

November 28, 2005

**IODP EXPEDITION 312:
SUPERFAST SPREADING RATE CRUST 3
WEEK 4 REPORT**

OPERATIONS

Reentry No. 3: Hole 1256D was reentered with a new C-9 RCB bit at 1955 hr on 20 November. The drill string was tripped to a depth of 1161 mbsf where the diameter of the hole was constricted indicated by a slight loss of drill string weight to the formation. The top drive was picked up and the hole was washed and reamed from 1161 mbsf to 1255 mbsf. During this process, hole debris accumulated in the bit throat and was cleared by a round trip of the deplugger.

After a fresh core barrel was dropped, expedition coring was finally initiated at 0715 hr on 21 November. Coring proceeded without incident as the hole was deepened from 1255.1 mbsf to 1309.7 mbsf with generally good hole conditions. A total of 50.5 rotating bit hours were accumulated by 0545 hr on 24 November. After the bit was pulled clear of the sea floor at 0915 hr on 24 November, the pipe trip was suspended for one hour while the drilling crew performed the routine maintenance of slipping and cutting 115 feet of drilling line. The used bit was at the rotary table by 1600 hr on 24 November. Examination of the used bit indicated normal wear on the cutting structure of the cones with some inserts missing on the nose of one cone and the gauge row of another. The bit body was undergauge by 3/16" and exhibited some minor damage due to downhole debris. The core guides were extensively worn. During this bit run, 54.6 meters of basement was cored and 8.58 meters recovered for an average recovery of 15.7%. The average rate of penetration to core the 54.6 meter interval was 1.1 meters/hour.

Reentry No.4: Hole 1256D was reentered with the third rotary coring bit of the expedition at 2312 hr on 24 November. After the formation took weight at 1205 mbsf, the top drive was picked up and the hole was washed and reamed from this depth to the bottom of the hole. Rotary coring in the hole resumed at 0530 hr on 25 November and advanced to 1345.5 mbsf with good hole conditions by 2115 hr on 27 November. At this time, the bit had accumulated 49.4 rotating hours. The bit deplugger was dropped after recovering 1256D-187R (1324.3 mbsf to 1329.1 mbsf) as a preventative measure to ensure that the bit throat was clear of debris.

The bit was pulled free of the sea floor at 0030 hr on 28 November and was recovered on deck at 0600 hr. This bit exhibited the same wear characteristics as the previous bit including being undergaged by 3/16". Additionally, there were ten inserts missing from the gage row on one of the cones and there were chipped teeth on the nose region of all four cones. The third RCB bit used during Expedition 312 cored 33.9 m and recovered 4.54 m for an average recovery of 18.8%. The average rate of penetration for the cored interval was 0.7 meters/hour.

SCIENCE UPDATE

Coring at Hole 1256D resumed in sparsely plagioclase-phyric to aphyric fine-grained basalt, designated Unit 66, but likely a continuation of Unit 65 from Expedition 309. Eleven lithological Units interpreted as dikes have been defined, of which two consist of mixed rubble and two (Units 69 and 76) appear to be near-complete cooling units graded from cryptocrystalline margins to fine-grained centers. A sharp, sub-vertical, contact between fine-grained basalt of Unit 68, and the graded cryptocrystalline chilled margin of Unit 69 is

preserved in several pieces from Section 175R-1 between 1271.3 to 1272.0 mbsf. Similar chilled contacts occur at ~ 1290 and 1295 mbsf, including an unusual piece in which two chilled contacts separate three intrusive events in Section 312-1256D-179R-1, 5-9 cm (Piece 2).

Ten samples from 7 of 9 recognized igneous units (Units 66-74) were sampled for ICP-AES analysis. No samples were taken from the mixed rubble Units 67 or 71. Samples chosen were generally aphanitic, fine grained, least altered, and representative of the unit.

Most rocks are moderately to highly altered with dark grey background alteration overprinted by cm-scale light grey to dark green alteration patches and alteration halos flanking chlorite, actinolite, pyrite, quartz, prehnite and laumontite veins. The laumontite and calcite veins tend to be late and cut across veins and halos filled with greenschist facies hydrothermal alteration minerals. Dike margins are commonly highly altered and mineralized with pyrite and trace chalcopyrite along the margins and in complex brittle vein networks within the intruding dike. The host dikes are commonly highly altered to actinolite, chlorite and titanite.

