308 --- 0199702060003
Scientific Notebook #23

SANTORINI

RECORD

Ron Green

CNWRA
CONTROLLED
COPY 23

Ronald Green = RG

Kenneth Ryan = KR

11/1/94 This Notebook will contain field
RH notes for the Natural Analog
Research Project.

RH
11/1/94

2/25/91 9 AM RH

Went to University of Chile & met w/ Nelson & Javier

Phil Godell
Bill Murphy
English Pedrey
Ra Lee

Discussed plans for visit.

Javier Allamirano
Alta Minera Exploracion Asesoria

Warehouse at Pena Blanca has most of core & cuttings
core is NX (~2½")

Aldua (on east side) is site of pilot plant (i.e. yellow cake)

About 100 km of 2/25/91 RH drillholes that averaged less than 100 m of depths (by Ironex) RH 2/25/91
plus earlier 120 km of borehole



Well logs had:

- ore grade
- depth
- location
- γ-logs

some of this information is on a computer base & has been correlated, this information is on computer disc (this is available)

There is also 15,000 km of Carlone exploration data of the Pena Blanca

2/25/91 RH 4 RH 5,000 km² of airborne radiometrics by KS 2/25/91

Some air photographs are available at 1:1000 & 1:5000

Maps of mines are at 1:5000

Topographics are at 1:1000

Geologic maps are available with rock type but not alteration, there are maps

Bill M explained the basic & limit of the Natural Analog project.

Exploitation at Margarita by CFM
- permission has been granted
Guillermo Rose is el Jefe

Exploration at Napal by CRM
- no permission yet, they will call Mexico City
Enrico Guzman is el Jefe

2/25/91
Ronald Green



PM
2/25/91
RG

Visited a vista east of Chihuahua, to the east of the Santa Eulalia mine, at hill w/ radio towers.

Photo #1 $\boxed{\text{roll 1}}$
panoramic view to the north, NE of Sierra Pena Blanca

Photo #2 N toward Sierra Pena Blanca

Photo #3 NW of Sierra Pena Blanca

2nd Panoramic view from knoll about 300-400 m east of radio tower

Photo #4 ENE
Photo #5 NE
Photo #6 NW
Photo #7 WNW

to show the transition from the playa to the east of Sierra Pena Blanca, across Sierra Pena Blanca, to the graben west of Sierra Pena Blanca.

2/25/91
returned to Ciudad Chihuahua, Ronald Green

2/26/91 RH Field trip to Peña Blanca from the west

Along road into Sierra Peña Blanca

11 AM Roll 1 Photo #8 contact of [illegible]abase dike & Corrales

Photo #9 } Corrales w/ fractures
Photo #10 } and alteration along fractures

Photos are in 3-ring binder w/ English Pearcy

On field trip are:
English Pearcy
Bill Murphy
Ron Green
Duncan Moss UTEP
Phil Goodell "
Nacho Reyes "
Javier Altamirano

Photo #11 Vista view of playa to east of Sierra Peña Blanca, about 1-2 Km east of Camp Nopol facing east



Same location
Photo #12 facing west toward cliff; Nopol 1 level ~~1~~0, adit
RH 2/26/91

Photo #13 immediately inside adit to the right, level 0 at end of tunnel. w/o flash

Photo #14 same spot as Photo #13; w/o flash

Photo #15 - camp lunch

Photo #16 & #17 immediately inside adit to the right at end of tunnel, pitchblend

Photo #18 E. Pearcy at work

Photo #19 facing west, Bill M pointing to northern limit of alteration (see arrow) about 8 m north of adit opening

Photo #20 on first level above Nopol 1 facing west showing excavation face w/ some alteration

Photo # 21 & 22 on 2nd level above Nopal I facing east looking down on first level to show alteration transition zone on top of the breccia pipe at Nopal I

Photo #23 on 2nd level above Nopal I facing west looking at Cerro Nopal

Photo #24 on 2nd level looking down on first level, same as Photos # 21 & 22

Photo #25 on first level above Nopal I facing east looking at trench showing alteration transition zone of breccia pipe

Roll #2

Photo #1 at end of road at Margaritas Pit. Facing south looking at excavation face w/ alteration zone, most massive alteration

Photo #2 scree boulder of jarosite w/ alteration on floor of Margaritas Pit



Photo #3 facing north at end of road; 200m north of Margaritas pit; C Peavy collected a sample at the photos location, the photo location is at an excavation pit ~ 4m deep cut-out, sample is thought to be Maraganite

Photo # 4 - 25 not controlled

Roll 3

Photo # 1 - 7 not controlled

Photo # 8 - 12 not controlled

Ronald Hess
2/26/91

2/27/91 RJ

Field trip to Sierra Pena Blanca
Phil Goodell, Duncan Ross, Nacho Reyes, Javier A. Ron Green, Bill Murphy, Enghil Peary

Photo # 13 Puerto 1, showing tailings pile w/ head works, facing north

Photos # 14 + 15 from road facing NE toward massive Mesa formation cliff, one photo (#14) wide ∡ and #15 using telephoto, rock sampled

Photo # 16 facing NE at the base of the massive Mesa formation cliff, the red formation is of the Pena Blanca formation, rock sampled

Photo # 17, 18, 19, 20 along stream bed with exposures of the Colorados showing alteration zones along fractures, open, closed & filled Boquilla Colorado stream

Photo # 21 along Boquilla Colorado stream, Colorados formation stream exposure of tuff with conglomerate of inclusions



Photo # 22 facing north along Boquilla Colorado stream showing prominent cliff of Nopal formation, sample location.

Photo #23 & 24 looking east & west from notch on Questa 2 Vista shots

Photo # 25 on notch of Questa 2 facing north at adit mouth located in alterated zone, near 60 anomaly

Roll 4

Photo # 1 from van at road, facing SE toward notch on Questa 2

Photo #2 & 3 located near road, ~~road~~ RJ Spring 2/27/91 spring is actually a stream bed that acts as an expression of the groundwater table. Spring ~2gpm at weir, La Parrita spring

Photo # 4 facing north toward adit mouth of Yellow Cave

Photo #5 facing east from adit mouth of Yellow Cane toward Denels Lake

Photo # 6, 7 & 8 Vista view from mouth of adit of Yellow Cane #6 is south, #7 is SE, # ~~7~~ 8 is to the east RH 2/27/91

Photo #9 is part of Vista, from same vantage as 6, 7 & 8 but to the SW

Randall [illegible]
2/27/91



2/28/91 RH Field Trip to Sierra Pena Blanca Bill Murphy, Ron Green, English Peavy, Phil Goodell, Nacho Reyes

Photo #10 Ranch well located in plain to east of Nopol 1, well head closed but rancher told me that depth to water was about 200 ft

Photo # 11 Inactive mining well located along canyon road about 1½ Km east of Nopol 1, depth to water not known but it took a pebble 8 seconds to reach water

Photos # 12 & 13 facing west from road, about 0.8 km east of Nopol 1; both of Nopol 1 RH 2/28/91

Photo # 14 & 15 facing west from knoll about 0.5 km RH 2/28/91 east of Nopol 1; both of Nopol 1

Photo # 16 & 17 facing west from knoll (south of 14 & 15 knoll) about 0.5 km east of Nopol 1

Photo #18 facing north in excavation pit at base of Nopal I showing alteration, Dill is scale

* Note earlier photos from 2/28/91 may not be numbered corrected, need to check after development Photo #18 is correct

Photos #19, 20 & 21 taken from upper western lip of excavation pit at base of Nopal I, 19 facing S ~~E~~ 2/28/91 20 facing SE & 21 facing S

Photo #22 Visto from Nopal I facing NE

Photo #23 10m level of Nopal I facing west showing lithofacies of Nopal formation

Photo #24 Close views of alteration along fracture zone in Nopal formation on 10m level of Nopal I facing west

end of Roll 4

Roll 5



Photo #1 10m level of Nopal I facing west showing alteration contact of semi horizontal fault (reddish color) with white host rock

Photo #2 on surface of 10m level at Nopal I showing slickenside

Photo #3 10m level of Nopal I facing west, same as Photo #1 but close up.

Comments on Groundwater

Well at La Parrita Spring: water level in well appears to be similar to level of stream bed in which the La Parrita Spring is located or about 1670m above sea level (as estimated using topo maps El Sauz). Stream had very low discharge. No pump on well.

Wells at road intersection near Margaritas Camp. Depth to water is greater than 200 ft (total length of tape). Surface

elevation is about 1920 m above sea level. The pumps is RH 7/23/92 fairly large indicating possibility of substantial water flow. Electric pumps

Well along road to east of Nopal I located about 1 km ESE of Nopal I. It took a pebble 8 seconds to hit water - diesel pump inactive ground elev 1340 m

Well in western edge of valley to east of Nopal I; ground elevation about 1250 m above sea level using El Sauz topo map. Rancher told me that it was over 200 ft to water. diesel pump.

Rolls 5 cont

Photo #4 example of flow at Nopal I

Photos #5 & 6 facing west; ~0.5 km north of El Tigre stream or main road of sampling outcrops of Esquedra formation

Ron Green
2/28/91



4/18/91 RH

Winnemucca, Nevada & trip north

Ron Green
Bill Murphy
England Peavey
Steve Castor
Bill Ott

@ Jim LaBrett

- Jim has considerable borehole data w/ groundwater elevations includes: latitude & longitude; hole depth & depth to groundwater

approximately 300 boreholes of which groundwater depth was recorded at about 200 of the boreholes

depth to groundwater measurements were made in 1977-79

checked about 6-8 boreholes. The 4/18/91 groundwater elevation was about 5000-5200 msl and the mineralized zones with the Porcelain Rhyolite were about 4600-4800 msl thus

it appears the mineralized zone is below the water table at this time.

Jim LaBrett said that there were some places, however, where the mineralized zone is a few feet above the water table.

Roll #1

photo 1-1 rocky for core at Jim LaBretts house

photo 1-2 English looking into core box of core from south drill area at Horse Creek

photo 1-3 piece of core (breccia) from core box shown in photo 1-2

photo 1-4 core rack showing open core boxes

photo 1-5 3 chip boards w/ Jim LaBrett & Steve Costa for scale



photo 1-6 board w/ rocks & unit names

photo 1-7 Horse creek, on hill looking east at road cuts

photo 1-8 Horse Creek, on hill, looking south east at road cuts

photo 1-9 Horse Creek, on hill, looking west toward Kuiper Creek valley

photo 1-10 Horse Creek, further up hill & further up creek looking southwest at road cuts in side of hills, lowest road cut on right is vantage pt for photos 1-7, -8, -9

photo 1-11 south of Horse Creek on road to south area; facing north toward massive outcrops

photos 1-12 and 1-13 Roughly perpendicular views of the Moonlight Mine from the north (12) and west (13). Taken by Murphy.

photo 1-14 Adit for moonlight mine, facing north

photo 1-15 on top of outcrop on top of Moonlight mine, facing north

photo 1-16 same as 1-15 but moved south about 50m & aimed slightly NE

photo 1-17 sign for Moonlight Mine on mine camp shed.

