Preliminary results from Integrated Ocean Drilling Program Expedition 330 to the Louisville Seamount Trail

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Integrated Ocean Drilling Program (IODP) Expedition 330 drilled five different guyots in the Louisville Seamount Trail ranging in age between 80 and 50 Ma. The primary goals of this expedition were to drill a sufficiently large number of *in situ* lava flows at each seamount for high-quality estimates of their paleolatitudes using paleomagnetic measurements, for improving the overall age progression using high-precision $^{40}Ar/^{39}Ar$ geochronology, and for detailed geochemical studies of the volcanic evolution of these seamounts. With these data we can provide the unique record of the paleolatitude shift (or lack thereof) of the Louisville mantle plume and compare it with the ~15° paleolatitude shift observed for seamounts in the Hawaiian-Emperor Seamount Trail over the same time period. It also allows us to directly compare the geochemical evolution of a typical Louisville seamount with seamounts in Hawaii and to test the apparent long-lived homogeneous geochemical character of the Louisville mantle source. These comparisons are of fundamental importance to determine whether these two primary hotspots have moved coherently or not, and to understand the nature of hotspots and convection in the Earth's mantle. Finally, the paleolatitude, age and geochemical data together will provide a more advanced test of whether the Louisville seamounts were formed from the same mantle source that also formed the Ontong Java Plateau. If this is found to be the case, it is possible that the plume head of the Louisville mantle upwelling caused the massive LIP volcanism that formed the Ontong Java Plateau around 120 Ma and at an average 24±2°S paleolatitude.

Diamondiferous conglomerate preserves evidence for kimberlite and the deep cratonic root of the Mesoarchean Southern Superior craton

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Current models of the Superior craton growth invoke formation of the cold diamondiferous root soon after the 2.7 Ga orogeny that consolidated the craton. We show that the Superior craton included an older cratonic nucleus that had developed the deep diamondiferous root prior to 2.7 Ga, and also provide evidence for a Mesoarchean Superoir kimberlite. This evidence contradicts current views that Archean diamondiferous volcanics differed from kimberlites, which became a major diamond–bearing primary rock only in the Proterozoic.

The evidence is found in 2.697-2.701 Ga diamondiferous conglomerates of the Michipicoten Greenstone Belt (MGB) of the Wawa subprovince. The conglomerate metamorphosed in the greenschist facies contains mainly lithic igneous mafic to felsic clasts of local provenance. The conglomerate matrix includes diamonds and paragenetic diamond indicator minerals with subtle signs of mechanical abrasion and varying degrees of chemical resorption. The diamonds are predominantly white single octahedral crystals. Comparison of the size distribution, resorbtion and N aggregation of diamonds in Wawa lamprophyres and the conglomerate diamonds confirms that the latter did not derive from the proximal lamprophyric source. Heavy minerals panned from the conglomerate and extracted in commercial labs include Cr-diopside, olivine, corundum, chromite, anorthite, magnetite, pyrope with kelyphitic rims and picroilmenite. Low abundances of heavy minerals (several grains per 4-70 tonnes of the conglomerate) are, in part, explained by their complete or partial replacement by the greenschist assemblage. Cr-diopside, olivine, chromite and anorthite were derived from mafic-ultramafic anorthosite- and chromitite-bearing layered complexes mapped in the MGB. Corundum may have come from kimberlites or other mafic rocks as the majority of corundum is the Cr-bearing ruby. The presence of pyrope with more than 6 wt% Cr_2O_3 suggests derivation from the cratonic root, as such high-Cr pyropes are never found in the off-cratonic continental or oceanic mantle. Picroilmenite has compositions typical of kimberlite and unlike that of ultramafic lamprophyres and other volcanics transitional to kimberlites. The Wawa conglomerate, therefore, should be considered analogous to the Witwatersrand conglomerate in recording indirect evidence for the Mesoarchean kimberlites.