Carbonaceous matter in constituent minerals from the Horoman Peridotite Complex, Hokkaido, NE Japan

Yoshihiro Sawada[1]; Yoshikazu Sampei[1]; Yukinobu Sakaguchi[2]; koji Seto[3]; Kiyoaki Niida[4]

[1] Geoscience, Shimane Univ; [2] Dept. Geosci., Shimane Univ; [3] ReCCLE, Shimane Univ.; [4] Earth and Planetary Sci., Hokkaido Univ

http://www.shimane-u.ac.jp

Voluminous carbonaceous matter derived from subducted slab is supplied to the mantle wedge, however, the characteristics of such carbonaceous matter is not so clear. Olivine (Ol), orthopyroxene (Opx), clinopyroxene (Cpx) porphyroclasts, and plagioclase (Pl) were separated from plagioclase lherzolite (Pl-Lz), spinel lherzolite (Sp-Lz) and harzburgite (Hz) of the lower zone of the Horoman Peridotite Complex for Pyrolysis-GC/MS and stable carbon isotope analysis. The results are:

1. Pyrolysis-GC/MS

1-1) Aromatic oxygen compounds were detected in bulk rock Sp-Lz and Pl-Lz samples, and in Cpx and Opx from both Sp-Lz and Pl-Lz., but not from Hz. 1-2) Aromatic chlorine compounds were detected in Pl-Lz, Sp-Lz and Hz bulk rocks, but not in the minerals. This suggests that the aromatic chlorine compounds occur on crystal boundaries. 1-3) Aliphatic hydrocarbons such as n-C8-13 alkanes and alkenes were detected in Pl-Lz bulk rock, Cpx, Opx and Ol, and also in Opx from Hz. They were not detected in the bulk rock Sp-Lz and its minerals. 1-4) Based on standardization against the amounts in Ol from Pl-Lz, amounts in Ol from Sp-Lz and Hz are 3-4 times greater, and that in Pl from Pl-Lz is 6 times. Amounts present in Opx from all rock types are 6-9 times. Cpx contains the greatest amounts, at 16-18 times Ol from Pl-Lz.

The above differences suggest:(1) alteration, (2) differences in structure and cleavage/crack-forming process between minerals, or (3) differences in rate of decomposition and escape of organic compounds to fluid phases during recrystallization. We support (3), because (1) is not reasonable from the fact that content in Ol, which is mostly affected by alteration, shows lowest value, (2) is impossible, considering the significant contrasts in relative abundances of the organic compounds in Cpx and Opx, even though the evolution process of cleavage/crack s is the same for both minerals.

2. Stable carbon isotopes

Delta13 C values (per mil) : Pl-Lz: non-carbonate carbon (TOC): bulk rock; -24.4, Ol: -27.7, Cpx: -17.7, Opx: -26.7, carbonate carbon (CC) : bulk rock: -14.6; Sp-Lz: TOC: bulk rock; -23.4, Ol: -23.7, Cpx: -26.0, Opx: -27.7, CC: -6.7; Hz: TOC: bulk rock; -21.2, Ol: -25.7, Opx: -26.7, CC: bulk rock: -5.9.

3. Origin of carbonaceous matter in the peridotite

The origin of carbonaceous matter in Horoman peridotite complex is interpreted thus: (1) The chemical effect of recrystallization in later stage is higher in olivine from Pl-Lz than those from Sp-Lz and Hz. The effect is less in Cpx than in other minerals, i.e., carbonaceous matter in Cpx may remain in a more primitive state. (2) Based on combined Py-GC/MS and stable carbon isotopes analyses, the carbonaceous matter in the minerals was originally derived from sediments (or rocks) of the subducted slab. This suggests that porphyroclasts of Ol, Cpx and Opx formed under mantle wedge conditions, although the source material might be MORB. (3) Stable carbon isotopes suggest that in the Horoman peridotite Complex, carbon derived from organic matter and/or decomposed materials from subducted slab sediments was mixed with original mantle carbon during the mantle wedge stage, indicating that wedge mantle is generally modified by fluids derived from subducted slab.