GEOLOGICAL EVOLUTION OF POSIDONIUS CRATER, MOON. K. B. Kimi[1,2], Harish[1,], S Vijayan[1] . [1]Planetary Sciences Division, Physical Research Laboratory, Ahmedabad, India, [2]Indian Institute of Technology Gandhinagar, India. kungree99@gmail.com and vijayan@prl.res.in

Introduction: Post-modification within impact craters by internal activities on the Moon is essential in understanding evolution over time. The internal activities causing modifications include magmatism[1] and lunar tectonics[2]. Features associated with such activities are infilled mare, dome, subsidence, contractional─wrinkle ridges, extensional─grabens, pits, rilles. Among these features, extrusive volcanic features[3] and small scale graben[2] are reported Copernican age. Studying such features within the craters will reveal sequences of diverse internal activity that modified the crater.

We studied the morphology, mineralogy and chronology of the Posidonius crater (diameter ~97 km) (Figure 1a). It is mare filled FFC[4], located on the northeastern rim of the Serenitatis basin. It holds records of multiple post modification features formed by internal activities. This study focuses on post modification processes and the geological evolution recorded within the Posidonius crater.

Data and Methods: We used LRO-WAC image ~100 meters/pixel [5] and LRO-NAC of spatial resolution ~0.5-2 meters/pixel[5] for studying morphology. For topography analysis, we used the LRO-NAC DTM [6] and SLDEM2015 DEM of spatial resolution ~59 meters/pixel with vertical resolution ~3-4 meters [7]. Chandrayaan-1 M^3[8] data was utilized for mineralogical analysis.

Results and Observations:

Morphology: The LRO-WAC[5] image and profile of the Posidonius crater are shown in figures 1a & 2a. It contains mare, fractures, rilles-like, pits chain, grabens, wrinkle ridges, slump materials, and a partially preserved central peak. Mare covers ~4053 sq km area of the crater floor. The westernmost floor covered with mare contains a pit chain connected to the rilles-like feature (Figure 1b & c) and small scale pit chains and grabens (Figure 1d & g). The pits shape varies from circular to elliptical shapes. Small scale grabens are also observed on the crater walls and the rims. The eastern region of the crater floor is crosscut by large scale fractures. These fractures truncate into the northern and western floor covered by a mare (Figure 1e). The eastern floor contains slump materials along the walls and has a higher elevation than the western floor. The crater wall/ rim of the eastern region of the Posidonius crater is also higher than the western region. The westernmost crater floor adjacent to the crater wall has a similar floor height to the eastern crater floor, but the floor lying between the eastern and west most floor has a lower elevated floor. The gradual transition from the higher elevated western floor toward the lower elevated floor can be observed in transects (Figure 2b, c). This transition region contains a rilles-like structure seen in the profile plot of figure 2(b&c) that dissects the mare surface into two parts. The rilles-like feature is also observed on the northeastern crater floor. Wrin-

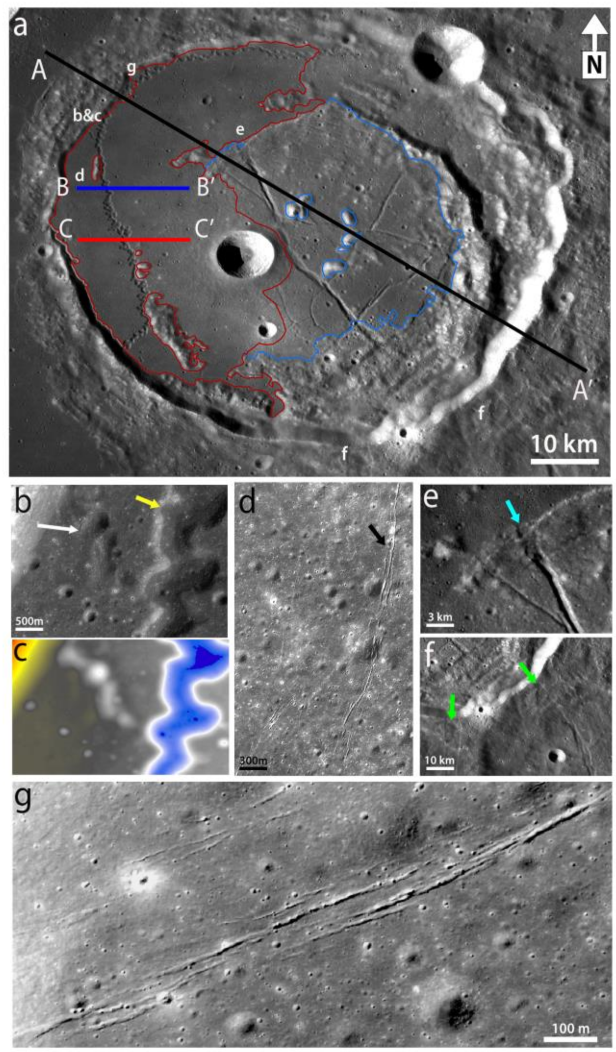

Figure 1: a) LRO-WAC image of a Posidonius crater with outlines of U-I(red) and U-II(blue). b) LRO-NAC image and c) LRO-NAC DTM containing pits chain (white arrow) and rilles-like (yellow arrow). d) LRO-NAC image of grabens. e) Truncated fractures. f) Regional graben (yellow lines). g) Small scale graben with chain of pits.

