Oct-Nov 78

Begaʻa magnetic survey
significant anomalies

grid#	X	Y	
2	8	25	9 m long 5uT magnetic high with lows on sides
4	21	1	2x3m magnetic high of 20uT
4	0	36	3x4m magnetic high of 15uT
5	5	3	2x4 m magnetic high with central peak of 35uT
6	5	38	2x3 m magnetic high of 10uT
6	18	38	3x3 m magnetic high of 10uT
7	11	13	8x16m multipole with 20uT high and 10uT low
8	19	5	3x4 m magnetic low of 15uT
10	24	18	8 m long magnetic high of 10uT
11	19	21	possible dipole with 3x5 m high of 20uT
11	1	27	magnetic high of 15uT with area 2x5m
11	-5	16	oriented dipole with 30uT high + 40uT low and high gradient
14	-2	18	15uT magnetic low with area 2x4 m
14	4	39	oriented multipole with high of 25uT and area of 3x5m
14	-1	37	2x3 m magnetic high of 10 uT
14	38	12	elongated 2x4 m magnetic high of 10uT
15	20	69	2x3 m magnetic high of 25uT with unrelated surrounding lows
15	24	57	2x4 m magnetic high of 15 uT

Bogaia
Oct-Nov '78

Mag. area:	6800
	900
(at 2m res.)	15,000
	5120
	3500
	1500
	1000
	300
	34,120 m^2 or 3.4 hectares or ~8.5 acres

res. area:	2500
	1000
(at 1m res.)	1100
	1000
	5600 m^2 or 0.56 hectare or ~ 1.4 acre

(in 6 days using a team of 5 with 2 machines going simultaneously)

$\frac{kg}{m^3}\left(\frac{1000\,g}{kg}\right)\left(\frac{m}{100\,cm}\right)^3$ ∴ specific gravity $= 10^{-3}\rho$ $\quad H = \frac{M_m V}{d^3}$ $\quad 0.3^3 = 2.7(10^{-2})$ $\quad 0.38^3 = 5.5(10^{-2})$

Sample	m, kg	V, m^3	$\rho, \frac{kg}{m^3}$	d, m	H, uT	$M_m \frac{uT\,m^3}{kg}$
Sandstone from N hill	13.9	$6.22(10^{-3})$	$2.23(10^3)$	0.30	0.4 ± 0.2	$7.8(10^{-4})$
Limestone from N hill	8.9	$4.39(10^{-3})$	$2.03(10^3)$*	0.30	0.2 ± 0.2	$6.1(10^{-4})$
Limestone from S hill	14.3	$6.46(10^{-3})$	$2.21(10^3)$	0.30	0.1 ± 0.1	$1.9(10^{-4})$
Soil from '77 cave (N hill)	10.2	$7.41(10^{-3})$	$1.38(10^3)$	0.38	1.0 ± 0.3	$5.4(10^{-3})$
Soil from cave 18	4.2	$4.21(10^{-3})$	$0.998(10^3)$	0.30	0.6 ± 0.2	$3.9(10^{-3})$
Soil from cave 3	10.1	$8.53(10^{-3})$	$1.18(10^3)$	0.30	0.7 ± 0.2	$1.9(10^{-3})$
Surface soil from SW #14	8.9	$6.81(10^{-3})$	$1.31(10^3)$	0.38	0.9 ± 0.4	$5.6(10^{-3})$
Soil from natural cave 8m S of 8	6.0	$5.33(10^{-3})$	$1.12(10^3)$	0.30	1.0 ± 0.1	$4.5(10^{-3})$

* more accurate

Magnetic properties of soil & rock from Pega'a

calcs of 17 Nov 78 from data of 12 Nov.

gen'l approximation of relative magnetic moment:

$$\left.\begin{aligned} \text{rock} &= 5(10^{-4})\,\frac{uT\,m^3}{kg} \\ \text{soil} &= 5(10^{-3})\,\frac{uT\,m^3}{kg} \end{aligned}\right\} M_m$$

---

also $H = \frac{M_v V}{d^3}$; $H_v = \rho M_m$, $\rho_{rock} \approx 2.1(10^3)\,\frac{kg}{m^3}$

$\rho_{soil} \approx 1.2(10^3)\,\frac{kg}{m^3}$

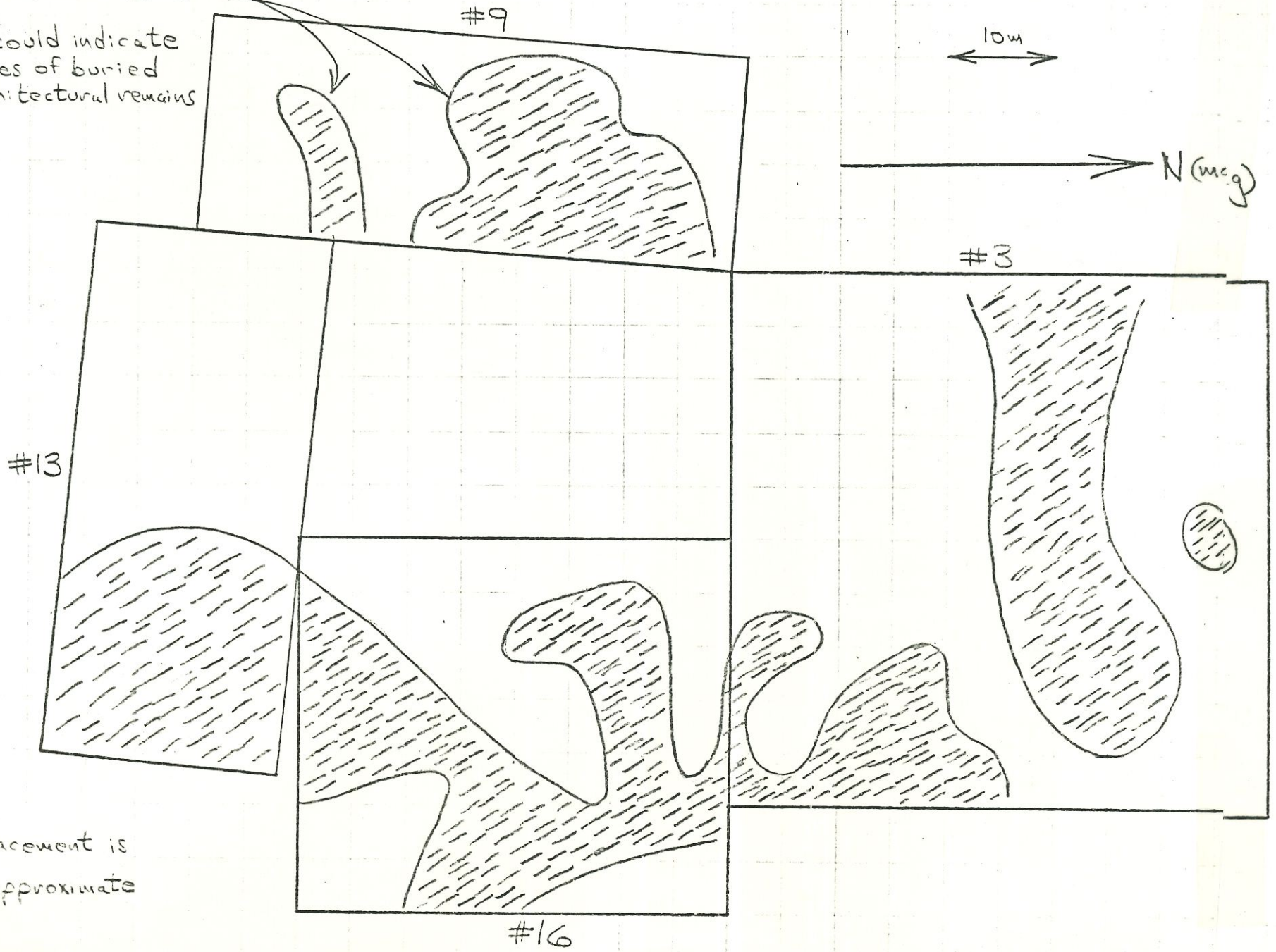
∴ M_v —— rock ≈ 1 uT

soil ≈ 5 uT

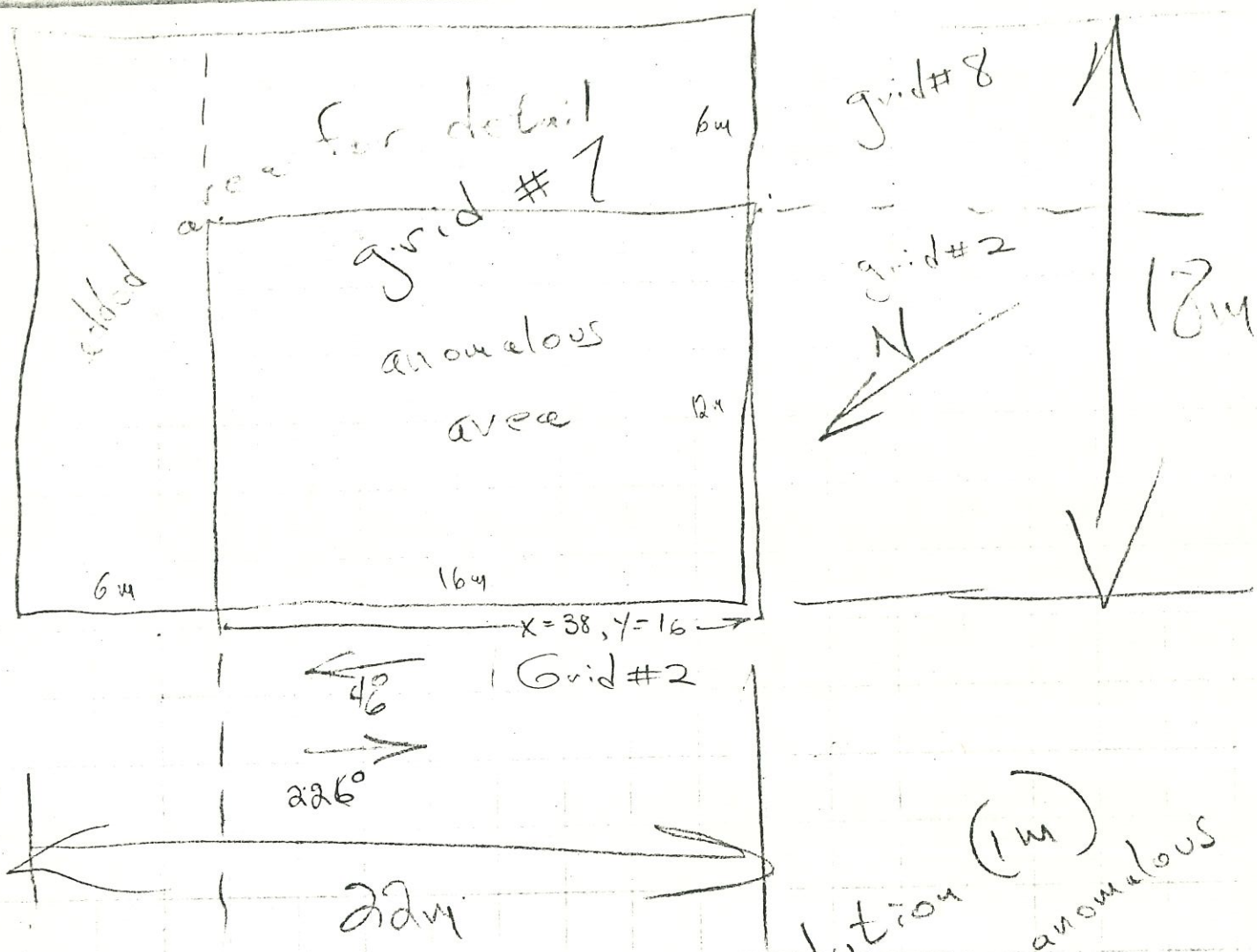
Bega'a resistivity survey, Oct-Nov 1978

areas of greater variability in resistance are indicated here

these could indicate zones of buried architectural remains



grid placement is only approximate



high resolution (1m) grid to include anomalous area in grid #2: new supplemental grid is #7

280 x 18

D.P. = Dirt pile

19 October 1978

Beqa'a Valley, Jordan

Umm ed-Dananir region

— this page not corrected for diurnal fluctuation (but corrections to apply are indicated at bottom)

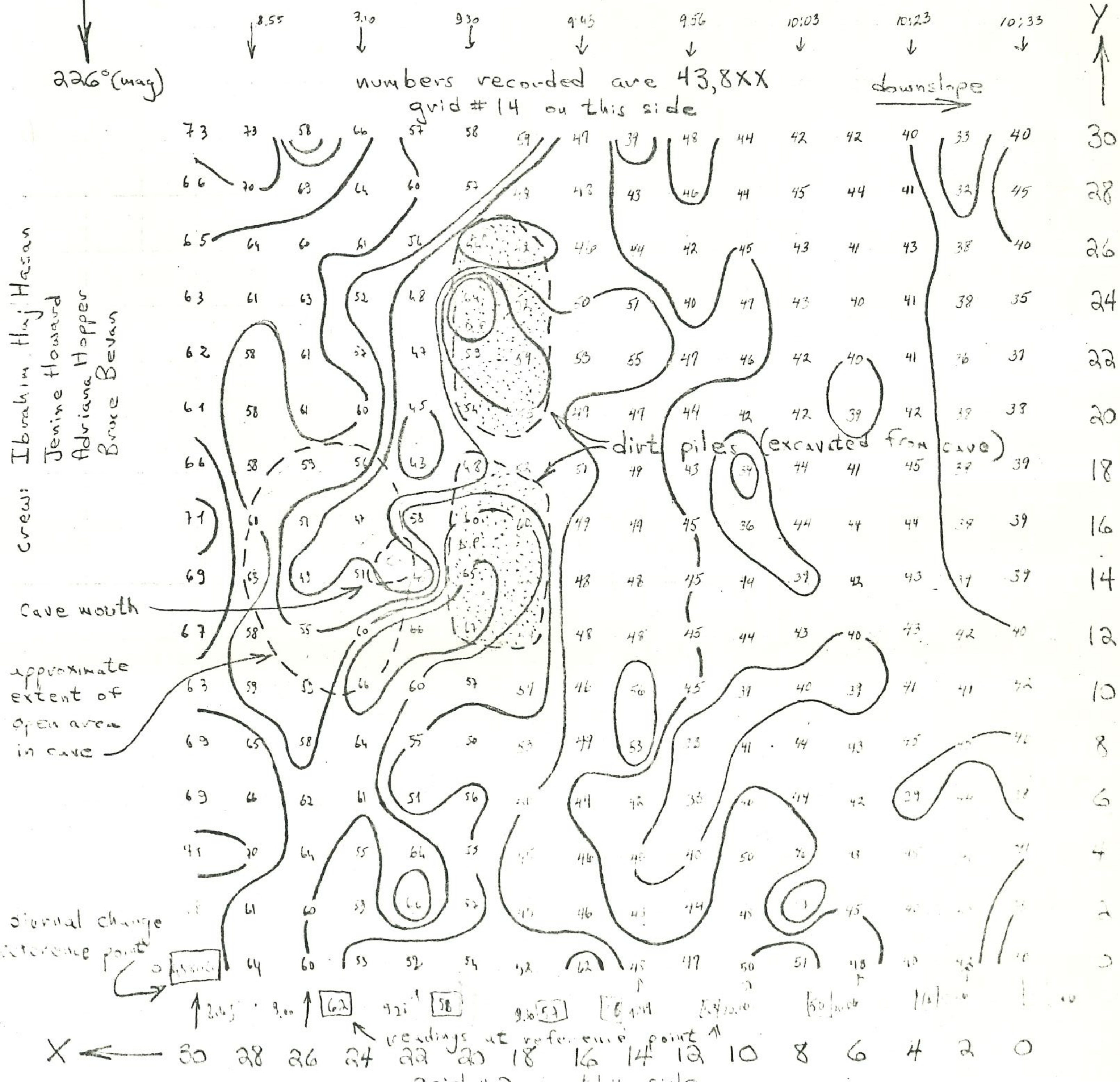
Cesium magnetometer in absolute mode (Varian 49-544)

