Christie, D.M., Pedersen, R.B., Miller, D.J., et al., 2001
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5. Site 1154[1]

Shipboard Scientific Party[2]

PRINCIPAL RESULTS

Site 1154 is located in Zone A, somewhat east of the locus of the residual depth anomaly. It lies ~70 km east of Site 1153, on seafloor of approximately the same age (~28 Ma). Seafloor in this region is characterized by a northeast-trending series of deep en echelon, east-west oriented grabens. The oblique trend and en echelon arrangement of the grabens suggest that they formed as failed rift grabens associated with a westward propagating rift. To the east, seafloor fabric appears normal, typical of Zone A. This is the third site in the initial east-west transect designed to locate the Indian/Pacific mantle boundary across the northern part of our operational area.

Between 0 and ~233 meters below seafloor (mbsf), we recovered a single wash core containing reddish brown pelagic clay overlying calcareous ooze, but the boundaries and the thicknesses of these units are unknown. From ~233 to ~266 mbsf, 9.4 m of light gray, moderately plagioclase-olivine phyric pillow basalt, with occasional glassy rims and slight to moderate alteration, was recovered. The hole was abandoned at ~266 mbsf as the >6000-m drill string was approaching its safe working limits.

Two handpicked glasses and three whole-rock powders were analyzed on board. The glasses are slightly more evolved than those from Site 1153, with 7.6–7.8 wt% MgO. The whole rocks have significantly less MgO (~6.0 wt%) and higher K_2O than the glasses but are otherwise similar in composition. As at Site 1153, these compositional differences are likely the result of alteration of the whole-rock groundmass.

Overall, Site 1154 glass compositions are offset from those of Site 1153 along low-pressure crystal fractionation trends; these trends are offset to generally higher incompatible element contents from those of the 0- to 7-Ma Zone A lavas. These observations suggest that, at ~28 Ma, Zone A lavas were derived from uniform parental magma compositions,

[1]Examples of how to reference the whole or part of this volume.
[2]Shipboard Scientific Party addresses.

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as they are today, but their source mantle was somewhat more fertile. On the Ba vs. Zr/Ba diagram, Site 1154 glasses are distinctly Pacific in character.

OPERATIONS

Transit to Site 1154

The 124-nmi transit to Site 1154 took 11.5 hr at an average speed of 11 kt. At 0115 hr on 2 December, the vessel slowed to 6 kt for a single-channel seismic and 3.5-kHz survey over the site. These data indicated a similar sediment thickness to that penetrated at Site 1153 (~200 m).

Hole 1154A

After the survey we deployed a beacon on Global Positioning System (GPS) coordinates ~450 m southwest of our prospectus coordinates, closer to the center of a localized sediment pond. Water depth at this site obtained by precision depth recorder (PDR) was 5747.4 m. A nine-collar bottom-hole assembly was made up of a C-7 four-cone rotary bit, a mechanical bit release, a head sub, an outer core barrel, a top sub, another head sub, seven 8¼-in drill collars, one tapered drill collar, six 5½-in drill pipes, and one crossover sub.

We spudded Hole 1154A with the rotary core barrel at 1235 hr on 2 December. We washed ahead to 233.2 mbsf before we encountered a hard contact, presumed to be igneous basement. Rotary coring advanced the hole from 233.2 to 267.6 mbsf, with an average recovery of 27% (Table T1). In an effort to increase recovery, we retrieved core barrels after advancing an average of 4.5 m. Whirl-Pak plastic bags containing fluorescent microspheres used as microbiological tracers were deployed on Cores 187-1154A-3R, 6R, and 9R.

T1. Coring summary, Site 1154, p. 20.

Coring was terminated 34.4 m into basement. The total drill string length at this depth was 6015 m, representing a static hook load of 675,000 lb. While advancing Core 187-1154A-9R, the driller noted evidence of deteriorating hole conditions. Since we had recovered adequate material to meet our scientific objectives, we decided to abandon Site 1154. On 4 December the bit cleared the seafloor at 1215 hr and cleared the rotary table at 1445 hr. The vessel was under way to the next site by 2130 hr.

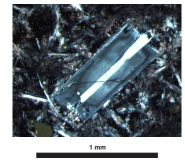
IGNEOUS PETROLOGY

Basalt was recovered from Hole 1154A between 233.2 and 265.8 mbsf. Total recovery was 9.42 m, equal to 27.38%. All recovered basalt was assigned to a single unit of light gray, moderately plagioclase-olivine phyric pillow basalt (Fig. F1). The basalt has undergone <10% low-temperature alteration (see "Alteration," p. 3). Of 198 recovered pieces, 26 (~13%) include glassy pillow rinds and/or chilled margins. The glass zone of chilled margins ranges from 8 to <1 mm in width but is 2–3 mm in most cases. Glass ranges from fresh to strongly altered (see "Alteration," p. 3). Small (<1 mm), euhedral to subhedral olivine and plagioclase phenocrysts are present in some of the thicker glass rinds (e.g., Section 187-1154-6R-1 [Piece 2]).

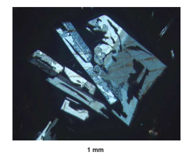
F1. Light gray, moderately plagioclase-olivine phyric pillow basalt, p. 8.

Phenocryst abundance varies throughout the core from 2% to 5% with an average of ~3%. Prismatic to tabular, subhedral plagioclase phenocrysts are from 0.5 to 6 mm in length and make up 2%–3% of the rock. In thin section, partially resorbed cores, twinning, and zoning are visible in some crystals (Figs. F2, F3). In addition, some plagioclase crystals display quench crystallization overgrowths (Fig. F2). A large (3–4 mm) anhedral plagioclase xenocryst, presumably rounded during magma transport, was identified in thin section (Sample 187-1154A-7R-1, 140–145 cm). Most plagioclase phenocrysts are fresh, but some are altered to clay and Fe oxyhydroxide within 0.5- to 2-cm-wide alteration halos that parallel fractures and exterior surfaces. Equant, euhedral to subhedral olivine is the second most abundant phenocryst phase (0.5%–1%) and ranges from 0.5 to 3 mm. Rare, skeletal olivine microphenocrysts are also present (Fig. F4). Within the alteration halos, most of the olivine is replaced (90%–100%) by Fe oxyhydroxide. In the fresher centers of individual basalt pieces, olivine appears fresh but is, in places, coated by a white clay mineral and/or flakes of cryptocrystalline silica (see **"Alteration,"** p. 3). In thin section, replacement by Fe oxyhydroxide and clay is visible along grain boundaries of some olivines. Glomerocrysts of plagioclase and plagioclase plus olivine make up 10%–15% of the phenocryst assemblage. The source of the unsystematic variation in phenocryst modal proportion cannot be precisely determined from the level of shipboard observation.

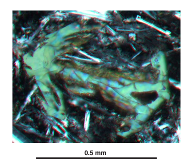
F2. Partially resorbed, twinned, and zoned plagioclase phenocryst, p. 9.



F3. Zoned, partially resorbed plagioclase with irregularly shaped melt pockets in larger phenocrysts, p. 10.

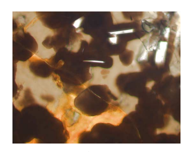


F4. Skeletal olivine microphenocryst, p. 11.

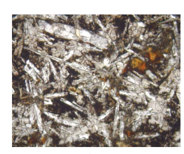


Chilled pillow margins exhibit a variety of quench crystallization textures, ranging from spherulitic to plagioclase sheaf to clinopyroxene plumose forms. Figure F5 shows typical plagioclase spherulites surrounded by clear glass, partially replaced by smectite. Acicular plagioclase forms the cores of the spherulites. The proportions of the groundmass phases cannot be accurately quantified because of the predominance of cryptocrystalline quench textures over most of the chilled margin. The groundmass of pillow interiors typically has an intersertal texture, with prismatic to lath-shaped plagioclase in roughly equal proportion to granular clinopyroxene, minor equant olivine, and interstitial glass (Fig. F6). Spherical vesicles, <1 mm in diameter, make up 1% of the rock.

