

The observation of shock textures in fragments of Kilabo, LL6 ordinary chondrites

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The Hayabusa space-craft reached S-type asteroid 25143 Itokawa in 2005 [1]. As a result of observations of telescope and a series of remote sensing researches, it is estimated that Itokawa has compositions similar to L or LL5 to 6 ordinary chondrites [2,3,4]. Then Hayabusa could have retrieved samples of Itokawa back to the Earth from the asteroid surface called MUSES-Sea Regio in 2010. Initial analyses showed that those samples collected by Hayabusa correspond to LL4 to 6 ordinary chondrites because analyses data of mineralogy, chemical compositions and oxygen isotopic ratios are consistent with LL4 to 6 chondrites [5,6,7,8,9,10].

The size of Itokawa samples analyzed by initial analysis is mainly as small as a few tens of micrometers. Sample size has problems because it is difficult for us to understand which processes and which parts of host rocks did micrometer sized samples come from on the surface of Itokawa. Therefore it is also difficult to extend their mineralogy and textures to those of larger scale.

On the other hand, many meteorites fallen to the Earth have been analyzed although their parent bodies are unknown other than the Moon and the Mars. But analyses of meteorites have not focused on micrometer sized samples so far. To study micrometer sized samples of meteorites in detail is important for extending their tiny samples to understanding of larger scale information about Itokawa samples. Furthermore, we may get new knowledge about meteorites from analyses of micrometer samples.

In this study, using the LL6 ordinary chondrite named Kilabo, we focused on shock textures in micrometer sized grains of Kilabo. Shock textures are generally observed in ordinary chondrites and caused by impact on the surface of asteroid [11]. As a result of initial analyses, Itokawa is supposed to be accumulated fragments of bigger parent body crushed by impact [5] and shapes of returned samples are also seems to be affected by impact [9]. This study observed shock textures in micrometer and millimeter samples of meteorites and compared both of them.

The results of the comparison showed that planar fractures, which typically observed in olivine and feldspar as shock textures, were found in real micrometer samples at 54% while they are found in millimeter samples at only 39%. In contrast, few micrometer samples have a melt texture caused by impact while Kilabo was reported that it has many shock veins by previous study [12].

These results suggest that micrometer grains broken from bigger chondritic materials are selective in specific textures in host materials. It is possible that these specific textures are also present in surface materials of Itokawa and also affect to brecciations on asteroid surface. Therefore micrometer samples made by brecciations may not be reflected mineralogy and textures of host rock because some shock textures occur in specific minerals.

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