IODP Proposal Cover Sheet

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Kane Megamullion Deep Drilling

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Title	KANE OCC, DRILLING LOWER CRUST AND MANTLE AT THE SLOW SPREADING MAR
Proponents	Henry Dick, Alessio Sanfilippo, Maurice Tivey, Frieder Klein, Virginia Edgcomb, Juan Pablo Canales, Brian Tucholke, Min Xu, Jason Sylvan, Katsuyoshi Michibayashi, Yasuhiko Ohara, Susan Lang, Jill McDermott, Chuan-Zhou Liu, Huaiyang Zhou, Benoit Ildefonse, Juergen Koepke
Keywords	Oceanic-Core-Complex, serpentinization, biogeochemistry, seismic
Area	Mid Atlantic Ridge

Proponent Information

Proponent	Henry Dick
Affiliation	Woods Hole Oceanographic Institution
Country	United States

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Abstract

Two 500-m deep holes are proposed on the long-lived detachment fault footwall at the Kane Megamullion, an oceanic core complex located at 23°N on the MAR. Proposed Hole KNA-01A is on peridotite, which based on seismic structure and geology represents mantle directly exposed on the seafloor. Proposed Hole KNC-01A, is on talc-serpentine schist, which is believed to mask a small 264 km2 gabbro batholith close to the same lithospheric flow line. There are 6 principle objectives: 1) Test the seismic and gravity interpretations of the Kane OCC geology. 2) Recover what will be only the 3rd deep section into lower ocean crust at an iconic MAR 'normal' ridge segment, to compare it to the strikingly different Atlantis Bank (high melt flux) and Atlantis Massif (low melt flux) sections in the Indian and Atlantic Oceans to see how crustal architecture evolves with melt flux. 3) Determine how the stress-strain history evolved from ductile to brittle deformation for a deeply rooted long-lived detachment in lower crust and mantle rock. 4) Determine the character of serpentinization with depth in exposed in an uplifted mantle massif at a slow-spreading ridge. 5) Determine how microbial communities and their biogeochemical signatures differ for peridotite and gabbro emplaced at the same spreading rate on the same lithospheric flow line. 6) Evaluate the source of the observed magnetic anomalies. The drilling strategy calls for both sites to be drilled to 500-m using a drill-in hard-rock guide base, and then to deepen whichever hole is in the best shape. Based on the tectonic setting, and past drilling history at Atlantis Bank, and Atlantis Massif, JRSO calculates these holes can be drilled 33.6 days, assuming 8.8 days Barbados-Bermuda transit. Based on a standard leg, this leaves 5 days, sufficient for additional ~130 m of drilling.

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Scientific Objectives

1) Test the seismic interpretation of the geology of Kane OCC.
2) Recover a deep section in the MAR lower crust formed at moderate magma supply
3) Determine the Origin and Stress-Strain History for long-lived Ocean Core Complexes
4) Determine the depth and character of serpentinization in mantle
5) Compare and contrast for the 1st time the geomicrobiology and biogeochemistry of long sections of lower crust and mantle emplaced at the same spreading rate, on the same lithospheric flow line, at the same ridge.
6) Determine which hypothesis best explains the magnetic anomaly hosted within the core complex.

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

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Proposed Sites (Total proposed sites: 6; pri: 2; alt: 4; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
KNA-01A (Primary)	23.49047 -45.38105	2315	0	500	500	Drill with coring to 500-m minimum, with option to go deeper if time permits to 1000 meters in mantle exposed on the seafloor to recover the first long section of the abyssal mantle for the purpose of determining the seismic character of the shallow mantle, and evaluate the alteration gradient, biochemistry and potential for carbon sequestration in the oceanic mantle.
KNA-02A (Alternate)	23.51191 -45.37665	2473	0	500	500	Drill with coring to 500-m minimum, with option to go deeper if time permits to 1000 meters in mantle exposed on the seafloor to recover the first long section of the abyssal mantle for the purpose of determining the seismic character of the shallow mantle, and evaluate the alteration gradient, biochemistry and potential for carbon sequestration in the oceanic mantle.
KNA-03A (Alternate)	23.48768 -45.36771	2413	0	500	500	Drill with coring to 500-m minimum, with option to go deeper if time permits to 1000 meters in mantle exposed on the seafloor to recover the first long section of the abyssal mantle for the purpose of determining the seismic character of the shallow mantle, and evaluate the alteration gradient, biochemistry and potential for carbon sequestration in the oceanic mantle.
KNC-01A (Primary)	23.49278 -45.28650	2080	0	500	500	Drill and core a long section of the lower ocean crust accreted at a moderate melt supply in the Mid-Atlantic Ridge segment. Site is covered by talc and serpentine schist on a detachment footwall, but based on seismic results, the schist is little more than a meter thick, and is underlain by lower crustal gabbro. The drilling will recover a lower crustal section and test this seismic interpretation.
KNC-02A (Alternate)	23.47182 -45.29118	2080	0	500	500	Drill and core a long section of the lower ocean crust accreted at a moderate melt supply in the Mid-Atlantic Ridge segment. Site is covered by talc and serpentine schist on a detachment footwall, but based on seismic results, the schist is little more than a meter thick, and is underlain by lower crustal gabbro. The drilling will recover a lower crustal section and test this seismic interpretation.
KNC-03A (Alternate)	23.49485 -45.29637	2194	0	500	500	Drill and core a long section of the lower ocean crust accreted at a moderate melt supply in the Mid-Atlantic Ridge segment. Site is covered by talc and serpentine schist on a detachment footwall, but based on seismic results, the schist is little more than a meter thick, and is underlain by lower crustal gabbro. The drilling will recover a lower crustal section and test this seismic interpretation.