F5. Spherulites and glass in the quench zone of a pillow, p. 12.



F6. Intersertal groundmass, p. 13.

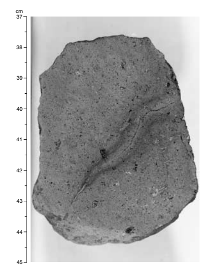


ALTERATION

Basalts recovered from Hole 1154A all show evidence of a minor degree of low-temperature alteration. The intensity of alteration varies from piece to piece. A few small pieces show no evidence of alteration, but virtually all pieces more than a few centimeters long show as much as 10% overall alteration. This alteration is predominantly concentrated on the surfaces of pieces and along open and partially filled fractures, penetrating up to a couple of centimeters into the interiors of pieces. The most obvious manifestation of low-temperature alteration in hand sample is a light gray to light red-brown discoloration halo visible on the cut face of the core that is in stark contrast to the darker gray, fresh interior of pieces. This halo is most commonly discontinuous and present only adjacent to weathered surfaces of the core and has a well-defined, sharp boundary with fresh basalt. Within this halo, phenocryst and vesicle abundances are masked by the alteration, but close inspection under binocular stereoscope bears out no change in either across the boundary from fresh interior to altered margin. An exception to this observation is when the alteration halo is adjacent to a glassy rim, in which case alteration is imposed upon a primary reduction in both abundance and size of vesicles and phenocrysts. Also common, particularly in alteration halos near fractures, is iron staining and alteration of phenocryst phases. Plagioclase is commonly altered to clay and Fe oxyhydroxide, and olivine is altered to iddingsite with some clay. In some pieces, the margins of olivines have been plucked as a result of the drilling or core splitting process and appear to have a thin coating of silica and/or pale yellowish clay within the cavity that remains, suggesting pervasive penetration of fluid perhaps along grain boundaries. Manganese oxide nodules (1–2 mm) and encrustations are common on weathered surfaces, particularly those on which sediment has adhered. Multiple, planar surfaces of many pieces are weathered light gray-green, indicating that these are pieces of talus that were picked up by the drill bit. Weathered surfaces commonly have patchy encrustations of microcrystalline quartz. In most cases, these weathered surfaces are <1 mm thick, and, where they have been chipped away, fresh basalt can be seen. Vesicles are commonly lined and less often filled with any or all of the following: cryptocrystalline silica, Fe oxyhydroxide, smectite, and rare zeolites.

Open fractures are much more common than veins, but the surfaces of fractures where visible are ubiquitously discolored to a dark green-gray and commonly have iron staining, although phenocrysts exposed on fracture surfaces are commonly fresh. These fracture surfaces are distinct in appearance relative to the weathered surfaces described above in that they lack the light gray-green color and dull luster. In some pieces vein halos decrease in width from the exterior margins of pieces toward the interior (Fig. F7). Vein fillings are most commonly silica, with less Fe oxyhydroxide and clay. Where fractures are partially filled, they contain variable amounts of the same alteration phases as seen in vesicles, with Fe oxyhydroxide and clay predominating.

F7. Alteration halo around an open fracture, p. 14.



Basalt glass was rarely recovered except as thin (a few millimeters thick) rinds on several pieces (see **"Igneous Petrology,"** p. 2). Where present, basalt glass is always fractured and partially palagonitized. As at previous sites, symmetric alteration halos with silica cores mantled by palagonite, mantled in turn by fresh glass, are common. In Section 187-1154A-6R-1 (Piece 2), minute (±1 mm long) euhedral quartz crystals coat the outer surface of a glassy pillow rind.

In thin section, olivine phenocrysts are seen to be predominantly altered to smectite, whereas the main alteration product of plagioclase is Fe oxyhydroxide. In some sections, olivine pseudomorphs show euhedral grain shapes, but only the cores of grains are preserved. In others, olivine alteration is restricted to fractures. Similarly, plagioclase is rarely completely replaced, and in any section there is more fresh plagioclase than altered. The groundmass shows little alteration, except in the vicinity of altered phenocrysts, where it is altered to smectite and Fe oxyhydroxide.

MICROBIOLOGY

At Site 1154 three rock samples (Samples 187-1154A-3R-1 [Piece 3A, 11–14 cm], 6R-1 [Piece 10A, 59–62 cm], and 9R-1 [Piece 3A, 11–13 cm]) were collected to characterize the microbial community inhabiting this environment (Table T2). Samples 187-1154A-6R-1 (Piece 10A, 59–62 cm) and 9R-1 (Piece 3A, 11–13 cm) are pillow basalt fragments including both the partly altered glassy margin and the more crystalline inte-

T2. Rock samples for cultures, DNA analysis, SEM/TEM, and contamination studies, p. 21.

rior. Sample 187-1154A-3R-1 (Piece 3A, 11–14 cm) consists only of the crystalline interior of a basalt. To sterilize them, the outer surfaces of the rock samples were quickly flamed with an acetylene torch; enrichment cultures and samples for high-pressure enrichment, DNA analysis, and electron microscope studies were prepared (see "Igneous Rocks," p. 7, in "Microbiology" in the "Explanatory Notes" chapter).

To evaluate the extent and type of contamination caused by drilling fluid, fluorescent microsphere tests were carried out for the three sampled rock cores (see "Tracer Test," p. 9, in "Microbiology" in the "Explanatory Notes" chapter and Table T2). One or two pieces from each core were rinsed in nanopure water, and the water was collected for filtration and examined under a fluorescence microscope for the presence of microspheres. Thin sections were used to examine the extent of contamination inside the samples. Microspheres were detected on all three filters and in the thin sections of Samples 187-1154A-3R-1 (Piece 3A, 11–14 cm) and 6R-1 (Piece 10A, 59–62 cm).

SITE GEOPHYSICS

Site 1154 was located based on 1996 single-channel seismic (SCS) site survey data. The location was confirmed by a short 3.5-kHz PDR and SCS presite survey from the *JOIDES Resolution* (JR). Onboard instrumentation used included a precision echo sounder, gyrocompass, seismic system, and GPS receivers.

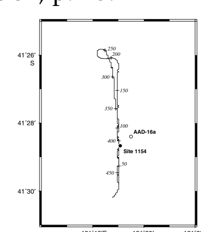
Echo Sounder

3.5-kHz PDRs were used to acquire bathymetric data as well as high-resolution reflection records of the uppermost sediment layers.

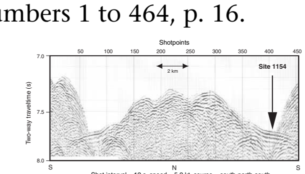
Seismic Reflection Profiling

Site selection for the third drill site of Leg 187 was based on a SCS survey conducted during the *R/V Melville* cruise Boomerang 5 in 1996. An ~1.5-hr SCS and 3.5-kHz PDR survey was conducted on approach to Site 1154 (JR SCS line S2; Fig. F8) to ensure the correct site location by comparing the GPS-navigated SCS data with the 1996 SCS image. The ship's average speed was 5.2 kt during the SCS survey. The water gun was triggered at a shot interval of 12 s, equivalent to ~32 m at 5.2 kt. Data acquisition and processing parameters were described in "Underway Geophysics," p. 10, in the "Explanatory Notes" chapter. Survey line S2 across a local sedimentary basin was conducted back and forth in north-south directions to locate the drill site. The final position of Site 1154 was shifted ~74 m southwest of the prospectus site AAD-16a. We marked this position near seismic shot number 408 of line S2 with a depth of 5747.4 m (see Fig. F9). Acoustic basement was contaminated with reverberations from small-scale relief. However, the sediment cover (Fig. F9) extends from 7.67 s to at least 7.82 s in two-way traveltime, equivalent to 150–250 m of sediment. Hole 1154A was drilled through 233 m of sediments before basement was reached, confirming the above estimate.

F8. Track chart of the JR SCS survey line S2, p. 15.