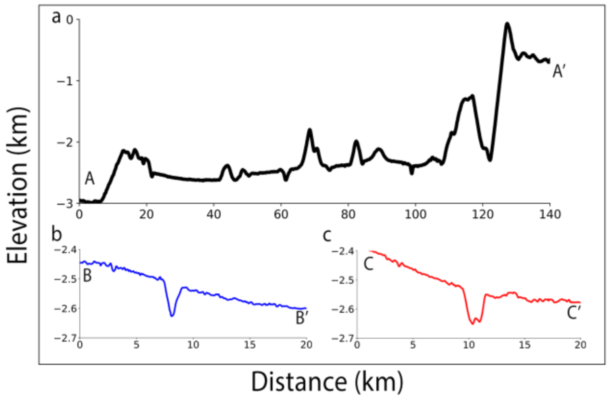

Figure 2: *The topographic profiles are taken across a) the Posidonius crater, (b-c) along the transition region containing rilles-like feature.*

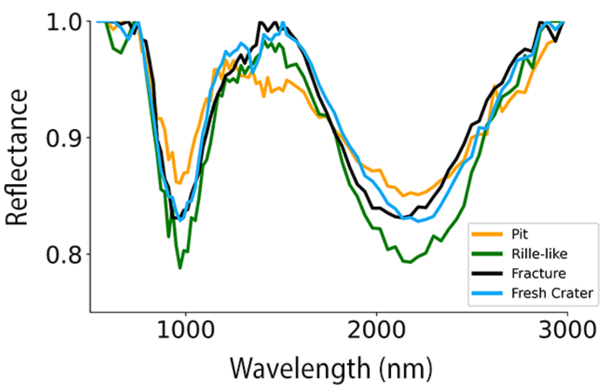

Figure 3: *Continuum removed reflectance derived from M*[3] *suggests presence of pyroxene.*

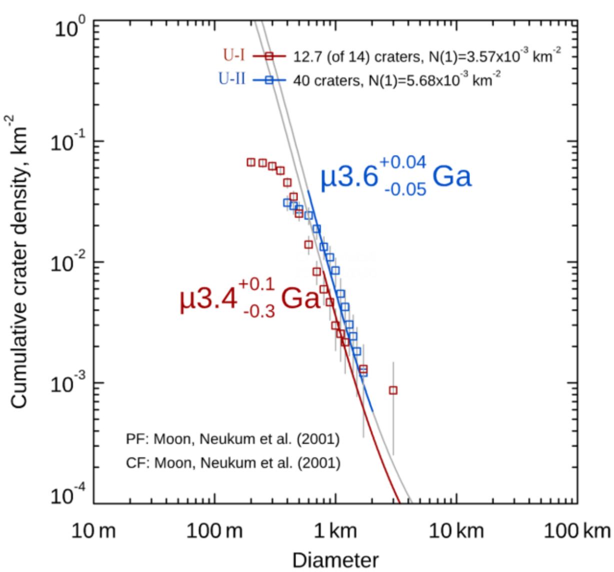

Figure 4: *CSFD plot of two distinct units: U-I & U-II.*

le ridges are observed on the northern floor, on the mare and over the rilles-like features. Regional graben dissect the southern crater rim (Figure 1f).

Mineralogy: The obtained spectra for the rilles-like structure (green), pits (yellow), fractures (black) and fresh craters(blue) is shown in figure 2e. The obtained spectra show absorption ~1 µm and after 2 µm, which correspond to mineral pyroxene (Figure 3). Absorption around this wavelength results from the Iron content [9].

Chronology: The crater size-frequency distribution (CSFD)[10] measurement of two distinct units reveals an age of ~ 3.4 Ga and ~3.6 Ga age (Figure 4). We observed that U-II containing large scale fractures has ~3.6 Ga age which is older than U-I of ~ 3.4 Ga.

Discussions: We interpret that after the formation of the Posidonius crater, the eastern-most crater wall probably separated from the main crater wall along the pre-existing concentric fractures generated during the Serenitatis basin followed by magma intrusion around ~3.6 Ga, resulting in FFC [4]. Later, mare infilling at ~3.4 Ga occurred, which partially obliterated the fractures formed on the floor. From the observed topography of the floor lying between the eastern and west floors, we expect subsidence [11] occurred after the mare infilling. We have also observed small scale pits and grabens. French et al., 2015 suggest that the magmatic intrusion resulted in small scale graben on the western crater floor of Poisonous crater, but we have observed small scale grabens on walls and rims. Therefore we expect different stress mechanisms have probably participated in the formation of small scale grabens. We expect the same stress mechanism probably created the collapsed feature like rilles.

Overall our study unfolds the geological evolution of the Posidonius crater and suggests that the crater has undergone multiple stages of complex modifications after the formation.

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