MOUNDS AND RIDGES INSIDE A FLOOR-FRACTURED CRATER IN CENTRAL EASTERN ARABIA TERRA. A. Rani1,2, A. Basu Sarbadhikari1, R. K. Sinha1,2, S. Karunatillake1, G. Komatsu4, and A. Bates5. 1Physical Research Laboratory, Ahmedabad, India (alka@prl.res.in), 2Indian Institute of Technology, Gandhinagar, India, 3LSU Geology and Geophysics, USA, 4International Research School of Planetary Sciences, Universitàd' Annunzio, Viale Pindaro 42, 65127 Pescara, Italy.

Introduction: Unlike the Moon, the process(es) responsible for the formation of floor-fractured craters (FFCs) on Mars are still an ongoing debate within the scientific community. Based on the relationship between location and surrounding geological environment, different possible processes have been proposed [1,2].

A large number (more than 50% of the total) of FFCs have been identified in Arabia Terra, along the dichotomy boundary [2]. It is one of the oldest provinces of Mars having a relatively thin crust along with highly cratered terrain. Many FFCs are modified by different geological processes, as implied by the exposed and well-preserved extensive fractures, knobs and ridges inside the craters. Earlier studies have proposed that FFCs are significantly influenced by groundwater migration, melting of subsurface ice etc. [2]. However, certain FFCs have been influenced by igneous activities, especially those near volcanic provinces [2]. Therefore, the role of the igneous intrusion in the formation or modification of the FFCs on Mars still remains to be understood.

In this study, we aim to document unique remnant structures hosted by an FFC in Arabia Terra to understand the various geological activities that the structures might have endured. In this context, we have conducted a detailed geomorphic investigation within Arabia Terra (~4°E to 60°E and 44°N to 8°N), and marked several FFCs (~ 60), ridges inside the craters, wrinkle ridges using a mosaic of CTX images (Fig. 1). Among all the craters, we discuss new observations of mounds and ridges in an unnamed crater from the central-eastern region of Arabia Terra. The crater lies northwest of Cassini crater (~85 km diameter), highly degraded and with an early Hesperian age (~3.6 Ga).

Methodology: Topographic investigation of the craters has been conducted with MOLA data. The numeric model age of the craters hosting mound and ridges are calculated by using Crater size-frequency distributions (CSFD). Most of the crater ages range from Late Noachian to early Hesperian, along with some resurfaced ages. For the detailed investigation of small features, a mosaic of high-resolution CTX and HiRISE images is used. CTX stereo image pairs are used to generate DEMs of the studied crater. Qualitative and quantitative nighttime THEMIS-IR image data are also used to observe the difference in the preliminary material property of the mounds and ridges with respect to those of the surroundings. Statistical analysis has been carried out to explain the various parameters of the mounds and ridges and their associations. Furthermore, in order to understand the origins of these features (mounds and ridges), whether volcanic or sedimentary, we conduct a detailed morphometric study.

Discussion: The topographic profiles of the crater along the N-S and W-E direction depict a relatively flat floor with small undulations. Diverse landforms such as mesas, deltas, scarps, etc. are also observed along with the presence of mounds and a dense pattern of the ridges inside the crater, which has not been reported in Arabia Terra (Fig. 2).

The combined morphological and nighttime THEMIS-IR images further aids to distinguish the different geomorphic features of the crater. The geomorphic features lying at the central portion of the crater, i.e., ridges and mounds have relatively higher thermal inertia (TI) values (~140 Jm⁻²K⁻¹s⁻¹/²) and appear brighter as compared to the surroundings (~40 Jm⁻²K⁻¹s⁻¹/²). The lower values of TI of the surrounding surface materials most plausibly represent the loose/unconsolidated soil/dust, whereas, high thermal inertia might be due to high density and thermal conductivity, implying that the mounds and ridges are hard and resistant to erosion, and therefore probably constituted...
of more resistant materials than the softer or loose surrounding materials [3].

![Fig. 2. Digital Terrain Model (DTM) of the central part of the crater, showing different landforms/morphological features viz. mounds, ridges, fault, mesas etc. (No exaggeration).](image1)

![Fig. 3. Height vs. basal diameter plot of Martian and terrestrial mounds (after [5]). Dashed lines represent the best linear least squares fits of parameters of each feature.](image2)

Morphometric study of the mounds and ridges has been carried out. Total 25 mounds of the significant sizes are considered and their corresponding average height and basal diameter are calculated. Morphometric and morphological study depicts good resemblance to the scoria cones and Martian mud volcanoes (Fig. 3) [4,5]. Erosional process might be plausible cause for small variation in slope. The morphologic observation of the mounds also reveals some significant dissimilarity in their layering thicknesses as well as in structures and textures in comparison to the reported mounds in Arabia terr [6-9]. The layering is thick and less rhythmic, unlike those of other proposed sedimentary layered deposits on Mars [6-9]. The association of ridges with mounds and their cross cutting relationship make it unique. The orientation of the ridges associated with mounds is unidirectional NW-SE trending; unlike the fractures developed by impact [10-12]. The azimuthal direction of the location of the mounds also shows a spatial pattern that is more or less in NW-SE direction, similar to the orientation of the ridges. The stratigraphic relationship between and the trends of the mounds and ridges further depicts that they are genetically related and may form simultaneously. Together, from our study we bring to the notice that the previously undocumented geomorphic features inside the impact crater possibly provide an evidence of igneous intrusive activity. However, the time of their origin and the formation process (i.e impact induced or any other regional activity) still remain to be understood.