多様な深海底蛇紋岩から明らかになった蛇紋岩化反応における磁鉄鉱の挙動

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Role of Magnetite in Serpentinization: Insights from Rock Magnetic Properties of Abyssal Peridotites

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Magnetic properties in serpentinized peridotites are of increasing interest in seafloor mapping and petrologic studies because such data can promote the understanding of serpentinization reactions and hydrogen creation in ultramafic rocks. In order to reveal the magnetic properties and magnetite growth in serpentinized peridotites, we have analyzed 30 serpentinized peridotite samples from a non-transform offset massif called the Yokoniwa Rise in the Central Indian Ridge. The results from multiple rock magnetic analyses and petrological observations illustrate the details of the creation and growth of magnetite in serpentinized peridotites that have undergone 17-100% serpentinzation. The magnetic carrier of these samples is pure magnetite, which did not suffer from maghemitization (low-temperature oxidation). The magnetic susceptibility ranged from 0.002-0.087 SI and increased nonlinearly with the progression of the serpentinization reaction. The natural remanent magnetization intensities of 0.2-8.4 A/m are comparable to those of basalts, which suggests that the remanence as well as induced magnetization of highly serpentinized peridotite can contribute to magnetization of the oceanic lithosphere. The amount of magnetite estimated from saturation magnetization increased nonlinearly from 0.1 wt% to 5.5 wt% with the progression of the serpentinization. Highly serpentinized peridotites have a well-developed serpentine mesh texture. Pseudo-single-domain (PSD) and multi-domain (MD) grains were formed during igneous processes in the mantle domain and/or during the initial stages of serpentinization. Super-paramagnetic (SP) particles were formed during the initial stages of serpentinization. Single-domain (SD) magnetite was formed during the later stage of serpentinization, and it is assembled inside of mesh structures composed of needle-like grains with strong magnetostatic interactions.