Project SloMo - Drilling through the lower crust to Moho at the SW Indian Ridge

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Project SloMo is a complex two-phase program to drill through the lower crust to Moho at the SW Indian Ridge at Atlantis Bank on a wave-cut platform flanking the Atlantis II Transform at 32˚42′S, 57˚17′E on ~11 Ma crust. The ~24 km^2 platform sits in 700-m of water at the center of a ~400-m^2 gabbro massif. A sub horizontal contact between the gabbro massif and mantle peridotite is exposed along the transform wall for 30 km at 4,200 m depth below the platform, and ~4 km above seismically determined Moho. IODP Hole 735B was drilled to 1508 m during Legs 118 in 1987 and 176 in 1997 ending with an engineering accident that permanently blocked the hole. The drilling conditions and recovery (ave. 87%), however, were the best ever encountered in a hard rock hole in the oceans. Thus, with the upper ocean crust removed by tectonics and erosion and its shallow depth, it is the optimal location for a deep drill hole to Moho on any slow or ultraslow spreading ridge. Phase 1 of the project plan is to use the JOIDES Resolution to drill to 3 km. Based on the geology, it is believed that the crust-mantle boundary beneath Atlantis Bank lies 2-3 km above Moho, which may be a serpentinization front in the mantle. If this is the case, then there may be an entirely new planetary biosphere beneath slow and ultraslow spreading crust as serpentinization is a methanogenic process that would provide food for life. This project, then, not only seeks to recover the full section of the lower crust and the crust-mantle transition, to determine the true nature of Moho at an ultraslow spreading ridge, but also to see if life on earth extends to greater depths than previously believed. SloMo consists of two phases: Phase 1 will use the JOIDES Resolution to drill to 3-km, while Phase 2 will bring Chikyu to the site to drill to 500-m below seismically determined Moho. Phase 1 of the SloMo project began with Expedition 360 in December and January 2015-2016 establishing Hole U1473A. Expedition 360 drilled to 790 meters below seafloor, with total recovery of 59%. Subsequently, Expedition 362T deepened the Hole to 809.4 m while doing remediation work. The Hole is currently in good condition and suitable for reentry to drill to the crust-mantle boundary, believed to lie at ~2500 mbsf. The cores and logs show that the basic stratigraphy of Hole 735B is continuous across the Bank to Hole U1473A ~2 km to the north, which is critical as the SloMo Project seeks to create a seismic laboratory where in-situ velocity measurements can be made hole-to-hole to directly determine seismic velocities in the lower crust in situ, and for placing receivers down hole to avoid surface bounce and the complications presented by the extreme topography of slower spreading ridges. It is anticipated that the site will be reoccupied in three to four years once the Resolution re-enters the Atlantic. Due to long transit times for Expedition 360, and an emergency port call in the middle of the expedition it will require two additional expeditions to reach the target depth of 3,000 m.

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