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Morphology of ring-mold craters within Occator crater

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Abstract

We found different shapes of ring-mold craters within in the huge ice-rich Occator crater on Ceres. The craters contain either a central pit or bowl or a central peak. The ice-rich material of Occator´s crater floor is supposed to have caused the formation of ring-mold craters.

1. Introduction

Ring-mold craters are common on lineated valley fill and lobate debris aprons on Mars. They are thought to be formed on layers with subsurface glacial ice [1]. Impacts into ice warm the ice and cause it to flow into the ring mold shape. We found similar craters within Occator crater on Ceres.

1.1 Data

For the analysis of craters Dawn Framing Camera (FC) data (monochrome and color ratio images) [2] from the Low Altitude Mapping Orbit (LAMO) with a spatial resolution of 35 m/px as well as a Digital Terrain Model (DTM) [3] derived from the High Altitude Mapping Orbit (HAMO) orbit data have enabled an initial characterization of the surface.

2. Observations

The observed craters are found within Occator crater and show an almost circular shape. The craters seem to be subsiding into the surface and, therefore, the rims are less elevated above the surrounding terrain. They show the typical ring-mold shape as known from Mars[1]. The craters contain either a central pit or bowl or a central peak (Fig. 1). The crater diameters range between 0.4 and 1.2 km.

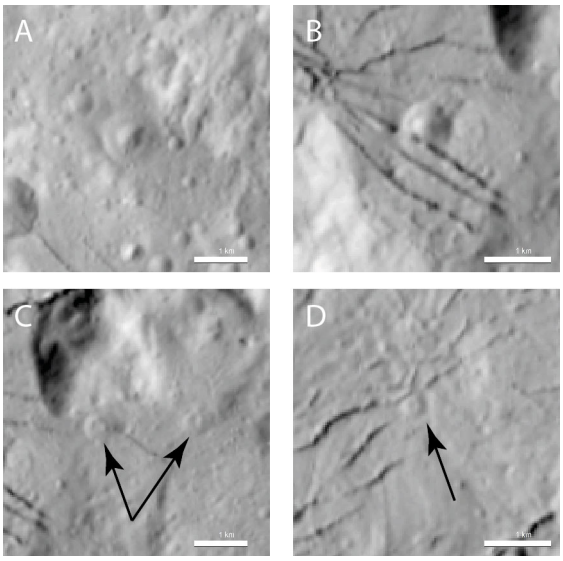

Figure 1: Ring-mold craters. A and B show craters with a central pit. C and D show craters with a central peak (arrows).

3. Summary and Conclusions

Latest results by the Dawn Spacecraft indicate that Ceres is a weakly differentiated body containing a shell dominated by an ice-rock mixture [4] and ammoniated phyllosilicates [5]. Recent observations

also show that hydrated salts could be warm enough to be mobile at a depth of 1.5-5 km below Ceres´ surface and would explain the buoyancy of ice and salt-enriched crustal reservoirs [6]. Occator is thought to be impacted in such a reservoir layer and triggered the mobility of ice and formed several ice-rich flow features and plain material [7]. The plains and flow materials also originate from the subsurface and their release is triggered by impacts [7].

So, it is likely that impacts hitting this material could form such ring-mold craters.

4. Future work

We will continue our survey of such craters all over Ceres and compare them to the Martian ones. The location of such craters provide important insight into detection of buried ice on Ceres.

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References

[1] Kress, A. M. and Head, J. W.: Ring-mold craters in lineated valley fill and lobate debris aprons on Mars: Evidence for subsurface glacial ice, GRL, Vol. 35, L23206, 2008.

[2] Sierks, H. et al.: The Dawn Framing Camera, Space Sci. Rev., 163, 263–327, 2011.

[3] Preusker, F. et al.; Dawn at Ceres - Shape model and rotational state, LPSC, March 2016, The Woodlands, Tx, USA, 2016.

[4] Fu et al.: The Global Scale Relaxation State of Ceres, AGU 2015, San Francisco, USA, 2015.

[5] De Sanctis M.C. et al.: Ammoniated phyllosilicates with a likely outer Solar System origin on (1) Ceres, Nature, 528, 241-244, 2015.

[6] Neumann W. et al.: Differentiation of Ceres and her present-day thermal state, LPSC, March 2016, The Woodlands, Tx, USA, 2016.

[7] Krohn et al.: Cryogenic flow features on Ceres: Implications for crater-related cryovolcanism, Geophysical Research Letters, 43, 1-10, 2016.