Ronald Heen
4/18/91



4/19/91 RH

Photos 1-18, 1-19 photos of Denio Junction (1-18) and Denio, NV (1-19) from a distance

Photos 1-20 Virgin Valley opal beds, facing west, near top of slope, face had scintillometer readings ~5K

Photo 1-21 Virgin Valley, opal beds, facing west, same location as photo 1-20 but view from the road

Photo 1-22 & 1-23 Virgin Valley, opal beds, lower (1-22) and upper (1-23) shot of opal beds

These beds are part of what Steve Castor refers to as the 'brown opal beds'. The elevation of these beds are presently about 75 ft above the base of the valley. The valley has water present in its base. The stream may be ephemeral but appears to be significant enough to have water

all year long. The sample zone is obviously well removed from the saturated zone

Photo 1-24 Virgin Valley, close up of 'green bed' about 8-10m below the 'brown opal beds' facing west

Photo 1-25 Virgin Valley, facing north, showing exposure of opal beds in foreground & basalt capped flows in background. Water in base of Virgin Valley is also viewed

Roll #2

Photo 2-1 Virgin Valley in wash off west of main road, facing south or southwest, looking at green beds

Photo 2-2 close up shot of photo 2-1

Photo 2-3, on top of rim overlooking location of Photo 2-2 (in foreground) In background are basalt capped mesas. Facing south



Photo 2-4 Virgin Valley, on east side of Valley, behind Peacock Mine offices, opal vein

Photo 2-5, 2-6, 2-7 same location as 2-4 but taken from inside the small adit by Steve Caston

Photos 2-8, 2-9, 2-10 photos taken of Steve Caston exiting adit.

Photo 2-11 10m west of adit, hand mined pit exposing opal beds

Photo 2-12, on top of mound behind adit, looking Northwest toward location of 'brown opal beds' and green layer in photos 1-20 to 1-25

Rod Heaton
4/19/81

9/24/91 Pena Blanca

RA

walked into wash from east with Nacho Reyes & Castilo Molino. Sounded mining well in wash ½ way between Nopal I and local well located in western edge of 9/24/91 RA ~~Que~~ Cuervos Valley.

Marked tape with green magic marker and with red surveyors flagging tape. Will measure distance of wire after returning to Chi. Sounded well at 12:10

Roll 9-91-1

photo 1, 2, 3 were taken of Nacho and Castilo sounding well w/ 200m electric tape

There was a very distinct electric signal when we encountered groundwater. Pump on well was piston type but was about 2 inch



piston set in 8-10 inch well casing. Sounding line was lowered between the pump casing and the well casing.

RA 9/24/91

Photo ~~X~~ 4

RA 9/24/91 level 0, Nopal I, facing ~~East~~ west looking at adit mouth, 12:50 PM

Photo 5, on top of Nopal I site, looking west toward Nopal Cap 1:50 PM

Photo 6 & 7 Nopal I, level +20 looking south, down onto level +10 showing exposure of breccia pipe and absence of vegetation 2:45 PM

Photo 8 & 9 Nopal I, level +20 looking east, down onto level +10 showing exposure of breccia pipe and absence of vegetation 2:55 pm

Measured depth to water to be 281 ft
Ronald A Green 9/24/91

9/25/91 RH

Photo 10 & 11 El Mezquite spring facing NW close up view of spring w/ stone fence.

Ronald Hoffer 9/25/91



9/26/91 RH

Photo 12 – Nopal 1 picture of water sampling baler, it had been constructed by Castle Nolino of PVC tube and brass check valve, the PVC fitting was glued to PVC tube, check valve was screwed onto PVC fitting. Fibrous twine was attached to baler

Photo 13 Nopal 1, +10 level facing south looking at carbonate vein w/ 6" ruler

Decided to evaluate boreholes at back edge of +10 level. A total of 19 open boreholes were identified, some of which were covered at surface, others weren't. Borehole were numbered from BH-1 to BH-19 and marked on +10 wall with a magic marker. Following are levels measured at boreholes

| | Borehole | depth to bottom | depth to water | elevation of top of borehole | water elevation |
|---|---|---|---|---|---|
| | BH-1 | 4'6½" | DRY | | |
| | BH-2 | 25'6" | DRY | | |
| | BH-3 | 27'7½" | DRY | | |
| | BH-4 | | ~~29'10.2"~~ RA 9/26/91 | | |
| | BH-4 | 30'5" | 30'3" | | |
| | BH-5 | ~~32'11.8"~~ RA 9/26/91 | | | |
| | BH-5 | 32.98 | 32".70 | | |
| * | BH-5.1 | 36.44 | 33.92 | | |
| | BH-6 | 32.28 | 31.91 | | |
| | BH-7 | 38.68 | 37.13 | | |
| [1] | BH-8 | 38.69 | 36.58 | | |
| | BH-9 | 31.34 | dry | | |
| | BH-10 | 19.32 | dry | | |
| | BH-11 | 36.65 | ~36.5 [1] | | |
| * | BH-12 | 38.30 | 22.75 | | |
| | BH-13 | 38.77 | dry | | |
| * | BH-14 | 37.02 | 33.78 | | |
| | BH-15 | ~5.0 | dry | | |
| | BH-16 | 31.58 | dry | | |
| | BH-17 | 36.46 | dry | | |
| | BH-18 | 23.60 | dry | | |
| | BH-19 | 27.02 | dry | | |
| | BH-1 | 19.20 [2] | dry | | |
| | BH-2 | 24.40 | dry | | |
| | BH-3 | 27.78 | wet [3] | | |
| | BH-4 | 30.45 | see above | | |



Noted rule was in 100ths of foot at BH-5

Photo 14 - plant w/ 29 ft root that was found in BH-6

Photo 15 - view of BH-3

[1] meter did not register but came up with 1½" end of tape wet

[2] Obstruction in BH-1 at 4½" was dislodged, hole was actually 19.20 at time of measurement

[3] Weight at end of tape was wet

Photo 16 - view of BH-12

Ronald Green
9/26/91

9/27/91 RS

Holes are labeled right to left facing cliff. One additional borehole was found between BH-5 and BH-6 and it was labeled BH-5.1

It looks like BH-12 and possibly BH-5.1, BH-8 and BH-14 can be sampled for water.

Photo #17 Caliche, Nopal I 25m South of adit on level 0

Photo #18, same as #17 different angle

Photo #19 location of cores A1 & A2

Photo #20 location of cores D1 & D2

Photo #21 location of cores B1 & B2

Photo #22 location of cores C1 & C2 By 9/27/91

all 4 cores are on 0 level Nopal I 20-25m south of adit

Photo 23 & 24 & 25 not controlled



Nacho survey elevation and location of the 20 boholes. Those locations and elevations will be indicated on his detailed plain-table maps and sent to CNWRA

Ronald Green
9/27/91

10/2/91 RFF

Note that the electric sounding tape would indicate water only when electrode at 7 inches from tip was wetted, thus all depth-to-water measurements have to be adjusted.

Likewise, weight at end of tape used to measure depth of borehole was 1½ inches longer than the tape. Those measurements also have to be adjusted

Ronald F. Fisher 10/2/91



6/23/92 RFF

Arrived at Abaturi site at noon. Visited site

Roll 1 Photo 1
view of top of excavation site roof illustrating depth of excavation. Note: site is virtually completely below current ground surface

1 Photo 2 13:45
looking North across caldera at Tibora

1 Photo 3 13:50
road cut 1 km west of Abaturi showing overlying lahar around rock fragment

1 Photo 4 14:00
road cut, dirt road 1 km west of Abaturi contact of ash fall & paleosol (?) w/ possibly 2 generations of rock fences

1 Photo 5 same dirt road contact of ash flow on paleosol

1 Photo 6 over crest a dirt road facing SE, showing hilltop reservoir & terraces on ht.

1 Photo 7 looking SE on knoll overlooking Akrotiri site

1 Photo 8 looking E on same knoll toward metamorphic knoll w/ caldera on left

1 Photo 9 looking S showing headlands at SW end of island

1 Photo 10 closer on knoll near Akrotiri site

1 Photo 11 south end toward Thira across caldera

1 Photo 12 south end facing SE headlands

1 Photo 13 south end toward lighthouse 15:35

1 Photo 14 pumice layer on paleosol at south end of island showing fractures in pumice layer w/ possible calcite leachate flow into paleosol



1 Photo 15-16 16:15 dirt road to Kambia beach, ~100m SE of crest, road cut, green alteration of pre-minoan volcanics, associated w/ fractures

1 Photo 17 Kambia beach looking toward red beach

1 Photo 18-19 on hill w/ radio tower looking N & NE

1 Photo 20 same location toward Santorini Image

6-23-93

6-24-92 R. Green Santorini

1 Photo 21 from Thira toward Nea Kameni (Kahmenhi)

1 Photo 22 from Thira south toward side of city on caldera rim 9:40.

1 Photo 23-25 Akrotiri site looking at east wall w/ basal rose unit exposed

2 Photo 1 inside room showing partially excavated rubble at base of room

2 Photo 2 looking at fill that appears to be ash fall - pumice lapilli, although the pumice was covered with dust there was evidence that there was iron oxide halos present