Readout #90, Sensor #195

Grid #1: includes burial cave excavated in 1977 (~1–1¼ m air space on top + ~½–¾ m soil below before rock on bottom of cave)

average field ≈ 43,850 nT, contour interval = 5nT

measurement spacing = 2m, sensor height ~ 0.7m



#1

19 Oct 78, resistivity survey, <u>Grid #1</u>

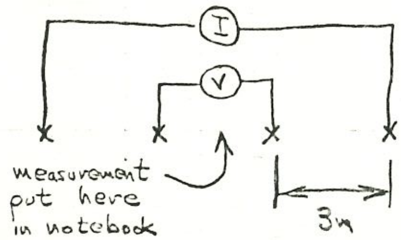
Bega'a Valley, Jordan

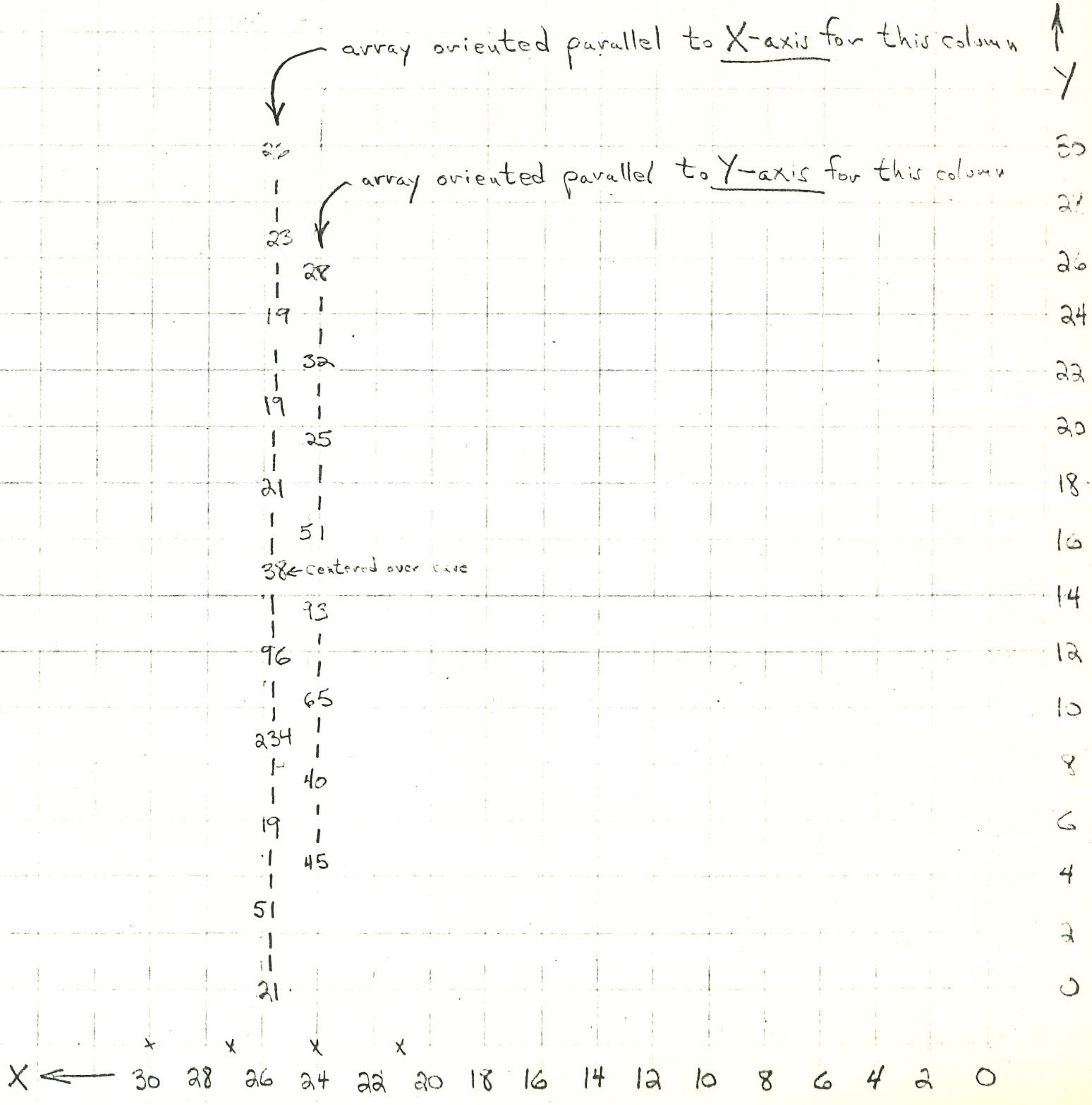
Gossen Geohm in Wenner configuration

Values recorded are resistance, $R = \frac{V}{I}$, in ohms (Ω)

probe spacing = 3m

~N





Begaa Valley, Jordan
Grid #2
1 Oct 78
Magnetic Map

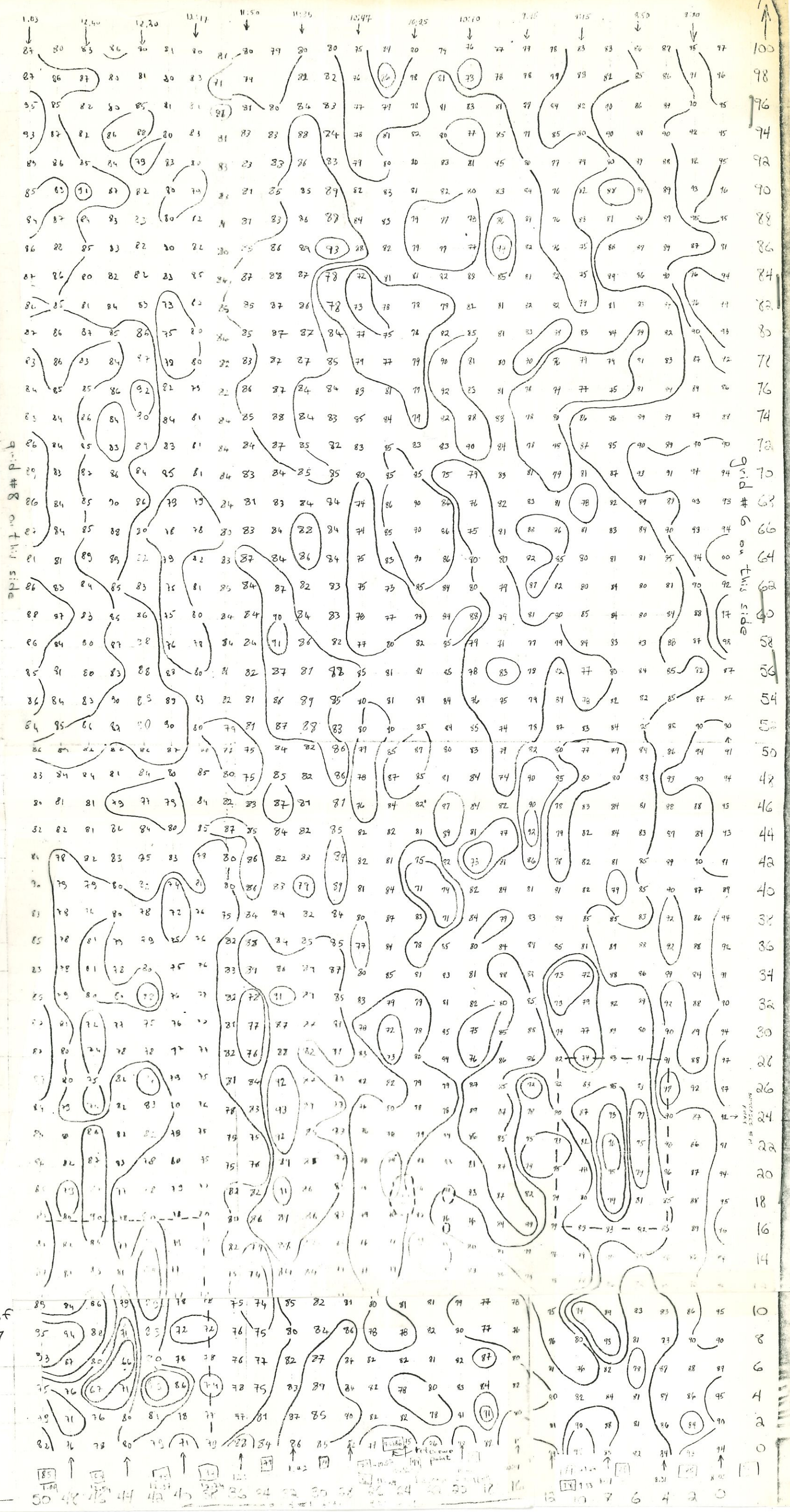
esium magnetometer
Varian 49-544 (ser. #90)
in absolute mode
sensor # 195
orrections for diurnal shift
at bottom of page

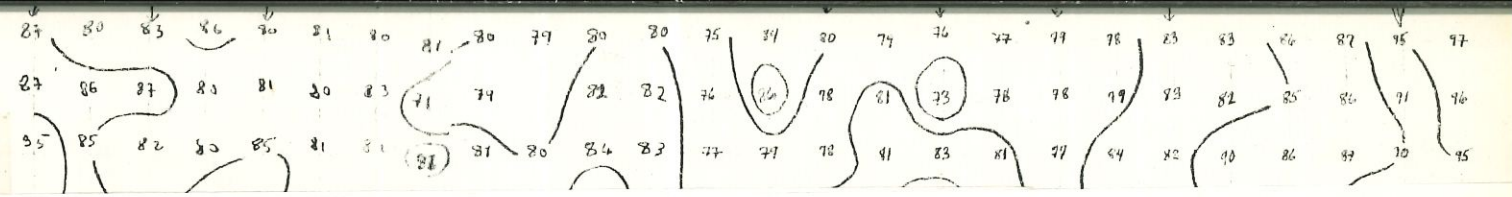
easurement spacing = 2m
ensor height ≈ 0.7 m
ontour interval = 5 nT
verage field = 43,880 nT
recorded numbers are 43,8XX

226° (mag)

N

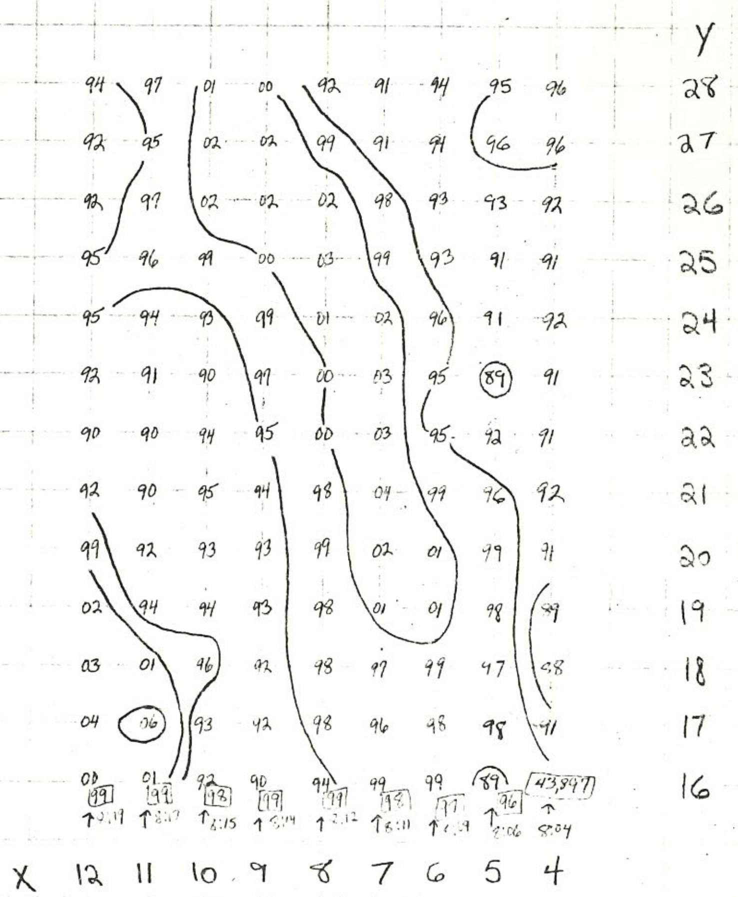
part of grid #7





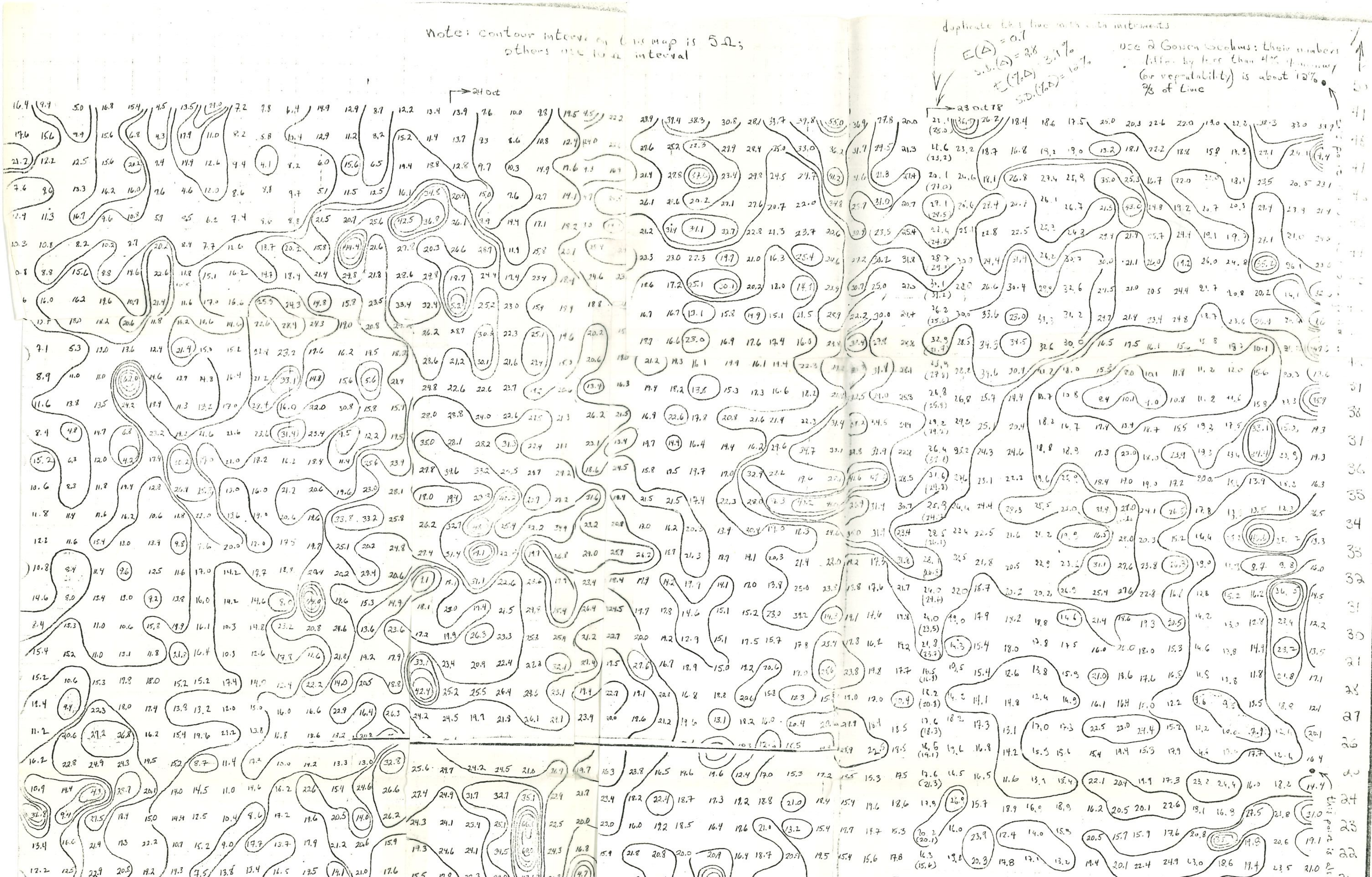
2

detail in grid #2, 4 Nov 78, → 22.6° (mag)



Y \ X	12	11	10	9	8	7	6	5	4
28	94	97	01	00	92	91	94	95	96
27	92	95	02	02	99	91	94	96	96
26	92	97	02	02	02	98	93	93	92
25	95	96	99	00	03	99	93	91	91
24	95	94	93	99	01	02	96	91	92
23	92	91	90	97	00	03	95	(89)	91
22	90	90	94	95	00	03	95	92	91
21	92	90	95	94	98	04	99	96	92
20	99	92	93	93	99	02	01	99	91
19	02	94	94	93	98	01	01	98	99
18	03	01	96	92	98	97	99	97	98
17	04	(06)	93	92	98	96	98	98	91
16	00 [99] ↑8:19	01 [99] ↑8:17	92 [98] ↑8:15	90 [99] ↑8:14	94 [99] ↑8:12	99 [98] ↑8:11	99 [97] ↑8:09	(89) [96] ↑8:06	[43,897] ↑ 8:04

#3


note: contour interval on this map is 5 Ω;
others use 10 Ω interval
24 Oct
duplicate this line with both instruments
E(Δ) = 0.1
S.D.(Δ) = 2.8
E(%Δ) = 3.1%
S.D.(%Δ) = 12%
23 Oct 78
use 2 Gossen Geohms: their numbers differ by less than 4% accuracy (or repeatability) is about 12%
2/3 of Line

