ANALYSES OF COMPOSITIONAL AND TOPOGRAPHICAL CHARACTERS OF THE WRINKLE RIDGE AND DARK HOLO CRATER ON MARE ORIENTALE BASIN. A.Karthi[1] and S.Arivazhagan[2]. Centre for Applied Geology, The Gandhigram Rural Institute – Deemed to be University, Gandhigram, Dindigul, Tamilnadu, India, karthiatkj@gmail.com[1] , arivusv@gmail.com[2].

Introduction: The investigation of the lunar morphology and compositional characteristics are the fundamental aspect of lunar exploration. The mineralogical characteristics of the morphological features could delineate the state of evolution history of the lunar surface [1]. The recent space missions have provided high resolution data that assist prominently in study of lunar structures and it can also permits to result the new aspects in lunar morphologies [2]. The integrated morphological based compositional analysis were done through using recent high-resolution data by many researchers [3,4,5,6,7]. In the present study, we have selected wrinkle ridge and dark halo crater (DHC) from the Orientale basin to study the topographical and compositional characters through reveal formation history.

Study Area: The Wrinkle ridge is identified extensively in Orientale basin in various trends. Among those the longest ridge (67 km) is observed in the western portion of the Orientale mare. The DHC has been found within the northern section of the Orientale's lacus veris (mare) amid the brighter highland surface. It perhaps perceptibly show the indication of the subsurface material excavated from greater depth to the surface.

Datasets and methods: Chandrayaan – 1 – Moon Mineralogy Mapper (M^3) global mode photometrically calibrated reflectance hyperspectral data that is truncated from 540-2500 nm to avoid stretching noises due to thermal emission [8] has been used to study the compositional characters. LRO- LROC – WAC and DTM (100m) have been used to study the topographical aspects of the selected features [9]. The reflectance experiment laboratory (RELAB) rocks and minerals spectral database have been used to validate the compositional spectra obtained from Ch-1 - M^3.

Topography: Lunar wrinkle ridges are commonly found in the mare basalt deposits that filled with impact basins [10]. Wrinkle ridges are generally characterized by low relief, linear to arculate, and broad ridges that runs several tens in kilometers outlining the mare. It is prevailed by a narrower and sinuous ridge that may be either symmetrically or asymmetrically placed on the arch near the edges of the mare basins [11]. It was created while basaltic lava cooled and contracted, they outline the ring structures buried within the mare and followed by circular patterns outlining the mare or intersect to protrude the peaks that are generally found near to craters [12,13].

In the present study, we have identified longest ridge which is located in the western portion of Orientale mare near Il'in crater. The cross section 1-5 of the ridge show the variations in elevation that ranges from 290 to 420m (Fig.1.A). DHC is located in the northern mare assemblages region which is located a sharp contrast in albedo region with in the mare (very low albedo). The DHC crater depth and diameter noticed as 695m and 1.42km respectively (Fig.1.B).

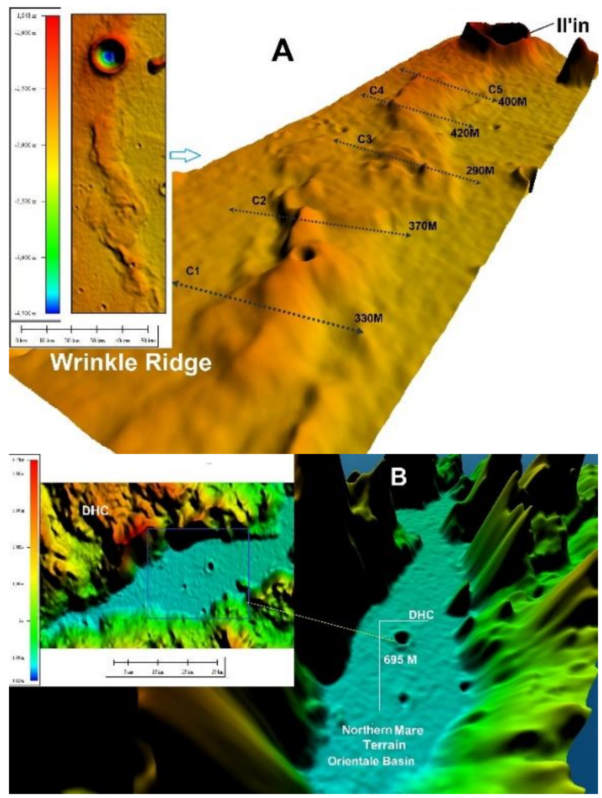

Fig.1.The topographical 3d models of wrinkle ridge (A) and dark halo crater (B).

