Indentifying dikes in the eastern Hellas rim region, Mars

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Abstract
The Hadriaca Patera (HP) volcano [e.g. 1-9] on Mars is situated on the north-eastern rim of the giant Hellas impact basin, and on the western edge of the vast volcanic plains of Hesperia Planum [10, 11]. The eastern Hellas rim region harbours also other, possibly separate centers of volcanism that have only recently been proposed [12, 13].

The area is additionally characterized by a multitude of fluvial features, extending from small, partly dendritic channel networks (e.g. 14-16, references therein) to vast, several km deep and hundreds of km long outflow valleys (e.g. 14, 16-19, references therein). The origins of the latter type have been theorized to be in volcanism and creation of sills and dikes beneath or near the channel heads [7, 19]. The Hesperia-Hellas region also shows evidence of even more significant volatile erosion prior to the formation of the outflow channels, also induced by endogenic activity [20].

We study a roughly 1200-km wide region around the HP volcano in search of real-life dike-indicative formations [for details and more discussion, see 21]. The origin and distribution of the dikes in the east Hellas region is of importance when discussing the regional geology, and especially when attempting to synthesize a chronology and causal relationships between regional events such as outflow channel formation. The dike patterns and sizes are related to the whereabouts and characteristics of their feeding magma bodies. Thus, the dike distribution around HP gives a hint about the heat flux in the region. This reflects on the possible formation scenarios of e.g. the outflow channels near HP as well as the formation of the several floor-fractured craters in the NE Hellas region.

We have identified and documented a large number of straight/curvilinear ridges, fractures and grabens on the volcano itself, on its flanks, and on the whole eastern Hellas rim region. The best candidates for actual dike manifestations include e.g. transitions from linear fractures or grabens to linear ridges as well as grabens harbouring narrow ridges on their floors.

Most dike candidates near HP are either radial or concentric to the volcano, indicating a causal relationship. However, many clusters farther away appear not to have been controlled directly by any HP-related magma reservoirs. The existence of the latter kind hint towards regions of separate - and so far unrecognized - magmatic centres, and may thus help put together e.g. the long-disputed formation scenarios of the outflow channels adjacent to them.

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References