24 oct

23 oct 78

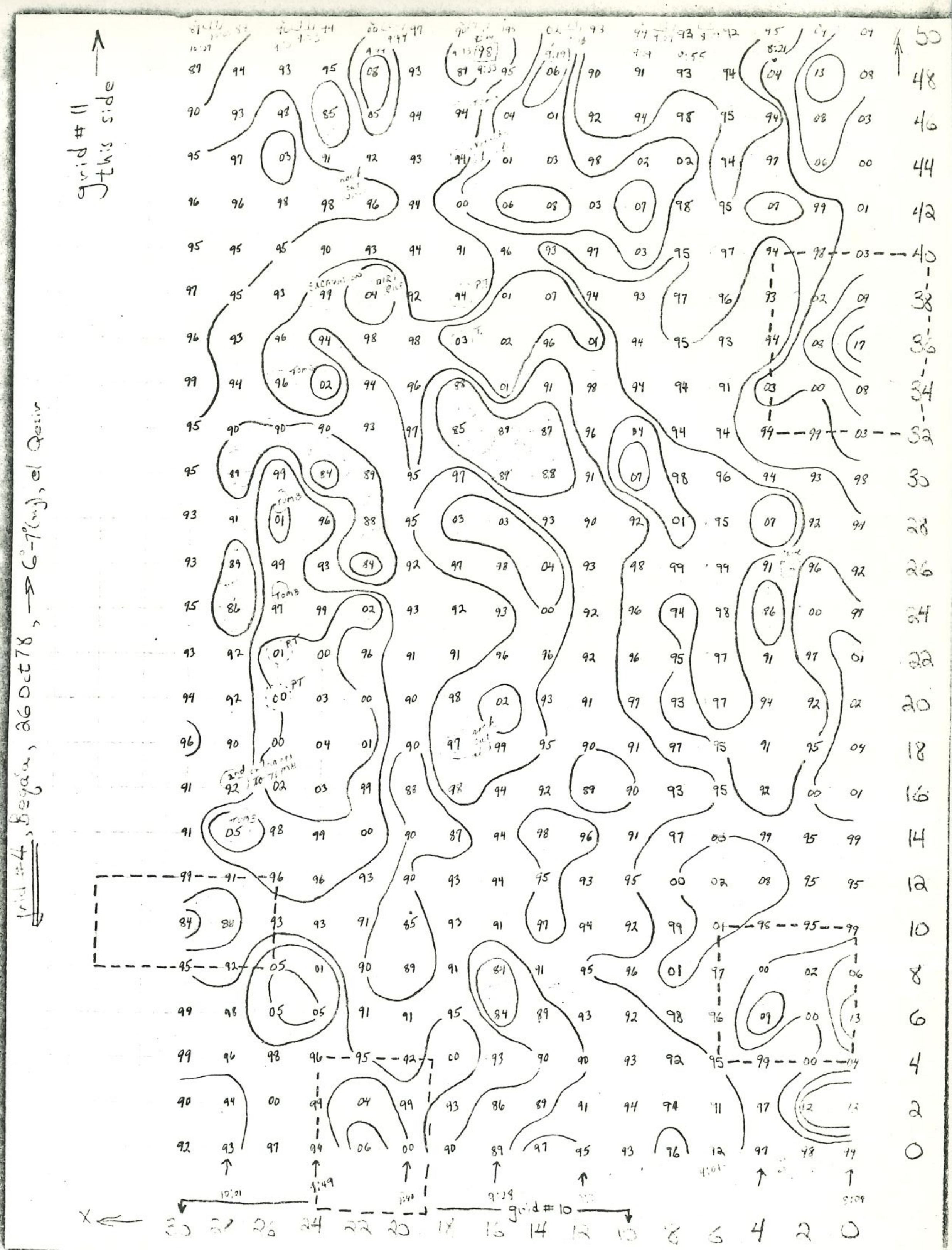
this point is also
X=0, Y=50 on grid#9

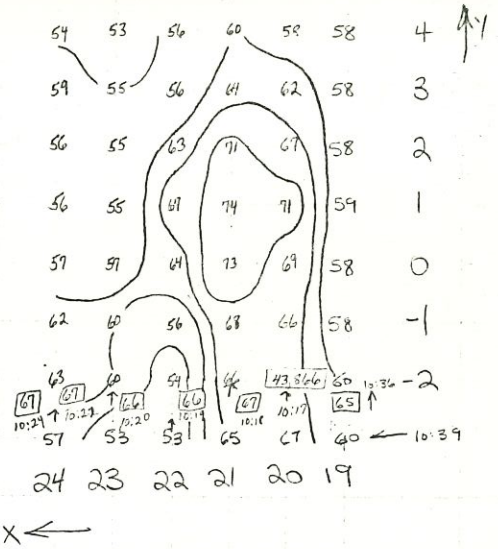
in tobacco field, near Bronze Int. Temple

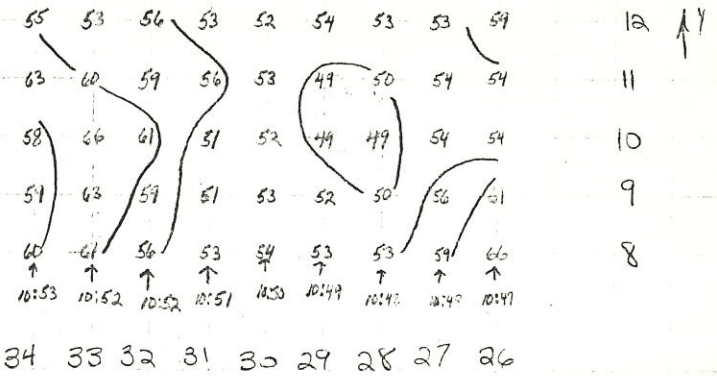
'25 Oct 18, Begaʻa, grid #3, resistivity → 91° (mag)

0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
–	10.7	11.6	10.0	9.7	12.9	11.3	17.1	15.3	16.4	11.4	21.4	11.1	–	12.5	12.5	9.5	16.7	11.2	15.2	13.2	13.7	12.3	10.1		

readings recorded at W end of array, 2m spacing


grid #11
this side
grid #10
TOMB
EXCAVATION
PT

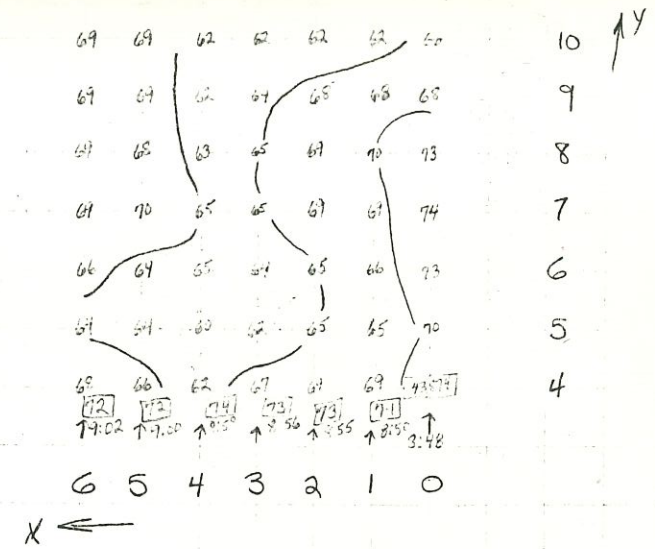


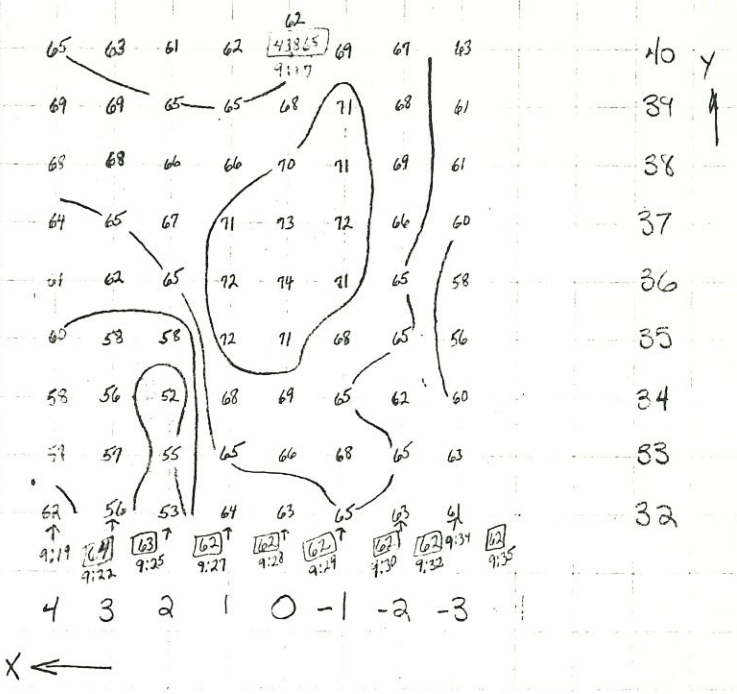


det. ilr on grid #4, 1 Nov 78

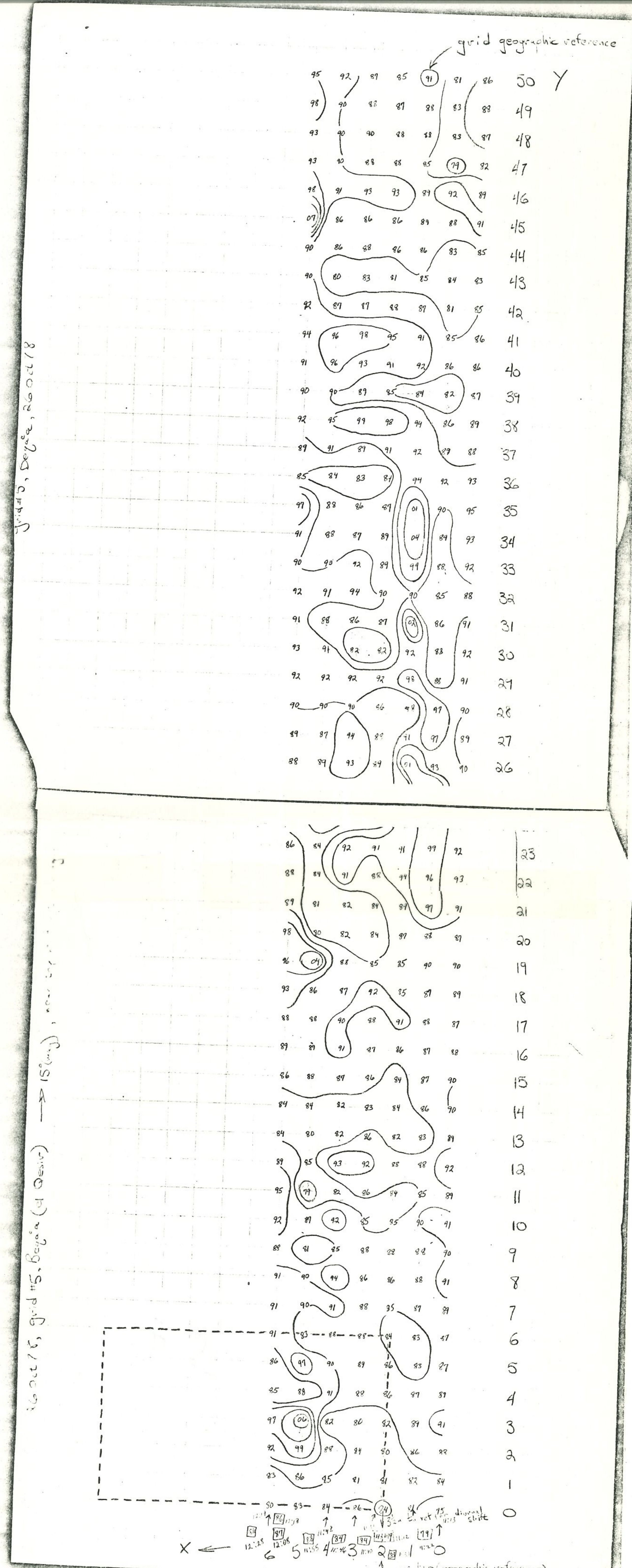
details on grid #4

1 Nov 78



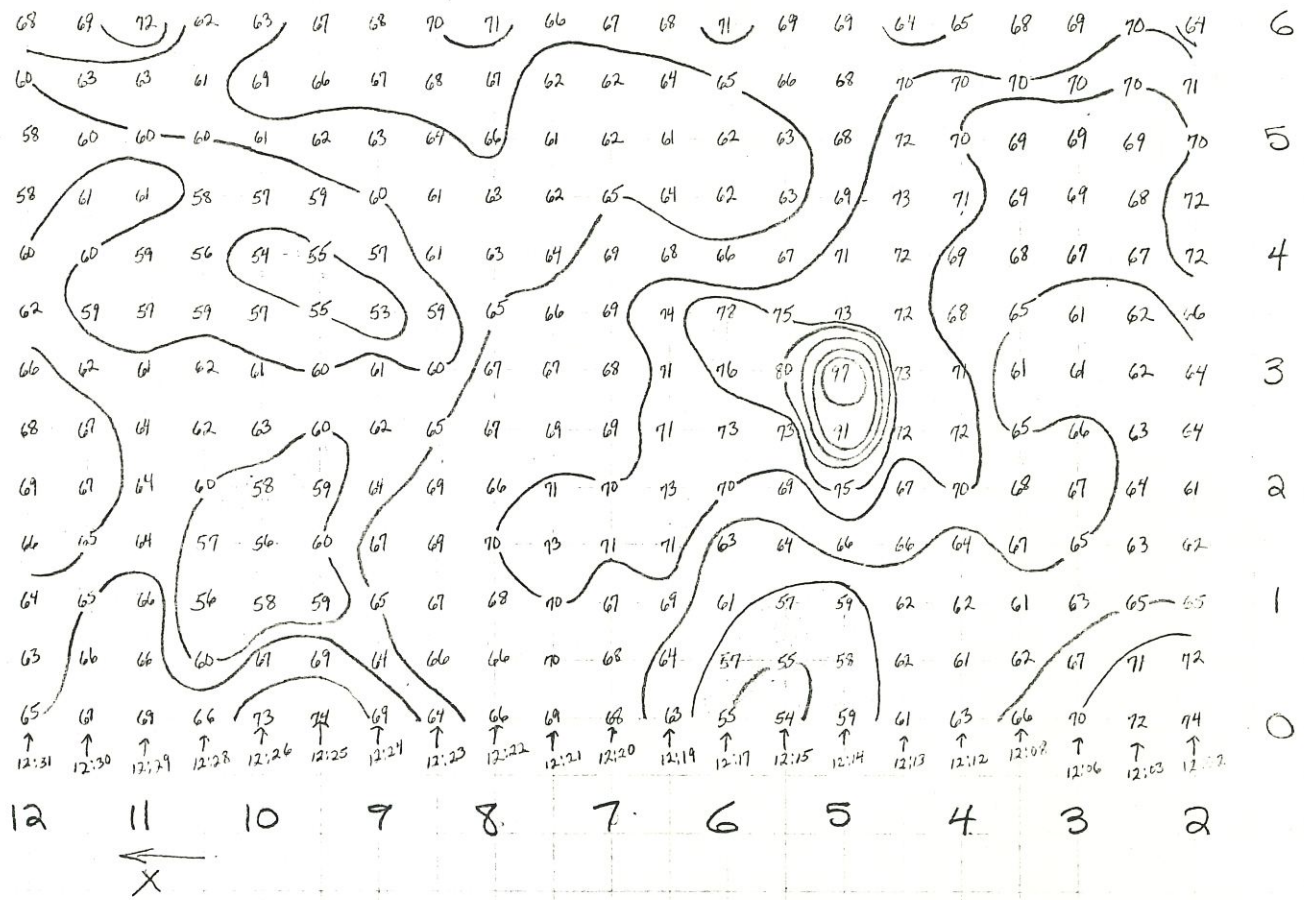


#5


grid geographic reference
Y
X
diurnal shift

grid #5 detail, near top of el Qasr, Bega'a, 2 Nov 78 ↑15(mag)

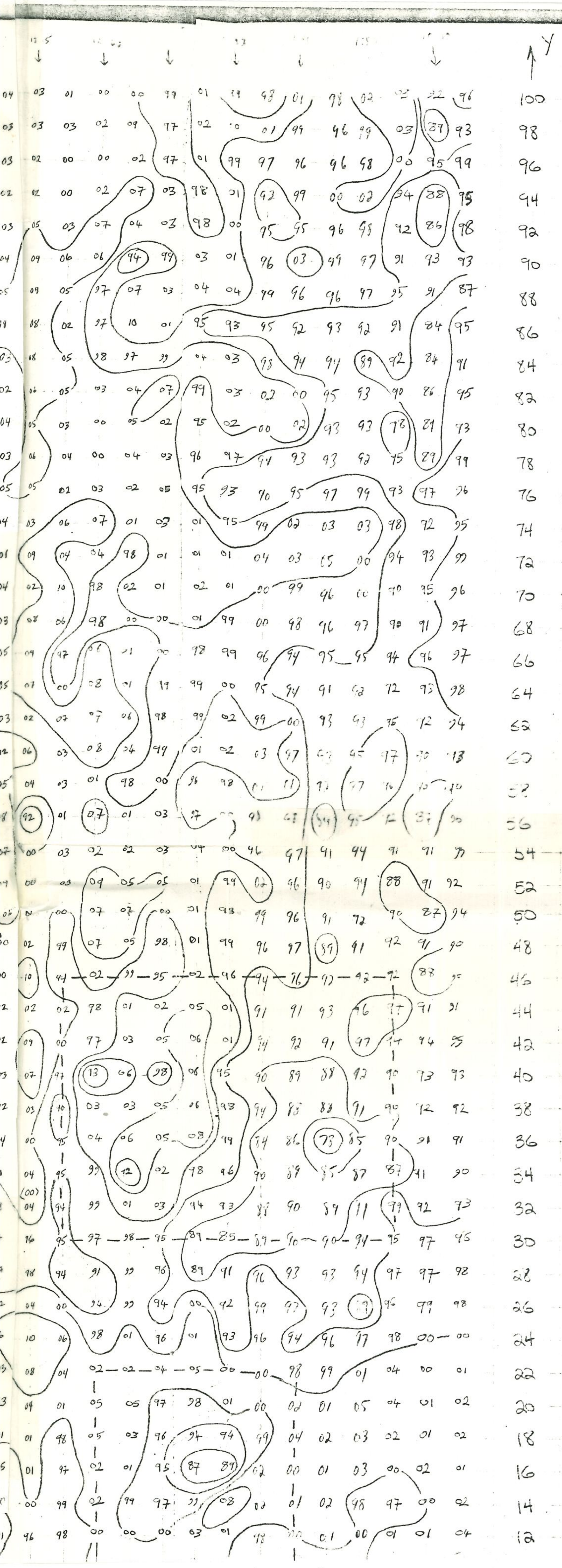
extends outside of #5; measurement spacing = ½ m ↑Y



