

**IODP Expedition 330: Louisville Seamount Trail**  
**Week 2 Report (20-26 December, 2010)**

**OPERATIONS**

The 824 nmi transit from Auckland to the first site of Expedition 330 was accomplished at an average speed of 10.3 knots. The vessel was positioning on Site U1372 (Prospectus Site LOUI-1C) by 1700 hr on 21 December. The corrected PDR water depth referenced to the dual elevator stool on the rig floor was 1960.3 mbrf.

The drill string was deployed in routine fashion to 1885 mbrf and a pressure test was performed on the new non-magnetic sinker bar for the third-party Göttingen Borehole Magnetometer (GBM). The GBM sinker bar was deployed in the drill string via the logging cable at 0300 hr on 22 December and recovered by 0550 hr. The unit did not leak.

After the driller tagged the seafloor at 1968.5 mbrf with the bit, the top drive and knobbies were picked up and Hole U1372A was spudded with the RCB at 0850 hr on 22 December. Initially, the driller could not apply very much weight on bit because the bottom hole assembly (BHA) was not buried. As a consequence, the rate of penetration (ROP) was very slow for the first few cores. Eventually, the ROP increased as the hole was deepened and more bit weight was applied. Basaltic basement (i.e., the first lava flow) was penetrated at 45.6 mbsf. The hole was deepened to 145.0 mbsf (99.4 m into basement) by the early morning of 26 December. At this juncture, it was time to change the bit since it had accumulated 64.4 rotating hours. The average ROP for the hole was 2.3 m/hr and 2.2 m/hr in basement. The average recovery was 68.9% for the entire hole and 64.8% while coring into basement.

Prior to the deployment of the free fall funnel (FFF), the vibration isolated television (VIT) was launched to observe the hole and the nature of the seafloor. The hole could not be seen because a cloud of heavy mud was suspended over the site. Following the recovery of the VIT, a FFF was made up and deployed at

1010 hr on 26 December. The VIT was then launched again to monitor the position of the FFF, which was mostly obscured by a cloud of heavy mud. However, it was obvious the funnel was upright with the three flotation balls clearly visible. While being observed via the VIT, the bit was withdrawn from the hole at 1140 hr on 26 December. The VIT was recovered concurrent with the retrieval of the drill string. The bit cleared the rotary table at 1700 hr and was found to be in very good condition and only under-gage by 1/16". Once a new bit and a rebuilt mechanical bit release (MBR) were made up, the BHA was deployed with an extra stand of drill collars. The FFF was reentered at 0100 hr on 27 December.

## SCIENCE RESULTS

During the first week all laboratory groups revised the Methods chapter for the expedition report, and the descriptive laboratory groups modified the DESClogik templates (the application that captures descriptive information and uploads it into the LIMS data base). The workflow for core descriptions was discussed and agreed upon by all igneous petrologists, alteration specialists, structural geologists and sedimentologists. In addition, the workflow for shipboard measurements and sampling was developed with involvement of all groups. The following summarizes the activity and preliminary results of the respective scientific disciplines since the first core arrival on December 22.

Based on macroscopic core, smear slide and thin section observations at Site U1372, the sedimentologists identified three stratigraphic units in the cores that were recovered this week. Unit I is composed of non-consolidated sandy foraminifera ooze with local occurrences of reworked glass fragments and pumice (Cores U1372A-1R to -3R). Unit II (Cores U1372A-4R-1 to -8R-2) is composed predominantly of basalt breccia and conglomerate with a minor interval of foraminifera limestone that includes Mn-crusts and mollusk fragments. Unit III (Section U1372A-8R-3 and below) includes the volcanic basement (beginning at 45.6 mbsf). The first occurrence of lava flow encountered downhole (Section U1372A-8R-3) is a peperite that includes minor amounts of micritic

limestone and fine volcanic sandstone, most likely devoid of datable fossils. Several subunits are currently being defined in Unit II, which will provide constraints on the stratigraphic development and late stage magmatic evolution of the drilled seamount.

