Estimation based on analysis of boulder motion of bulk density of the boulders on the surface of Ryugu at touchdown operation

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The Hayabusa2 project is a sample return mission that aims to bring back samples from the C-type asteroid "Ryugu".The Hayabusa2 spacecraft successfully touched down on Ryugu on February 22, 2019. Previous observations suggest thatRyugu has a relatively high porosity of >50% and many largesurface boulders.These characteristics indicate that Ryugu has a rubble pile structure. Estimation of the macroporosity requires the bulk density of the constituent blocks of Ryugu, which is currently unknown. At present, the estimated porosity is calculated using the grain density values of two carbonaceous meteorites withsimilar spectrato Ryugu. The grain densities are 2.42±0.06 g/cc(CI) and 2.74-3.26 g/cc(CM)respectively. The total porosity is estimated using these values of 51±1% and 57-63%, respectively.On February 22, when the Hayabusa2 spacecraft touched down, the optical navigation camera, ONC-W1, observed the state of the landing. In this study, we analyzed the images from ONC-W1 and estimated the bulk density of the boulders on Ryugu's surface.

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