Test of Varian Associates Portable Caesium Magnetometer, Tucson, Arizona

August 16-19, 1965

For description of the site, see newspaper clipping.

From Varian there were:

Lee Langan, Sales Engineer

Sheldon Breiner, Geophysicist

Robert Morris, Design Engineer

Dean Smith, Electronics Technician

Jon Wilcox, Manager, Public Relations

From ASCA, E. K. Ralph

Surveys made are shown in Grids #1 to #3.

Main problems with the instrument were:

1) The readout (the mechanism which converts and displays the frequencies detected in the form of numbers) was temperature sensitive and possibily otherwise unstable. (Due to lack of time, it had not been given temperature tests in the laboratory). As seen in Grid #1, readings jumped from 100 to 900, etc. as a result of this defect.

2) Two sets of batteries - new Ni-Cd alkaline types - held up only 3 hours with both sensors in use. Whether or not they were ever fully charged is not known. Battery charger will be redesigned for greater power output and flexibility. (Ralph will

organize a set of lightweight lead acid cells which should last longer).

3) A means of positioning the sensors a fixed distance above the ground is needed, and also redesign of the carrying staff especially for possible gradiometer use.

4) Other minor design changes and corrections, including intensification of the readout numbers so that they can be seen in sunlight.

Varian Associates hopes to have all changes and corrections made by September 17th with starting date at Sybaris, September 20th. Whether or not these can be accomplished by then will be known definitely by Aug. 27th.

Instrument Components

2 Readouts

These include all the circuitry except for the sensors, various connections, etc. for single, differential, or gradiometer modes of sensor use, and the "readout" numbers themselves. They measure about 11 x 11 x 3" and weigh about 5 lbs. Maximum sensitivity = 0,1 gamma.

2 Sensors and Sensor Electronics

Same as before except caesium has been subsituted for rubidium. This change makes them less sensitive to orientation.

2 Sets of Batteries - Ni-Cd and alkaline solution

Each encased in box ca 11 x 11 x 3" and weight, ca. 10 lbs. Required voltage range = 24 to 30v. Each set of batteries is rated for 7 1/2 AH. Each readout draws 0.8A. Each sensor draws 0.8A.

Total for dual use = 3.2 A. For differential or gradiometer use, only one readout is required. (For differential, one sensor is fixed; for gradiometer, both sensors are moved on a staff with one about 1 meter above the other. Single sensor use is similar to Elsec proton magnetometer).

Grid #1

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	095		098		002		000		097		095		090		026		063		086		093
1	095																				
2	005		004		100		099		090		094		020		116		099		070		064
3																					
4	093		098		106		083		000		094		010		006		089		80945		934
5			FE																		
6	096		096		992		999		012		014		013		094		960		923		905
7																					
8	086		012		995		000		000		997		097		80027		80937		80959		80962
9																					
10	097		80099		80019		80099		80989		80973		064		086		098		094		80096
11																					
12	80025		80097		80012		80089		80077		80961		80953		80017		80027		80006		80097
13																					
14	097		80003		80015		80099		80088		80988		80959		80014		80015		80089		80085
15																					
16	80093		80096		80004		80092														
17																					
18																					
19																					

burned house

house

house

N

8/16/65

Arizona

BB; 13;41

D. Merriam

Houses

~A.D. 1100

Desert Hohokam

Scale: 1cm = 1m

Gradio (0.1): 0926 MST

994
062
966
957 3
960
961 1
958 3
974 16
963 11
956 7
950 6
963 13
961 2
953
962
961
959
960

