# SILICATE+CHROMITE+METAL+PENTLANDITE INCLUSIONS IN LODRANITE BRECCIA NWA 4478: EVIDENCE FOR A REDUCED REGOLITH ON THE LODRANITE/ACAPULCOITE PARENT BODY

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Two dense, brown stones lacking fusion crust found in Algeria represent the first known breccia related to the acapulcoite/lodranite parent body, and contain reduced mineral assemblages similar to those observed in QUE 93148.

**Petrography:** The specimens are composed of mineral and polycrystalline clasts (up to 8 mm across) with interstitial comminuted debris of the same phases. Large mineral clasts consist of either olivine or orthopyroxene (with clinopyroxene exsolution lamellae associated with blebs of Ni-free iron metal). The lithic clasts consist mainly of coarse interlocking olivine grains ($Fa_{10.6-10.9}$, FeO/MnO = 22.1-23.9, up to 3 mm across) and sparse large chromite grains (Cr/(Cr+Al) = 0.822-0.825, Mg/(Mg+Fe) = 0.506 - 0.520, $TiO_2$ = 0.31-0.37 wt.%) with interstitial (apparently intercumulus) clinopyroxene ($Fs_{3.9}Wo_{41.9}$, FeO/MnO = 10.2, some with exsolution lamellae of orthopyroxene $Fs_{9.1}Wo_{1.3}$, FeO/MnO = 11.9), orthopyroxene, kamacite, pyrrhotite, pentlandite and troilite. The modal abundance of metal (+ limonite after primary metal) measured by BSE imaging on a large polished slice is 5 vol.%. Plagioclase is absent. Olivine grains contain numerous blebby to worm-like polycrystalline inclusions of clinopyroxene+chromite+orthopyroxene+pentlandite, and clinopyroxene grains contain similar inclusions composed of orthopyroxene+chromite+kamacite; some examples exhibit symplectitic intergrowths of these various phases. Some olivine grains contain multiple blade-like lamellae of another olivine phase with different composition ($Fa_{9.8}$). Narrow elongate zones or discontinuous veinlets of metal are present within clinopyroxene, and adjacent to such metal the pyroxene has a more magnesian composition.

**Oxygen Isotopes:** Acid-washed silicate material analyzed by laser fluorination gave, respectively, $\delta^{18}O$ = 2.23, 2.43, 2.23, 2.40; $\delta^{17}O$ = 0.14, 0.30, 0.07, 0.11; $\Delta^{17}O$ = -1.034, -0.984, -1.107, -1.147 per mil: values typical of lodranites [2].

**Conclusions:** Primary clast textures, grain sizes, mineral compositions and oxygen isotopic compositions indicate that this specimen is a lodranite breccia, and implies that there is a regolith on the ALPB. The polyphase inclusions within mafic minerals are similar to those described in lodranite-like achondrite QUE 93148 by [1], and along with the lamellae in olivine imply an episode of reduction after the formation of the primary magmatic cumulate assemblage.

**References:** [1] Goodrich C. and Righter, K. 2000. *MAPS* 35: 521-536 [2] Clayton R. and Mayeda T. 1996. *GCA* 60: 1999-2018; Irving A. et al. 2007. *LPS XXXVIII*, #2254.