A new rotary-shear hydrothermal apparatus towards the reproduction of earthquake faulting beneath the internal ocean of Enceladus

*Takehiro Hirose[1], Takazo Shibuya[2]

1. Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology, 2. JAMSTEC

Sodium-rich-ice grains erupting from the Saturnian moon Enceladus suggest the presence of hydrothermal activity in Enceladus' ocean. Knowledge of water chemistry of the interior ocean is crucial for exploring planetary habitability and life, in particularly based on metabolic theory. Water-rock reactions which define this water chemistry include two different processes; one is static chemical reaction over geological timescale, and another is dynamic chemical reaction associated with frictional heating along a fault (similar to earthquake in the Earth) induced by tidal force between Enceladus and Saturn or neighboring satellites. In this study we focus on the later short-time period reaction by experimentally reproducing faulting processes that are expected to occur in the interior of Enceladus by the tidal force. The aim of the experimental study is to evaluate quantitatively how the disequilibrium water-rock reactions during faulting affect the water chemistry of the interior ocean.

The rotary-shear hydrothermal apparatus installed at Kochi/JAMSTEC is capable of producing slip rate of 10 nm/s –1 m/s, normal stress of 350 MPa, fluid pressure of 120 MPa and temperature of <500oC, which can thus reproduce faulting processes in the interior of Enceladus. In the poster, we will present the outline of the apparatus and the scope of the reserch.

Keywords: water-rock reaction, earthquake, Enceladus

