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Syrtis Major volcano evolution characterised from a terrestrial analogue.

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New developments in 3D visualisation software enable interrogation of volcanic architecture by analysis of surface morphology and composition. We apply this remote sensing approach using Geovisionary™ software to investigate volcano evolution in the Manda-Hararo rift segment, Afar, (Ethiopia) and compare this with the Syrtis Major volcanic complex on Mars.

In Afar, extensive exposure and low erosion rates in arid conditions allow comparison to Mars using remote sensing data sets of similar resolution. We use this comparison to understand the evolution of the Syrtis Major low-angle basaltic shield volcano – an edifice measuring 1500 km by 1000 km, formed in the early Hesperian (3.7 – 3.0 Ga). The complex is capped by calderas containing evolved volcanic products. Extensional fault systems and fissures, probably resulting from lack of buttressing on its ENE side, are aligned to the NNW-SSE these are comparable in morphology to the central part of Afar's Manda-Hararo rift segment.

We present results of an initial field campaign at the Manda-Hararo rift segment and an initial survey of the Syrtis Major calderas. In Afar oblique views of lava flow surface morphologies and cross-sections through successive lava flows reveal details of the relationships between lavas, topography and local structure. Lobes range in scale from 0.1 m to 10 m wide and are typically 1.5 m thick. Most lavas in this rift segment are pāhoehoe, emplaced as inflating lobes. Cross-sectional surfaces, exposed in fault scarps, show interfingered lava flows. Some very recent low volume (< 0.5 km3) rubbly pāhoehoe lavas occur at the rift axis. Distinct 'a'ā lava flows originating from Dabbahu volcano are faulted and interfingered with lavas from a rift axial source. MRO data has been interrogated for similar morphologies. We examine evidence of similarities in emplacement style and the interaction of lavas from both Syrtis Major calderas, using Geovisonary™.

Insights gained from the Manda-Hararo rift segment study will guide us in producing an architectural model of the evolution of the Syrtis Major complex, with the aid of further high resolution Mars imaging, including newly requested data from the Mars Reconnaissance Orbiter spacecraft.