Volcanic Systems of the Basin & Range (122-125)

21
300

R

BRITTAIN HILL, 12/92 -

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FIELD TRIP TO LATHROP WELLS AREA, NV, 12/6/92

PURPOSE - TO COLLECT SCORIA + ROCK SAMPLES FOR GEOCHEMICAL ANALYSIS OF MELT INCLUSIONS. DATA USED TO CONSTRAIN VOLATILE CONTENT OF QUATERNARY CRATER FLAT AREA ERUPTIONS.

SAMPLE LOCATIONS - NUMBERS REFER TO BRITTAIN HILL, 12-92, SAMPLE #. SAMPLE LOCATIONS SHOWN ON MAP COPIES, PAGE 2.

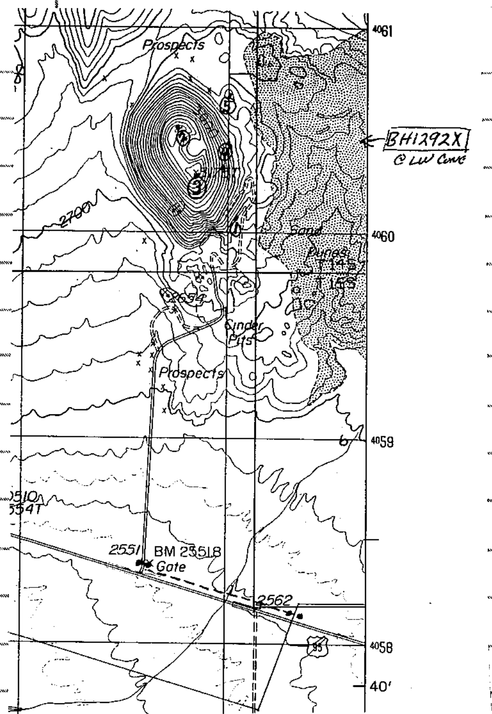
BH1292-1: QUARRY FACE @ SE FLANK OF MAIN LATHROP WELLS CONE, ~2800' ELEVATION. FRESH SCORIA FROM LOWER WALL ON NE SIDE OF PIT. SCORIA ARE ANGULAR + NON-OXIDIZED - UPPER PART OF CONE IS PERVASIVELY OXIDIZED RED CINDERS.

- XENOLITHS OF WELDED TUFF ARE COMMON. SCORIA IS AT TIMES BEDDED TO ~0.5m, WITH XENOLITH-RICH (0.5-1%) + XENOLITH-SPARSE (≪0.5%) BEDS. XENOLITHS COMMONLY >1cm DIAM, AND 10-20 cm ALSO OCCUR. ABOUT 1/2 THE XENOLITHS ARE VERY ANGULAR + LACK ADHERING BASALTIC SCORIA/RIMS; ESPECIALLY THE LARGER (≳5cm) XENOLITHS. OTHER, GENERALLY SMALLER (<5cm) XENOLITHS ARE RIMMED BY BASALT + SHOW VARIABLE AMOUNTS OF MELTING, EMBAYMENT + INFLATION.
- CINDERS ARE ALL WELL INFLATED + RELATIVELY ANGULAR. NO RIBBON/SPATTER BOMBS OR AGGLUTINATION OBSERVED. BOMBS GENERALLY HAVE OXIDIZED ZONES IN THE INTERIORS W/ LITTLE OXIDATION ON THE EXTERIOR, SUGGESTING CONTINUED DEGASSING AFTER ERUPTION

BH1292-2 N SUMMIT OF LATHROP WELLS CONE, 0.5m-DEEP CAT ROAD ON NE FLANK OF SUMMIT.

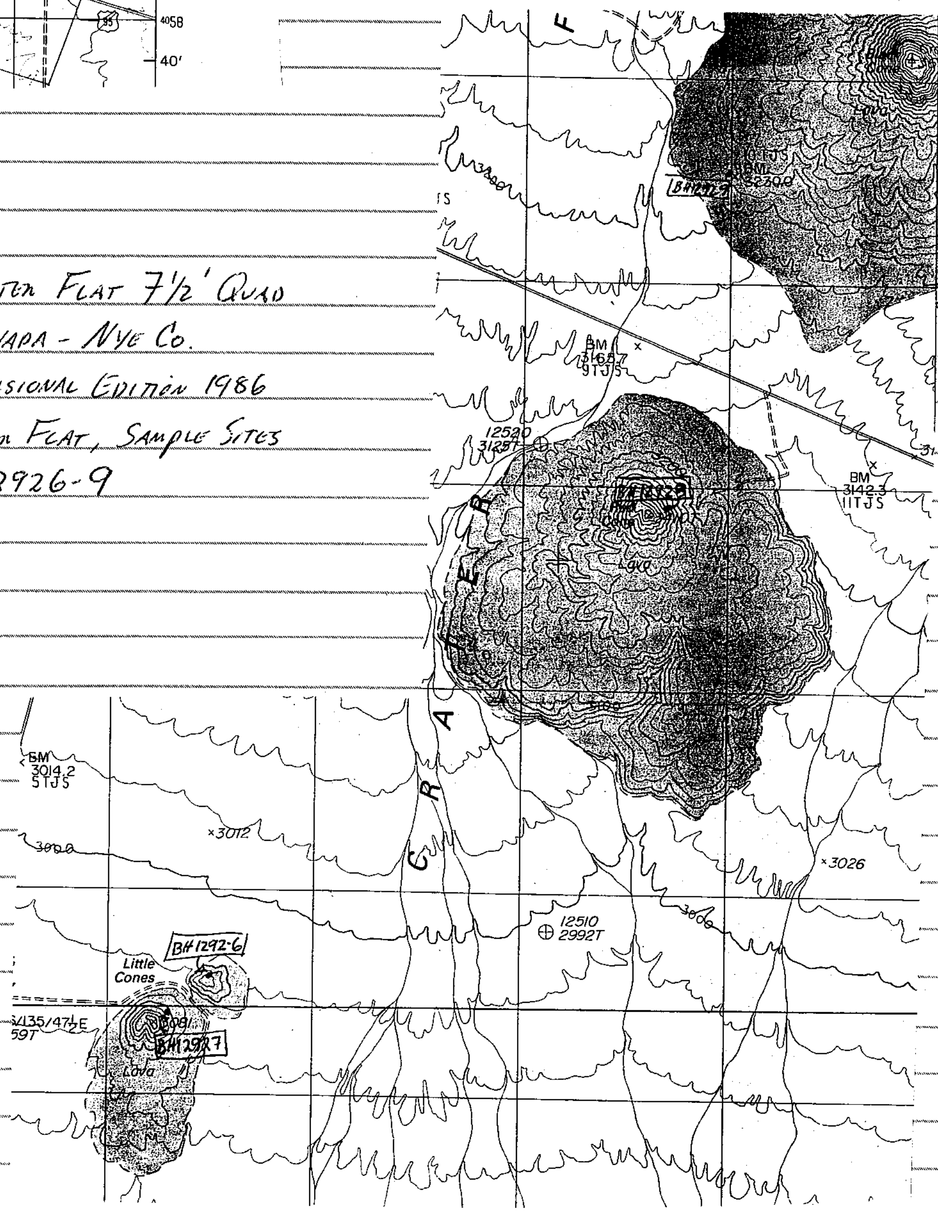
- BOMBS + LAPILLI OF OXIDIZED CINDERS IN NON-REWORKED BED. OXIDATION IS MOST ADVANCED ON RIMS OF SCORIA; INTERIORS ARE MORE FRESH. BOMBS ARE FLATTER + MORE DEFORMED THAN AT SITE #1 - HAVE RIBBON BOMBS + SOME IMPACT DEFORMATION.
- XENOLITHS ARE MUCH LESS ABUNDANT THAN SITE #1, AND DIAMETERS ≲2cm ONLY ARE OBSERVED.

BH1292-3 - S SUMMIT OF LATHROP WELLS CONE. SURFACE IS EROSIONAL + WEATHERED. THERE ARE NUMEROUS POORLY-INFLATED (VESICULARITY <3%) BLOCKS + BOMBS(?) ON SURFACE. SAMPLE IS FROM FRESHEST INTERIOR OF POORLY-INFLATED 10cm BLOCK.



BIG DUNE 7½' QUAD
NEVADA - NYE CO
PROVISIONAL EDITION 1986
LATHROP WELLS, SAMPLE SITES
BH12921-5

CRATER FLAT 7½' QUAD
NEVADA - NYE CO.
PROVISIONAL EDITION 1986
CRATER FLAT, SAMPLE SITES
BH12926-9



BH1292-4 - PIECE OF LARGE (25×40×20+ cm) XENOLITH IN ROAD CUT AT ABOUT 3000' ELEVATION ON E FLANK OF LATHROP WELLS CONE.
- XENOLITH HAS A THIN (<0.5cm), PATCHY BASALTIC RIND. LOWER BOUNDARY IS ABOUT 10-20% INFLATED + LOOKS BAKED/PARTIALLY MELTED. XENOLITH IS A WELDED IGNIMBRITE W/ INTERBEDDED COARSE VOLCANIC SANDSTONES - PEBBLY VOLCANIC WACKE.

BH1292-5 - SCORIA MOUND ON NW MARGIN OF LAVA FLOW Q_{l5} (CROWE et al., 1988). SAMPLE IS LEAST OXIDIZED CORE OF BOMBS FROM LOWEST LEVEL IN TRENCH AT SUMMIT OF THE SCORIA MOUND.

BH1292-6 LITTLE CONE NE - CRATER FLAT 7½' QUAD. SAMPLE FROM N SUMMIT AREA, INTERIOR OF A LOW VESICULARITY SPINDLE BOMB. SAMPLE HAS FRESH OLIVINE + TRACES OF AMPHIBOLE PHENOCRYSTS ≤1mm.
- MOST OF THE SCORIA HAVE AMYGDULES OF (CLAY ± ZEOLITE?) + VESICLES COATED W/ SAME. OLIVINE IN THOSE SAMPLES HAS WELL-DEVELOPED IDDINGSITE COATINGS. THIS ALTERATION NECESSITATES SAMPLING A LOW-VESICULARITY BOMB IN ORDER TO AVOID WEATHERING ALTERATION.

