Earth & Planetary Science

High-pressure and high-temperature *in-situ* X-ray observation using synchrotron radiation has become an indispensable technique for Earth and planetary sciences. Pressure and temperature conditions available in the laboratory using a laser-heated diamond anvil have been extended considerably at SPring-8 and have reached to the condition corresponding to the center of the Earth. The first paper by Kuwayama *et al.* is a work of this category and is no doubt frontier research in this field. One of the unique features of SPring-8 is that there are many multi-anvil type high-pressure and high-temperature apparatus combined with synchrotron radiation. Although the pressure range attainable by this type of apparatus is limited compared with that attainable by a diamond anvil, many unique studies have been carried out using the merit of a much larger sample space available in multi-anvil apparatus. Higo *et al.*'s work provides direct information on the elastic wave velocity of minerals in the Earth's deep interior. Many arguments can be made on the mantle structure by comparing these data with the results obtained from seismic observations. The kinetics of the phase transformation of silicates are an important factor for the discussions of dynamics in the Earth, and Kubo *et al.* have succeeded in obtaining high-quality data in this field. Molten silicates play very important roles in many processes in the Earth, but because of technical difficulties, only very limited knowledge of its physical properties has been so far obtained. Urakawa *et al.* have succeeded in developing a new technique for determining the density of silicate melts under mantle conditions. This will provide fruitful information on the evolution and dynamics of magma in the mantle. These four papers provide new frontier research information in the fields of Earth and Planetary Science.

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