6903
3,06
9009

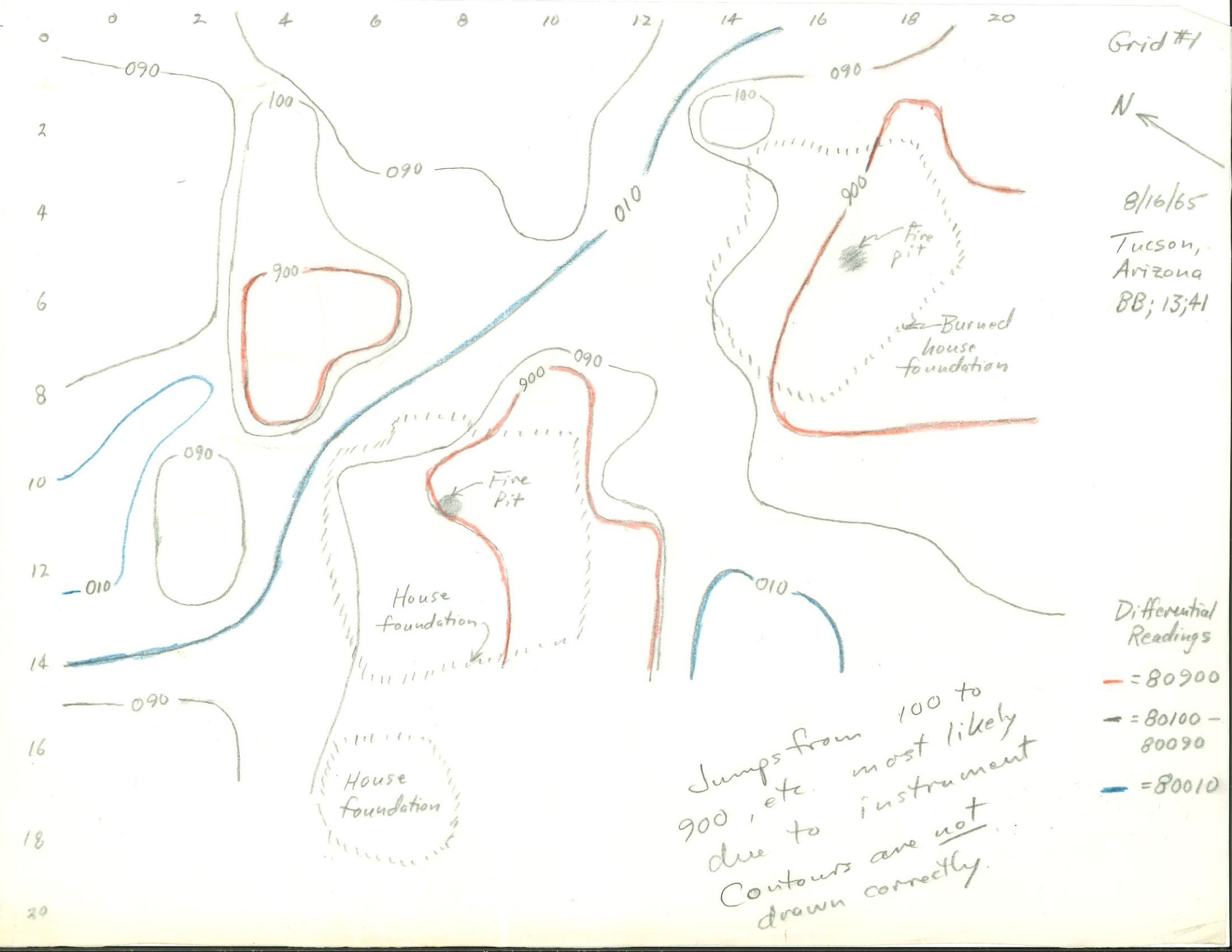
6.2
.07
.434

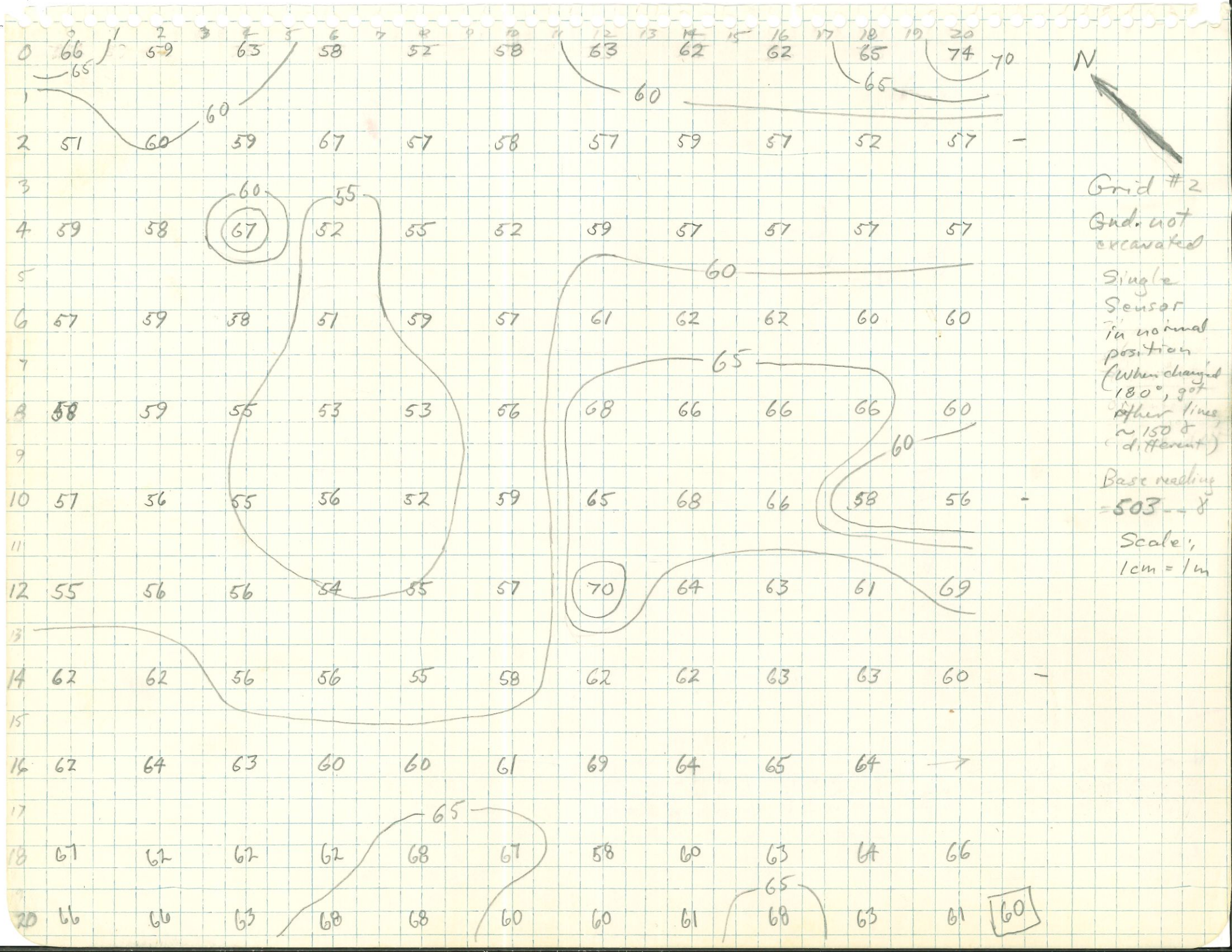
960.3
.07
67.221

957
960
961
958
974
963
956
950
963
961
9603

