The Formation And Evolution Of The Bright Faculae In Occator Crater On Ceres

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Ceres is a 940-km-diameter dwarf planet, located in the main asteroid belt. Since 2015, NASA's Dawn spacecraft has orbited Ceres, and observed bright regions on the mostly dark surface. The brightest regions are in the 92-km-diameter Occator crater, which are approximately seven times brighter than average Ceres, as defined by their single scattering albedo (Russell et al., 2016; Li et al., 2016). The central bright region in Occator crater, called the Cerealia Facula, is located in a ~9 km wide and ~700 m deep central pit (e.g. Schenk et al., 2016). There are also bright regions in the eastern floor of Occator crater, called the Vinalia Faculae. Geologic mapping reveals that the faculae belong to a type of geologic material that is unique on Ceres, and that they are associated with the central pit and fractures in the floor of Occator crater (Scully et al., 2017; Buczkowski et al., 2017). Ceres has long been thought of as an icy world, thus, the faculae were initially speculated to be water ice. However, Dawn's spectral data indicate that the faculae only contain ≤2-3 vol.% water ice, and are composed of a large amount of sodium carbonate, which distinguishes them from Ceres' average surface composition (De Sanctis et al., 2016). The faculae's distinct composition indicates that they have not mixed significantly with Ceres' average material. This interpretation, in addition to geologic mapping and crater size-frequency distribution analyses, indicate that the faculae are geologically young, i.e. approximately tens of millions of years old (Scully et al., 2017; Neesemann et al., 2017). The presence of this geologically young and distinctly composed material on Ceres' surface is intriguing. Here we will use geological, compositional and geophysical studies to decipher the formation and evolution of the faculae, which will also provide insights into Ceres' broader evolution.