QUANTITAIVE COMPOSITIONAL VARTIATIONS OF LUNAR VOLCANOES: EVIDENCE FOR A PARASITIC RELATIONSHIP. H. V. Bhatt[1], T. D. Glotch[1]. [1]Stony Brook University, NY. (henal.modha@stonybrook.edu).

Introduction: The near side of the Moon experienced voluminous volcanic activity. There are two types of volcanic regimes i.e., 1) mare regions, and 2) shield volcanoes. Both appear dark and smooth and can only differentiated with topographic data. Mare regions are larger compared to volcanic shields. One of the largest shields—the Cauchy shield volcano resides within Mare Tranquillitatis while the relatively smaller Gardner shield lies on the northern mare-highland boundary of Mare Tranquillitatis (Fig. 1). Both of the shields are associated with Mare Tranquillitatis, differing in size, topography, and morphology, but aligning in composition.

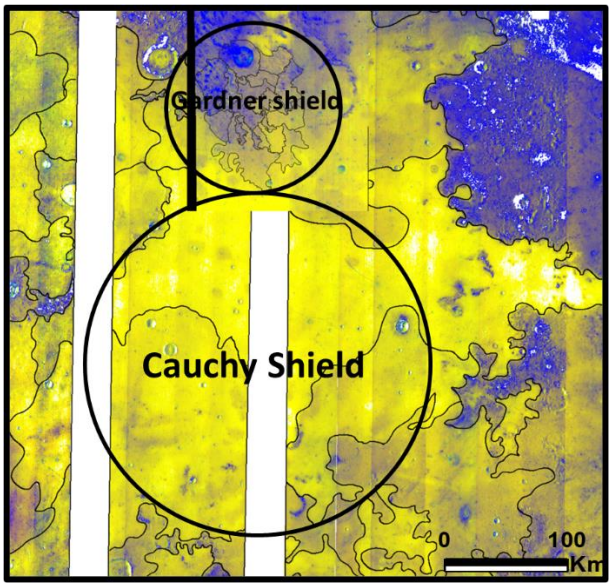

Fig. 1 M3 integrated band depth (IBD) false color composite (FCC) of the Cauchy and Gardner Shield volcanoes shows basaltic material with yellow colors delineated with black boundaries.

Data and Methodology: To understand compositional variability, we used 80 m and 140 m resolution VNIR M3 data from the Chandrayaan-1 mission. We generated an integrated band depth (IBD) parameter map as per [1] and calculated detailed band parameter analysis as per [2], [3]. We fit reflectance spectra with 4th order polynomials with a long wavelength cut off at 2600 nm.

Results and Conclusion: The derived values of band parameters were plotted in a band area ratio (BAR) vs Band I center plot modified after [4], [5] (Fig. 2). The resulting band parameter values for both of the shields overlap. All the values of spectral band parameters cluster above the BA, region indicating the presence of high calcium pyroxene-bearing basaltic material, trending towards the OC region. Unit S-11 values in Fig. 2 indicate the presence of pyroclastic material at the Gardner shield [3].

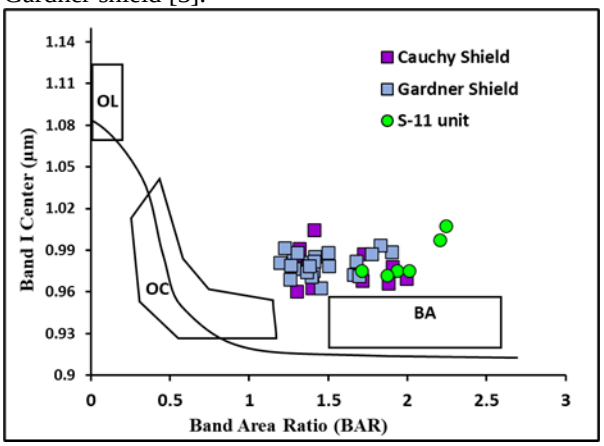

Figure 1. BI center vs. BAR plot shows HCP bearing basaltic material at the Cauchy shield and Gardner shield modified after [4], [5]. S-11 is an explosive deposit with a mixture of pyroxene and small amounts of glass.

Both of the shields are associated with Mare Tranquillitatis and occur close proximity with different sizes and topography but similar compositions, indicating a possible petrogenetic connection. While the timing of eruptions of different units may vary, the origins of the lavas from each shield might have been same. Gardner shows the presence of explosive material [3] while no explosive material is identified at the Cauchy shield. The Cauchy shield is ~400 km long and the Gardner shield is ~70 km long. The Cauchy shield's flow units are larger and more voluminous compared to Gardner, which experienced smaller and less voluminous eruption. The major difference between these two shields is that the Cauchy shield is a non-mascon region and the Gardner shield overlies a small mascon. This observation indicates that the mantle would be closer to the surface at Gardner while the crust is thicker underneath the Cauchy shield. Despite such major differences, the shields have similar compositions and occurred in very close vicinity, indicating a high probability of a single source origin. Through this work we conclude that the Gardner and Cauchy shields show petrogenetic correlation, indicating that the Gardner shield would have been a parasitic shield of the larger Cauchy shield.

References: [1] Mustard J. F. et al (2011), JGR, 116, E00G12. [2] Bhatt H. et al (2020), JESS, 129, (45). [3] Bhatt H. et. al. (2024), 55th LPSC, Contribution no. 2203. [4] Gaffey M. J., et al. (1993) Icarus, 106(2), 573- 602. [5] Cloutis E. A. et al., (1986), JGR, 91(B11), 11641- 11653.