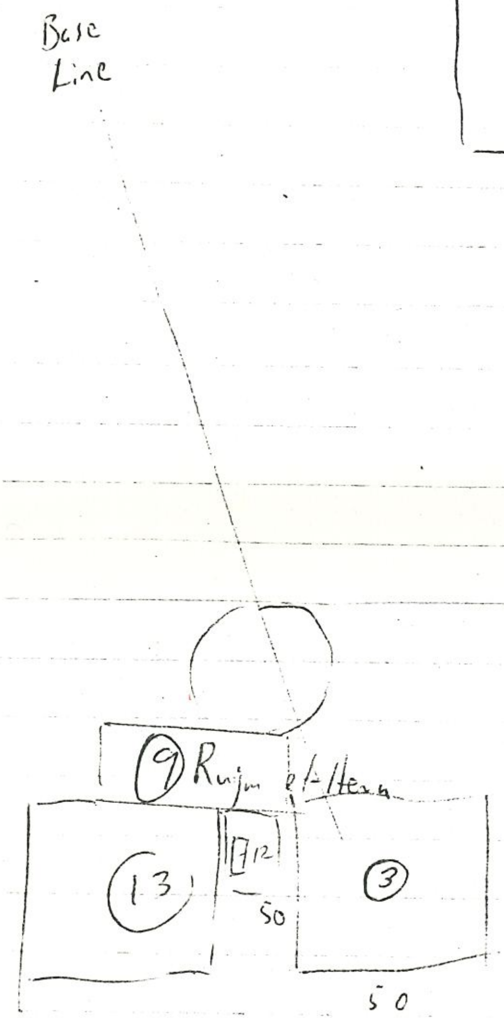
Oct. 24 Tues. Susan, Adriana, Janine Bruce, Ibrahim, Pat Mohammed (Grid 3)
1) continued 50 x 50 m grid - another 1/3 finished
2) visited caves and sites on road to Ez-Rameiyin and in western part of Baqa Valley -- found line of 5 caves

Oct. 25 Wed. Janine, Susan, Bruce, Ibrahim, Pat, Moham.
1) continued 50 x 50 m grid (Grid 3) + finished
2) Bruce used audio magnetometer to locate promising areas to south of Umm el-Quanir

Oct. 26 Thurs. Janine, Susan, Sue, Bruce, Ibrahim, Pat Moham.
1) set up 50 x 50 m. grid (Grid 4) south of Umm el-Q.
2) marked 10 caves on first (lowest) level and sherded (Group D)
3) sighted in on grid corners and caves w/ compliance of 2 walls.
4) Grid 5 finished w/ magnetometer

(26)





✓ do more resistivity
have plan made
1:1000 also

✓ Pottery read

✓ 1) sherd Umm ed-Dan.
spring area
✓ 2) finish traverses - by car
✓ 3) do hills - espec. plants
stone enclosures
4) rujm in Wadi behind
5) Abu Nuseir, etc.
✓ 6) get data on caves; other caves to be mapped
Soil samples - several of brown, reddish brown
B+W photos
el-Quseir

(get declination.)

Oct 28 Sat. Sue, Susan, Bruce, Pat, Ibrahim
Moh. I, Moh. II, Mousa

1) sightings to Group A, Grid 3, Group B
2) Grid 6 (Gp A) done with magnetometer
3) 100 m. traverse // B to walls on N hill

Oct. 29 Sunday Paid up
Susan, Bruce, Pat, Ibrahim, Moh. II, Mousa, Moh. I
Janine stayed to work on pottery

1) Grid 7 set up east of Grid 2 – magnetometer
2) shaded at Kh. Umm ed-Dom. + Spring
3) trip to Amman – Salaries photocopy + supplies
(up to 10/29)

Oct. 30 Mon.
Bruce, Moh. II, Mousa, Ibrahim, Susan, Pat, Moh. I

1) Set up 50 x 30 grid west of #1 K. el-Hemm – resistivity
2) visited + shaded Kh. + Ain Umm ed-Dom., caves 24-27, Rujm el-Hawi
3) insp. on Group B caves begun
4) traversed 100 – 500 m.

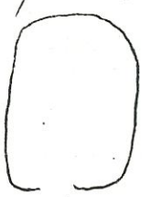
soil

Group B

Cave 1 — 3 m. wide
2 m. deep
1 m. high

squarish opening; smoothed off walls + curved elliptical shape
~~pebbly~~ no deeper but may go down or wider

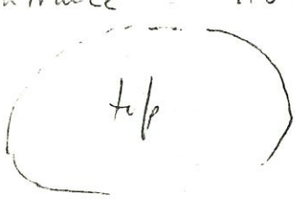
#2 — 4 m. deep
2 m. wide
1 m. high

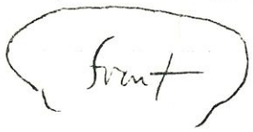


~~elliptical~~ ~~square~~ opening
elliptical
may go ~~deeper~~ down, but no deeper or wider
Smoothed off walls and nice curves

#3 ~5 ~~7~~ m. deep
~5 ~~25~~ wide
80 high
Entrance — 110 wide, 80 high

many bones
white limestone
~~may~~ probably goes deeper, wider + down
somewhat smoothed curved walls
large brown soil rabbit dump