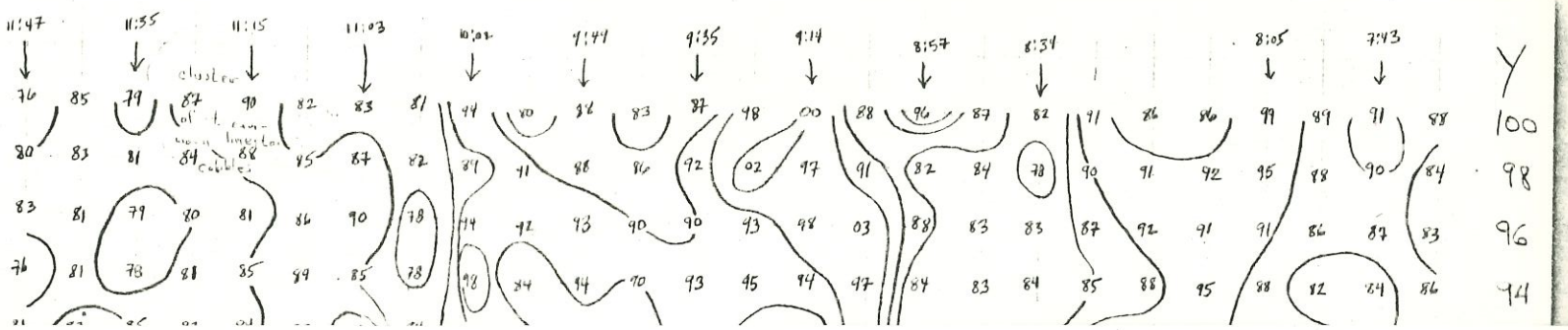
#14

dry wall terrace
with squared stones

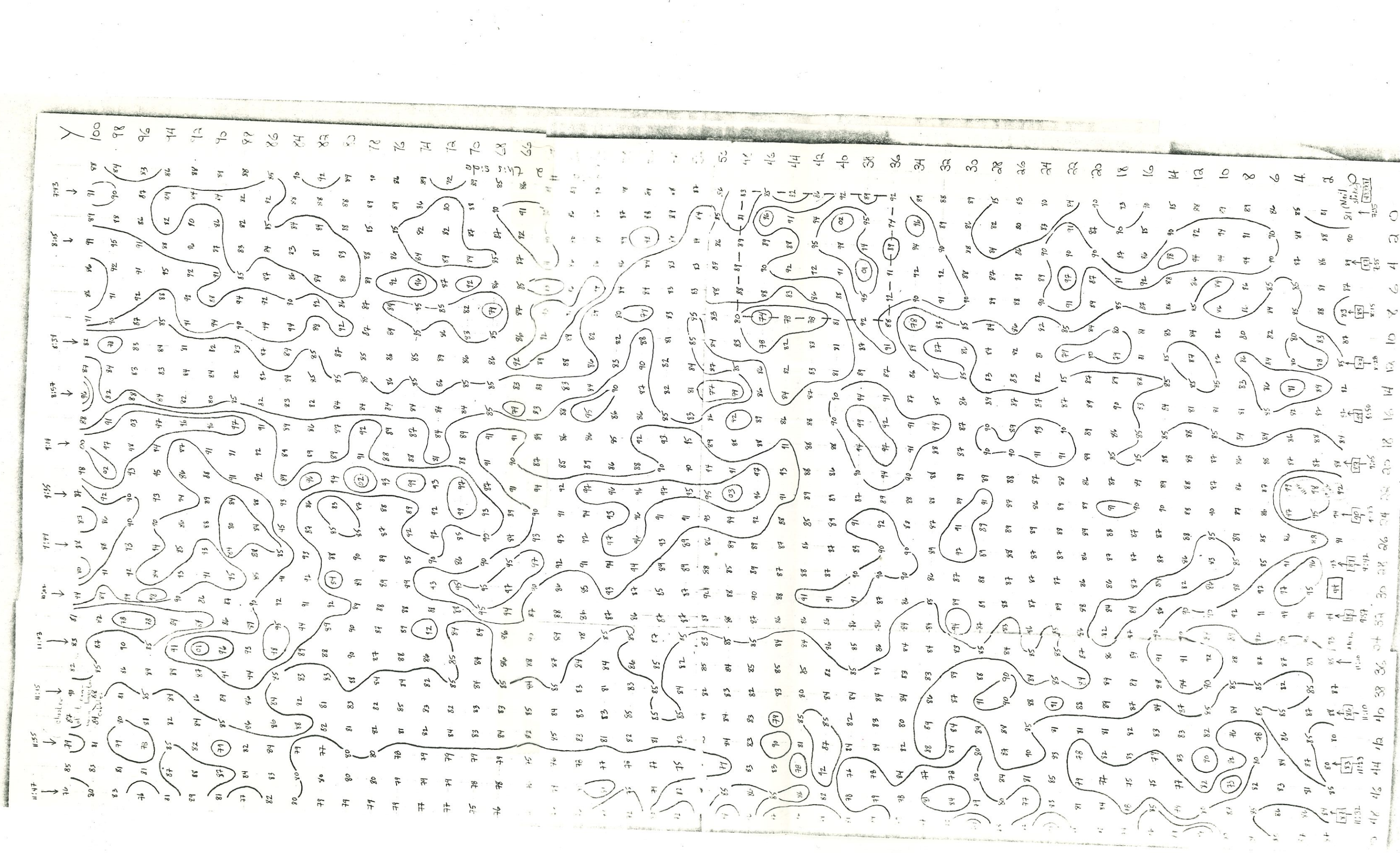
megalithic
terrace

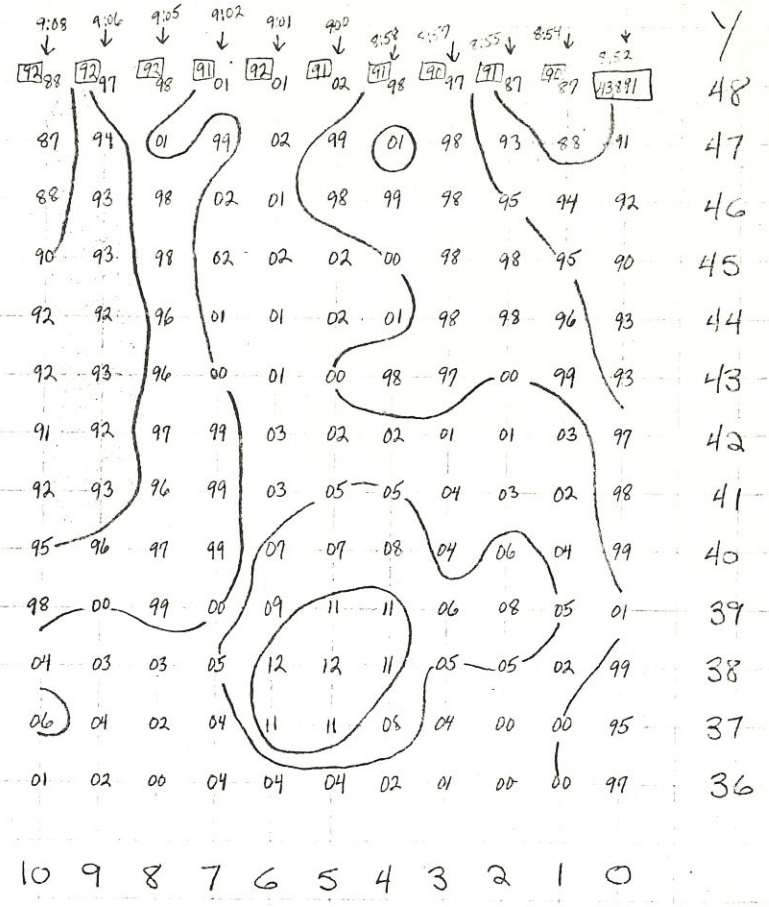


Missing sides + bottom + 38-34 in X


11:47
11:35
11:15
11:03
10:02
9:44
9:35
9:14
8:57
8:34
8:05
7:43
Y
100
98
96
94

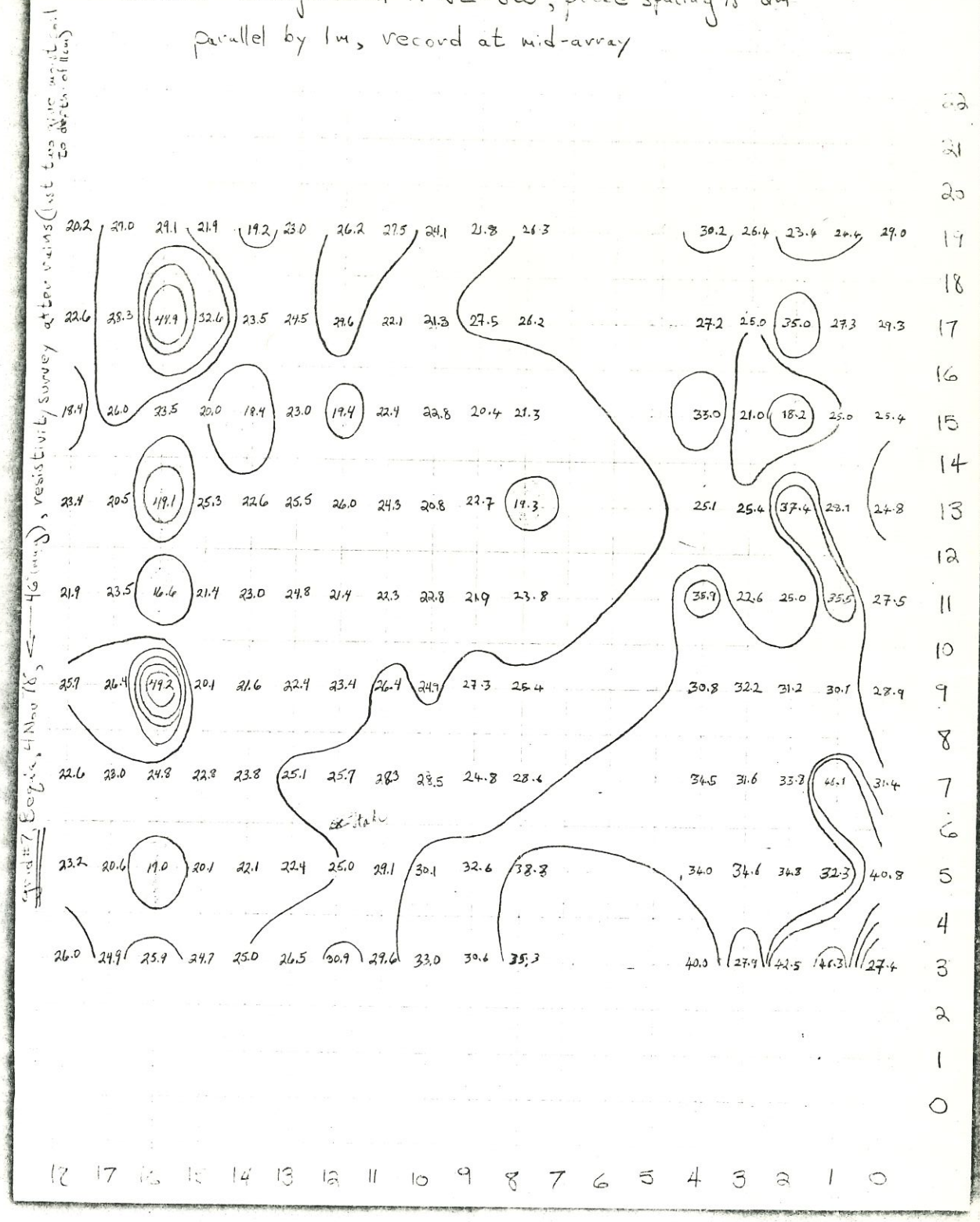
#6





Grid #6 detail, 4 Nov 16, Degala, → 46° (mag)

Wenner configuration is NE-SW, probe spacing is 2m parallel by 1m, record at mid-array