BH1292-7 LITTLE CONE SW. SAMPLES FROM INTERIORS OF 3 LOW-VESICULARITY BOMBS ON NE FLANK OF MAIN CONE.
- SCORIA APPEAR MORE OXIDIZED + ALTERED THAN LITTLE CONE NE.

BH1292-8 RED CONE. SAMPLES FROM AGGLUTINATED CINDER BEDS ON NE FLANK OF MAIN CONE, 3300' ELEVATION.
- BEDS OF MODERATELY ANGULAR CINDERS ARE WELL-INDURATED, PARTIALLY AGGLUTINATED, OXIDIZED CINDERS + ASH FROM 3300' TO SUMMIT @ 3410'
- SAMPLES FROM POORLY INFLATED, LEAST OXIDIZED CORES OF RIBBON BOMBS.

BH1292-9 - LAVA FLOW ON SW MARGIN OF BLACK CONE, ~10m W OF BENCHMARK 3230.0. OLD P-MAG SITE. SAMPLE FROM FRESH INTERIOR OF BLOCK AT MARGIN OF FLOW. COULD NOT REACH MAIN CONE DUE TO RAIN + DARKNESS.

ARC/INFO - SETTING MASTER TIC + FAULT LOCATIONS
SAN FRANCISCO VOLCANIC FIELD, AZ   [signature] 3/24/93

MASTER TICS

1) GENERATE SFOTIC - CREATE FILE
GEN> GRID - MAKE GRID
GEN> FISHNET ORIGIN: -112.333, 35.167
>Y AXIS COORD: -112.333, 35.833 - USE ANY X
>CELL SIZE: 0.1667 - 10/60 ; 10' GRID
>#ROWS, COLS: 4, 7
GEN> QUIT - SAVES ON EXIT

BH 4/6/93
2) ~~CLEAN~~ BUILD SFOTIC POINT - BUILD TOPOLOGY OF POINTS

3) PROJECT COVER SFOTIC SFOTICPJ SFOPFILE - PROJECTS SFOTIC INTO REAL COORDINATES
WHERE:
SFOPFILE - PROJECTION FILE, CONTAINING:
INPUT
projection geographic
units dd - DECIMAL DEGREES
datum nad27 - N. AM. 1927 DATUM
PARAMETERS
OUTPUT
projection utm - OUTPUTS UTM
UNITS METERS
ZONE 12 - AZ ZONE 12 UTM
datum nad27
PARAMETERS
END

4) - NOW HAVE SFOTICPJ W/ 4 TIC POINTS + 36 OTHER POINTS, NEED TO CONVERT THE POINTS TO TICS, + RE NUMBER.

- NODEPOINT SFOTICPJ SFOUTMTIC - GENERATES 36 POINTS
- BUILD SFOUTMTIC POINT - TOPOLOGY
- ADDXY SFOUTMTIC - ADDS REAL COORDS TO POINTS.

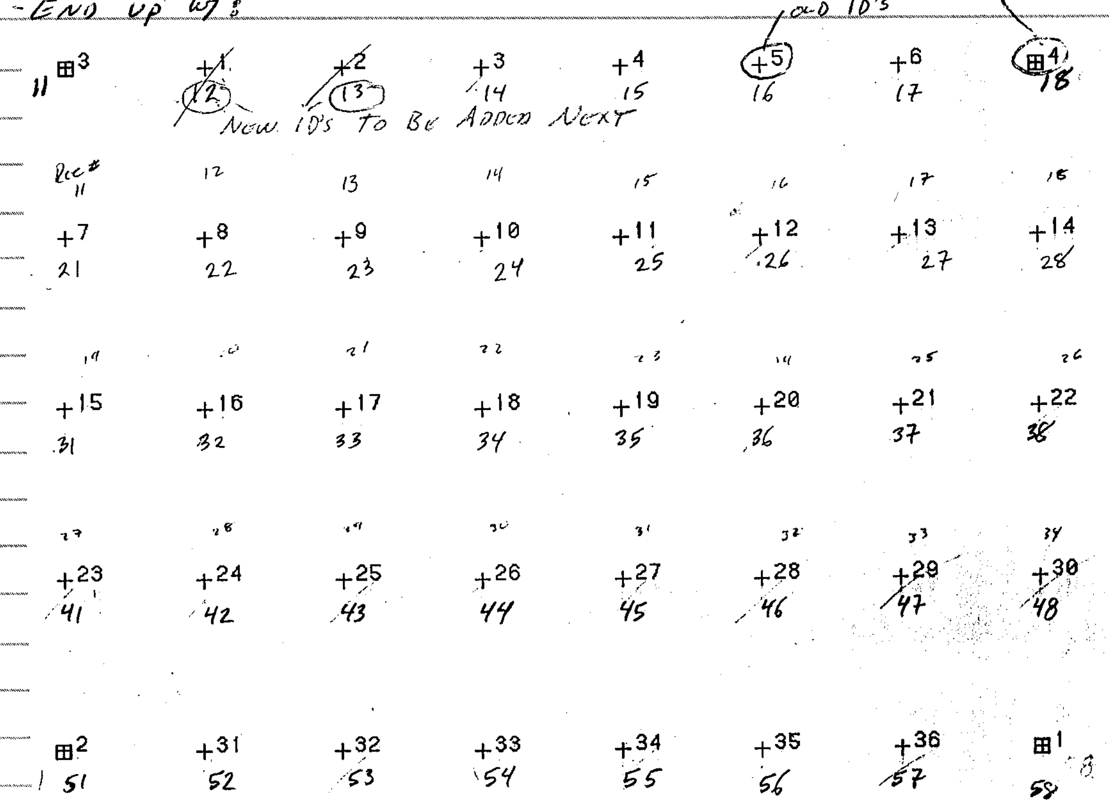
- NEED TO PRINT COPY OF SFOUTMTIC to use w/ RENUMBERING

PRINT
- ARCEDIT, EDIT SFOUTMTIC, DE TIC IDS point IDS, DRAW
- OPEN A 2ND XTERM WINDOW, + CD /U3/bhill/RASTERS
>SNAPSHOT - SET FOR 4 SEC DELAY, START + CLICK ON ARCEDIT WIN.
- SAVE SNAPSHOT AS Fn.rs
RAS > /usr/openwin/bin/xview/RAS2PS <Fn.rs> Fn.ps - CONVERTS TO POSTSCRIPT
RAS > ipr -PIMAGEN Fn.ps - PRINTS TO IMAGEN

- CAN EDIT Fn.ps FOR REVERSE IMAGE, LANDSCAPE:
- vi Fn.ps
- :g/FF/s//xx/g - CHANGE ALL "FF" to "xx"
- :g/00/s//FF/g - " " "00" "FF" - CHANGES IN HEADER NEED CORRECTION!
- :g/xx/s//00/g

CHANGE: 18.0, 18.0 TRANSLATE TO 594.0, 18.0 TRANSLATE
+ ADD LINE: 90 ROTATE

- SAVE + ipr -PIMAGEN Fn.ps
- END UP W/:



5) CHANGE TIC ID'S:

ARC: INFO — ENTER INFO

COMMAND> SELECT SFOUTMTIC.TIC

D> UPDATE PROMPT

RECNO > 1

TICID > 58 — FROM CHART BOTTOM p. 5

— ENTER FOR X + Y COORDS, DO FOR RECNO 2-4.

D> Q STOP — SAVES ON EXIT

6) CHANGE POINT ID'S:

ARC> RENAME SFOUTMTIC SF — 2 LETTER FN SIMPLIFIES ALL THIS

— OPEN A NEW xterm WINDOW

• vi pts.JUNK — MAKE A TEMP FILE

ARC> INFO — INTO INFO

COMMAND> SELECT SF.PAT

D> LIST

— USE L MOUSE BUTTON, COPY HEADERS, ID'S + COORDS INTO JUNK FILE

— SAVE pts.JUNK + QUIT vi

D> Q STOP

ARC: COPY pts.JUNK pts2.JUNK — BACKUP FILE

— AGAIN, GOTO OPEN XWINDOW + vi pts2.JUNK

ARC: INFO — RE-ENTER INFO

COMMAND> SELECT SF.TIC

D> ADD — ADD TIC INFO

— IN vi WINDOW, REMOVE COMMAS By :g/,/ /g

RECNO>5

IDTIC> 12 — NEW TIC ID FROM TABLE ON BOTTOM p. 5

XTIC > COPY #'S FROM vi WINDOW

YTIC > " " "

— REPEAT THROUGH RECNO 36

D> Q STOP

7) ARCEDIT — CHECK SF FOR TIC ACCURACY

— IF OK, THEN

COPY SF SFTIC, WHICH IS MASTER TIC FILE FOR SAN FRANCISCO V.F.