2 Photo 3 Akrotiri site, east end near north wall, close to top showing contact of ash fall and top unit



2 Photo 4 SE corner showing a large section of ash fall

2 Photo 5 section of hall with stucco & frieze showing

2 Photo 6 on ridge near ancient Thira toward Perissa

2 Photo 7 on saddle, toward Kameni basalt

Rudolph
6-24-92

6-25-92 RJ

R from Ohotiri

2 Photo 8 looking south from main road at exposure of ash fall in gravel pit

2 Photo 9 looking north from main road at exposure of ash fall in gravel pit

2 Photo 10 looking west from main road at Kahmenh

2 Photo 11 at base of quarry looking at base pumice layer

2 Photo 12 close up of Photo 11

2 Photo 13 same location as Photo 11 & 12 showing contact of pumice layer & overlying ash

2 Photo 14 contact of base pumice unit on paleosol w/ English, on left is paleo stream bed cobble (possibly)



2 Photo 15 & 16 2 vantages of archeological sites on questa in base of quarry

2 Photo 17 distant view of section in photos 11, 12 & 13

2 Photo 18 north end of quarry, paleochannel filled w/ ash fall w/ ~30 cm bombs w/ English

2 Photo 19, 20, 21 Close up shots of alteration clasts in base pumice unit in quarry

2 Photo 22 base of quarry contact between base pumice & overlying ash fall (Phase 1 & 2 contact)

2 Photo 23 from Thira east toward Kahmenh

2 Photo 24 facing south Thira

2 Photo 25 Thira - looking taxi

6-25-92 [signature]

6-26-92 Akrotiri Ran Jen
RH

3 Photo 1 near road to Akrotiri
N. Aspro

3 Photo 2 near road to Akrotiri
N. Palea Kameni

3 Photo 3 photo of 2 intrepid
warriors

3 Photo 4 contact of lappilli
layer & underlying (?) RH clinoptilolite
layer w/ Bills feet

3 Photo 5 clinoptilolite (?)
layer in pit along side
trail, near cave

3 Photo 6 knob of suspected
clinoptilolite, from 2-church
road, near gate

3 Photo 7 & 8 cave at sample
location SAN-WMM-001
cave is next to pit along side
trail near gate at end of road
from 2-church, sample from
(?) zeolite section



3 Photo ~~10~~ 9 RH hiked past
roadcut near church, along
side road to beach; showing
ravine outcrop of greenish
mineral on zeolite knob
off SW end of island

3 Photo ~~11~~ 10 RH & ~~10~~ 11 RH outcrop
exposure near church on hill side
of zeolite knob, showing heterogeneities

3 Photo 12 location of sample
SAN-WMM-002 green colored
zeolite (?) from behind church on
zeolite knob

3 Photo 13 distant view of
church at location of SAN-WMM-002

3 Photo 14, 15, 16 vantage view
overlooking Akrotiri site

3 Photo 17 English perched on
mesa near Akrotiri site

3 Photo 18-19 views of the
gully leading up to Akrotiri site
w/ view of the bypass fluvial
system

6-27-92 Floyd McCoy, U of Hawaii
RH

Earth Corps

Earth Watch March/April 1992
pg 6-7 also 29

"Site Unseen" A closer look'

w/ Ground pooling radar, can find buried ruins w/o lifting a shovel.

4 meters deep

Earth Corps Briefing

The Buried Aegean

Dr Floyd McCoy

Assoc. scientist in Woods Hole & U of Hawaii

Earth Watch
Investigating in the Plant



Earth Watch Headquarters
680 Mount Auburn St
P.O. Box 403
Watertown MA 02272-9104
Phone (617) 926-8200
FAX (617) 926-8532

Floyd McCoy
Windward College
U of Hawaii
Kaneohe, Hawaii 96744
808-247-3637

Makai - Kamai

Rachel Hunt
6-27-92

6-28-92 RH Santorini

3 Photo 20 view of Akrotiri from Ancient Thira

3 Photo 21 view of ancient Thira

3 Photo 22 beach at Athermia w/ Bill & English on beach

3 Photo 23 at base of cliff at Athermia, older basement rocks, suspected source of sulfide veins, just above possible adit

3 Photo 24 & 25 I a quarry facing north & south

4 Photo 1 beach at base of I a quarry, outcrop to rear

RH 6-28-92



6-29-92 RH Akrotiri w/ Doman

4 Photo 2 evidence of rubble under volcanic ash indicating earthquake prior to eruption. There was also evidence that rubble was removed from some streets prior to ash & pumice deposition

4 photo 3 Akrotiri, looking down gradient at site along ravine showing walls eroded to base. There is a drain at the base. See upright boards for location of drain

4 photo 4 same location as 3 showing gradational erosion of walls away from ravine base

4 photo 5 Delta House location of lounges, on bedrock under matting & under slate. Slate probably collapsed, but slate was horizontal

Missed pages, Roalet [illegible] 6-29-92
p46-47

RH



RH

4 Photo 6 Delta house, upper room, location of lead weights

4 photo 7 & 8 base of pier put into bed rock (older volcanics) they found an older chamber that was a possible tomb & later a room for clay preparation

4 photo 9 looking south along ravine w/ delta house on right showing proximity of leads & bronzes to the ravine

4 photo 10 area in street with inverted bed cast, just west of Delta 16 & 15 pumice & ash has been removed to close to previous road level

4 photo 11, final resting place of Navigantes

4 photo 12, vein of inverted bed showing contact of basal ash and underlying pre-volcanic sediments, earth & rubble, indicates only 20-30 cm of pumice



overlying the level on which the bed is lying

4 photo 1~~4~~ 3 RS 7/29/92 collapsing floor of slate (?) used in floors, broken and out top of underlying rubble B3

4 photo 1~~5~~ 4 RS 7/29/92 a south entrance facing north, upstream along ravine showing eroded walls

4 photo 1~~6~~ 5 7/29/92 RS Western edge of B7 showing window or door w/ stream (gray) sediments at top overlying ash with molds of former timbers

4 photo 1~~7~~ 6 7/29/92 RS Western edge of B6 showing stream sediments & broken clay pot RS

4 photo 1~~8~~ 7 7/29/92 facing west, series of pottery in B2

4 photo 1~~9~~ 8 RS 7/29/92 floor of Δ8, which is location of lead weights

4 photo ~~20~~ 19 RS 7/29/92 room north of Δ8 & Δ8a at bedrock site where bronzes were found

© RK 7/29/92

4 photos 2X ground level shot looking down gradient of ravine from immediately in front of row north of Δ8

RK 7/29/92

4 photos 2X photos of English standing on location of suspected plough # is head is slightly (~ 10 cm) above tops of walls up & down stream of his location

2 RK 7/29/92

4 photos 2X English standing on bedrock (same as 22) with camera location showing uniformity of wall height from stream erosion

3 RK 7/29/92

4 photos 2X facing east end of Δ17 showing depth of stream deposits in the row, lower than tops of eroded walls

RK 7/29/92

4 photos 2X north wall of Δ17a showing green colored tuff, possibly from zeolite unit

5

RK 6-29-92 5X photos 1 looking at collapsed staining in Δ5 indicating earthquake prior to eruption



5 photos 2 facing south 3 plan wall of Xcste 2

5 photos 3 Xcste 4, picture of exposed plaster with pantry & pigments

5 photos 4 Xcste 2 south facing, looking at window in Xcste 2 with fluvial fill and door in Δ17 with tuff volcanic fill

5 photo 5 Marine Cafeteria, lunch spot for Dr. Burns

5 photo 6 Chumash - Akrotiri

5 photos 7, 8, 9 standing at north edge of site, 3 photos of east wall of ravine, some appear natural (north end) but others have been excavated (south end)

5 photo 10, Bill in the ravine up gradient from site, sampling ash

possible camera error

never taken RJS 7/29/92

5 photo 11 grave vine, circular, fallen

5 photo 12 field where Floyd McCoy conducted GPR & detected suspected 3 story buildings, to east of site.

These corrections made 7/29/92 Randolph

5 photo 13 side of ravine, up gradient (north) of site, west side of ravine, exposure of subsurface ash & pumice, moist w/ extensive RJS roots

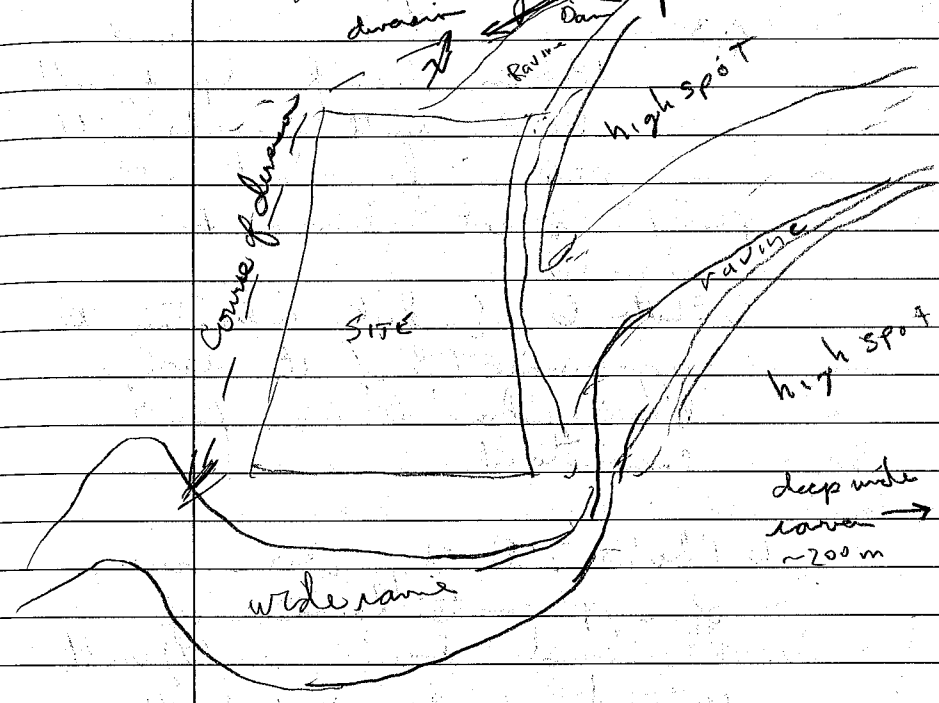
5 photo 14 south end of site with ravine wall to the east. This wall is of pumice & could be for other ravine as well

5 photo 15, 16, 17, 18 from SE corner of site on small hill, 4 shot panoramic view of north side of site

5 photo 19, 20 up gradient & down gradient of major ravine located to east of site, taken from left rim of ravine



5 photo 21, 22, 23, 24, from due SE of east corner of site looking down gradient to west (2 shots) then upgradient of ravine RJS immediately east of site




Possible mis-count of photos – need to check after developed, there were only 2

Randolph 6-29-92

6-30-92 Akrotiri, Radcliffe
RH

6 Photo 1-5, Bill, English, Doumas, Alexandra measuring to locate the position of the large bronze basin in Δ3

185 cm down from top of west wall
80 cm south of north wall
325 cm from west wall

pier 18 is set in base of Δ3

6 Photo 6 English indicating the approximate top of the bronze basin, where it was first encountered

6 Photo 7, 8 top down view of approximate location of base under basin, one (7) with centimeter scale, 8 indicating w/ arrow an 'X' in the dirt showing best approximate location

6 Photo 9 oblique view of location with 8-10 cm thick packed earth floor on bedrock, bedrock is in the foreground



6 Photo 10 English & Bill sweeping loose material off top of packed dirt and collecting sample

6 Photo 11 English & Bill collecting sample into plastic bag

6 Photo 12 close up of packed earth contact with bedrock after loose material had been swept away

6 Photo 13 view of English sweeping out loose material in a small crevice located south of vessel (basin) location

6 Photo 14 English 'blowing' off dust from bedrock and packed earth

6 photo 15, 16, 17, 18 close ups of crevice with cm scale. Views taken from different angles to try and show fractur coating

6 Photo 19 English collecting white material filling north end of crevice

6 Photo 20 English locating site of bedrock sample, 35 cm south of 'x' location

6 Photo 21 English sampling bedrock from 35 cm south of 'x' location

6 Photo 22 English chiseling out bedrock sample from 35 cm south of 'x' location

6 Photo 23 reconstructed vase in lab w/ tables of sherds in background

Base of Δ2 at location is measured to be 22.18 m (msl) as per map of Clancy Parlegrean (sp!)