F9. SCS profile of line S2 from shot numbers 1 to 464, p. 16.



SEDIMENTS

For Site 1154, we used a drilling strategy similar to that implemented at Site 1153 (i.e., washing through the sediment section until we encountered igneous basement). We recovered a single wash core (Core 187-1154-1W) that contained 2.46 m of sediment (see **"Site 1154 Core Descriptions,"** p. 1). The upper part of Section 187-1154-1W is severely drilling disturbed and contains poorly sorted fragments as large as 2 mm in size of variably colored clay in a soupy clay matrix. Below this interval the core is very dark brown to dark brown and contains several intervals, ranging in thickness from 1 to 5 cm of light brown and dark grayish brown clay. The contacts between these intervals are, for the most part, gradational and irregular, but a distinct 3-cm-thick olive-gray layer with very sharp upper and lower contacts is near the base of Section 2. The lower contact of the olive-gray layer abuts a very dark brown clay. The upper part of Section 3 appears to be deformed with irregular wisps of very dark grayish brown, dark brown, and light brown clay. At the bottom of Section 3 is a thin (2 cm) interval of light brown silty clay. The contact between these lower two intervals was disturbed by drilling and is poorly defined.

A smear slide from the dark brown clay contains a trace amount (<1% by mode) of 2- to 3-µm subangular to subrounded brown translucent grains of volcanic glass; even less abundant are similarly sized angular to prismatic grains of quartz and plagioclase. The light brown silty clay at the bottom of the recovered section is a calcareous ooze with abundant microfossil fragments and very rare glass and crystal fragments, as in the clay above. Although we cannot ascertain where (within the 233-m interval that we washed through) material was entrained into the core barrel, the sediments recovered are similar in composition, appearance, and gross stratigraphy to those sampled at Site 1153, with dark brown clay overlying a calcareous ooze.

GEOCHEMISTRY

Introduction

Site 1154 basalts were recovered from ~28-Ma seafloor formed within Zone A of the Southeast Indian Ridge. Three whole-rock powders were analyzed by both X-ray fluorescence (XRF) and inductively coupled plasma–atomic emission spectrometry (ICP-AES), and two samples of fresh basalt glass chips were analyzed by ICP-AES only. The results are shown in Table **T3**. The ICP-AES analyses are of marginal quality because of dissolution problems and inexperience with the JY2000 instrument early in Leg 187. The major element data for the glass samples are compromised the most because SiO_2 concentrations could only be estimated by difference from 100%. Despite the analytical difficulties, XRF and ICP-AES analyses agree well, with the exception of Ni and Cr, which are both lower in the ICP-AES analyses, and Ba, which is below the detection limit of the XRF analysis.

T3. Compositions of basalts from Hole 1154A, p. 22.

Hole 1154A

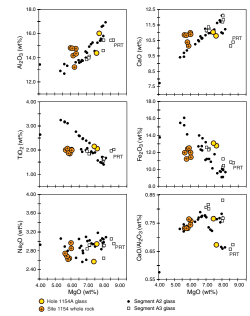
Samples from Hole 1154A are assigned to a single plagioclase-olivine phyric basalt unit based on macroscopic and microscopic examination (see **"Igneous Petrology,"** p. 2). The whole-rock samples contain ~6 wt% MgO (Fig. F10). Like Sites 1152 and 1153, the glass samples from Hole 1154A have higher MgO contents (7.6–7.8 wt%) and lower K_2O (0.11–0.14 wt%) than the whole-rock samples (Table T3). Except for MgO and K_2O, all other element concentrations are similar for whole-rock and glass samples. The compositional differences between the whole-rock and the glass samples cannot result from simple low-pressure crystal fractionation, as the whole rock–glass tie lines are oblique to the fractionation trends for 0- to 7-Ma Zone A lavas (Figs. F10, F11). These observations are similar to those at Sites 1152 and 1153, again suggesting that alteration or a nonequilibrium magmatic process has affected the whole-rock compositions.

Site 1154 glasses are, for the most part, comparable to Zone A axial lavas. These glasses have slightly high Fe_2O_3 and Y concentrations, similar to Site 1153 glass, relative to Zone A axial samples. The most primitive Site 1155 glass has low CaO/Al_2O_3 values, suggesting it was erupted in an environment similar to the Zone A propagating rift tip (PRT) lavas. This is only weakly supported by slightly higher concentrations of moderately incompatible elements like Y and Zr but not by the low concentrations of highly incompatible elements like Ba and Sr. The similarity of Na_2O contents between Site 1154 glasses and 0- to 7-Ma Zone A glasses indicates that the extent of mantle melting was the same to slightly higher. High Fe_2O_3 contents in Site 1154 glasses suggest fractionation from a parental magma derived at higher mean pressures of melting relative to the present Zone A lavas, although little else distinguishes them. Therefore, the magmatic environment appears to have been similar to that beneath the present Zone A spreading axis.

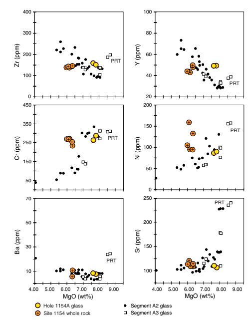
Mantle Domain

The Ba/Zr systematics of Site 1154 basalts (Fig. F12) suggest that Pacific-type mantle was present beneath Zone A at ~28 Ma. The Na_2O/TiO_2 vs. MgO diagram is also consistent with a Pacific-type mantle source.

F10. Major element compositions vs. MgO of Site 1154 basalts, p. 17.



F11. Trace element compositions vs. MgO of Site 1154 basalts, p. 18.



F12. Variations of Zr/Ba vs. Ba and Na_2O/TiO_2 vs. MgO from Site 1154, p. 19.

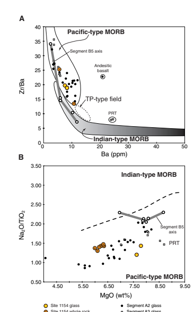


Figure F1. Photograph of interval 187-1154A-3R-1, 120–130 cm, showing light gray, moderately plagioclase-olivine phyric pillow basalt, typical of that recovered throughout Hole 1154A. Areas of altered groundmass plucked from the cut surface appear as black irregular patches.

Figure F2. Photomicrograph, with crossed polars, of Sample 187-1154A-3R-2, 23–26 cm (see "Site 1154 Thin Sections," p. 15), showing partially resorbed, twinned, and zoned plagioclase phenocryst.

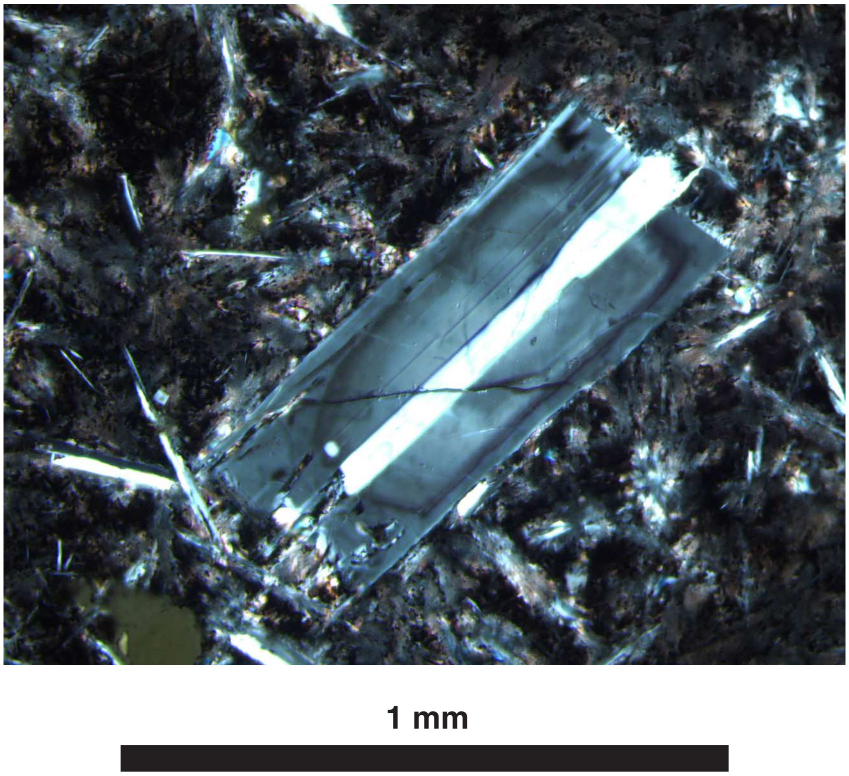


Figure F3. Photomicrograph, with crossed polars, of Sample 187-1154A-9R-1, 11–14 cm (see "Site 1154 Thin Sections," p. 19), showing zoned, partially resorbed plagioclase with irregularly shaped melt pockets in larger phenocrysts.

