PETROLOGY AND BULK COMPOSITION OF ULTRAMAFIC OLIVINE-ORTHOCUMULATE SHERGOTTITE NORTHWEST AFRICA 11261

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Introduction: As the recovery of more unpaired Martian meteorites continues apace (almost exclusively in the barren desert regions of northwest Africa), previously unrecognized lithologies or geochemical varieties should be expected to be discovered. The latest example out of the 107 unpaired specimens now known is a 114.2 gram stone coated by reddish-brown weathering products (see Figure 1). The dark green interior is much fresher, yet still contains some thin veinlets and grain boundary coatings of fine-grained calcite, presumably a product of terrestrial alteration.

Figure 1. *Cut NWA 11261 stone showing the red-brown limonitic weathering products coating the exterior and the dark green interior. Photo by Bob Falls.*

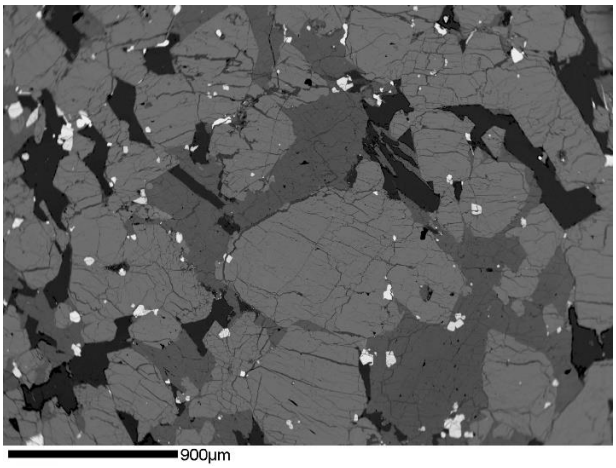

Figure 2. *Back-scattered electron image showing the olivine-orthocumulate texture with intercumulus pigeonite and maskelynite. Bright grains are mostly chromite.*

Petrography: Unlike other poikilitic shergottites (e.g., [1]) that have fairly large oikocrysts (perhaps accumulated in excess prior to crystallization of surrounding equigranular regions), NWA 11261 has an overall orthocumulate texture (see Figure 2). Sparse pyroxene oikocrysts (up to 3 mm) enclosing small olivine chadacrysts are also present. Olivine ($Fa_{36.0\text{-}37.3}$, FeO/MnO = 48-50) is dominant, along with intercumulus pigeonite (~10 vol.%; $Fs_{29.3\text{-}30.3}Wo_{8.6\text{-}6.8}$, FeO/MnO = 27-32) and maskelynite (~6 vol.%, $An_{51.2\text{-}51.8}Or_{1.4\text{-}1.7}$), plus accessory chromite (with variable Ti content), ilmenite, pentlandite, pyrrhotite, Mg-bearing merrillite, rare baddeleyite and minor barite. Mafic silicate phases have limited compositional variation; olivine has polycrystalline melt inclusions surrounded by radial expansion cracks.

Elemental Abundances and Hf-Nd Isotopes: Analyses of major and trace elements on powder produced by grinding 1.9 grams of clean interior material in an agate mortar, as well as analyses of whole rock Hf and Nd isotopic compositions, are in progress.

Discussion: Among shergottites with poikilitic texture, the majority contain less than 10 vol.% maskelynite, and hence are ultramafic in terms of their bulk major element composition. Others contain more than 10 vol.% maskelynite and have been called permafic [2]. NWA 11261 is clearly an ultramafic shergottite, and we interpret it to be a product of magmatic crystal accumulation. All previously known ultramafic shergottites and two permafic ones (NWA 1950, NWA 2646) have *intermediate* incompatible trace element signatures, yet four permafic examples are *enriched* [3]. So far no examples of *depleted* ultramafic shergottites have been documented, and it will be of considerable interest to establish the affinities of NWA 11261.

References: [1] Irving A. J. *et al.* (2017a) *Lunar Planet. Sci.* **XLVIII**, #2068. [2] Irving A. J. et al. (2010) *Lunar Planet. Sci.* **XLI**, #1547. [3] Irving A. J. *et al.* (2017b) *Lunar Planet. Sci.* **XLVIII**, #2712.