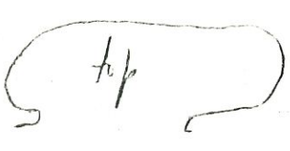


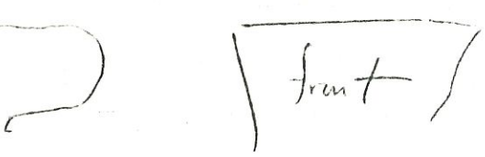


#4 50 ~~60~~ deep
80 ~~60~~ ~~40~~ wide
40 high
entrance — 60 wide
20 high

white limestone

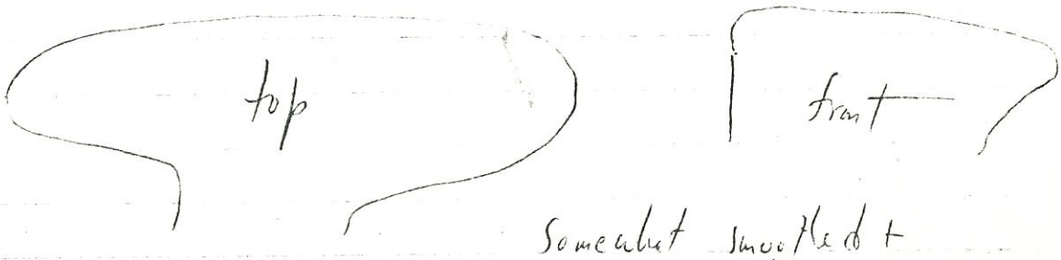
may go deeper
Smoothed off + curved walls
brown soil rabbit dump
& rectangular entrance
no bones





#5 2.5 m deep
3 m wide
50 high
entrance – 60 ~~wide~~ high, 130 wide
white limestone

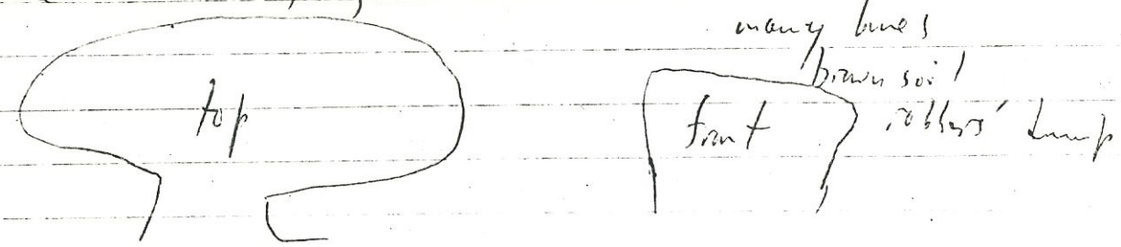
many bones
may go deeper



somewhat smoothed + curved walls
large brown soil robbers' dump

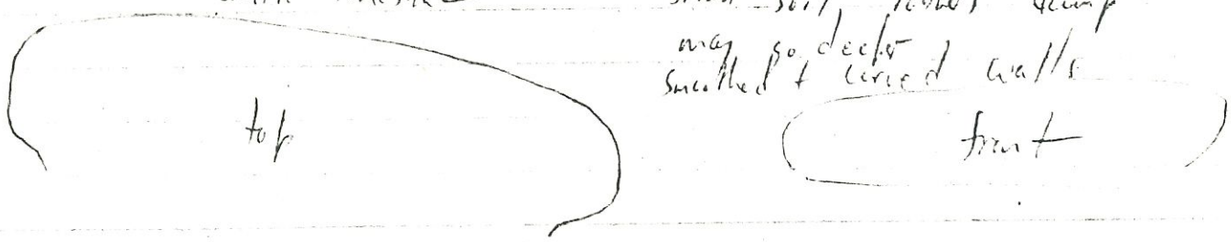
#6 220 deep
270 wide
60 high
entrance – 70 high, 70 wide

white limestone
may go deeper
somewhat smoothed + curved walls
many bones
brown soil
robbers' dump



#7 200 deep
230 wide
70 high
white limestone

entrance – 190 wide
70 high
bones
brown soil, robbers' dump
may go deeper
smoothed + curved walls

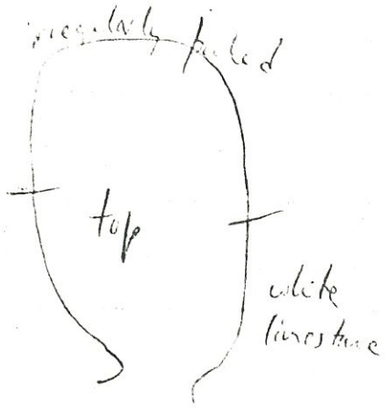


#8 140 deep
220 wide
90 high
entrance – 190 wide
80 high

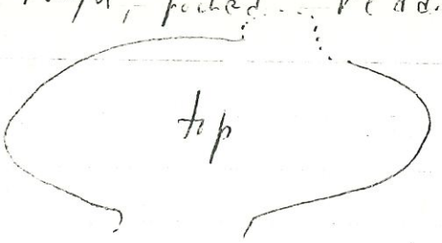
no bones
brown soil, robbers' dump
white limestone
smoothed + curved walls
may go deeper

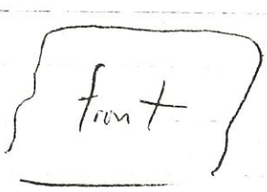
46

#9 290 deep
150 wide
75 high
entrance 60 wide
70 high
smoothed sl + curved walls
bones
brown soil rabbits' dump
may go deeper

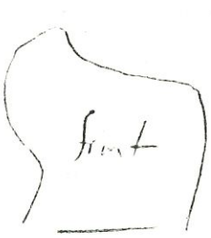


#10 4 m. deep
4 m. wide
1 m. high
entrance 80 wide
70 high
rough, fractured reddish limestone – somewhat ~~smoothed~~, curved walls
may go deeper
bones
may go deeper
brown soil rabbits' dump

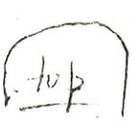




#11 290 deep
110 wide
70 high
entrance 70 wide
70 high
smoothed sl + curved
may go deeper
bones
brown soil rabbits' dump
white limestone



