

**NORTHWEST AFRICA 5131: ANOTHER TAFASSASSET-LIKE METACHONDRITE RELATED TO THE CR CHONDRITE PARENT BODY.**

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**Petrography:** NWA 5131 is a 533 gram achondrite previously thought to have affinities with LL chondrites (based largely on its olivine composition); however, new oxygen isotopic data clearly indicate that it is instead related to CR chondrites, and is in many ways quite similar to Tafassasset. The specimen is an inequigranular metamorphic aggregate of olivine (62 vol.%,  $Fe_{29,3}$ ,  $FeO/MnO = 68$ ), orthopyroxene (28 vol.%,  $Fs_{24,7}Wo_{2,1}$ ), and metal (5 vol.%) with accessory clinopyroxene, intermediate plagioclase, chromite ( $cr\# 82$ ) and troilite. Finer grained portions consist of polygonal grains meeting at 120° junctions, but there also are regions with poikiloblastic texture. Orthopyroxene poikiloblasts up to 4mm across enclose smaller chadacrysts of olivine and metal. No chondrules can be distinguished, but the poikiloblastic texture may represent former chondrule regions that have been highly recrystallized.

**Oxygen isotopes:** Results obtained by laser fluorination of acid-washed material ( $\delta^{18}O = 2.12, 2.10$ ;  $\delta^{17}O = 0.42, -0.45$ ;  $\Delta^{17}O = -1.536, -1.555$  per mil, respectively) plot well below the TFL along the trend for CR chondrites.

**Discussion:** NWA 5131 provides additional supporting evidence for the existence of at least some regions of extensive thermal metamorphism within the CR chondrite parent body. Although the vast majority of CR chondrites are hydrated and of petrologic type 2, there are two known highly equilibrated CR6 chondrites (NWA 2994, NWA 3100) [1]. Tafassasset (like NWA 5131) is best termed a CR metachondrite, since it is completely lacking in chondrules. As we have already argued [1, 2], such thermally metamorphosed specimens, as well as the paired, very ancient igneous-textured achondrites NWA 011/2400/2976/4587/4901, with very similar oxygen isotopic compositions [3], imply much more complexity within the CR parent body than originally envisioned. Like the CV-CK chondrite parent body, it may well have a metallic core surrounded by a metamorphic mantle (perhaps containing plutonic igneous bodies) and a chondrule-rich regolithic crust. It remains to be seen whether NWA 5131 also exhibits the fractionated, non-chondritic compositional characteristics found in Tafassasset, NWA 2994 and NWA 3100 [1]. Hypotheses about the size and/or thermal history of the CR chondrite parent body may need to be reconsidered in light of discoveries of highly equilibrated specimens like NWA 5131.

**References:** [1] Bunch T. et al. (2008) *Lunar Planet. Sci. XXXIX*, #1991 [2] Bunch T. et al. (2005) *Lunar Planet. Sci. XXXVI*, #2308 [3] Yamaguchi A. et al. (2002) *Science* **296**, 334-336; Floss C. et al. (2005) *MAPS* **40**, 343-360; Spivak-Birndorf L. et al. (2009) *72<sup>nd</sup> Met. Soc Mtg.*, #5390; Bouvier A. and Wadhwa M. (2010) *Lunar Planet. Sci. XLI*, #489.