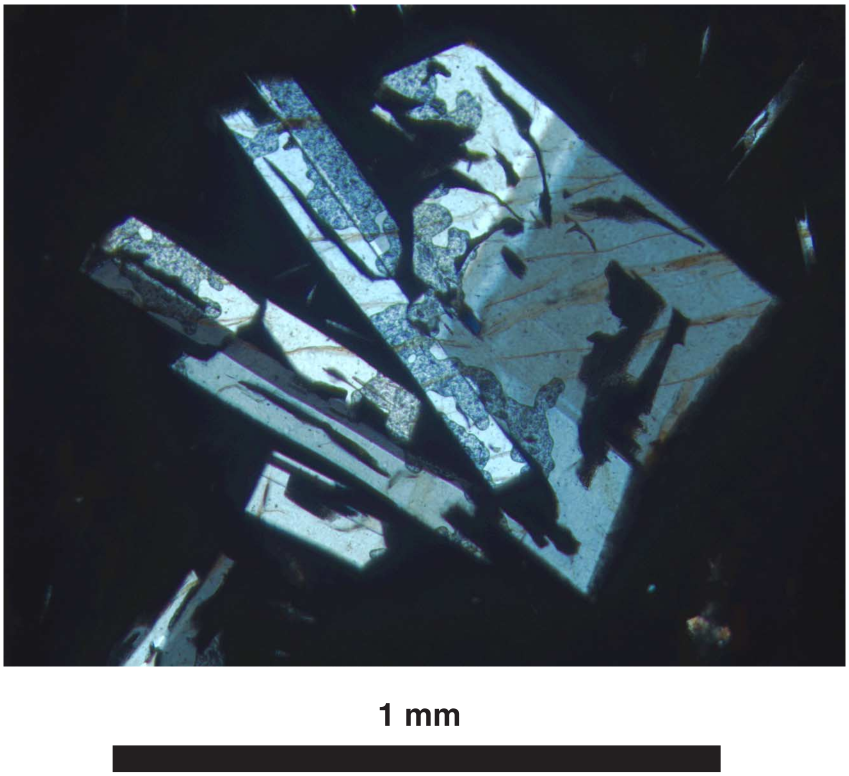


Figure F4. Photomicrograph, with crossed polars, of Sample 187-1154A-3R-2, 23–26 cm (see **"Site 1154 Thin Sections,"** p. 15), showing a skeletal olivine microphenocryst.

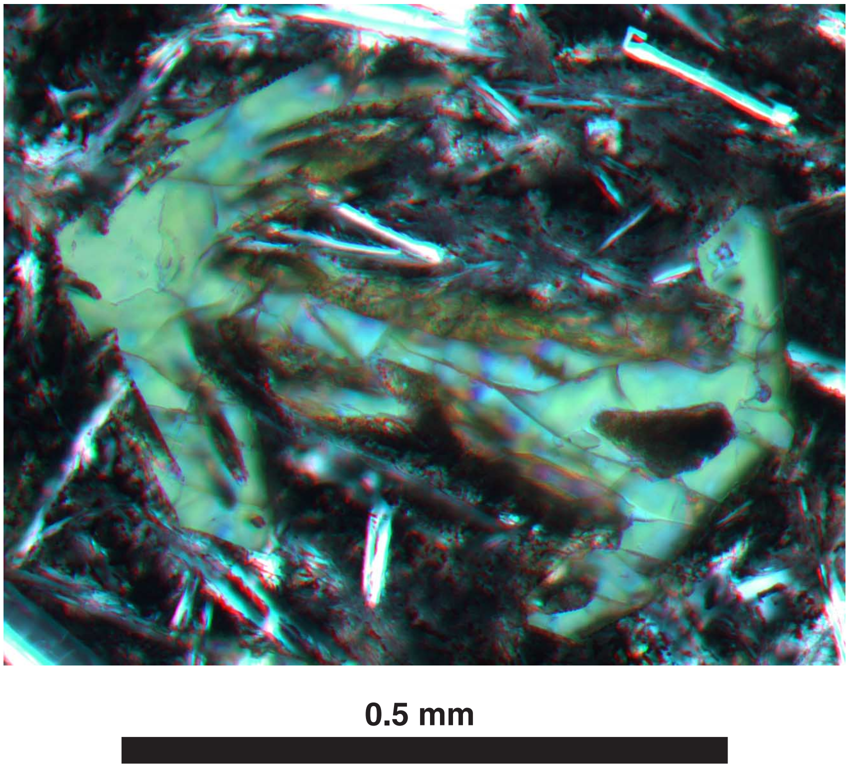


Figure F5. Photomicrograph of Sample 187-1154A-9R-1, 11–14 cm (see **"Site 1154 Thin Sections,"** p. 19), showing spherulites and glass in the quench zone of a pillow. Note smectite replacement of glass (lower half).

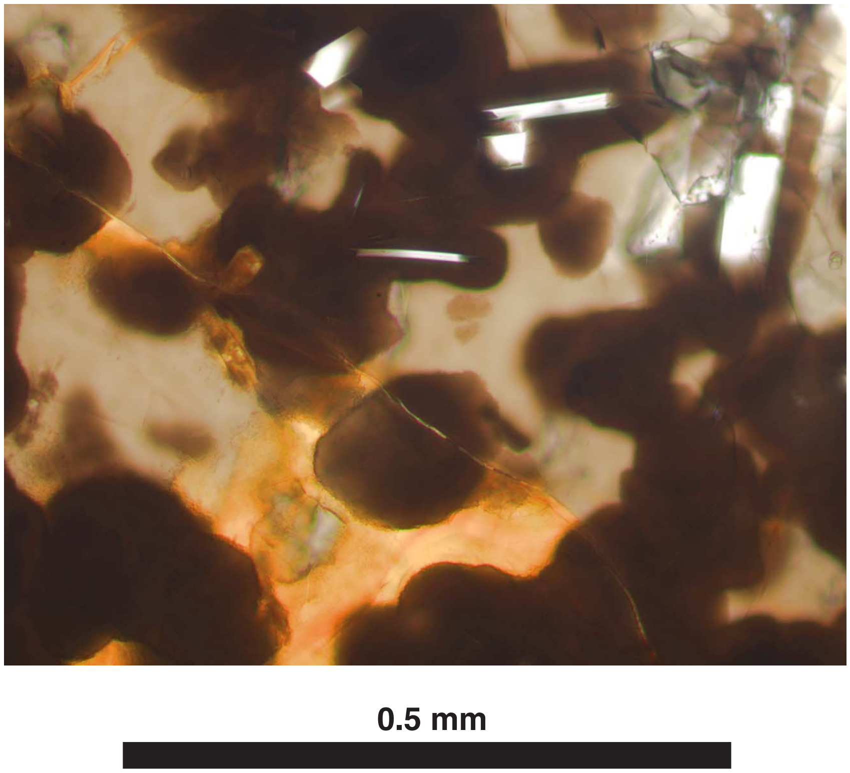


Figure F6. Photomicrograph in plane-polarized light of Sample 187-1154A-7R-1, 140–145 cm (see "Site 1154 Thin Sections," p. 18), showing intersertal groundmass consisting of prismatic to tabular plagioclase, anhedral clinopyroxene, and minor olivine.

