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X-ray diffraction analysis of Hayabusa-returned samples

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Hayabusa spacecraft successfully captured dust particles on the Muses C Regio of asteroid 24153 Itokawa. Hayabusa touchdowned Itokawa twice and the particles at the first touchdown site were stored in the room B of the sample catcher and those at the second touchdown site were stored in the room A. Room-A particles were investigated first in early 2011 (Nakamura et al. 2011) and room-B particles were analyzed later. In this report, we describe the results of mineralogical analysis of room-B particles.

We used Synchrotron X-ray diffraction method at photon factory beamline 3A and at Spring-8 beamline 39XU by applying ultra-high inteisity of X-ray to identify crystals species in the Itokawa dust particles. Unfortunately the particles are very small, but we have to draw maximum information from the particles. For this purpose, synchrotron radiation X-ray is the most powerful tool, because it enables us to identify crystal species in such a small partilce without any destructive treatment. We can perform a variety of destructive analyses, as shown later, after non-destructive X-ray analysis.

Synchrotron-radiation X-ray diffraction analysis indicates that mineralogy of the room-A dust particles is identical to most primitive solar system materials, chondrites, and dissimilar to terrestrial rocks (Nakamura et al. 2011). The analysis of individual particles indicates that most abundant mineral is highly crystalline olivine and next abundant minerals are low- and high-Ca pyroxene. Plagioclase is also abundant, but crystallinity differs between particles. Plagioclase crystallization temperatures based on triclinicity are obtained to be 600 - 800 °C (Nakamura et al. 2011). Room-B particles have mineralogies and mineral chemistries similar to those of room-A particles (Figs. 1 and 2). The similarity suggests that Muses-C regio has relatively homogeneous mineralogy that represent average mineral signatures of asteroid Itokawa.

Acknowledgement

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References

[1] T. Nakamura *et al*., Science **333** (2011) 1113-1116.

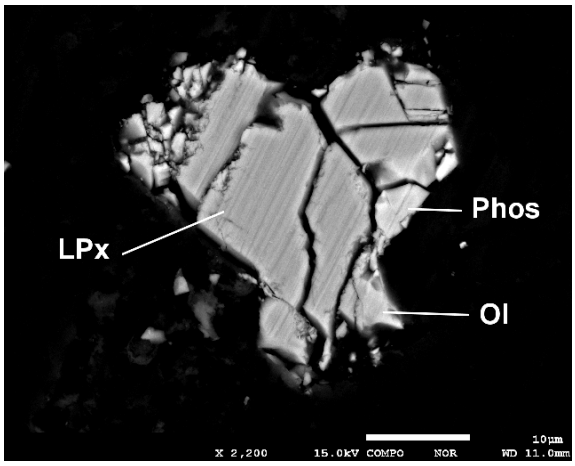

Fig. 1: Back-scattered electron image of room-B particle RB-QD04-0025, consisting of low-Ca pyroxene "LPx", phosphate merrillite "Phos", and olivine "Ol"..

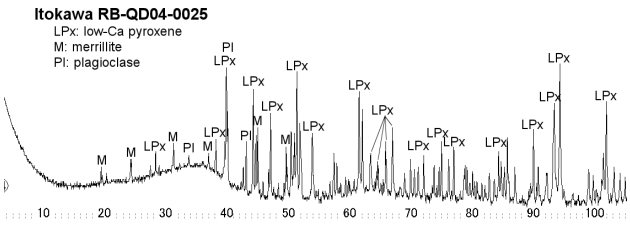

Fig.2: A diffraction pattern of RB-QD04-0025.

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