IODP Proposal Cover Sheet

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Ontong Java Nui LIP

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Title	Testing the Ontong Java Nui hypothesis
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Area	Ontong Java Plateau/ Magellan Rise

Proponent Information

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Abstract

Large Igneous Provinces (LIPs) such as the Ontong Java Plateau (OJP) in the western equatorial Pacific provide information on mantle processes and composition, and their formation may have global environmental consequences. The OJP is the largest oceanic plateau and is probably the most voluminous igneous edifice on Earth. Despite its importance, the size, volume, and formation rate of the OJP are not yet well constrained. The maximum extent of OJP-related volcanism may be even greater as currently estimated, because volcanological studies indicate that long lava flows (or sills) from the OJP may have reached the adjacent Nauru, East Mariana, and possibly Pigafetta basins. Moreover, the similarity in age and some geochemistry of lavas from the Ontong Java, Hikurangi, and Manihiki plateaus suggests that they may have been once part of a single LIP (Ontong Java Nui, OJN). If true, the massive volcanism may have covered >1% of Earth's surface. The lack of detailed knowledge of the size, age, and composition of the OJP has given rise to various models such as a surfacing mantle plume head, bolide impact, and fusible mantle melting, but no model satisfies all observational data and no consensus has been reached on its origin.

The OJP is divided into the High Plateau to the west and the Eastern Salient to the east. The basaltic basement of the OJP was cored at seven sites Deep Sea Drilling Project (DSDP Site 289) and Ocean Drilling Program (ODP Sites 289, 803, 807, 1183, 1185, 1186, and 1187) expeditions -but all sites are exclusively located on the High Plateau. In order to examine the true extent of the OJP (i.e., whether the flows in the Nauru, East Mariana, and Pigafetta basins, as well as the Manihiki, and Hikurangi plateaus are parts of the OJN), we propose drilling on the Eastern Salient and adjacent basins to recover basement samples. We also propose drilling through the sedimentary section on the Magellan Rise, a small plateau that formed >20 Myr before the proposed OJN emplacement. Because of its older age, the sedimentary sequence on Magellan Rise may preserve ash layers or other chemical tracers that cover the entire eruptive history of OJN. The sediment layers from the Magellan Rise are also useful to evaluate environmental effects of the OJN emplacement, including older and younger perturbations related to other LIPs.

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Scientific Objectives

This project will investigate the true areal extent of the Ontong Java Plateau (OJP). The primary questions are:
(1) Did the OJP, Manihiki, and Hikurangi plateaus form as a single super plateau, Ontong Java Nui (OJN)?
(2) Where and how active were the main eruptive centers, and how might the adjacent basins have been covered by lava flows from OJP?

The secondary objectives are to
(1) provide critical data to test existing and develop new models of LIP formation,
(2) examine the geodynamic effects and evolution of the OJP, and
(3) investigate the environmental effects of the OJP emplacement.

The project will employ non-riser drilling to core OJP basalts from four to five sites and sedimentary rocks at one site (Magellan Rise). Basalt samples will be analyzed for geochronology, geochemistry, eruption depth and paleolatitude, to address the primary objectives. Coring in adjacent basins will recover off-plateau lava flows to test their origin (primary objective 2). Sedimentary strata that contain information on the syn-LIP eruption events of the OJN (primary objective 1) and the environmental effects of the LIP emplacement (secondary objective 3) will be cored above the Magellan Rise. Sedimentary sections above the OJP basement will be recovered to estimate the subsidence history of the OJP after its formation (to address secondary objective 2). Temperature and thermal conductivity measurements will be conducted to test whether the mantle root beneath the OJP is thermal or chemical in nature (secondary objective 2).

Non-standard measurements technology needed to achieve the proposed scientific objectives

None

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Proposed Sites (Total proposed sites: 11; pri: 6; alt: 5; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
OJP-01A (Primary)	-5.2934 172.1152	4316	200	150	350	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-02B (Alternate)	-7.4979 172.1160	5413	300	150	450	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-03B (Primary)	-6.2220 167.5235	3494	140	150	290	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-04B (Primary)	-7.5131 166.7239	3650	350	150	500	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-06A (Primary)	-8.9695 161.6792	2596	750	150	900	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-07B (Alternate)	-7.3133 161.2194	1730	580	150	730	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-08A (Alternate)	-7.4697 172.1158	5414	300	150	450	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-09A (Alternate)	-7.1567 166.9454	3898	340	150	490	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-10A (Primary)	-0.0778 163.2456	4459	300	150	450	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-11A (Alternate)	0.0971 164.2338	4418	400	150	550	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
MR-01A (Primary)	7.0683 -176.8250	3176	1172	50	1222	Core sediments to collect sin-LIP sediments that cover all eruption events of Ontong Java Nui. Core basaltic rocks for geochemistry, isotopic cgemistry, and age. Determine geochemical and isotopic signature of Magellan Rise.