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Europa's Great Lakes

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Unique to the surface of Europa, chaos terrain is diagnostic of the properties and dynamics of its icy shell. While models have suggested that partial melt within a thick shell or melt-through of a thin shell may form chaos, neither model has been able to definitively explain all observations of chaos terrain. However, we present a new model that suggests large melt lenses form within the shell and that water-ice interactions above and within these lenses drive the production of chaos. Our analysis of the geomorphology of Conamara Chaos and Thera Macula, was used to infer and test a four-stage lens-collapse chaos formation model: 1) Thermal plumes of warm, pure ice ascend through the shell melting the impure brittle ice above, producing a lake of briny water and surface down draw due to volume reduction. 2) Surface deflection and driving force from the plume below hydraulically seals the water in place. 3) Extension of the brittle ice lid generates fractures from below, allowing brines to enter and fluidize the ice matrix. 4) As the lens and now brash matrix refreeze, thermal expansion creates domes and raises the chaos feature above the background terrain. This new "lense-collapse" model indicates that chaos features form in the presence of a great deal of liquid water, and that large liquid water bodies exist within 3km of Europa's surface comparable in volume to the North American Great Lakes. The detection of shallow subsurface "lakes" implies that the ice shell is recycling rapidly and that Europa may be currently active. In this presentation, we will explore environments on Europa and their analogs on Earth, from collapsing Antarctic ice shelves to to subglacial volcanos in Iceland. I will present these new analyses, and describe how this new perspective informs the debate about Europa's habitability and future exploration.