OCEAN DRILLING PROGRAM

LEG 109 SCIENTIFIC PROSPECTUS

BARE ROCK DRILLING IN THE MID-ATLANTIC RIDGE RIFT VALLEY

Wilfred B. Bryan
Co-Chief Scientist, Leg 109
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Thierry Juteau
Co-Chief Scientist, Leg 109
Universite de Bretagne Occidentale
Faculte des Sciences
6 Avenue LeGorgeu
29287 Brest
France

Andrew C. Adamson
Staff Scientist, Leg 109
Ocean Drilling Program
Texas A & M University
College Station, TX 77843-3469

Philip D. Rabinowitz
Philip D. Rabinowitz
Director
ODP/TAMU

L E Garrison
Louis E. Garrison
Deputy Director
ODP/TAMU

Robert B Kidd
Robert B. Kidd
Manager Science Operations
ODP/TAMU

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INTRODUCTION

Leg 109 of the Ocean Drilling Program is the second of two legs dedicated to drilling zero-age crust in the median valley of the Mid-Atlantic Ridge (MAR) south of the Kane Fracture Zone (KFZ). Leg 106 was the first of these legs and started drilling a hole (648B) on the summit plateau of a small axial volcano 70 km south of the fracture zone using a newly designed hard rock guide base (HRGB) (Detrick, Honnorez, et al., in press). The prime objective of Leg 109 is to further deepen Hole 648B and to run a comprehensive suite of geophysical logs in the basement at this site. The drillship JOIDES Resolution is scheduled to depart Dakar, Senegal on April 26 and to arrive at Hole 648B after 6 days of transit. The leg will end in Bridgetown, Barbados on June 22.

PREVIOUS STUDIES

The Kane Fracture Zone is a major transform fault located on the Mid-Atlantic Ridge at 23°N (Figure 1). Magnetic anomalies show the Mid-Atlantic Ridge to be spreading at different rates to the north and south of the fracture zone. To the north, spreading is symmetrical at 1.4 cm/yr half rate, and to the south, asymmetrical at 1.7 cm/yr to the west and 1.1 cm/yr to the east (Purdy et al., 1978). Basalts have been recovered along the median valley walls, and variably deformed and metamorphosed gabbroic and ultramafic rocks have been found at both ridge-transform intersections and along the fracture zone walls (Melson et al., 1968; Miyashiro et al., 1969, 1970, 1971; van Andel et al., 1971; Dick et al., 1980; Bryan et al., 1981; Karson and Dick, 1983). Petrological and geochemical studies of basalts from the region (Melson et al., 1968; Bryan and Sargent, 1978; Bryan et al., 1981) show them to be typical mid-ocean ridge basalts (MORBs).

Seismic refraction data from the 120 km long rift valley segment immediately south of the Kane Fracture Zone reveal the presence of relatively normal crustal thicknesses (6-7 km) and upper mantle velocities of approximately 8 km/s (Purdy and Detrick, 1984) (Figure 2). No evidence was found for the presence of a large axial magma chamber in either the crust or upper mantle along this ridge segment. However, anomalous seismic velocities were found in the lower crust centered beneath the along-axis topographic high near 22°55'N (Figure 3) and interpreted as the remnants of the most recent phase of magmatic activity that has temporarily left behind a region of elevated temperatures and pervasive cracking. Anomalously thin crust has been reported from the eastern ridge-transform intersection and along the Kane Fracture Zone (Cormier et al., 1984; Detrick and Purdy, 1980).

This area has been the site of detailed Sea Beam (Detrick et al., 1984) and Sea MARC (Mayer et al., 1985) investigations aimed at establishing the tectonic framework of this ridge segment and identifying sites suitable for "bare-rock" drilling. Nearly complete Sea Beam and Sea MARC 1 coverage of the rift valley was obtained from 22°44'N to the Kane Transform. These data indicate the presence of an inner rift valley 10-15 km wide that is bounded by two 500 m high N-S trending scarps (Figure 4). The inner rift valley structure is complex with changes in both cross-section and depth along its length.

Several phases of rift valley development are evident. The earliest is a constructional phase resulting in strings of small valley-parallel volcanoes, most with broad summit plateaus and collapsed summit craters. During a later ongoing extensional stage these volcanoes are cut by valley-parallel faults and surrounded and partially buried by more recent fissure eruptions. The most recent volcanic activity appears to be associated with a several hundred meter high linear volcanic ridge which trends obliquely across the northern part of the rift valley. Hydrothermal activity was found along the ridge near 23°22'N (Site 649) during Leg 106.

SCIENTIFIC OBJECTIVES

ODP Legs 106 and 109 are designed to investigate the first of the 12 COSOD top priority program recommendations: "processes of magma generation and crustal construction at mid-oceanic ridges" (COSOD, 1981).

Specific questions to be addressed under these objectives are:

a) What is the origin, nature and evolution of oceanic crust at zero age in a slow spreading mid-ocean ridge environment?

b) What are the processes of magma generation and crustal accretion?

   1) Nature and relative abundance of parental and primitive melts, and their relation to 'evolved' basalts in time and space.

   2) Definition of magma 'batches' and associated small magma chambers; depth of chambers.

   3) Depth and extent of low-T alteration, of hydrothermal alteration, and nature of the transition between the two, presence of possible mineralization, effects of alteration on magnetic signature. When do these processes start affecting the crust?

   4) Nature of tilting and deformation at depth; effects on magnetic polarity.

   5) Comparison of the crustal structure, rock type and physical properties of the rocks with inferences from seismic models and survey ship measurements?

The prime aim of Leg 109 is to re-enter and deepen Hole 648B and to run a comprehensive suite of downhole logs in the basement at this site. Back-up plans included logging DSDP Hole 395A, drilling in the walls of the KFZ, drilling in the active hydrothermal vents of Site 649, and drilling and logging DSDP Hole 418A. The order in which the back-up sites would be drilled or logged would depend on the time available following the termination of operations at Hole 648B. Each site is described below, followed by a section outlining the proposed drilling program.

Hole 648B

Hole 648B was the first bare-rock drill hole attempted by ODP using the new hard rock guide base system (Detrick et al., in press). The hole is located about 70 km south of the KFZ at 22°55.3'N 44°56.8'W (Figure 5), on the flat summit plateau of a small axial volcano (Figure 6). The volcano is about 800 m in diameter and stands about 50 m above the surrounding rift valley floor. It is one of several valley-parallel axial volcanoes, most with collapsed summit craters identified on the Sea MARC 1 records (Figures 6, 7). The summit plateau is extremely flat (<4 m relief) and consists almost entirely of elongate pillow lavas up to 1-2 m in height with a light to moderate sediment cover (Figure 8). Surficial rubble is present near the rim of the central crater, within the crater, and near the base of the eastern plateau scarp. Post-eruptive N-S fissuring is common throughout the eastern summit plateau. Several small fissures present in the area of the guide base show an average separation of about 20 m. Figure 9 shows a map of the area around the HRGB as constructed from video tapes following base deployment.

Hole 648B was drilled to a total depth of 33.3 m during Leg 106, with a total 6.2 m of very fresh, plagioclase-olivine, sparsely phyric basalts being recovered. The texture of the groundmass ranges from glassy to subvariolitic to intersertal to intergranular, indicating that most samples are probably derived from parts of pillow lavas. The presence of plagioclase and olivine glomerocrysts and absence of chromian spinel suggest that the basalts are typical, moderately evolved MORBs. They are petrographically quite similar to the basalts dredged from the same general area of the MAR median valley, and to the basalts cored at DSDP Sites 395 and 396, 130 km west and 170 km east of the site, respectively. Incipient alteration is evidenced by the presence of occasional clay minerals coating sample surfaces, lining vesicles, and forming 2-4 mm thick black halos and streaks. The physical properties and magnetization of these rocks reflect the low porosity and high degree of freshness of the samples.

Site 649

This site is located about 25 km south of the KFZ on the crest of a northeast trending ridge in the northern portion of the rift valley (Figures 4 and 10). Here, during a 36-hour video survey of the area during Leg 106, a major new hydrothermal vent field was discovered. The area contains many sulfide chimneys and hot black smoker vents and is covered by a thick blanket of hydrothermal sediment (Figure 11). The chimneys range up to several meters in diameter and more than 11 m in height, and display the spectacular dendritic, tubular structures and elaborate ornamentation previously observed on the East Pacific Rise and Juan de Fuca Ridge. During Leg 106, ten shallow holes were drilled at this site to sample the hydrothermal deposits and the underlying basement rocks (Figure 12). Recovery of the sulfide deposit was generally poor, but shipboard analyses indicate that they are composed of chalcopyrite, sphalerite, pyrite, marcosite and pyrrhotite in varying proportions (Detrick et al., in press). Lenses of massive sulfide were also drilled and recovered from a hole at the base of a massive black smoker. Where recovered, the underlying basalts are fresh (Detrick et al., in press).

Hole 418A

This hole, drilled during DSDP Legs 51 and 53, is located in the western Atlantic on 110 m.y. old ocean crust. It penetrates to a total depth of 544 m sub-basement through a sequence of pillow basalts into the upper part of the dike transition zone (Figure 13). The hole was logged extensively during Leg 102.

Detailed studies of core samples from Hole 418A have provided information about petrogenetic processes occurring at late stages of flow and crystallization within sea floor lava tubes and pillows. Most significantly, selective sorting and redistribution of phenocrysts account for much of the compositional variation within the crust (Staudigel and Bryan, 1981). Similar processes have been documented in modern basalts dredged near the Kane Fracture Zone near Sites 648 and 649 (Bryan et al, 1981). It therefore appears that such processes characterized crustal formation near 22°N during much of the past 110 m.y. Deeper penetration at this site would help to clarify whether dynamic crystal-liquid fractionation also occurs during flowage within feeder dikes, or by gravity settling within temporary sill-like magma chambers.

Magnetic properties at Hole 418A also are of special interest, as a major polarity reversal occurs at about 190 m sub-basement. In addition, the very fresh basalts encountered in this hole were found to have very high NRM intensity, which decreased gradually with depth. Possible further changes in intensity and polarity extending into the dike zone can be expected, and would be appropriate objectives for borehole magnetometer studies on Leg 109.