Section 312-1256D-174R-1, 91-109 cm, (Piece 18) contains a highly to completely altered region where the diabase is replaced by different mineral assemblages in subconcentric, cm-scale zones. The core of this altered region is quartz-laumontite-prehnite±epidote surrounded by chlorite, surrounded by epidote-quartz-actinolite and an external light gray zone of zeolite (laumontite?) and actinolite. Large pyrite grains occur along the diffuse boundary between the light gray and dark gray moderately altered diabase. Whether these highly altered patches were originally zones representing a greater proportion of mesostasis or primary porespace remains uncertain. In Section 312-1256D-176R-1, 6-18 cm chlorite-pyrite patches are developed along an irregular quartz-chlorite-pyrite vein that bisects the core but are also present away from veins. The patches are mostly spherical, but in places are elongate with shallow dips. Patches are more common above 1280 mbsf.

From 1255.1 through 1305.62 mbsf 25 pieces, a total of 2.85 m (29% of the recovered sections), were oriented. Recovery of oriented pieces decreased below 1276 mbsf. True dip was calculated on 37 structures including veins, fractures, intrusive contacts, and one shear-vein. The shear-vein has subhorizontal quartz-chlorite mineral fibers with weakly defined steps indicating sinistral shear-sense. There are three populations of structures with approximate mean dips of 38, 63, and 90 degrees. Quartz-chlorite-sulfide veins have moderate-to-steep dips. In places more shallowly dipping chlorite-rich veins preferentially crosscut quartz-rich veins, although the opposite relationship is also observed. Deformation intensity is low throughout the recovered sections, with locally moderate and high brittle deformation-intensity. Deformation intensity peaks at 1280 mbsf next to a brecciated dike margin that has multiple chilled margins. One crosscutting relationship between 2 different chilled margins indicates that brecciation was essentially penecontemporaneous with dike emplacement.

Measurements made with the Multi-Sensor Track on core pieces at least 8 cm long indicate magnetic susceptibility values of 3000-4500 SI units at 1260 mbsf, comparable with values at the end of Expedition 309. Values increase below 1277 mbsf to 6000-10000. Gamma ray attenuation measurements of bulk density range from 2.4 to 2.6 gm/cc, significantly below values of 2.6-2.7 obtained at the end of Expedition 309. Natural gamma ray values of 0 to 3 corrected counts are comparable to those at the end of Expedition 309. A high value of 6.3 was measured on the last rock piece in Core 312-1256D-176R-2, 88-91 (Piece 9). The first minicube samples are currently being processed.

Paleomagnetic results from discrete samples from 1261-1278 mbsf show moderate drilling overprint. Inclinations after demagnetization range from 15° to 40°, with most samples showing decreasing inclinations even at high demagnetization fields, suggesting incomplete removal of overprint. Declinations (relative to the cut surface) after demagnetization appear random and are probably reliable enough to use in structural analysis.

A total of 28 oriented pieces that vary in length from 70 to 270 mm (average of 122 mm) from Cores 173R to 187R were scanned with the DMT Core Scanner. Some pieces contain fractures that suggest reorientation to a geographic reference frame should be possible.

TECHNICAL SUPPORT ACTIVITIES

The Felker rock saw arbor and motor were overhauled to replace bearings. The first sets of thin sections have been prepared for description. The microBio lab is being inventoried and is being 'decommissioned'. Equipment and consumables are being prepared for storage. In the Subsea and Downhole lab, parts are sorted and identified to be crated or boxed. The 2nd WSTP has been laid out for assessment. Changes in hardware supporting the VSP will place the sound source a few meters deeper than previous experiments. The foam cups decorated by the School of Rock participants were sent to depth on the subsea camera frame.

HSE: The last fire drill was rained out for all practical purposes. Individuals mustered, their names checked off and they were dismissed. The fire crew worked on a clothes dryer fire simulation - rain shorted out the elements. The IODP Safety Officer made a presentation to both shifts of the technical staff and to the science party. Some points from the presentation were discussed in a TransOcean safety meeting. Some main deck pathways have been renewed with anti-skid compound.