6 Photo 24 photo of base map w/ elevations

7 Photo 1-6 same as 6 photo 24 diffent scales & focuses.

7 Photo 7 facing east in basement of Δ2 at sample JAN-WM II-008



7 photo 8 ~~west~~ east wall of Δ2 basement, south 1 meter from 008 sample location

7 photo 9 south wall of Δ2 basement, original wall

7 photo 10 east wall of Δ2 basement, 90 cm north of sample 008, showing fracture

7 photo 11 north wall of Δ2 basement, showing 2 vertical fractures

7 photos 12, 13, 14 3 different scale photos of fracture, ~25 cm below surface (cm scale) oriented & vertically approximated toward 'x' location

7 photo 15, view of floor sherds stacked along south wall of Δ2

7 photo 16 the 3 cabelleros on site at Δ2

7 photo 17 downgradient outflow of ravine diversion

7 photo 18 SE corner of House of the Ladies showing wall collapse on Phase 1 pumice, supporting premise that Phase II blew over any above surface structures

7 photo 19 wall at south end of west wall showing Phase 1 w/ some Phase 2, all Phase 3 and some Phase 2 have been eroded & covered by Phase 4

7 photo 20 proposed location of packed earth location

7 photo 21 115 cm west of 'X' location, proposed site of packed earth sample, approximately over fracture observed on east wall of basement to Δ2

7 photo 22 English collecting packed earth sample SAN-WMA-009

7 photo 23 location from where SAN-WMA-009 was collected

7 photo 24 Earthwatch Port country

Ronald Green 6-30-92



7-1-92 Akrotiri R Green

RG

Magnetometer survey

8 photo 1 Colin Matchett & Arland Jensen of Earthwatch setting up magnetometer

Proton Magnetometer Type 820
Elsec 820

Livermore Scientific Engineering of Oxford, England
Railway Lane
Littlemore
Oxford OX4 4PZ UK

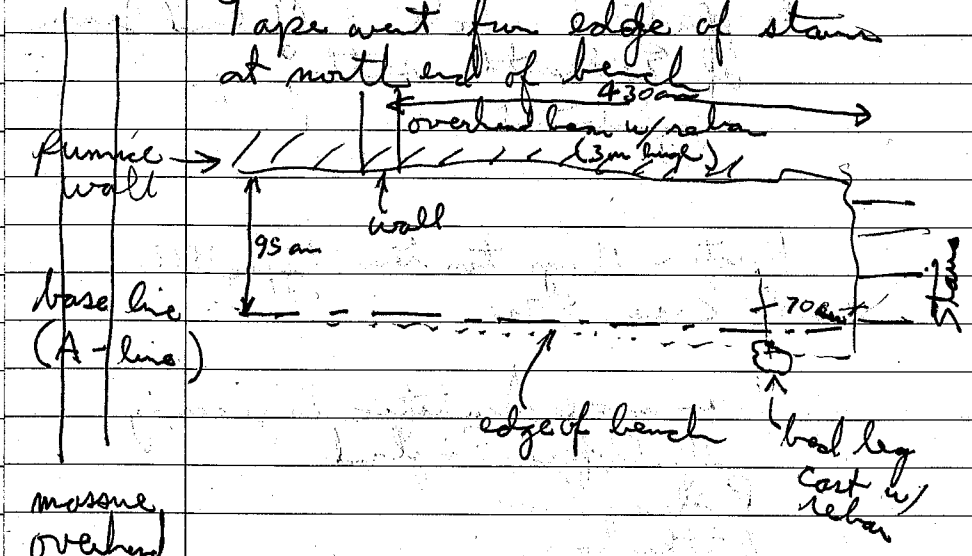
Plan to do profile along bench containing the inverted bed to see if any metallic objects are detected. Will perform one profile at two heights

Field average set at 45,000 γ

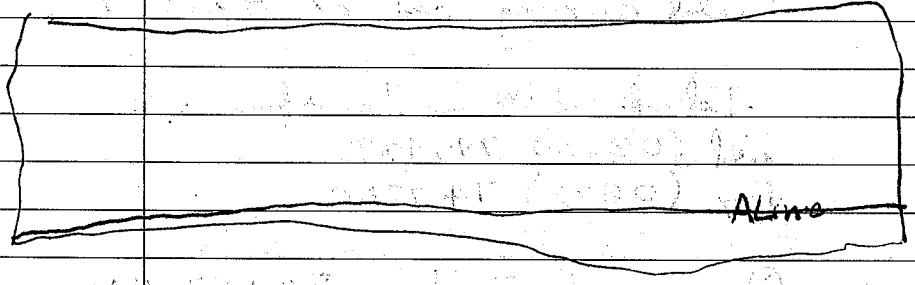
Tel of Littlemore Scientific
Tel (0865) 747437
Fax (0865) 747780

Operating Instructions 820V2.MAN
January 1989

Removed retrainer post on cement post




Close-up






Dry run of A-line 9:49
instrument held by Arland

| | rep | | |
|---|---|---|---|
| 0 | | 85 | 44290.7 |
| 50 | | 86 | 44300.2 |
| 100 | | 87 | - 300.4 |
| 150 | | 88 | - 302.8 |
| 200 | | 89 | - 283.4 |
| 250 | | 90 | - 263.0 |
| 300 | | 91 | - 205.0 |
| 350 | | 92 | - 189.7 |
| 400 | | 93 | - 237.4 |
| 450 | | 94 | - 288.7 |
| 500 | | 95 | - 377.6 |
| 550 | | 96 | - 456.0 |

Try repeat of A-line again

A-line, head was oriented properly, instrument held by Colin & read by Arland

| | rep |
|---|---|
| 0 | 284.9 |
| 50 | 300.1 |
| 100 | 302.9 |
| 150 | 305.7 |
| 200 | 294.6 |
| 250 | 281.5 |
| 300 | 222.5 |
| 350 | 210.6 |
| 400 | 249.0 |
| 450 | 302.0 |

| | |
|---|---|
| 500 | 385.0 |
| 550 | 461.2 |

Retry w/ properly oriented land
A-line – Arland read again
Colin instrument again

| | |
|---|---|
| 0 | 281.8 |
| 50 | 293.0 |
| 100 | 297.9 |
| 150 | 303.0 |
| 200 | 290.5 |
| 250 | 276.0 |
| 300 | 222.4 |
| 350 | 203.7 |
| 400 | 242.4 |
| 450 | 295.0 |
| 500 | 374.0 |
| 550 | 456.3 |

8 Photo 203 pictures of bench with tape laid out

8 Photo 4,5 pictures of data collection



A-line Arland reading, Colin or instrument, at 10 cm spacing

| location | reg | reading | time |
|---|---|---|---|
| 0 | 122 | 44277.3 | 10:16 |
| 10 | | 279.1 | |
| 20 | | 279.8 | |
| 30 | | 284.2 | |
| 40 | | 287.0 | |
| 50 | | 290.5 | |
| 60 | | 294.2 | |
| 70 | | 293.5 | 10:17 |
| 80 | | 295.5 | |
| 90 | | 295.7 | |
| 100 | | 295.1 | |
| 110 | | 295.0 | |
| 120 | | 294.3 | |
| 130 | | 295.1 | |
| 140 | | 297.0 | |
| 150 | | 299.7 | |
| 160 | | 300.6 | |
| 170 | | 289.3 | |
| 180 | | 297.3 | |
| 190 | | 291.1 | |
| 200 | 142 | 286.5 | 10:20 |
| 210 | | 284.1 | |
| 220 | | 282.4 | |
| 230 | | 279.7 | |
| 240 | | 278.7 | |
| 250 | | 274.7 | |

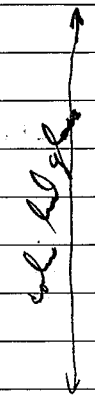
| | | | |
|---|---|---|---|
| 260 | | 268.6 | |
| 270 | | 248.1 | |
| 280 | | 230.8 | |
| 290 | | 219.3 | |
| 300 | 152 | 214.5 | 10:22 |
| 310 | | 208.9 | |
| 320 | | 208.6 | |
| 330 | | 203.7 | |
| 340 | | 202.7 | |
| 350 | | 204.9 | |
| 360 | | 212.3 | |
| 370 | | 219.2 | |
| 380 | | 225.2 | |
| 390 | | 234.5 | |
| 400 | 162 | 242.1 | 10:24 |
| 410 | | 256.1 | |
| 420 | | 268.7 | |
| 430 | | 281.6 | |
| 440 | | 290.4 | |
| 450 | | 299.1 | |
| 460 | | 302.3 | |
| 470 | | 309.5 | |
| 480 | | 326.5 | |
| 490 | | 347.4 | |
| 500 | 172 | 379.2 | 10:26 |
| 510 | | 403.6 | |
| 520 | | 421.4 | |
| 530 | | 432.0 | |
| 540 | | 445.0 | |
| 550 | | 459.6 | |
| 560 | 178 | 462.7 | 10:27 |