#12 40 wide 30 high 30 deep
maybe entrance to cave; smooth cut wall,
brown soil rabbits' dump
bones
reddish limestone
may go deeper

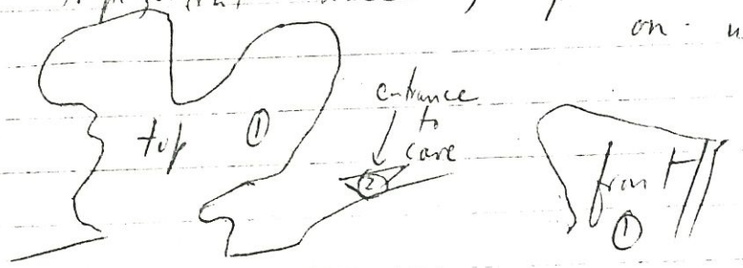


#13. .200 deep (may be more) reddish limestone
35 wide
10 high
brown soil
front

(skip 2 pages for catalogue)

#24 60 deep
50 wide
40 high
no bones
brown soil rabbits' dump
front
entrance - ⌀ 50 wide 30 high
top
elliptical shape, ragged walls
entrance quite regular - looks worked
reddish limestone (sandstone inclusions)

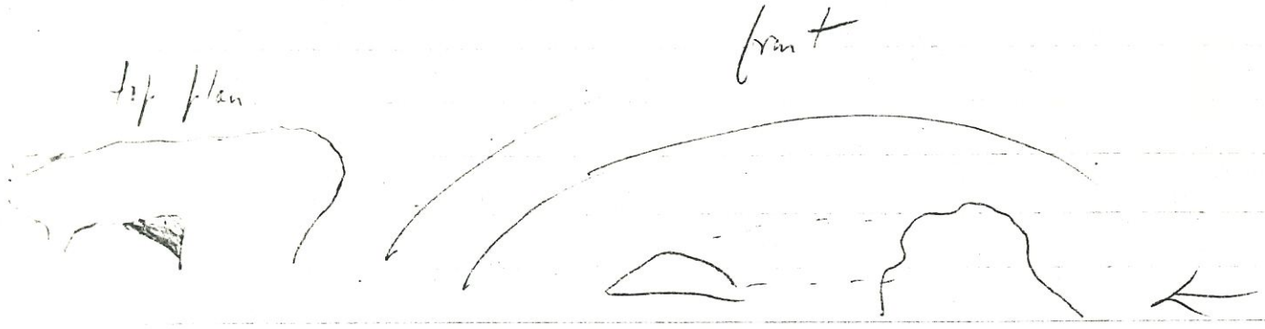
#25 2.80 deep
1.10 ⌀ wide
.70 high
soft white limestone
brown soil - rabbits' dump
no clear evidence of holes
2 entrances - may be connected, but appears
to be wall between.
trapezoidal entrance; poss. worked doorway
on north (offset)

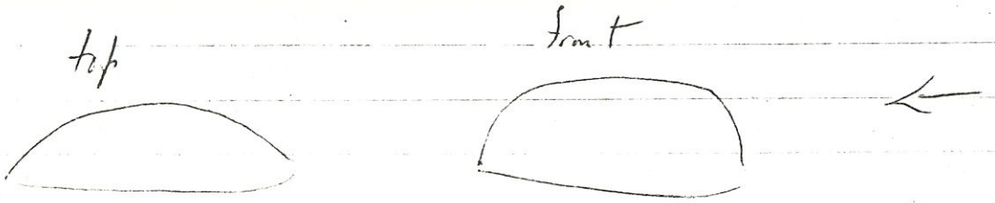


② - 1.5 m. deep × 1-2 m. wide + high
① - curved + smoothed off walls
not much pottery
no bones

#26 1.50 diameter
50 × 50 doorway - worked insets
brown soil rabbits' dump
white limestone
curved + smoothed off walls
no bones
may go down

5b





#27 1.10 deep
90 wide
60 high
entrance — 80 high, 40 wide
brown soil rabbit dump
may go down
no bones
white limestone

#28 290 wide
30 high
80 deep
2 openings — connected → wall in back but could go back further if lower
could be wider, deeper + lower
jagged walls
rabbit dump — little pottery
soft limestone
undercutting
brown soil
no bones

#29 150 wide
60 deep
60 high
elliptical entrance + shape
smoothed off + curved
may go down
no bones
brown soil — rabbit dump
no pottery !?
soft reddish limestone

#30 3 m. wide
1.20 deep
65 high
reddish limestone above
soft limestone (closest cl. below

wide
long elliptical entrance
elliptical shape
smoothed off + curved walls
may go down
soft reddish limestone
animal jaw bone

Oct. 31 Tuesday Rained out
Susan (½), Ibrahim, Bruce, Pat

1) car greased + oiled
2) air photo permit
3) receipts for supplies, etc.

Nov. 1 Wed. Mah. I, II, Mousa, Susan, Jenine, Bruce, Pat

1) tested intresting areas in grid 4
2) set out 2 other 50 x 30 m. grids next to grid 4
3) Dept. of Antiq. — dropped off receipts, financial matters, tax stamps

Nov. 2 Thurs. Mah II Mousa, Susan, Jenine, Bruce, Pat, Ibrahim

1) did 50 x 100 m. magnetometer grid on south hill
2) data on caves
3) houses in wadi to west of south hill
4) detailed magnetometer work
5) Dept. of Antiq. — 1:10,000, 1:25,000 maps finances

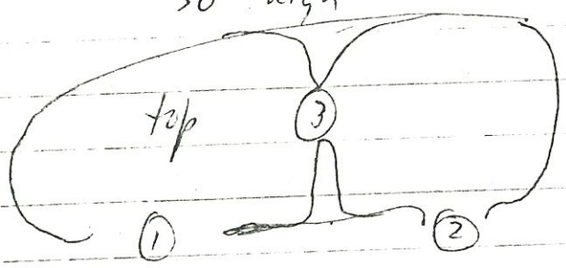
#14 2 m. deep
4 m. wide
60 high
2 entrances
reddish limestone w/ sandstone inclusions
somewhat smoothed + curved walls