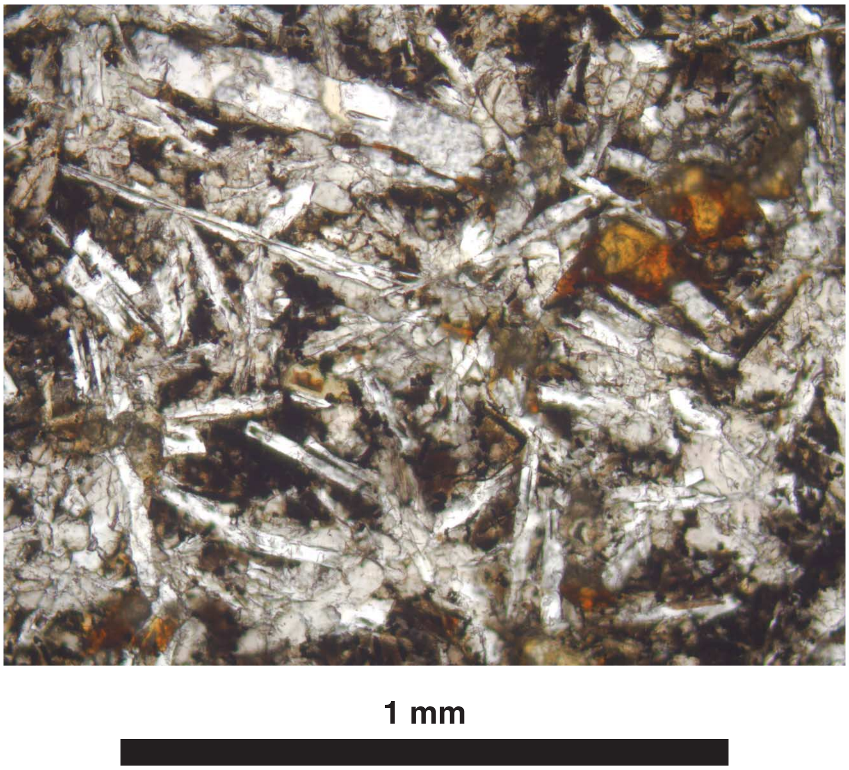


Figure F7. Photograph of interval 1154A-2R-1, 37–45 cm, showing an alteration halo around an open fracture that decreases in width into the sample and terminates with a silica infilling.

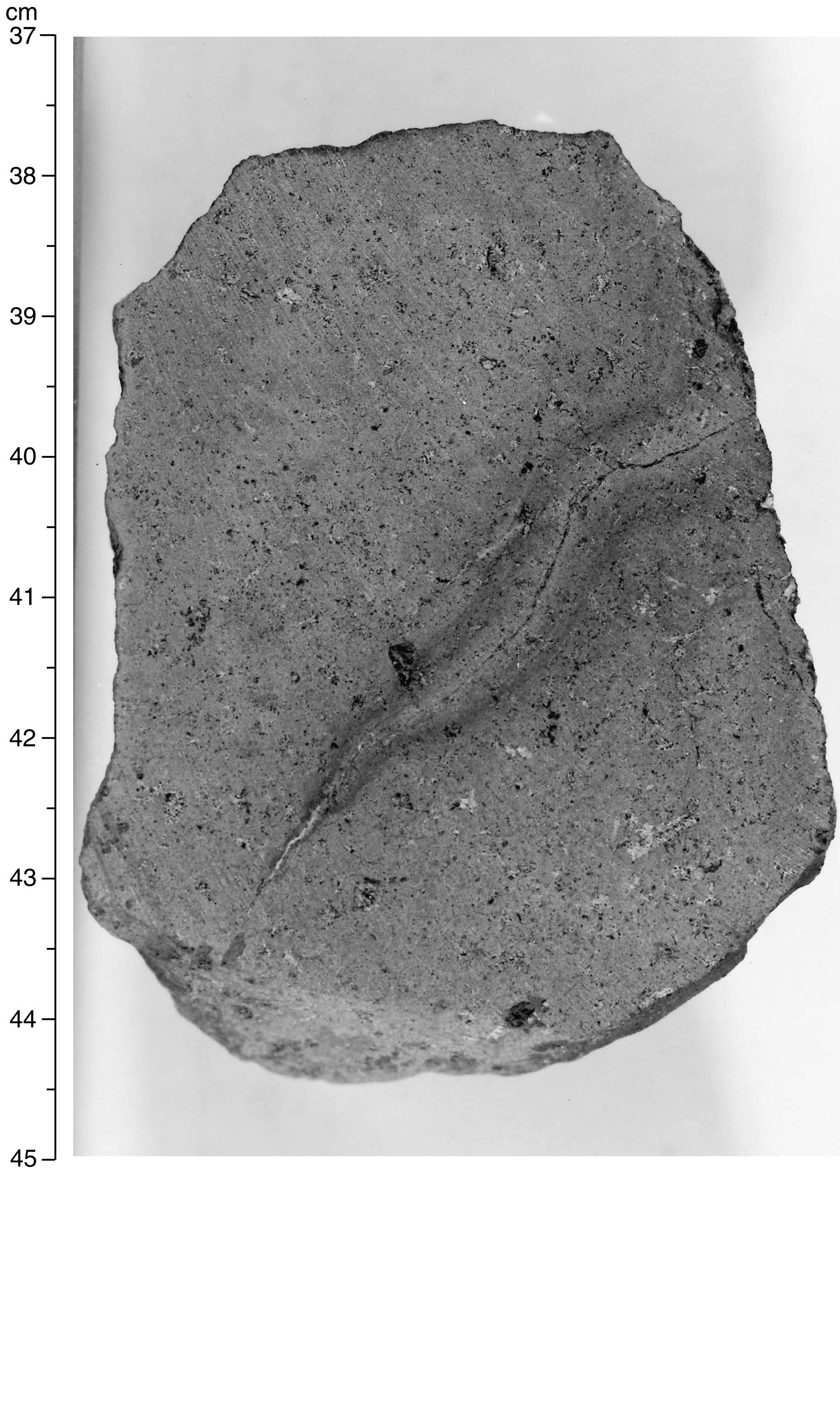


Figure F8. Track chart of the *JOIDES Resolution* single-channel seismic survey line S2. Cross = 50-shot intervals; open circle = prospectus site (AAD = Australian Antarctic Discordance); solid circle = Site 1154. Survey line S2 was conducted back and forth in north-south directions, turning at about shotpoint 240.

