The first detailed visible multi-band imaging observations of asteroid Ryugu

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We have conducted multi-band visible imaging observations of asteroid Ryugu covering its entire disk from 20 km of distance and covering equatorial regions with higher spatial resolution at 5 – 7km of distance. These observations revealed a number of important properties of Ryugu: 1) a classic bi-cone top shape with upright spin axis, 2) equatorial ridge encircling the entire body, 3) the presence of large boulders particularly around the poles, 4) Gradual latitudinal decrease in number density of large boulders toward equator [1], 5) General uniformity in visible spectra on the entire globe [2], 6) The presence of bright spots and bright surfaces on a large boulder, which exhibit bluer spectra [2], 7) Circular depressions with bowl-shaped profiles and raised rimes, consistent with impact craters [3], 8) The number density of these depressions is on the same order of magnitude as that of crater candidates on Itokawa [4]. 9) Preferential deficiency in small circular depressions with a similar size frequency slope as Itokawa and Eros, suggesting the presence of granular medium subject to seismic shaking and crater erasure. 10) Boulder size measurements indicate that they are too large to be impact ejecta from observed craters, suggesting that they may be direct fragments from Ryugu's parent body.

The bowl-like shape of large (~200m in diameter) circular depressions, consistent with gravity-controlled craters, and the deficiency in small circular depressions suggest that Ryugu may be mantled with strengthless materials at least 10's meter of thickness. Such mobile interior in Ryugu may have played an important role in forming/modifying the circum-equatorial ridge belt [5] and clustered large boulders around the poles, underling the importance of high-resolution observations for granular flows by both Hayabusa2 and MASCOT lander [6]. Furthermore, variations in spectroscopic properties of large boulders may reflect heterogeneity in Ryugu's parent body, its detailed spectroscopic characterization is of great importance for uncovering the history of asteroid leading to the present state of Ryugu and will be also important for understanding the geologic context for the samples to be obtained from Ryugu.

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References: [1] Honda, C. et al. (2018), DPS mtg [2] Tatsumi, E. et al., (2018) DPS mtg, [3] Cho et al. (2018), DPS mtg, [4] Morota et al., DPS mtg, [5] Michel et al., DPS mtg, [6] Jaumann et al. (2018) DPS mtg.