ARC/INFO: 3/25/93

DIGITIZE FAULTS FROM 2 MAPS @ SFO V.F., + COMBINE [signature]

DIGITIZE FAULTS

1) DIGITIZER mgrid2 /dev/ttyb:9600:7bit:even

2) ARCEDIT

> CREATE SF1956A SFTIC — MAKE FROM MASTER TIC FILE

> COORDINATE DIGITIZER DEFAULT — CALIBRATE DIGITIZER

— CALIBRATE, GOT RMS 0.001 + 1.72 METERS

> DE ARC NODE LABELS IDS — SET DRAW ENVIRONMENT

> EF ARC — EDIT FEATURE

> ADD — BEGIN DIGITIZING, "2" FOR NODES, "1" FOR VERTICES "9" to END

— REPEAT FOR SF1960A

> SAVE — CHECK W/ DRAW

3) COPY SF1956A SF1956BD

ARC> BUILD SF1956BD LINE — BUILD ARC TOPOLOGY

— REPEAT FOR SF1960A

4) ARCEDIT — CHECK DISTANCES BETWEEN SF1960BD + SF1956BD ARCS, TO SET SNAP TOLERANCES (HERE IS 150m)

JOIN COVERAGES

1) ARC> APPEND SFAULT LINE — JOIN 2 COVERAGES OF ARCS

1ST > SF1960BD

2ND > SF1956BD

2) BUILD SFAULT LINE — TOPOLOGY

3) MATCHNODE SFAULT SFAULTMN 150 # EXTEND

— MATCHES NODES WITHIN 150 M, CREATES SFAULTMN

4) BUILD SFAULTMN LINE — CREATE ARC + NODE TOPOLOGY

BUILD SFAULTMN NODE

5) COPY SFAULTMN SFAULTMJ

6) ARCEDIT — To Remove Pseudonodes + Check Arc ID's For Duplication
>EDIT SFAULTMJ
>DE ARC IDS NODES PSEUDO
>DRAW — Note Pseudonodes on Joined Arcs

Pseudonodes
>EF ARC — Edit Arcs
>SELECT ALL
>UNSPLIT NONE — Removes Pseudonodes
>DRAW — Check For Connectness, + SAVE

Arc Labels
>EF ARC — EDIT ARC ID'S
>SELECT — Point w/ Mouse
>CALCULATE SFAULTMJ-ID = # — Change Duplicate ID's - Look At List To Determine Header
>SAVE + QUIT

ARC> COPY SFAULTMJ SFAULT1
>BUILD SFAULT1 LINE — Reconstruct Topology

ASCII File
To Produce An ASCII File w/ Arc ID's + Vertex Coordinates:
ARC> UNGENERATE LINE SFAULT1 SFAULTOUT

Arc/Info From IRIS
LOGGING ONTO ARC/INFO FROM IRIS:
- LOGON To WYSE Terminal
>TWM&
>vt100 — Goto IRIS Terminal + Open Xterm Window
>xhost +bren
>rlogin bren
/u2...> setenv DISPLAY 129.162.200.219:0
- Run Arc/Info
- Kill Open TWM Windows w/ L Mouse Button
- LOGOUT

[signature] 3/31/93

Arc/Info: Joining SFO V.F. Maps using Matchnode Snaps Too Many Arcs. Need To 1) Remove Pseudonodes From Built Coverages 2) Append + 3) Manually Snap Boundary Faults

1) Remove Pseudonodes From SF1956BD + SF1958BD + Build Topology

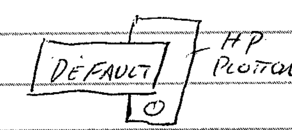
2) Append SFAULT LINE using: SF1957BD, SF1956BD, SF1960BD, SF1959BD + SF1958BD.
BUILD SFAULT LINE

3) ARCEDIT > NODESNAP 10 — Set Snap = 10m
>EDIT SFAULT — Goto Map Boundaries + Find Arcs To Combine
>EF ARC
>SELECT — Select Arc to Move
>MOVE — Move To End Nodes
>SELECT MANY — Select 2 Arcs to Join
>UNSPLIT NONE — Remove Pseudonode
>CALCULATE SFAULT-ID = # of Longer Arc

Repeat Until Boundary Faults Connect. SAVE, QUIT + BUILD SFAULT LINE

Arc/Info: Creating HPGL Plotter Files

1) Arcplot: MAPEXTENT SFAULT
>DISPLAY 1040 — Output to File
Output Fn: SF.gra
>Mapunits meters
>Mapscale 100000
>TICS SFAULT IDS
>Arcs " IDS
>Quit



2) ARC: ROTATEPLOT SF.gra SF1.gra — To Change Default To Portrait (Not Done For This Map)

3) HPGL SF1.gra SF1.hpgl 1 # # # 7596 a -1
4) cp SF1.hpgl /gsiris∅ - Copy To Iris

5) rlogin gsiris + cd /SCR∅
/OLDusr/local/bin/
6) Iris >^EMACS SF1.hpgl - Emacs Editor
- ^D - Delete 1st ~13 Characters @ Top of File, To "IN;"
^X^S - Save ^X^C Exit

7) Iris > cp SF1.hpgl /SCR∅/PLOTS - Goto Plotter + Insert Paper
- When Plot Finished, Hit F1 2x To Set Plotter in Ready Mode. Open Cover + Remove Plot, Close Cover

Selecting Items + Lookup Tables

Arc/Info 4/2/93

ADDING ATTRIBUTE VALUES FROM ASCII FILES:

1) Ascii File w/ Columns Delineated w/ "9", must Be a Constant Fixed Format w/ No Column Headers. Note Column Format (Width=4, I, C, or B)

2) Copy Coverage: SFAULT SFAULTAGE

3) INFO
> DEFINE FAULTAGE.DAT
ITEMNAME > SFAULTAGE-ID
In Width > 4
Outwidth > 5
Item > B

Itemname > AGECODE
IW > 1
OW > 3
IT > I

Witnessed by

4) > ITEMS FAULTAGE.DAT - To Check Format + ID's.

5) > ADD FROM /U2/...Full-Path/ASCII.Fn - Adds Codes To Faultage.Dat

6) > JOINITEM SFAULTAGE.AAT FAULTAGE.DAT ~
SFAULTAGE.AAT SFAULTAGE-ID SFAULTAGE-ID
- Joins Faultage.Dat To SFaultage Arc Attributes, using SFAULTAGE-ID As Common.

7) Q STOP

8) Arcplot - Check Joins
> MAPEXTENT SFAULTAGE
> ARCLINES SFAULTAGE AGECODE - Linecolor = Code
> Quit

Selecting Ages

1) Arc > RESELECT SFAULTAGE SF1 LINE - Select From SFaultage Lines → SF1 output
> RES AGECODE EQ 1 - Reselects Age = 1
>

2) Repeat For Agecode = 2, 3, 4

3) Ungenerate Line SF1 SF1OUT - Makes Ascii File

Printing on PS Printer

1) Arcplot
> MAPEXTENT SFAULTAGE - Entire Field
> DISPLAY 1040 - File Output
Fn > SF1OUT.gra
> Mapunits Meters
> Mapscale 500 000
> TICS SFAULTAGE IDS
> Arcs SF1
> Quit

2) RotatePlot SF1.gra SF1a.gra

3) POSTSCRIPT SF1a.gra SF1a.eps

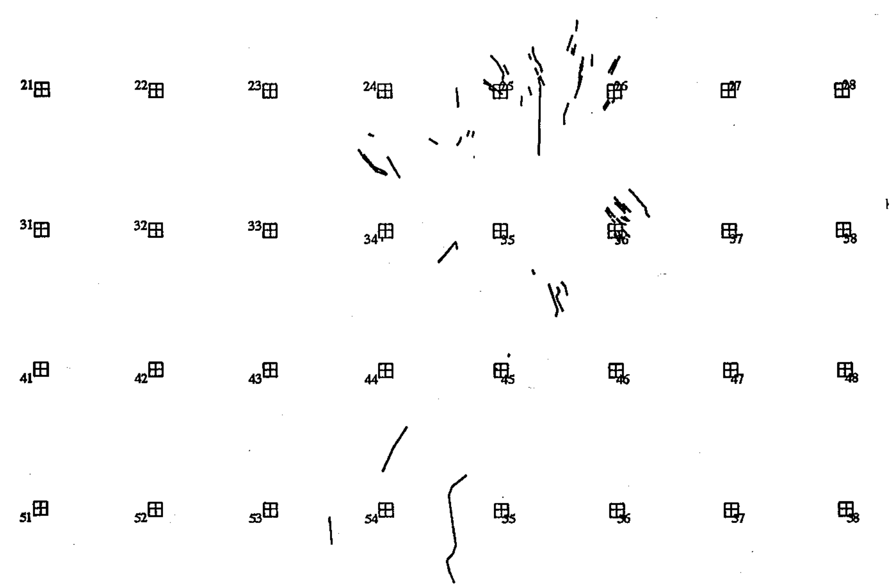
4) mv SF1a.eps SF1a.ps — Rename

5) ipr -PImagen SF1a.ps

11x17" Prints

```
To get an 11x17 print out of the Imagen:

1)Convert to HPGL format:
Arc: hpgl sf4a.gra sf4a.hpgl 1 # # # 7475 a -1

2) Make header:
Arc: echo "@document(language hpgl, inputbin upper)" > hsf4.hpgl
Submitting command to Operating System ...

3) Concatenate header + File:
Arc: cat sf4a.hpgl >> hsf4.hpgl
Submitting command to Operating System ...

4) Print:
Arc: ipr -Pimagen hsf4.hpgl
Submitting command to Operating System ...


Can try directly:
1) Make header:
Arc: echo "@document(language Ultrascript, inputbin upper)" > hsf4.ps
Submitting command to Operating System ...

2) Concatenate header + File:
Arc: cat sf4a.ps >> hsf4.ps
Submitting command to Operating System ...

3) Print:
Arc: ipr -Pimagen hsf4.ps
Submitting command to Operating System ...
```

1:1,000,000
Print of ~~SEAULTAGE~~ BH
SF1



Point Data

Arc/Info: 4/5/93

Adding Vents to SF Coverages [signature]

1) Construct Data File w/ Vent #, X-coordinate, Y-coordinate
   - SFVENTSLOC - Contains Vent ID + Coords For San Francisco Volcanic Field Vents (605)
   - Make Sure File Name Does NOT Have An Extension

2) GENERATE SFVENTS — Creates Vent Coverage
   G> INPUT SFVENTSLOC
   G> POINTS — Hits Unexpected EOF - OK
   G> Q — External + Bounds

3) BUILD SFVENTS POINTS — Build Topology

4) PROJECT COVER SFVENTS — Creates Cartographic Projection For Coverage
   P> INPUT
   P> ~~PARAMETERS~~ BH 5/18/93
   P> Proj UTM
   P> Units Meters
   P> Zone 12
   P> Datum NAD27
   P> Parameters
   P> Output
   P> Proj UTM
   P> Units Meters
   P> Zone 12
   P> Datum NAD27
   P> Parameters
   P> END

5) INFO — Data Format
   - DEFINE VENTID.DAT

Itemname	In Width	Out Width	Format
SFVENTS-ID	4	5	I
VENTID	6	7	C
CLUSTER	1	2	I

5) CONT

I> ADD FROM /U2/...FULL PATH/ SFEVENTSDAT

I> Q STOP

(IN FILE, JOIN FILE, OUT FILE)

6) ARC> JOINITEM SFEVENTS.PAT VENTID.DAT SFEVENTS.PAT ~
SFEVENTS-ID
RELATE ITEM

- JOINS VENTID.DAT DATA W/ SFEVENTS, POINT AT. TAB. USING SFEVENTS-ID.

