Spectral characterization and morphology of Olivine-pyroxene-spinel bearing lithologies on Moon: Implications for lunar endogenic processes

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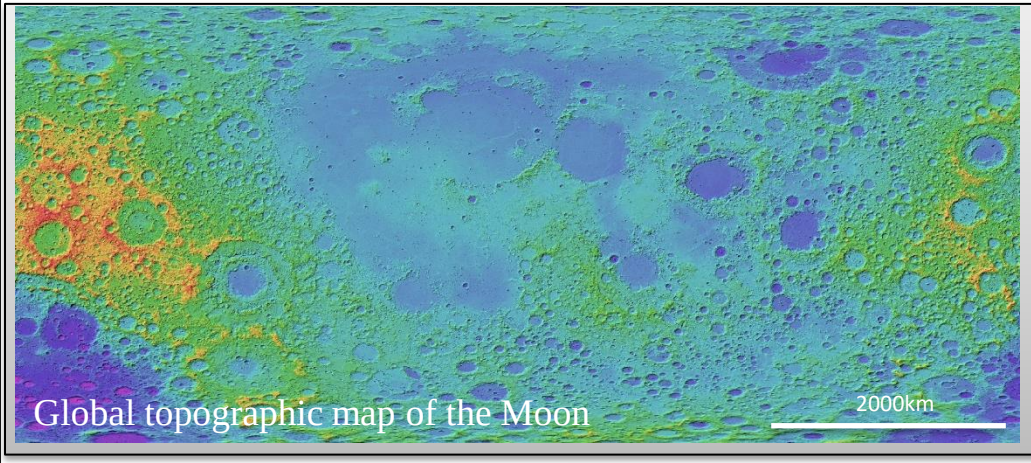
INTRODUCTION

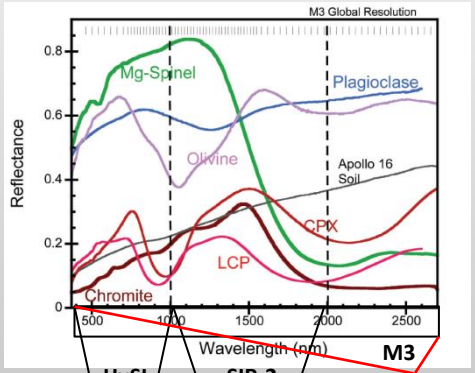


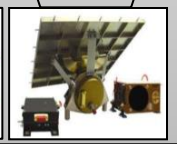
The present study will identify spectral and chemical features of **olivine, pyroxene, plagioclase, chromian spinel and Mg-Al spinel** bearing lithologies and the morphology of spinel bearing rock terrains on Moon through a multi-disciplinary approach by using high-resolution satellite data from HySI and TMC payloads of ISRO's Chandrayaan-I mission and geological data sets to model the endogenic processes operated on Moon. M3 data will be used to understand spectral features of chromian poor spinels.

Major objectives

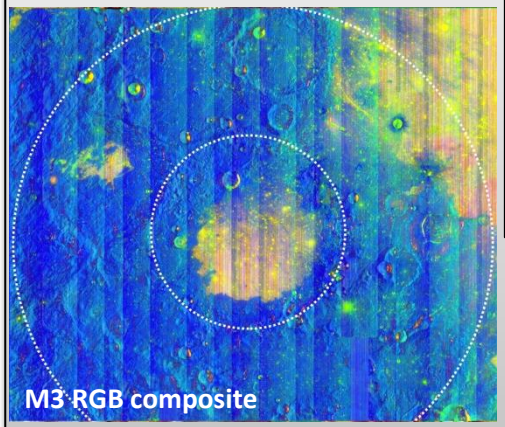
- To analyze the relation between chromian rich and chromian poor spinel bearing lithological units and its association to anorthosites and Mare basalts on Moon to model the lunar crust-mantle evolution processes.
- To determine the hyperspectral and chemical characteristics of analogue olivine-pyroxene-plagioclase-chromian and Mg-Al spinels bearing lithologies in India to have a better spectral characterization and comparison of lunar lithologies.
- To formulate a petrogenetic mechanism on formation of lunar mantle- lower crust to have further insights on the lunar evolution and differentiation history.

