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IODP Proposal Cover Sheet

769-APL2

☐ **New** ☒ **Revised** ☐ **Addendum**

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Please check if this is Mission proposal	☐

Title:	Revealing the *in situ* Crustal Architecture in DSDP/ODP Hole 504B		
Proponent(s):	Masako Tominaga (Woods Hole Oceanographic Institution, USA), Keir Becker (University of Miami, USA), Yumiko Harigane (Kanazawa University), C. Geoffrey Wheat (University of Alaska, USA), and Damon A. H. Teagle (University of Southampton, UK)		
Keywords: *(5 or less)*	Upper Ocean Crust construction and evolution processes, Hydrogeochemistry, Downhole Stratigraphy, Electrofacies Analyses, Formation MicroScanner logging	Area:	Panama Basin, eastern equatorial Pacific

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Permission to post abstract on IODP Web site: ■ Yes ☐ No

Abstract: (*400 words or less)*

The primary objective of this APL operation is to study the *in situ* architecture of upper ocean crust in DSDP/ODP Hole 504B by acquiring Formation MicroScanner (FMS) images of *in situ* borehole wall. Hole 504B crust drilled during a total of seven DSDP and ODP legs has been a "reference" of upper ocean crust. Results from Hole 504B revealed important information on hydrology and chemical flux in the upper ocean lithosphere, including heal flow, alteration petrology, hydrothermal geochemistry, and biogeochemistry and also on geophysics of upper ocean crust such as magnetics, physical properties, and seismics. However, many of these studies inevitably relied on the shipboard lithostratigraphy, which was extrapolated from recovered cores with very low recovery rate (~ 30 %), and so highly subjective. Recent studies from Hole 1256D logging analyses show that unrecovered intervals in a drilled basement are permeable structures, such as highly fractured sections and breccias. The FMS logging in Hole 1256D revealed that nearly 50 % of the *in situ* architecture is composed with these lithologies and most of them were not recovered, and hence never being recognized in the shipboard lithostratigraphy. This discrepancy between shipboard lishostratigraphy and FMS logging results makes it clear that a shipboard lithostratigraphy in a drilled hole with very low core recovery rates can lead erroneous conclusion in critical elements for understanding of the evolution of the oceanic crust and the mechanism of global chemical fluxes. To reassess what we learned from Hole 504B based on more accurate downhole lithostratigraphy, we will conduct multiple FMS logging runs in Hole 504B.

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Scientific Objectives: (*250 words or less*)

We will test our hypothesis that *the hydrothermal alteration and mineralization style are spreading-rate dependent (e.g. 504B vs. 1256D)* by answering following questions: (1) To what extent can we improve current 504B shipboard lithostratigraphy, particularly by revealing sections that were not recovered including highly fractured and brecciated?; (2) Can we correlate differences in 504B and 1256D alteration styles and intensities with differences in their volcanic architecture?; and (3) How can a new FMS-based lithostratigraphy model improve previous results in terms of global chemical flux (e.g. the estimation of CO_2 uptake by hydrothermal alteration in upper ocean crust)?

We will also take temperature logs, and if time will be permitted, borehole fluid samples. Obtaining borehole temperature (and fluid samples) will address questions of how the hydrothermal fluid in Hole 504B evolved from the last measurements by CORK observatory.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
Hole 504 B	(Lat) 1° 13.632 (Lon) -83° 43.812	3460	274.5	1836.5	2111	To obtain detailed crustal architecture by multiple FMS logging runs.