

WHERE TO OBTAIN SAMPLES OF A KEY UNSAMPLED LUNAR ROCK TYPE: MG-SPINEL ANORTHOSITE C. M. Pieters^{1,2}, ¹Planetary Sci. Institute, Tucson, AZ; ²Brown Univ. Providence, RI.
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Introduction: Documented lunar samples returned to Earth decades ago during the Apollo/Luna Era form the cornerstone of our understanding of the formation and evolution of the primary lunar crust. A continuing improvement of instruments that obtain compositional information from orbit has allowed us to infer and map the distribution of crustal rock types for many unexplored areas with increasing confidence. We know where crustal *anorthosites* are exposed (some massive and highly crystalline [e.g. 1,2]), where *dunites* and *troctolites* are exposed as mountains or in crater walls [e.g. 3], and where *noritic anorthosites* dominate [e.g. 4,5,6,7]. However, a widely distributed crustal rock type, Mg-spinel bearing anorthosite recently identified with the orbiting spectrometer M³ [8,9], has yet to be found in returned lunar samples even though the individual minerals are readily recognized [10]. The observed *Mg-spinel anorthosite* is hypothesized to be a product of early crustal evolution and is thought to be associated with other rock types linked to the early Mg-suite [e.g., 11,12]. Targeted samples are essential to bridge this crustal evolution knowledge gap.

Mg-Spinel Target Areas: Criteria for identifying Mg-spinel anorthosite are discussed in the survey of [9]. The most reliable locations have been confirmed with more than one independent measurement. Three targets known to expose *Mg-spinel anorthosite* of high scientific interest are illustrated here. As described in [9], all are in regions of thin crust and expose crustal materials associated with the inner ring of a basin. M³ data shown here across each of these targets areas highlight exposures rich in **Mg-spinel as green**, **pyroxene as red**, and **plagioclase as blue**.

Theophilus crater central peaks. (11.5S; 26.1E) Displaying some of the most well exposed outcrops dominated by Mg-spinel, this is the type-area for Mg-spinel anorthosite [8,9].

Montes Teneriffe of Imbrium inner ring. (47.1N; 11.8W) With access over later more recent mare basalt, this is perhaps the easiest exposure to visit.

Thomson crater rim on the farside (32.7S; 166E). This mare filled large crater within the Ingenii basin on the edge of SPA, is one of the more compositionally diverse and interesting regions [9; 9 supp].

References: [1] Cheek et al. (2013) *JGR* **118**. [2] Donaldson Hanna et al. (2014) *JGR* **119** [3] Yamamoto et al. (2010) *Nature Geo* **3**. [4] Isaacson & Pieters (2009) *JGR* **14**. [5] Lucey et al., (2014) *Am Min* **99**. [6] Ohtake et al. (2014) *GRL* **41**. [7] Moriarty & Pieters (2018) *JGR* **123**. [8] Dhingra et al. (2011) *GRL* **38**. [9] Pieters et al.

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