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Evidence for an additional uppermost geological unit in the Medusae Fossae Formation, Equatorial Mars

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The Medusae Fossae Formation (MFF) is a geological formation comprising three geological units (members) spread across five principal outcrops. The MFF dominates roughly a quarter of the longitudinal extent of the equatorial region of Mars, extending east-west across a distance of $\sim$ 5,500 km between the southern Elysium Planitia and the Tharsis region. The nature of these materials is often referred to as enigmatic, as their exact origin remains unknown.

Harrison et al. (Icarus, 2010) presented new observations of outlying occurrences of MFF materials on the southern highlands, atop the dichotomy boundary. They presented two hypotheses to explain these observation: 1) the MFF had a much larger pre-erosional extent than previously thought or 2) these materials had initially been eroded from the main outcrops of the formation, then transported southward by wind and subsequently reworked. A subsequent extension of this work provided evidence for an even larger extent of outlying MFF materials, particularly around and south of the easternmost portions of the MFF.

Here we present these new outlier data, together with new textural classification and facies mapping of this region of the MFF. These data show that MFF outlier textures, whilst external to the main MFF outcrops in many places, are also found superposing large areas of the "main" MFF formations.

These data support the first of the two working hypotheses presented, but also suggest that these so-called outlying materials represent a previously unmapped, stratigraphically uppermost unit of the Medusae Fossae Formation. We also suggest that, based upon our own morphometric study of yardangs across members and analogue studies by de Silva et al. (Icarus, 2010), these represent a less indurated material than other units of the formation.

In the overall context of the origins of the MFF, we find that our data are consistent with the Medusae Fossae materials being a large-scale ignimbrite complex, perhaps with multiple sources, including the Tharsis volcanic province.