Hole 395A

This hole is located 130 km west of Hole 648B on 7 m.y. old ocean crust (Figure 1). With a total basement penetration of 580 m, it represents one of the deepest holes drilled in Atlantic Ocean crust. Although core recovery was poor in many intervals, a substantial amount of petrographic, geochemical, and physical properties data were obtained from core fragments in this hole (Figure 14; Shipboard Party, 1978). Nonetheless, it is not clear how well the recovered fragments represent the rock units *in situ*. Detailed logging data, previously not obtained for this hole, would provide much of the overall stratigraphic detail which is not easily deduced from the fragmented core.

Kane Fracture Zone

The intersection of the median valley with the Kane Fracture Zone north of Site 649 has been surveyed extensively by ANGUS photo-traverses and the submersible ALVIN (Karson and Dick, 1983). Reconnaissance dredging on the western median valley wall, starting near the deep nodal basin at about 23°35'N, 44°57'W, showed a general sequence from peridotite to gabbro and massive greenstone to basalt near the top of the valley wall. The submersible observations and photo surveys show that this sequence is disturbed by numerous normal faults, and further, that much of the dredged material is likely to be talus derived from some unknown position above the location of dredge recovery. Also, the smooth and massive character of most gabbro and greenstone ledges prohibits direct sampling either by dredging or from the submersible.

The samples and observations from the surveys are sufficient, however, to establish that the complete range of lithologies usually inferred for oceanic lithosphere are exposed in the scarp west of the nodal basin. They also are in the same general sequence observed in ophiolite complexes and expected within the layer 2/layer 3 mantle stratigraphy in the deep ocean crust. A series of shallow holes, starting in the nodal basin and progressing up the scarp, seems plausible based on bare-rock spud-in experience on Leg 106. This series of holes would provide much more complete documentation of these lithologies and would clarify their relative _in situ_ positions on the scarp. Samples oriented with respect to the vertical, as defined by the drill core, will be especially valuable for studies of deformation fabrics and magnetic polarity associated with deep crustal rocks adjacent to a fracture zone.

DRILLING PROGRAM

The prime aim of Leg 109 is to deepen Hole 648B and to run a suite of downhole logs in the basement at this site. The hole is cased to a depth of 8 m below seafloor (BSF) and is full of cement, placed there at the end of Leg 106 in an attempt to stabilize the rock formation. The very young crust at Site 648 proved extremely difficult to drill during Leg 106, with severe torquing of the drill string and sloughing of debris into the hole. The operations plan for Leg 109 calls for Hole 648B to be deepened to about 86 m BSF using a 12.25-inch bit, and then cased. It is hoped this second string of casing will isolate the most unstable sections of the hole and increase the chances of drilling the hole to even greater depth. Further drilling will use standard 9.875-inch coring bits - calculations suggest a further 200 m of hole can be drilled in the operational time available. Progress will be reviewed after 30 operational days, and if penetration and recovery rates are felt to be too low, then the back-up program will be initiated. If these rates are considered satisfactory, then drilling will continue with the final 4-4.5 days on site being spent running a suite of downhole logs in the hole.

If operations at Hole 648B have to be curtailed before the end of the leg, then a number of back-up sites have been selected for basement drilling and/or logging. Operational time available will determine the order in which these sites are selected. Three likely scenarios are described below.

<u>Option 1</u> Drilling in Hole 648B is difficult and slow. If, after 30 days on site, penetration and recovery rates are considered to be too low, drilling operations at Hole 648B will terminate and the basement logged (assuming there is sufficient hole). The ship will then transit to Hole 395A where 8.25 days of downhole logging will take place in the basement at this site. Any residual time available, possibly up to 4 days, will be spent either drilling in the KFZ or in the active hydrothermal vents of Site 649.

<u>Option 2</u> Hole 648B is abandoned before 30 operational days. This position might arise if drilling conditions in the Hole 648B deteriorate to such an extent that the hole can no longer be profitably advanced.

Depending on the length of open hole, the basement will be logged, after which the ship will transit to Hole 395A. The same 8.25 days logging package as above will be run in the basement at this site. The number of operational days remaining will be proportionally greater than in Option 1, and consequently we envisage being able to drill both the KFZ and hydrothermal vent (Site 649) back-up sites.

Option 3 Hole 648B is abandoned soon after arrival. If this situation arises, the ship will transit to Hole 395A to run the same downhole logs as described above. The leg will then be dedicated to deepening and logging Hole 418A. If operations at Hole 648B last only a few days, then Hole 418A could be deepened by as much as 300 m in the operational time available. Logging of the basement at this site would take about 6.25 days. The longer the time spent at Hole 648B, the less Hole 418A can be advanced. The decision as to when Option 2 would be followed instead of Option 3 would be made at sea.

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LEG 109 OCEAN DRILLING PROGRAM

Kane Fracture Zone

Location of Proposed Sites

Site Number	Latitude	Longitude	Water Depth	Penetr.	Operations	Objectives
648B	$22^{O}55.320'$N	$44^{O}56.825'$W	3344m	1000m+	Rotary coring/ re-entry Logging	Origin, evolution and nature of magma generation/crustal accretion.
395A	$22^{O}45.35'$N	$46^{O}04.90'$W	4485m	--	Run full suite of logs	Establish comprehensive set of logs in ocean crust near a slow spreading ridge.
KFZ/NB*	23^{O} 40'N	45^{O} 03'W	4000-4500m	1000m+	Rotary coring	Study basalts and ultramafic rocks of deep crust as exposed on fracture zone walls.
649	$23^{O}22.160'$N	$44^{O}57.072'$W	3312m	1000m+	Rotary coring	Study three-dimensional variability in an active hydrothermal vent area and basalt alteration.
418A	$25^{O}02.10'$N	$68^{O}03.44'$W	5519	200m	Rotary coring/ re-entry Logging	Deepen and log a deep hole in old ocean crust.

* Kane Fracture Zone/Nodal Basin

LEG 109 OCEAN DRILLING PROGRAM

Kane Fracture Zone

Site Occupation Schedule

Site	Location	Travel Time (Days)	Drilling Time (Days)	Departure Date (Approximate)
Primary Site				
	Depart: Dakar			26 April 1986
	Underway	5.7		
648B	22°55.320'N 44°56.825'W		drilling 43.0 logging 4.7	19 June 1986
	Underway	3.6		
	Arrive: Barbados			22 June 1986
		9.3		57 days

Site Occupation Schedule

(Alternative Sites)

Site	Location	Travel Time (Days)	Site	Location	Travel Time (Days)
Depart:	Dakar			26 April 1986	
Back-up	Option 1&2*		Back-up	Option 3*	
	Underway	5.7		Underway	5.7
648B	22°55.320'N 44°56.825'W	?	648B	22°55.320'N 44°56.825'W	?
	Underway	0.2		Underway	0.2
395A	22°45.35'N 46°04.90'W	8.25 logging	395A	22°45.35'N 46°04.90'W	8.25 logging
	Underway	0.2		Underway	4.2
KFZ**	23°40'N 45°03'W		418A	25°02.10'N 68°03.44'W	6.25*** logging
	Underway	0.2		Underway	3.0
649	23°22.160'N 44°57.072'W				
	Underway	3.6			
		9.77			13.1
Arrive :	Barbados			22 June 1986	
Cruise Duration: 57 days					

*** approx 0.5 day at beginning
5.75 at end of drilling

* Options 1&2 will depend on time available following termination of drilling at Hole 648B. Decision will be made on site.

** Kane Fracture Zone

FIGURE CAPTIONS

Figure 1. Map of the North Atlantic showing the location of the Mid-Atlantic Ridge south of the Kane Fracture Zone (KFZ) drilled on Leg 106, and locations of DSDP Holes 418A and 395A.

Figure 2. Seismic crustal structure of the Mid-Atlantic Ridge rift valley south of the Kane Fracture Zone. Leg 106 beacon sites, the locations of which are superimposed, are discussed in the Leg 106 prospectus.

Figure 3. Bathymetry profile along the axis of the Mid-Atlantic Ridge rift valley showing the position of Sites 648 and 649 relative to the Kane Fracture Zone and variations in the depth of the median valley floor (from Purdy and Detrick, in press).

Figure 4. Detailed bathymetry of Mid-Atlantic Ridge median valley south of the Kane Fracture Zone, showing position of drill sites.

Figure 5. Detailed Sea Beam bathymetry map of the area around Site 648. Serocki Volcano, on which Site 648 was drilled, is one of a group of small axial volcanoes which have been cut by valley-parallel faults and fissures. Contour interval is 10 m.

Figure 6. Idealized depth profile across Serocki Volcano showing the location of Site 648 relative to the central crater and the summit plateau.

Figure 7. Sea MARC I record across Serocki Volcano, 5 km swath width.

Figure 8. Geologic map of Serocki Volcano constructed from the video survey results. Inset shows tectonic interpretation of the area immediately surrounding Serocki Volcano based on available Sea Beam and Sea MARC I data (Ryan et al., in prep.)

Figure 9. Map of the area around the HRGB, constructed from video tapes recorded after the guidebase was deployed during Leg 106.