1.7
2)3.4

3.4
2.2)7.5.0
66
90
88
2

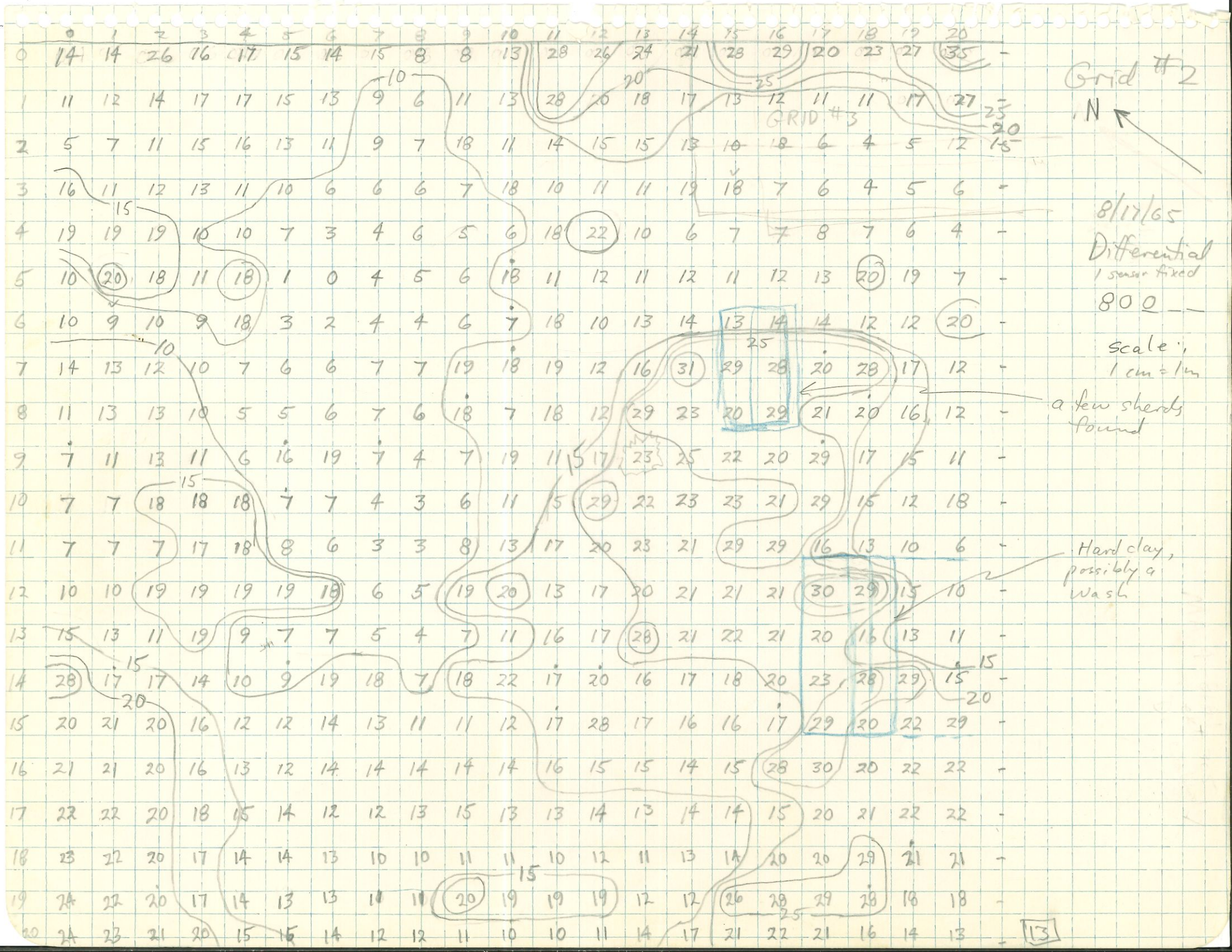

Grid #1
N
8/16/65
Tucson, Arizona
BB; 13;41
Differential Readings
= 80900
= 80100 - 80090
= 80010
Jumps from 100 to 900, etc. most likely due to instrument
Contours are not drawn correctly.
090
100
900
010
Fire pit
Burned house foundation
House foundation
House foundation