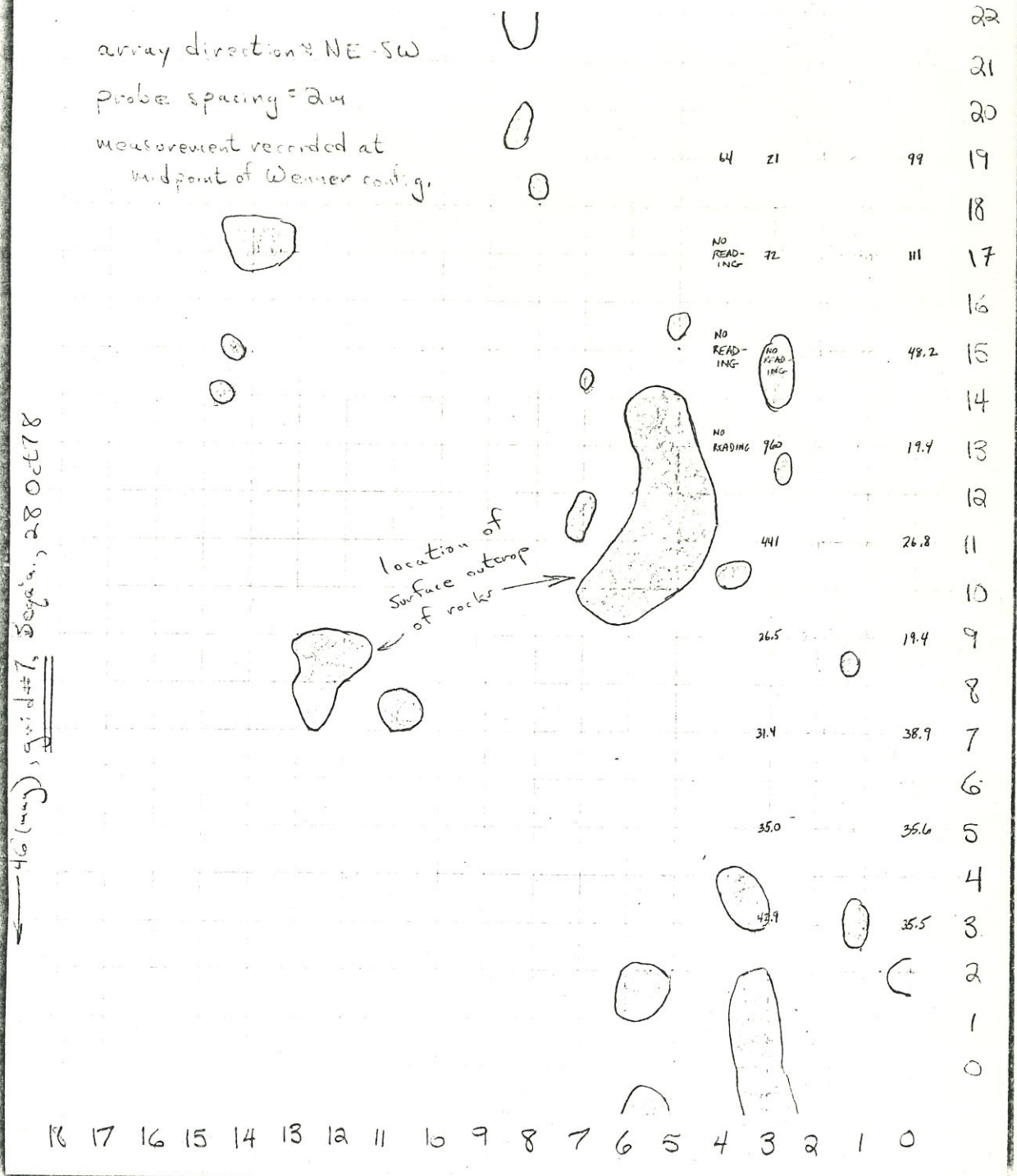


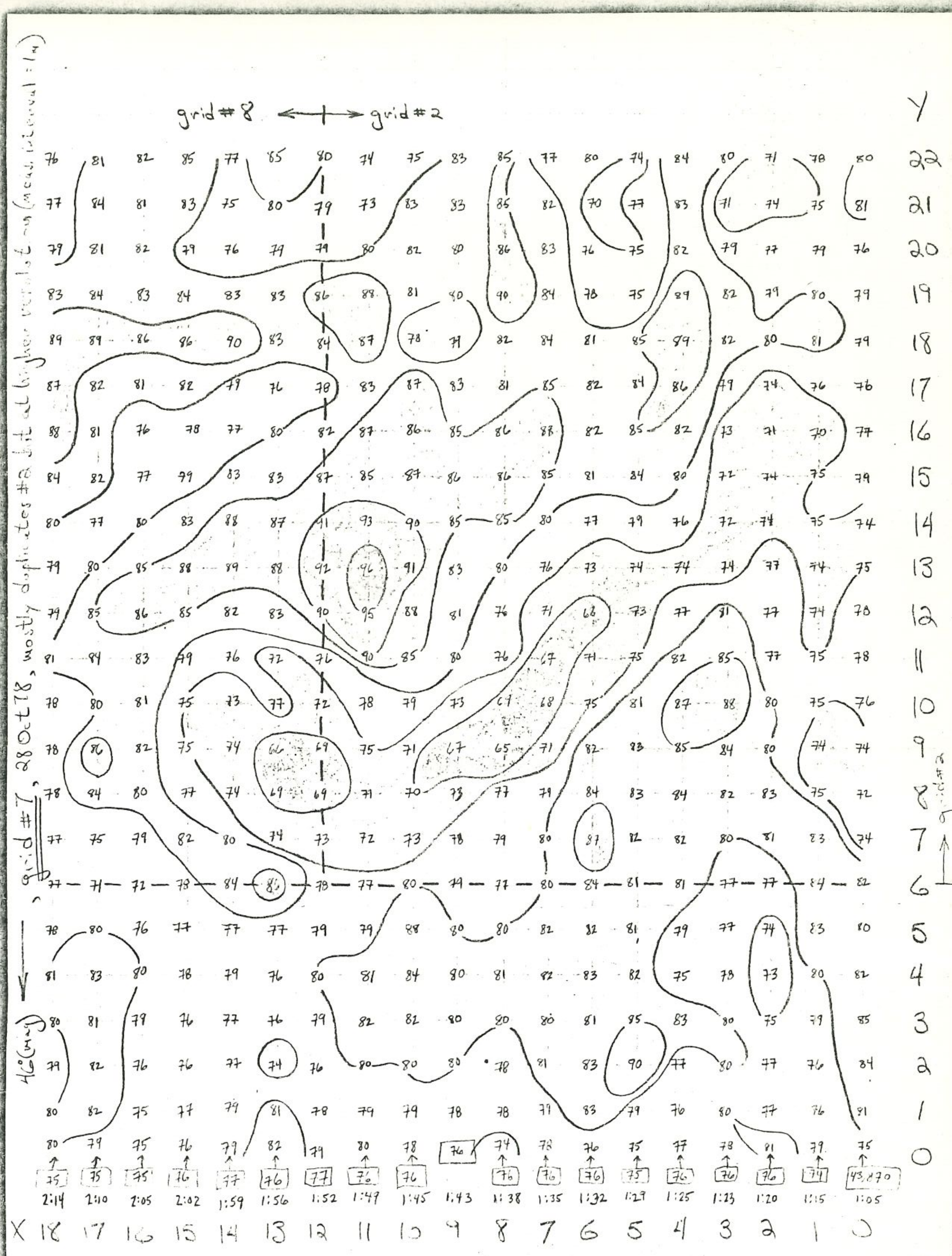
dry, stony soil prevented resistivity readings at all but a few points

array direction: NE-SW

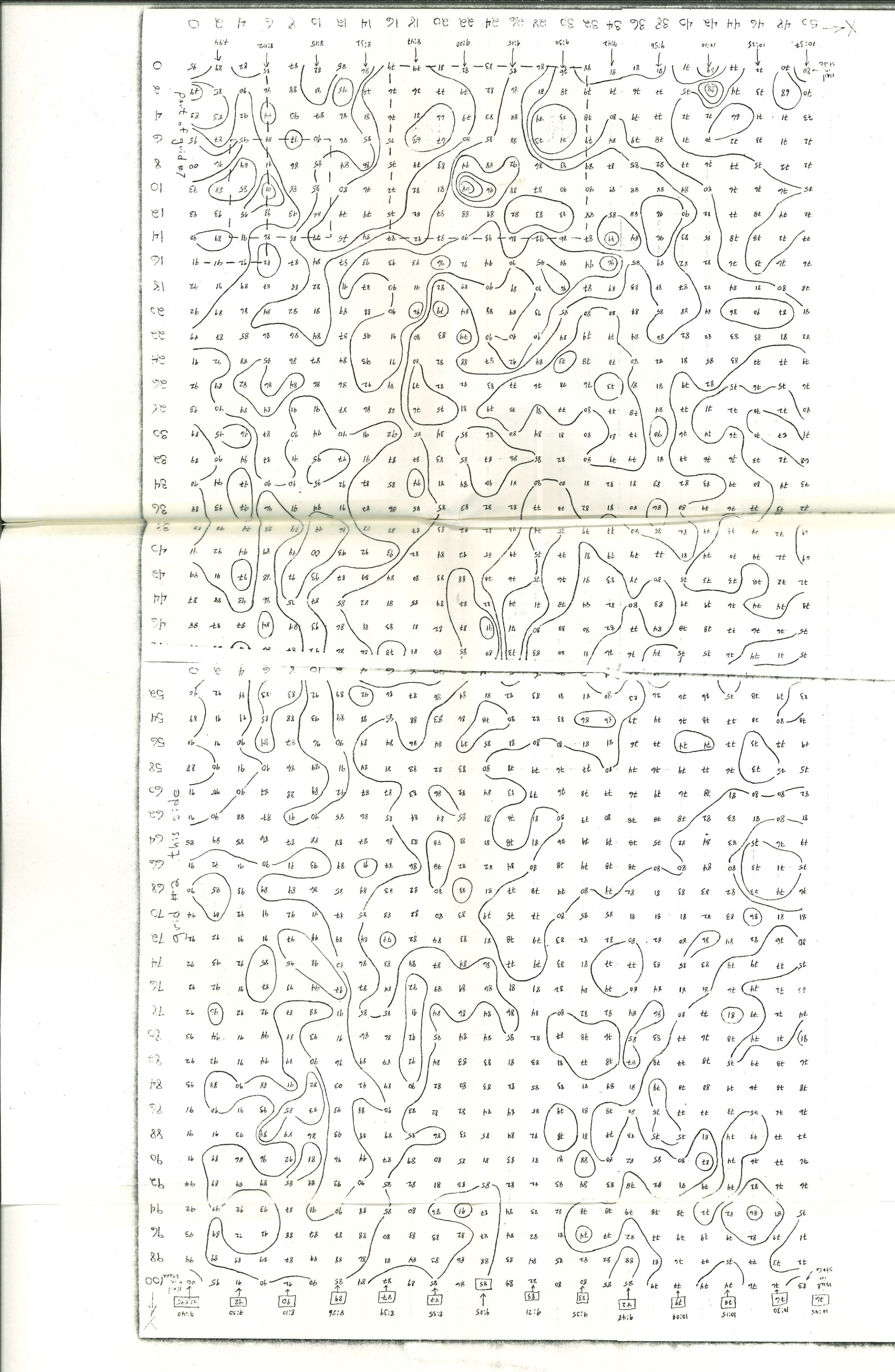
probe spacing = 2m

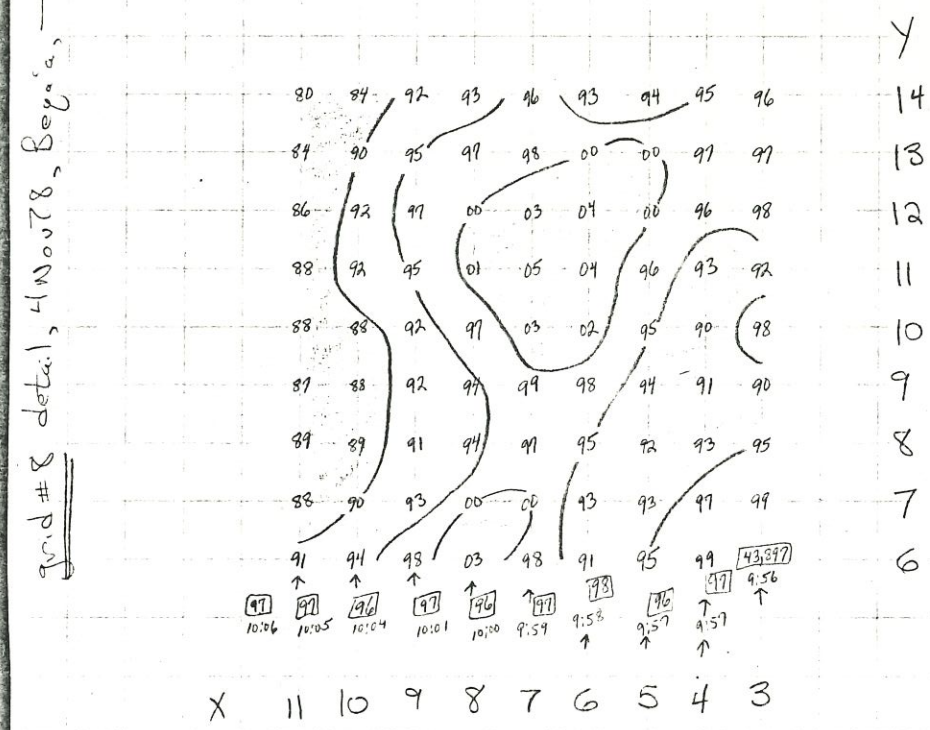
measurement recorded at midpoint of Wenner config.

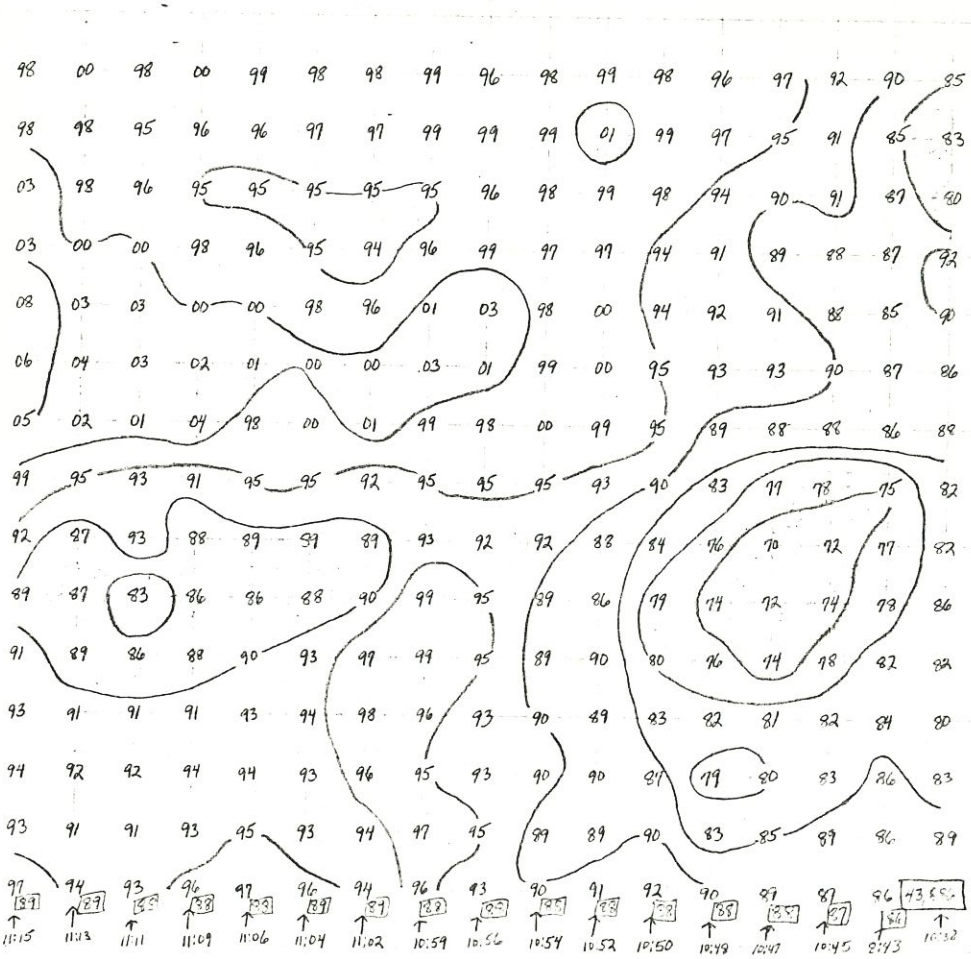


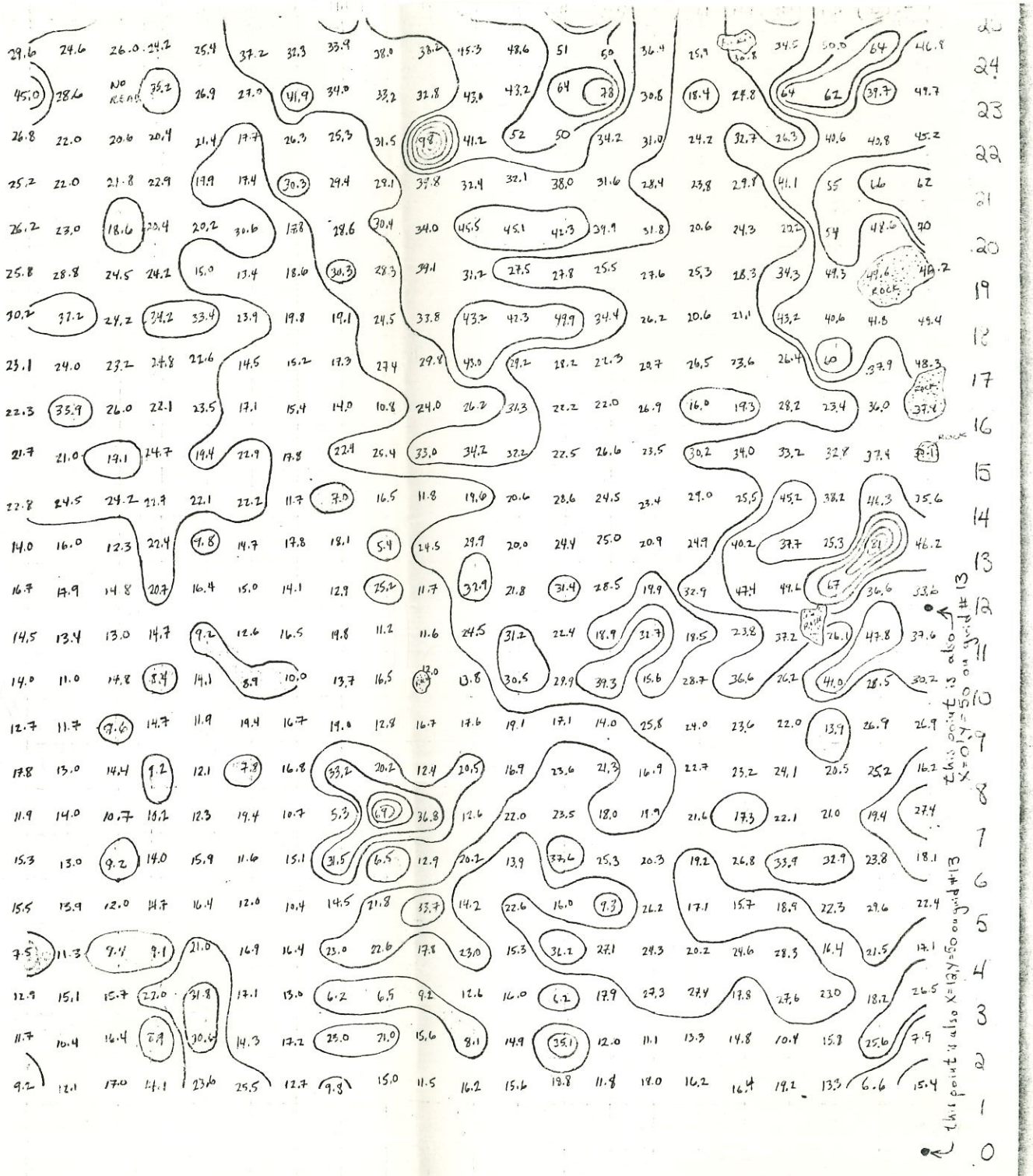

grid #8 ← | → grid #2
grid #7, 28 Oct 78, mostly duplicates #2 but at higher
46° (mag)

