

August 22, 2005

**IODP EXPEDITION 309:
SUPERFAST SPREADING RATE CRUST 2
WEEK 6 REPORT**

OPERATIONS

REENTRY #9 (RCB Bit #8): The bit was pulled on 16 August after it had accumulated 57.8 hours of rotation. Bit #8 cored 58.6 m with 17.74 m of recovery (30.3 %) with a ROP of 1.01 m/hr. The bit had lost about 2/3 of its gauge cutters on one cone and two cones had lost their core trimming cutters. The bearings on three cones were very loose and one cone could not be turned. TD for the bit was 4849.2 mbrf (1203.8 mbsf).

REENTRY #10 (RCB Bit #9): The drill string was recovered and a new bit deployed (S/N CL-540). Hole 1256D was reentered at 0304 hr on 17 August. The bit was lowered to a depth of 4800 mbrf (1154.6 mbsf). The top drive was picked up, the bit began taking weight at 4832 mbrf (1186.6 mbsf), and the hole was reamed to bottom. A core barrel was dropped and coring resumed at 0730 hr on 17 August. Coring continued without incident. A 150 barrel mud sweep was pumped before pulling the final core barrel, which was retrieved at 1100 hr on 20 August. The bit was then pulled to the casing shoe and lowered back to bottom. No fill was encountered. Another 150 barrel mud sweep was pumped to clean the hole. The bit was then pulled out of the hole and cleared the cone at 2025 hr. After Core 170R was retrieved the bit had accumulated 53.1 hours of rotation. Bit # 9 had cored 51.3 m with a recovery of 37.57 m (73%) and an ROP of 0.97 m/hr. The bit was in very good condition and the bearings were effective. Four gauge cutters and some inserts from the cones were damaged or missing.

REENTRY #11 (Logging BHA): RCB Bit #9 was laid out and a logging BHA made up. The BHA reentered the hole at ~0800 on 21 August. The bit was set approximately 6 m above the casing shoe and preparations were made for logging Hole 1256D.

SCIENCE UPDATE

From August 13th to 20th, 109.9 m of basaltic basement was cored (Cores 147R to 170R; 1145.2 to 1255.1 mbsf), yielding a total of 53.4 m of recovery (48.6 %). Fifteen lithological units (51 to 65) have been defined based on systematic changes in grain size or the presence of chilled margins and/or breccias. Unit 51 consists of aphyric fine- to medium-grained doleritic basalt with seriate, subophitic to intergranular textures. All other units are aphyric cryptocrystalline to microcrystalline massive basalts, although eight units (52, 53, 55-57, 60, 61, and 64) are intruded by sub-vertical basaltic dikes with sharp to irregular chilled margins that are locally brecciated. These breccias are composed of curved platy to subangular cryptocrystalline basalt clasts and altered glass cemented by chlorite, sulfides, silica, and/or anhydrite. Units 54, 56, 60, and 61 have intricate and irregular dike contacts and Pieces 14 and 16 of Section 166R-1 display multiple, cm-wide dike (Unit 61B) intrusions. Most basalts are holocrystalline with variolitic texture in the cryptocrystalline parts but are intergranular where microcrystalline.

Alteration in Cores 147-163 becomes more pervasive, associated with the development of greenschist facies mineral assemblages, resulting in grayish-green moderate background alteration in areas with coarser grain size of primary minerals.

In contrast, the dark gray color of the dike chilled margins reflects only slight alteration. Veins are common at dike contacts, commonly grading into breccias. A tentative chronology has been established based on the spatial relationships of secondary minerals: (1) chlorite, titanite, albite, actinolite and pyrite; (2) quartz, epidote, pyrite, chalcopyrite, sphalerite; (3) anhydrite, prehnite, laumontite and calcite. Where basalt is moderately to highly altered to chlorite, actinolite and titanite adjacent to veins single and composite light- to dark-gray and/or green 1-8 mm thick alteration halos occur.

Twenty new vein samples were analyzed by XRD. Chlorite, anhydrite, albite, pyrite, and quartz are common vein minerals with rare prehnite and chalcopyrite. Sphalerite was identified in anhydrite-rich veins of Sections 151R-1 and 153R-1. Laumontite is abundant in veins from Sections 155R-1 and 155R-2, either alone or together with quartz, pyrite, and chlorite. Laumontite and anhydrite have not been identified in the same sample.

Fracturing is moderate to intense, heterogeneously partitioned, and characterized by sub-vertical vein systems with dilational features filled with secondary minerals. Structures related to the cooling of magma are present as well as single and multiple dike contacts with dip angles from ~50° to sub-vertical.

Fifteen rock samples were analyzed for major and trace elements by ICP-AES. The ranges of representative element composition (normalized to 100%) for fresh samples are SiO₂ 48-54 wt%, FeO 9-14 wt%, MgO 6-8 wt%, CaO 7-13 wt%, Na₂O 2-5 wt% , Cr 20-320 ppm, Sr 52-188 ppm, Zr 59-132 ppm, and Ba 7-107 ppm. Magnesium number ranges from 45-60, with an average of 54. These values are typical of MORB and the trace element composition indicates a close affinity to EPR-MORB. There is no correlation between phenocryst abundance or lithology with chemical composition. An increase of Na₂O and concomitant decrease in CaO at about ~1020 to 1050 mbsf coincides with the appearance of albite associated with the development of dark- and light-green alteration halos and moderate background alteration.

Stable remanent magnetic directions in Cores 145R-2 to 162R-2 show steep inclinations varying between 70° and 25° suggesting we have not achieved full demagnetization isolating the primary remnant magnetization component.

Thermal conductivity, compressional wave velocity, and porosity data indicate a step change in properties of the rocks above and below 1060 mbsf. The average thermal conductivity from ~752 mbsf to 1060 mbsf is 1.8 W/m/K and 2.1W/m/K from 1060 to 1220 mbsf. Seismic velocity is, on average, 5.4 km/s above and 5.8 km/s below 1060 mbsf. There is also a decrease in porosity in the massive units below 1060 mbsf from 4 to 2 %.

Core scanning benefited from the high recovery, with 157 pieces totaling 34.1 m scanned from Cores 149R-170R. High recovery and large piece size, including 18 pieces of 40-101 cm length, give very good prospects of orienting much of the core after logging images are collected.

LAB REPORT

This was a routine week in the labs, processing and sampling the recovered basalts. The final sample parties have produced a surge of samples for shipboard analysis that has just about maximized the labs' daily output.

The vacuum that supports the operation of the LP30 thin section lapping machine was lost. After ruling out the pump itself, the machine's panels were removed to investigate. An old repair of a damaged custom blown glass water trap and 20 year old vacuum hose had failed and were repaired.

A variation on the oil injector pump plumbing that supports the operation of the seismic sources was confirmed not to work. The original configuration was restored; the lines filled with synthetic oil and pressure was maintained. The high pressure air regulator was tested, along with the firing circuits and solenoids. Final preparation for the VSP/WST phase of logging program is in progress.

HSE: The emergency drill was conducted by the engine room team and focused on the aquachem station that provides the ship's fresh water. METS and the forward fire team stood by; others, not involved, mustered at their life boat.