

**December 19, 2005**

**IODP EXPEDITION 312:  
SUPERFAST SPREADING RATE CRUST 3  
WEEK 7 REPORT**

**OPERATIONS**

**Reentry No. 12:** Rotary coring in Hole 1256D with the seventh coring bit started at 0415 hr on 12 December and continued to 0500 hr on 15 December. During this period, coring advanced the hole from 1398.6 to 1444.6 mbsf. A 75 bbl high-viscosity mud flush of the hole was circulated every 20 m of advance. There was one roundtrip of the deplugger to insure that the bit throat was not obstructed with rock fragments. The C9 bit was pulled free of the seafloor at 0810 hr on 15 December and was recovered by 1345 hr. The seventh rotary bit used during Expedition 312 cored 46.0 m and recovered 10.68 m for an average recovery of 23.2%. The average rate of penetration for the cored interval was 0.9 m/hr. The used C9 bit exhibited uniform wear on the cones consistent with the rotating hours and was under gauge by 1/8 inch. There were chipped inserts on the nose, middle, and gauge rows. There was no evidence of damage attributable to metal fragments, indicating that the fishing exercise was successful in cleaning cone debris from the bottom of the hole.

**Reentry No. 13:** Hole 1256D was reentered with the eighth and final rotary bit of the expedition at 2220 hr on 15 December. After the formation took weight at 1368 mbsf, the top drive was picked up and the hole was washed and reamed to bottom at 1444.6 mbsf. Rotary coring in the hole resumed at 0130 hr on 16 December and advanced with good hole conditions to 1507.1 mbsf by 0300 hr on 19 December, when the bit accumulated 53 rotating hours. A 75 bbl high-viscosity mud flush of the hole was circulated every 20 m of advance. The last rotary bit used during Expedition 312 cored 62.5 m and recovered 18.49 m for an average recovery of 29.6%. The average rate of penetration for the cored interval was 1.2 m/hr. During the entire expedition, 252.0 m was cored with an average recovery of 18.5%. The average rate of penetration for all coring bits was 0.8 m/hr. Hole 1256D is now being conditioned in preparation for the extensive logging program.

**SCIENCE UPDATE**

Cores 209R to 212R recovered 45 cm of moderately altered basalt dikes from 1396.5 to 1406.1 mbsf assigned to Unit 80. At the bottom of Core 212R, a pair of ~1 cm-thick quartz diorite dikes (Unit 80b) occur. Hole 1256D then passed from the sheeted dike complex into the plutonic sequence consisting mainly of oxide-bearing gabbros. This marks the first time in the history of deep ocean drilling that an *in-situ* section of upper oceanic crust has been penetrated through lavas, dikes, and into gabbros.

The dike-gabbro contact occurs at the base of Core 213R. Core 214R recovered 3.33 m of gabbro and pegmatitic gabbro, from 1410.9 to 1415.7 mbsf. Subsequent Cores 215R to 223R recovered 13.52 m of gabbros with 35% recovery. These gabbros are characterized by doleritic patches surrounded by coarser intergranular oxide-bearing gabbro regions. A ~1 m sub-vertical contact shows complex stoping relations indicating intrusion of gabbro

into basalt. Several units are based on rapid textural and modal variations and dike units have diffusive boundaries (Units 82-89). Gabbro Unit 89 ends with a rapid grain size decrease toward the bottom of Section 223R-2 and continues in three cobbles in Core 224R. At ~1455 mbsf, Unit 90 consists of fine grained highly altered basalt fragments in Cores 225R-226R. Drilling in Hole 1256D terminated at 1507.1 mbsf.

Sixteen samples were collected from Units 81–90, consisting of basaltic dikes (6), tonalite (1), and gabbro (9). Three of the basaltic dikes occur above the gabbro units and 3 are from beneath. The bulk chemistry of the basaltic dikes and junk basket basalts fall along a fractional crystallization trend observed previously in major and trace elements. Plutonic rocks are medium to coarse grained, so larger samples (~50 cc compared to ~20 cc) were taken in order to obtain a representative bulk chemical analysis. Bulk chemistry of the gabbros is anxiously awaited.

