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The MoHole: an ultra-deep drilling into the oceanic mantle

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The MoHole project, which will drills into an intact portion of oceanic lithosphere, is a long-standing ambition of scientific ocean drilling. The 2010 MoHole workshop in Kanazawa followed from several scientific meetings on ocean lithosphere drilling, which reached a consensus that a deep hole through a complete section of fast-spread crust is a renewed priority for the community. New deep drilling technologies now make it possible to fulfill our aspiration to drill completely through intact oceanic crust and into the upper mantle, and address a number of first-order scientific goals: what is the geological nature of the Moho? How is the oceanic crust formed at mid-ocean ridges, and what processes influence its subsequent evolution? What are the geophysical signatures of these processes? What are the interactions with the oceans and biosphere, and their influence on global chemical cycles? What are the limits of life, and the factors controlling these limits? What is the physical and chemical nature of the uppermost mantle, and how does it relate to the overlying magmatic crust?

The selected MoHole target would ideally meet a suite of scientific requirements including fast spreading rate, simple tectonic setting, "normal" crustal seismic structure, and strong reflectivity of Moho. Several technological constraints limit the range or possible sites, including in particular the trade-off between seafloor depth, which should be small enough to allow using mud re-circulating technologies, and temperature at Moho/upper mantle depths, which should be low enough (~?250 degree C) to allow ultra deep drilling (> 6000m) in basement. The workshop participants discussed three areas in the Pacific Basin: 1) the region around Site 1256, 2) the eastern Pacific plate off Mexico, 3) the eastern edge of the north Hawaiian arch.

This is an executive summary of the Kanazawa WS report* (Ildefonse et al., 2010, Scientific Drilling:doi: 10.2204/iodp.sd.10.07.2010).

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