Petrography and mineral chemistry of wehrlites in contact zone of gabbro intrusions and mantle peridotites of the Naein ophiolite

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Introduction
Geological background
Ophiolites have played a major role in our understanding of Earth’s processes ranging from seafloor spreading, melt evolution and magma transport in oceanic spreading centers, and hydrothermal alteration and mineralization of oceanic crust to collision tectonics, mountain building processes, and orogeny. They provide the essential structural, petrological, geochemical, and geochronological evidence to document the evolutionary history of ancient continental margins and ocean basin. Ophiolites include a peridotitic mantle sequence, generally characterized by high-temperature plastic deformation and residual chemistry, and a comagmatic crustal sequence (gabbros, diabase dikes, and submarine basalts), weakly or not deformed. According to this interpretation, ophiolites were allochthonous with respect to their country rocks. They were assembled during a primary accretion stage at an oceanic spreading center, and later tectonically emplaced on a continental margin or island arc (Dilek, 2003).

The indigenous dikes of pyroxenites and gabbros that were injected into a melting peridotite, or intrusive dikes of pyroxenite and gabbro that injected when the peridotite was fresh and well below its solidus, are discussed in different ophiolite papers. Pyroxenite formation and contact of gabbro and mantle peridotite are discussed in different articles (Dilek, 2003). When a gabbro intrude a fresh mantle peridotite could not significantly react with it, but if intrusion occurs during the serpentinization, the gabbro will change to rodingite.

Materials and Methods
Mineralogical analyses were conducted by wavelength-dispersive EPMA (JEOL JXA-8800R) at the Cooperative Centre of Kanazawa University (Japan). The analyses were performed under an accelerating voltage of 15 kV and a beam current of 15 nA. JEOL software using ZAF corrections was employed for data reduction. Natural and synthetic minerals of known composition are used as standards. The Fe³⁺ content in minerals was estimated by assuming mineral stoichiometry.

Results
In the contact zone of leucogabbros and mantle peridotites of the Naein ophiolite, wehrlite and olivine clinopyroxenite are formed. Rock-forming minerals of these wehrlites are olivine (chrysolite), clinopyroxene (diopside), Cr-spinel, serpentine, amphibole (tremolite and tremolitic hornblende), epidote and magnetite.

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Comparison of mineral chemistry of olivine, clinopyroxene and chromian spinel in wehrlites and mantle peridotites indicate that chemical composition of clinopyroxene and olivine in these rocks are different, but chemistry of Cr-spinels in harzburgite and wehrlite are nearly same.

**Discussion**

According to the resistance of Cr-spinel against the metamorphism and alteration, it can be concluded that the wehrlites in contact zone of gabbros and mantle peridotites are formed at the expense of harzburgite. Olivine and clinopyroxene of wehrlites are formed by serpentine metamorphism and interaction of serpentine and calcium of gabbro, respectively. Field study of the research area shows that the leucogabbro intrudes the harzburgite. This research shows that after the serpentinization of mantle harzburgite, the gabbro intrusions crosscut the serpentinized peridotites, and wehrlite and olivine clinopyroxenite formed in the contact zone.

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**References**