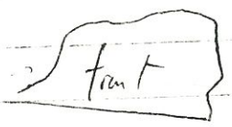
① entrance 130 wide
70 high

② entrance 60 wide
35 high

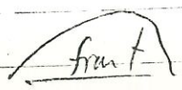
③ entrance 60 wide
50 high

brown soil / rabbit dump
bones
goes deeper





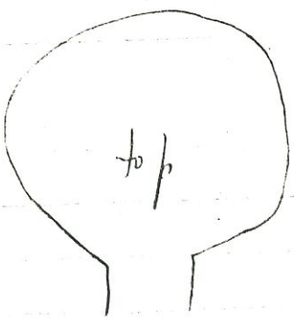
#15 60 wide
20 high
40 deep
white limestone
poss. cave
brown soil rabbit dump



poss. // #14

#16 2 m. deep
2 m. wide
60 high
entrance 50 wide
50 high

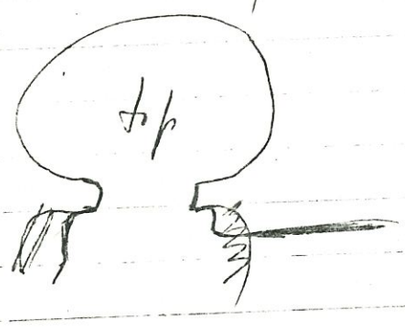
white limestone
smoothed curved walls
may go deeper
bones
brown soil rabbit dump



#17 160 deep
160 wide
80 high

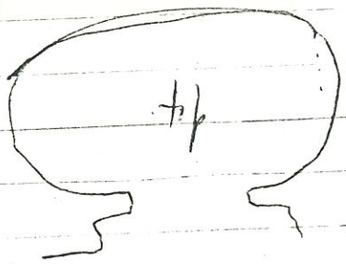
entrance - 60 wide
75 high

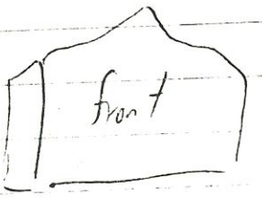
white limestone
offset entrance — N + S
bones
smoothed + curved walls
may go deeper
brown soil rubbis' dump



#18 220 deep
180 wide
70 high
entrance 50 wide
55 high

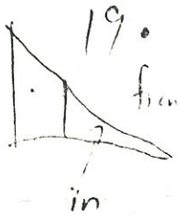
smoothed curved walls
white limestone
offset on south poss. portal
only partially dug out
may go deeper
no bones
brown soil rubbis' dump





#19 100 deep
60 wide
60 high

white limestone
no bones
partially cut cave
brown soil rubbis' dump



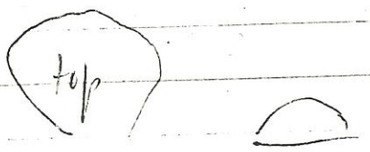
#20

130 deep
230 wide
40 high
entrance 50 high
110 wide

white limestone
no liners
some walls smoothed, curved
most very rough
brown soil / rubble dump
may go deeper

#21 70 deep
40 wide
15 deep

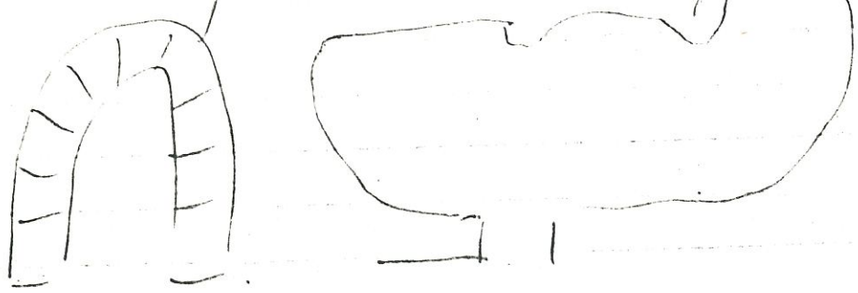
white limestone
rough walls
brown soil
no clear robbers' dump
poss. not cave
may go deeper



#22 10 m. wide
4 m. deep
2 high

entrance — 90 wide
170 high

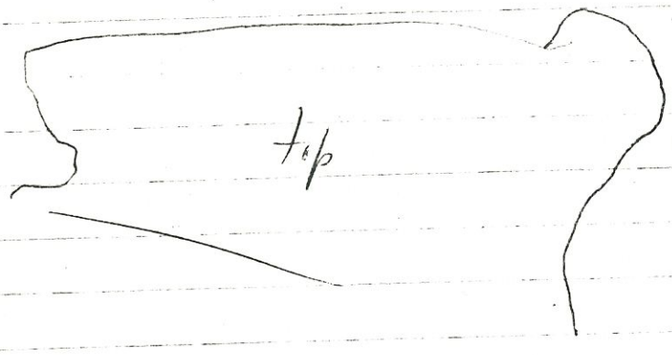
very ~~some~~ black ceiling
smoothed + curved walls
wall w/ entrance built
at cave mouth
no robbers' dump
brown soil in front

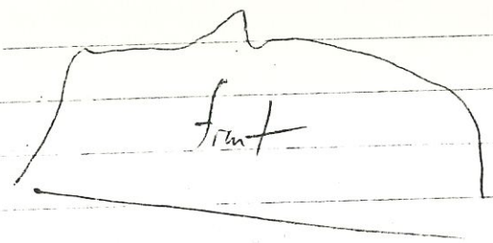


#23: 3.5 m. deep
4.5 wide
1.5 high

entrance 2.5 wide
110 high

white limestone
somewhat curved
smoothed wall
smoke blackened
in places
no clear rabbet ramp
some
~~no~~ bones
brown soil in front
of cave
may go deeper





