Mid-Atlantic Ridge Sulfide Prospects

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On the Mid-Atlantic Ridge (MAR) have been 15 active hydrothermal fields discovered (Hannington, 2001). All objects locate between Island and 14 N. In many places were paleo Black Smokers, methane plumes and sulfide mineralization also discovered. 4500 dredge stations implies that sulfides are not developed in a continuous belt along the entire length of the ridge, but are constrained to nodes with low seismicity (query for erthquackes with M>4) or high viscosity [Mazarovich and Sokolov, 1998, Mazarovich et al., 2001].

Authors created map of Atlantic sulfide mineralization setting and prospects of further discoveries on the base of satellite altimetry data (Sandwell and Smith, 1997; Smith and Sandwell, 1997), earthquake epicenter distribution (CNSS.., 2001), and a variety of geological data.

MAR aseismic gaps nature is the most important problem. Most likely, these segments are zones of relatively high heat flow, which is responsible for lithospheric ductility. This is further supported by heat flow data (Podgornykh and Khutorskoy, 1997).

We discussed the correlation topographic relief, the free air gravity field, seismicity, distribution of sulfide mineralization, Bouguer anomalies, and seismic tomography. along a profile drawn along the Mid-Atlantic Ridge. The seismic tomography pattern obtained from S-wave data best reflects the temperature regime and partially molten state of the mantle (Becker and Boschi, 2002). Our analysis draws on the RG5.5 model (Zhang and Tanimoto, 1992).

It is readily apparent that seismicity distribution along the ridge shows “clusters” ca. 1.5–2 arc degrees across, with the documented sulfide occurrences and other related phenomena gravitating to the spaces between the “clusters.” In discussing the relatively well-understood North Atlantic, it is worth notice that sulfide occurrences gravitate not to zones of strong, not frequent seismic events (for samples of M 4+ events) as such, but to zones associated with plume phenomena in the upper mantle.

In our opinion, the most likely underlying cause of this relationship is that the presence of the plume propagating (or simply functioning) along the ridge gives rise to an additional joint system in the crust, which facilitates water influx and circulation and water enrichment in components typical of hydrothermal solutions. In addition, massive plume-related basaltic magmatism, the supply of essential volatiles in the plume zone, and elevated heat flow, create further conditions to promote hydrothermal activity.