FINE DUST COATING ON RYUGU INDICATED BY COMPARING RYUGU SAMPLE TO IN-SITU DATA

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C-type asteroid (162173) Ryugu was thoroughly investigated by remote sensing observations with Hayabusa2 [1], and in-situ observations by MASCOT [2] and samples were successfully returned to Earth and distributed to various research institutions [3]. Here, we present a comparison of the mid-IR spectrum of sample C0137 to data obtained in the same spectral range with the MASCOT Radiometer.

Hayabusa2 revealed that Ryugu is a rubble-pile asteroid with a surface dominated by boulders and coarse gravel, despite a low overall thermal inertia derived from telescopic observations that was interpreted as fine sand-like regolith prior to arrival [1,4,5,6,7]. The full diurnal temperature curve observed by the MASCOT Radiometer revealed that the low thermal inertia is a bulk property of the boulders rather than a substantial dust layer on top of a more compact boulder [4]. Consequently, little to no dust were found on Ryugu and observations of the OSRIS-REx mission to (101955) Bennu came to the same conclusion [8,9]. The low thermal inertia of the boulders was interpreted as high-porosity material [5,6,7], while recent works indicate that cracks could also significantly reduce the thermal inertia of the materials on Ryugu or Bennu [10, 11]. It is unclear whether no or little dust is produced on these asteroids or if most of the produced dust is lost immediately.

In the presented work we find that a very thin layer of dust, maximal 55 µm, covering a porous or cracked boulder with a thermal inertia of around 305 $Jm^{-2}K^{-1}s^{-1/2}$ can still be supported by MASCOTs observations. These results are obtained by thermophysical modelling of Ryugu's surface using a two-layer model, varying thermal inertia of the dust and the boulder, as well as the thickness of the dust layer as free parameters.

We also find a significantly reduced spectral contrast around 10µm on Ryugu compared to thin section spectra of C0137. The comparison is achieved by convolution of the mid-IR spectrum of C0137 by the MASCOT Radiometer's instrument function and subsequent analysis of the instrument's band ratios. A fine dust layer of as little as 13µm could already explain such a change in the spectrum while leaving to trace in the diurnal temperature variation and a similar explanation was found for the low contrast of the mid-IR spectra observed at Bennu [12].

The presence of dust in form of a very thin coating indicates that dust is produced on Ryugu while most of it is lost. This could make small asteroids like Ryugu and Bennu relevant sources of dust in the solar system.

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