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衝撃を受けた火星隕石 DaG 735 でのオリビンからシリケイトペロブスカイトとマグネシオブスタイトへの分解
Dissociation of olivine to silicate-perovskite and magesiowustite in the shocked Martian meteorite DaG 735

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Equilibrium high-pressure and -temperature experiments indicate that olivine dissociates to (Mg,Fe)SiO_3-perovskite (Pv) + magnesiowustite (Mw) around and below the transition zone of the Earth. The dissociation of olivine has never been reported from any natural samples so far. Therefore, the dissociation mechanism of olivine in natural samples may be unclear. We report first evidence for the natural dissociation of olivine in the shergottite Dar al Gani (DaG) 735 at high-pressure and -temperature condition induced by a dynamic event on Mars. Olivine (Fa_{34-41}) adjacent to or entrained in the shock vein and melt pockets of Martian meteorite, olivine-phyric shergottite Dar al Gani 735 dissociated to (Mg,Fe)SiO_3-perovskite (Pv) + magnesiowustite (Mw), whereby perovskite partially vitrified during decompression. Transmission electron microscopy (TEM) observations reveal that micro-texture of olivine dissociation products evolve from lamellar to equigranular with increasing temperature at the same pressure conditions. This is in accord with the observations of synthetic samples recovered from high-pressure and temperature experiments leading to equigranular (Mg,Fe)SiO_3-Pv and Mw have 50-100 nm in thickness and lamellar (Mg,Fe)SiO_3-Pv and Mw have ~20 and ~10 nm in diameter, respectively. The measured partitioning coefficient, $K^{Pv/Mw}$ = $[FeO/MgO]_{Pv}/[FeO/MgO]_{Mw}$, between (Mg,Fe)$SiO_3$-Pv and Mw in equigranular and lamellar textures are ~0.15 and ~0.78, respectively. The dissociation of olivine implies that the pressure and temperature conditions recorded in the shock vein and melt pockets during the dynamic event were ~25 GPa but 700 degree at least.

キーワード: オリビン, 分解, シリケイトペロブスカイト, マグネシオブスタイト, TEM, FIB
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