Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SCG08-10 Room:311 Time:April 29 12:10-12:30

Subduction origin for UHP chromitite from the Nishisongi metamorphic rocks, Western Kyushu, Japan

NISHIYAMA, Tadao[1*] ; MORIBE, Yousuke[1] ; ISHIMARU, Satoko[1] ; ARAI, Shoji[2] ; MORI, Yasushi[3] ; SHIGENO, Miki[3]

[1]Graduate School of Science and Technology, Kumamoto University, [2]Department of Earth Sciences, Kanazawa University, [3]Kitakyushu Museum of Natural History and Human History

Ultrahigh-pressure (UHP) chromitite from the Luobsa Ophiolite in non UHP terrane has been an enigima because of its peculiar occurrence. We newly found a UHP chromitite from serpentinite in the Nishisonogi metamorphic rocks (NMR), a member of the Nagasaki Metamorphic Rocks, in Western Kyushu, following our finding[1] of it from the Higo Metamorphic Rocks (HMR), Central Kyushu. The UHP chromitite from NMR documents well a fluid -chromite interaction, showing partial graphitization of microdiamond. Such a fluid - chromite interaction is not observed in HMR chromitite. The NMR are high P/ T (epidote-glaucophane schist subfacies) metamorphic rocks of Cretaceous in age, mainly consisting of pelitic and psammitic schists intercalating with minor basic schists[2]. The peak metamorphic condition of the crystalline schists is estimated as 1.4 GPa and 520 ^{o}C by an assemblage of garnet with inclusions of chloritoid and omphacite, glaucophane, paragonite, and phengite in a garnet galucophanite[3]. Serpentinite and serpentinite melanges occur as elongated bodies or lenses concordant with schistosity trending N-S of the country schists[1]. Jadeitite and omphacitite occur as tectonic blocks in the serpentinite melange, showing the peak condition of 1.5 GPa and 500 ^{o}C by coexistence of jadeite and quartz[4]. Microdiamond - bearing chromitite was found from serpentinite in a melange at Ooseto Town, Saikai City. Chromitite occurs as a thin layer several cm thick and meter-size long in a serpentinite with numerous magnesite (or ankerite) veins. The layer is strongly deformed to show a schlieren - like structure. The serpentinite consists of fine-grained antigorite with no relics of olivine and pyroxenes. The chromitite consists of an aggregate of rounded and fractured chromite crystals with small amounts of talc and magnesite as a matrix and veins. Microdiamond occurs as aligned crystals in narrow zones ranging from a few μm to several tens of μm in chromite. Chromite is zoned, consisting of Mg-rich core $(Mg_{0.33}Fe^{2+}{}_{0.65}Mn_{0.03})(Cr_{0.84}Al_{0.12}Fe^{3+}{}_{0.04})_2O_4$ and Fe-rich rim $(Mg_{0.06}Fe^{2+}{}_{0.89}Zn_{0.02}Mn_{0.03})(Cr_{0.85}Al_{0.12}Fe^{3+}{}_{0.04})_2O_4$. The microdiamond - bearing zones are conspicuously richer in Fe_2O_3 [$(Mg_{0.03}Fe^{2+}{}_{0.94}Mn_{0.04}Zn_{0.01})(Cr_{0.67}Ti_{0.01}Fe^{3+}{}_{0.31}0)_2O_4$], observed as a brighter zone in a BSE image, than other part of chromite in the same grain. The network -like distribution of the zones clearly indicates fluid infiltration associated with the following exchange reaction of trivalent cations between chromite and the fluid: Cr^{3+} + Al^{3+}(in chromite) = Fe^{3+}(in fluid)

Microdiamond occurs either as polyhedral or as platy crystals, 1 to several μm across. Identification of diamond was carried out with an energy dispersive X-ray spectroscopy (EDS) analysis (carbon peak) and Raman spectroscopy with a He-Ne laser. We observed a broad Raman peak at 1331 cm^{-1}, which is comparable to the peak (1332 cm^{-1}) characteristic of diamond. Graphite peak at about 1600 cm^{-1} is also observed, showing partial graphitization of microdiamond. These lines of evidence shows that the fluid infiltration may have occurred after inclusion of microdiamond.

It is quite astonishing that microdiamond is preserved in such a completely serpentinized ultramafic rock. Chromite can be a good container of microdiamond to prevent graphitization during geologically long duration of exhumation and serpentinization. Our finding suggests the subduction origin of UHP chromitite from NMR rather than mantle migration origin[5] in the case of the Luobusa Ophiolite.

References

1. Nishiyama. T., Shiosaki, D., Eguchi, H., and Yoshiasa, A. JpGU Meeting, S-MP46 (2014);2. Nishiyama, T. Mem. Geol. Soc. Japan 33, 237-257 (1989) ;3. Moribe, Y. unpublished Mc thesis, Kumamoto University (2014);4. Shigeno, M., Mori, Y., Shimada, K., and Nishiyama, T. Eur. J. Mineral., 24, 289-311 (2012);5. Arai, S. J. Mineral. Petrol. Sci., 105, 280-285 (2010)

Keywords: microdiamond, UHP chromitite, subduction zone, Nishisonogi metamorphic rocks, ultrahigh-pressure metamorphic rocks