

# Electrical conductivity of serpentinites

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Serpentinites play important roles in circulation of water in subduction zones. Mapping their distributions is essential to good understanding of subduction zone processes: earthquakes, volcanism, etc. The electrical conductivity is one of observable physical properties, which provides us information on materials in the Earth's interior.

Stesky and Brace (1973) reported that some serpentinites have high conductivity of  $1e-2$  S/m even at the room temperature, and that other serpentinites have low conductivity of  $1e-5$  S/m. Microstructural observation suggested that the observed high conductivity is caused by the connection of magnetite grains, which are produced during serpentinization.

The problem is whether magnetite grains are interconnected only on the grain scale (mm) or on the rock formation scale (km). In order to clarify it, we have performed electrical conductivity measurement of serpentinites and microstructural observation.

Serpentinite specimens containing antigorite were sampled in Hida outer-belt (Toyama, Niigata and Nagano prefectures), and cut into a test piece of 3mm width, 3mm length, and 2 mm thickness. Measurements were performed under the room pressure and at the temperature below 550C. The conductivity measurement was done with a peridotite (Hokkaido, Horoman) as a reference. Most of serpentinite specimens show conductivities similar to the peridotite. Some serpentinite specimens have higher conductivities than the peridotite by 4-6 orders.

Microstructural observation showed heterogeneous distribution of magnetite grains in serpentinites. Magnetite grains are concentrated in some parts (mm scale), however they are hardly seen in other parts (mm scale). The concentration of magnetite grains might be the trace of breakdown of Cr-spinel in a peridotite.

We have investigated the scale dependence of the connectiveness of magnetite grains by measuring the conductance between two points with different distance. Higher conductance is observed only within 10 mm. We conclude that the connectiveness of magnetite grains is only on the grain scale, and that the electrical conductivity is similar to a peridotite on rock formation scale.