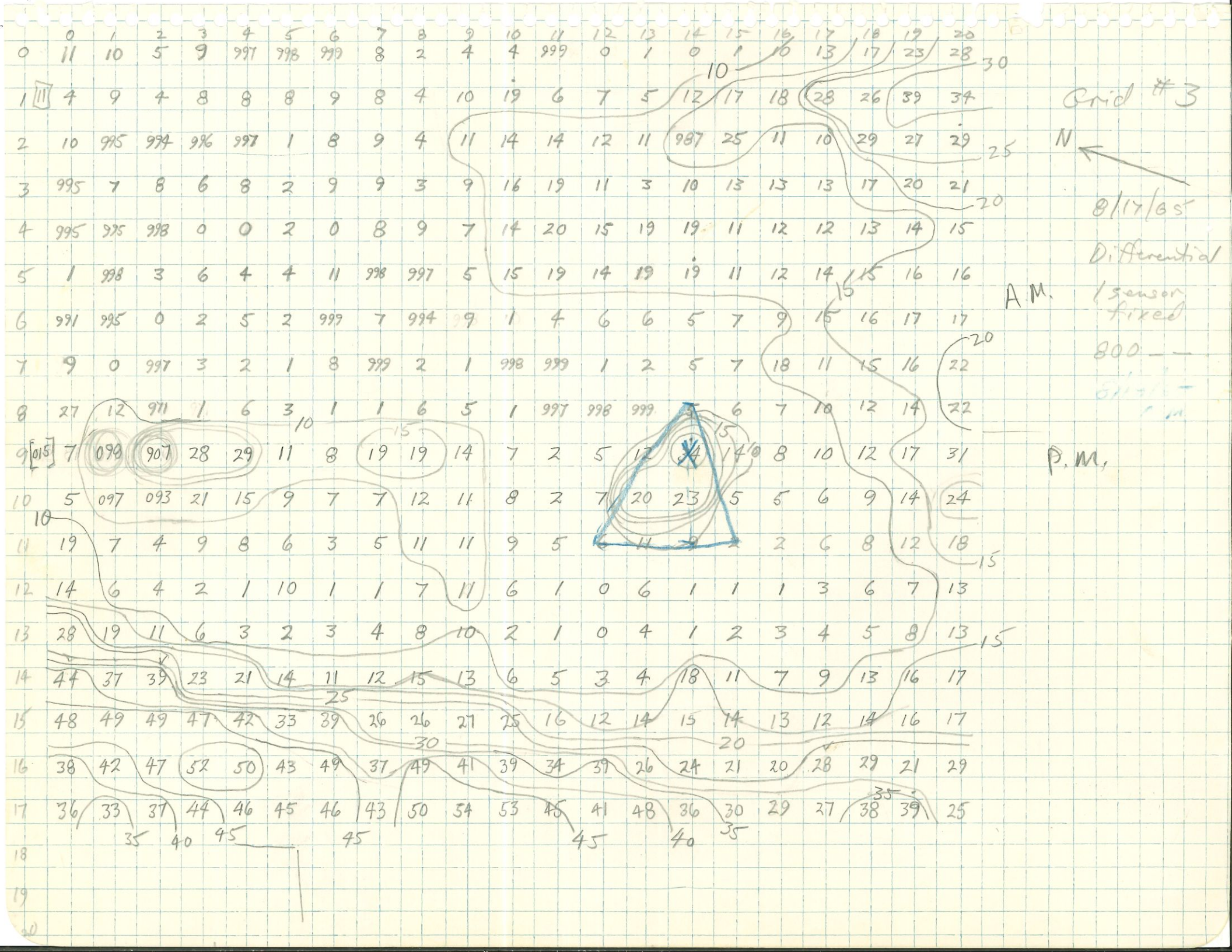

0 66 59 63 58 52 58 63 62 62 65 74
1 51 60 59 67 57 58 57 59 57 52 57
2 59 58 67 52 55 52 59 57 57 57 57
3 57 59 58 51 59 57 61 62 62 60 60
4 58 59 56 53 53 56 68 66 66 66 60
5 57 56 55 56 52 59 65 68 66 58 56
6 55 56 56 54 55 57 70 64 63 61 69
7 62 62 56 56 55 58 62 62 63 63 60
8 62 64 63 60 60 61 69 64 65 64
9 67 62 62 62 68 67 58 60 63 64 66
10 66 66 63 68 68 60 60 61 68 63 61 60
65
60
55
60
65
60
65
60
65
N
Grid #2
Gnd. not excavated
Single Sensor in normal position (when changed 180°, got other lines ~150 & different)
Base reading = 503 - 8
Scale: 1cm = 1m

50 364
359
341
356
357
356
364
361
361
361
360
363
366
357
364
363
362
360
361
362
362
361
364
363
359

Total field ~ $\frac{50300}{H \times 10^5}$ = no γs/d.

~ 0.7 γ per digit


Grid #2
N
8/17/65
Differential
1 sensor fixed
800 --
Scale:
1 cm = 1 m
a few sherds found
Hard clay, possibly a wash
GRID #3


Grid #3
N
8/17/65
Differential
1 sensor
fixed
A.M.
P.M.

Beth Ralph
from Sheldon Breiner

Hohokam Artifacts Are Unearthed

Electronic 'Nose' Can Sniff Out Ruins

By BOB THOMAS

An electronic machine that will be used in the search for the lost Greek city of Sybaris is being tested by locating Arizona Hohokam Indian ruins on the San Xavier Reservation.