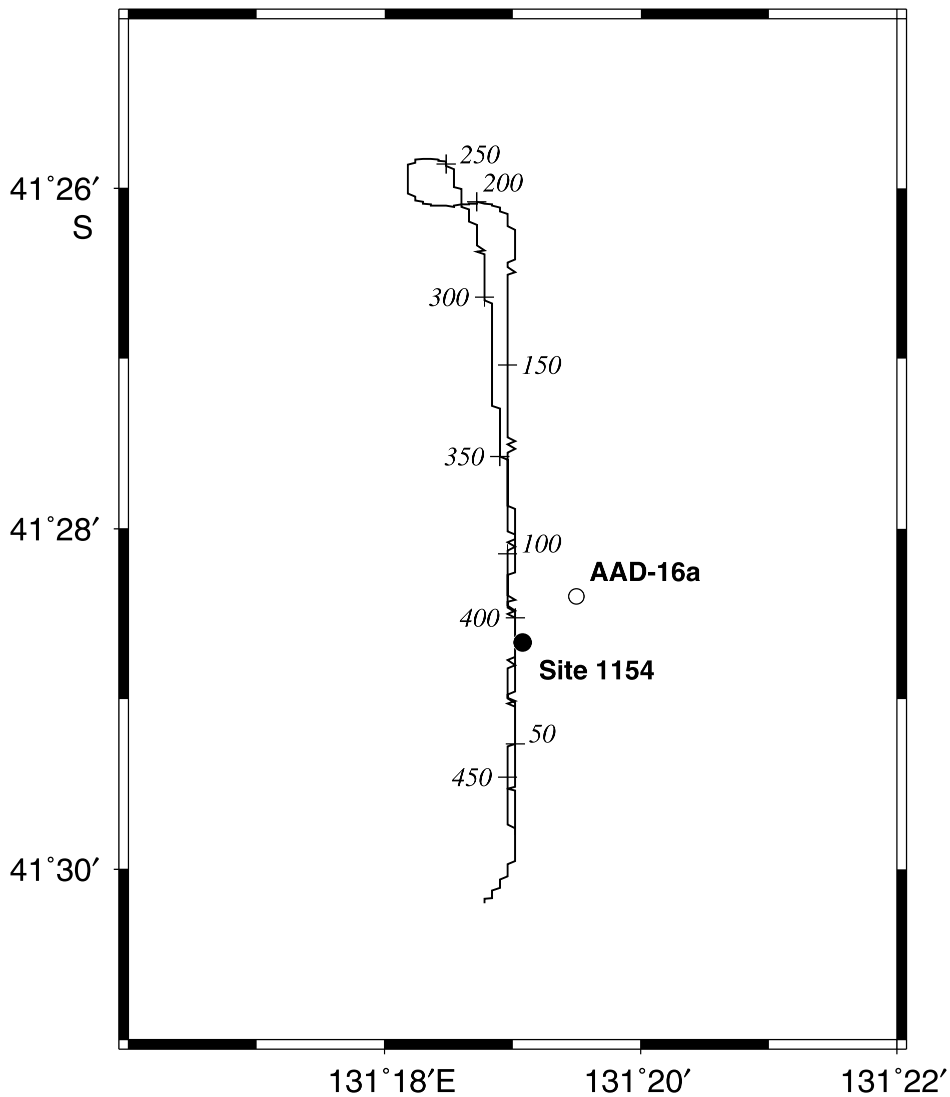


Figure F9. Single-channel seismic profile of line S2 from shot numbers 1 to 464. The large arrow marks the position of Site 1154 near shot number 408. Shots 1 to ~240 were run from south to north, and the line was rerun north to south after the turn between shots 240 and 250.

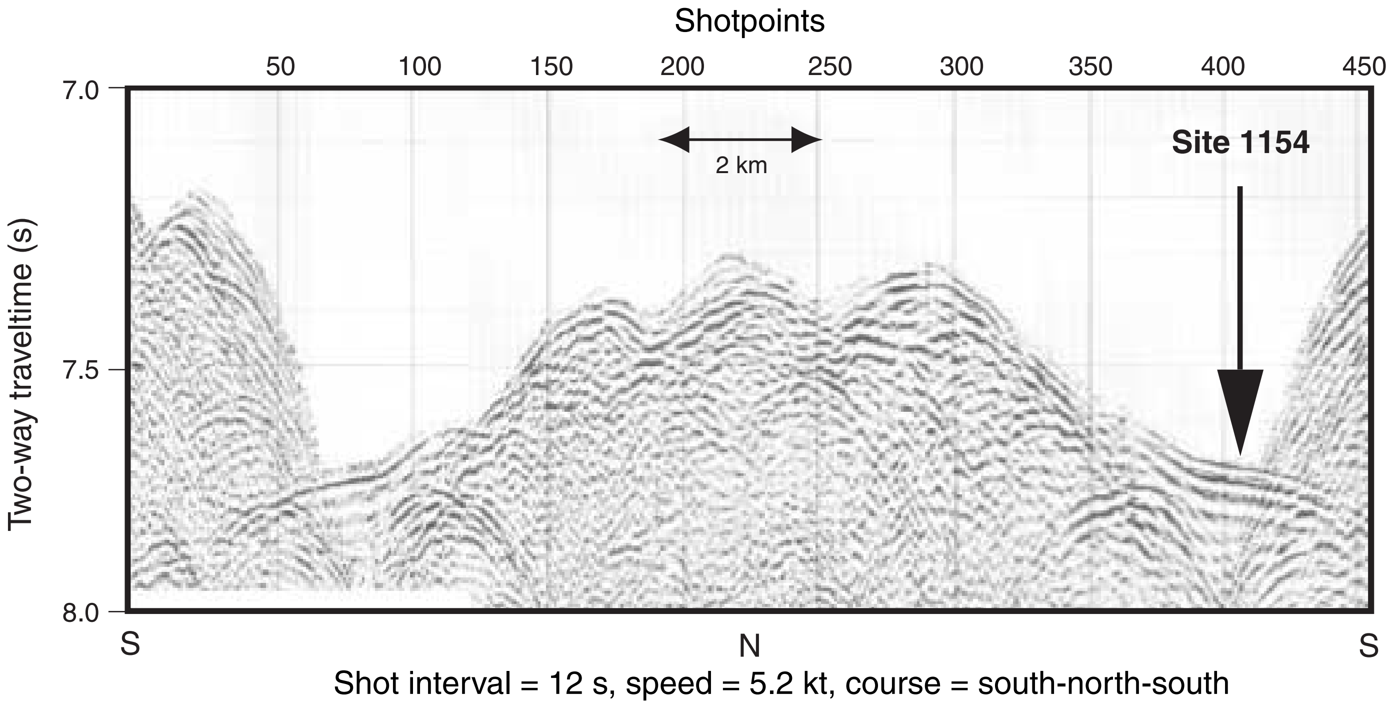


Figure F10. Major element compositions vs. MgO of Site 1154 basalts compared with 0- to 7-Ma glasses from Zone A. PRT = propagating rift tip lavas from these segments. Only the average X-ray fluorescence or average rerun ICP-AES values are shown.