7) DISPLAY IN ARCPLOT

P> MAPEXTENT SFEVENTS

P> POINTMARKERS SFEVENTS CLUSTER

P> ARCLINES SFAULT AGECODE

5/18/93

MAP FILES

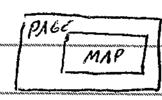
CONSTRUCTING MAP FILES IN ARCPLOT

1) ARCPLOT

P> MAP SFO.MAP - OPEN NEW MAP FILE

P> PAGESIZE 34 22 - 34X22 SHEET

P> MAPLIMITS 15 4 34 18



P> MAPPOSITION CEN CEN

P> MAPUNITS METERS

P> MAPSCALE 250000

P> TICS SFTICS NOIDS

P> ARCLINES SFAULTAGE AGECODE - FAULTS W/ AGE

P> POINTMARKERS SFEVENTS CLUSTER - 9 Δ CLUSTERS

P> TEXTSIZE 0.5

P> MOVE ★

P> TEXT 'SAN FRANCISCO VOLCANIC FIELD' LC - TEXT ELEMENTS

: - ADD LAT LONG, SCALE TEXT A/A

P> MAP END - SAVES MAP

ARC/INFO

EDITING MAP FILES IN ARC PLOT

5/19/93

1) ARCPLOT > MAP SFO.MAP - DISPLAYS OLD SFO MAP

2) P> MSELECT ALL - SELECTS ALL ELEMENTS

P> MCOPY SFO1.MAP - COPIES TO NEW MAP SFO1

P> CLEAR

P> MAP SFO1.MAP - WORK ON COPY

3) ADD FAULT LEGEND:

a) OPEN TEXTEDIT + MAKE SFMAPKEY:

• 1

QUATERNARY

• 2

QUATERNARY - TERTIARY

• 3

TERTIARY OR OLDER

• 4

UNDETERMINED

b) ARCPLOT > TEXTSIZE 0.125

P> KEYAREA ★ - DEFINE AREA FOR KEY

P> KEYLINE SFMAPKEY NOBOX - CREATES LEGEND

4) ADD POINT LEGEND

a) TEXTEDIT SFMAPPT.KEY, SAME FORMAT AS SFMAPKEY FOR CLUSTERS 1-9

b) ARCPLOT > KEYAREA ★

c) KEYMARKER SFMAPPT.KEY NOBOX

5) ARCPLOT > BOX ★ - ADD BOX AROUND LEGEND

6) MAP COMMANDS:

~~MLIST~~ (OH 5/19) - MINFO - LISTS MAP ELEMENTS

MSEL# SELECT ELEMENT OR ★ TO MOUSE

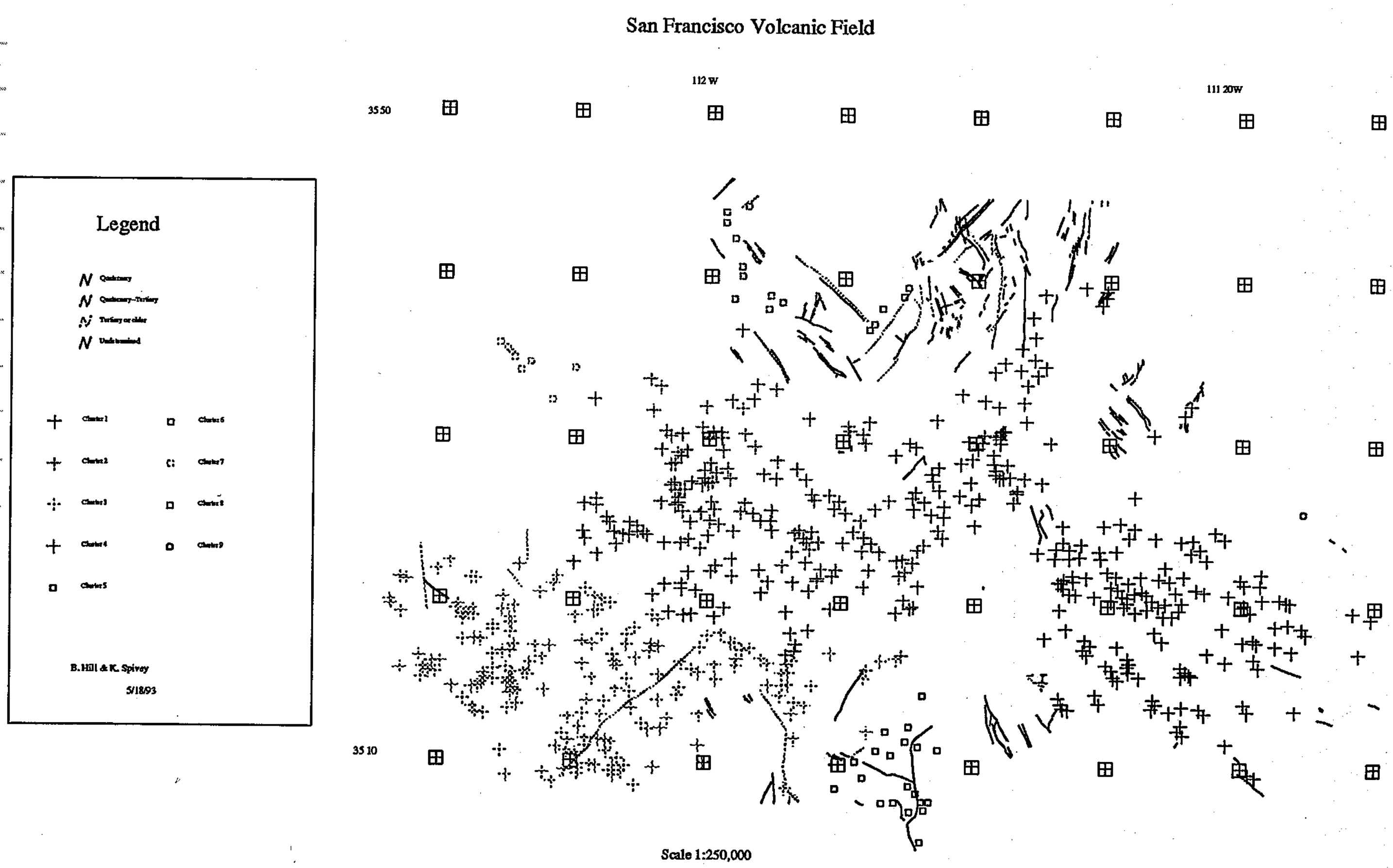
MDEL - DELETES SELECTED ELEMENT

6) Cont.

MSCALE # - Scales Element
MMOVE * - Moves Elements
MFRESH - Redraws Map.

Postscript Print

1) From Arcplot, Make SF02.GRA
2) Arc> POSTSCRIPT SF02.GRA SF02.EPS 0.3 → Scale for 11x8.5
3) mv SF02.EPS SF02.PS
4) lpr -Pimagen SF02.ps



LUT's

Adding Lookup Tables 6/18

- Specifying Symbol Type for Vent Clusters in SFVF.

1) INFO > DEFINE VENTS.LUT

ITEM > CLUSTER ITEM > SYMBOL - This Item Must Be Included
IW > 2 IW > 2 As Named, in All Lookup Tables
OW > 2 OW > 2
TYPE > I TY > I + Q STOP

2) INFO > ADD ! - Add At Prompts

$RECNO	CLUSTER	SYMBOL	
1	1	1	+
2	2	5	□
3	3	13	△
4	4	41	▽
5	5	21	◇
6	6	45	☆
7	7	25	⊠
8	8	49	✳
9	9	69	★

- QSTOP to Save

3) In Arc/Plot, To Display Symbols:

P> POINTMARKERS SFVENTS CLUSTER VENTS.LUT

MAP AML's

Creating Map AML's 6/18/93 [signature]

1a) Open Xterm Window + TEXTEDIT fn.aml

- Can Copy old .aml + Edit - A Lot Easier

1b) In Arc/Plot, Could Setup A Watch Box to Echo Commands:

P> &WATCH fn.wat - Now Do Commands
P> &WATCH &OFF
Arc> &CWTA fn.wat fn.aml - Converts Watch to AML File

2) Using Textedit, Create This Type of File

SFVENT2.AML

```
kill sfvent2.map          — Delete Line 1st Time Run
map sfvent2.map
mapextent sftic
pagesize 11 8.5
maplimits 2 1.5 10 7.5
```

Cont.