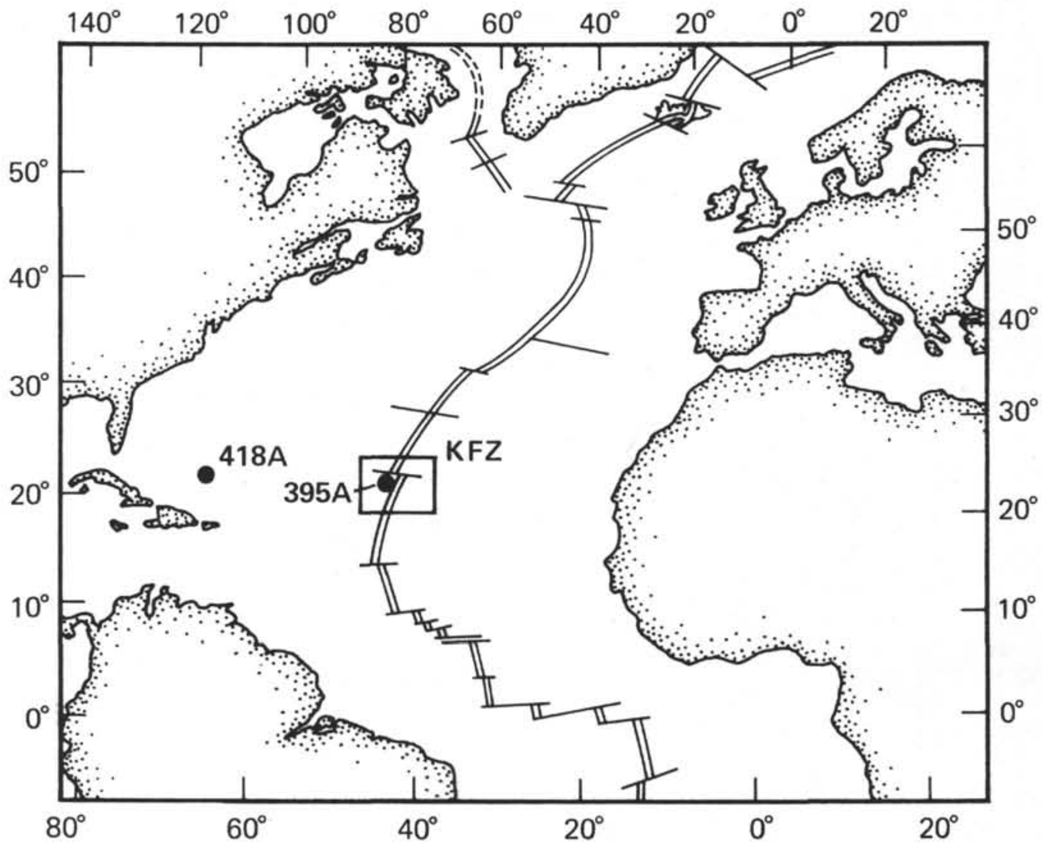
Figure 10. Sea Beam bathymetry map of eastern intersection of the Mid-Atlantic Ridge rift valley and the Kane Fracture Zone showing the location of Site 649 (from Detrick et al., 1985).

Figure 11. Geologic map of the Snake Pit Hydrothermal Area constructed from the Leg 106 video and sonar survey.

Figure 12. Location and simplified stratigraphy of Holes 649A-G in relation to an active black smoker.

Figure 13. Stratigraphy of sediment and basement at Hole 418A (from Shipboard Scientific Parties, 1979).

Figure 14. Basement stratigraphy at Holes 395 and 395A. Lithologic units and chemical types (A_2, etc.) are defined in Shipboard Scientific Party (1978). Heavy lines on left and right sides of magnetics column indicate positive and reversed polarity, respectively (from Shipboard Scientific Party, 1978).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120°
100°
80°
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40°
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40°
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418A
395A
KFZ
80°
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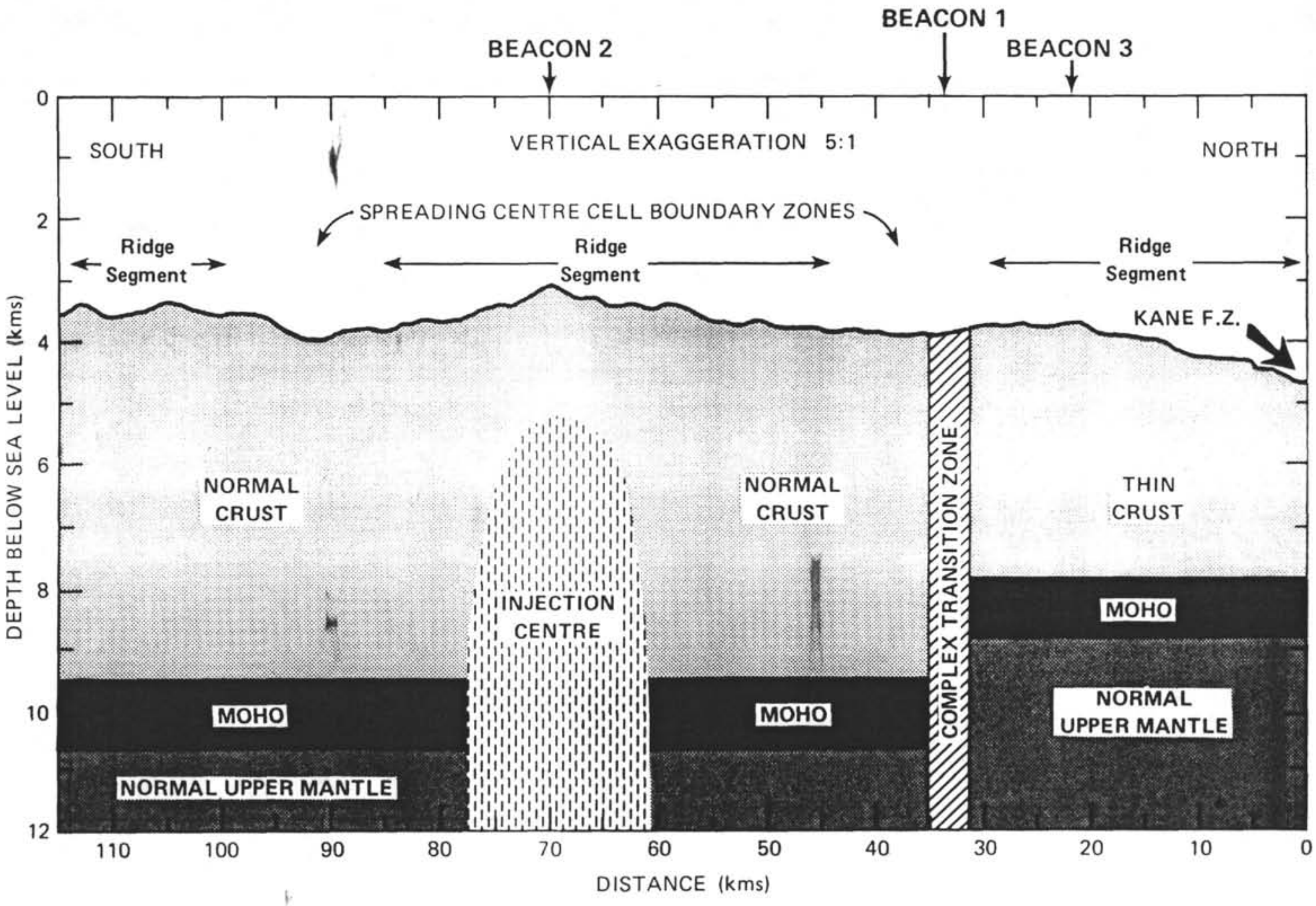
FIGURE 1