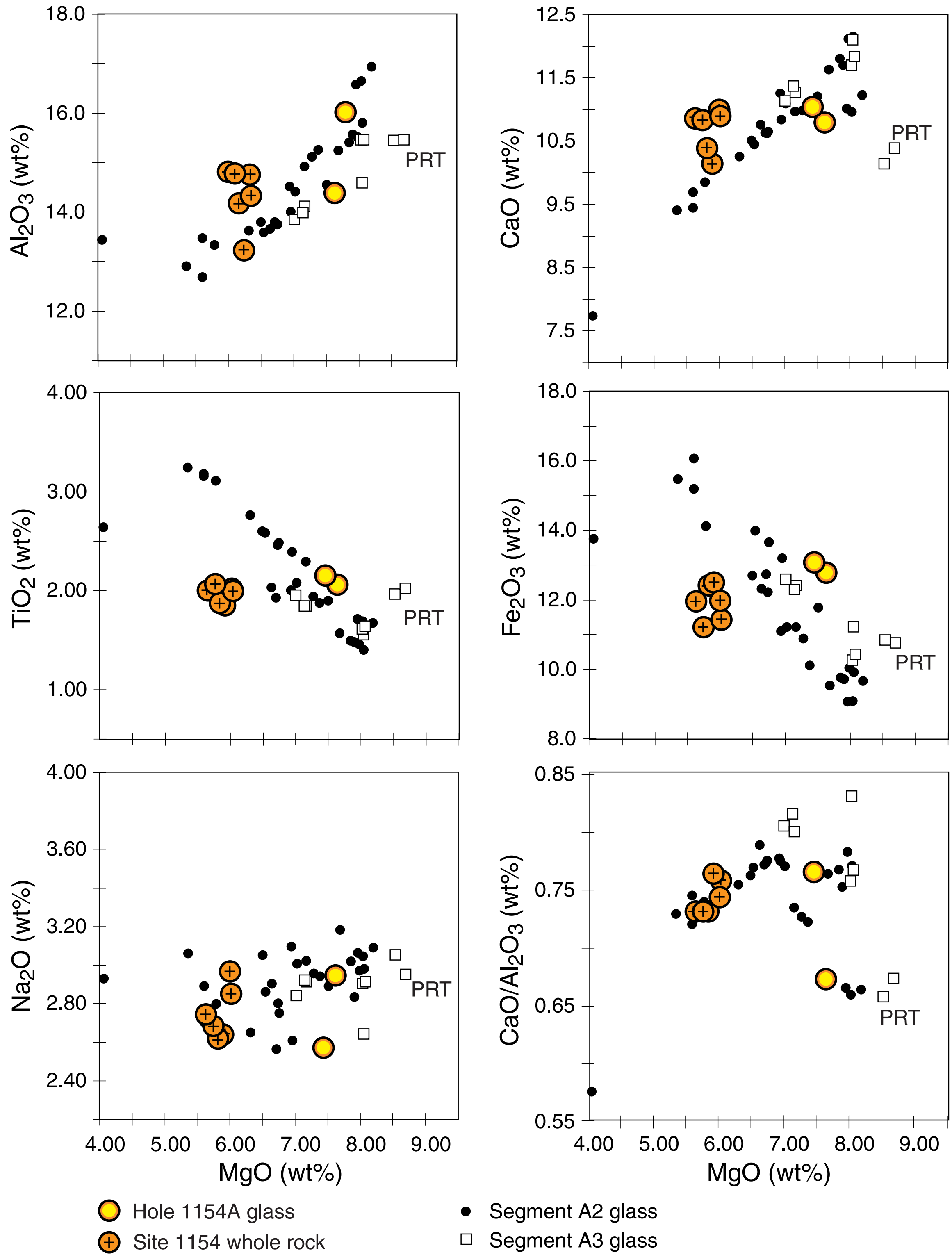


Figure F11. Trace element compositions vs. MgO of Site 1154 basalts compared with 0- to 7-Ma glasses from Zone A. PRT = propagating rift tip lavas from these segments.

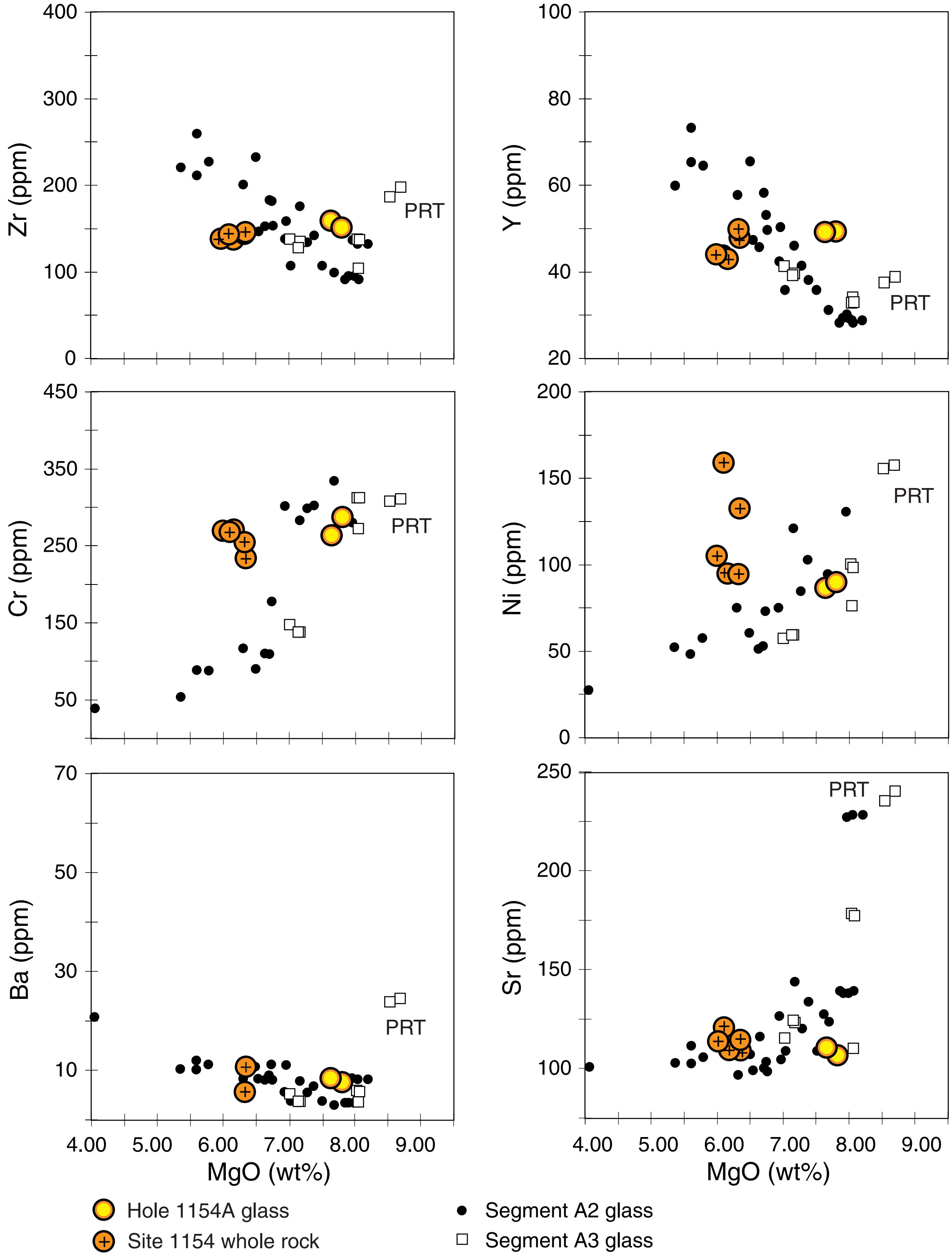


Figure F12. A. Variations of Zr/Ba vs. Ba of Site 1154 basaltic glass and whole-rock samples compared with Indian- and Pacific-type MORB fields defined by zero-age Southeast Indian Ridge (SEIR) lavas dredged between 123°E and 133°E. **B.** Variations of Na_2O/TiO_2 vs. MgO of Site 1154 basaltic glass and whole-rock samples compared with Indian- and Pacific-type MORB fields defined by zero-age SEIR lavas dredged between 123°E and 133°E. PRT = propagating rift tip lavas. Dashed line separates Indian- and Pacific-type zero-age SEIR basalt glass.

