

August 15, 2005

**IODP EXPEDITION 309:  
SUPERFAST SPREADING RATE CRUST 2  
WEEK 5 REPORT**

**OPERATIONS**

REENTRY #7 (RCB Bit #6): The drill string was recovered and a new CC-9 bit deployed (S/N BF-741). Hole 1256D was re-entered at 0951 hr on 5 August. The bit was lowered to a depth of 4657 mbrf. The top drive was picked up and the hole reamed to bottom. Approximately 3m of fill was encountered at the bottom of the hole. Coring resumed at 1430 hr on 5 August from 4696.7 mbrf (1051.3 mbsf). Coring continued without incident. Bit #6 was pulled at 0930 hr on 8 August with 50.8 hrs. The bit had cored 57.6 m (1108.9 mbsf), recovering 21.45 meters of core (37.2 %) with a rate of penetration of 1.13 m/hr. The bit was in very good condition with one broken insert, one missing insert, and 1/16" under gauge. There were 3 gauge inserts missing, all from the same row and some gouging on the gauge diameter.

REENTRY #8 (RCB Bit #7): The drill string was recovered and a new CC-9 bit deployed (S/N BF-742). Hole 1256D was re-entered at 0148 hr on 9 August. The bit was lowered to a depth of 4715 mbrf (1069.6 mbsf). The top drive was picked up and the hole reamed to bottom. Approximately 3 m of fill was encountered at the bottom of the hole. Coring resumed at 0800 hr on 8 August at 4754.3 mbrf (1108.9 mbsf).

While cutting core 146R, the driller noticed a 100 psi pressure loss. The drill string was pulled off bottom and a 350 psi drop in pressure was noted. Core 146R was recovered at 1330 hr on 11 August after a 3.0 m advance and a recovery of 3.5 m. After dropping another core barrel, the pressures remained 350 psi lower than normal. It was suspected that there was a crack in the BHA. The decision was made to pull the drill string and inspect the BHA for cracks. When the bit cleared the reentry cone, the vessel was repositioned approximately 50 m from the cone. The BHA was on deck at 2300 hr on 11 August. Bit #7 was pulled after 42.5 rotating hours. The bit had cored 36.3 m to a depth of 1145.2 mbsf with a recovery of 17.7m (46.8%) and an ROP of .85 m/hr. The bit was in very good condition, with three broken or missing inserts on the cones and no gauge cutters missing. All drill collars and subs were inspected for cracks. With none found, a new CC-9 bit was made up to the drill string and the drill string was again lowered. One stand of 5-1/2" transition pipe was laid out, as well as the TDC and cross-over sub because of excessive wear at the connections.

REENTRY #9 (RCB Bit #8): A new core barrel was dropped while running in with Bit #8 (S/N BF-853) so that drill-stand pressures could be checked as the pipe was lowered. The drill string was filled with seawater every 25 stands and the pressure checked. Pump pressure increases were noted at 25 and 50 stands but because there was no further pressure increases with 75 and 100 stands deployed, a crack in the drill string was suspected. The VIT was lowered when 100 stands were below the rotary table. A pill of high viscosity mud was pumped as a tracer as the camera was lowered. The camera passed through very cloudy water just above the BHA, indicating that mud had exited the drill pipe somewhere and drifted down. The camera was pulled up above the BHA and another mud pill was circulated. As the VIT

was again lowered towards the BHA, a vigorous jet of drilling mud was observed streaming from the 5" pipe about two stands above the 5-1/2" transition pipe. The drill string was pulled back up to the rig floor. This time the bottom two stands of 5" drill pipe were replaced.

The drill string was again lowered below the rotary table. Hole 1256D was reentered for the 9<sup>th</sup> time at 0230 on 13 August. The drill string was lowered to the bottom (1145.2 mbsf), encountering approximately 3 m of fill. A core barrel was dropped and coring resumed at 0730 on 13 August.

### **SCIENCE UPDATE**

From August 7th to 13th, 84.3 m of basaltic basement was cored (Cores 129R-146R), yielding a total of 33.9 m of recovery (40.2 %). Seven lithological units (44 to 50) have been defined. Unit 47 includes 90 cm of spectacular, sulfide-impregnated dike margin breccia with complex intrusive relationships and multiple intricate, margin-parallel sulfide veins and cross-cutting anhydrite veins. Other units (44-46, 48-50) consist of massive basalt. Unit boundaries were determined by the presence of thick breccia occurrences and/or changes in phenocryst abundance. Units 44 and 46 are subdivided into 4 and 2 subunits, respectively, based on increasing or decreasing trends in grain size. The majority of the massive units are aphyric (phenocryst < 1 vol. %) microcrystalline basalts. Unit 50 is sparsely (clinopyroxene-) plagioclase-olivine phyric microcrystalline basalt with irregular development of ophitic textures in some pieces. Textures are predominantly variolitic near unit boundaries, and subophitic to intergranular toward the interiors.

