August 8, 2005

IODP EXPEDITION 309:
SUPERFAST SPREADING RATE CRUST 2
WEEK 4 REPORT

OPERATIONS

REENTRY #5 (RCB Bit #4): The drill string was recovered and a new CC-9 bit deployed (S/N BF-856). The bit was lowered to a depth of 3640 mbrf and the WSTP was deployed to obtain a ocean bottom water sample and temperature. The WSTP was then recovered and Hole 1256D was reentered at 1013 on 30 July. The bit was lowered to a depth of 4514 mbrf. The top drive was picked up and approximately 4 m of fill was washed and reamed from the bottom of the hole. Coring resumed at 1445 on 30 July at 4604.2 mbrf (964.8 mbsf).

Coring continued without incident to a depth of 4619.8 mbrf. After retrieving Core 110R and dropping the next core barrel, the driller noticed a pressure drop of 200 to 250 psi. The core barrel was pulled and a de-plugger was dropped in an attempt to clear the bit throat. The de-plugger was retrieved with a positive indication that it had latched, so another core barrel was dropped but pressures were still lower than normal.

While retrieving Core 111R, the driller again noticed pressure drops of 200-250 psi when lifting the BHA off bottom. The pressure increased when weight was applied to the bit, suggesting there was a crack in the BHA. The drill string was retrieved and a crack was found in the bit sub approximately 15" from the bit.

Bit #4 was pulled with 17.8 rotating hours, 20.4 meters cored (1.14m/hr) and a recovery rate of 46.7%. The bit cleared the cone at 0600 on 1 August. The bit was in good condition with only one broken insert. The bearings were effective and the bit was ~3/16" under gauge.

REENTRY #6 (RCB Bit #5): A new CC-9 bit (S/N BF-858) and sub-bit assembly was deployed and Hole 1256D was reentered at 1403 on 1 August. The bit was lowered to a depth of 4514 mbrf. The top drive was picked up and the hole washed and reamed to bottom. Approximately 3 m of fill was encountered at the bottom of the hole. Coring resumed at 1945 on 1 August from 4624.6 mbrf (979.2 mbsf).

Coring continued without incident. Mud sweeps were increased to 50 barrels to ensure cutting removal. Bit #5 was pulled at 1845 on 4 August after 50.1 hrs of rotation. The bit had cored 72.1 meters (1051.3 mbsf), recovering 20.56 meters of core (28.5%) with an average rate of penetration of 1.44 m/hr. The bit was in very good condition with one broken insert, one missing insert and 1/16" under gauge.

REENTRY #7 (RCB Bit #6): A new CC-9 bit was deployed (S/N BF-741) and Hole 1256D was reentered at 0951 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 3 m of fill was encountered at the bottom of the hole and coring resumed at 1430 on 5 August from 4696.7mbrf (1051.3 mbsf).

SCIENCE UPDATE

From July 31 to August 6, 102 m of basaltic basement was cored (Cores 108R-128R) yielding 28.4 m of recovery (28 %) that was divided into eight lithological units (35-43). Units 35, 37, 38, 41, and 43 are sheet flows whereas units 36 and 39 are more massive basalt sections. Unit 40 (Cores 117R-1 and 117R-2) is composed of disrupted fine-grained basalt with fine cataclastic zones containing variable grain sizes (sub-millimetric to millimetric) and basaltic clasts with complex textures (from chilled to doleritic). Unit 42 (Cores 122R and 123R) is a 2.77 m-thick volcanic breccia cemented by pyrite with quartz, saponite, anhydrite, carbonate, and possible zeolite, indicating intense hydrothermal alteration. The breccias contain angular dark grey and dark green basalt and hyaloclastite clasts with light green alteration halos along the margins. Glass has been altered to light green saponite.

The majority of the basaltic flows are aphyric. Units 35B and 37 are (olivine-) plagioclase-clinopyroxene phyric, and Unit 39 is moderately plagioclase-olivine phyric. Spherulitic flow margins and variolitic flow interiors are the dominant textures. Rounded chilled margins with altered glass in Core 127R suggest that we are still penetrating the extrusive part of the oceanic crust.