SFVENT2.AML CONT:

```
mapposition cen cen
mapunits meters
mapscale automatic
tics sftic noids
textquality proportional
textfont 94021
move 6 7.75
textsize 0.3
text 'San Francisco Volcanic Field' CC
textsize 0.12
move 8.68 7.3
text '111 20W' CC
move 4.44 7.3
text '112W' CC
move 2 7.1
text '35 50' CC
move 2 2
text '35 10' CC
move 8.66 1.5
text 'B. Hill & K. Spivey' CC
move 3.3 1.5
text 'Scale 1:574000' CC
textsize 0.12
markerset plotter.mrk
pointmarkers sfvents cluster vents.lut
keyarea 0.6 1.8 1.95 6.57
keyseparation 0.1 0.12
textjustification CL
keybox 0.25 0.25
keymarker sfmappt.key nobox
linesymbol 1
box 0.49 3.29 1.92 6.63
*map end
```

- USE MAPINFO TO CHECK ACTUAL MAP BOUNDARIES; MINFO IS LIMITED.

3) IN ARC/PLOT:

P> CLEAR

P> &RUN SFVENT2.AML — TO PRODUCE SFVENT2.MAP

4) TO EDIT THIS MAP IN ARCPLOT (E.G., CUT + PASTE INDIVIDUAL COMMANDS INSTEAD OF RUNNING AML EACH TIME TO CHANGE):

— DELETE LAST LINE (*) – LEAVES AN OPEN MAP COMPOSITION

5) TO PRINT AFTER RUNNING AML:

P> DISPLAY 1040

P> PLOT SFVENT2.MAP

P> QUIT — NOW ROTATE + PLOT ETC. .GRA FILE.

ARC/INFO: — B. Hill 6/21/93

BUFFERS

BUFFERS AROUND FAULTS

– TO CREATE A 1KM-WIDE BUFFER AROUND MAPPED FAULTS IN SFVF:

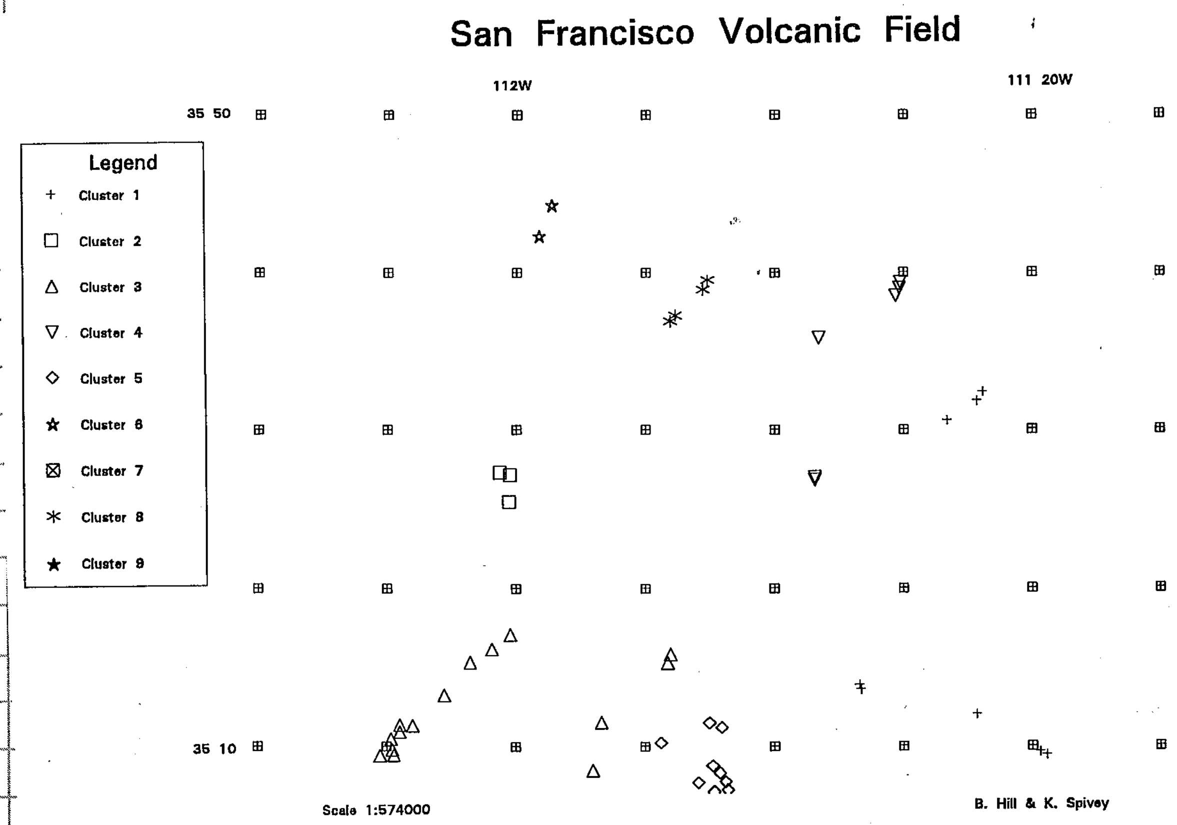
1) ARC> BUFFER SFAULTAGE SFAULTBUF # # 1000 # LINE
(IN, OUT, 1000M, 'KEEP LINES ON BUILD)

2) TO SELECT ALL VENTS LOCATED WITHIN 1 KM OF FAULT:

ARC> INTERSECT SFVENTS SFAULTBUF SFVENTSBUF POINT # JOIN
(IN COV, BUF COV, OUT, IN TYPE)

3) PLOT OR EDIT LIKE ANY OTHER COVERAGE; SFVENT5.AML

```
(1) kill sfvent5.map
map sfvent5.map
mapextent sftic
pagesize 11 8.5
maplimits 2 1.5 10 7.5
mapposition cen cen
mapunits meters
mapscale automatic
tics sftic noids
textquality proportional
textfont 94021
move 6 7.75
textsize 0.3
text 'San Francisco Volcanic Field' CC
textsize 0.12
move 8.68 7.3
text '111 20W' CC
move 4.44 7.3
text '112W' CC
move 2 7.1
(2) text '35 50' CC
move 2 2
text '35 10' CC
move 8.66 1.5
text 'B. Hill & K. Spivey' CC
move 3.3 1.5
text 'Scale 1:574000' CC
textsize 0.12
markerset plotter.mrk
pointmarkers sfventsbuf cluster vents.lut
keyarea 0.6 1.8 1.95 6.57
keyseparation 0.1 0.12
textjustification CL
keybox 0.25 0.25
keymarker sfmappt.key nobox
linesymbol 1
box 0.49 3.29 1.95 6.85
move 1.31 6.72
textsize 0.17
text 'Legend' CC
map end
```



Initial Entry for Arc/Info project: The Arc/Info project involves the creation of a Geographic Information System (GIS) for volcanic systems of the Basin & Range, which will be used to create and test quantitative and conceptual models of tectonism and volcanism. This project is discussed in detail as Task 2 of the Volcanic Systems of the Basin and Range Project Plan. Many of the procedures in this notebook involve developing efficient procedures in Arc/Info for entering and formatting data, and creating useful multilayered geologic maps.

Primary investigators on this project are: Brittain Hill and Kathy Spivey (CNWRA). Other participants in some aspects of this project are Ron Martin and Steve Young (CNWRA), who are creating a related GIS on Basin and Range tectonics.

The volcanism GIS is being developed on Arc/Info, version 6.1, which is run primarily from the Sun SPARC 2 computer system. Remote sessions occasionally are run through X-Windows emulators on terminals and IBM PS/2 computers.

There are many sources for the data used in this project. Primary sources include published geologic maps, data from the geologic literature, and digital files from U.S. Government agencies (e.g., U.S.G.S, N.O.A.A.). Secondary sources of data are university theses, unpublished reports such as open-file reports, and digital files from other researchers. All entries in the GIS preserve the original source of the data through a unique sample number, which shows the name of the volcanic system and the reference number of the original source.

Brittain Hill 6/24/94

- The Data For Volcanic Fields Used In Exercises on Pages 4-19 is Preliminary + Not Used To Construct Models For CNWRA Work. These Data Are Used As An Example Data Set To Develop Procedures In Arc/Info.

Brittain Hill 9/2/94

Pages 1 through 20 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
SWRI-QA
12/12/94

9/26/95 - Geologic Map of 1975 Tolbachik Deposits

- Basemap From: /u4/phunter/ai/tolbachik/contours = Contour Map Digitized From IVGG Base Map. Coregistered Using GPS Points From 1994 Field Work.

- Drew Geo Map using CONTOUR Copy, w/ Units + Contacts Modified From Fedotov et al. (1984 - Blue Book) Fig I-59, CONTOUR Base Map, + Personal Field Obs. - Rest of Doc in Field Volc Notebook

Brittain Hill 9/28/95

Entries For This Notebook Are Continued In 3-Ring Binder "Volcanic Systems" Notebook, Which Is Periodically Archived.

Brittain Hill 7/9/96

7/9/96

1/3/97

Volcanic Systems of the Basin and Range Research Project
Electronic Scientific Notebook #2, Started September 9, 1996 - Brittain Hill

This notebook is a continuation of controlled scientific notebook #56, issued to Brittain Hill

Project: Document basis for eruption duration - power relationships for basaltic volcanoes used in IPA modeling. Application of these data given in Jarzemba (1996), which stochastically samples a range of power (i.e., eruption mass) and durations to arrive at values for YMR volcanoes. Range used in Jarzemba (1996) is based on limited data, and incorporates large, fissure-fed basaltic eruptions that are not analogous with YMR.

Eruption volume calculations are documented for these volcanoes on pages 51-66 of notebook #56. Whereas the duration of the entire eruption is generally well documented, modeling requires that the duration of the explosive phase of the eruption is known. Commonly, basaltic volcanoes have an early effusive stage dominated by low energy bursts, cone construction, and lava flow emission, with little convective ash dispersal. Latter stages of the eruption generally produce the bulk of the tephra fall deposits. Column heights are generally reported as maximum values rather than average heights. Where appropriate, a range is shown.

