Expectation for neutron utilization in magma research

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A new neutron institution (J-PRAC) has been built, and the establishment of a beam line of high pressure materials science is planned. In this talk, we review the recent works of magma researches which have been clarified by in situ X-ray studies and spectroscopic studies, etc., and emphasize the expectation for neutron utilization in magma research.

Water is one of the important volatile elements of the Earth, and the existence has a great influence on magma generation. By the present, the melting temperature and composition of hydrous magma have been clarified, and found the sudden change of composition of the magma generated under hydrous condition at around 3-5GPa and formed ultrabasic magma at higher pressure (e.g., Inoue, 1994 and Kawamoto et al., 2004). The effort has been done to clarify the structure of hydrous magma by in situ X-ray diffraction under high pressure and temperature (c.f. Yamada et al.,2007, and Yamada et al. in this session). However, the detection of hydrogen is not possible in X-ray diffraction, and the neutron scattering experiments are expected to detect the hydrogen.

Furthermore, it has been clarified that immissible liquid of silicate-rich hydrous magma and water-rich fluid disappears under high pressure (e.g. Mibe et al., 2002). This means that it is impossible to define hydrous solidus under high pressure. So it is very important to clarify the pressure at which these phenomena are occurred, in situ X-ray radiography experiment has been conducted under high pressure and temperature (Mibe et al., 2007). However, the contrast of X-ray image between two liquids is not so large, and it is expected to use neutron radiography to enhance the image.

Furthermore, pressure induced structure change of germanate liquid has been observed by XAFS (c.f. Arima et al. in this session), but the usage of neutron give us more detailed complementary information. Furthermore, we would like to talk about the other expectations for neutron utility in magma research.