B-line is 10 m to west of A-line same set up as last line

68
-115

B-line



| | | | |
|---|---|---|---|
| 0 | 179 | 4423.4 | 10:32:30 |
| 10 | | 278.9 | |
| 20 | | 283.8 | |
| 30 | | 288.9 | |
| 40 | | 292.5 | |
| 50 | | 294.2 | |
| 60 | | 296.7 | |
| 70 | | 298.1 | |
| 80 | | 296.6 | |
| 90 | | 295.6 | |
| 100 | | 295.1 | 10:35 |
| 110 | | 293.6 | |
| 120 | | 293.0 | |
| 130 | | 293.3 | |
| 140 | | 296.1 | |
| 150 | | 298.9 | |
| 160 | | 299.5 | |
| 170 | | 297.3 | |
| 180 | | 291.9 | |
| 190 | | 287.7 | |
| 200 | 199 | 283.6 | 10:37 |
| 210 | | 277.3 | |
| 220 | | 274.7 | |
| 230 | | 270.7 | |
| 240 | | 266.3 | |
| 250 | | 264.3 | |
| 260 | | 259.4 | |

| | | | |
|---|---|---|---|
| 270 | | 252.9 | |
| 280 | | 248.2 | |
| 290 | | 244.6 | |
| 300 | | 235.3 | 10:39 |
| 310 | | 232.4 | |
| 320 | 211 | 221.8 | |
| 330 | | 213.6 | |
| 340 | | 207.4 | |
| 350 | | 206.1 | |
| 360 | | 212.5 | |
| 370 | | 219.8 | 11/1/94 |
| 380 | | ~~218~~ 228.2 | ~~RH~~ |
| 390 | | 237.2 | |
| 400 | 219 | 248.4 | 10:41:3 |
| 410 | | 261.6 | |
| 420 | | 276.7 | |
| 430 | | 289.9 | |
| 440 | | 300.0 | |
| 450 | | 304.4 | |
| 460 | | 310.2 | |
| 470 | | 318.2 | |
| 480 | | 332.3 | |
| 490 | | 354.9 | |
| 500 | 229 | 380.6 | 10:43:30 |
| 510 | | 403.9 | |
| 520 | | 418.4 | |
| 530 | | 429.3 | |
| 540 | | 493.2 | |
| 550 | | 459.12 | 11/1/94 |
| 560 | | 468.4 | ~~RH~~ |
| 570 | 236 | 469.3 ~~468.5~~ | |



C-lines, 20 cm from A-lines

| | | | |
|---|---|---|---|
| 0 | 237 | 44272.1 | 10:50:30 |
| 10 | | 278.2 | |
| 20 | | 281.0 | |
| 30 | | 286.6 | |
| 40 | | 291.2 | |
| 50 | | 293.1 | |
| ~~60~~ | | 295.8 | |
| ~~70~~ | | 295.0 | |
| ~~80~~ | | 294.0 | |
| 90 | | 294.8 | |
| 100 | 247 | 293.9 | 10:53:15 |
| 110 | | 291.8 | |
| 120 | | 290.1 | |
| 130 | | 289.0 | |
| 140 | | 292.4 | |
| 150 | | 296.0, 259.6 (253) | 2-readings |
| 160 | | 296.7 | |
| 170 | | 295.5 | |
| 180 | | 290.3 | |
| 190 | | 287.1 | |
| 200 | 258 | 282.8 | 10:56 |
| 210 | | 275.8 | |
| 220 | | 271.8 | |
| 230 | | 267.8 | |
| 240 | | 264.9 | |
| 250 | | 261.1 | |
| 260 | | 259.7 | |
| 270 | | 254.0 | |
| 280 | | 245.8 | |

| | | | |
|---|---|---|---|
| 290 | | 246.9 | |
| 300 | 268 | 239.6 | 10:58 |
| 310 | | 237.5 | |
| 320 | | 224.7 | |
| 330 | | 213.3 | |
| 340 | | 202.8 | |
| 350 | | 198.9 | |
| 360 | | 200.8 | |
| 370 | | 209.1 | |
| 380 | | 217.9 | |
| 390 | | 228.5 | |
| 400 | 278 | 239.6 | 11:00 |
| 410 | | 252.3 | |
| 420 | | 270.5 | |
| 430 | | 285.6 | |
| 440 | | 298.7 | |
| 450 | | 304.7 | |
| 460 | | 305.0 | |
| 470 | | 313.0 | |
| 480 | | 324.8 | |
| 490 | | 346.9 | |
| 500 | 288 | 366.8 | 11:02 |
| 510 | | 394.5 | |
| 520 | | 405.7 | |
| 530 | | 420.2 | |
| 540 | | 430.1 | |
| 550 | | 434.2 | |
| 560 | | 461.2 | |
| 570 | 295 | 478.1 | 11:03:45 |



D-line 10 m from C-line

11/11/94 same set up as A, B, C-lines

| | | | |
|---|---|---|---|
| 0 ~~23~~ | 296 | 44 269.3 | 11:05:45 |
| 10 | | 275.9 | |
| 20 | | 285.9 | |
| 30 | | 293.0 | |
| 40 | | 298.5 | |
| 50 | | 299.3 | |
| 60 | | 302.6 | |
| 70 | | 302.7 | |
| 80 | | 302.8 | |
| 90 | | 301.5 | |
| 100 | 306 | 299.2 | 11:08:15 |
| 110 | | 293.8 | |
| 120 | | 290.1 | |
| 130 | | 291.2 | |
| 140 | | 275.5 | |
| 150 | | 299.2 | |
| 160 | | 298.3 | |
| 170 | | 295.0 | |
| 180 | | 288.7 | |
| 190 | | 281.4 | |
| 200 | 316 | 275.1 | 11:10:30 |
| 210 | | 270.1 | |
| 220 | | 265.0 | |
| 230 | | 261.8 | |
| 240 | | 257.7 | |
| 250 | | 256.1 | |
| 260 | | 252.1 | |
| 270 | | 256.0 | |
| 280 | | 250.6 | |

| | | | |
|---|---|---|---|
| 290 | | 251.0 | |
| 300 | 326 | 245.3 | 11:12:45 |
| 310 | | 239.8 | |
| 320 | | 227.2 | |
| 330 | | 209.2 | |
| 340 | | 184.7 | |
| 350 | | 172.7 | |
| 360 | | 176.2 | |
| 370 | | 188.8 | |
| 380 | | 200.5 | |
| 390 | | 215.8 | |
| 400 | 336 | 235.1 | 11:15:00 |
| 410 | | 255.1 | |
| 420 | | 277.9 | |
| 430 | | 300.1 | |
| 440 | | 317.9 | |
| 450 | | 322.3 | |
| 460 | | 318.6 | |
| 470 | | 320.5 | |
| 480 | | 334.4 | |
| 490 | | 353.0 | |
| 500 | 346 | 381.2 | 11:17:30 |
| 510 | | 415.1 | |
| 520 | | 440.6 | |
| 530 | | 448.0 | |
| 540 | | 440.2 | |
| 550 | | 437.4 | |
| 560 | | 452.4 | |
| 570 | 353 | 486.9 | |



E-line 10 m over from D-line
same set up as A, B, C, D-lines

| | | | |
|---|---|---|---|
| 0 | 354 | 44 260.5 | 11:21:45 |
| 10 | | 281.0 | |
| 20 | | 296.1 | |
| 30 | | 303.9 | |
| 40 | | 306.7 | |
| 50 | | 309.0 | |
| 60 | | 309.2 | |
| 70 | | 310.7 | |
| 80 | | 310.1 | |
| 90 | | 307.0 | |
| 100 | 364 | 302.7 | 11:24:10 |
| 110 | | 297.0 | |
| 120 | | 292.1 | |
| 130 | | 294.9 | |
| 140 | | 303.6 | |
| 150 | | 307.8 | |
| 160 | | 304.5 | |
| 170 | | 298.7 | |
| 180 | | 289.9 | |
| 190 | | 281.2 | |
| 200 | 374 | 273.0 | 11:26:20 |
| 210 | | 264.1 | |
| 220 | | 259.8 | |
| 230 | | 253.1 | |
| 240 | | 249.5 | |
| 250 | | 247.9 | |
| 260 | | 250.3 | |
| 270 | | 254.4 | |
| 280 | | 255.6 | |

| | | | | |
|---|---|---|---|---|
| | 290 | | 253.1 | |
| | 300 | 384 | 249.6 | 11:28:45 |
| | 310 | | 236.6 | |
| | 320 | | 211.4 | |
| | 330 | | 181.9 | |
| | 340 | | 153.6 | |
| | 350 | | 134.6 | |
| | 360 | | 120.3 | |
| | 370 | | 137.5 | |
| | 380 | | 160.7 | |
| | 390 | | 193.6 | |
| | 400 | 394 | 223.8 | 11:31:10 |
| | 410 | | 256.6 | |
| | 420 | | 295.0 | |
| 11/1/94 | 430 | | 324.5 | |
| RH | 440 | | 350.0 | |
| ~~edge of rock~~ | 450 | | 348.8 | |
| ~~edge of rock~~ edge of rock at 460 | 460 | | 330.0 | (402) |
| | 470 | | (3) 341.2 | 339.5 |
| | 480 | | 344.7 | |
| | 490 | | 363.9 | |
| | 500 | 405 | 417.1 | 11:34:45 |
| near 2nd rock | 510 | | 498.2 | |
| | 520 | | 530.8 | |
| | 530 | | 494.8 | |
| | 540 | | 481.5 | |
| 11/1/94 RH | 550 | | 11/1/94 438.9 | |
| | 560 | | RH ~~4~~ 208.3 | |
| | 570 | | 474.0 | |
| | 580 | 413 | 510.3 | 11:36:45 |
| | 560 repeat | 414 | 43981.1 | 11:37:30 |