BEACON 1
BEACON 2
BEACON 3
SOUTH
VERTICAL EXAGGERATION 5:1
NORTH
SPREADING CENTRE CELL BOUNDARY ZONES
Ridge Segment
Ridge Segment
Ridge Segment
KANE F.Z.
NORMAL CRUST
NORMAL CRUST
THIN CRUST
COMPLEX TRANSITION ZONE
INJECTION CENTRE
MOHO
MOHO
MOHO
NORMAL UPPER MANTLE
NORMAL UPPER MANTLE
DEPTH BELOW SEA LEVEL (kms)
0
2
4
6
8
10
12
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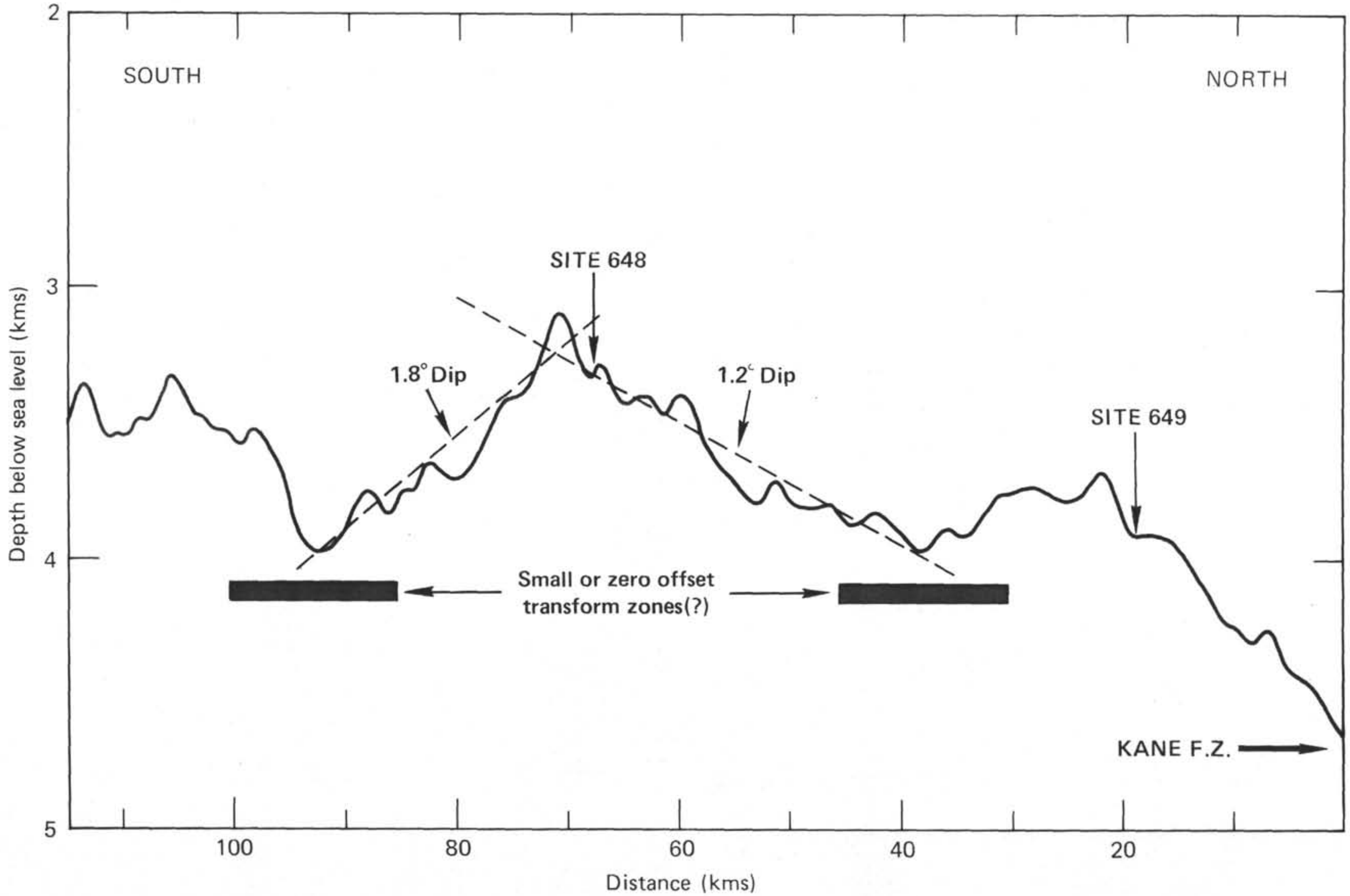
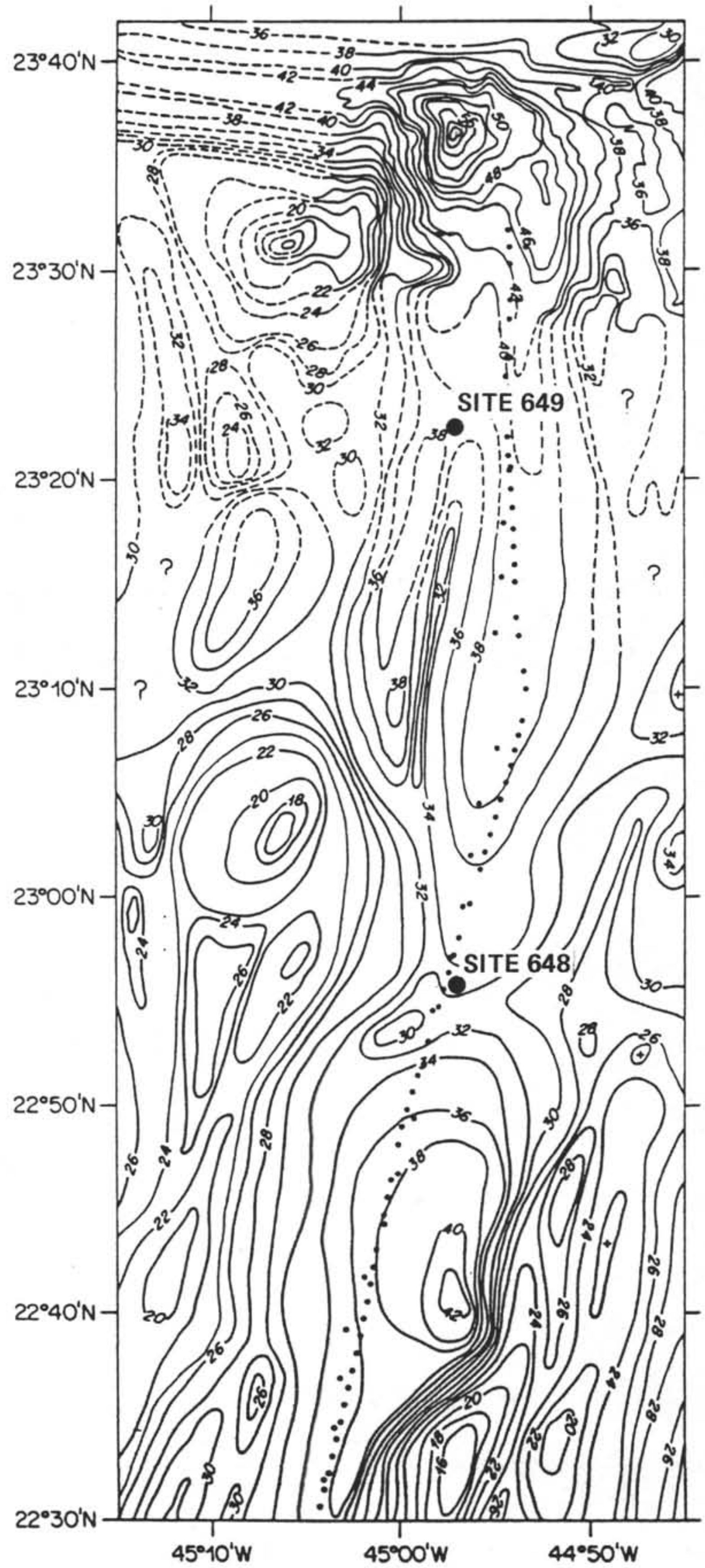
100
90
80
70
60
50
40
30
20
10
0
DISTANCE (kms)

FIGURE 2

FIGURE 3


SOUTH
NORTH
SITE 648
1.8° Dip
1.2° Dip
SITE 649
Small or zero offset
transform zones(?)
KANE F.Z.
Depth below sea level (kms)
2
3
4
5
100
80
60
40
20
Distance (kms)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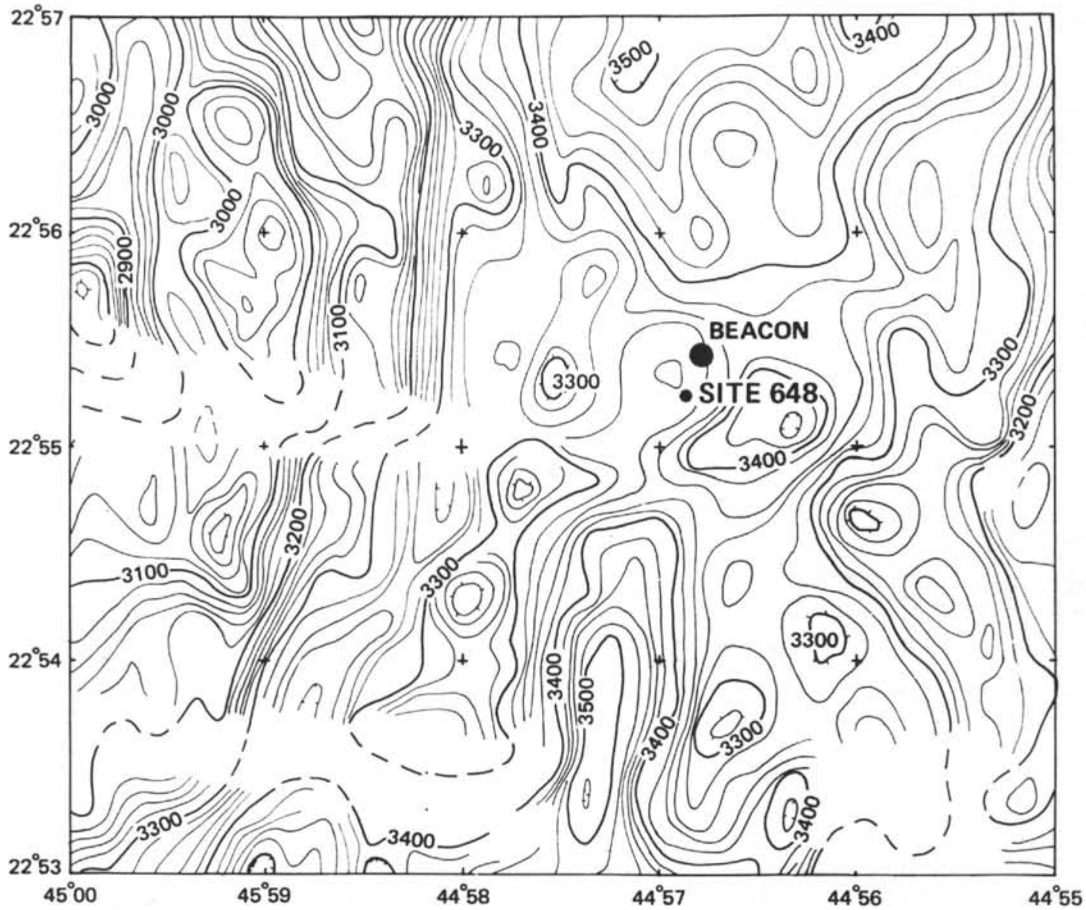
45°00'W
44°50'W
SITE 649
SITE 648
?

FIGURE 4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44°55
BEACON
SITE 648
3000
2900
3100
3200
3300
3400
3500

FIGURE 5

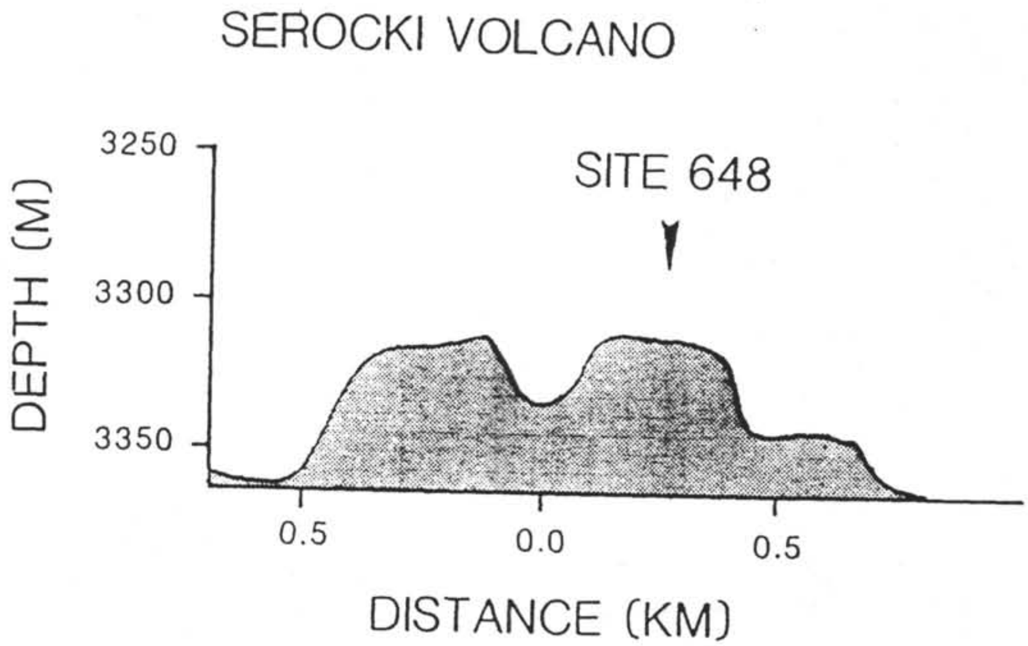

SEROCKI VOLCANO
SITE 648
DEPTH (M)
3250
3300
3350
0.5
0.0
0.5
DISTANCE (KM)

