



The Geomorphology of Lyot crater, Mars

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Lyot crater, Mars, is a relatively young (<3 Ga), deep (~ 7 km below Mars datum) impact basin situated at about 50deg. N, just north of the dichotomy boundary. The impact almost certainly penetrated the cryosphere, and would have exposed any groundwater zone existing beneath. Recent studies have linked large fluvial channels located outside of Lyot's ejecta blanket with impact-release of groundwater or melting of ice [1], and small fluvial channels within the basin with much later climate-related events [2]. Thus the deposits and channel systems in and around Lyot crater provide an ideal study area for (i) investigations aimed at exploring the sediments and volatiles excavated during impact and perhaps a way of testing whether there was a groundwater zone, and (ii) studies of glacial and periglacial environments useful for studying water on Mars throughout its history.

Here we present preliminary mapping of the various ice- and water-related landforms found in and around Lyot crater. Of particular interest are polygonal networks of metre-scale clasts (perhaps periglacial in origin?) and a variety of channels, fans and lobate flows that could be interpreted as proglacial fluvial systems [2]. The putative glacial assemblage exists within the crater rim and in high relief areas outside of the crater. Fluvial-like channels and fans are seen both within the crater and on the ejecta blanket. The networks of polygonal clasts occur only on the margins of the continuous ejecta blanket, at a radial distance of about 300 km from the crater's centre.

The clastic polygons that compose the networks are found only on the Eastern side of Lyot basin, and extend in a broad swathe from about nor-northwest to southwest of the crater. The polygons are generally one to two hundred metres in diameter and consist of lines of clasts (sometime double lines) with flat, low centre-regions between them. Their spatial distribution strongly indicates that they have a genetic link to the formation of the impact crater.

Our working hypothesis is that the glacial/fluvial assemblages are related to climate-controlled deposition of ice, with later flow and probably thaw as well. The polygonal clast network is harder to explain, but could reflect the location of water ice-rich zones of the ejecta blanket. Hence, this could be material excavated from the cryosphere during impacts and then reworked by periglacial processes at a much later time.

- [1] Harrison, T.N., et al., Impact-induced overland fluid flow and channelized erosion at Lyot Crater, Mars. *Geophys. Res. Lett.*, 2010. 37(L21201): doi:10.1029/2010GL045074
- [2] Dickson, J.L., et al., Amazonian-aged fluvial valley systems in a climatic microenvironment on Mars: Melting of ice deposits on the interior of Lyot Crater. *Geophys. Res. Lett.*, 2009. 36(L08201): doi:10.1029/2009GL037472.