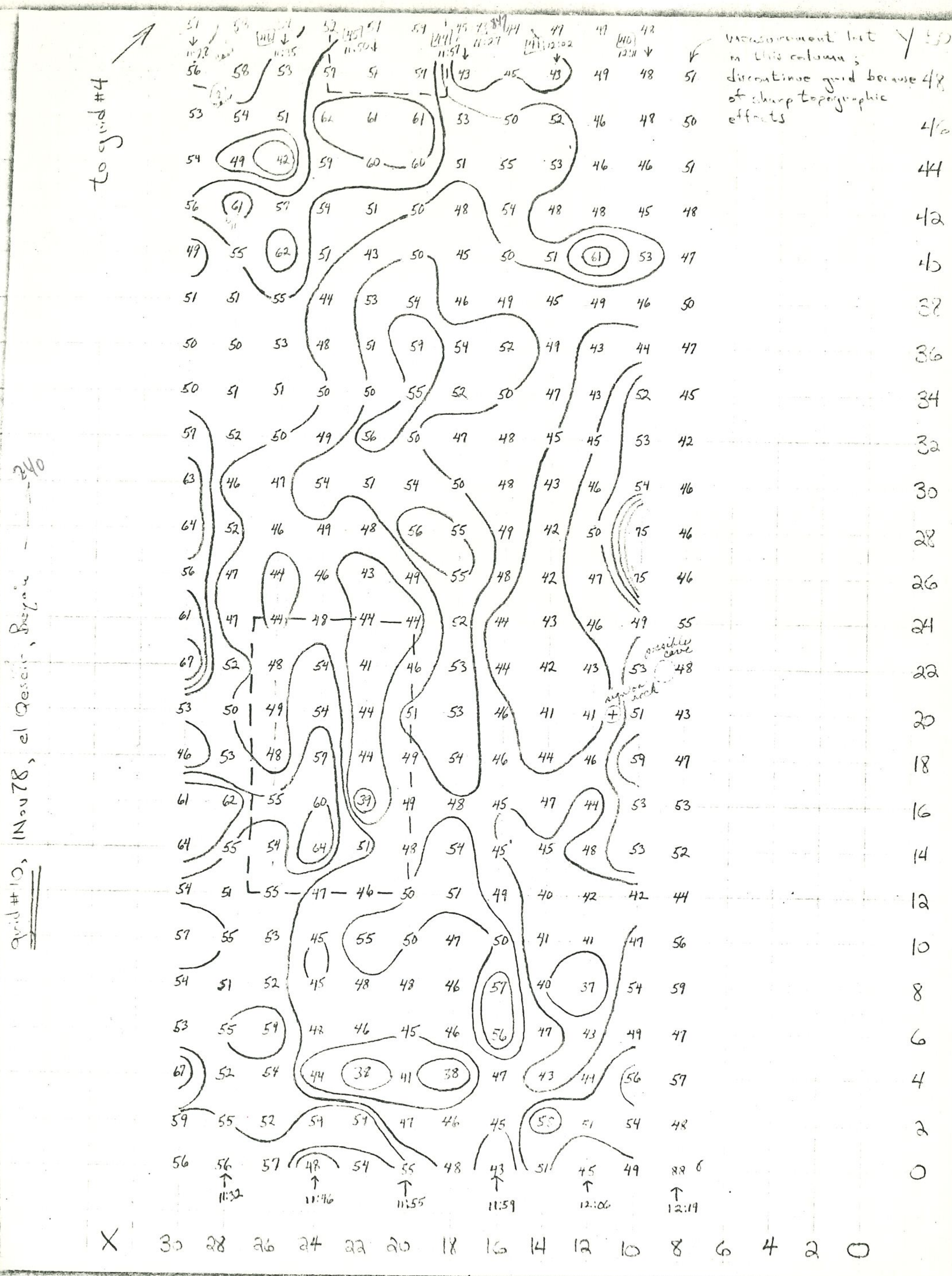
#8



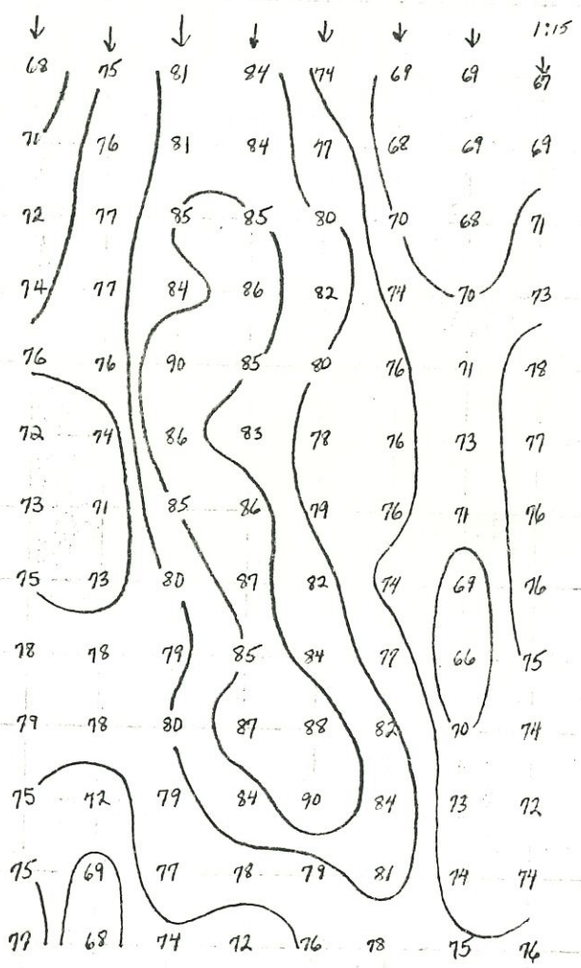

grid #8 detail, 4 Nov 78, Begin, → 226° (mag)
X 11 10 9 8 7 6 5 4 3
Y 14 13 12 11 10 9 8 7 6
10:06
10:05
10:04
10:01
10:00
9:59
9:58
9:57
9:57
9:56


Y
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
X
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
11:15 11:13 11:11 11:09 11:06 11:04 11:02 10:59 10:56 10:54 10:52 10:50 10:48 10:47 10:45 8:43 10:32


this point is also X=13, Y=50 on grid #13
this point is also X=0, Y=50 on grid #13
X 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0


grid #10, 1Nov78, el Qesein
to grid #4
measurement lost in this column; discontinue grid because of sharp topographic effects
possible cave
11:32
11:46
11:55
11:59
12:06
12:19
X
30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
Y
50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0

grid #10 detail, 9 Nov 78, Begaʻa, south hill, → S (mag)



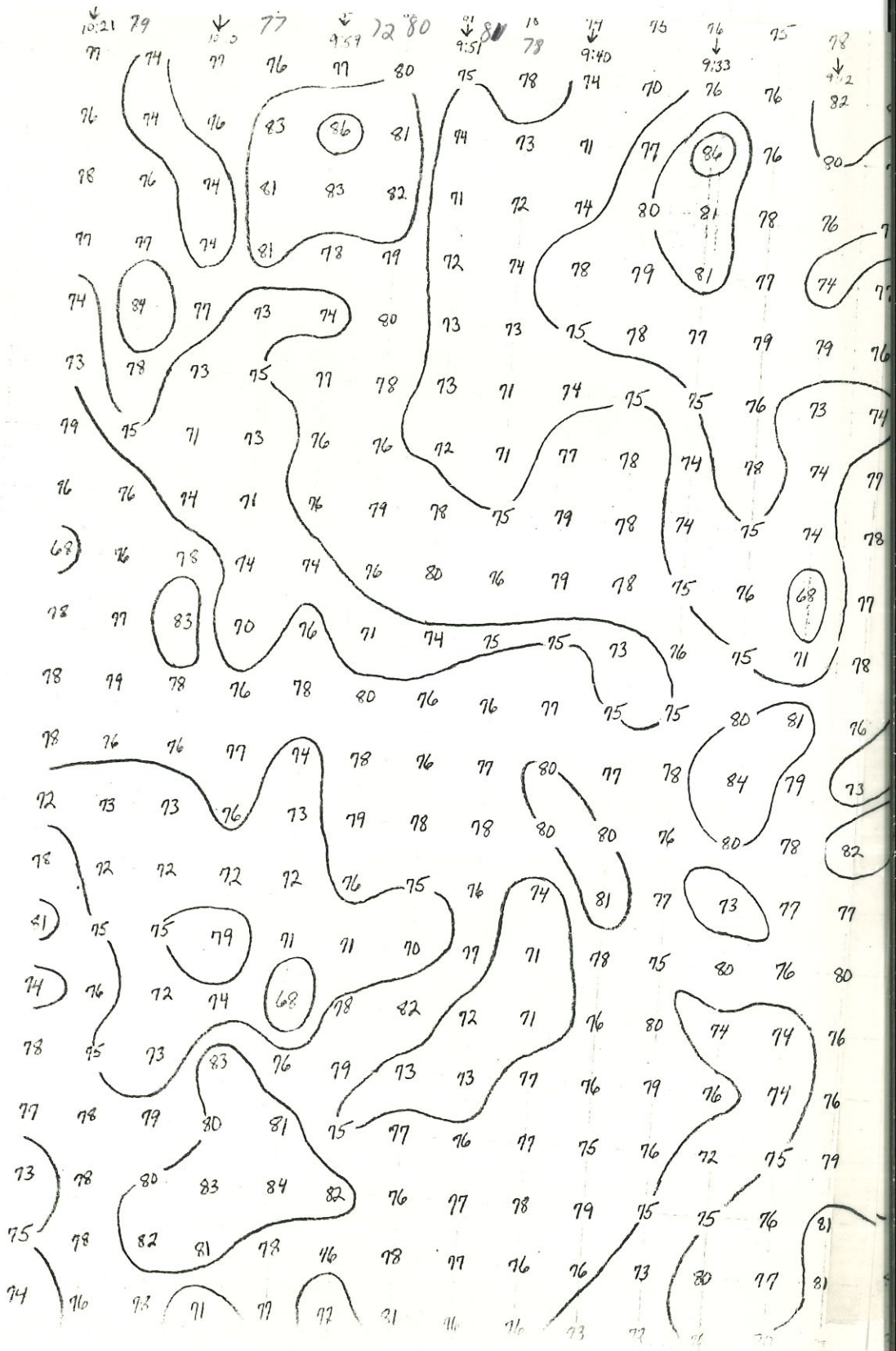
Y
24
23
22
21
20
19
18
17
16
15
14
13
12

