超マフィック型海底熱水系における高磁化帯の起源

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Origin of Magnetic Highs at Ultramafic Hosted Hydrothermal Systems

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Near-seafloor vector magnetic measurements were performed on an inactive ultramafic-hosted hydrothermal vent field, called Yokoniwa, using a deep-sea manned submersible *Shinkai6500* and an autonomous underwater vehicle *r2D4*. The Yokoniwa Hydrothermal Field has developed at a non-transform offset massif of the Central Indian Ridge. The distribution of crustal magnetization from the magnetic anomaly revealed that the Yokoniwa Hydrothermal Field is associated with enhanced magnetization, as seen at the ultramafic-hosted Rainbow and Ashadze 1 hydrothermal sites of the Mid-Atlantic Ridge. The results of rock magnetic analysis on seafloor rock samples (including basalt, dolerite, gabbro, serpentinized peridotite, and hydrothermal sulfide) showed that only highly serpentinized peridotite carries high magnetic susceptibility and that the natural remanent magnetization intensity can explain the high magnetization of Yokoniwa. These observations reflect abundant and strongly magnetized magnetite grains within the highly serpentinized peridotite. Comparisons with the Rainbow and Ashadze 1 suggest that in ultramafic-hosted hydrothermal systems, strongly magnetized magnetite and pyrrhotite form during the progression of serpentinization due to hydrothermal circulation. After the completion of serpentinization and production of hydrogen, pyrrhotites convert into pyrite or nonmagnetic iron sulfides, which considerably reduces their levels of magnetization. Our results revealed origins of the magnetic high and the development of subsurface chemical processes in ultramafic-hosted hydrothermal systems. Furthermore, the results highlight the use of near-seafloor magnetic field measurements as a powerful tool for detecting and characterizing seafloor hydrothermal systems.