IODP Proposal Cover Sheet

967 - Pre

Ontong Java Nui LIP

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Title	Testing the Ontong Java Nui hypothesis
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Area	Ontong Java Plateau

Proponent Information

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Abstract

Ontong Java Plateau (OJP) in the western central Pacific is the largest oceanic plateau and is probably the most voluminous igneous edifice on Earth. Large Igneous Provinces (LIPs) such as OJP are important because they provide information on mantle processes and composition, and because their formation may have global environmental consequences. Despite its importance, the size, volume, and formation rate of the OJP are not well constrained yet. The maximum extent of OJP-related volcanism may be even greater, as the Early Cretaceous lavas filling the adjacent basins, Nauru, East Mariana, and possibly Pigafetta have been proposed to be closely related to the OJP. Recently, volcanological studies indicate that long lava flows (or sills) from the OJP may cover the adjacent basins. Moreover, the similarity in age and geochemistry of the Ontong Java, Hikurangi, and Manihiki plateaus suggests that they may have been once part of a single LIP (Ontong Java Nui). 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, and no consensus model exists to explain its origin.

OJP is presently the best sampled among Pacific oceanic plateaus. The basaltic basement of the OJP has been sampled by seven Deep Sea Drilling Project (DSDP) and Ocean Drilling Program (ODP) sites – 289, 803, 807, 1183, 1185, 1186, and 1187 – but they are concentrated only in the High Plateau. In order to examine the true extent of the OJP (i.e., its relation to Nauru, East Mariana, Pigafetta, Manihiki, and Hikurangi), basement samples from another part of the plateau (Eastern Salient) are required. We propose drilling at five sites on the plateau and adjacent basins to recover basement samples with variable compositions. We also propose drilling through the sedimentary section on Magellan Plateau, an oceanic plateau that formed >20 Myr before the proposed Ontong Java Nui emplacement. Because of its older age, the sedimentary sequence on Magellan Plateau may preserve ash layers that cover all Ontong Java related eruption events.

The purpose of this project absolutely hit one of the major themes of IODP Science Plan 2013-2023: "Earth Connections: Deep Processes and Their Impact on Earth's Surface Environment Challenges." Two challenges in the theme: Challenge 8 and Challenge 9 will be addressed by the drilling of the most voluminous igneous edifice on Earth.

967 - Pre

Scientific Objectives

This project seeks to investigate the true areal extent of the Ontong Java Plateau (OJP), the largest igneous edifice on Earth. The principal question is (1) whether the three plateaus, Ontong Java, Manihiki, and Hikurangi once formed the single super plateau known as the Ontong Java Nui? Secondary objectives are to (2) trace the flows or sills filling the adjacent basins to eruptive centers on the main plateau, (3) test existing models and provide critical data for the development of new models of LIP formation, and (4) examine the geodynamic effects and evolution of the OJP.

The project will employ non-riser drilling to core OJP basalts from five sites and to core sediments at one site from Magellan Plateau. Basalt samples will be analyzed to document the geochronology, geochemistry, isotope chemistry, and paleolatitude, and address all scientific objectives. Sediment samples above the Magellan Plateau will be used to recover syn-LIP sediments that contain the record of all eruption events of Ontong Java Nui (to examine the principal objective). The sedimentary section above the OJP basement will be used to estimate subsidence history of the plateau after its formation (to resolve the 3rd and 4th objectives). Temperature and thermal conductivity measurements will be conducted to test whether the mantle root beneath the OJP is thermal or chemical in nature (to unravel the 4th objective).

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

None

967 - Pre

Proposed Sites (Total proposed sites: 8; pri: 6; alt: 2; 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	4325	200	150	350	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-02A (Alternate)	-7.5121 172.1159	5400	200	150	350	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-03A (Primary)	-6.2340 167.5162	3500	200	150	350	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-04A (Primary)	-7.5070 166.7275	3700	300	150	450	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Stewart Basin.
OJP-05A (Primary)	-0.2040 162.5333	4350	700	150	850	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic similarities to Ontong Java Plateau and/or Nauru Basin.
OJP-06A (Primary)	-8.9695 161.6792	2580	500	150	650	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
OJP-07A (Alternate)	-7.4704 161.0999	2003	1200	150	1350	Core basaltic rocks for geochemistry, isotopic chemistry, and age. Determine geochemical and isotopic signature of Eastern Salient.
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.