X 27 26 25 24 23 22 31 20

Grid #11

Baghdad, 2 Nov 78 → 5° mag. al-North

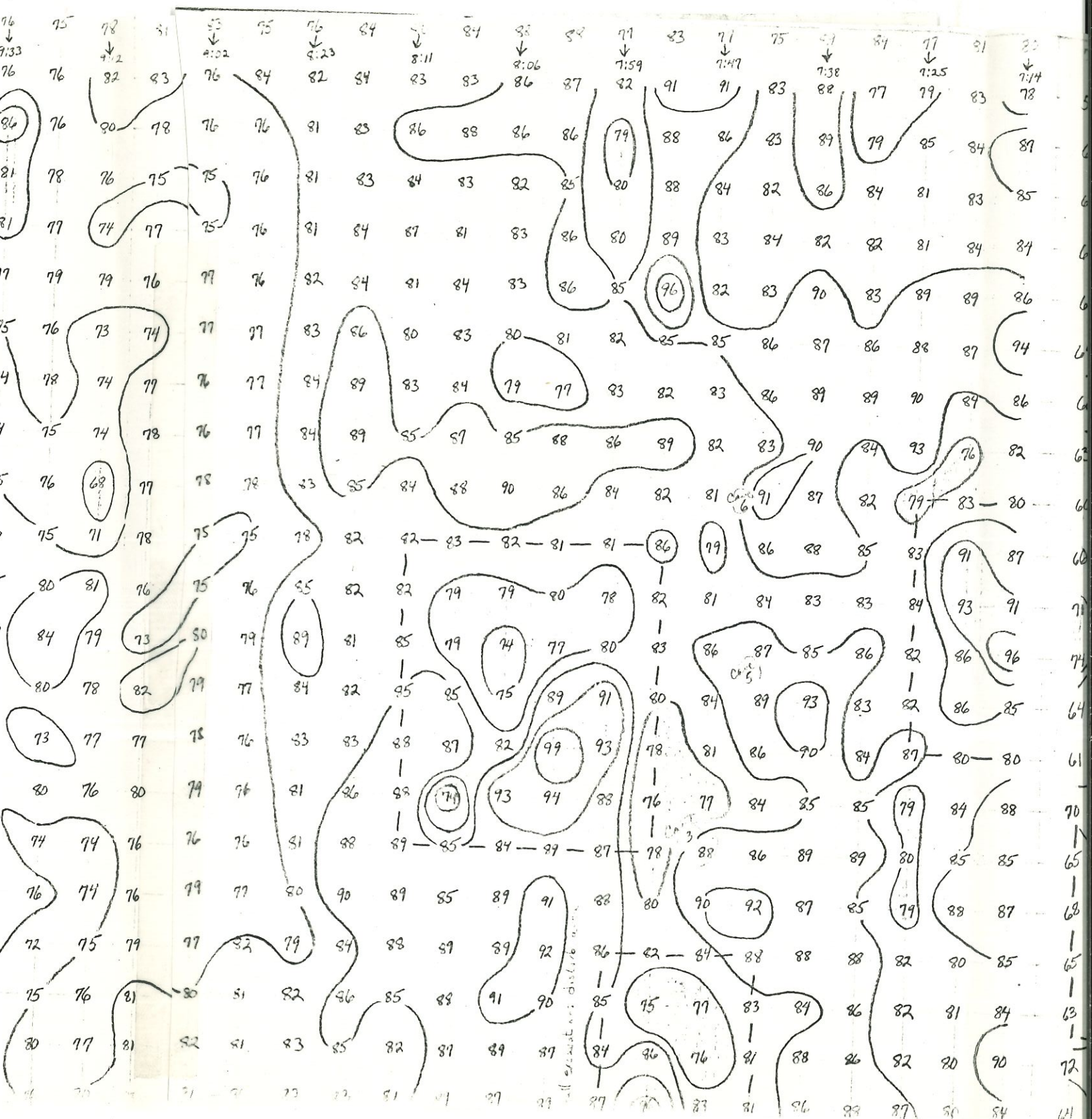
#11



Grid #11
Began 2 Nov 78 → 5° imag., al-Qesir

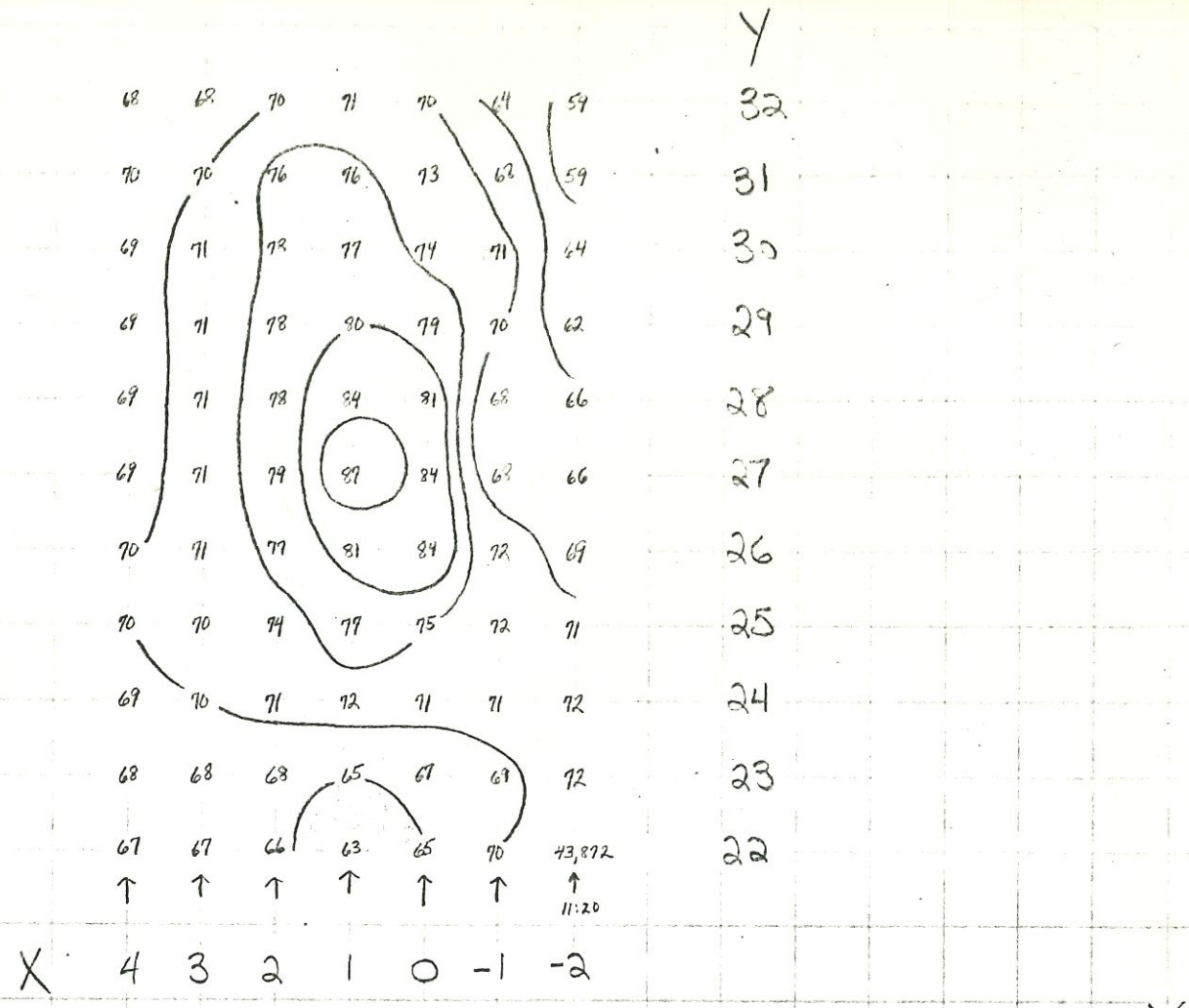
not surveyed at bottom

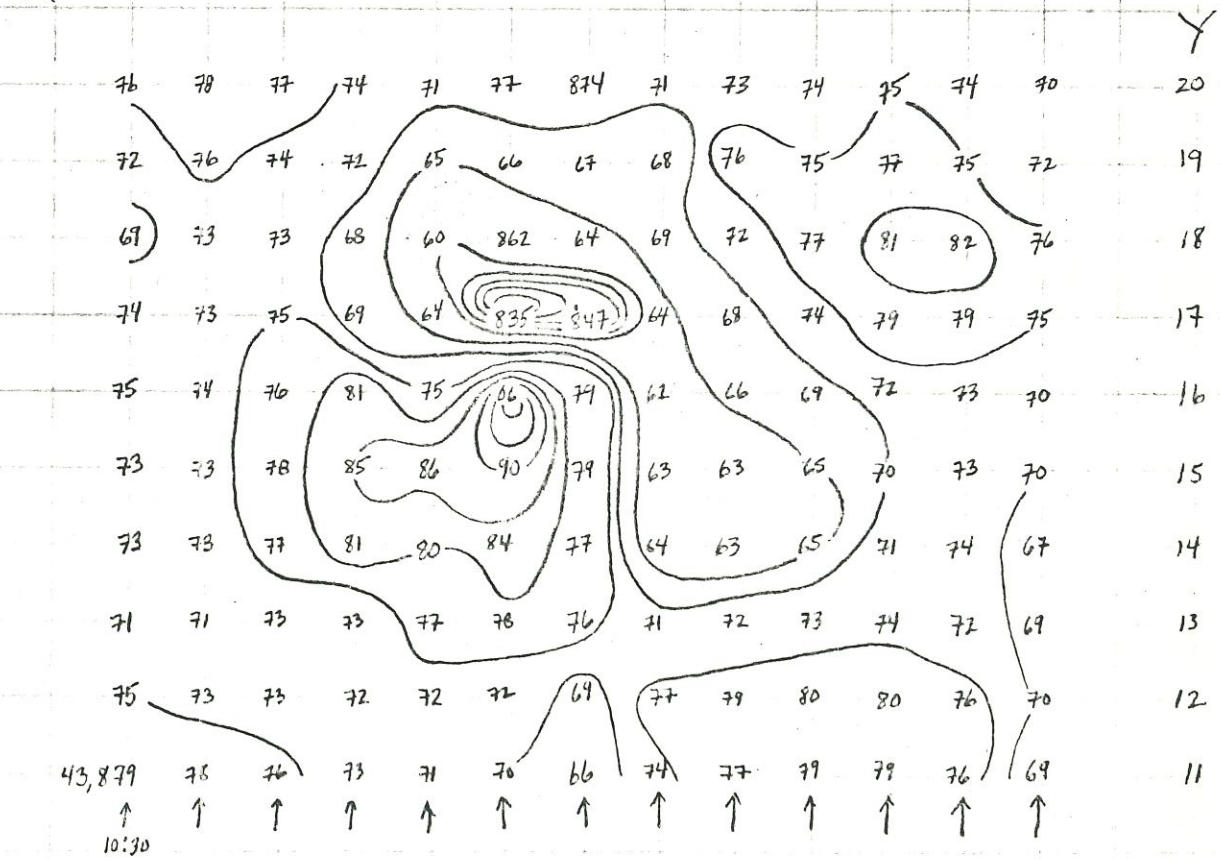
grid #4 ↓

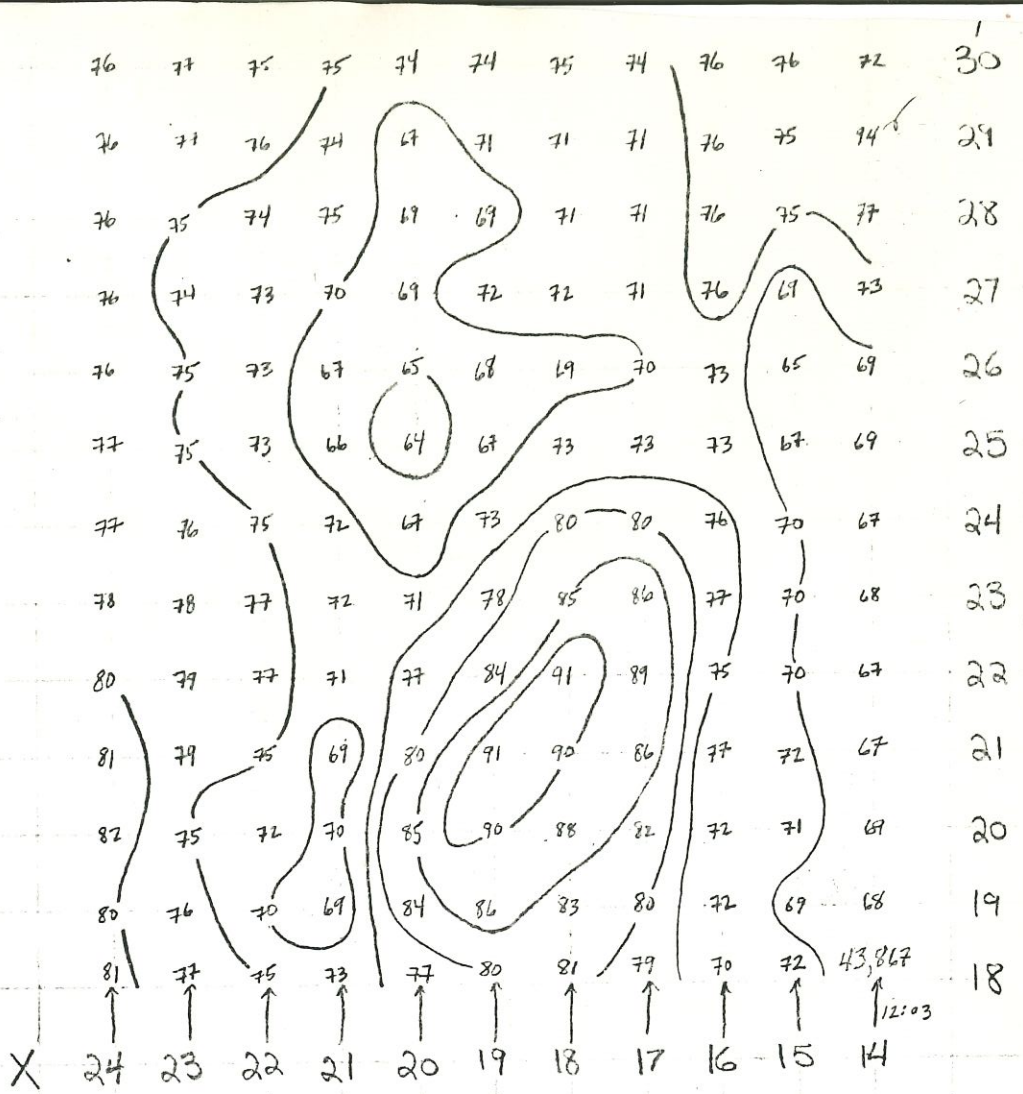


grid #15
on this side

Grid #11 detail, Begin, 1 Nov 78, → S (mud), south hill







excavations from tomb robbers disturb this area; no detail done

Grid #11 details, Beycesultan, South hill, 4 Nov 78, — 5' (unit)

#13

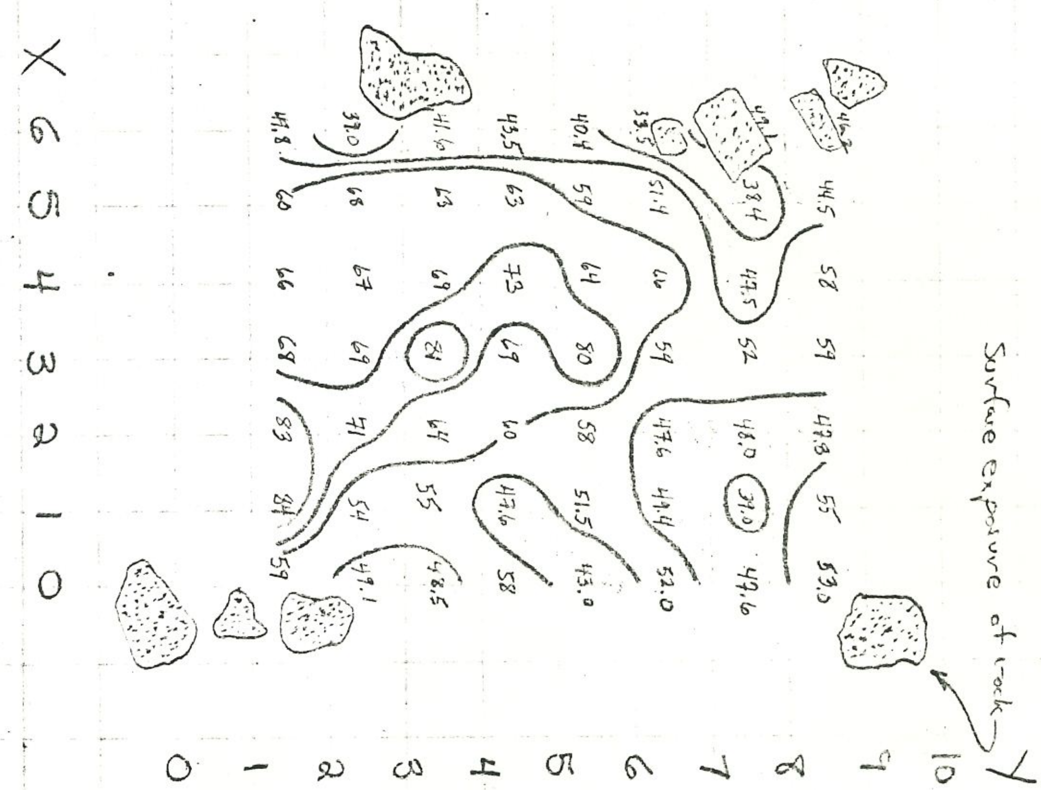
this point is also
X=0, Y=40 on grid #16

Grid #1a, 3 Nov 78, Beijing, → 92° (mag), inside Bronze Age rectangular enclosure (middle court)

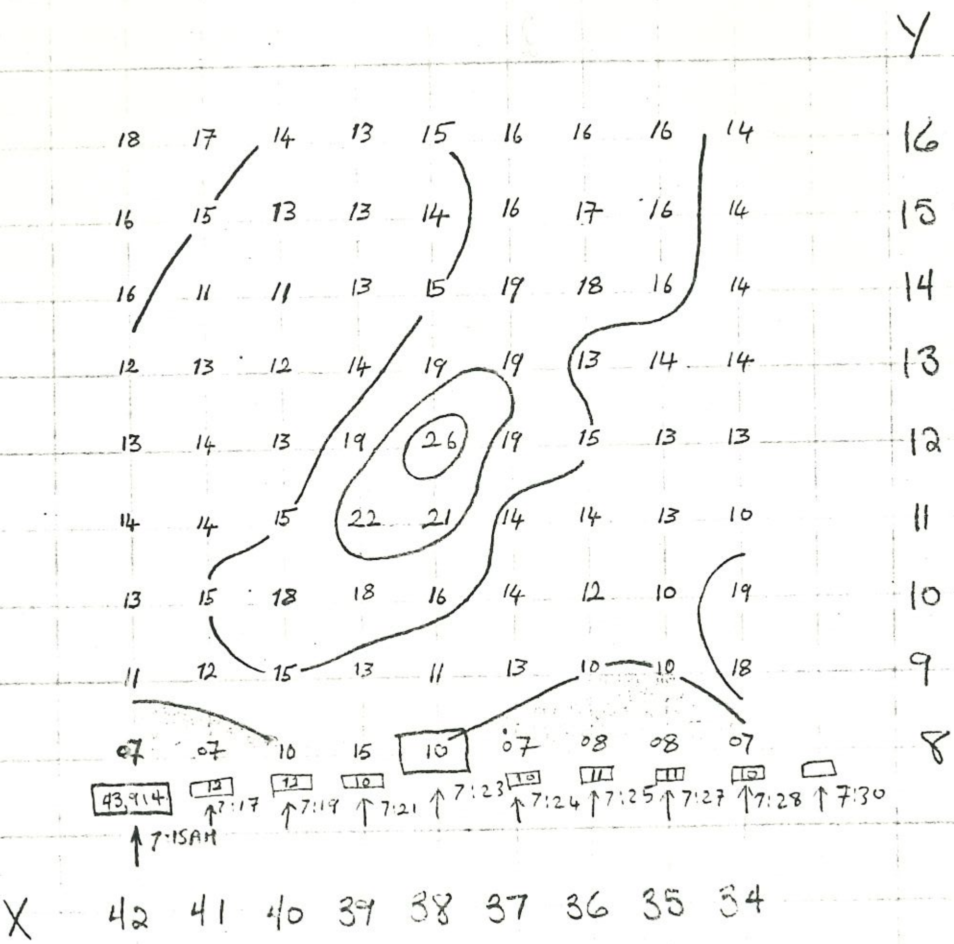
resistivity survey

probes of Wenner config, oriented E-W

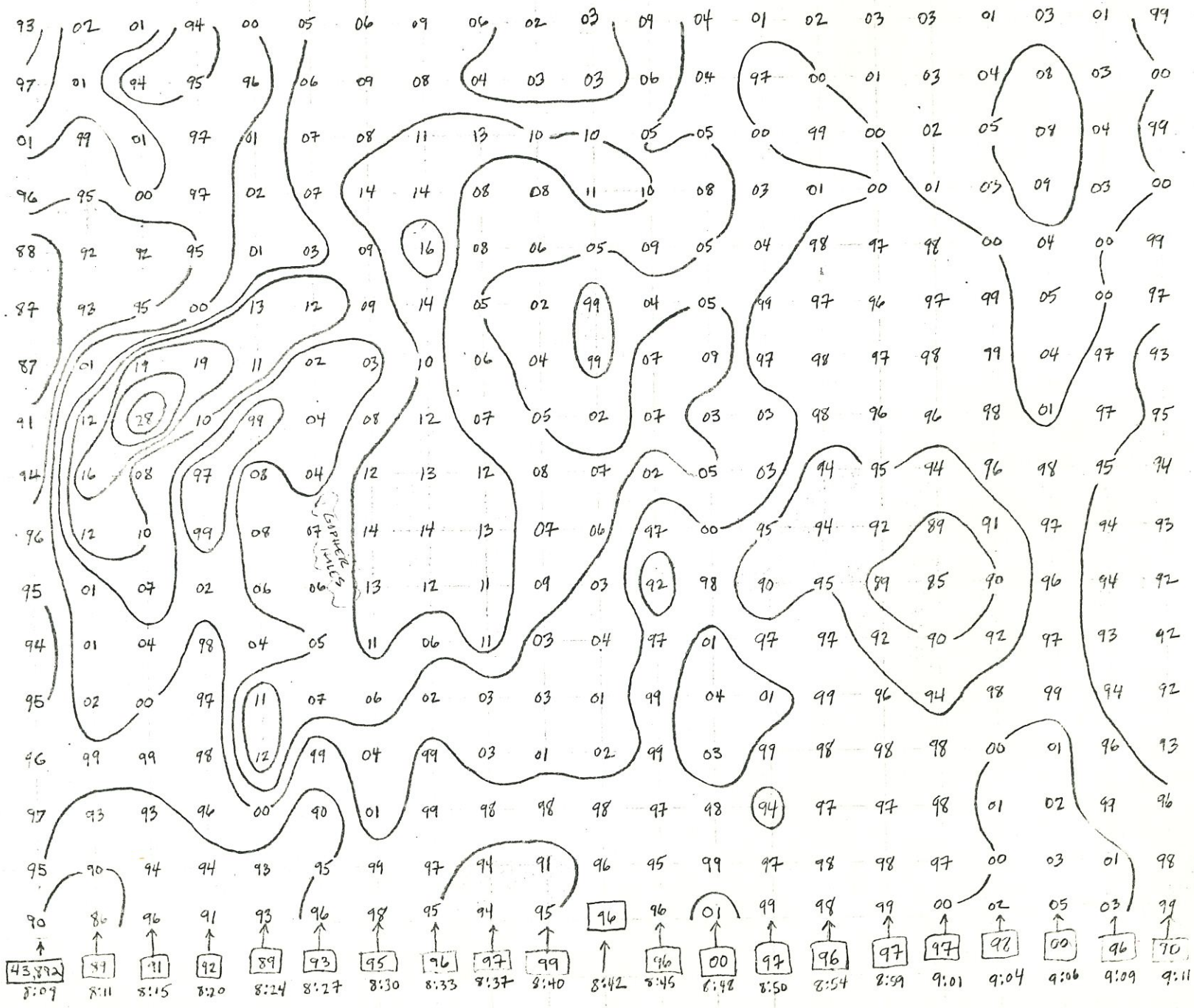
probe spacing is 1m, record at mid-array



grid #14 detail, 12 Nov 78, Bega a, north hill, → 46° (mag)



grid #14 detail, 12 Nov 78, Bega'a, north hill, ↑ 46° (mag)



grid #14 detail 12 Nov 78, Beg'n a, north hill, → 46° (mag)

Y \ X	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8
22	05	00	96	95	93	91	93	99	00	01	02	02	06
21	05	99	99	97	93	87	87	94	97	99	01	01	03
20	03	97	97	95	90	87	86	95	95	98	99	01	01
19	02	97	95	93	93	87	83	96	95	97	98	01	01
18	02	97	95	93	95	91	84	94	94	98	00	03	01
17	01	97	96	95	95	93	93	99	97	01	02	03	03
16	00	96	96	95	97	96	95	98	99	02	02	02	03
15	99	97	96	96	98	97	96	00	98	00	98	00	99
14	99	96	96	97	98	98	98	03	97	00	98	98	97
13	98	96	97	98	98	98	99	01	98	00	97	97	95
12	99	98	98	00	99	99	00	02	01	01	93	91	90
11	96	97	97	00	99	99	03	03	02	01	74	90	90
10	95	99	98	99	00	04	07	03	01	01	94	89	93
(boxed)	43913	11	05	07	08	07		04	07	09	07	10	07
(time)	9:30	9:32	9:45	9:46	9:50	9:52	9:53	9:55	9:57	9:59	10:00	10:02	10:04