FIGURE 6

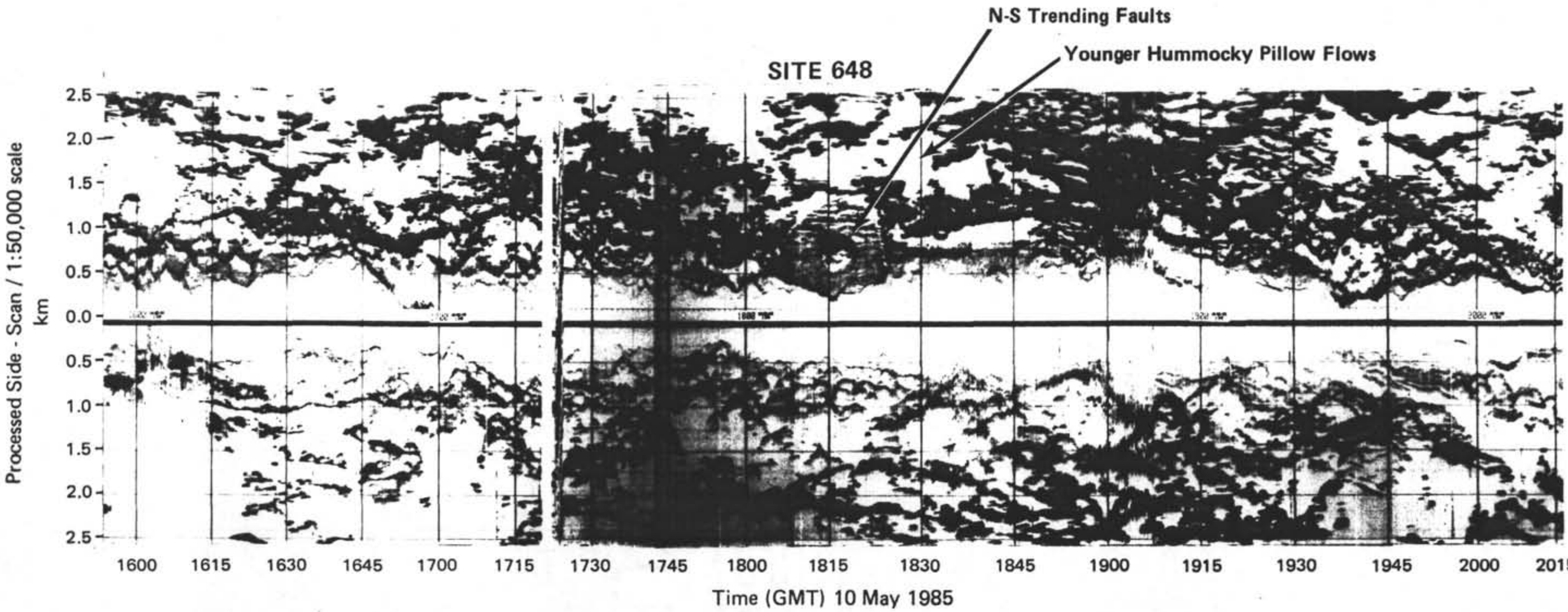
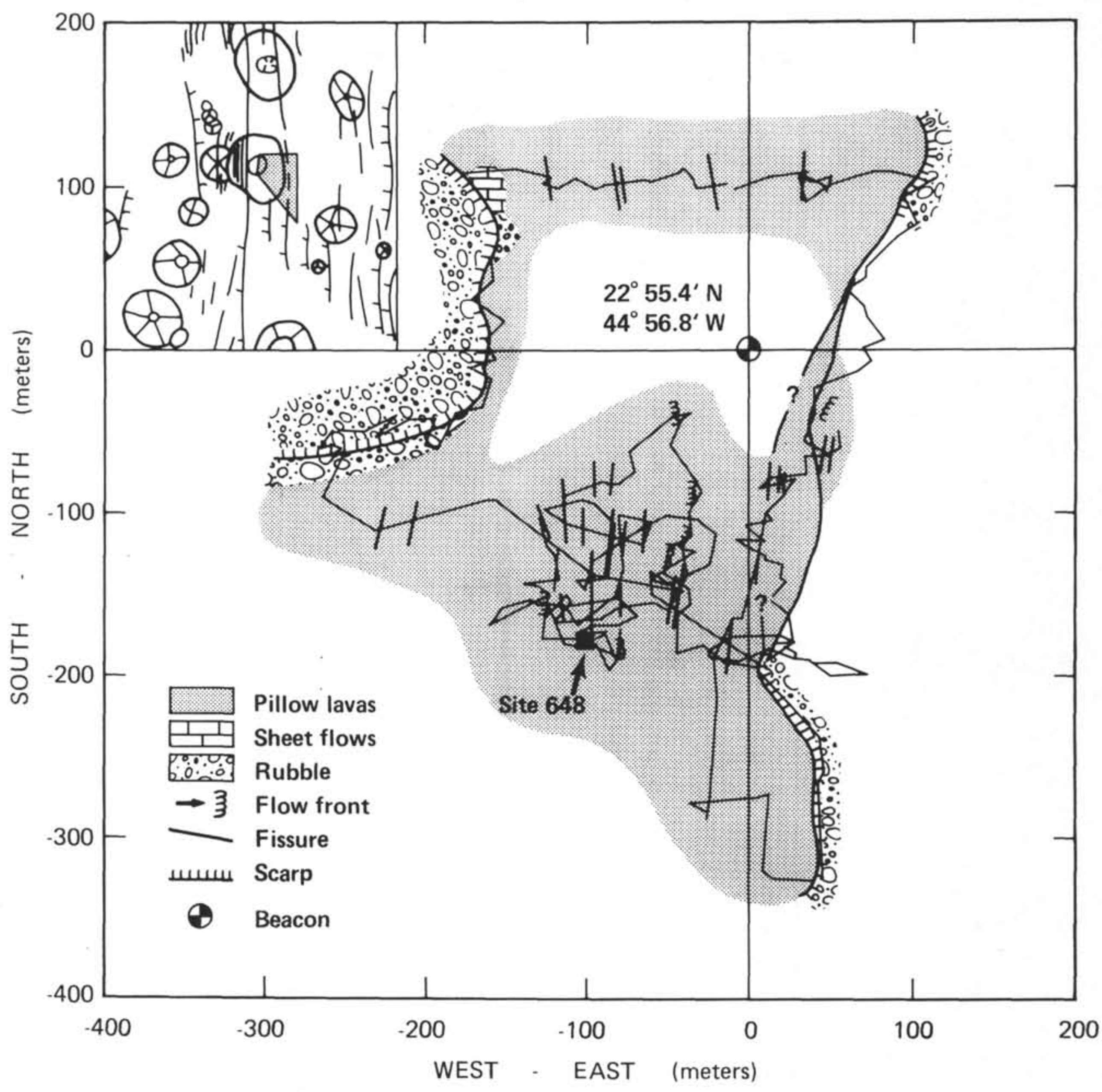

N-S Trending Faults
Younger Hummocky Pillow Flows
SITE 648
Processed Side - Scan / 1:50,000 scale
km
2.5
2.0
1.5
1.0
0.5
0.0
0.5
1.0
1.5
2.0
2.5
1600
1615
1630
1645
1700
1715
1730
1745
1800
1815
1830
1845
1900
1915
1930
1945
2000
2015
Time (GMT) 10 May 1985

FIGURE 7



200
100
0
-100
-200
-300
-400
SOUTH - NORTH (meters)
-400
-300
-200
-100
0
100
200
WEST - EAST (meters)
22° 55.4′ N
44° 56.8′ W
Site 648
Pillow lavas
Sheet flows
Rubble
Flow front
Fissure
Scarp
Beacon