(12)

Nov. 4 Sat. Jenine, Susan, Mohan. II, Mous. Ibrahim, Bruce, Pat

1) Detailed magnetometer work in grids 2 + 86

2) German school — flute calls

3) Traverses on el-Hawuya - south

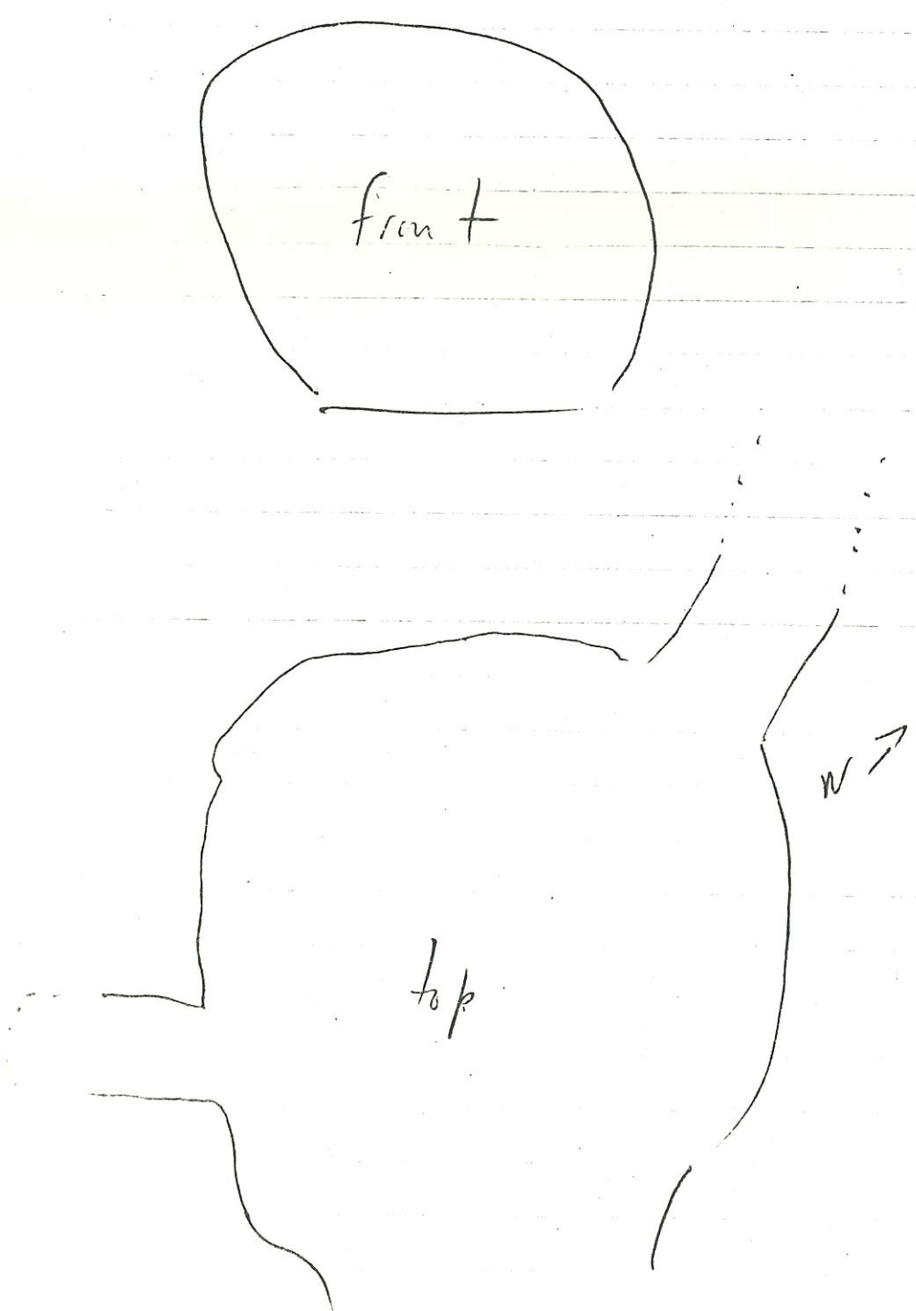
Cave #1, Group A

3 openings in roof

bones may go deeper reddish limestone

deep 12 m
wide 7 m
high 2 m
entrance - 3 m. wide
1.5 high

← large + small stones, boulders, etc.
large scattered brown soil rubbers' dump
blackened ceiling
somewhat rounded + curved walls,
tunnel in N side goes about 5 m.
toward cave 2
tunnel to S about 3 m. —


front
top
w

Comp A, Cave 2

10 m. deep,
8–10 m wide

Somewhat smoothed + curved walls

Nov. 5 Sun. ~~Jenine~~ Jenine, Susan, Mt. II, Musa, Ibrahim
Bruce, Pat

1) Resistivity survey south of Rujm el-Hmeir (#1)

2) Dept. of Antiq., plane calls

Nov. 6 Mon. Jenine, Susan, ✓ Ibrahim, Bruce, Pat, Sue

1) Began plan of rectangular building

2) Magnetometer work – grid #14 (north)

3) Began pottery reading

Nov. 7 Tues Jenine, Susan, Sue, Ibrahim, Bruce, Pat

1) Checked on air photography – Taleb Hadidi not in

2) Dept. of Antiq. – money, time, division

3) Magnetometer survey – grid #15 (south)

4) pottery dropped off at ACOR

No. 8 Wed Jenine, Susan, Mousa, Moh. II, Bruce, Pat, Ibrahim

1) Resistivity grid #16 - near building
2) Aerial photo permit
3) Pottery set up for reading
4) Division material set up
5) Pottery reading Cave