#15

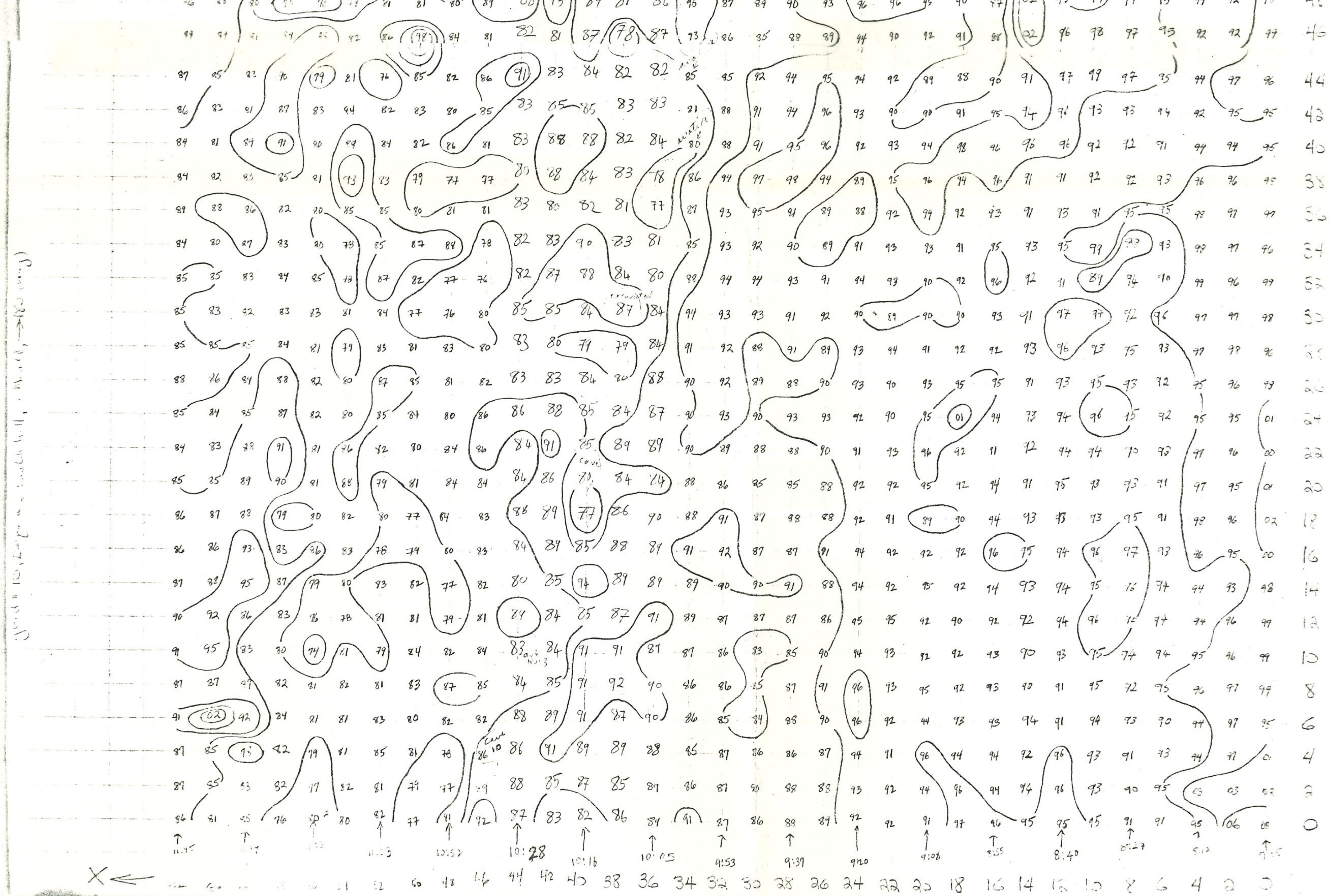
grid #11 on this side

2nd reference

shift reference

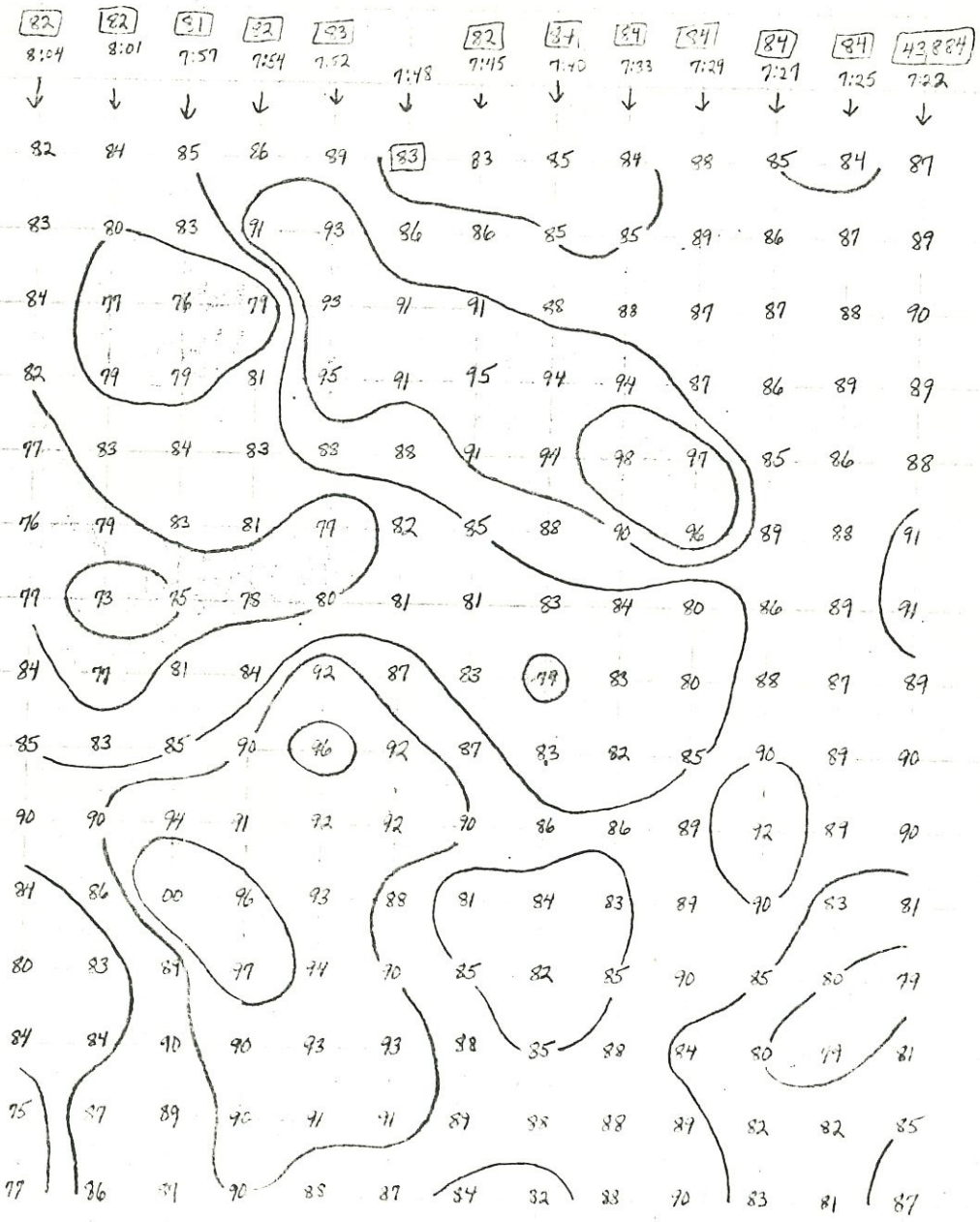
1st reference

Y



X←
44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0

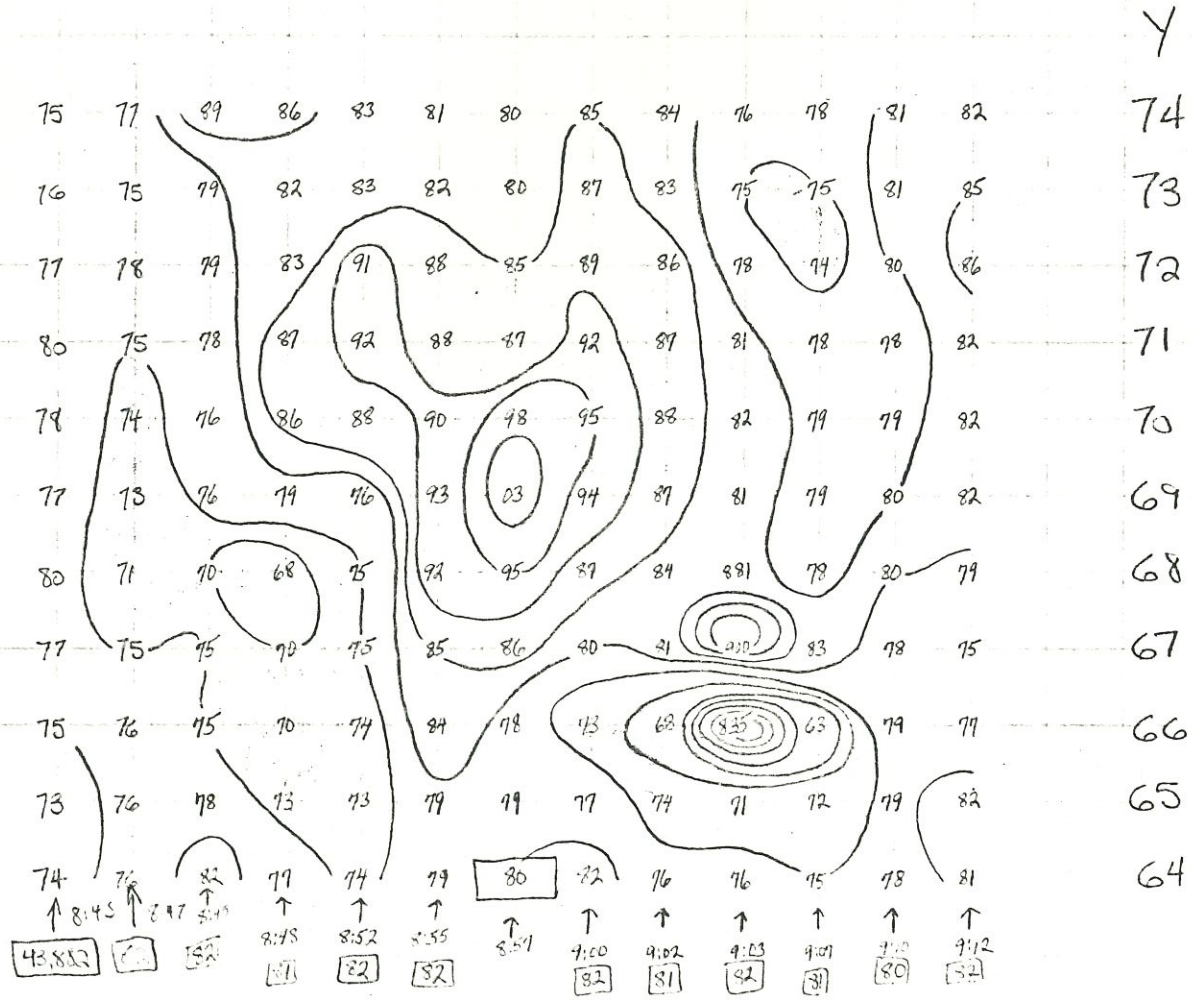
detail on grid #15, Begur, South hill, 9 Nov 18, → 185° (mag)



Y: 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56

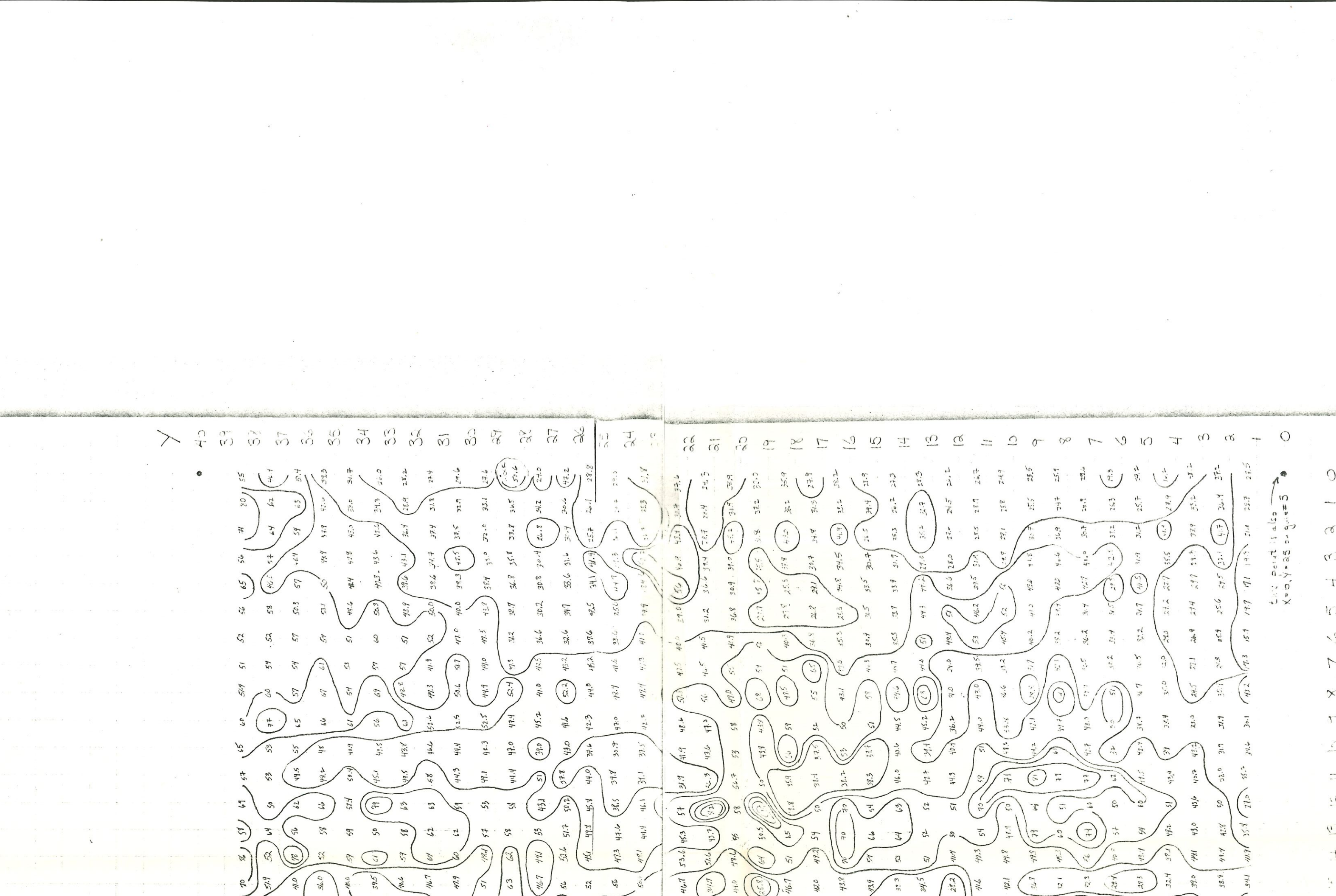
X: 52 51 50 49 48 47 46 45 44 43 42 41 40

detail on grid #15, Bogota, South Hill, 9 Nov 78, → 185° (mag)



16

#16



grid #17

11/12/78

NW Corner & NE corner + S rooms
Rujm el-Hamra (E)

↑ 5' E

↖ 314° W 8.5 m. to stake

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

0	71	50	46.1	49.8	43.9	45.1	43.3	32.6	34.6	29.2	34.0	34.3	37.7
1	37.7	[illegible]	31.8	35.2	42.5	45.4	38.5	32.4	34.3	25.1	33.1	32.3	46.1
2	16.1	22.1	19.2	22.5	32.1	35.3	34.6	39.6	43.2	34.5	39.8	32.9	49.1
3	23.2	19.7	20.3	22.3	19.6	26.2	33.9	31.1	40.5	35.9	39.4 ~~46.1~~	41.8	41.8
4	24.5	16.2	23.2	16.2	33.6	24.8	36.7	33.7	43.0	40.8	46.1 ~~41.7~~	40.6	46.2
5	20.6	23.8	19.6	23.2	57	13.3	38.3	22.5	42.2	46.7	41.7	51	41.2
6	20.4	29.2	23.0	16.8	22.6	33.8	26.0	39.8	29.6	55	39.0	50.0	56 ~~56~~
7	50	38.8	31.6	43.3	48.2	52	56	64					
21	62	50	51	47.2	40.1	46.0	42.8	51	41.0	47.0	37.7	61	
22	66	60	51	45.6	40.0	43.6	47.7	41.3	63	35.4	50	45.1	
23	80	74	68	68	51	56	53	63	46.1	70	42.0	51	
24	73	91	90	72	76	56	62	71	53	82	41.4	56	
25	97	77	71	63	70	67	63	66	58	71	56	57	
26	93	86	58	64	54	55	52	49.0	41.0	53	55	45.4	