

**NORTHWEST AFRICA 5784, NORTHWEST AFRICA 5968 AND NORTHWEST AFRICA 6157: MORE VESTAN DUNITES AND OLIVINE DIOGENITES**

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**Ultramafic Vestan Samples:** Until recently the only known ultramafic rocks tied to 4Vesta were orthopyroxene-rich diogenites, but increasing numbers of peridotites (with >40 vol.% olivine) and dunites (with >90 vol.% olivine) exhibiting Vestan affinities are being recovered as meteorites. FeO/MnO ratios in mafic minerals and oxygen isotopic compositions in these olivine-rich specimens have the same ranges for these parameters as in eucrites and diogenites (and for that matter, in mesosiderites).

**NWA 5784** is a cataclastic dunite composed of 91 vol.% olivine (Fa<sub>28.6-31.3</sub>; FeO/MnO = 45.4-48.1), 5 vol.% plagioclase (An<sub>94.5</sub>), 2 vol.% orthopyroxene (Fs<sub>23.6-27.0</sub>Wo<sub>1.6-0.9</sub>; FeO/MnO = 27.1-30.5), clinopyroxene (Fs<sub>8.1-10.7</sub>Wo<sub>45-39.2</sub>; FeO/MnO = 18.0-19.7), chromite (Cr/(Cr+Al) = 0.70) and Ni-poor metal. Severe crushing is prevalent throughout the rock, and many of the olivine and plagioclase fragments show mottled extinction.

**NWA 5968** is a large (15 gram) monomineralic dunite clast with attached matrix (composed mainly of exsolved pigeonite, calcic plagioclase and altered metal). The clast consists entirely of very coarse (>31 mm × 14 mm) magnesian olivine (Fa<sub>8.8</sub>; FeO/MnO = 41.5) charged with submicron inclusions (possibly spinel). A sub-parallel set of compression fractures cross-trend a second set of annealed shear fractures that contain tiny, recrystallized olivine grains. Scattered patches of planar deformation features and undulatory extinction suggest a moderate shock level.

**NWA 6157** is a coarse grained (up to 7 mm) harzburgitic peridotite with a primarily protogranular texture composed of 50 vol.% olivine (Fa<sub>29.3-30.1</sub>, FeO/MnO = 42.1-46.2) and 45 vol.% orthopyroxene (Fs<sub>24.3±0.0</sub>Wo<sub>2.8</sub>, FeO/MnO = 26.0-29.4) with accessory clinopyroxene (Fs<sub>11.2</sub>Wo<sub>42.7</sub>, FeO/MnO = 19.7), chromite, troilite and kamacite. Plagioclase is absent.

**Oxygen Isotopes:** Acid-washed subsamples of NWA 5784 analyzed by laser fluorination gave (in per mil): δ<sup>17</sup>O 1.67, 1.39; δ<sup>18</sup>O 3.56, 3.10; Δ<sup>17</sup>O -0.205, -0.243. Analyses of NWA 5968 and NWA 6157 are in progress.

**Comparisons:** Other dunites with affinities to Vesta include NWA 2968 [1], MIL 03443 [2] and rare clasts within howardites. NWA 5968 has some similarities to NWA 2968, but NWA 5784 is more ferroan even than MIL 03443 (and with more aluminous chromite). Among other olivine diogenites (including ALHA 77256, EETA 79002, GRA 98108, NWA 1459, NWA 1877 and pairings, NWA 4223 and NWA 5480) [3], NWA 6157 is most similar to NWA 4223, but differs from it in both mineral compositions and texture.

**References:** [1] Bunch T. et al. 2006. *MAPS* **41**, #5252. [2] Krawczynski M. et al. 2008. *LPS XXXIX*, #1231; Beck A. and McSween H. 2009. *LPS XLI*, #1104 [3] Sack R. et al. 1991. *GCA* **55**, 1111-1120; Righter K. 2001. *LPS XXXII*, #1765; Irving A. et al. 2003. *LPS XXXIV*, #1502; Irving A. et al. 2005. *LPS XXXVI*, #2188; Irving A. et al. 2009. *LPS XL*, # 2466.