FIGURE 8

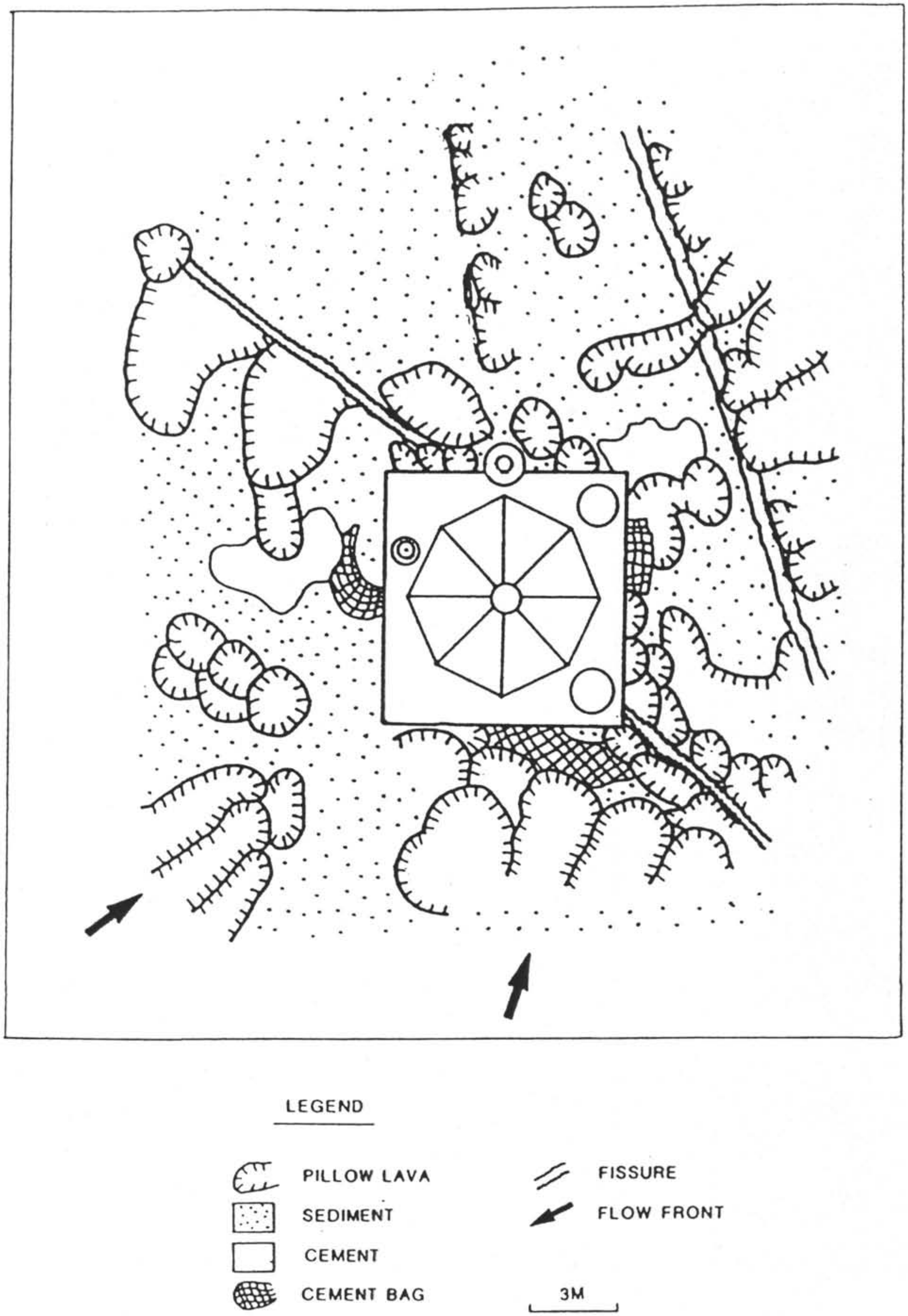

LEGEND
PILLOW LAVA
SEDIMENT
CEMENT
CEMENT BAG
FISSURE
FLOW FRONT
3M

FIGURE 9

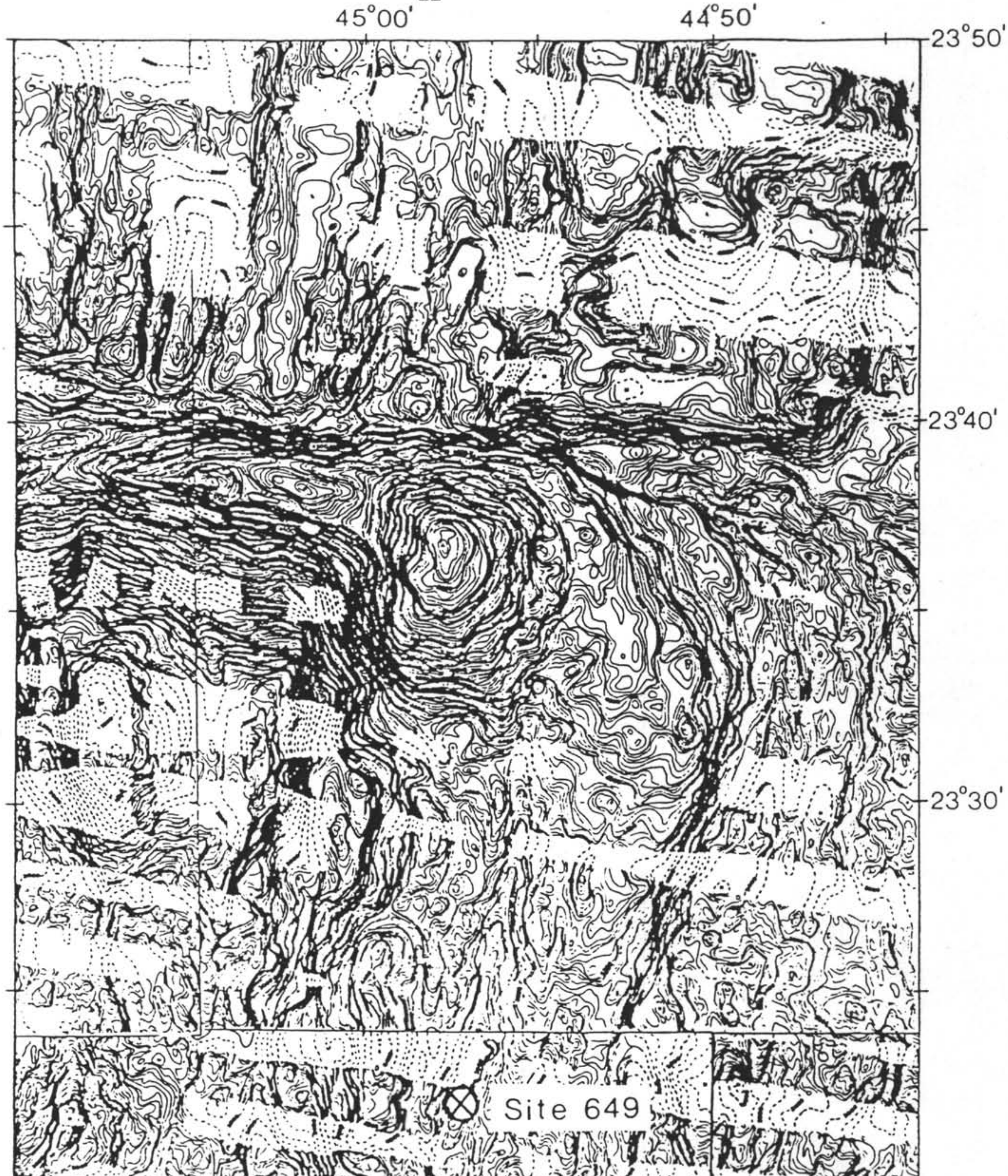
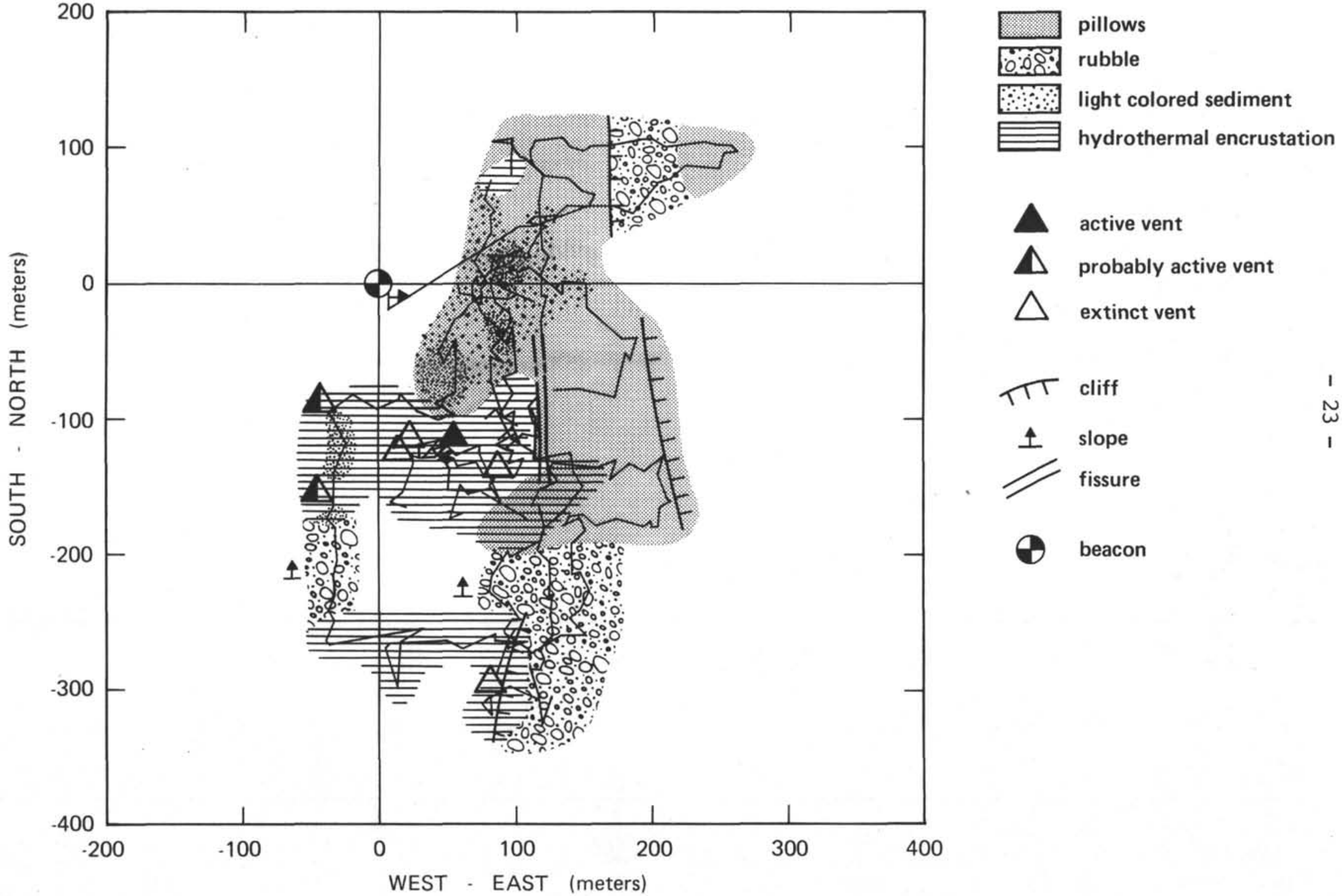
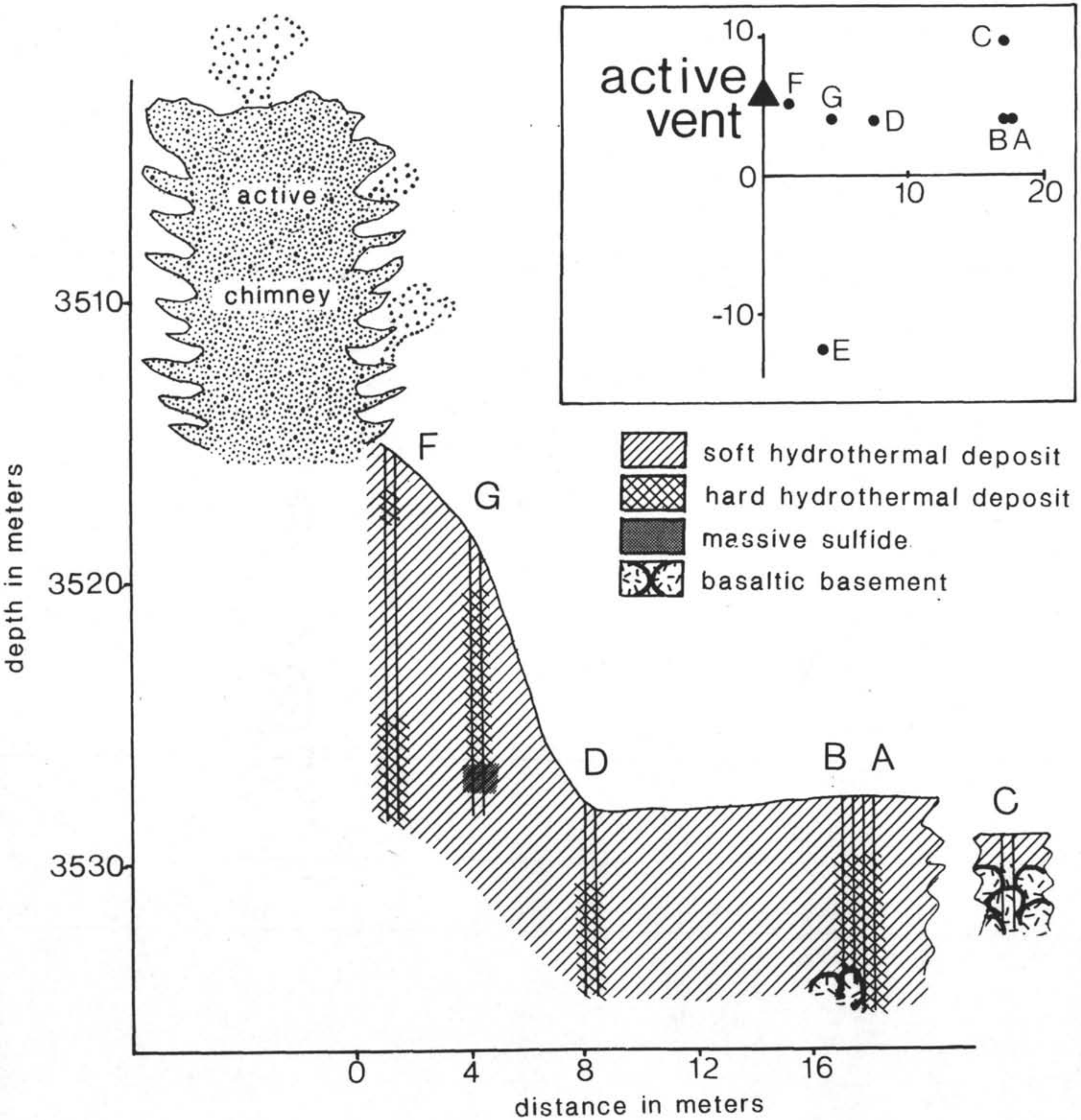