Patchy greyish-green alteration is first observed in Cores 128R and 130R and becomes more widespread in Cores 142R to 146R. This greyish-green background alteration is commonly associated with an increase in the grain size of primary minerals. In cores 128R to 146R, veins and breccia-cement are composed of chlorite, chlorite/smectite, pyrite, chalcopyrite, quartz, anhydrite, calcium carbonate, and minor laumontite, clinocllore, and prehnite. Saponite is present only in veins above Core 131R. A dramatic network of millimetric chalcopyrite and pyrite-bearing veins is observed in Core 140R. Single and composite dark/light grey/green 1 to 11 mm-thick alteration halos are developed adjacent to veins where basalt is moderately to highly altered to chlorite/smectite, albite, titanite, and rare actinolite. The change from dominantly clay minerals replacing primary minerals to assemblages of chlorite/smectite and albite signals a change from predominantly low-temperature alteration to sub-greenschist facies hydrothermal conditions.

From Core 128R to Core 146R fracturing is heterogeneously partitioned. Core 128R is moderately fractured and includes incipient breccia and vein sets occurring in rubble. From Core 129R through Core 131R (massive flow units) fracturing is moderate to high and characterized by sets of subparallel veins and conjugate vein systems, that are commonly observed in the coarser-grained rocks in Hole 1256D. From Section 131R-2 to 134R-2 rocks are slightly fractured, and characterized by conjugate veins. Structures related to the cooling of lavas are also present. Section 135R-1 is highly fractured by conjugate sets of veins and incipient brecciation. Breccias are heterolithic and display flow structures in the matrix. From Core 136R downhole, rock fracturing is characterized by sets of subparallel, nearly vertical veins, vein networks, and breccias, associated with igneous contacts, where chilled basalt is in contact with coarser-grained basalt. Sections 136R-1, 137R-1, 140R-1, 143R-1, 144R-2, 145R-1, 146R-2 show the greatest fracturing. Section 146R-2

exhibits a complex set of veins filled with anhydrite and saponite displaying dilational shear deformation.

Twelve new rock samples were analyzed for major and trace elements by ICP-AES (totaling 36 samples and 5 replicates). Representative compositions of the samples normalized to 100% are: SiO<sub>2</sub> 48-52 wt%, FeO 10-13 wt%, MgO 6-8 wt%, CaO 9-13 wt%, Na<sub>2</sub>O 2-3 wt% , Cr 20-320 ppm, Sr 52-188 ppm, Zr 59-128 ppm, and Ba 7-107 ppm. Magnesium number ranges from 45-60, with an average of 54. These values are typical of MORB generated at the EPR. A change in slope and/or step-like linear variation of Fe, Mg, Mn, Ca, Ca/Al, Zr/Ti, Zr/Y, and Mg# at 908 mbsf suggests the presence of two distinctive geochemical cycles of magmatic injection or magmatic evolution for the rocks recovered in Expedition 309.

Alternating field demagnetization analyses of the archive-half sections from 1052.3 to 1140.3 mbsf, corresponding to cores 107R-1 to 145R-2, show less drilling overprint compared to previous cores. Stable remanent magnetic directions yield steep positive inclinations (~45°). Inclinations of discrete samples from the working-half obtained after AF demagnetization are in good agreement with those from the archive-half, suggesting that low-coercivity minerals carried little or no paleomagnetic information after the 40-50 mT demagnetization step. The good correlation between the concave magnetic intensity patterns, after 20-30 mT of AF demagnetization, and the petrologically defined volcanic units allowed us to estimate an average thickness of  $1.0 \pm 0.5$  m for the individual cooling units.

Physical properties measurements are generally consistent with the overlying cores but some significant changes occur below Unit 43. At ~1060 mbsf, discrete samples show an increase in the P-wave velocity, bulk density, and thermal conductivity, to 5.7 km/s, 2.9 g/cc, and > 2 W/m/K, respectively. NGR counts are actually quite high in the volcanic breccia sections within massive flows of Units 44 and 45. Magnetic susceptibility shows an inverse relationship with degree of alteration.

A significant number of long core pieces (57 %) in Cores 133R to 148R range in size from 75 mm to 805 mm (191 average) and were imaged on the DMT Scanner.

## **LAB REPORT**

Some notable cores were photographed before splitting. Bit trips have provided lulls for sample selection and cutting. The DMT scanner was hanging. Rebooting corrected positioning issues but the operators are waiting for newer software to be forwarded. A conference call was conducted to aid JOI personnel planning the School of Rock, the teacher at sea program to be conducted on the Expedition 312 transit. There was a glitch seeing data entered into JANUS on a recent core which has caused concern. The anomaly is a rare, innocuous, but reoccurring problem and is being analyzed on shore. Scaffolding supporting the refurbishing project of the helideck safety net perimeter afforded an opportunity to change out the net block and shackles that support the port hose puller. Group photographs were taken after the emergency drill.

HSE: The emergency drill conducted this week utilized METS and select others to verify the operation of all the ships alarm bells. The zone 27 heat detector was activated for awhile and was difficult to locate. Referring to original electrical plans, zone 27 turned out to be associated with old wiring for the original Downhole lab, now the Lamont topside office. All was well there; eventually the ceiling will come

down to clarify the incident. Non-participants went to their lifeboat until the drill concluded. Excused night shift personnel attended an evening safety meeting.