Cerro Negro volcano, Nicaragua:

1947: McKnight (1995) reports newspaper accounts that main ash accumulation began in Leon on July 15, 1947. Wilcox (USGS Geologist) first-hand report states main convective phase of eruption ended the evening of July 24, 1947. Total convective duration is 10 days, column heights 4-6.5 km

1968: Taylor and Stoiber (1973) report that tephra deposition was continuous between October 25 and December 5, 1968. Duration is thus 42 days, column heights 1-1.5 km.

1971: Viramonte et al. (1971) report a convective duration of 7 days and column heights of 6 km

1992: Connor et al. (1993) report the bulk of the tephra was deposited in 18 hours, with column heights to 6.5 km

1995: Documentation in the Field Volcanism notebook #88 by B. Hill shows the main tephra deposition occurred over 4 days, with column heights to 2 km.

Heimaey: Eruption duration of 26 days from Self et al. (1974), with column heights 1-2 km.

Paricutin: Eruption duration for main period of fall deposition (3/18/43 to 6/9/43) of 84 days from Luhr and Simkin (1993), with column heights of 4-6 km.

Tolbachik: Duration of Cone 1 (14 days, 6-10 km high) and Cone 2 (38 days, 2-3 km high) from Fedotov et al. (1983), for main tephra-producing phases of eruption.

Height, duration and mass flow data for these eruptions are shown in table ERUPTDYN.

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	A	B	C	D	E	F	G	H	I	J	K
8		Observed	Duration				DRE				
9		H (km)	(s)	H (m)	Q (W)	(kg/m3)	v (m3/s)	s (J/kgK)	T (°K)	Tf	F
10	Hekla 1947	24	1.80E +03	21.1	4.3E +13	2500	17000	1.1E +03	1200	270	1
11	Hekla 1970	14	7.20E +03	14.0	8.5E +12	2500	3333	1.1E +03	1200	270	1
12	Tarawera 1886	9.5	1.08E +04	30.4	1.9E +14	2640	84259	1.1E +03	1375	270	0.7
16											
17	Heimaey	2	2.25E +06	2.2	4.9E +09	2600	2.3	1.1E +03	1325	270	0.7
18	Paricutin	4-6	7.26E +06	4.0	5.7E +10	2530	26.6	1.1E +03	1375	270	0.7
19	Tolbachik Cone 1	6-10	1.21E +06	4.8	1.1E +11	2640	49.6	1.1E +03	1400	270	0.7
20	Tolbachik Cone 2	2-3	3.28E +06	3.5	3.2E +10	2610	14.0	1.1E +03	1400	270	0.7
21											
22	CN47	4-6.5	8.64E +05	3.5	3.3E +10	2600	15.9	1.1E +03	1325	270	0.7
23	CN68	1-1.5	3.63E +06	1.9	2.6E +09	2600	1.2	1.1E +03	1325	270	0.7
24	CN71	6	6.05E +05	3.8	4.9E +10	2600	23.0	1.1E +03	1325	270	0.7
25	CN92	6.5	6.39E +04	6.4	3.6E +11	2600	172.1	1.1E +03	1325	270	0.7
26	CN95	2	3.46E +05	2.4	7.9E +09	2600	3.8	1.1E +03	1325	270	0.7

Table ERUPTDYN: Eruption dynamics for analog basalt volcanoes.

Data from the 1947 and 1970 Hekla eruptions are from Wilson et al. (1978), and Tarawera from Walker et al. (1984) are shown for comparison, as they were used in Jarzemba (1996). Wilson et al. (1978) calculate the height of the eruption column (*H*)

$$H = 8.2Q^{0.25} \qquad \text{3-1}$$

The steady rate of thermal energy release (*Q*) is given by

$$Q = tvs(T_i - T_f)F \qquad \text{3-2}$$

where t is the magmatic density in kg m^{-3}, v is the mass flow rate in $m^3 s^{-1}$, s is the specific heat for basalt (1.1×10^3 J $kg^{-1} K^{-1}$), T_i is the temperature of the erupting magma, and T_f is the final temperature of the deposit (270 K). There is good agreement between the Wilson et al. (1978) calculated heights with measured eruption column heights shown in Table ERUPTDYN. The largest discrepancy occurs for the 1975 Tolbachik Cone 1 eruption, which has reported column heights to 6–10 km. These heights likely represent very short periods during the eruption, whereas the more time-averaged column height is probably closer to 5 km as calculated.

In another approach, Walker et al. (1984) related mass discharge rate (*M*) in kg s^{-1} to column height (*H*) as

$$H = 0.24M^{0.24} \qquad \text{3-3}$$

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Mass discharge rates (*M*) obtained in table ERUPT2 by taking the measured volume of the fall deposit and dividing by the measured duration of the tephra-producing phase of the eruption. Calculated column heights using Equation 3-3 agree with heights calculated using Equations 3-1 and 3-2 and column heights measured during the eruptions (Table ERUPTDYN). These data support the use of Equations 3-1 through

				Measured	Calcd	Meas
	Observed	*Duration*	*Calcd*	*DRE*	Vol	Vol
	H (km)	*(s)*	*H (km)*	*M (kg/s)*	*DRE (m3)*	*DRE (m3)*
Hekla 1947	24	1.80E+03	19.4	4.25E+07	3.06E+07	*9.00E+07*
Hekla 1970	14	7.20E+03	12.9	8.33E+06	2.40E+07	*3.30E+07*
Tarawera 1886	9.5	1.08E+04	29.3	2.22E+08	9.10E+08	9.10E+08
Heimaey	2	2.25E+06	2.1	6.02E+03	5.20E+06	5.20E+06
Paricutin	4-6	7.26E+06	3.9	6.73E+04	1.93E+08	1.93E+08
Tolbachik Cone 1	6-10	1.21E+06	4.6	1.31E+05	6.00E+07	6.00E+07
Tolbachik Cone 2	2-3	3.28E+06	3.3	3.66E+04	4.60E+07	4.60E+07
CN47	4-6.5	8.64E+05	3.4	4.12E+04	1.37E+07	1.37E+07
CN68	1-1.5	3.63E+06	1.8	3.22E+03	4.50E+06	4.50E+06
CN71	6	6.05E+05	3.8	5.98E+04	1.39E+07	1.39E+07
CN92	6.5	6.39E+04	6.2	4.48E+05	1.10E+07	1.10E+07
CN95	2	3.46E+05	2.4	9.78E+03	1.30E+06	1.30E+06

Table ERUPT2: Eruption charcteristics using methods in Walker et al. (1984).

3-3 by Jarzemba (1996) to derive eruption parameters stochastically for use in the Suzuki (1983) model.

Data in Tables ERUPTDYN and ERUPT2 show that the Hekla and Tarawera eruptions are several orders of magnitude larger than the volcanoes analogous to YMR. Based on the Quaternary record in the YMR, no volcanic events have a total eruption volume >0.2 km^3 DRE, whereas Tarawera has a volume of 0.91 km^3 DRE. Both Hekla eruptions occurred in 1-2 hours along 3-5 km long fissures on the flanks of a composite cone. This eruption style does not represent a reasonable analogy with the YMR volcanoes. Quaternary YMR volcanoes have estimated total eruption volumes of <0.01 to 0.2 km^3 DRE, with estimated fall deposit volumes from <0.001 to 0.02 km^3. With the exception of Hekla and Tarawera, the volcanoes shown in tables ERUPTDYN and ERUPT2 are reasonable analogs for YMR volcanoes.

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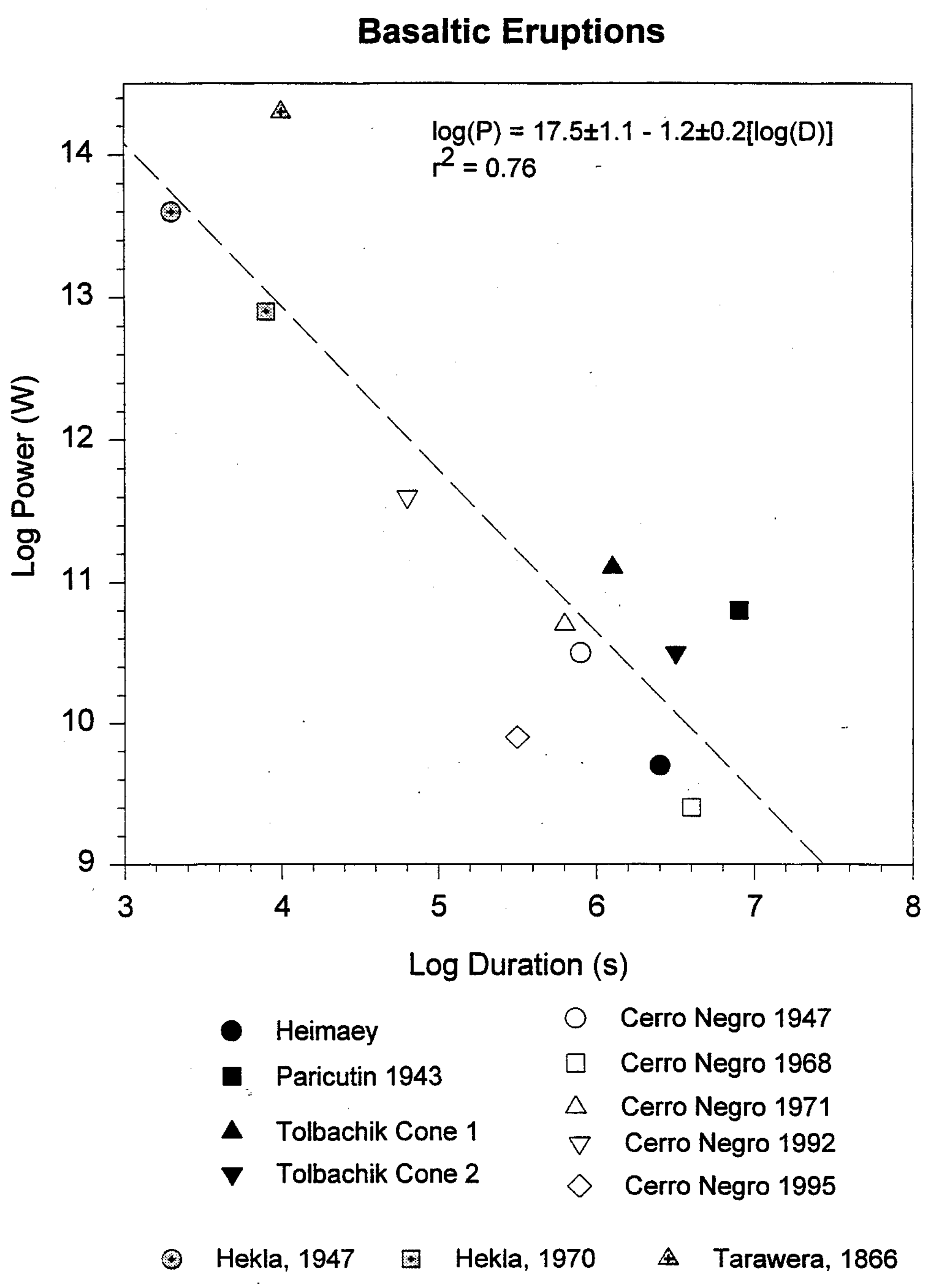
Using these volcanoes, the relationship between eruption power and duration becomes less clear than used in Jarzemba (1996). The Tarawera and Hekla eruptions produce a King-Kong effect, giving a linear regression that is not accurate for basaltic eruptions