Nov. 9 Thurs. Jenine, Susan, Moh. II, Mousa, Bruce, Pat, Ibrahim

1) detailed magnetometer work on south hill
2) do Salt to see landlord but not there
3) el-Hamra, Abu Nuseir, Jelad visited
4) info. on Rujm el-Hamra, Hawi
5) position of Hawara + Ain Umm ed-Dam
6) Division

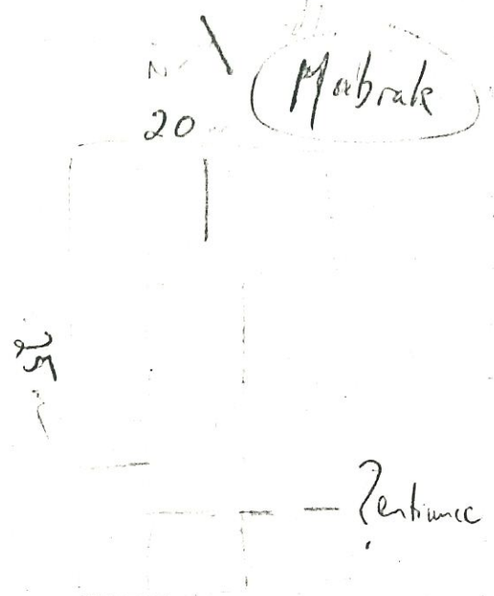
Nov. 12 Sunday Jamie, Susan, Pat Mich. II,
Mouse, Ibrahim, Pat, Bruce

1) Resistivity survey inside building

2) detailed magnetometer work on north hill

3) soil samples

4) tests of soil w/ magnetometer


N
20
Mabrak
Pentimee

Statistics for Survey Pottery

1. Caves

A. Group A

1. Cave 1

LB I-A - 14

possible MB II C - 1

+

2. Cave 2

3. Cave 3 ~~2 sherds~~

~~#~~ LB II / Iron I - 4

~~(2) LB II A-B - 128~~

~~+ Byzantine +~~

+

B. Group B

1. Cave 1

2. Cave 2

3. Cave 3

LB II A-B - 128

Byzantine - 1

4. Cave 4

5. Cave 5

Late Bronze I A - 25

6. Cave 6

LB I A - 29

Late Roman II - 1

7. Cave 7 - 2 bags

① Middle Bronze II C / LB I A - 4

② Middle Bronze II C / LB I A - 11

8. Cave 8

Roman / Byzantine - 5

Late Bronze II - 2

9 Cave 9

LB I A - 15

10. Cave 10

Late Bronze - 1

Mameluke - 1

11. Cave 11
MB II C / LB I A - 10

12. Cave 12
MB II C / LB I A - 2

13. Cave 13
MB II C - 34

- North of Cave 13
Middle Bronze II C/ - 6
Late Bronze I A

14. Cave 14
Late Bronze - 1

15.

16. Cave 16

Early Byzantine - 1

17.

18.

19.

20. Core 20
Byzantine - 3

21.

22.

23. Cave 23

* Mameluke - 2 (green glazed - not photos.)

24.

25. Cave 25

Byzantine - 2

UD - 2

+

26. Cave 26

+ Late Bronze - 1

27. Cave 27
LB - 1

28. Cave 28
Roman - 1
Late Bronze II - 2

29. Cave 29
Late Bronze II - 5
Roman - 1

30. Cave 30
Late Bronze II - 1

II. Sites

A. Site 1 (Rujm el-Hawa [E])

1. 1A 3 m. around exterior
Iron IIC - 2
Early Byzantine - 1
Modern - 1
UD - 1

South room?

2. 1B Early Byzantine - 1
1 small body sherd

3 1C Central unit?
MBIIC/LBIA - 3
Early Byzantine - 4
UD - 2

4. 1D 3 m. wide around exterior
Late Bronze or Iron - 2
Early Byzantine - 5
Mameluke - 1

5. 1E North room
Iron IIC - 4
Byzantine/L. Roman - 7
Umayyad - 1
Mameluke - 1
Modern - 1

6. 1F — Iron IIc - 2
Late Roman III - 1
Byzantine - 15
modern - 1

50 x 50 Grid north of #1

SITE 2 — Rujm el-Henu (W)

1. 2A — 3m exterior perimeter
Iron IIc - 7
modern - 8
U.D - 4

2. 2B — north side
Late Bronze II - ~~1~~ 1

3. 2C — North half of interior
Iron IIc - 6
modern - 6

4. 2D — Rectangular Tower
Iron IIc - 6

5. 2E — Circular Tower
UD - 2

6. 2F — South half - interior
Iron IIc - 53
modern - 3
UD (possibly Iron II) - 36

SITE 3 Khirbet Umm ed-Damanit

Lower Terraces

1. 3A
   - ✓ MB II B - 1
   - ✓ LB II - 1
   - Iron I A - 5
   - Iron I C - 1
   - Iron II B-C - 6
   - UD - 22

Middle Terrace (olive trees)

2. 3B
   - Iron II C - 7
   - Early Roman III - 4
   - UD - 1

3. 3C

4. 3D
   - Upper terraces (east)
   - Possible Iron I A * - 1
   - Iron II C - 10
   - Early Roman III - 11
   - Early Byzantine - 3
   - Mameluke - 2
   - UD - 11

5. 3E

6. 3F Terrace below olive trees + road

✓ Late Bronze - 1

Poss. Iron IA - 1

Iron II B-C - 19

Y Early Byzantine - 2

UD - 7

7. 3G Middle Terrace (w/ olives)

Iron II C - 6

+ Roman / Byzantine - 1

8 3H Middle Terrace (East)

