

# iSAS/IODP Proposal Cover Sheet

551-Full

New

Revised

Addendum

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Title:	Exploring the Plutonic Crust at a Fast-spreading Ridge: New drilling at Hess Deep		
Proponent(s):	K.M. Gillis, R.-B. Pedersen, J.H. Natland, P.B. Kelemen, H.J.B. Dick, B. Ildefonse, J. Miller, and D.K. Smith		
Keywords: <i>(5 or less)</i>	Fast-spreading, gabbro, magmatic processes, hydrothermal flux	Area:	Equatorial Pacific

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Permission to post abstract on iSAS Web site:  Yes  No

Abstract: *(400 words or less)*

The primary objective of further drilling at Hess Deep is to study the nature of intermediate and deep level gabbroic rocks that formed at a fast-spreading ridge. Samples recovered during Leg 147 revealed important new information on the nature of EPR crust and upper mantle. Although we aim for more favorable drilling conditions, similar recovery from the lowermost crustal sequence should be sufficient to address questions related to crustal accretion processes and the nature and extent of deformation and hydrothermal alteration in the lower ocean crust. For example, lower crustal rocks recovered by drilling should provide data on compositional variation that can be used to determine if the lower EPR crust was modified by diffuse, reactive porous flow or not. Documentation of the nature of variation in mineral compositions, crystal sizes, and both crystal shape and lattice preferred orientation, in combination with direct observation of intrusive contacts, would constrain how magma is transported between magma lenses at the crust–mantle transition and just beneath the sheeted dikes. Previous drilling and submersible studies at Hess Deep have shown that shallow level gabbros, sheeted dikes, and the crust–mantle transition zone there are similar in many important respects to the same horizons in the Oman ophiolite. However, a crucial remaining test is to determine whether Hess Deep lower crustal rocks are similar in composition, texture, and scales of variation to the modally layered, “cumulate” gabbroic rocks found in the Oman lower crustal section. Comparison with Hole 735B core should reveal important information on the relations between crustal accretion and spreading rate.

## Scientific Objectives: (250 words or less)

The principal objective of the proposed leg is to study the nature of lower levels of young plutonic crust that formed at a fast-spreading ridge. Recovery of 200 to 300 m long cores of intermediate to deep level gabbroic rocks that formed at the East Pacific Rise will address questions such as:

- Is the flow of magma through the lower crust and upper mantle porous or focused?
- Does the lower crust form from a crystal mush or from discrete magma reservoirs?
- How are crustal accretion variables influenced by spreading rate?
- Are ophiolites representative of “normal” oceanic crust?
- How do volatiles evolve in magma – hydrothermal systems?
- What is the nature of hydrothermal alteration in the EPR lower crust?
- What is the scale of lateral variability of the uppermost mantle?
- What are the microstructures and deformation mechanisms in the lower crust?

## Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
HD-01A	2°15.8'N 101° 31.8'W	4400	<30	>300	~>330	To obtain an intact section of intermediate level plutonic rocks that formed at the fast-spreading East Pacific Rise.
HD-02A	2°15.5'N 101° 31.8'W	4600	<30	>300	~>330	To obtain an intact section of deep- level plutonic rocks that formed at the fast-spreading East Pacific Rise.
HD-03A	2°15'N 101° 31.8'W	4750	<30	>300	~>330	To obtain an intact section of deep- level plutonic rocks that formed at the fast-spreading East Pacific Rise.
HD-04A	2°16.7'N 101°26'W	3900	<30	>300	~>330	To obtain an intact section of ultramafic rocks associated with the fast-spreading East Pacific Rise.