

Architecture and Composition of two Different Types of Modern Massive Sulfide Deposits at the MAR: Krasnov and Ashadze

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Recent discoveries along the Mid Atlantic Ridge (MAR) provide us with an opportunity to evaluate new information about the architecture and composition of oceanic hydrothermal deposits. The Ashadze (12° 58'N) and Krasnov (16° 38'N) hydrothermal fields with associated massive sulfides were discovered on the MAR during cruises of the Russian RV "Professor Logatchev" in 2003 and 2004 respectively. Ashadze and Krasnov represent two types of MAR hydrothermal systems associated with different host rocks - mafic (Krasnov) and ultramafic (Ashadze).

The Ashadze and Krasnov hydrothermal fields have differences in such key factors as their oceanographic and geological settings, morphology, size, age, and composition of hydrothermal fluids and mineralization.

Water depth. The Ashadze field occurs at 3300- 4530 m below sea level and the Krasnov at 3700-3750 m. The Ashadze-1 site at 4080 m is the deepest active black smoker field so far known to occur in the global ocean. There is a water depth control for some aspects of the hydrothermal system.

Hydrothermal activity and fluid composition. The hydrothermal system at Ashadze is active and characterized by high concentrations of hydrogen and methane. The Krasnov field is inactive.

Morphostructural setting of deposits. The Krasnov deposit lies in a depression connecting the axial volcanic high with the eastern rift slope. Ashadze is the only MAR hydrothermal field on the western slope of the rift zone. It is situated on the terraces of the slope. Fault control of deposit localization is evident for the Ashadze field as a whole and for the chain of hydrothermal mounds at the Ashadze-2 site.

Hydrothermal field morphology and size of sulfide deposits. The Ashadze field consists of a cluster of 3 hydrothermal sites. "Chimney forest" was detected at Ashadze-1 and crater-like structures were mapped at the Ashadze-2 site. Krasnov deposit is represented by two large ore bodies. The largest (Main) sulfide mound has dimensions 500 x 300 m. A giant outcrop of massive sulfides 70-100 m high (!) along the escarpment zone was detected in the central part of the Main mound. Another smaller sulfide mound is situated 100 m to the north from the first one. A preliminary estimate of the sulfide resources in the Krasnov field is about 17.4 Mt. Resources of the Ashadze deposits is nearly 4 times smaller.

Age of sulfide deposits. Based on isotope geochronology the ore-forming process at Krasnov field started 119.2 kyr BP and ended 5.6 kyr BP. The start of high-temperature hydrothermal activity at the Ashadze field was dated to be 27.3 kyr BP and this process is continuing. The correlation between the age and the size of deposits is clear.

Composition of deposits. Iron sulfide is the principal mineral type in the Krasnov deposit. Copper and zinc sulfides are less abundant. On the contrary Cu-Zn sulfides are the major minerals in Ashadze deposits, which are also enriched in gold, selenium, and several other metals.

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