FIGURE 10



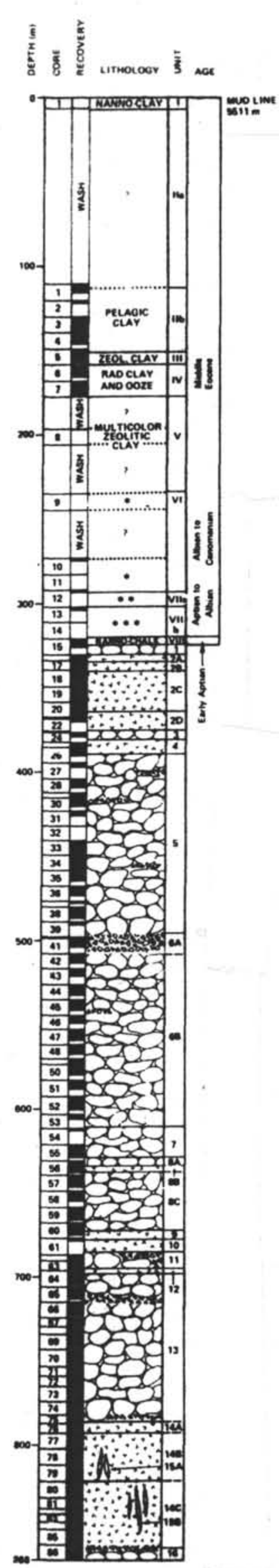
200
100
0
-100
-200
-300
-400
SOUTH - NORTH (meters)
-200
-100
0
100
200
300
400
WEST - EAST (meters)
pillows
rubble
light colored sediment
hydrothermal encrustation
active vent
probably active vent
extinct vent
cliff
slope
fissure
beacon

FIGURE 11



active
vent
F
G
D
C
B A
E
10
0
-10
10
20
active
chimney
3510
3520
3530
depth in meters
F
G
D
B A
C
soft hydrothermal deposit
hard hydrothermal deposit
massive sulfide
basaltic basement
0
4
8
12
16
distance in meters

FIGURE 12


418A
DEPTH (m)
CORE
RECOVERY
LITHOLOGY
UNIT
AGE
MUD LINE 5511 m
NANNO CLAY
WASH
PELAGIC CLAY
ZEOL. CLAY
RAD CLAY AND OOZE
MULTICOLOR ZEOLITIC CLAY
Middle Eocene
Albian to Cenomanian
Aptian to Albian
Early Aptian

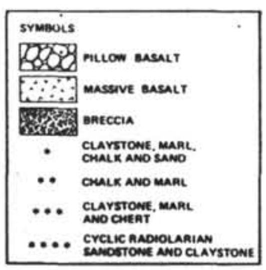

SYMBOLS
PILLOW BASALT
MASSIVE BASALT
BRECCIA
CLAYSTONE, MARL, CHALK AND SAND
CHALK AND MARL
CLAYSTONE, MARL AND CHERT
CYCLIC RADIOLARIAN SANDSTONE AND CLAYSTONE

FIGURE 13

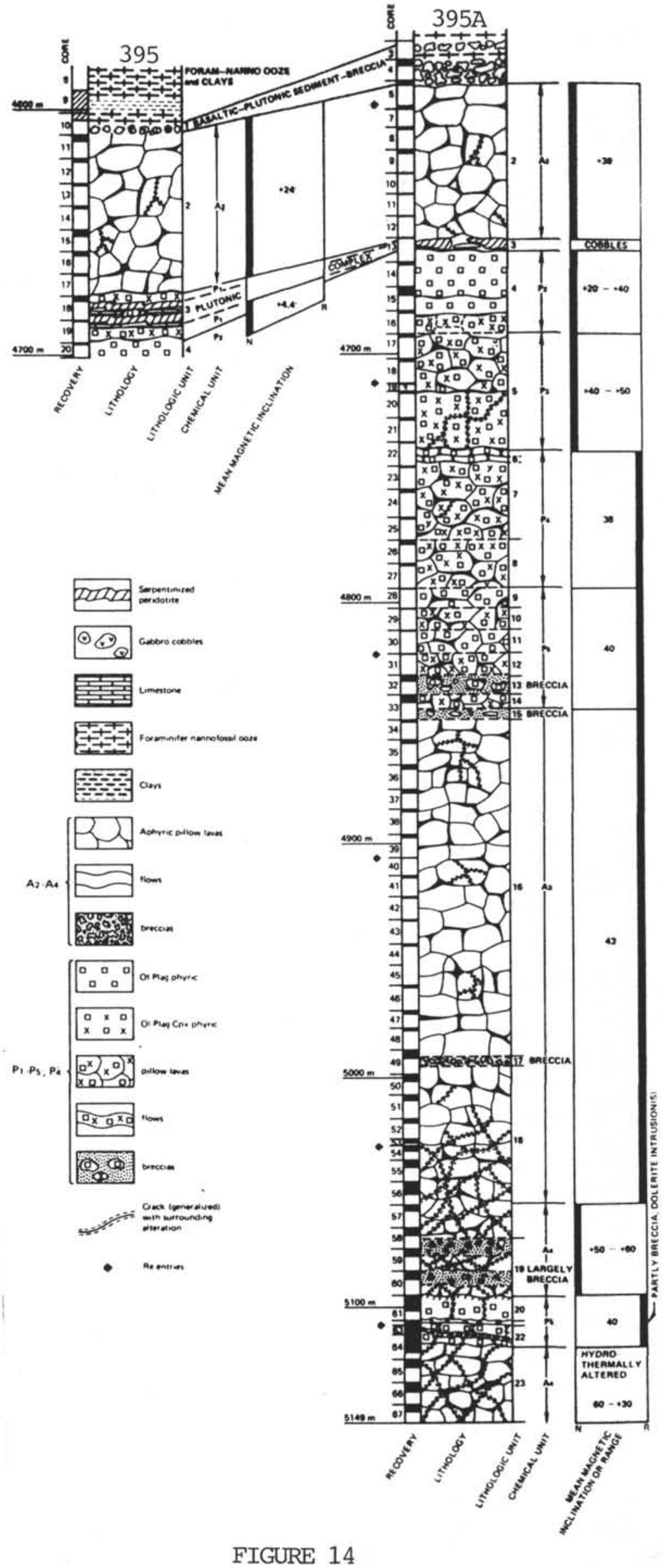

395
395A
FORAM-NANNO OOZE and CLAYS
BASALTIC-PLUTONIC SEDIMENT-BRECCIA
PLUTONIC
COMPLEX
COBBLES
BRECCIA
LARGELY BRECCIA
HYDRO THERMALLY ALTERED
PARTLY BRECCIA, DOLERITE INTRUSION(S)
4600 m
4700 m
4800 m
4900 m
5000 m
5100 m
5149 m
RECOVERY
LITHOLOGY
LITHOLOGIC UNIT
CHEMICAL UNIT
MEAN MAGNETIC INCLINATION
MEAN MAGNETIC INCLINATION OR RANGE
Serpentinized peridotite
Gabbro cobbles
Limestone
Foraminifer nannofossil ooze
Clays
Aphyric pillow lavas
flows
breccias
Ol Plag phyric
Ol Plag Cpx phyric
pillow lavas
Crack (generalized) with surrounding alteration
Re entries

FIGURE 14

SITE NUMBER: Hole 648B

POSITION: $22^{\circ}55.320'N$ $44^{\circ}56.825'W$ SEDIMENT THICKNESS: 20-30 cms

WATER DEPTH (UNCORR.): 3344 m PRIORITY: 1

PROPOSED DRILLING PROGRAM:

Re-enter and rotary core zero age crust to maximum depth that time allows and run logging package.

