Serpentinization process of the mantle peridotite in the northern Fizh block, the Oman ophiolite

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We examined serpentinization processes in the Fizh mantle section of the northern Oman ophiolite on the basis of microscopic observation and chemical analysis of serpentines. The mantle section of the Oman ophiolite is composed of partially-serpentinized harzburgite, dunite and minor amount of lherzolite. Lizardite ubiquitously occur in the Fizh mantle section and develops typical mesh texture associated with lizardite veins. Some clinopyroxenes are partially replaced by tremolite indicating possible fluid suppy at high temperature. Because no antigolite has been found in the Fizh mantle section the reaction of clinopyroxene with hydrothermal fluid is estimated to have occurred at 600-900 °C.

The peridotites in the basal part of the mantle section contain abundant magnetites within the meshes and veins of serpentine. Moreover, some talc replaces the rim of orthopyroxenes. On the other hand, in the inner part of the mantle section and near the Moho, no magnetite occur in the meshed serpentine and only small amounts of magnetite occur in some veins that crosscut earlier meshed serpentine. The compositions of veined serpentines associated with magnetite are higher in Si+Al and lower in Fe+Mg relative to the magnetite-free meshed and veined serpentines. This is consistent with the model in which serpentine and magnetite formed from brucite under high silica activity [1]. The serpentines associated with magnetite in the basal peridotite are slightly lower in Mg# [=Mg/[Mg+Fe] atomic ratio] than those of veined serpentines associated with magnetite in the inner part. This may indicate that Fe difussivity was greater due to higher temperature during magnetite formation in the basal part. We consider that the fluid was liberated from metamorphic sole and infiltrated the basal part of the mantle section during oceanic thrusting. Subsequently serpentines and magnetites formed at relatively lower temperature. On the other hand, because the amount of serpentine is uniform in the innner part and has no correlation with the distance from the Moho Transition Zone lizardite formed at relatively lower temperature, probably less than 300 °C, by infiltration of surface water since obduction of the ophiolite.

[1] Bach et al. (2006) GRL, 33, L13306.