Samples for biostratigraphic investigations were taken from the core catchers (CC) of all cores containing unconsolidated sediment (Stratigraphic Unit I: Cores U1372A-1R to -3R). All were utilized for nannofossil and foraminiferal analyses. In addition to those samples, one sample was taken at the 0-1 cm interval from each core section for nannofossil analyses. Those sediments, composed of winnowed foraminiferal ooze, are likely the result of the accumulation of selectively coarse sediment due to relatively energetic intermediate water currents. Large portions of the recovered sediment were soupy and more or less disturbed so that the original structure or bedding may have been destroyed. Preliminary age estimations for Samples U1372A-1R-CC and U1372A-3R-CC are Holocene-Pleistocene and middle Pliocene to late Miocene, respectively. The middle and late Miocene, and early Pliocene nannofossils and planktonic foraminifers co-occur in Samples U1372A-3R-CC, which indicates that there is a hiatus or an interval of very low sedimentation rate at the bottom of Core U1372A-3R.

The three petrology laboratory groups (igneous petrology, alteration petrology and structural geology) closely collaborated with the sedimentologists for the description of the igneous clasts encountered in the coarse conglomerate of Stratigraphic Unit II (see above). The conglomerate is largely composed of basaltic clasts ranging from aphyric to highly olivine-phyric. The uppermost flows of the igneous basement (Stratigraphic Unit III) have peperitic tops implying emplacement into soft carbonate sediments. From 65 to 83 mbsf (starting in Core U1372A-10R) the lava flows have scoriaceous tops implying subaerial eruption. Basaltic breccias encountered at 92.43 mbsf (Core U 1372A-13R) were tentatively interpreted as hyaloclastite, and some of the flows below this level may be pillow lavas, indicating submarine emplacement. Overall, the lava flows range in composition from aphyric to highly olivine-phyric with up to 15% olivine

phenocrysts. Highly olivine-phyric basalt containing fresh olivine was encountered from 57.17 to 59.49 mbsf (Core U1372A-9R).

While the igneous petrologist focused on the identification and description of different lithological (flow) units, the structural geologists paid particular attention on the distribution, size, and orientation of veins, joints, and aligned vesicles. A particular highlight was the observation of numerous geopetal structures (filled vesicles where material is deposited horizontally). All geopetals observed have infills that are presently horizontal or nearly so, indicating little tilting or faulting of this part of the seamount since its eruption in the Cretaceous.

The alteration petrologists focused on the description of secondary minerals and other characteristics resulting from seawater alteration of the volcanoclastic breccias (Stratigraphic Unit II) and the peperite/basaltic flows (Stratigraphic Unit III). They have closely interacted with the igneous and structural petrologists to identify and characterize phenocryst alteration and infilling in veins and vesicles. It appears that the volcanic clasts, comprising the volcanoclastic breccias of Unit II, are inhomogeneous in terms of alteration, from slightly to nearly completely altered. Rare occurrences of olivines are in most cases nearly totally transformed into iddingsite. The peperite of Unit III is strongly altered (groundmass and olivine phenocrysts), and highly vesicular. Vesicles are mainly filled with carbonates (calcite?), zeolite, different types of clay minerals, and occasionally by clayey sediments and micrite. The basaltic massive flows below the peperite are variably altered. Some flows are well preserved with occurrence of nearly fresh olivine in particular in the interior of the flow units. The altered basalts of Unit III are characterized by iddingitized olivines, presence of clay in the groundmass, and filling of vesicles by zeolite, carbonates, and clay minerals. The alteration state of feldspar phenocrysts will be further observed on thin sections that are currently in production.

Eight sedimentary samples (six from soft sediment, two from sedimentary rock) were taken from Units I and II by the geochemists for measurement of total organic carbon, total carbon, and total nitrogen on the CHNS analyzer. Further

measurements are being conducted to determine the capabilities and limitations of the new miniature X-ray fluorescence instrument, the Thermo Scientific Niton XL3 Analyzer. Results from measurements of rock slabs and the sawn faces of pieces of core have been disappointing so far. However, pellets made from finely ground rock powders yield better results. Processing of eight samples from clasts of the breccia and conglomerate of lithologic Unit II for ICP-AES analysis is underway.

