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

PPS22-P06 Room:Poster Time:May 1 18:15-19:30

Preliminary experiments on the formation process of lingunite in shocked meteorites

KONO, Mari[1*] ; KUBO, Tomoaki[1] ; KATO, Takumi[1] ; KONDO, Tadashi[2]

[1]Kyushu Univ., [2]Osaka Univ.

Albite-rich hollandite (lingunite) has been frequently found in shocked meteorites with other high-pressure minerals (Gillet et al., 2000; Tomioka et al., 2000). According to the laser-heated diamond anvil cell (LHDAC) experiments by Liu (1978), following the decomposition of albite ($NaAlSi_3O_8$) into jadeite ($NaAlSi_2O_6$) plus quartz (SiO_2) at 2-3 GPa, these phases recombine to form lingunite in the range of pressure between 21 and 24 GPa at about 1000 ℃, and then it decomposes again into calcium ferrite-type NaAlSiO4 plus stishovite at pressures above 24 GPa. Similarly, Tutti (2007) observed $NaAlSi_3O_8$ lingunite at 21-23 GPa and 2000 ℃ using LHDAC. In contrast to these LHDAC studies, high-pressure experiments using multi-anvil type (MA) apparatus revealed that the maximum solubility of $NaAlSi_3O_8$ component in hollandite structure is limited to ˜50 mol% at 14-25 GPa and 800-2400 ℃ (Yagi et al., 1994, Liu, 2006). This contradiction has not been solved yet, which makes it difficult to understand the shock conditions for the presence of lingunite in shocked meteorites. Tutti (2007) suggested that the stability of lingunite might be sensitive to temperature and could transform back when quenching rate is slow like MA experiments. However, the formation conditions of lingunite has not been well constrained even by LHDAC experiments.

To investigate the formation process of lingunite, we preliminarily carried out LHDAC experiments using a powder of natural albite as a starting material. The samples were compressed at room temperature, and then heated by the double-sided laser heating method using a Nd:YAG laser. The emission spectra were measured on both side of the heated sample, and used to estimate temperature. Heating duration at the maximum temperature was several minutes. Recovered samples were analyzed by X-ray diffraction method at BL-ARNE7 and BL-ARNE1 of photon factory, KEK. The results obtained suggest that jadeite and stishovite are present at 22 GPa and 1230 ℃. The assemblage changed into calcium ferrite-type structure and stishovite at 25 GPa and 1400 ℃. Hydrous aluminum silicate (phase egg) was also present in both samples probably due to the effect of absorbed water in the powdered stating material. We measured X-ray diffraction patterns at several points in the sample, which showed changes of the ratio of the constituent minerals due to the presence of pressure and temperature gradients, however we did not observe lingunite in any measured points. Although experimental conditions are still rather limited, our preliminary results suggest that the formation condition of lingunite is more than 1400 ℃ at these pressure ranges.

Keywords: lingunite, high pressure, LHDAC, shocked meteorite