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The change of texture of olivine and plagioclase by the shock process in troctolite

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The collision phenomena are important for understanding evolution of planets, their surfaces. Although there are a lot of experimental studies on plagioclase and olivine, two constituent minerals of an ordinary meteorite, we need to know the shock wave effects on these minerals more detailed. We conducted shock experiments on a troctolite using a single stage propellant gun at NIMS in Tsukuba. At peak preasures of 10 GPa, 20 GPa, 30 GPa, 45.5 GPa and 58.3 GPa. The recovered samples are investigated by SEM, EPMA, XRD and the cathode luminescence method (CL method). In samples recovered at 10 GPa and 20 GPa, the intense cracks were observed. Above 30 GPa, however, the polished surface of plagioclase became, indicating that it transformed into glass. At 45.5 GPa and 58.3 GPa, the textures indicated partial melting. From XRD analyses, we found that the diffraction peaks of plagioclase decreased greatly at 30 GPa and most plagioclases changed amorphous. The CL emission intensity decrease. There are three peaks centered at about 330 nm, 400 nm and 550 nm for the initial plagioclase. In the 30 GPa sample, two peaks centered at ~ 330 nm and 380 nm. The EPMA analyese indicates no compositional change but a slight deviation from the total of 100 %.

On the other hand, the irregular cracks were observed in olivines recovered samples from 10 GPa, 20 GPa, 30 GPa and 45.5 GPa. At 58.4GPa, however, cracks were not observed, suggesting that olivine became soften.

During analysis by EPMA, amphiboles were found in all samples except the sample at 20 GPa, and calcite left at 58.4 GPa. On the other hand, clay minerals disappeared above 45.5 GPa. We keep detailed study further.

Keywords: troctolite, shock pressure, shock experiment, olivine, plagioclase