Petrologic, Elemental and Isotopic Characterization of Unique Depleted Olivine Microwebsteritic Shergottite Northwest Africa 13179

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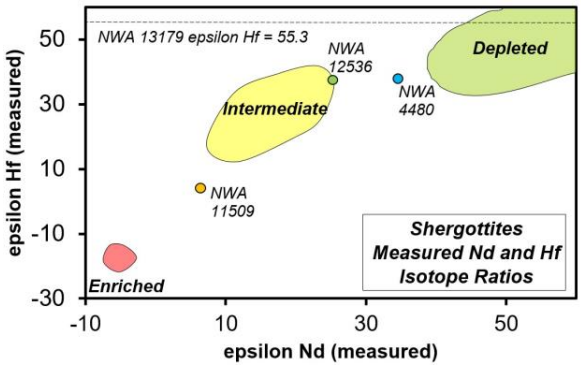
A 175 gram crusted stone found in the Sahara is the first known example of an ultramafic Martian meteorite with depleted ITE characteristics. The specimen is a medium-grained (~0.7 mm) aphyric pyroxenite composed mainly of zoned pyroxenes, ~15 vol.% olivine and <5 vol.% interstitial maskelynite, plus accessory chromite, Ti-chromite, pyrrhotite, pentlandite, ilmenite, silica polymorph and merrillite. Pyroxene grains are zoned from orthopyroxene cores ($Fs_{14.7\text{-}14.9}Wo_{1.2\text{-}1.4}$, FeO/MnO = 28-30) to pigeonite ($Fs_{20.5\text{-}44.2}Wo_{4.0\text{-}12.6}$, FeO/MnO = 27-36) and subcalcic augite ($Fs_{34.9}Wo_{28.4}$, FeO/MnO = 35). Olivine grains are zoned from $Fa_{17.7}$ cores to $Fa_{21.6\text{-}30.3}$ rims (FeO/MnO = 44-50).

The bulk rock CaO (4.7 wt.%), Al_2O_3 (3.8 wt.%) and Mg/(Mg+Fe) value (0.75) place this specimen in the ultramafic field of [1], and the REE pattern shows strong depletions in La-Sm. The εHf value of +55.3 confirms an affinity to depleted shergottites like Tissint and at least 15 other presumed launch-paired Martian stones [2]. We interpret NWA 13179 to be the first known igneous cumulate from a (possibly quite ancient) depleted shergottite magma.



References: [1] Irving A. et al. (2010) *LPS* **LXI**, #1547
[2] Lapen T. et al. (2017) *Science Advances* **3**, e1600922.