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Preliminary results of IODP Expedition 330: Louisville Seamount Trail

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The Louisville Seamount Trail is a 4,300 km long volcanic chain that is inferred to have been built in the past 80 Myr as the Pacific plate moved over a hotspot. It is the South Pacific counterpart of the much better studied Hawaiian-Emperor Seamount Trail. Paleomagnetic studies on drill cores of ODP Leg 197 from the Emperor seamounts revealed a ~15 degree southward motion of the Hawaiian hotspot prior to 50 Ma, calling into question whether the primary Pacific hotspots constitute a fixed frame of reference. Two end-member geodynamical models have been considered; (1) the Hawaiian and Louisville hotspots have moved in concert, (2) they have moved independently (mantle flow model, which predicts little latitudinal motion of Louisville hotspot). IODP Expedition 330 seeks to test these models using modern paleomagnetic and geochronological techniques. Another primary objective of the expedition is to determine the magmatic evolution and melting processes of Louisville volcanoes. Prior to Expedition 330, the only dredged samples recovered have been alkali basalts, which suggest that shield-building stage in the Louisville volcanoes is mostly alkalic, in sharp contrast to the massive tholeiitic shield-building stage of Hawaiian volcanoes. Geochemical and isotopic studies of the rocks recovered during Expedition 330 will allow us to map the fundamental differences between Louisville and Hawaiian hotspot volcanism.

Expedition 330, from 13 December 2010 to 12 February 2011, planned to drill ~350 m into the igneous basement of four seamounts of different ages, from 50 to 80 Ma, along the Louisville Seamount Trail. It was expected that by drilling to such depths we would be able to sample a sufficient number of lava flows required to average out the secular variations of the geomagnetic field, and as a result be able to obtain a reliable estimate of the paleolatitude of the hotspot at the time each of the seamounts was formed. So far we have occupied five sites on four seamounts, and drilling is still ongoing while this abstract is being written. At Site U1374 on Rigil Guyot with an estimated age of ~73 Ma, we reached 522 mbsf with an extraordinarily high average core recovery of 88%. The rock samples obtained during this expedition will enable us to fulfill the scientific objectives after onboard and post-cruise research.

Keywords: IODP, Louisville Seamount, hotspot, mantle dynamics, paleomagnetism