MELTING AND SUBSEQUENT DECOMPRESSION PROCESSES RECORDED IN A SHOCK VEIN OF AN L6 CHONDRITE

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Introduction: High-pressure polymorphs of olivine, pyroxene and feldspar exist in a shock vein induced by a dynamic event. Several previous studies proposed that some high-pressure polymorphs were formed from chondritic or olivine melts [1,2] although the direct evidences for melting during the dynamic event have not been reported. The assemblages of high-pressure polymorphs in the shock veins are identical to those of synthetic equilibrated samples recovered from static high-pressure and -temperature experiments using Allende meteorite and KLB-1 peridotite [3,4]. Conversely, here we report clear evidences for rapidly grown olivine and disequilibrium phase assemblage in a shock vein of Yamato 791384 (hereafter, Y-791384) L6 chondrite.

Results and discussion: Major mineral constituents of a chondritic host-rock of Y-791384 are olivine ($Fa_{24\text{-}25}$), low-Ca pyroxene, albitic feldspar, troilite and metallic Fe-Ni. A shock vein with a width of 300-500 µm exists in the chondrite host-rock. The shock vein consists mainly of a matrix and a few coarse-grained low-Ca pyroxene, olivine and albitic feldspar (now jadeite) fragments. The matrix includes rapidly grown feather-shaped olivine, glassy material, magnesiowüstite, metallic Fe-Ni, troilite and minor majorite. We observed the matrix including feather-shaped olivine by TEM. The average chemical composition of the feather-shaped olivine is Fa_{16}, which is depleted in a fayalite component compared with the original olivine ($Fa_{24\text{-}25}$) in the chondritic host-rock. Silica-rich glass-like materials exist around the olivine. Most feather-shaped olivine crystals were observed on the surface of magnesiowüstite, majorite and metallic Fe-Ni. Most grains of majorite show corrosion textures. Some magnesiowüstite grains show dendrite-like textures.

The occurrence of feather-shaped olivine in the shock vein is the clearest evidence for rapidly grown olivine from melt related to a shock event in nature. The shock vein would be heated beyond the liquidus of the L6 chondrite by the shock event. Magnesiowüstite was crystallized from the chondritic melts first. Subsequently, majorite was formed from the melt. The feather-shaped olivine nucleates on the magnesiowüstite and majorite.

Shock veins previously studied have achieved equilibrium condition, which allow us to estimate shock pressure condition [3,4]. However, the coexistence of feather-shaped olivine and magnesiowüstite in the matrix parts of present shock vein invalidates the estimation because they cannot coexist at equilibrium condition [5]. The part of shock vein studied here did not achieve equilibrium completely because of short duration of high-pressure and –temperature condition. Alternatively, the shock vein would record decompression stage. Cooling histories recorded in shock veins of meteorites would have varieties, which will allow us to understand P-T-t history during a dynamic event.

References: [1] Miyahara M. et al., 2008, *Proceedings of the National Academy of Sciences* **105**:8542–8547. [2] Miyahara M. et al., 2009. *Physics of the Earth and Planetary Interior* **177**:116–121. [3] Ohtani E. et al., 2004, *Earth and Planetary Science Letters* **227**:505-515. [4] Chen M. et al., 1998, Science **271**:1570-1573. [5] Agee C.B. et al., 1995, *Journal of Geophysical Research* **100**:17725-17740.