SEISMIC RECORD:

3.5 kHz, OBS and OBH measurements

HEAT FLOW:

LOGGING: Yes

OBJECTIVES:

Origin, evolution and nature of oceanic crust at a slow spreading ridge. Processes of magma generation and crustal accretion.

BASEMENT TYPE:

Basalt forming a flat topped volcano with collapsed summit crater (approximately 50 m deep) located to the west of the ridge axis in the shallowest portion of the median valley. The summit area is constructed primarily of bulbous pillow lavas 1 - 2 m in diameter. Narrow N - S trending fissures dissect the surface of the volcano.

SITE NUMBER: Site 395A

POSITION: 22^{O} 45.35'N 46^{O} 04.90'W SEDIMENT THICKNESS: 93 m

WATER DEPTH (UNCORR.): 4485 m PRIORITY: 2

PROPOSED DRILLING PROGRAM:

Re-enter Hole 395A and run complete set of logs.

SEISMIC RECORD:

See site survey data from DSDP Leg 45.

HEAT FLOW:

LOGGING: Yes

OBJECTIVES:

Establish a baseline set of logs for basaltic crust near a slow spreading mid-ocean ridge.

BASEMENT TYPE:

Basalt pillows, flows and dikes.

SITE NUMBER: KFZ (Kane Fracture Zone)

POSITION: 23° 40'N 45° 03'W SEDIMENT THICKNESS: 0 - <200 m

WATER DEPTH: 4000-4500 m PRIORITY: 2

PROPOSED DRILLING PROGRAM:

Multi single-bit holes into the tops of faulted blocks forming the walls of the KFZ, and/or continuous rotary coring through <200 m of sediment with maximum penetration into basement using standard re-entry.

SEISMIC RECORD:

Many 3.5 kHz records and a Deep-Towed Vertical Array Experiment across the proposed area.

HEAT FLOW:

LOGGING: No

OBJECTIVES:

Drilling into faulted blocks of oceanic crust in a major fracture zone and/or drilling as deep as possible into the oceanic basement beneath the eastern nodal basin of the Kane Fracture Zone, to obtain lithologies representative of the major oceanic crustal layers.

SEDIMENT TYPE:

Carbonate ooze, and breccias or rubble zones(?).

BASEMENT TYPE:

Basalt, gabbro, peridotite and serpentinite.

SITE NUMBER: Site 649

POSITION: 23°22.160'N 44°57.072'W SEDIMENT THICKNESS: 0-13 m

WATER DEPTH (UNCORR.): 3528.5 m PRIORITY: 4

PROPOSED DRILLING PROGRAM:

Multiple single-bit holes near active "black smoker" to look at 3-dimensional variability in sulfide deposit composition and to recover basement rocks below the hydrothermal deposits.

SEISMIC RECORD:

3.5 kHz, OBS and OBH measurements

HEAT FLOW:

LOGGING: NO

OBJECTIVES:

Study an active hydrothermal system and its associated sulfide deposits.
Study hydrothermal alteration of mid-ocean ridge basalts.

BASEMENT TYPE:

Basalt forming a flat-topped hydrothermally active area on the ridge axis dissected by approximately 2 m wide N - S trending fissure. The flanks consist of bulbous shaped flows with steep flow fronts and of large amounts of talus. Active hydrothermal vent field to west of fissure , >40,000 m^2 in extent.

SITE NUMBER: Hole 418A

POSITION: 25° 02.10'N 68° 03.44' W   SEDIMENT THICKNESS: 324 m

WATER DEPTH: 5519 m   PRIORITY: 2

PROPOSED DRILLING PROGRAM:

Re-enter Hole 418A and deepen by rotary coring to maximum possible depth in time allowed. Run complete suite of logs on newly cored interval.

SEISMIC RECORD:

D/V Glomar Challenger Leg 52, 10 Feb 1977, 0943 hr.

HEAT FLOW: Yes

LOGGING: Yes (ODP Leg 102)

OBJECTIVES:

To investigate the nature, structure and history of hydrothermal alteration in old oceanic crust (110 m.y.); to investigate the nature of lower levels of oceanic layer 2 and the transition to layer 3.

SEDIMENT TYPE:

0 - 324 m BSF: Pelagic claystone and oozes. Lowermost 50 m dominated by claystone, marls, chalk, sand and chert.

BASEMENT TYPE:

324 - 868 m BSF: Basalt pillows, with minor interbeds of breccia and/or massive basalt.

SHIPBOARD PARTICIPANTS

OCEAN DRILLING PROGRAM LEG 109

Co-Chief Scientist: WILFRED B. BRYAN
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Co-Chief Scientist: THIERRY JUTEAU
Universite de Bretagne Occidentale
Faculte des Sciences
6 Avenue Le Gorgeu
29287 Brest
France

Igneous Petrologist/ ODP Staff Scientist: ANDREW C. ADAMSON
Ocean Drilling Program
Texas A&M University
College Station, TX 77843-3469

Igneous Petrologist: JEAN-PHILIPPE EISSEN
11 rue de Murbach
67100 Strasbourg Cedex
France

Igneous Petrologist: TIMOTHY L. GROVE
Department of Earth, Atmospheric and Planetary Sciences
Massachusetts Institute of Technology
Cambridge, MA 02139

Igneous Petrologist: REJEAN HEBERT
Department de Geologie
Universite Laval
Quebec G1K 7P4
Canada

Igneous Petrologist: TOSHITSUGU FUJII
Earthquake Research Institute
University of Tokyo
Yayoi, Tokyo 113
Japan

Igneous Petrologist: STEPHEN C. KOMOR
Bureau of Mines
Avondale Research Center
4900 LaSalle Road
Avondale, MD 20782

Igneous Petrologist:	HUGH G. RICHARDS Department of Geology The University Newcastle upon Tyne, NE1 7RU United Kingdom
Geochemist:	LAURIE K. AUTIO Department of Geology and Geography Morrill Science Center University of Massachusetts Amherst, MA 01003
Geochemist:	MICHEL LOUBET Universite Paul Sabatier Laboratoire de Mineralogie 38 rue des 36 Ponts 31062 Toulouse Cedex France
Paleomagnetist:	M. MANSOUR BINA Centre National de la Recherche Scientifique 4 Avenue de Neptune 94107 St. Maur des Fosses France
Paleomagnetist:	YOZO HAMANO Earthquake Research Institute University of Tokyo Bunkyo-ku, Tokyo 113 Japan
LDGO Logging Scientist:	DAN MOOS Borehole Research Group Lamont-Doherty Geological Observatory Palisades, NY 10964
Downhole Instrumentation/ Packer Specialist	KEIR BECKER Rosenstiel School of Marine and Atmospheric Sciences University of Miami 4600 Rickenbacker Causeway Miami, FL 33149-1098

Magnetometer and Temperature Logging Specialist:	JOHANNES KOPIETZ Federal Institute for Geosciences and Natural Resources P.O. Box 51 01 53 D-3000 Hannover 51 Federal Republic of Germany
Magnetic Susceptibility Specialist:	KRISTIAN KRAMMER Institut fuer Allgemeine und Angewandte Geophysik Theresienstrabe 41 D-8000 Munich 2 Federal Republic of Germany

OPERATIONS AND TECHNICAL STAFF

Cruise Operations Superintendent:	STEVE HOWARD Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Drilling Consultant:	BOB RAULS Southern International Inc. 4401 North West 4th Street Suite 121 Oklahoma City, OK 73107
Laboratory Officer:	TED "GUS" GUSTAFSON Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Assistant Laboratory Officer:	BILL MILLS Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Curatorial Representative:	DIANA STOCKDALE Ocean Drilling Program West Coast Repository Scripps Institution of Oceanography La Jolla, CA 92093
Schlumberger Logger:	STEVE DIANA Schlumberger Houston 8460 Gulf Expressway Houston, TX 77023
Special Tools Engineer: (Cementing Specialist)	ANDY HOUSLEY 2709 Silver Maple Bryan, TX 77801
Downhole Magnetometer Engineer:	CHRISTOPH CZORA Federal Institute for Geosciences and Natural Resources P.O. Box 51 01 53 D-3000 Hannover 51 Federal Republic of Germany
System Manager:	JOHN EASTLUND Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Electronics Technician:	RANDY CURRENT Ocean Drilling Program Texas A&M University College Station, TX 77843-3469

Electronics Technician:	DWIGHT MOSSMAN Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Yeoperson:	GAIL PERETSMAN Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Photographer:	ROY DAVIS Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	WENDY AUTIO Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	LARRY BERNSTEIN Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	BETTINA DOMEYER Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	TAMARA FRANK Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	HENRIKE GROSCHEL Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	HARRY "SKIP" HUTTON Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	MARK "TRAPPER" NESCHLEBA Ocean Drilling Program Texas A&M University College Station, TX 77843-3469

Marine Technician:	JOHN WEISBRUCH Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Marine Technician:	DAWN WRIGHT Ocean Drilling Program Texas A&M University College Station, TX 77843-3469
Weather Observer:	VERNON ROCKWELL Ocean Drilling Program Texas A&M University College Station, TX 77843-3469