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Formation of chaotic terrains on Mars through burial of ice

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Chaotic terrains are some of the most enigmatic geological features on Mars: over hundreds of kilometers, rock units are fractured, tilted and have collapsed. These terrains represent the source of major outflow channels, and are often associated with hydrated minerals and layered light toned deposits, all suggesting a strong involvement of water in the process by which these terrains form. However, a physical model for the cause and process of chaotization, that explains their geological features, as well as their abundant occurrence on Mars, as opposed to the absence of similar terrains on Earth, is lacking. Here we present a simple explanation, based on the structural analysis of the geometrically confined Aram Chaos terrain. Our scenario is based on the sustained presence of a subsurface unit of ice, which melts as the result of the accumulation of rocky overburden. The base of the rock ice unit will start melting when 1 to 3 kilometers of overburden has accumulated. The catastrophic quantity of liquid water, required to generate the outflow channels, is a logical consequence of our model. Although the presence of large quantities of water on Mars is no longer disputed, our results demonstrate that water should, for much of the Martian evolution, be regarded as a rock unit, in contrast to its dominantly liquid role on Earth. An important implication of our model is that a subsurface ice unit, possibly with a thin lower layer of liquid water, may still be present in the Martian crust. Such sites would be of great importance as potential habitats for microbial life