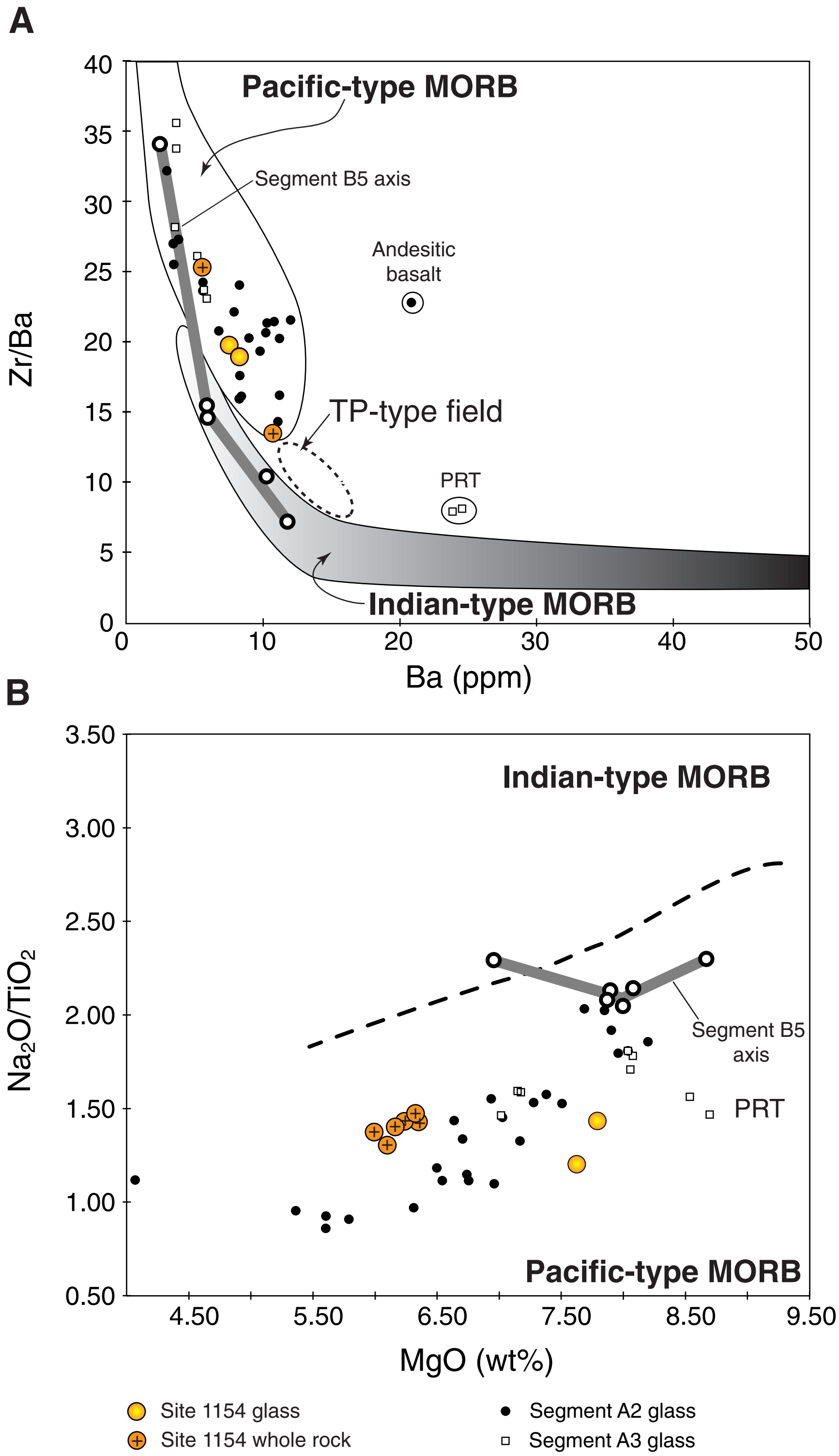


Table T1. Coring summary, Site 1154.

Hole 1154A
Latitude: 41°28.6695′S
Longitude:131°19.0354′E
Time on hole: 0325 hr, 2 Dec 99–2130 hr, 4 Dec 99 (66.08 hr)
Time on site: 0325 hr, 2 Dec 99–2130 hr, 4 Dec 99 (66.08 hr)
Seafloor (drill-pipe measurement from rig floor, mbrf): 5747.4
Distance between rig floor and sea level (m): 11.0
Water depth (drill-pipe measurement from sea level, m): 5736.4
Total depth (from rig floor, mbrf): 6015.0
Total penetration (mbsf): 267.6
Total length of cored section (m): 34.4
Total core recovered (m): 9.42
Core recovery (%): 27.4
Total number of cores: 9
Number of drilled cores: 1

Core	Date (Dec 1999)	Ship local time	Depth (mbsf)		Length (m)		Recovery (%)	Comment
			Top	Bottom	Cored	Recovered		
187-1154A-								
1W	3	0100	0.0	233.2	233.2	2.49	N/A	
2R	3	0430	233.2	237.2	4.0	0.73	18.3	
3R	3	0810	237.2	241.7	4.5	1.70	37.8	Deployed Whirl-Pak on Core 3R
4R	3	1305	241.7	246.7	5.0	1.80	36.0	
5R	3	1920	246.7	251.3	4.6	0.99	21.5	
6R	3	2250	251.3	256.5	5.2	0.85	16.3	Deployed Whirl-Pak on Core 6R
7R	4	0405	256.5	261.2	4.7	1.21	25.7	
8R	4	0815	261.2	265.8	4.6	1.69	36.7	
9R	4	1110	265.8	267.6	1.8	0.45	25.0	Deployed Whirl-Pak on Core 9R
				Cored:	34.4	9.42	27.4	
				Drilled:	233.2			
				Total:	267.6			

Notes: N/A = not applicable. This table is also available in **ASCII** format.

Table T2. Rock samples incubated for enrichment cultures and prepared for DNA analysis and electron microscope studies and microspheres evaluated for contamination studies.

Core, section	Depth (mbsf)	Sample type	Enrichment cultures			DNA analysis		SEM/TEM samples	Microspheres*	
			Anaerobic	Aerobic	High pressure	Wash	Fixed	Air dried	Exterior	Interior
187-1154A-										
3R-1	237.31	Rock	10	3		X	X		Yes	Yes
6R-1	251.89	Rock	8	4		X	X	X	Yes	Yes
9R-1	265.91	Rock	8	4	X	X	X	X	Yes	No

Notes: SEM = scanning electron microscope; TEM = transmission electron microscope; * = contamination test; X = samples prepared on board. This table is also available in **ASCII** format.

Table T3. Glass and whole rock major and trace element compositions of basalts, Hole 1154A.

	Hole 1154A											
Core, section:	3R-1	3R-1	3R-1	3R-1	3R-2	3R-2	3R-2	5R-1	5R-1	5R-1	4R-2	2R-1
Interval (cm):	50-53	50-53	50-53	50-53	23-26	23-26	23-26	58-62	58-62	58-62	42-44	31-37
Depth (mbsf):	237.70	237.70	237.70	237.70	238.88	238.88	238.88	247.28	247.28	247.28	243.56	233.51
Piece:	10	10	10	10	4	4	4	11	11	11	7	7
Analysis:	XRF	XRF	ICP	ICP	XRF	XRF	ICP	XRF	XRF	ICP	ICP	ICP
Rock type:	Moderately plagioclase-olivine phyric basalt				Moderately plagioclase-olivine phyric basalt			Moderately plagioclase-olivine phyric basalt			Glass	Glass
Major element (wt%)												
SiO_2	49.00	49.77	52.60	52.02	48.72	48.17	50.59	48.87	48.91	51.08	47.01*	48.60*
TiO_2	2.06	2.09	2.02	2.00	1.88	1.89	1.86	2.01	2.02	2.03	2.07	2.16
Al_2O_3	14.74	14.86	13.97	14.73	14.36	14.03	13.25	14.84	14.84	14.77	16.03	14.40
Fe_2O_3	11.17	11.22	11.37	11.47	12.55	12.27	12.48	11.93	11.96	11.96	12.76	13.06
MnO	0.18	0.19	0.19	0.19	0.17	0.17	0.18	0.18	0.18	0.19	0.21	0.21
MgO	6.01	6.18	6.32	6.37	6.19	6.13	6.23	5.97	6.01	6.33	7.80	7.63
CaO	10.75	10.90	10.55	11.22	10.44	10.32	10.13	10.85	10.85	10.99	10.79	11.03
Na_2O	2.61	2.77	2.81	2.90	2.64	2.61	2.64	2.75	2.75	2.97	2.95	2.58
K_2O	0.44	0.45	0.35	0.37	0.59	0.59	0.51	0.50	0.50	0.43	0.14	0.11
P_2O_5	0.18	0.19	0.22	0.20	0.18	0.17	0.22	0.18	0.18	0.20	0.24	0.21
LOI	0.62	0.62			0.75	0.75		0.82	0.82			
CO_2												
H_2O												
Total:	97.14	98.62	100.39	101.47	97.72	96.35	98.10	98.08	98.20	100.94	100.00	100.00
Trace element (ppm)												
Nb	6				6			6				
Zr	143		142	149	137		131	139		144	151	159
Y	44		47	48	43		43	44		50	49	49
Sr	120		110	118	110		101	114		109	107	111
Rb	8				15			12				
Zn	104				97			98				
Cu	67				55			57				
Ni	159		133	132	95		74	105		95	90	87
Cr	268		224	243	271		214	270		255	287	264
V	346				345			347				
Ce	39				35			38				
Ba			10	11			7			6	6	6
Sc			40	41			36			40		

Notes: * = some SiO_2 by difference for ICP-AES (i.e., 100.00% totals); LOI = loss on ignition. This table is also available in **ASCII** format.