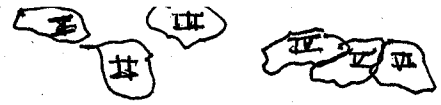


F-line 10 cm from D-line
same set up on D-line

| | | | |
|---|---|---|---|
| 0 | 415 | 44247.4 | 11:41:25 |
| 10 | | 286.7 | |
| 20 | | 303.5 | |
| 30 | | 312.2 | |
| 40 | | 316.0 | |
| 50 | | 316.7 | |
| 60 | | 315.1 | |
| 70 | | 317.1 | |
| 80 | | 317.8 | |
| 90 | | 314.1 | |
| 100 | 425 | 308.4 | 11:43:30 |
| 110 | | 300.2 | |
| 120 | | 297.1 | |
| 130 | | 304.9 | |
| 140 | | 314.1 | |
| 150 | | 315.0 | |
| 160 | | 309.7 | |
| 170 | | 297.9 | |
| 180 | | 288.6 | |
| 190 | | 278.5 | |
| 200 | 435 | 269.5 | 11:45:40 |
| 210 | | 260.7 | |
| 220 | | 253.9 | |
| 230 | | 246.7 | |
| 240 | | 239.4 | |
| 250 | | 238.4 | |
| 260 | | 238.8 | |
| 270 | | 244.6 | |
| 280 | | 247.7 | |

| | | | | |
|---|---|---|---|---|
| | 290 | | 248.5 | |
| | 300 | 445 | 237.6 | 11:47:50 |
| | 310 | | 222.4 | |
| | 320 | | 199.2 | |
| | 330 | | 167.2 | |
| | 340 | | 122.3 | |
| | 350 | | 088.3 | |
| on surface of rock between rocks surface of 2nd rock | 360 | | 078.0 | |
| | 370 | | 079.5 | |
| | 380 | | 150.2 | |
| | 390 | | 182.5 | |
| | 400 | 455 | 222.4 | 11:50:15 |
| | 410 | | 262.3 | |
| | 420 | | 312.0 | |
| | 430 | | 359.5 | |
| | 440 | | 394.9 | |
| | 450 | | 392.0 | |
| edge of rock II | 460 | | 365.0 | |
| | 470 | | 362.6 | |
| | 480 | | 377.4 | |
| | 490 | | 314.4 | |
| in front of I | 500 | 465 | 419.2 | 11:52:50 |
| | 510 | | 427.6 | |
| | 520 | | 571.2 | |
| | 530 | | 588.7 | |
| | 540 | | 504.7 | |
| | 550 | | 438 18.8 | |
| | 560 | | 431 62.0 | |
| | 570 | | 44 463.7 | |
| | 580 | 473 | 532.5 | 11:55:20 |






G-line 10 cm from F-line
Same set up as F-line

| | | | |
|---|---|---|---|
| 0 | 474 | 44 270.3 | 12:01:15 |
| 10 | | 298.7 | |
| 20 | | 314.4 | |
| 30 | | 321.3 | |
| 40 | | 324.6 | |
| 50 | | 328.6 | |
| 60 | | 328.1 | |
| 70 | | 328.3 | |
| 80 | | 327.6 | |
| 90 | | 323.9 | |
| 100 | 484 | 317.2 | 12:03:30 |
| 110 | | 312.2 | |
| 120 | | 311.2 | |
| 130 | | 319.4 | |
| 140 | | 326.8 | |
| 150 | | 324.3 | |
| 160 | | 312.9 | |
| 170 | | 300.3 | |
| 180 | | 291.0 | |
| 190 | | 277.5 | |
| 200 | 494 | 269.0 | 12:06:45 |
| 210 | | 257.9 | |
| 220 | | 250.3 | |
| 230 | | 238.9 | |
| 240 | | 234.8 | |
| 250 | | 232.4 | |
| 260 | | 237.1 | |
| 270 | | 237.3 | |
| 280 | | 242.2 | |

| | | | | |
|---|---|---|---|---|
| | 290 | | 240.8 | |
| | 300 | 504 | 230.0 | 12:09:05 |
| | 310 | | 198.0 | |
| | 320 | | 165.9 | |
| | 330 | | 125.4 | |
| | 340 | | 077.5 | |
| on VI | 350 | | 038.0 | |
| | 360 | | 050.3 | |
| on V | 370 | | 083.2 | |
| on IV | 380 | | 139.8 | |
| | 390 | | 184.1 | |
| | 400 | 514 | 235.9 | 12:11:45 |
| | 410 | | 310.0 | |
| | 420 | | 355.2 | |
| in hole | 430 | | 43 772.9 | |
| on III | 440 | | 44 417.8 | |
| | 450 | | 458.9 | |
| on II | 460 | | 398.5 | |
| | 470 | | 383.2 | |
| | 480 | | 412.4 | |
| on I | 490 | | 505.7 | |
| | 500 | 524 | 570.0 | 12:14:45 |
| (hung at) | 510 | | 614.3 | |
| | 520 | | 668.2 | |
| | 530 | | 43 999.9 | |
| | 540 | | 44 590.2 | |
| | 550 | | 44 146.6 | |
| | 560 | | 014.6 | |
| | 570 | | 413.3 | |
| | 580 | 532 | 537.8 | 12:17:20 |



H-line 10 m from G-line
same set up as G-line

| | | | |
|---|---|---|---|
| 0 | | (in wall) | |
| 10 | 533 | 44310.4 | 12:20:35 |
| 20 | | 315.8 | |
| 30 | | 334.4 | |
| 40 | | 339.6 | |
| 50 | | 338.4 | |
| 60 | | 342.5 | |
| 70 | | 344.0 | |
| 80 | | 341.6 | |
| 90 | | 336.0 | |
| 100 | 542 | 332.4 | 12:22:35 |
| 110 | | 327.9 | |
| 120 | | 328.1 | |
| 130 | | 333.2 | |
| 140 | | 335.6 | |
| 150 | | 330.5 | |
| 160 | | 319.4 | |
| 170 | | 304.4 | |
| 180 | | 294.2 | |
| 190 | | 279.5 | |
| 200 | 552 | 265.6 | 12:25:00 |
| 210 | | 256.3 | |
| 220 | | 246.0 | |
| 230 | | 234.9 | |
| 240 | | 226.0 | |
| 250 | | 220.8 | |
| 260 | | 216.6 | |
| 270 | | 216.2 | |
| 280 | | 211.5 | |

| | | | | |
|---|---|---|---|---|
| | 290 | | 215.0 | |
| | 300 | 562 | 195.5 | 12:28:00 |
| | 310 | | 178.7 | |
| | 320 | | 146.9 | |
| | 330 | | 098.5 | |
| | 340 | | 061.9 | |
| | 350 | | 026.5 | |
| | 360 | | 022.0 | |
| bankedge II | 370 | | 054.9 | |
| on IV | 380 | | 119.0 | |
| on IV | 390 | | 178.4 | |
| | 400 | 572 | 235.2 | 12:30:35 |
| | 410 | | 313.4 | |
| | 420 | | 385.7 | |
| on III | 430 | | 243.7 | |
| | 440 | | 382.1 | |
| | 450 | | 397.7 | |
| | 460 | | 408.1 | |
| | 470 | | 382.7 | |
| | 480 | | 415.4 | |
| on I | 490 | | 495.3 | |
| | 500 | 582 | 590.7 | 12:33:15 |
| | 510 | | 515.6 | |
| | 520 | | 652.2 | |
| | 530 | | 42 344.0 | |
| | 540 | | 44 614.7 | |
| | 550 | | 11/11/94 RPS 515.9 | |
| | 560 | | 476.1 | |
| | 570 | | 530.1 | |
| | 580 | | 618.7 | |
| | ~~590~~ | | | |



I-line 10 cm from H-line
same setup as H-line

| | | | |
|---|---|---|---|
| 0 | | no reading in wall | |
| 10 | 592 | 4 4339.8 | 12:42:50 |
| 20 | | 356.5 | |
| 30 | | 11/11/94 RPS 358.0 | |
| 40 | | 356.6 | |
| 50 | | 358.5 | |
| 60 | | 261.8 | |
| 70 | | 352.5 | |
| 80 | | 353.4 | |
| 90 | | 349.0 | |
| 100 | 601 | 344.9 | 12:45:00 |
| 110 | | 342.2 | |
| 120 | | 340.1 | |
| 130 | | 342.2 | |
| 140 | | 340.9 | |
| 150 | | 338.8 | |
| 160 | | 320.8 | |
| 170 | | 307.9 | |
| 180 | | 297.0 | |
| 190 | | 283.9 | |
| 200 | 611 | 270.7 | 12:47:30 |
| 210 | | 257.3 | |
| 220 | | 245.7 | |
| 230 | | 232.6 | |
| 240 | | 223.1 | |
| 250 | | 217.1 | |
| 260 | | 212.1 | |
| 270 | | 207.9 | |
| 280 | | 205.4 | |

| | | | | |
|---|---|---|---|---|
| | 290 | | 196.7 | |
| | 300 | 621 | 183.4 | 12:49:45 |
| | 310 | | 158.7 | |
| | 320 | | 121.9 | |
| | 330 | | 088.8 | |
| | 340 | | 057.3 | |
| | 350 | | 032.4 | |
| | 360 | | 032.8 | |
| | 370 | | 064.0 | |
| on IV | 380 | | 127.4 | |
| | 390 | | 194.6 | |
| edge of IV | 400 | 631 | 256.2 | |
| | 410 | | 323.8 | 12:52:26 |
| | 420 | | 378.6 | |
| on III | 430 | | 306.2 | |
| | 440 | | 341.8 | |
| | 450 | | 358.1 | |
| | 460 | | 380.2 | |
| | 470 | | 370.7 | |
| | 480 | | 400.2 | |
| on I | 490 | | 493.1 | |
| | 500 | 641 | 5419 | 12:54:30 |
| | 510 | | 554.1 | |
| edge of I | 520 | | 41 658.0 | |
| | 530 | | 43 822.4 | |
| | 540 | | 44 614.0 | |
| | 550 | | 530.9 | |
| | 560 | | 513.0 | |
| | 570 | | 551.6 | |
| | 580 | | 619.1 | |
| | 590 | 650 | 683.5 | 12:57:23 |



8 Photo 6,7 photos of magnetometer survey

8 Photo 8,9 location of magnetometer survey at south end of profile, this line is located to immediate south (left) of last (southernmost) major rock

Repeat A-line at 0.5 m

| | | | |
|---|---|---|---|
| 0 | 657 | 44293.4 | 1:08:00 |
| 50 | | 309.3 | |
| 100 | | 311.5 | |
| 150 | | 316.3 | |
| 200 | | 306.7 | |
| 250 | | 290.9 | |
| 300 | | 223.2 | |
| 350 | | 219.0 | |
| 400 | | 258.7 | |
| 450 | | 311.2 | |
| 500 | | 396.5 | |
| 550 | 662 | 473.2 | 1:11:00 |

