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Present status of a consortium study of a NaCl bearing Itokawa particle

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Hayabusa spacecraft returned samples from S-type Near-Earth Asteroid (NEA) Itokawa in June 2010. After the return, Extraterrestrial Sample Curation Team (ESCuTe) of JAXA have recovered particles from a sample catcher of Hayabusa, and more than 400 particles initially described have been presented in public (Yada et al., 2014). Among them, some types of particles having rare features are assigned to consortium studies, because they are supposed to be applied by multiple proposals so that they could not be distributed. Members of the ESCuTe would lead consortium studies to ask for research plans from worldwide researchers, discuss a research flow for the particles with the researchers to maximize their scientific gain, and push the plan forward.

One of the consortium studies is for a silicate particle bearing NaCl. The sample ID RA-QD02-0129 is 40 micron in size, mainly composed of silicate similar to plagioclase in chemical composition, and have euhedral NaCl particles of 3-5 micron in size on its surface. This is the only silicate particle bearing NaCl among those initially described so far.

In planetary material samples, NaCl is very rare and unique component. It has been discovered only in Monahan and Zag H chondrites among all ordinary chondrites so far. Trace of extinct 129I was discovered in the NaCl in the meteorites, which means that it should have formed in their parent body(ies), H chondrite or other, in the early solar system and involved in the meteorites in some processes afterward (Zolensky et al., 1999; Whitby et al., 2000). The formation of NaCl should be linked with water in their parent bodies, so it could provide important information about the origin of its parent body. Additionally, water and salt should be closely linked with organic material revolution and might provide interesting suggestion for the origin of life.

One of the most important purposes of this consortium is to prove extraterrestrial origin of the particle (silicate) and NaCl. And next step is to clarify whether its parent body would be Itokawa and/or LL chondrite parent body or other ones. What can prove the extraterrestrial origin of the NaCl is (1) discovery of solar flare tracks in the NaCl, (2) detection of solar wind He on its surface, (3) presence of space weathering layer on its surface. Transmitted electron microscope (TEM) observation for ultrathin section of the NaCl made by focused ion beam (FIB) system will be necessary for (1) and (3), and a laser ionization mass spectrometer is necessary for (2). In the research plan so far, terrestrial NaCl with instrumentally implanted He and NaCl in Monahan meteorite will be prepared for the rehearsal analyses to establish analytical techniques and then we will try the real particle.

References:
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