

高圧下における MgSiO_3 – SiO_2 系の相平衡関係の解明Phase equilibrium relations in MgSiO_3 – SiO_2 system under high pressures*森口 拓弥¹、米田 明¹、伊藤 英司¹*Takuya Moriguti¹, Akira Yoneda¹, Eiji Ito¹

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Melting relations in the MgO – SiO_2 system have been extensively studied since Bowen and Anderson (1914) under atmospheric pressure. Chemical differentiations in the deep magma ocean have been simulated based on the high pressure experimental data (e.g. Kato and Kumazawa, 1985; Ito and Katsura, 1992). Almost all of these works have been carried out on the compositions ranging from MgO to MgSiO_3 , assuming that the bulk mantle composition is peridotitic or close to that derived from CI chondrite. Recently, however, enstatite chondrite (E-chondrite) has been paid attention as the bulk earth source material (Javoy et al., 2010) because the isotope systematics over O, N, Mo, Re, Os, and Cr for the Earth and Moon are nearly identical to those of E-chondrite. In E-chondrite, the silicate composition is characterized by $\text{MgO}/\text{SiO}_2 = \sim 0.5$ (in weight ratio) which is substantially lower than that of the peridotitic mantle (~ 0.85).

In this context, understanding of melting relations over compositions between SiO_2 and MgSiO_3 is indispensable to clarify the mantle fractionation. It also relates to investigations of chemical compositions of the crust at early stage of the Earth. However, there have been very limited works on the effect of pressure in the MgSiO_3 – SiO_2 system. In addition, available information regarding phase relations in the system is so far limited to 5 GPa (Dalton and Presnall, 1997). In this study, therefore, we would determine the melting relations at pressures 5 to 20 GPa, focusing on the compositions of MgO – $x\text{SiO}_2$ ($x = 0.8$ to 1.2), covering silicate compositions of E-chondrite.

References

- Bowen and Anderson (1914) The binary system MgO – SiO_2 . *Am. J. Sci. 4th ser.* 37, 487-500.
Dalton and Presnall (1997) No liquid immiscibility in the system MgSiO_3 – SiO_2 at 5.0 GPa. *Geochim. Cosmochim. Acta* 61, 2367-2373.
Ito and Katsura (1992) Melting of ferromagnesian silicates under the lower mantle conditions. *Am. Geophys. Union Monogr.* 67, 315-322.
Javoy et al. (2010) The chemical composition of the Earth: Enstatite chondrite models. *Earth Planet. Sci. Lett.* 293, 259-268.
Kato and Kumazawa (1985) Garnet phase of MgSiO_3 filling the pyroxene-ilmenite gap at very high temperature. *Nature* 316, 803-805.

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