AGU Fall Meeting
San Francisco, USA
13–17 December, 2004

Eos Trans. AGU, 85(47)
Abstract V23B-0628

New insights into serpentinization at Atlantis Massif, 30°N Mid-Atlantic Ridge, using wide-angle seismic method

S. C. Singh [1], J.A. Collins [2], J.P. Canales [1], B.E. Tucholke [2], R.S. Detrick [2]

[1] Institut de Physique du Globe de Paris, Department of Marine Geosciences, 4 Place Jussieu, Paris, 75252 France
[2] Woods Hole Oceanographic Institution, Department of Geology and Geophysics, Woods Hole, MA 02543 United States

The Atlantis Massif is an ultramafic core complex that was formed in the last 1.5-2.0 Myr at the intersection of the Atlantis Fracture Zone and the Mid-Atlantic Ridge near 30°N by tectonic extension along a long-lived oceanic detachment fault. The exhumation of deep crustal and upper mantle rocks in the footwall of the fault provides an excellent tectonic window into the oceanic lithosphere. The Atlantis Massif will be the subject of a deep-drilling investigation for upcoming IODP Legs 304 and 305 (November 2004 - February 2005). Near-offset seismic reflection data (offset up to 3 km) across the core complex imaged a reflection at 0.2-0.25 s below the seafloor, which has been interpreted as an older detachment fault [Canales et al., Earth Planet. Sci. Lett., 222, 543-560, 2004]. The application of a non-conventional multichannel seismic (MCS) imaging technique allows us to include wide-angle seismic reflection data (offset up to 6 km) in the imaging process. We find that this reflection is continuous along most of the profiles and is present beneath the exposed detachment surface over an area larger than previously estimated from the near-offset MCS sections. Complementary data from on-bottom shots and ocean bottom seismometers constrain both P and S-wave velocities down to 0.5-0.6 km below the seafloor, at approximately the depth of the widespread reflection. The combined seismic data suggest that the interval between the seafloor and the reflection contains serpentinized peridotite. We quantify the amount and distribution of alteration in this layer by using an effective medium theory, and we interpret the results to shed new light on serpentinization processes at Atlantis Massif. IODP drilling results this winter will allow us to compare our interpretation to ground-truth measurements.