Shock events in the early solar system recorded in L6-chondrites: pressure-temperature conditions and its timing

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Impact events are the fundamental process of planetary formation. Shocked meteorites have recorded impacts events occurred in the solar system. Therefore, examination of these meteorites is useful to understand the impact phenomena and processes of the planetary formation.In this study, we investigated mineralogy of shock melt veins in two L6 chondrites (Sahara 98222 and Yamato 74445) and estimated the P-T conditions during their impact events.

We studied thin sections of Sahara 98222 and Yamato 74445 containing shock melt veins. The mineralogical features and the texture of these meteorites were investigated by an optical microscope with transmitted and reflected lights and a scanning electron microscope. Mineral phases in and around the shock melt veins were identified by using a micro-Raman spectrometer. Chemical compositions of minerals were analyzed by the SEM equipped with an Energy Dispersive X-ray Spectrometer (EDS) and a Electron Probe Micro Analyzer with a Wavelength-Dispersive X-ray Spectrometer (WDS) at Tohoku University.

We found that the shock melt veins of these meteorites contain several high-pressure minerals (wadsleyite, jadeite and tuite for Sahara 98222 and wadsleyite, ringwoodite and akimotoite for Yamato 74445). Based on the mineralogy existing in the shock veins; we estimated the pressure and temperature conditions of these meteorites experienced during their impact events: 13-15 GPa, 2000-2200 degrees C for Sahara 98222 and 15-24 GPa, 2200-2400 degrees C for Yamato 74445, respectively.

Recently, we also performed a U-Pb dating of phosphates in and around the shock melt vein of Sahara 98222 using a Sensitive High Resolution Ion MicroProbe (SHRIMP) to clarify when these shock events occurred. Sahara 98222 contains apatite and whitlockite as phosphate minerals and we choose about ten phosphate grains in and around the shock melt vein.The sizes of them ranges from about ten to several hundreds micrometers and whitlockite in the shock melt vein is transformed to a high-pressure phase, tuite. In this meeting, we will present also preliminary results of the U-Pb dating measurements.