Repeat anomaly to locate it better

| | | neg | |
|---|---|---|---|
| E | 560 | 663 | 44624 |
| E | 555 | | 43876.0 |
| E | 550 | | 44398.3 |
| E | 545 | | 44462.4 |
| | | | |
| F | 560 | | 43989.9 |
| F | 555 | | 44049.0 |
| F | 550 | | 43862.7 |
| F | 545 | | 44490.5 |
| F | 540 | 671 | 44567.1 |
| | | | |
| G | 560 | | 43428.9 |
| G | 555 | | 44243.0 |
| G | 550 | | 42577.9 |
| G | 545 | | 44544.0 |
| G | 540 | | 44618.2 |
| | | | |
| H | 560 | 677 | 44133.0 |
| H | 555 | | 44463.4 |
| H | 550 | | 44517.6 |
| H | 545 | | 44567.4 |
| H | 540 | | 44632.9 |
| H | 535 | | 44386.7 |
| H | 530 | | 42209.0 |



| | | neg | |
|---|---|---|---|
| I | 560 | 684 | 44517.8 |
| I | 555 | | 44523.0 |
| I | 550 | | 44529.8 |
| I | 545 | | 44583.8 |
| I | 540 | | 44657.4 |
| I | 535 | | 44701.2 |
| I | 530 | | 42190.5 |
| | | | |
| J in 10a part I | J 530 | 697 | 43685.0 |
| | J 525 | | 43408.4 |
| | J 535 | | ~~43~~ 44671.4 |
| | | | |
| 5cm post G | G½ 560 | 694 | 43834.4 |
| | G½ 555 | | 44085.7 |
| | G½ 550 | | 44470.2 |
| | G½ 545 | | 44561.2 |
| | G½ 540 | | 44630.8 |
| | G½ 535 | | 44651.7 |
| | G½ 530 | | 43438.5 |

8 photo 9,10 perform detailed survey of anomaly

8 photo 11,12,13,14 close up of anomaly location

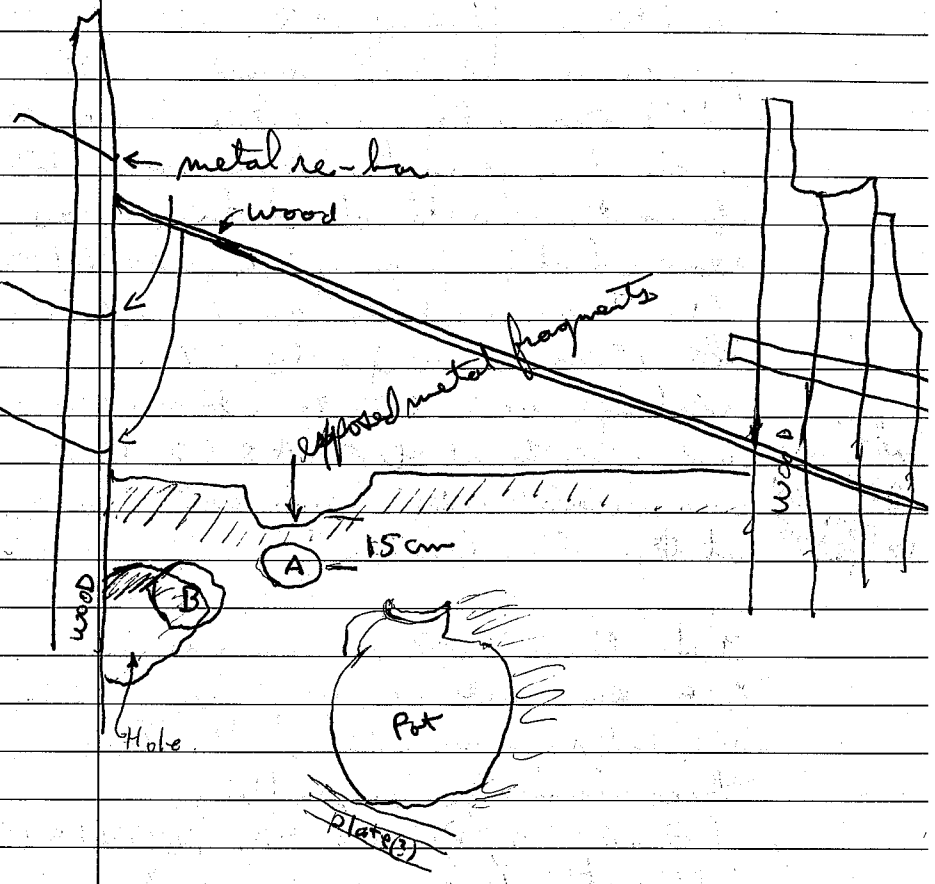
End of controlled pulse Run 7-1-92

9/1/93 RH On Santorini Ron Green & English Peary visited Akrotiri, identified metal artifact per Christos Dunas

Emplaced gypsum block into borehole augered into sidewall of gulch upgradient from site. Borehole is ~ 24" deep, block pushed to back then backfilled with material, mostly cuttings. Some question as to if block is completely buried. Initial reading at 2:20 PM is ØØ.

9/2/93 RH Conducted EM-38 survey at Δ8a. Found no anomaly in Δ8a except for small signal (~12 w/ background of about 3-4) at exact location of metal exposed at surface. Conducted survey in Δ8. No anomaly ~~of RH~~ detected on floor of Δ8 but did find two anomalies on wall separating Δ8 and Δ8a. Site (A) is is measured at about 28 and (B) is at about 50. The meter readings were all in Q/P. It does not seem to be associated with the metal re-bar because there was a low (but not to background of 3-5)






between the anomaly (B) and the metal.

Measured moisture content at two points in floor of Δ8a. Both points were at west corner of Δ8a at location where one enters/leaves the room. The point had been excavated of about 0.5 meter of debris was removed during July/August of 1993. The two readings were made with ~~the 15 cm wave guides. The readings were 0.9% at DELTA8A1 and 0.0% at DELTA8A2.~~ Probe was inserted into debris with rocks at these two locations.

note: DELTA8A1 IS BEST TRACE

Made three TDR measurements in Δ18. Side wall was very fresh (1 day old) but rock was too hard. Took three readings in cuttings. DELTA18A, DELTA18B, DELTA18C all with 15 cm wave guides. They had the following values:

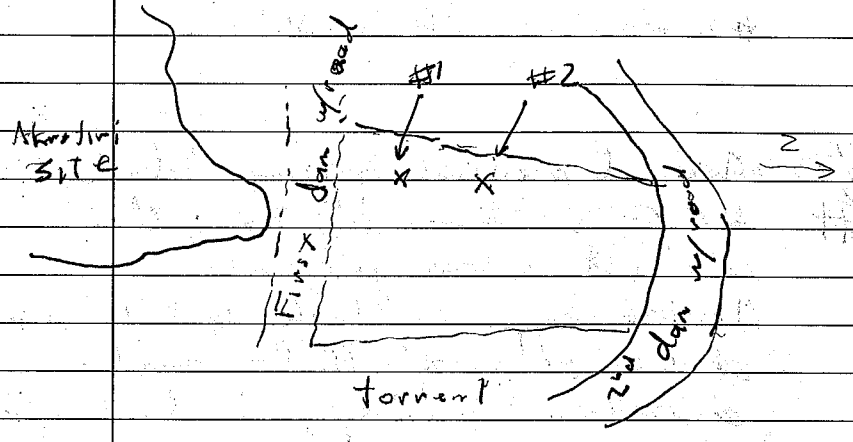
DELTA18A - 9.1%
DELTA18B - 7.6%
DELTA18C - 7.0%



9/3/93 RK

Checked gypsum block #1 in ravine; at 9:25 the meter reading was 2 (this translates to a suction of ~ 20-25 bars)

Installed 2nd gypsum block into west wall of torrent




dug hole (downward inclined) about 20" into fine grained Mazama ash fall. Took 3 TDR readings as I dug:

TORRENT 1 5.5%
TORRENT 2 6.0%
TORRENT 3 6.1%

Soils were moist to the touch. Augered to a total depth of 0.9 m and installed gypsum block #2 at bottom of hole. Backfilled with moist cuttings and topped auger hole with end of auger. Backfilled dug hole to surface.

Initial reading on gypsum block #2 was 00 at 10:35 a.m.

9/4/93 RH

Measured moisture gypsum block #2 @ 9:25 a.m. @ 23; this is about 2 bar pressure. Moisture gypsum block #1 measured at 05 for about 10 bar suction at 9:30 a.m., initially, good meter to 100

Saturated lysimeter over night in DI water brought from CIWRA. Dug hole into west side of forest until moist fine grained layer was encountered. Augered one foot further then inserted lysimeter. There is some question as to if the lysimeter is in good hydraulic connection with the surrounding soil. Will leave in for a few days to see if any



water is obtained. A vacuum of 0.86 bar was imposed upon the lysimeter. The suction held thus indicating the lysimeter was fully saturated. Depth of lysimeter is from 2-3 into side of stream bed. Installed at 30%. Measured moisture at bottom of dug hole with TDR

LYSIMTR1 4.4%

---

Set up study site in South east quadrant of excavated site. The site is [redacted] tuff, at least or about 2 meters thick. The ash fall tuff is characterized as a layer cake structure with not much variation between layers.

[redacted]

Conducted 2 Permeter tests:
AKROTIRI-1
AKROTIRI-2

9/5/93 Read moisture gypsum blocks
RH zeroed meter to 100

| | | | |
|---|---|---|---|
| 10:40am | #1 | 09 | (~6 bar) |
| 10:40am | #2 | 37 | (~1.3 bar) |
| 11:00am | #3 | 32 | (~1.8 bar) |

TI measurements (location on pg 92)
followed published procedures w/ instrument
ran TI-1 w/ -20 mm bubbler
setting → results on forms

[redacted]

ran TI-2 w/ -40 mm bubble setting
results on forms
[redacted]



TI-3 -60 mm, results on forms
could not get TDR into ground.

