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ICING IN THE CAKE: EVIDENCE FOR GROUND ICE ON CERES (Invited Presentation)

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Since the late 1970's, the possibility of ice on Ceres has been a topic of broad discussion that engages data ranging from surface spectroscopy to shape and density. Thermal models suggest that subsurface ice on Ceres is stable for the lifetime of the solar system. Dawn arrived at Ceres in 2015 with a suite of instruments to answer this question but without obvious surface deposits of ice and few spectral detections, understanding ice on Ceres requires other clues. In this presentation, we will describe how geomorphology has provided evidence of widespread "ground ice" across Ceres. These silicate-ice mixtures are inferred from careful analysis of mass wasting features. Mass wasting on Ceres is pervasive—in over 20% of craters above 10km in size.

We have identified three end-member classes of lobate mass wasting morphologies distinct from dry landslides: Type 1--tongue-shaped, furrowed flows hundreds of meters thick on steep slopes, Type 2--tens of meter thick spatulate-sheeted flows on shallow slopes, and Type 3--cuspate-sheeted flows, also tens of meters thick, but with morphology that indicates fluidization. These features are distinct from those on dry Vesta, which shares a similar impactor population and velocity distribution due to its similar location in the main belt. Thus, the best explanation for the differences in morphology between mass wasting on Ceres and Vesta is differing material properties. Morphologically, each of the three classes of mass wasting feature possesses an analog found in ice-rich terrain, from glaciated regions on Earth and Mars to the surfaces of the icy satellites. These similarities help characterize how down slope mass motion may occur on Ceres. In the most spectacular cases, we identify features that share commonality with rock glaciers or with lahars.

Mass wasting features also increase in number and aerial coverage towards the poles, and shows progressively more fluidization towards the low latitudes. This distribution is consistent with the predicted ice table depth on Ceres from thermal models, and matches the overall trend in hydrogen observed by GRaND. We conclude that the geomorphology and distribution of mass wasting is evidence that Ceres' subsurface contains significant ground ice most abundant near the poles.

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T174. The Geology of Dwarf Planet Ceres
Monday, 26 September 2016: 8:00 AM-12:00 PM

Room 201 (Colorado Convention Center)

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