Cathodoluminescence and laser probe 40Ar/39Ar dating of a shocked ordinary chondrite

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Y-75097 is a L6 ordinary chondrite. Due to a shock event, shock veins and maskelynites have been formed. Maskelynite is a shocked product, a glass of plagioclase composition. We applied the Cathodoluminescence(CL) method to the shocked chondrite Y-75097 to investigate the trace element distribution and lattice defects due to the shock. We also applied laser probe 40Ar/39Ar dating to a thin section of Y-75097 to study shock effect to constrain the timing of the shock event.

CL and EPMA study of the shock vein and maskelynites revealed that the shock vein consists of feldspar relatively rich in Ca, and has a very small quantity of Fe. The shock vein shows red CL. Plagioclases around the shock vein were partly replaced by maskelynites. Plagioclases gradually change their CL color depending on the distance (mm scale) from the shock vein.

Laser step heating and laser probe 40Ar/39Ar analyses revealed several features of Y-75097. In both step heating and laser probe experiments, large releases of 40Ar gas were found, but they are not the majority. They are probably formed as bubbles during the shock event. Little 40Ar releases often correlate with large uncertainties of 36Ar and 39Ar, resulting in unreliable data sets. Inverse isochron plot yields that initial ratio of 40Ar/36Ar is about 170, and the calculated age is 300-400 Ma. This initial ratio suggests that it was reset during the shock event. Furthermore, younger ages are observed from areas apart from the shock vein. This implies that the initial ratio of 40Ar/36Ar were not 170, but much smaller in the surrounding areas, suggesting a strong heterogeneity of argon isotope distribution.