THE DISTRIBUTION OF LOCALIZED LUNAR PYROCLASTIC DEPOSITS AS RELATED TO CRUSTAL THICKNESS;
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Overview: The distribution of localized lunar pyroclastic deposits (LLPD) have been examined with regard to crustal thickness as inferred from Clementine altimetry data [1]. These preliminary analyses indicate that LLPD occur in regions of increasing (60-70 km) crustal thickness along the margins of major mare-filled basins (where crustal thicknesses are <60 km). These results suggest that crustal thicknesses of ~60 to 70 km permit lunar magmas to just reach the lunar surface without producing significant lava flows. LLPD emplacement appears to be associated intimately with crustal thinning due to impact and mare infilling of basins on the lunar near side. On the far side, the emplacement of LLPD may be inhibited by inadequate magma supply in underlying mantle source regions.

Localized lunar pyroclastic deposits (LLPD) are seen on the margins of many lunar impact basins [2; 3; 4; 5]. LLPD form as a result of intermittent, small-scale, vulcanian-style eruptions of volatile-rich magma that reach the lunar surface but generally do not produce lava flows [6, 7]. The locations of several LLPD have been examined with regard to crustal thickness as inferred from Clementine altimetry data [1]. Near-global altimetry, gravity, and uncorrected crustal thickness maps of the Moon with 2°-binning were prepared by NASA/Goddard [1]. Crustal thickness data have not been corrected for the attraction due to mare fill in flooded basins, so a 20% error in crustal thickness exists in these areas [1]. LLPD examined as part of this preliminary analysis include: dark-halo craters in the floor-fractured craters Alphonsus (13°S, 4°W), Atlas (45°N, 45°E), Franklin (39°N, 48°E), Vitruvius (17°N, 31°E), Schrodinger (75°S, 135°E), and J. Herschel (62°N, 41°W); and irregular LLPD on the margins of southern Mare Imbrium, western Oceanus Procellarum, southeastern Mare Serenitatis, southern Mare Humorum, and southern Orientale Basin. Major mare deposits occur in areas with crustal thicknesses on the order of 60 km or less (±20%). LLPD occur in regions of increasing (60 to 70 km, ±20%) crustal thickness along the margins of major mare-filled basins. These results suggest that crustal thicknesses of ~60 to 70 km permit lunar magmas to just reach the lunar surface. The emplacement of LLPD appears to be intimately associated with crustal thinning due to impact excavation and subsequent mare infilling of basins on the lunar near side.

On the lunar far side, crustal thicknesses associated with the lunar "cryptomaria" (mare deposits buried by later impact ejecta) in the Schiller-Schickard and South Pole/Aitken regions also fall within the 60 to 70 km range of crustal thickness [1]. Although relatively small maria are observed in association with areas of thinner crust (<60 km) within the Orientale, South Pole/Aitken, Moscoviense, Schrodinger, and Mare Australe basins (see [8] for review), LLPD have so far been observed only in the Schrodinger basin [9]. In keeping with the general paucity of maria on the lunar far side, the emplacement of LLPD may be inhibited there by the low rates of magma production due to a deficiency in heat-producing elements (e.g., U, Th) in underlying mantle source regions [10]. Examination of Clementine multispectral image data for the lunar far side will permit further study of these and other questions regarding the origin and emplacement of LLPD on the Moon. For example, further analyses of the distribution and composition of pyroclastic deposits on the Moon may provide clues to lunar volcanic eruption conditions and their relationship to subsurface structural and compositional heterogeneity.

References: [1] Zuber et al., 1994, *Science*, v. 266, 1839; [2] Head, 1974, *PLPSC 5th*, 207; [3] Gaddis et al., 1985, *Icarus*, v. 61, 461; [4] Hawke et al., 1989, *PLPS 19th*, 255; [5] Coombs and Hawke, 1992, *PLPS 22nd*, 303; [6] Wilson, 1984, *Vistas Astron.*, v. 27, 333; [7] Head and Wilson, 1979, *PLPSC 10th*, 2861; [8] Wilhelms, 1987, USGS Prof. Pap. 1348; [9] Robinson and Shoemaker, 1994, *Eos Trans.*, v. 75, 399; [10] Lucey et al., *Science*, v. 266, 1855.