Abstract #835

English

Possible Evidence for Sublunarian Aquifers: the Ina "D-Caldera"

The Ina "D-Caldera" (18.7°N, 5.3°E) is one of the more unusual features in the solar system. Ina is neither an impact crater nor an ordinary volcanic crater. The interior is characterized by numerous humps that resemble menisci, hence the appellation "lunar meniscus hollow" (LMH) to describe the feature. Since its discovery as a result of the Apollo 15 mission, at least 40 other similar structures have also been identified. It is thought that escaping volatiles—primarily H2O and CO2—are responsible for excavating the Ina caldera. The exact mechanism for this process remains unknown, however, as it is difficult to see how gases alone could become pressurized enough, and then suddenly released, to cause the resultant depression. In order to explain Ina's debris halo that extends to a distance of ~500 m from the caldera's edge, velocities on the order of ~25 to ~50 m s-1 must have been achieved. Probably the closest terrestrial analogue for LMHs are maars: craters that form when groundwater comes into contact with hot magma close to the surface causing the groundwater to flash into steam, resulting in a violent explosion. However, since Ina is a very recently formed structure, it is unlikely that hot magma played a role in Ina's creation. Nevertheless, it is the case that heat flow experiments conducted during the Apollo era imply that the temperature and hydrostatic pressure at the base of a thick regolith at mid-latitudes should favor the formation of liquid water. If this liquid water were saturated with CO2, and the overlying pressure were suddenly released, exsolution of CO2 into the gaseous phase would provide enough explosive force to excavate the Ina caldera. Thus question is whether there would be enough juvenile water within the underlying mantle "source rock". Ina is perched atop a 700 km2 dome that likely represents the results of a mantle plume that failed to reach the surface. Mantle plumes on Earth are known to contain up to 3% water; if the depth of the "fracked" zone is 50 km, then the total primordial stock of water beneath the Ina dome would be on the order of 1010 to 1012 tonnes—of which only a tiny fraction would be required to excavate the Ina caldera. Thus obtaining abundant water supplies from the Moon may be as simple as drilling a shallow water well in the right location.

French

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Author(s) and Co-Author(s)

Mr. Warren Platts
(UnknownTitle)
Groundhog GeoScience LLC