



## **Semenov submarine hydrothermal massive sulfide cluster (13°31'N, Mid-Atlantic Ridge)**

Elena Amplieva (1), Viktor Ivanov (2), Viktor Beltenev (2), and Irina Dobretsova (2)

(1) IGEM RAS, Moscow, Russian Federation (amplieva@igem.ru), (2) Polar Marine Geosurvey Expedition, Saint-Petersburg, Russia

There are 14 hydrothermal fields on the Mid-Atlantic Ridge (MAR) between 12°58' and 37°51' N, which are located in different geological and geochemical environments at water depths from 850 m (Menez\_Gven) to 4080 m (Ashadze). The discovery of a new type of massive sulfide deposits of the Logachev Field at 14°45' N [Bogdanov, et al., 1997] and Rainbow at 36°13' N [Fouquet, et al., 1997] associated with peridotites caused intense study of this region. Several new hydrothermal fields associated with ultrabasic and basic rocks were revealed by the Russian R/V Professor Logachev. The Semenov cluster of massive sulfide deposits, the largest among the known ones and located in peridotites and basalts at 13°31'N, was discovered in 2007 [Beltenev et al., 2007]. In 2009 the 32nd cruise on the Russian R/V Professor Logatchev carried out investigations in the northern part of the Mid-Atlantic Ridge between 11° and 14°N [Beltenev, et al., 2007; Beltenev, et al., 2009]. The studies of the Semenov cluster and sample collection were performed by the underwater photo-TV profiling, the dredge, the rectangular corer, and the TV-controlled grab system.

All of hydrothermal massive sulfide deposits of the Semenov cluster are related to a latitudinally elongated, uplifted seamount of about 10 km length, 4.5 km width, and 850 m elevation above the surrounding seafloor. The seamount is located at depths from 2500 to 2800 m below the water surface. It has a complex geological structure composed of serpentized peridotites, gabbroids, basalts, metabasalts, and plagiogranites. Geological sampling recovered massive sulfides at four sites around the seamount preliminary named as Western, North-Western, Eastern, Central and North-Eastern (Ivanov et al., 2008). Two of them were examined during the 32nd cruise of the R/V Professor Logatchev. Eastern site is located at depths from 2560 to 3020 and Central site is located at depths from 2160 to 2340 m.

Pyrite, and marcasite are the major ore minerals of Central and Eastern sites; chalcopyrite, and hematite are less abundant. Sphalerite, isocubanite, bornite and pyrrhotite pertain to the category of rare minerals. Gangue minerals are barite, quartz, aragonite. Pyrite is the major ore-forming mineral, which is predominant in massive ore. The modes of pyrite occurrence are diverse: grains, perfectly faceted crystals, isometric segregations, and colloform and framboidal grains; their size varies from 1–2  $\mu\text{m}$  to a few millimeters. Marcasite occurs as xenomorphic segregations in the intergranular space between pyrite grains and in the outer zone in pyrite colloform aggregates. Chalcopyrite occurs as xenomorphic segregations in the intergranular space in the pyritic ore. Large segregations of chalcopyrite contains inclusions of sphalerite. Hematite occurs along contact between the pyritic ore and ocean sediments. Sphalerite occurs as small inclusions in the pyrite and in the chalcopyrite. Sphalerite grains contain emulsionlike inclusions of chalcopyrite.

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