Methodology: Hyperspectral Remote sensing for lunar surface compositional mapping



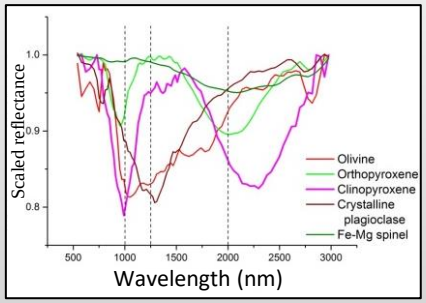


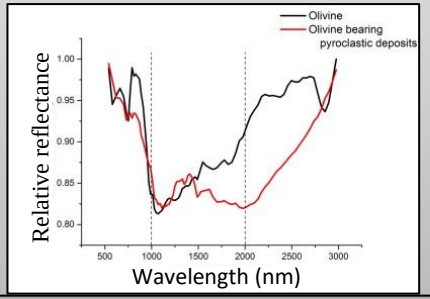
Major results: Mineralogical Mapping

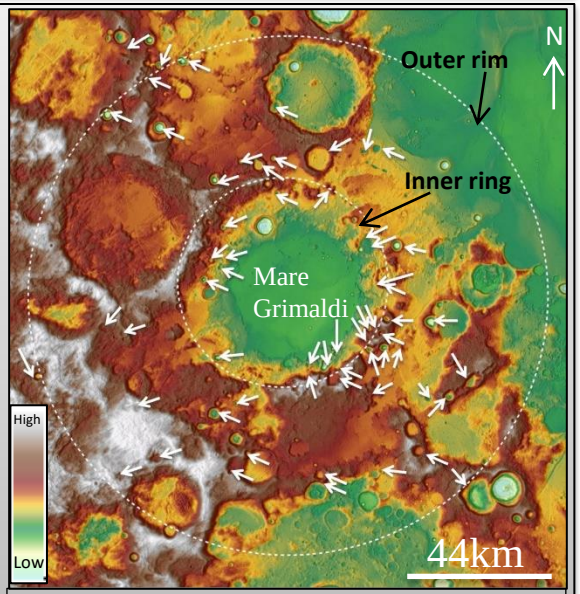


R: BD1.05µm (Olivine)
G: IBD2µm (Spinel)
B: R0.95/R0.75 (Pyroxenes)

Minerals identified:

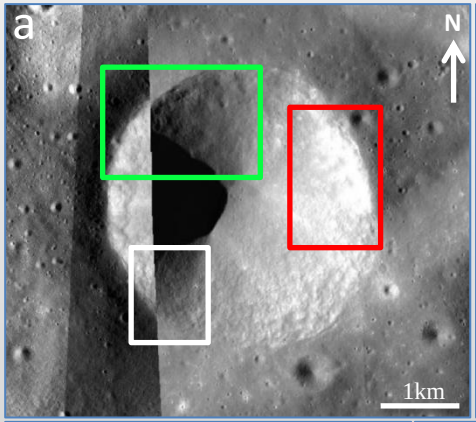


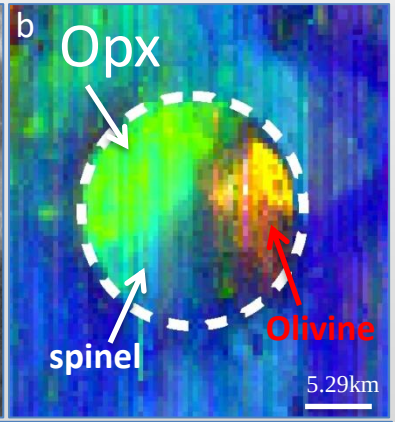


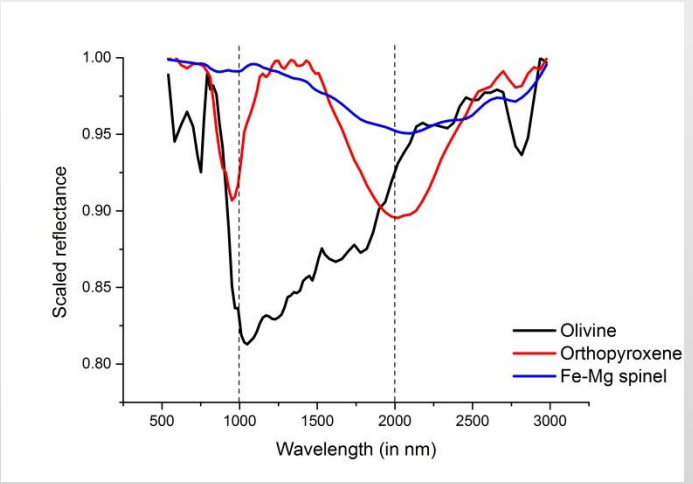


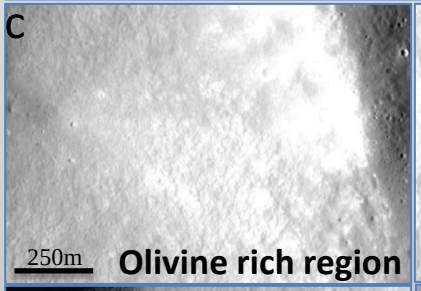
Olivine detected regions in the peak ring craters