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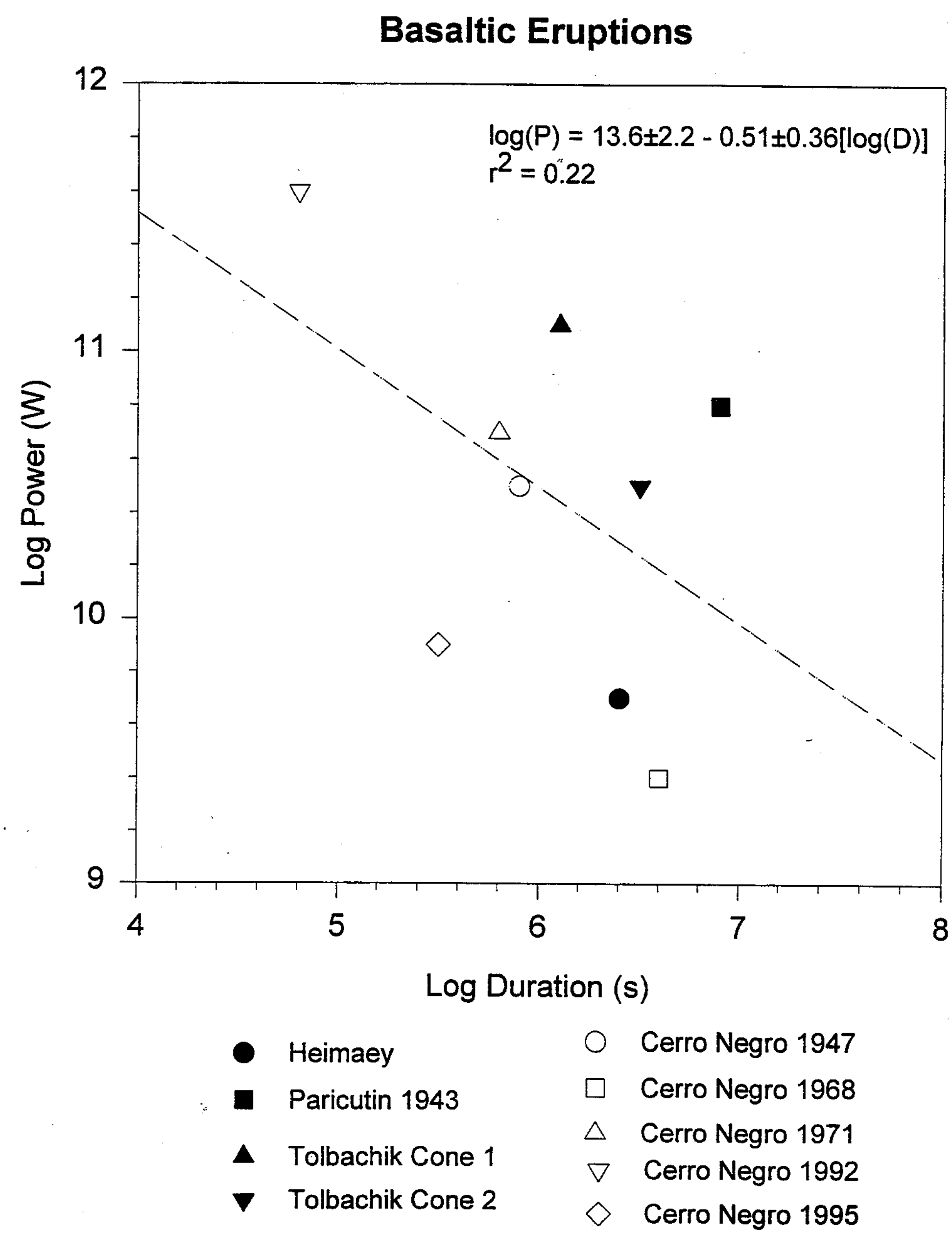
When these anomalously large eruptions are removed from the data set, a more accurate relationship (albeit less satisfying) occurs. A linear regression does not accurately represent this data set. Future PA's should use a distribution about these data, rather than a regression.



[illegible] 1/3/97

Project: Documentation of the volume of subsurface material erupted during production of the Cone 1 white-ash phase of the 1975 Tolbachik, Kamchatka, eruption. These data are critical as they constrain the area that can be disrupted during the later stages of a small-volume basaltic eruption. Proximal facies of the Cone 1 white ash include xenolith breccias, that contain multiple subsurface lithologies with a range of thermal histories. Xenoliths in these breccias range in size from mm to decimeters, and range from nearly nonaffected by thermal effects to wholly melted and plastically deformed for the same lithologies. Similar xenoliths have been found at Lathrop Wells and, to a lesser extent, Little Black Peak volcanoes in the YMR. Thus, these YMR volcanoes may have undergone a late-stage brecciation event that disrupted millions of cubic meters of shallow (i.e., < 1km) bedrock. This constraint is critical to bounding performance model parameters regarding the area disturbed directly by basaltic eruptions, and constrains the maximum number of waste cannisters that can be breached during an eruption.

Background: Geology of the Tolbachik area is summarized in Field Volcanism scientific notebook #88. White ash event summarized from Budnikov et al., 1983: Cone 1 began to form on July 6, 1975, as the initial vent for the 1975 Tolbachik eruption. The eruption continued until August 7, 1975, at which time there was a 9 hour pause in the eruption. Beginning at 17:50 on August 8, 1975, "white ash" began to erupt from Cone 1, and continued until 6:00 on August 9 1975. The Cone 1 eruption ceased with the white ash event, but activity continued at 18:50 on August 9, 1975, with the formation of Cone II immediately north of Cone 1. Dispersal of the white ash was primarily in the western sector, with some in the more southern sector as well. Budnikov et al. (1983) report $7x10^6$ m^3 of white ash was produced, based on their calculations.

Independent calculation of white ash volume: Using thicknesses measured in July, 1994 field work (Scientific notebook #88), produced the isopach map on the next page using Arc/Info coverages. Thin isopachs are the 1975 fall deposit, from Budnikov et al. (1983). Contour outlines of South Cone and Northern Cones and lavas also shown in thin line. 1994 fall sample locations shown with X. Thick isopach lines represent interpred thicknesses based on field measurements and reported dispersal patterns. Values are in cm for both isopach maps.

Polygon areas for this isopach map, from Arc/Info. Record # refers to following isopachs: 2=1 cm, 3= 2.5 cm, 4= 5 cm, 5=10 cm, and 6=30 cm.

```
Arc: list isowhite.pat
Record            AREA         PERIMETER ISOWHITE# ISOWHITE-ID
     1   -143457179.74165   45983.13508      1          0
     2     88487436.98221   73723.39733      2          0
     3     34246999.09728   44513.09484      3          0
     4     12088613.67116   27481.19334      4          0
     5      5494958.65202   17903.23676      5          0
     6      3139171.33898    7194.87601      6          0
Arc: █
```