Sybaris, in southern Italy, became so notorious for the indulgence of its citizens that "sybaritic" has become a synonym for pleasure and luxury.

Yesterday a group from the Applied Science Center for Archaeology at the University of Pennsylvania, and scientists from Palo Alto, Calif., tried the machine out on an archeaology "dig" on the right-of-way of the new Nogales Freeway.

Elizabeth K. Ralph, associate director of the center, tested the machine, called a rubidium magnetometer.

She will carry the magnetometer with her when she leaves for Italy next month to continue her search for Sybaris.

The device detects changes in the frequency of earth's magnetic field, caused, for instance by a piece of burned wood.

When charcoal, fired clay pots or other residue of human life are encountered, the jumps in frequency can be measured so that the general outline of a buried structure can be "mapped" on a graph.

This will be invaluable to archaeologists who now dig trenches with the hope of hitting ruins.

Working on a site suggested by James Sciscenti, 30, Arizona State Museum field archeaologist, Dr. Ralph used the machine to plot the foundation of a Hohokam house buried two to three feet under sand.

Helping her were two geophysicists from Palo Alto, Sheldon Breiner and Bob Morrison, employes of Varian Associates, of Palo Alto, manufacturers and developers of the magnetometer.

She said, "We used a similar machine last year to search for Sybaris, and it showed us it can locate walls and pottery. We didn't find the city—but we hope that this year the magnetometer will save us time by locating the bigger ruins so that we can dig for the more important structures."

The lost city is believed to be on the Gulf of Tarentum, now called the Gulf of Taranto, in the "arch" between the heel and toe of southern Italy. The ctiy thousand years of soil from an alluvial plain.

★ ★ ★ ★

Complicating the excavation of Sybaris is a water table only a few feet beneath the surface, which means powerful pumps must be used to keep a site clear of water.

Breiner said similar magnetometers are being used for underwater archaeology and to find petroleum and mineral deposits.

★ ★ ★ ★

Using conventional pick-and-shovel excavating, the museum team has accomplished a lot on nine sites some 15 miles south of Tucson.

Eight sites are prehistoric — homes of the Santa Cruz branch of the Hohokams who lived between 900 and 1100 A.D.

One site is historical — the ranch home of Fritz Contzen, a pioneer who first came to Arizona in 1855 as a member of the U.S. Boundary Commission.

Located three miles south of the San Xavier Mission, the ranch was called by Contzen "Punta de Agua."

Just south of the Contzen ranch is the prehistoric ruin of a small Hohokam settlement.

The 10 Papago Indians excavating the ruins under Sciscenti's direction found 14 urns holding cremated bones. Two complete skeletons were also found, which is unusual because the Hohokams practiced cremation.

Four of the nine sites on the reservation remain unexcavated. Sciscenti, who has been working on the project since June 21, hopes to complete the job by Sept. 10.

The museum has received a $16,146 contract from the Arizona Highway Dept. to do the archaeological research before the highway is completed.

★ ★ ★ ★

Contzen Came To Arizona In 1855

Fritz Contzen was one of the first Americans to settle in Arizona.

Shortly after arriving in 1855 he and his brother, Julius, were on their way to Hermosillo for supplies when they were jumped by 35 Apaches who had killed 12 Mexican soldiers the day before.

Two Papago Indians who were with the Contzens escaped and went to Imuris, Mexico, for help.

When the rescue party from Imuris arrived they found 12 dead Apaches and both brothers wounded. Fritz, hit in the left leg, was a cripple for many years after the fight.

His brother never recovered, dying two years later at the San Xavier Mission.

Fritz never forgave the Apaches. He participated in the infamous Camp Grant massacre later in which a group of Tucson men and a large party of Papagos slaughtered a peaceful tribe who were under the protection of the U.S. Army.

Most of the dead Apaches were women and children.

Contzen later founded the San Xavier Mine near the mission and the Young America Mine near Silverbell.

He died in Tucson in 1909 at the age of 78.

GOOD MORNING
The drunken driver has no hangover during the mourning after.

