Maskelynite in Zagami Martian meteorite: Comparison with experimentally shocked plagioclase

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Maskelynite is a glass found in heavily shocked meteorites and having a plagioclase composition. Maskelynite has been thought to be a diaplectic glass, which transformed from plagioclase without fusion. Recently, Chen and El Goresy (2000) suggested that maskelynite is a glass formed by melting of plagioclase at high pressures. In this study, maskelynite in Zagami Martian meteorite was analyzed together with a melted plagioclase at ambient pressure and experimentally shocked ones.

Melted plagioclase at ambient pressure was obtained by heating for 45 minutes at 1450 C. Shock-recovery experiments of plagioclase were performed by Yamaguchi and Sekine (2000) at 29.4, 35.5, 42.0 and 52.8 GPa by using a single stage 30 mm bore propellent gun at National Institute for Research in Inorganic Materials. Chemical compositions of glasses in polished thin sections were analyzed by EPMA operated at 15 Kv, 8 nA and with a 10 micron-meter beam diameter. Grains of 100-150 micron-meter in size were directly take out of polished thin sections and mounted on glass fibers of 3 micron-meter in diameter for X-ray analysis with a 114 mm-diameter Gandolfi camera. A rotating anode X-ray generator with a Cr-anode, 0.2 x 2 mm fine filament, and V-filter was used as the X-ray source.

Chemical compositions of maskelynite in Zagami and of experimentally shocked plagioclase were shown in Figs. 1 and 2, respectively. As shown in Fig. 1, Ab-component in maskelynite vary in the range of about 5 %. Ab-component of experimentally shocked plagioclase decreases with the increase of shock-pressure, whereas the melted plagioclase at ambient pressure shows a very similar chemical composition to plagioclase before melting.

Fig. 3 shows peak-positions and FWHMs of X-ray diffraction of glasses analyzed in this study. Maskelynite and glasses transformed from plagioclase by shock show X-ray diffractions of which peak-positions shift toward high-angle side compared to the melted plagioclase at ambient pressure. The shift of a peak-position of X-ray diffraction reveals that mean interatomic distance is a little shorter in maskelynite and glasses transformed by shock than the melted plagioclase and that they have a dense structure.

References: Chen, M and El Goresy, A. (2000) EPSL 179, 489-502. Yamaguchi, A. and Sekine, T. (2000) EPSL 175, 289-296.

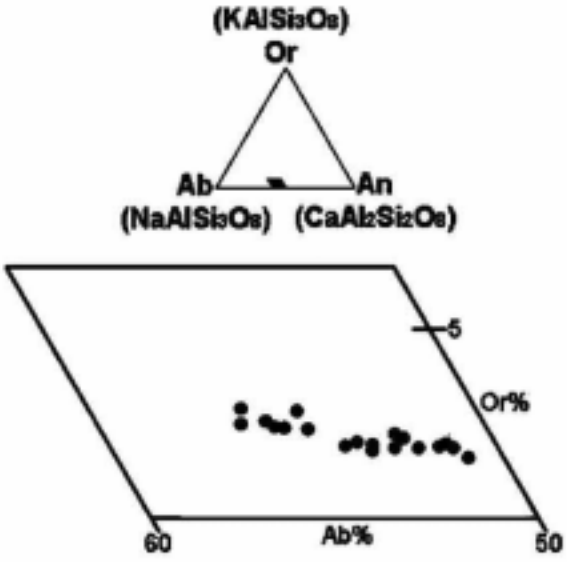


Fig. 1 Chemical composition of maskelynite.

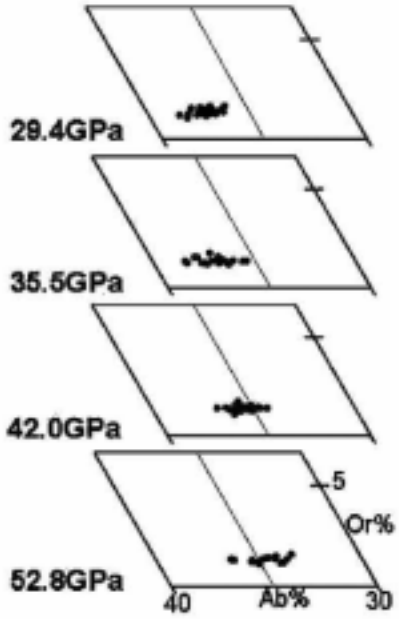
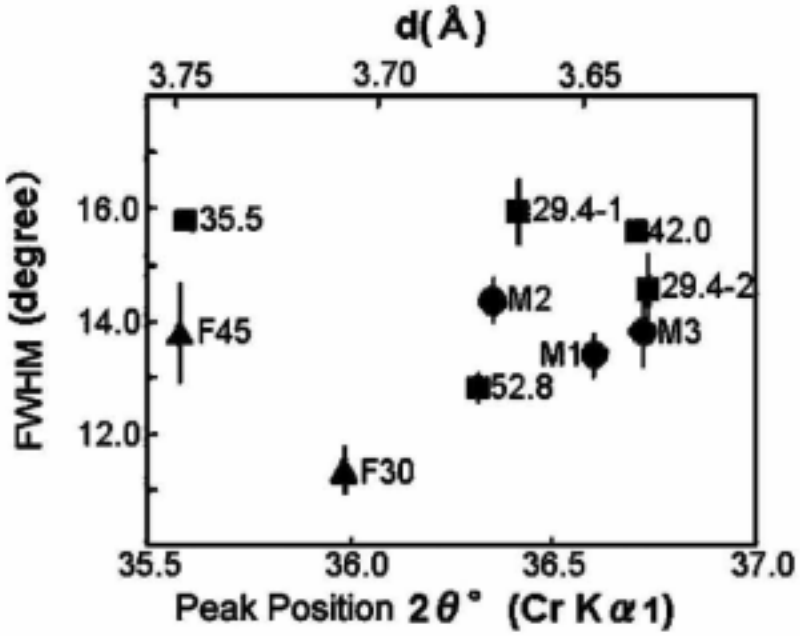


Fig. 2 Chemical composition of shocked plagioclase.



▲: Melted plagioclase ■: Shocked Plagioclase
●: Maskelynite in Zagami

Fig. 3 Peak position and FWHM of glass.