9/6/93 Read moisture gypsum blocks
RH zeroed meter to 100

| | | | |
|---|---|---|---|
| 9:55am | #1 | 13 | (~4 bar) |
| 9:55am | #2 | 45 | (~1.15 bar) |
| 10:20am | #3 | 56 | (~0.9 bar) |

Checked lysimeter - it was still
under a vacuum, set pressure
at 0.86 bar

TI-4 -80 mm, results on forms

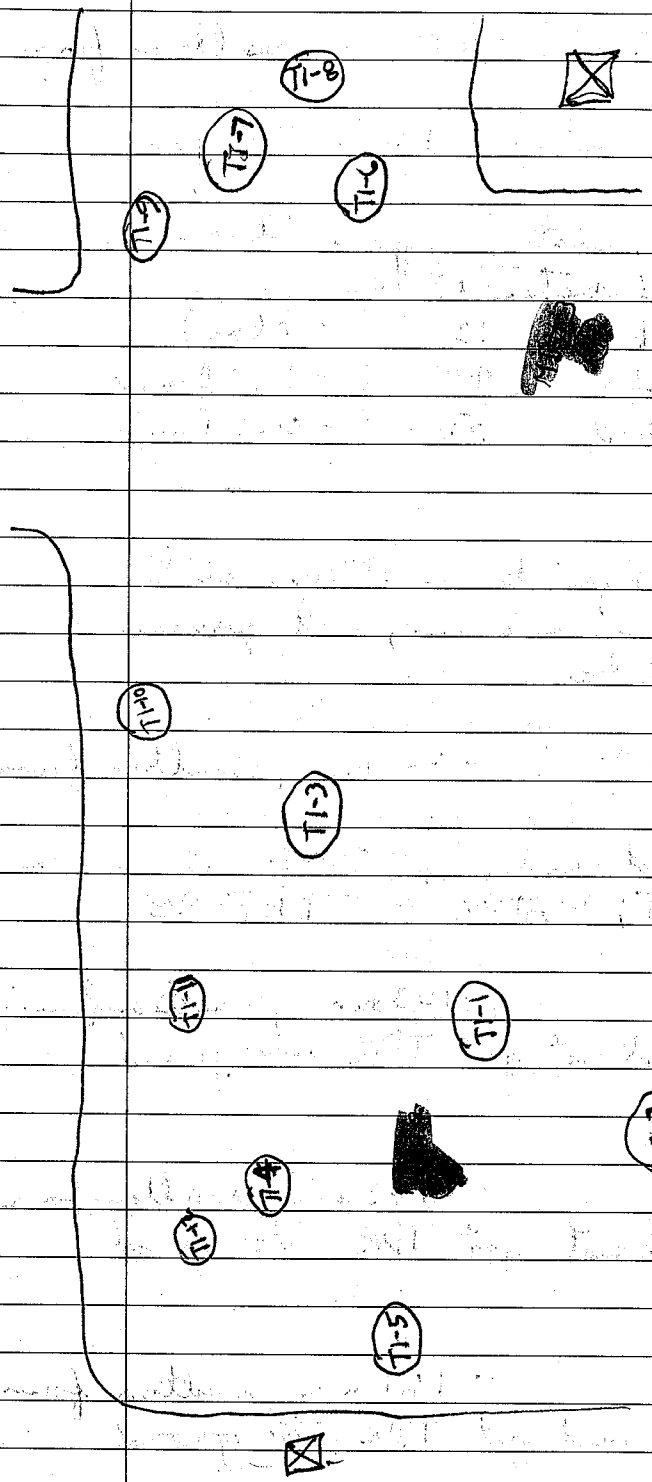
7.2% at ready, 0.0% at 50cm
TI4 AFTER & TI4 FORE

11:50am TI-5 -103 mm, results on forms
could not get TDR into ground

TI-6 -143 mm, results on forms
could not get TDR into ground

TI-7 -161 mm, results on forms
could not get TDR into ground

Relative location of TI tests






TI-8 -205mm, results a form could not get TDR into ground

9/7/93 RH Read moisture blocks. zeroed meter to 100

| | | | |
|---|---|---|---|
| 8:30 | #1 | 16 | (~3.5 bar) |
| 8:30 | #2 | 49 | (~1.05 bar) |
| 9:10 | #3 | 60 | (~ 0.8 bar) |

No water was observed in the lysimeter so I pulled it. Also pulled moisture block #1.

Put moisture block #4 in center of 4 TI measurement locations

RH 9/7/93

9/8/93 RH

Read moisture blocks
served meter to 100
9:45 am #2 52 (~1 bar)
12:55 pm #3 61 (~0.8 bar)
12:55 pm #4 41 (~1.3 bar)

9/9/93 RH

Read moisture blocks, served meter
8:55 am #2 53 (~1 bar)
9:05 am #3 61 (~0.8 bar)
9:05 am #4 54 ~~(1.3 bar)~~ RH (~1 bar)

Re-established lysimeter suction at 0.86 bar Vacuum appeared to be about 0.7 bar when pump was connected.

Collected core samples at 2 locations near tuff testing area. SAN-COR-001 thru -003 were in sidewall, dry.
SAN-COR-004 thru -006 were at a depth of 65 cm into floor of tuff. Also ran [redacted] CORE w/ moisture [redacted] of 6.7.93.



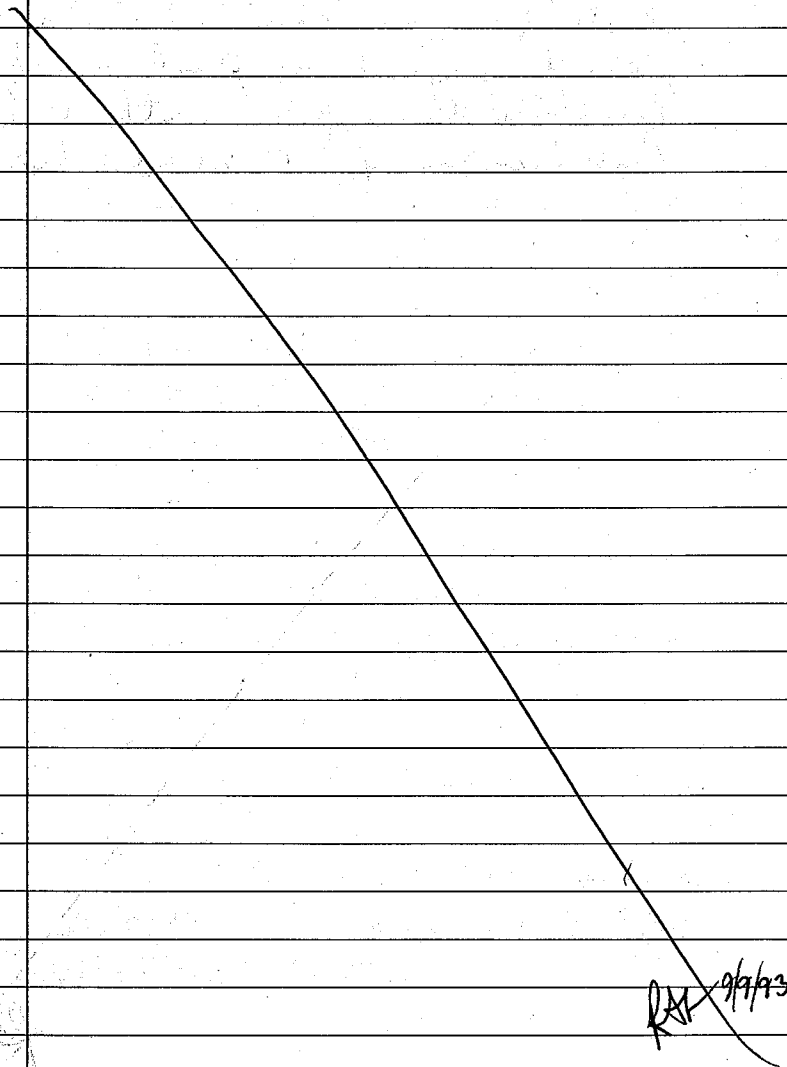
9/8/93 (cont)

Removed lysimeter from tower and re-installed it about 0.8 m from moisture block #3. Put it at a depth of 2 ft (at base). Lysimeter was re-saturated during night of 9/7/93 with DI water (from San Antonio). Tried to pack moisture removed cuttings around lysimeter but auger hole (~6 cm diameter) did not permit as good as pack as desired. Backfilled to surface with cuttings. Put suction of 0.86 bar on lysimeter.

RH 9/8/93

9/9/93 cont

Conducted Guelph Permeameter test in basement (in Cape Riva) of Δ3, rates were consistent with other Guelph test in Cape Riva but $K_{fs}$ was negative because test was not run out to steady state. Data are on forms & additional sheets



RA 9/9/93



11/1/93 KM

Weighed untaped samples in rings, in pyrex dishes.

| | | |
|---|---|---|
| SAN-COR-005 | 72.110 g g | 0.65 cm. |
| SAN-COR-006 | 43.782 g | 0.65 cm |
| SAN-COR-002 | 171.64 g | Side wall |
| SAN-COR-001 | 68.054 g | side wall |
| SAN-COR-004 | 177.22 g | 0.65 cm |
| SAN-COR-003 | 43.156 g | side wall |

Placed in oven at 100°C

11/5/93 KM

Weight of dry samples in rings in pyrex dishes.

| | |
|---|---|
| SAN-COR-004 | 169.75 g |
| SAN-COR-002 | 170.20 g |
| SAN-COR-005 | 68.248 g |
| SAN-COR-001 | 67.659 g |
| SAN-COR-006 | 43.162 g |
| SAN-COR-003 | 43.015 g |

4/25/94 KM

Estimated Volume of samples

SAN-COR-001 = $\pi \left(\frac{2.8\text{cm}}{2}\right)^2$ 3.7cm 22.8 $cm^3$

SAN-COR-002 = $\pi \left(\frac{4.2\text{cm}}{2}\right)^2$ 5.5cm = 76.2 $cm^3$

SAN-COR-003 = $\pi \left(\frac{3.2\text{cm}}{2}\right)^2$ 3.1cm = 11.8 $cm^3$

11/5/93 Will remove samples SAN-COR-001, SAN-COR-002 and SAN-COR-003 from brass tubes to permit tare volume calculation and to have samples for the water activity meter.

11/12/93 KM

Weight of ring + disk

SAN-COR-003 = 32.193 g
SAN-COR-002 = 96.52 g
SAN-COR-001 44.558 g

Residual water

Pages 1 through 98 of this Scientific Notebook were reviewed for compliance with QAP-001 in response to Corrective Action Request 94-02. Corrections and clarifications were made as appropriate. In some cases, the date of a change will reflect the date of this review rather than the date of the original Scientific Notebook entry.

Randy Folck
SWEC-QA
11/2/94



I have reviewed this notebook and find it generally in compliance with QAP-001. There is sufficient information for a qualified person to repeat the activity.

E.C. Ray
1/14/97

This project has ended.

E.C. Ray
1/14/97

## ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK NO. 23

| | |
|---|---|
| **Document Date:** | 11/01/1994 |
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| **Remarks:** (computer runs, etc.) | All photographs relative to this notebook are contained in binders located at the Center for Nuclear Waste Regulatory Analyses Laboratory Building No. 57 at the contact address listed above. |