The sample return from the Jupitar Trojan D/P type asteroid.

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Analyses of returned samples from Moon (e.g., New views of the MOON, 2006), asteroid (e.g., Nakamura et al., 2011) and comet (e.g., Brownlee et al., 2006) were essential to understand their origin and nature as well as increasing our knowledge about the Solar System. The most recent returned sample was from the S-type asteroid Itokawa by Hayabusa mission in 2010. The results by series of analyses provided new insights for the connection to meteorite researches, space weathering processes, small asteroidal body formation in the Solar System (e.g., Nakamura et al., 2011; Yurimoto et al., 2011). JAXA Hayabusa 2 and NASA Osiris-REx are both current sample return missions from the organic-rich asteroids, Ryugu (C-type) and Bennu (B-type), respectively (Tachibana et al., 2014; Lauretta et al., 2014). Both missions have complementary scientific goals that are to understand the Solar System evolution in the point of view of organics, water and associated minerals. We, therefore, are working on the possibility of the sample return from Trojan asteroid that is expected to contain primordial chemical information at the very beginning of Solar System formation.

D/P-type Jupiter Trojan asteroids likely consist of dominant of organics (carbonaceous materials) and anhydrous silicates (hydrated silicates cannot be excluded), possibly with water (ice) in its interiors (Guilbert- Lepoutre, 2014). Beside in-situ HRMS analysis of isotopic ratios, elements and molecules in surface and subsurface samples on the Trojan asteroid, analysis of returned samples containing non-volatile materials (organics and minerals) as well as water (ice) will open a new insight of the detailed scientific objectives for the Solar System evolution. Since, in-situ analysis is limited in terms of sample preparations, lack of relationship among components, and mineralogical/petrological contexts, the state-of-the-art microanalysis techniques on the Earth will provide these additional information such as isotopic ratios of individual component (organics and associated minerals), trace amount of gaseous spiecies (e.g., Noble gases, CO, CO2, NH3, CH4 gasses in the ice), and organic compounds that are hard to be detected under the current in-situ HRMS system (e.g., amino acids).

The details of the sample return capsule are not yet fixed but a cryo-system is highly encouraged. Thus, we will receive “extraterrestrial ice (water)” that has a pristine water at the Solar System which contains the information of nebular gas, formation of ice, reservoir of volatiles (water and organics), and the origin of the Earth’s water.

In this talk, we will present the possibility of sample return from the Trojan asteroid by the Solar Power Sail mission.

Keywords: Jupitar Trojan Asteroid, Sample Return

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