Results and Discussion: The OMAT of Wrinkle ridge has high maturity at the southern edge whereas low maturity noticed at the center. The FeO of the Wrinkle ridge ranges from 0-12%. Very low and low content of TiO_2 (1 - 4%) was observed at the southern portion. The OMAT of the DHC shows the high maturity at southern portions and low maturity observed at the inner parts of the crater. The FeO concentration of the DHC ranges from 0-12%. The TiO_2 concentration of the DHC ranges from 0- 3.5% which is observed at the southern (very low TiO_2) and northern regions (low TiO_2). M^3 spectral profiles and respective spectral locations of the wrinkle ridge and DHC are shown in Fig.2. The WR1-2 spectra are showing the strong narrow asymmetrical Cpx absorption between 970-1010 nm, weak and moderate plagioclase absorption near 1250 nm, moderate Ti-ilmenite absorption observed between 1408-1469 nm, and strong broad absorption noticed between 2177-2217 nm which are representing the pigeonite bearing basaltic composition. The WR-3 shows the moderate asymmetrical Cpx absorption at 990nm, Weak plagioclase absorption near 1250nm, strong broad absorption at 1489nm, and broad asymmetrical Cpx absorption at 2217nm which represent the ilmenite dominant basalt. The WR-4 spectra shows the strong narrow symmetrical Cpx absorption at 990 nm, weak plagioclase absorption at 1250 nm, and strong broad asymmetrical absorption at 2217 nm indicating the gabbroic composition [14,15,16,17].

DHC – 1 spectra is showing the strong asymmetrical olivine absorptions observed near 1050 nm moderate plagioclase absorption observed near 1250 nm, the moderate Ti-ilmenite absorption at 1489 nm represent the olivine basaltic composition. DHC - 2 spectra is showing the strong asymmetrical Cpx absorption at 1010 nm along with broad asymmetrical absorption at 2177, the moderate plagioclase absorption near 1250 nm, the weak and moderate Ti-ilmenite absorptions in 1409-1489 nm represent the basaltic composition. DHC-3 spectra has strong narrow asymmetrical Cpx absorption near 970 nm, weak plagioclase absorption near 1250 nm, moderate Ti-ilmenite absorption at 1469 nm and broad absorption at 2217 nm which represent the pigeonite bearing basaltic composition. DHC - 4 spectra is showing the strong symmetrical and moderate asymmetrical Opx absorption at 930 nm and 1918 nm, moderate plagioclase absorption near 1250 nm which represent the noritic composition.

Conclusion: The present study M^3 spectral characterization results are showing the different rock units such as basaltic, gabbroic and noritic compositions. The enhanced FeO and TiO_2 abundances exhibited the variations of mare deposit. In consistent to, it is observed that the wrinkle ridge may have formed due to the local stresses from the loading by basalt filling from subsurface [13]. Very low to low TiO_2 mare basalt (0-3.5%) observed in the DHC that indicate the compositional variability which divulges the possibility of the younger units on the surface from sub-surface derivatives.

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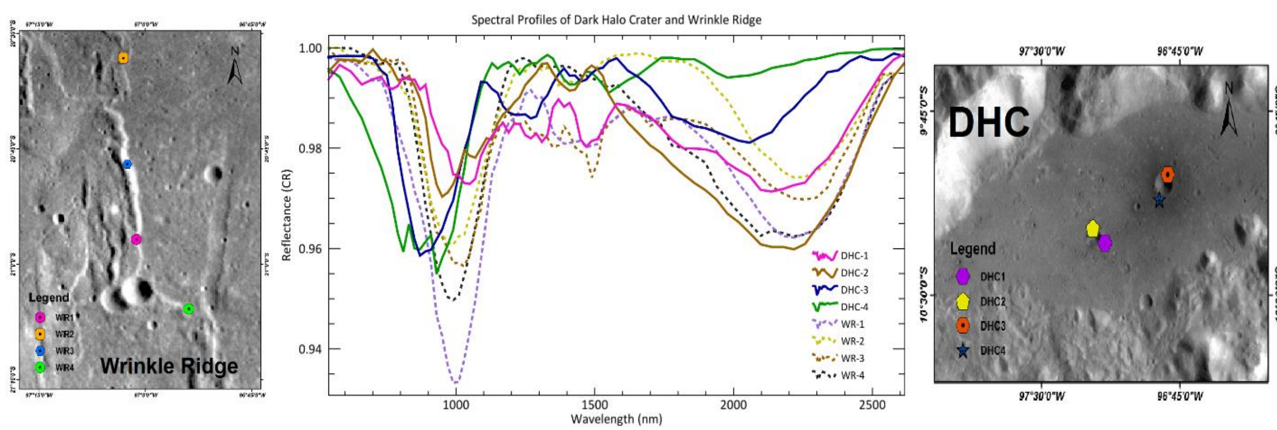

Fig. 2. The reflectance spectral plots of wrinkle ridge and dark halo crater and their respective locations.