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Exploring hydrated minerals on asteroids with ground-based observatories and space-borne telescope

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The knowledge of hydrated minerals among asteroids is important for understanding a wide range of solar system formation, evolutionary processes, and thermal history. Formation of hydrated minerals occurs in environments where anhydrous rock and water are together. The distribution of hydrated minerals in the main belt region is a clue to solve the questions of the homogeneity of the solar nebula, the existence of heat sources, and how much mixing of planetesimals occurred. The presence of hydrated minerals indicates that conditions in the past were more conducive to the presence of liquid water on small bodies.

Many asteroids are known to exhibit a broad absorption feature in the 3 micron band due to hydrated minerals, water ice, and organics. Spectral range between 2.5 and 2.85 micron contains a strong absorption band of typical hydrated minerals. However, this spectral range is largely obscured by the terrestrial atmosphere and we need space-borne telescopes to observe these features in detail. The Infrared Camera (IRC) onboard the AKARI infrared satellite has a spectroscopic capability in the near-infrared (between 2 and 5 micron) with a high sensitivity. We observed 70 asteroids with the IRC, carried out in its warm mission phase. From these observations, wide variety of the absorption feature of hydrated minerals on asteroids has been obtained. Especially, the peak region of the absorption around 2.7 and 2.8 micron has been clearly observed in asteroid spectra for the first time with AKARI. This distinctive spectral shape is considered as the evidence for hydrated minerals, and their detailed features vary among asteroids depending on the origin of the associated hydrated minerals.

In this talk, we report the observations of search for hydrated minerals on asteroids in the 3 micron band with AKARI/IRC and other ground-based observatories, and discuss the distribution of hydrated minerals in the main belt regions.

Keywords: asteroids, hydrated minerals, near-infrared spectroscopy