NORTHWEST AFRICA 773 – AN UNUSUAL ROCK FROM THE LUNAR MARIA. R. L. Korotev, R. A. Zeigler, B. L., Jolliff, and L. A. Haskin, Washington University, Saint Louis, Missouri

Northwest Africa 773 is unique among lunar meteorites, as well as Apollo samples, in terms of lithology and composition. It combines (1) a VLT (very-low-Ti) basaltic composition and clastic components and (2) a magnesian (high Mg/Fe), olivine-rich-cumulate clast lithology with (3) trace-element ratios and signature similar to those of KREEP. The cumulate lithology has the combination of a magnesian major-element composition and a highly evolved KREEP-like signature in much the same way as do magnesian-suite nonmare cumulates.

Fagan et al. [1] described two lithologies, a regolith breccia and a cumulate olivine gabbro. In our assessment, the breccia consists almost entirely of VLT mare basalt components and the cumulate lithology is a related hypabyssal olivine gabbro. Both lithologies are unlike any sample from the lunar maria of which we are aware in having relative concentrations of incompatible elements, including REE "pattern", that are identical to that of high-K KREEP [2] yet absolute concentrations that are only 12% (matrix) and 8% (gabbro) as great. Most peculiar, Eu concentrations are half (matrix) and a third (gabbro) those of other mare basalts and KREEP-bearing nonmare samples of similar Sm concentrations.

We have studied both lithologies by bulk compositional methods (INAA, fused-bead EMP) and by mineral analysis (EMP). In our sample, the breccia contains clasts of the cumulate lithology ranging in size from several millimeters to small, individual mineral clasts. The breccia also contains mineral and lithic clasts of other basaltic lithologies, including some that range to very low Mg/Fe, including fayalite-hedenbergite-silica symplectites, similar to VLT mafic components of QUE94281 [3]. In our subsamples, the olivine-gabbro cumulate contains some 48% olivine, 25% pigeonite (plus minor opx), 15% augite, 10% plagioclase, and <1% ilmenite, barian K-feldspar, RE-merrillite, troilite, and FeNi metal. The cumulate is rich in Co (88 µg/g) and Ni (210 µg/g, but Ir <4 ng/g). Its texture is igneous, with the most sodic plagioclase, K-feldspar, ilmenite, and merrillite representing trapped melt and filling interstices between relatively coarse grains of olivine and pyroxene (0.1–1 mm). Olivine Fo ranges from 65 to 70 and CaO, 0.13–0.26%. In pyroxene, Mg-Fe are well equilibrated: Mg' (Pig) ~72–74, Mg' (Aug) ~75–80. Compositions lie along the 1100ºC isotherm and Wo contents indicate crystallization through the ~1200–1100ºC interval [4]. Micrometer-scale exsolution occurs in some pigeonite grains. Plagioclase ranges from ~An_{94} to An_{80} and contains ~0.4–0.8 wt% MgO+FeO. K-feldspar compositions include BaO ~0.7–1.7 wt%. Mineral compositions are consistent with a near-surface origin for the cumulate lithology. Mineral and major-element compositions of both lithologies are similar to those observed in other lunar VLT basalts and the mafic component of QUE94281, especially the mafic glasses [3]. For compatible elements, the bulk composition of the brecciated matrix is consistent with a mixture of VLT mare basalt and 10–20% of the olivine gabbro. There is little to no evidence, petrographical or compositional, for the presence of feldspathic, nonmare material such as that which dominates most lunar meteorites. We have also not found evidence for any unrelated clastic components of basalt, glass, or crystalline impact-melt breccia of KREEP composition in the matrix or olivine gabbro.

References: [1] Fagan et al. (2001) *Meteorit. Planet. Sci.*, *36*, A55. [2] Warren & Wasson (1979) *Rev. Geophys. Space Phys.*, *17*, 73–88. [3] Jolliff et al. (1998) *Meteorit. Planet. Sci.*, *33*, 581–601. [4] Lindsley & Anderson (1983) *PLPSC13*, A887–A906.