✓ Late Bronze - 2

+ Iron II C - 12

Early Roman III - 23

Late Roman - 3

UD - 8

? 3I

3J Lower Terraces

+ ✓ Late Bronze II - 1

Iron II A-B - 8

Iron II C - 9

Early Roman III - 5

UD - 14

11. 3K — Middle Terraces (olive trees)

Iron IA - 1
Iron IIC - 5
Early Roman III - 5
UD - 2

12. 3L — Low Terraces

Late Bronze II - 1
Possible Iron IA - 1
Iron IIC - 11
Early Roman III - 2
Early Byzantine - 2
UD - 10

13. 3M — high terrace / tier

Late Bronze II - 11
Iron IA - 14
Iron Ic - 12
UD (possibly) Iron / LB) - 20

SITE 4 Rujm el-Hawaya

Possible Iron IA - 1

Iron II c - 5

Mameluke - 2

SITE 5 Rujm el-Hawi

Iron II c - 2

Early Byzantine - 2

Modern - 2

UD - 1

SITE 6 Ain Umm ed-Danamir

Iron II B-C 24

SITE 7 el-Qeseir

EB II/III - 11

EB IV - 1

Early Byzantine - 1

UD - 5

TRAVERSES

1. T 0-50

Byzantine - 4
UD - 3

2 T 50-100

Late Bronze II - 1
Early Byzantine - 6
modern - 1
UD - 8

3. T 100-500

Iron II c - 7
Late Roman III - 3
Early Byzantine - 4
UD - 4

4. T 500-600

Iron IIc - 2
Late Roman - 1
Byzantine - 8
Modern - 2
UD - 7

TRAVERSES

QOSEIR
QN-Grid
1. Q100 - 150

Late Bronze II - 1
Iron IA - 1
Early Byzantine - 1
Mameluke - 10
UD - 17

QOSEIR NORTH

1. QN 0/50

LB II - 9
Early Roman - 3
Early Byzantine - 11

2. QN 50/100

LB IA - 3
LB II - 11
Early Byzantine - 4

3. QN 150/200

MB IIA - 2
Byzantine - 5
Modern - 1
UD - 5

4. QN 250 - 300

Iron I-A - 1
Byzantine / Roman - 5
Byzantine - 3
Modern - 2
UD - 8

* Concentration of sherds in QN 250 - 300

Byzantine - 1
modern - 2

III. Transects JEBEL HAWAYAH NORTH

~~A. Valley Transects~~

~~1 0 100~~

1. HN 150 / 200

Iron II - 2
Byzantine - 1
Modern - 1
UD - 2

2. HN 200 / 300

UD - 4
Iron II - 2

Kirbat

خربة ام الدنانير

rest of Kh. Umm ed-Dan. — Abu Orabi family محمود

owner of Kh. Umm ed-Dan. - dof female ابو عبد الرزاق (توفيق)
ابو عاطف (ابو غانم)
خالد
مفلح (ابو محمد)

north hill

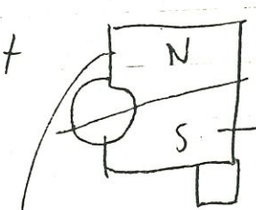
Rujm + north hill near El-Hanu Abu Mohammed
(الحنو)

'Ain Umm ed-Danair — Mahmoud, Abu Aref,
ام الدنانير Khaled, Hussein, Hassan

رجم الحنو
Rujm el-Henu

a) Ahmed El-Gathi احمد القاضي
east (Salt)
70 yrs. old
has sons

b) west



→ Ahmed El-Gatti

عبد الله الجعفري
Abdullah Jabir (Salt)
منصور الجعفري his brother - Mansur } died
جبر الجعفري brother - Rajeb } + many sons

رجم الحاوي
Rujm el-Hawi - ?

عمارة الجيري
يوسف ثمينة
el-Qeseir - Yusuf Thamra (office el-Hajar) real estate } same building
القصير (Amman) ALS office next Post Office
for foreign education

Landowners –

1) Abed El-Razag (Mahmoud)
2) Abu ~~Razag~~ – Tofik — father of Mubarak
3) Abu Aref Tofik — w/ car
4) Khaled Abu Razi — Mousa's father
5) Abu Mefleh, – Mohamed's father
Abu Mohammed
6) Hussein – Mousa's uncle
(// Spain)
7) Hassan – // Morocco

S-15

WES

Photos — Close-up 11/21/75

#15 Plus-X

1	#175	(Animal figurine)	side	1/125	5.6
2	"			"	"
3	"	"	top	"	"
4	52	Camp	top	1/30	8.5
5	12	"	"	"	"
6	43	"	"	"	"
7	24	"	"	"	"
8	6	"	"	"	"
9	8	"	"	"	"
10	19	"	"	"	"
11	41	"	"	"	"
12	39	"	"	"	"
13	42	"	"	"	"
14	31	"	"	"	"
15	4 blades		"	"	"
16	"		"	"	8
17	denticulates + notches		"	"	8.5
18	"		"	"	8
19	scrapers (1)		"	"	8.5
20	"		"	"	8
21	"		"	"	7
22	scrapers (2)		"	"	8.5
23	"		"	"	8
24	"		"	"	7
25	"		"	"	5.6
26	South slope		"	"	8.5
27	"		"	"	11
28	"		"	"	8
29	Chisel + Burins		"	"	8
30	"		"	"	8.5
31	"		"	"	11