The Arizona Daily Star
★ An Independent NEWSpaper Printing The News Impartially ★

Second NEWS SECTION

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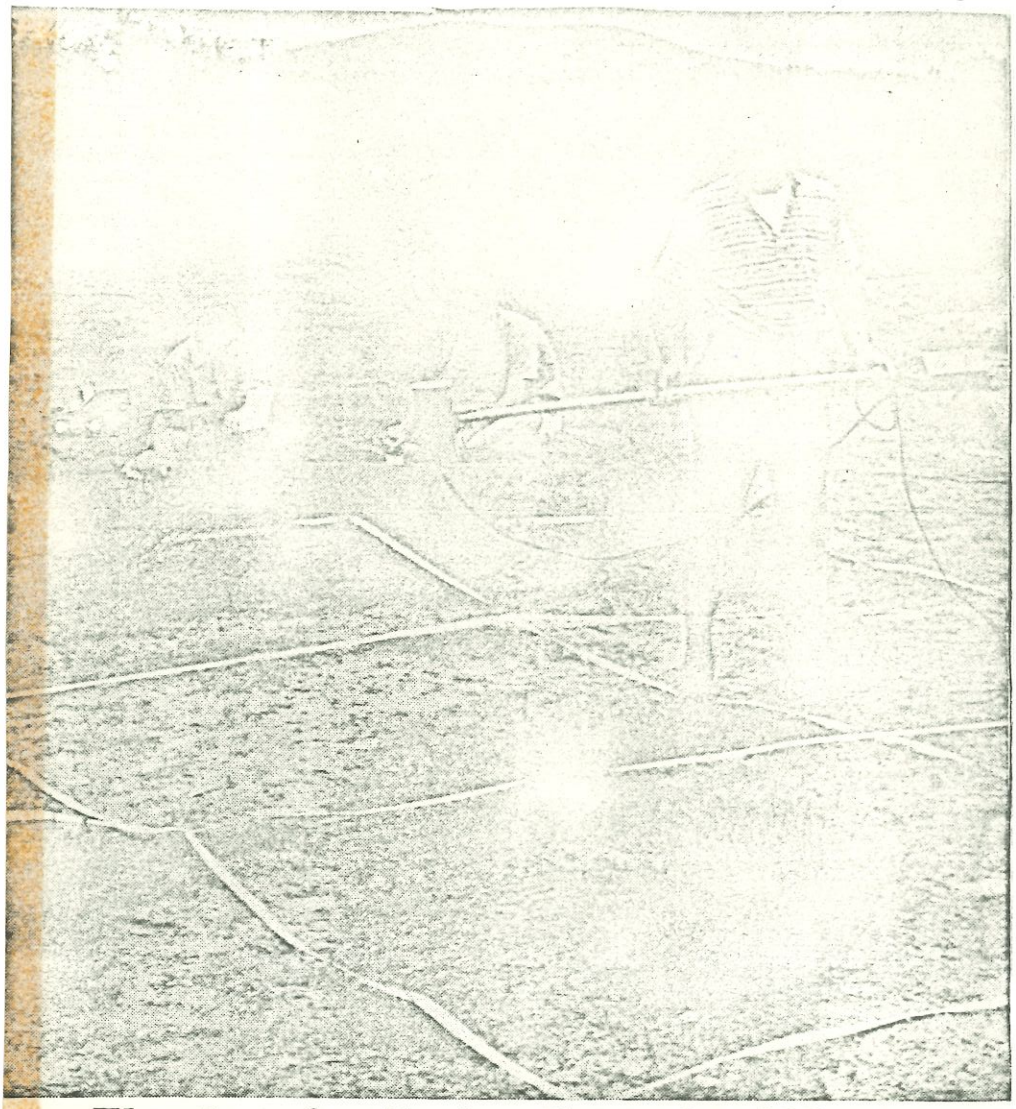

Electronic Detective At Work

Beneath this grid system lies a thousand-year-old Hohokam Indian ruin, pinpointed by the electronic machine held by geophysicist Sheldon Breiner. Dr. Elizabeth K. Ralph, taking notes at the left, plans to use the device, a rubidium magnetometer, to try to find the ancient Greek city of Sybaris in southern Italy. Reading the magnetometer's scope is Bob Morrison, of Varian Associates, developers of the achaeological aid.