The physical property laboratory group spent this week running tests on whole core and discrete samples from all three stratigraphic units as they became available. All sections from Cores U1372A-2R to -20R have been run through the Whole Round Multi-Sensor Logger (WRMSL), which records bulk density, magnetic susceptibility, and P-wave velocity measurements in the case of sediment cores. Sections from Cores U1372A-2R to -18R have been measured in the Natural Gamma Ray (NGR) Logger to detect variations in the natural abundance of U, Th, and K. Nondestructive thermal conductivity measurements have been completed for 12 locations along the working half of the core down through Core U1372A-10R. Discrete samples from Cores U1372A-4R to -10R were chosen in collaboration with the paleomagnetists and are now moving through the sequence of paleomagnetic, P-wave, and moisture and density analysis. Together the process takes approximately 60+ hours and is done in batches. The full set of measurements is now completed through Core U1372A-5R. The physical property group has also spent the week developing an automated data filtering program for processing core logger data, based on methods developed during IODP Expedition 324. This program is nearly complete and should be ready for implementation with Expedition 330 data soon.

Paleomagnetists measured the remanent magnetization of archive half-cores U1371A-4R through -13R (in total 72.45 m of core) at 2 cm intervals using the pass-through cryogenic magnetometer together with alternating-field (AF) demagnetization over 8 steps up to a peak field of 50 mT using the in-line AF demagnetizer. Directions of the remanent magnetization have been picked using the principal component analyses for oriented pieces longer than 10 cm. In

addition, AF demagnetization has also been carried out on 22 discrete 8 cm<sup>3</sup> cubes up to a peak field of 160 mT using the D-Tech AF demagnetizer, with the remanent magnetization measured with the spinner magnetometer. The first batch of eight discrete cubes is currently being thermally demagnetized. The majority of the AF demagnetization data – both continuous and discrete – show stable remanent magnetization, with some samples exhibiting high coercivity. In general, the drilling-induced magnetic overprint has been limited, probably due to the exclusive use of non-magnetic core barrels during this expedition. The anisotropy of magnetic susceptibility of all discrete samples has been measured, but not yet analyzed.

Expedition 330 also sails one microbiologist who spent the first few days at sea preparing the microbiology laboratory for sampling. Since the arrival of the first core, he has collected two pelagic sediment samples and nine rock samples from cores down to a depth of 135 mbsf. Sediment cores were subsampled for cell counts and molecular biology. On all other rock samples, a regular suite of subsamples was collected for cell counts, molecular biology and stable isotope analysis. Additionally, three rock samples were used to set up cultivation experiments, which are underway in the cold room. A contamination test was performed by injecting fluorescent microspheres into one of the core barrels and analysis is underway of those samples (so far with a negative outcome, i.e. no microspheres detected inside of rock samples).

## EDUCATION AND OUTREACH

In addition to the 29 scientists, one educator and one videographer are sailing on this expedition. The videographer, capitalizing on the excitement of starting the expedition, shot footage and produced an introductory music video called “Aboard the JOIDES Resolution.” The song was previously recorded in San Francisco. (It is now posted on the Ocean Leadership You Tube channel: <http://www.youtube.com/watch?v=6tDnmyYMCgG> as well as on the JR Facebook page: <http://www.facebook.com/video/video.php?v=1771681936528>.) Also, the videographer conducted an informational interview with co-chief

scientist Anthony Koppers, wrote a new song called *Calm Before the Core*, and started testing the new system for video conferencing using Wirecast and Skype, an external firewire camera and professional microphones. She has also shot 67 GB of footage of ship operations, and is currently researching and planning the next video, which will be on the specific objectives of Expedition 330.

The educator has continued posting daily blogs on the *JR* website (alternating between three different blogs, each targeted for a different audience) and also Facebook posts. The *JR* website had 1,063 visits between December 20-26, 447 of whom were new visitors to the site. The JR Facebook page has received many comments and “likes” on the week’s posts and has increased its followers from 2,175 fans on December 17 to 2,235 fans on December 26. The educator also completed a map showing the hometowns of each of the 330 science party members and posted it on the JR website: <http://joidesresolution.org/node/1622>. He has continued confirming videoconferences with schools and museums for January and February and has begun recruiting scientists to participate. Twenty-eight videoconferences are currently scheduled.

## TECHNICAL SUPPORT AND HSE ACTIVITIES

The USIO technical staff is engaged in providing full support for coring operations at Site U1372. Other activities included the following:

1. Completed distribution of supplies and updated inventory.
2. Completed minor software upgrades to various applications.
3. Assisted with repairs to the downhole magnetometer logging tool.
4. Assembled the new core liner engraving system and started software development.

The weekly fire and boat drill was held as scheduled on Sunday, December 26.