32	Grinding Stones + Pestle		top	5.6	1/30
33	"			8	"
34	"			8.5	"
35	"			11	"
36	"			11.5	"

16 Plus-X

1	Cores - north slope ①		top	16	1/8
2	"			11.5	"
3	"			11	"
4	" ②			16	"
5	"			11.5	"
6	"			11	"
7	#1	bwl	top	16	1/15
8	"		"	11.5	1/15
9	"		"	11	1/15
10	#7	lamp	"	11.5	"
11	"	"	"	11	"
12	#4	juglet	"	11.5	"
13	"	"	"	16	"
14	#50	bwl	"	11.5	"
15	"	"	"	11	
16	#28	"		11.5	
17	"	"		16	
18	#21	juglet		11.5	
19	"	"		16	
20	#20	"		11.5	
21	"	"		16	
22	#23	"		16	
23	"	"		11.5	
24	#17	"		16	
25	"	"		11.5	

26	#36	bw/	top	8	1/15
27	"	"		8.5	"
28	#32	jwglet		8	
29	"	"		8.5	
30	#25	"		8	
31	"	"		8.5	
32	#22	"		8	
33	#22	"		8.5	
34	#16	bw/		8	
35	"	"		8.5	
36	#49	bw/		8.5	

#17 Plus-X

1	#18	jwg	top	4	1/125
2	#18	"	"	4.5	"
3	#27	"		5.6	
4	"	"		7	
5	#5	jwg	side	8	
6	#5	"		7.5	
7	#10	"	"	8	
8	"	"	"	7.5	
9	S3K	Ir IA, IIc, ER III		5.6	1/60
10	"			7	"
11	S3D	Piss Ir IA 1 Ir IIc, 1 Mam		4	1/30
12	"	2 Ir IIc 2 ER III		4.5	"
13	S2B	LB II		5.6	1/15
14	"			4.0	"
15	2 extras to test card				
16					
17	Page 11, Group B	MoIIc/LBA		8	1/30
18	"			8.5	"
19	S3H	2 Ir IIc 3 ER	LR missing	8	"
20	"	"		8.5	"

21	S3J	Iron IIA-B, Ir IIC, ER III	5.6	1/30	
22	"		7	"	
23	S6	Ir II B-C, Zoomorphic effigy right	5.6	"	
24	"		"	"	
25	HN 200-300	Ir. II	7	"	
26	"	"	5.6	"	
27	B:6	LB IA, LR	7	"	
28	"		5.6	"	
29	QN 100/150	LB II Iron (3)	8	1/60	
30	"	Ir IA EB yy	8.5	"	
31	S7	EB II-III FB IV	8	"	
32	"	(3) B yy	8.5	"	
33	S3A	MB II B Iron IA (2) Ir II B-C	8	"	
34	"	LB II Ir IC B yy 1	8.5	"	
35	QN 0/50	LB II (3) ER (2) EB yy (3)	8	"	
36	"		8.5	"	

18 Plus-X

1	T 50/100	LB II EB yy (2)	X	1/60	
2	"	"	8.5	"	
3			8	"	
4	T 500/600	Ir II C (3) LR EB yy.	8.5	"	
5	"		8	"	
6	S3B	Ir II C (3) ER Iron III (2)	8.5	"	
7	"	"	8	"	
8	B27	LB	8.5	"	
9	"		8	"	
10	A3	LB II / Iron I	8.5	"	
11	"	"	8	"	
12	B16	E B yy	8.5	"	
13	"	" yy	8	"	
14	B10	Iron LB II	"	↓	↓
15	"				
16	S1D	LB/Iron EB yy Iron.	↓	↓	

17 S1D "
18 S2D I, II C (3)
19 "
20 B26 LB II
21 "
22 B8 LB II B Ran/B_{33} (2)
23 "
24 S2A I, II C (2)
25 "
26 B25 B_{33}
27 "
28 B28 LB II Ran (2)
29 "
30 S37 LB II (2) Ran IA (2) I, IC (2)
31 "
32 B9 LB IA
33
34
35 B12 MB IIC/LB IA
36 "

19 Plu-X

1 B5 LB IA (3)
2 "
3 B30 LB II
4 "
5 S36 I, II C (2) Ran- B_{33}
6 "
7 S3L I, II C (2)
8 "
9 QN 150/300 MB IIA B_{33}
10 "
11 A1 MB IIC (1) LB IA (2)
12 " LB IA

8 1/60

13 T 100/500 I, II C(2) LR III(2) E. B_{43} (2) 8 1/60
14 " 8.5 "
15 S4 Poss. I, IA Mam
16 "
17 T 0-50 B_{43} (2)
18 "
19 S3H LB II(2) ER III(2) LR (2)
20 "
21 B14 LB
22 "
23 S2C I, II C
24 "
25 S1E I, II C (2) B_{43}/LR III Urinary Mam.
26 "
27 "
28 extra before
29 S1A I or II C EB 43
30 "
31 B13 MB II C
32 "
33 QN 150/200 MB II A B_{43}
34 " " "
35 B28 1 LB II 1 Room
36 "

#20

1 B7 MB II C/LB I A (4)
2 "
3 S2F I, II C (8)
4
5 left out
6
7
8

9	S3F	LB	Ir IIB-C	EB 33	8	1/60
10	"	Poss. Ir. IA	(2)		8.5	
11	S1C	MD IIC/LB IA (3)	EB 33 (2)			
12	"					
13	QN 50/100	LB IA (2)	LB II (2)	EB 33 (2)		
14	"	"				
15	S3L	LB	Ir IIC (2)	ER III (1)		
16	"	Poss. Ir. IA		EB 33 (1)		
17	S2A	Ir. IIC (2)				
18	"	"				
19	HN 150/200	Ir. II	B 33.			
20	"					
21	B- work of 13	LB IA (4)				
22	"					
23	"					
24	S1F	Ir IIC (2)	LR III (1)	B 33 (3)		
25	"					
26	B3	LB II (6)				
27	"					
28	2 pickers lost Le	shutter problem				
29	S5 -	Ir IIC EB 33			5.6	1/30
30		"				
31						
32						
33						
34						
35						
36						