Geophysical Research Abstracts, Vol. 9, 02386, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02386

Seismic velocity structure of the upper oceanic crust beneath the Lucky Strike hydrothermal vent field (37.3°N Mid-Atlantic Ridge)

T. Seher (1), W. Crawford (1), S. Singh (1), M. Cannat (1), V. Combier (1), H. Carton (1)

(1) Géosciences marines, Institut de Physique du Globe de Paris- Boite 89 - 4 place Jussieu - 75252 Paris cedex 05 (seher@ipgp.jussieu.fr)

During the 2005 SISMOMAR cruise, a MoMAR (Monitoring the Mid-Atlantic Ridge) project, seismic reflection and refraction data were acquired at the Lucky Strike segment of the MAR. The cruise included a 18x3.8 km^2 3D multi-channel reflection survey while 25 Ocean Bottom Seismometers (OBS) were deployed in a 18x18 km^2 box. Both the reflection and OBS boxes were centered over the central volcano summit and hydrothermal fields, and extended out to the median valley bounding faults. The wide-angle reflections and refractions recorded on the OBS during the seismic reflection measurements are used to construct a high-resolution velocity image of the subsurface using seismic traveltime tomography.

Crustal velocities are lower on the ridge axis than off axis, which can be interpreted as evidence for hotter, more fractured lavas on the axis. Seismic layer 2A thins significantly as the crust moves off-axis. We suggest that tectonic stretching and hydrothermal filling might explain this phenomenon. We also observe regions of anomalously low velocities on axis, which are interpreted as fluid intrusions in the hydrothermal recharge and discharge zones or zones of magmatic activity. Ridge parallel regions of high velocities coincide with the eastern and western bounding faults. A sinusoidal pattern in the traveltime residuals indicates the presence of anisotropy. This anomaly is localised in the upper two kilometers of the oceanic crust, is predominatly parallel to the ridge axis and provides evidence for faulting and fracturing.

We will present a tectonic model explaining the different observations, including an important role for faults as the primary discharge and recharge zones for hydrothermal

circulation.

This research was funded by the European Commission with the MoMARnet program (Monitoring deep sea floor hydrothermal environments on the Mid Atlantic Ridge - A Marie Curie Research Training Network).