

Stratigraphy of icy deposits within Korolev crater, Mars and their relationship to Planum Boreum

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Korolev crater is a large, ~80 km diameter, well-preserved crater located at 73° N, 163° E on Mars. The proximity of Korolev crater to Planum Boreum, essentially the north polar ice cap of Mars, causes it to be influenced by a seasonal, polar cover of CO₂ ice as well as the existence of perennial H₂O ice [Armstrong et al. 2005]. In fact, as a result of the Shallow Radar (SHARAD) sounder on Mars Reconnaissance Orbiter (MRO) we now know that the water ice deposits in Korolev are up to ~2 km thick [Moore et al., 2012]. The domal, icy deposit within Korolev may either be a remnant of a once-larger polar ice sheet, or an independent construct deposited essentially as we see it today. Intriguingly, the radar characteristics of the water ice deposits within Korolev appear very similar to the nearby north polar layered deposits (NPLD) of Planum Boreum. This work attempts to both characterize the three dimensional structure of the deposits within Korolev crater and to investigate their relationship to Planum Boreum and the NPLD.

The icy deposits within Korolev crater are stratified into three radar-distinct zones with the possibility of one additional deep zone. This zonation is purely based on the presence or absence of radar reflectors and their vertical distribution. While the analysis of radar stratigraphy using radar-derived units can be improved via careful bedding analysis and sequence stratigraphy, the isolated and relatively small Korolev deposit makes this more of a challenge and perhaps intractable. Additionally, a first order analysis of radar facies within Planum Boreum as done by Putzig et al. [2009] indicated that there were four to five radar units in the NPLD separated by dark, reflector free zones. To first order, the results from this early radar study seem to complement the mapping results from Korolev crater.

As Korolev crater and the icy deposits contained therein do not directly connect with the polar ice cap of Planum Boreum, attempts to constrain the ice deposits in Korolev using the NPLD have not yet been successful. However, our work here attempts a broad correlation of the radar reflectors in Korolev and Planum Boreum rather than a very specific and sequence stratigraphic correlation. Additionally, the results from a recently concluded radar study of another circumpolar deposit, Abalos Mensa, have indicated that north polar domed landforms not directly connected to Planum Boreum can be independent features. However, these deposits are still genetically linked to growth of the modern ice cap through regional atmospheric processes [Brothers et al. submitted]. This research explores the independent formation scenario for Korolev crater. Can the sequence of radar reflectors in Korolev be linked to sequences in the NPLD as has been done for Abalos Mensa? If feasible, then the simplest explanation for the Korolev's deposits and their position deep within the crater would be local atmospheric deposition. This would illustrate the significance of atmospheric conditions on ice deposition for the entire north pole of Mars.

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