

The Geological Mapping Of Ceres From Nasa's Dawn Mission

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Geological mapping is a technique to determine the geologic history of a planetary surface from stratigraphic analysis of images of surface features, supplemented with topographic and compositional data. As part of NASA's Dawn mission to dwarf planet Ceres, we led a geologic mapping campaign during the prime mission, taking advantage of the mission's multiple orbital phases with images of ever-increasing spatial resolution. We produced the first global geologic map at Survey orbit resolution (415 m/pixel), to broadly characterize the surface geology and variety of morphologic units. We just completed a detailed global geologic map using images from the High Altitude Mapping Orbit (140 m/pixel), which is being used to determine Ceres' time-stratigraphic history. We are also leading a team of mappers who have produced 15 quadrangle geologic maps covering the whole surface using images from the Low Altitude Mapping Orbit (35 m/pixel), which provide additional information on geologic relations in specific regions.

Globally Ceres is dominated by ancient cratered terrain that once may have been the bottom of a frozen ocean, now interpreted to be the upper surface crust heavily altered by impact craters and composed of hydrothermally-altered silicates (ammoniated phyllosilicates, carbonates, chlorides) and water ice (currently ~30-40% of crust). Most of Ceres' geologic units are related to impact cratering, including crater central peak, floor, rim (terraces), and various ejecta materials. Geologically young crater materials appear bluish in color ratio composite images. Lobate, flow-like deposits are observed, variously interpreted as landslides, ground ice flows, impact melts, and cryovolcanic flows. Evidence of cryovolcanism (cold volcanism by briny, water-based compounds) is suggested at multiple locations, including effusive flows and tholi (domes, Ahuna Mons and Cereania Facula) and possibly explosive deposits (Vinalia Faculae). We are currently using relative stratigraphy & crater counts of map units to determine the geological timescale of Ceres.