Earth & Planetary Science

From the solar system to Earth's interior, SPring-8 research covers various experimental techniques. The present issue selected four topics. The first topic, "Composition, mineralogy and three-dimensional structures of particles derived from short period comet Wild II" by Tomoaki Nakamura is the research using X-ray fluorescence and diffraction analysis as well as microtomography of precious samples brought to Earth by the "STARDUST" project during NASA's comet sample return mission. Many scientists are involved in this project and the present result is one of the most important ones. They have found a wide range of compositions and structures in the comet Wild II particles that were collected and brought to Earth by NASA's Stardust spacecraft. The present findings suggested the existence of high temperature events in the early solar system, which can make us say "Stardust Findings Suggest Comets More Complex Than Thought."

The other three topics are related to the structure and physical properties of deep Earth materials. The X-ray absorption experiment under high pressure using a single crystal diamond capsule was carried out for "Anomalous compression of basaltic magma: implications for pressure-induced structural change in silicate melt" by Satoru Urakawa *et al*. The migration of silicate melt in the mantle is controlled by a density relationship with the surrounding solids. This study demonstrates the compressibility changes brought about by structural change in the melt under high pressure. For the structure-property research on large-volume samples at high pressure, the elaborate work, "High-pressure generation to simulate the earth's deep interior" by Tange *et al*., was carried out using the large-volume press. They succeeded in generating an extremely high pressure exceeding 70 GPa using the multi-anvil apparatus with sintered diamond cubes. One of the most powerful tools for a high-pressure and high-temperature X-ray diffraction experiment is the laser-heated diamond-anvil cell (LHDAC). The research, "Post-perovskite phase transition in Earth's deep mantle" by Kei Hirose accurately determined the $MgSiO_3$ post-perovskite phase transition boundary using multiple pressure standards. The result shall provide a more accurate understanding of the origin of the seismic boundary near the bottom of the mantle. Earth & Planetary Sciences are endless sources of interest for SPring-8.

Masaki Takata