SHOCK METAMORPHISM OF THE NEW BASALTIC LUNAR METEORITE NORTHWEST AFRICA 12008.

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Introduction: Basaltic lunar meteorites are usually used to constrain the composition of the lunar mantle and the magmatic history of the Moon. In the meteorite collection, only 11 basaltic lunar meteorites have been recovered up to date. Northwest Africa (NWA) 12008 is the latest basaltic lunar meteorite. Previous investigations suggested that NWA 12008 is unique and not paired with other basaltic lunar meteorites [1,2]. Shock metamorphism is an important dynamic process that may affect the interpretation of geochronological data. Therefore, we studied the shock-induced feature in NWA 12008 to constrain its shock metamorphism.

Results: A polished section of NWA 12008 is used in this study. It shows an ophitic texture with minor phenocrysts of olivine and pyroxene. Plagioclase occurs as elongated laths with interstitial regions mainly filled by fine-grained pyroxene. Almost all plagioclase grains have transformed into glass, probably maskelynite. In olivine and pyroxene phenocrysts, irregular fractures are common. However, parallel fractures, which are perpendicular to the **c** axis of pyroxene, are common in relatively fine pyroxene grains. In olivine phenocrysts, radiating fractures surrounding melt inclusions are observed. A few thin shock melt veins (<20 μm in width) are observed in our sample. The shock melt veins are composed mainly of tiny Al-rich pyroxene grains (<1 μm in size). Aggregates of stishovite and silica glass (up to 13 μm in size) and pyroxene fragments with a smooth outline are also observed in the shock melt veins. The presence of stishovite is confirmed by its EBSD pattern. No high-pressure polymorphs were observed for olivine and pyroxene grains that are directly adjacent to the shock melt veins.

Discussion: High-pressure minerals are important clues to constrain the shock pressure. In this study, stishovite is such a mineral to constrain the lower limit of shock pressure. Based on the phase diagram of SiO_2 [3], stishovite is stable at a pressure of >8 GPa. This indicates that the shock pressure NWA 12008 has experienced is at least 8 GPa. Based on a recent study of [4], the complete transformation from plagioclase to maskelynite suggests that the sample experienced a shock pressure of at least 24 GPa. This inferred pressure is much higher than the pressure that was expected for the transformation (>15 GPa) from olivine to ringwoodite. However, ringwoodite was absent in this study. This might suggest a very short shock duration. This inference is consistent with the scale of the widths of shock melt veins in NWA 12008. Based on the typical width of the shock melt veins, the shock duration might be very short (<0.1 ms, [5]). Such a short duration can also account fo the absence of coesite in NWA 12008. In shocked eucrites with similar shock degree but relatively long shock durations, coesite is present as a rim surrounding stishovite+silica glass aggregates [6,7]. In summary, NWA 12008 has experienced a shock metamorphism up to 24 GPa with a short shock duration.

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