

Petrologic and chemical diversity of new Apollo 17 2-4 mm basaltic regolith fragments

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Serenitatis basin presents 29 spectrally different lava compositions on its surface [1]. At depth, the chemical diversity of buried flows is not known, making it difficult to constrain the complete evolution of the mantle under this basin. Apollo 17 basalts are typically characterized by 6-7 types with an age range of 3.9-3.6 Ga. For both vertical and horizontal representation, 25 2-4 mm Apollo 17 basaltic regolith fragments from soils 71063/4, 74243/4, 75063/4 are being systematically investigated for chemical and isotopic composition and chronology. Nine fragments were selected using a M4-Tornado μ XRF [2]. Integration with literature data will help define lunar mantle heterogeneities over time.

SEM/EMP – basaltic fragments from each soil show a variety of textures and mineral/matrix compositions. Soil 71063/4: 71063,6 mostly matrix with olivine (olv) xeno/phenocrysts (Fo₆₅₋₇₀), pyroxene (px; En₄₁₋₆₄Wo₈₋₃₉Fs₁₇₋₃₂), plagioclase (plag; An₈₅₋₈₇) and minor chromite (chr); 71063,7 a gabbro (phases >1mm) with olv (Fo₅₆₋₇₁), px (En₃₆₋₆₉Wo₆₋₂₆Fs₂₅₋₄₁), plag (An₉₃₋₉₆) and ilmenite (ilm); 71064,12 quenched melt with 50-200 μ m olv crystals (Fo₇₂₋₇₆) and ~10 μ m chr. Soil 74243/4: 74243,38 fine grained basalt, vesicles, mineral and lithic clasts of different composition, olv (Fo₆₄₋₇₃), high/low-Ca px (En₃₆₋₆₉Wo₆₋₂₆Fs₂₅₋₄₁), ilm with armalcolite (arm) cores, plus small spinels; 74243,41 quenched melt with olv (Fo₆₄₋₇₃) and arm phenocrysts; 74243,42 two distinct fine grained textural domains, includes lithic and mineral clasts, vesicles, Fe-Ni-S grains; 74244,12 px prophyritic ilm basalt, px are En₃₁₋₄₆Wo₂₇₋₄₆Fs₁₆₋₄₂, plag is An₈₁₋₈₅, and ilm with arm cores. Soil 75063: 75063,5 a 2-size domain olv micro-gabbro with dissimilar mineral chemistry, coarser domain (0.5->1 mm) composed of plag (An₈₉₋₉₂), olv (Fo₃₃₋₅₂), px (En₃₂₋₄₅Wo₉₋₃₅Fs₃₃₋₅₃), and ilm; 75063,13 type 1A, olv prophyritic ilm basalt, sub-variolitic texture, contains olv (Fo₆₉₋₇₃), plag (An₈₅₋₈₈), and varying size ilm.

Magma generation – initial modelling [3] using matrix compositions of samples 71063,6 and 71064,12 gives primary pressure (0.3-1.6 GPa) and temperature (1230-1350°C) conditions consistent with other Apollo 17 data.

[1] Hiesinger *et al.* (2000) JGR. [2] Fernandes *et al.* (2016) 47th LPSC. [3] Lee *et al.* (2009) EPSL 279, 20-33.