INSIGHTS INTO THE VARIED SOURCES OF FACULAE-FORMING BRINES IN CERES’ OCCATOR CRATER, DERIVED FROM GEOLOGIC MAPPING.


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ABSTRACT

The Dawn spacecraft orbited dwarf planet Ceres, identifying the 92-km-diameter Occator crater, which contains enigmatic bright deposits called faculae [1]. During Dawn’s second extended mission (XM2), spectacularly high spatial resolution images were obtained: ≥3 m/pixel. Here we use the XM2 data to create a highest resolution geologic map of Occator’s interior (scale: 1:200,000), published in [2]. We find that the faculae are hydrothermal deposits that were emplaced ballistically and as flows [also see 3], originating from numerous localized brine sources throughout the crater floor, rather than from one centralized source. We name this process brine effusion, which encompasses both emplacement styles (ballistic and flows) because effusion applies to all fluids (i.e. gases and liquids). Pathways to the surface for the faculae-forming brines were likely opened by the prevalent impact-induced fracturing [also see 4]. The system was brine limited: sufficient amounts of the faculae-forming brines were not always available to completely coat the surface. The majority of the central faculae (Cerelia and Pasola Facula) were not emplaced prior to central pit formation. The central faculae were primarily sourced from an impact-induced melt chamber [also see 5], with some contribution from a deeper, pre-existing brine reservoir [also see 6]. Vinalia Faculae, in the crater floor, were sourced from the laterally extensive deep reservoir only. Vinalia Faculae are comparatively thinner and display greater ballistic emplacement than the central faculae because the deep reservoir brines took a longer path to the surface and contained more gas than the shallower impact-induced melt chamber brines.


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Figure: XM2-based geologic map of Occator crater’s interior, at 1:200,000 and with a simple cylindrical projection [from 2].