The gabbros are generally dark gray to dark green in color, and moderately to completely altered. Clinopyroxene ranges from fresh to completely replaced by amphibole. It is unclear in some cases whether hornblende is primary or secondary. Disseminated sulfides occur throughout, and alteration patches are common in Cores 213R, 215R, 218R, 222R, and 223R. The patches are characterized by the occurrence of actinolite, chlorite, epidote, prehnite, titanite and zeolite. Rare to abundant veins composed of actinolite +/- epidote +/- quartz are observed throughout this section.

One hundred twenty seven features including fractures, veins, elongate magmatic intrusions, and sharp igneous contacts were measured in 69 oriented pieces from 1377 to 1464 mbsf. Intense grain-scale fracturing is present in the gabbro at the upper contact. There are intervals with very poorly developed magmatic shear zones and local cataclastic zones confined to plagioclase grain boundaries. Leucocratic intrusions into the otherwise melanocratic gabbro consist of “bands” and “patches” that do not define layering, veins, or dikes. From 1410 to 1417 mbsf, the patches have shallow-to-moderate dip angles and elongate shapes. Below 1417 mbsf, the patches define slightly more continuous and widely-spaced bands. Amphibole veins and alteration patches are present below 1430 mbsf.

Following trends that began near 1340 mbsf in the dikes, bulk and grain density increase to values close to 3.3 gm/cc, whereas porosity decreases to near 0.25%. Fluctuations in thermal conductivity (2.1–2.4 W/mK) and compressional velocity (5.7–6.2 km/s) appear inversely related to small changes in porosity. Magnetic susceptibility increases in the lowermost dikes to 6,000–14,000 SI units. The highest values in Hole 1256D (~16,500 SI units) occur in the uppermost gabbro at ~1410 mbsf and then decrease rapidly to 1,000–2,000 SI units below 1420 mbsf. Bulk density from gamma ray attenuation increases steadily across the dike/gabbro boundary to 3.0–3.2 gm/cc. A few high values (5–12 corrected counts) occur in uppermost gabbros. Increasing evidence supports a correlation between compressional velocity and percentage of alteration minerals.

Paleomagnetic measurements included discrete and archive samples from the 1369–1430 mbsf interval and a thermal study on 8 discrete samples. AF demagnetization of the

archive half gabbros show that these rocks have a fraction of the original predrilling remanent signal carried by high remanent stability grains as an important fraction of the drilling overprint component was usually removed by 40mT. Magnetization intensity of gabbros measured so far, with NRM at 2–15 A/m (including overprint), overlaps substantially with the intensity measured on flows and dikes.

Ninety-two oriented pieces from Cores 212R–217R, 219R–223R, 227R, and 230R were scanned with the DMT core scanner. Lengths of scanned pieces vary from 20 to 300 mm, averaging 124 mm. A series of 20 mm pieces in Core 215R were shrink-wrapped and then scanned to compare a horizontal fracture zone in the FMS and UBI logs.

### **TECHNICAL SUPPORT ACTIVITIES**

Core recovery increased this week, providing a surge in core lab activity. Tens of meters of whole round cores passed through the scanners and were imaged. Numerous samples were cut for thin sections, X-ray, chemistry, and physical property measurements. A meeting to plan logging and to introduce the marine mammal protocol was held. The GI sound source hose and electrical support have been put into place. APCT documents were reviewed for shore editors. Final versions of property locations and SIMAN inventory were made for those ashore to prepare shipping documents for US Custom, supporting the demobilization of the ship in Galveston.

**HSE:** The weekly boat drill was also a General Alarm bell test. The METs team dispersed to verify that the alarm bells in IODP spaces were ringing.