**COMPOSITIONAL UNITS ON THE MOON: THE ROLE OF SOUTH POLE-AITKEN BASIN.** C. A. Peterson[1], B. R. Hawke[1], D.T. Blewett[1,2], D. B. J. Bussey[1] P. G. Lucey[1], G. J. Taylor[1], P. D. Spudis[3], [1]Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, HI 96822, [2]NovaSol, 1100 Alakea Street, 23rd floor, Honolulu, HI 96813, [3]Lunar and Planetary Institute, Houston, TX 77058.

**Introduction:** Many of the large-scale geochemical provinces found on the Moon today are strongly linked to the impact that created South Pole-Aitken (SPA) basin. This basin has a topographic rim about 2500 km in diameter, an inner shelf 400 – 600 km in width, and an irregular depressed floor at an elevation about 12 km below the rim crest [1]. Topographically high regions surround the SPA basin and are especially pronounced to the north and east; models also show very high levels of crustal thickness in those areas and relatively thin crust beneath the basin [2].

Multispectral images of the Moon were returned by the Galileo and Clementine spacecraft. Belton *et al.* [3] noted an enhancement in mafic materials in the SPA interior. Lucey *et al*. [4] derived methods that use Clementine UVVIS data to quantify the iron and titanium content of lunar surface materials and, in addition to confirming the enhanced FeO content in the basin interior, noted that regions in the far northern farside are extremely low in FeO. This indicates extensive exposures of anorthosite.

More recently, the Lunar Prospector spacecraft returned GRS data that are being used to produce elemental abundance maps [5]. Preliminary thorium maps have been produced [6], and iron maps are also being produced using techniques totally independent from those used with the Clementine data.

**Method:** Clementine UVVIS data cover most of the Moon between 70°N and 70°S [7]. We have used these data to produce FeO and $TiO_2$ maps. Elemental abundance maps derived from data returned by the Lunar Prospector mission are currently being produced. A preliminary thorium map is available for analysis.

**Results and Discussion:** *SPA Interior.* Apollo orbital geochemistry data were obtained for the northern portion of the SPA basin. Enhanced FeO and Th values were noted [8]. The mafic nature of the basin floor was confirmed by Galileo multispectral data [3]. Additional evidence was provided by Clementine and Lunar Prospector.

It has been suggested [9,10] that the mafic enhancement of the basin floor results from the exposure of lower crustal or perhaps even mantle material. Recent work demonstrates that neither cryptomaria nor pyroclastic deposits can account for the mafic character of the SPA interior deposits [11,12].

There have been recent suggestions that the Th (and possibly the FeO and $TiO_2$) enhancements in SPA are related to Imbrium ejecta deposits in the vicinity of the Imbrium antipode [13]. It seems unlikely that the mafic and Th anomalies on the interior of SPA basin can be fully attributed to Imbrium ejecta.

Enhanced FeO and $TiO_2$ values are seen in various portions of the SPA interior and not just in the vicinity of the antipode. In the vicinity of the antipode, several large post-Imbrium craters expose Th-rich material excavated from a depth of several km, far below the level of any reasonable thickness of Imbrium ejecta. Other large impact craters excavate Th-rich material far from the Imbrium antipode. Wieczorek and Zuber [14] suggest that Imbrium ejecta would not be concentrated at the mapped antipode because of lunar rotation during ejecta transport in ballistic trajectories.

*SPA Exterior – Farside & West Limb*. There is an anorthosite-rich zone on the northern farside identified by Lucey *et al.* [15]. This area exhibits extremely low FeO values. More recent work using higher resolution Clementine imaging data generally supports this interpretation [16]. Support is also provided by $TiO_2$ data as well as Lunar Prospector Th data. Lucey *et al.* [15] suggested that this anorthosite zone might be the surface of the plagioclase-rich flotation crust formed by the crystallization of the magma ocean.

The terrain that lies between the mafic anomaly on the interior of SPA and the "anorthosite-rich" zone exhibits intermediate FeO abundances. This intermediate terrain can be divided into inner and outer zones. The inner zone is more mafic (FeO-rich) and is located between the transient crater cavity ring and the main (outer) ring. It is covered by thick SPA ejecta. The outer zone is much less mafic and is located between inner zone and the "anorthosite-rich" zone. Small areas of very low FeO material, interpreted as pure anorthosite, occur in the outer zone. Many of these are correlated with inner rings of post-SPA basins that appear to expose anorthosite from beneath more mafic SPA ejecta deposits.

*SPA Exterior – Nearside.* SPA must have emplaced vast amounts of ejecta in the southern highlands and on the lunar nearside in general. We suggest that relatively mafic SPA ejecta was emplaced on top of pure anorthosite in the southern highlands. Thompkins and Pieters [17] identified two exposures of anorthosite in the central peaks of craters in the far southern nearside. No basins exist that might have exposed anorthosite in the far south, but farther north the Mutus-Vlaq and Humorum basins have exposed anorthosite from beneath the more mafic surface material.

**References:**

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