In Cores 108R to 121R dark grey background alteration is dominant with veins containing saponite, pyrite, chalcopyrite, silica minerals, carbonates, anhydrite, and zeolites. Veins are commonly flanked by dark grey pyrite-rich halos. Core 117R-1 contains a dark brown halo with a pyrite front associated with silica minerals in amygdales. In Cores 124R to 128R background alteration changes. These rocks are dark grey to dark green with veins containing saponite and pyrite that are flanked by dark to light grey, dark to light green, or black halos with pyrite fronts.

From Core 108R to Core 127R fracturing is heterogeneously partitioned throughout the massive units and sheet flows. Highly fractured areas are locally characterized by shear veins, vein networks, and breccia. Fractures with curved-radial and Y morphology, related to the cooling of lava, are observed in all cores. Two kind of breccias are present in Core 122R: 1) hyaloclastic breccia composed of aphyric cryptocrystalline altered basalt clasts with locally deformed flow banding embedded in a matrix of altered glass clasts cemented by sulfide, and 2) volcanic breccia containing aphyric cryptocrystalline altered basalt clasts cemented by anhydrite and sulfides.

Twelve new rock samples were analyzed for major and trace elements by ICP-AES and the data was reduced (totaling 24 samples and 4 replicates). Analyses with high totals have elevated SiO_2, suggesting the silica analyses remain problematic. Despite the presence of pervasive slight to moderate low-temperature background alteration, the freshest samples from each igneous unit have been selected for geochemical analysis. Representative compositions of the samples are: Mg# 45-59, TiO_2 1.1-1.9 wt. %, Ni 56-88 ppm, Cr 120-325 ppm, and Zr 64-133 ppm. There is a cyclic decrease in the Mg# with depth, similar to Leg 206, suggesting successive episodes of fractionation and magma injection.

Alternating field demagnetization (AFD) of archive-half samples from 951.5 to 1052.3 mbsf show less drilling overprint since the replacement of the bit-sub assembly. Inclinations remain positive with occasional and rapid fluctuations to steep values and negative inclinations at ~970 mbsf. Peak values of the remaining magnetic intensity show a good correlation with the margins of cooling units established from the visual core descriptions.

Physical properties measurements are generally consistent with the overlying cores. A notable exception is the distinct increase in natural gamma radiation within hyaloclastic breccia in Core 122R. The hyaloclastic breccia also has the lowest GRA density and highest thermal conductivity.

We continue to recover a significant number of long core pieces (35 %) that range in size from 80 mm to 490 mm and can be imaged on the DMT Scanner. These images will be useful for post cruise integration of the recovered core with the wireline logs and for re-orientation of core pieces into the proper geographic reference frame. A user friendly instruction manual has been made to assist future IODP Expeditions that will use the DMT Scanner.

LAB REPORT

Core lab activities have been routine. There were several mechanical and equipment situations to deal with. A floating electrical ground situation was detected leading to lights and AC systems circuit breakers being tripped to isolate the problem. An electric motor for the chem lab heat hood had failed and was replaced. The elevator has stopped two times leading to service and limit switch adjustment. The SPEX X-press hydraulic rock crusher was put into service this expedition after being serviced at the factory. There was difficulty with the ram retracting initially and it finally failed to retract at all. Discussions with the vendors service department failed to help. A mechanic assisted in disassembly and found a ball missing from a check valve. That corrected, the system is back in service.

Some users of the epoxies used to fix labels on the rock pieces are again developing sensitivity to the product. The nitrile gloves are to be used and an effort is made to keep ones face from the associated fumes.

HSE: This week's emergency drill was conducted in the lab stack. A spilled flammable liquid scenario was designed and conducted by the METS and staged at the Lower Tween refrigerated storage area. The locker venting system was demonstrated and the flammable vapors alarm and the CO_2 fire system were pointed out. The Emergency response plan for the scenario was reviewed with the ships fire team. Non-participants in the emergency drill went to their lifeboat.