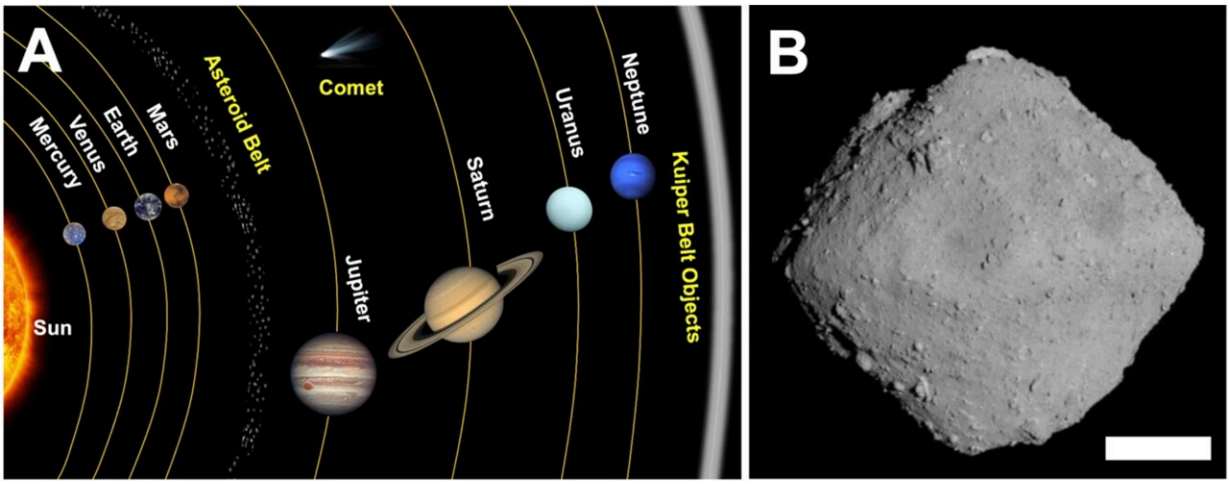
Ryugu asteroid origins in the solar nebula decoded by carbonates

August 15 2023, by Hannah Bird



Location of asteroid belt and a photograph of Ryugu taken in 2018 (scale bar equals 200m). Credit: Oba et al. 2023/JAXA.

Japan's Aerospace Exploration Agency sent the Hayabusa2 spacecraft to 162173 Ryugu in 2019, an asteroid in orbit near Earth that is comprised of rocky fragments originating from a larger parent body. Multiple rovers brought samples from the asteroid's surface back down to Earth for scientists to study.

The samples are indicative of chemically primitive meteorites, similar to Ivuna-type chondrites, and contain particular chemical compounds that suggest the presence of water. In particular, alterations of the asteroid's

surface by water on the parent body, at estimated temperatures up to 150°C, produced secondary minerals (including phyllosilicates, carbonates, sulfides and oxides) and the researchers aimed to understand the timescale and conditions over which these changes occurred.

Charting the asteroid's formation, collaborative studies by 89 scientists from global universities and research institutes, published in *Nature Geoscience*, focuses on two particular compounds: calcium carbonate (calcite) and calcium–magnesium carbonate (dolomite). The carbon source for these carbonates is postulated to be carbon monoxide, carbon dioxide, methane and/or organic matter that may have formed in the solar nebula, the gaseous cloud from which the solar system is said to have originated.

The samples were inspected using specialist microscopes for petrology (the study of rocks), whereby crystals of both calcite (