Shock processes of the vein and host in an L6 chondrite, NWA 8612

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Meteorites commonly preserve the evidence for planetesimal collisions. Especially, shock veins in meteorites formed through such process. High-pressure polymorphs of silicate, oxide, and phosphate minerals have been abundantly reported in veins and melt pockets of many chondrites and differentiated meteorites. Such minerals provide a key to evaluate the physical conditions for the formation of veins. On the other hand, much is unknown about the thermal history of the host lithology in meteorites during shock processes.

Here we present our results on the vein and host in a newly classified NWA 8612 chondrite (L6), and discuss the thermal histories of both lithologies.

NWA 8612 contains a thick shock vein. We identified ringwoodite, wadslyeite, majorite, majorite-pyrope garnet, jadeite, lingunite, tuite, and xieite, from this vein by a laser micro Raman spectroscopy. Pyroxene glass transformed from bridgmanite is also encountered. The mineral assemblage reflects the temperature and pressure condition, ~23 GPa and ~2000 °C.

On the other hand, the host of NWA 8612 shows texture and mineral assemblage typical of type 6 chondrites. However, maskelynite is commonly encountered, and the abundance decreases with increasing the distance from the vein. This suggests that the pressure decreases with increasing the distance.

The host contains Fe-Ni metal and troilite, like those in the other L6. However, some metal grains show plessitic texture. Some opaque mineral assemblages consist of metal and troilite, and show fizzed texture, fine-grained mixture of these phases. Such texture indicates that these assemblages were heated more than the eutectic temperature, 988 °C, and cooled rapidly. On the other hand, the host silicate phases never show any partial melting textures, indicative of lower temperature condition than the silicate solidus temperature, ~1100 °C. Therefore, the host was subjected to much lower temperature and pressure condition than the vein. Thus, the high-pressure shock processes took place only in local areas in meteorites.

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