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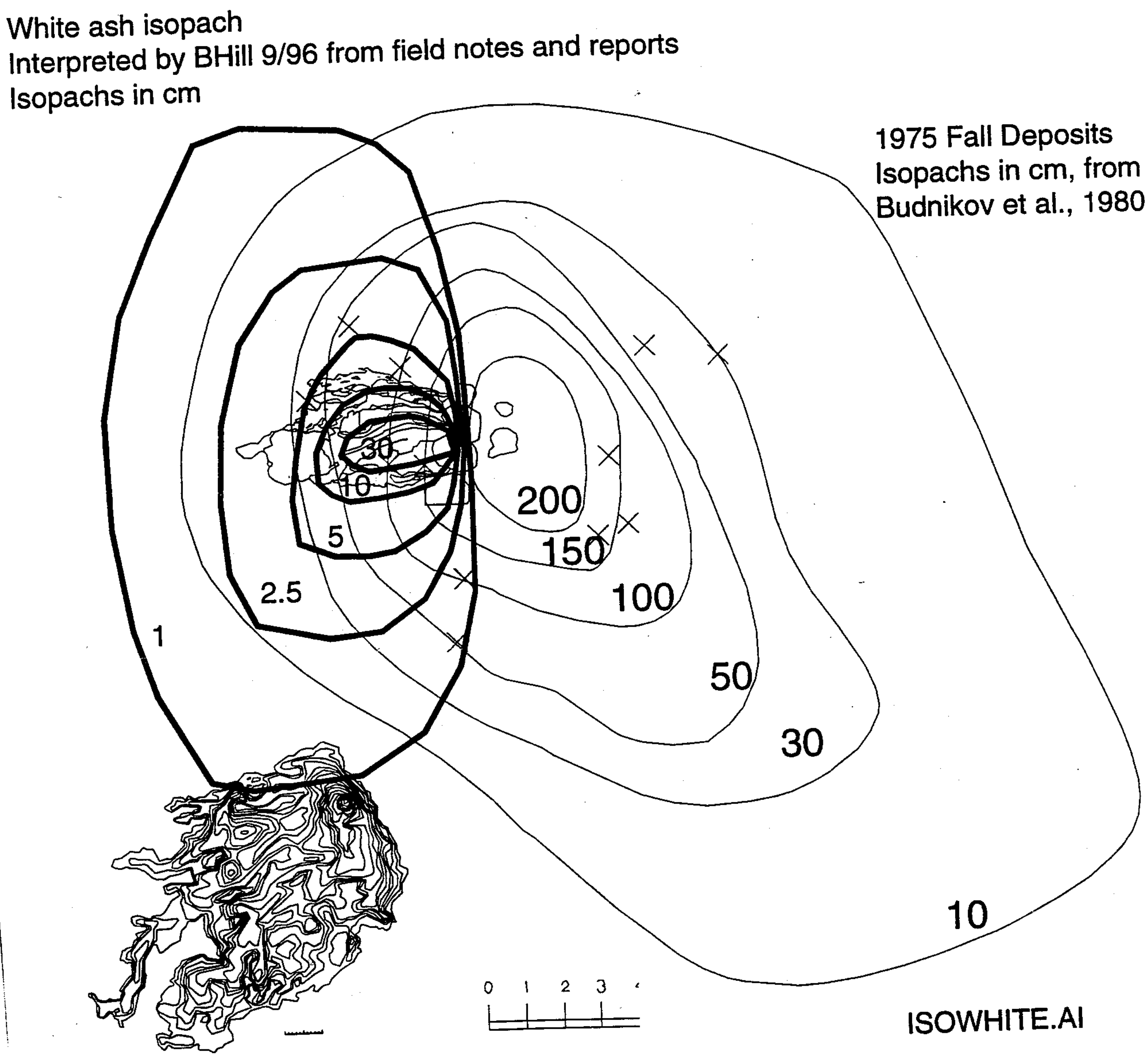
White ash isopach
Interpreted by BHill 9/96 from field notes and reports
Isopachs in cm
1975 Fall Deposits
Isopachs in cm, from
Budnikov et al., 1980
1
2.5
5
10
30
200
150
100
50
30
10
0 1 2 3
ISOWHITE.AI

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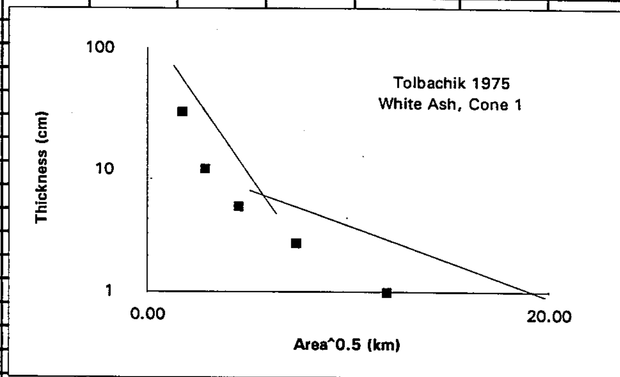
Using the data from the isopach coverages, calculate the total volume of the white ash eruption using the methods outlined on page 51 of notebook #56.

Tolbachik 1975 White ash													
Pyle plot	A/I isopak	TOTAL	Area^0.5	Thick		From SigmaPlot curve fits							Volume
Isopach	area m2	area m2	(km)	(cm)		To (km)	k	T1 (km)	k1				Isopach m
1	8.85E+07	1.43E+08	11.98	1		0.00196	3.662041	0.000141	0.228902				8.85E+05
2.5	3.42E+07	5.50E+07	7.41	2.5									8.56E+05
5	1.21E+07	2.07E+07	4.55	5		Aip^0.5=	[ln(Ti/To)]/(-k+ki) =		0.77				6.04E+05
													0.00E+00
10	5.49E+06	8.63E+06	2.94	10		Firestein & Nathenson (1992)							5.49E+05
30	3.14E+06	3.14E+06	1.77	30		Volume=	2To/k^2	2To	.....	k*Aip+1/k^2	e^-kAip		9.42E+05
							0.000292	0.003919	22.43501	0.28394202	0.060337		
													3.84E+06
						Volume	0.00553	km^3		DRE w/ 1.2 g/cc fall			
							5.53E+06	m^3		2.77E+06			
	Using SigmaPlot 2.0 for exp curve fit to data:												
	where y = a exp^(-bx)												
	PROXIMAL			DISTAL									
	10-30 cm curve			*1-5 cm curve*									
a	195.95		a	14.09									
b	3.66		b	0.23									



Calculated volume of 5.5×10^6 m^3 compares favorably with the 7×10^6 m^3 reported in Budnikov et al. (1983), who measured the fall deposits immediately after the eruption and considered more points than I examined in the July 1994 field season. Thus, the volume of the Cone 1 white ash deposit should be considered 7×10^6 m^3.

The white ash represents pulverized wall rocck. Maleyev and Vande-Kirkov (1983) report a deposit density of about 1.2 g/cm^3. Assuming an inital density of 2.4 g/cm^3, this reduces the volume of the white ash to 3.50×10^6 m^3 DRE. Budnikov et al. (1983) and Maleyev and Vande-Kirkov (1983) report 30% of the white ash consists of juvenile basalt. This value is confirmed by unpublished research by Phil Doubik, State University of New York Buffalo (personal communication to Bhill, September 1996). Volume of wall rock ejected by white ash is thus 2.45×10^6 m^3 DRE.

Water table at Tolbachik is reported as 500 m below surface, based on unpublished electrical soundings by Igor Fedorchenko (Institute of Volcanic Geology and Geochemistry, Petropavlovsk-Kamchatsky, Russia; personal communication to B Hill, July 1994. Confirmed August, 1995). Base of volcanic section under Tolbachik is reported as 400-500 m, based on seismic and crustal sections exposed to east (Shanster, 1983), which corresponds to water table depth. Flyorov (1979) estimates volcanic section of about 1000 m. Range of depths used in this analysis. Phil Doubik did a component analysis on white ash from Hill location 24 (Field Volc notebook #88). He found 57% of xenoliths were volcanic (<500-1000m), and 43% are sedimentary (>500-1000m). For Cone 2 white ash, abundances are 30% volcanic and 70% sedimentary. A range of abundances is considered in this analysis.

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Assuming a cylindrical conduit and fixed height of the volcanic section (varying from 500-1000m), the conduit radius necessary for the white ash volumes is calculated. Using that radius, the height of the sedimentary section is then calculated. The initial conduit radius is varied from 0.5 to 2 m, with negligible effect on volume:

- Cone 1 white ash volume: 7x10^6 m^3 (Budnikov et al., 1983)						
- Assume white ash beds represent 50% volume expansion (2.4 to 1.2 g/cm3), thus:						**3.50E+06**
- Doubik and Budinkov have 30% ash as juvenile						
- Rock volume is thus:	**2.45E+06**					
- Depth to water table is 500 m						
- Base of volcanic section ranges 700-1000 m, but may be water table (500m)						
- Percent of lithologies variable::						
	- Phil Doubik: WA-1 is 43% sed, 57% volc					
	v57, s43	**v70, s30**	**v40, s60**			
Volume volcanic=	1.40E+06	1.72E+06	9.80E+05			
Volume Sed =	1.05E+06	7.35E+05	1.47E+06			
Assuming cylinder, volume = pi r^2 h. Account for initial conduit (r1) at 1-3 m diam (trivial)						
R = [vol/(pi h) + r1^2]^0.5						
Lithology	**Volume (m3)**	**Height (m)**	**R if r1 0.5m**	**R if r1 1m**	**R if r1 2m**	
Volc 57%	1.40E+06	500	*30*	*30*	*30*	
Seds 43%	1.05E+06	*373*	30			
Volc 57%	1.40E+06	700	*25*	*25*	*25*	
Seds 43%	1.05E+06	*537*	25			
Volc 57%	1.40E+06	1000	*21*	*21*	*21*	
Seds 43%	1.05E+06	*760*	21			
Volc 70%	1.72E+06	500	*33*	*33*	*33*	
Seds 30%	7.35E+05	*215*	33			
Volc 70%	1.72E+06	700	*28*	*28*	*28*	
Seds 30%	7.35E+05	*298*	28			
Volc 70%	1.72E+06	1000	*23*	*23*	*23*	
Seds 30%	7.35E+05	*442*	23			
Volc 40%	9.80E+05	500	*25*	*25*	*25*	
Seds 60%	1.47E+06	*749*	25			
Volc 40%	9.80E+05	700	*21*	*21*	*21*	
Seds 60%	1.47E+06	*1061*	21			
Volc 40%	9.80E+05	1000	*18*	*18*	*18*	
Seds 60%	1.47E+06	*1444*	18			
		Average =	25			
		Std Dev =	5			

Using these constraints, the white ash represents widening of the conduit from around 1-2 m diameter out to 36-66 m diameter. With a reasonable range of parameters, this averages 50±10 m. By analogy, this represents the area of disruption that may have occurred at Lathrop Wells or Little Black Peak volcanoes in the YMR. This area of disruption should be considered in repository performance models.

FINAL ENTRY:

This notebook is being closed on January 3, 1997. Following reorganization of research projects into KTI's in FY97, the division of IA work between notebooks #56 and #88 (Field volcanism) has become inappropriate. Technical investigations associated with the IA KTI will be continued in electronic notebook #88. Notebook #90 will continue to document IA KTI analytical work being conducted by Steve Lynton at the Smithsonian Institution.

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