

Constraints for Ryugu's mineralogical composition by estimating average grain density using rock porosities, bulk density and an estimate for the macroporosity

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The macroporosity of Ryugu - seen as a rubble pile - can be estimated, following semi-empirical mixing models which depend on size distribution of the boulders constituting Ryugu, and their angularity and sphericity. We use this estimate with the measured bulk density of Ryugu and the estimates of porosity of constituent rocks by the radiometers TIR and MARA to constrain the average grain density, which is the quantity with the largest remaining uncertainty and linked to composition. Results are obtained by a constrained weighted least-squares optimization and and result probability distributions by Monte Carlo calculations. Low grain densities, like for CI (2.27 g/cm³ after Consolmagno et al, 2008) are very unlikely.