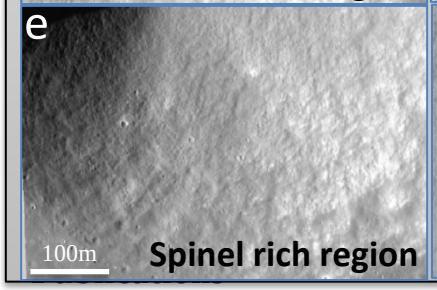
Morphological Analysis: Olivine-Orthopyroxene-Spinel (OOS) Suite lithology

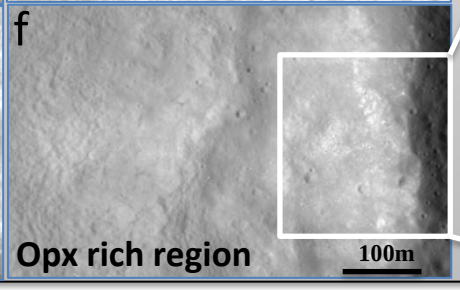


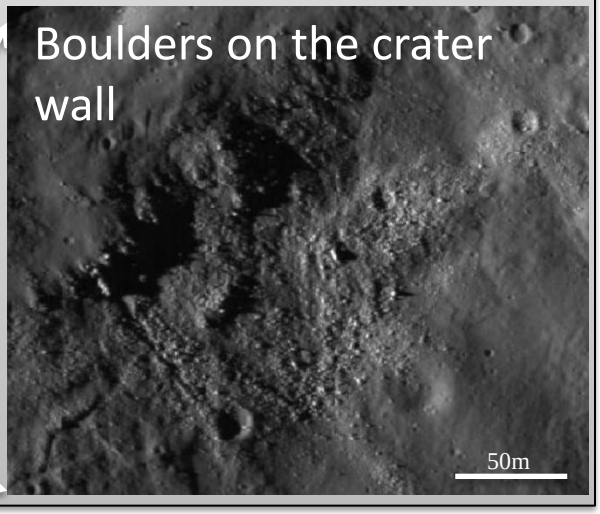












Implications:

Detection of OOS suite lithology in the peak ring craters of the basin on the near side of the Moon is significant in understanding the endogenic processes on Moon.

Future work

- To determine the compositional variations among lunar spinels and olivines identified in different locations and their association with the major lunar rock types in order to interpret the possible origin of these minerals.
- Probing similar areas on Moon with exposures of primary rock forming minerals using HySI and M3 data.
- Combined hyperspectral and chemical analyses of the analogue samples would enable a comparison with the lunar lithologies and a model for the geochemical evolution of the lunar mantle-lower crust can be proposed.

Publications

- Second best poster prize for the poster titled '**Characterization of Localized pyroclastic deposits in the Grimaldi basin'** presented at a **Brainstorming session** on 'Vision and Explorations for Planetary Sciences in Decades 2020-2060'. This was organized by **Physical Research Laboratory**, Ahmedabad.
- Thesniya**,** P. M., Rajesh, V. J., 2018. **Compositional mapping of a previously unidentified localized pyroclastic deposit in the Grimaldi basin.** In: Abstracts of the 30th Kerala Science Congress, pp. 121-122.
- Thesniya**,** P. M., Rajesh, V. J., 2018. **Detection of primary mineral assemblages in Grimaldi basin on the nearside of the Moon: Implications for the evolution of the lunar crust**. In: Proceedings of the 5th UGC-SAP-DRS II (2013-18) conference, vol. 5, pp. 13-19.
- Saranya, R. C., Thesniya**,** P. M., Rajesh, V. J., Ajith, G., 2018. **Compositional diversity of lunar magmatic spinels: Implications for endogenic processes.** In: Proceedings of the 5th UGC-SAP-DRS II (2013-18) conference, vol. 5, pp. 24-27.
- Thesniya**,** P. M., Rajesh, V. J., 2018. **Olivine rich exposures in the Grimladi basin on the nearside of the Moon: Implications for lunar endogenic processes.** In: abstracts of the 42nd COSPAR Scientific Assembly.