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Microseismicity of Lucky Strike Segment, Mid-Atlantic Ridge

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Lucky Strike, one of the largest hydrothermal fields found at the Mid-Atlantic Ridge (MAR), is located at the crest of an axial volcano. This segment is characterized by a well-developed axial valley that is narrowest and shallowest at its center, where the crust is presumably thicker. Hydroacoustic monitoring in the area detected a seismic swarm in 2001, associated with teleseismic events, centered on this segment. The nature of the acoustic signal suggests that this crisis was due to a magmatic event (diking and/or seafloor eruption), but no direct seafloor observations are available to date. This swarm indicates that segment is magmatically and tectonically active. We present preliminary results of the first microseismicity study of this segment. As a part of a MOMAR project, the SISMOMAR experiment was carried out in June 2005 to determine the velocity and reflectivity structure of the crust and upper mantle. An array of 20 OBS instruments (French INSU facility) were deployed over a 18x18 km box with a 4.5 km spacing centered at the hydrothermal field. We obtained a ~ 6 day-long non-continuous time window within which an active source was not used in order to detect the microearthquakes. During this period more than 400 events were observed, which can be classified in 2 groups. We identified a first group of events as microearthquakes (90) that have clear P- and S- phases. A second group of events have smaller amplitudes, precluding the identification of P- and S-wave arrivals. We have preliminary locations for 33 of the 90 microearthquakes, with arrivals on 5 or more OBSs. Hypocenter distribution shows seismicity extending up to 20 km off-axis. Microearthquakes cluster under the axial volcano, and at the SW inside corner and non transform discontinuity. Initial results of earthquakes' depths point out an epicenter distribution at the mid-crustal level (max. depth ~ 3-3.5 km) for the seamount and above the magma chamber, and deeper at/below the inside corner. We will investigate the nature of microseismic events, and their relationship to volcanic and tectonic activity. In addition, our results should provide some insight about hydrothermal circulation.