NORTHWEST AFRICA 5782: A COMPLEX, POLYMICT ACAPULCOITE + LODRANITE BRECCIA CONTAINING HEDOD CLASTS. T. E. Bunch[1], D. Rumble, III[2], J. H. Wittke[1], A. J. Irving[3], P. P. Sipiera[4] and D. A. Gregory [1]Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011 (tbear1@cableone.net), [2]Carnegie Institution, Washington, DC 20015, [3]Dept. of Earth & Space Sciences, University of Washington, Seattle, WA 98195, [4]Planetary Studies Foundation, Galena, IL 61036 and Field Museum of Natural History, Chicago, IL.

Introduction: Two similar, partly weathered stones (total weight 130 grams) found together recently in Morocco are samples of a genomict fragmental breccia containing clasts and debris derived from acapulcoites and several different lodranites, but also sparse exotic clasts with HEDOD affinities. Separate evidence for impact-induced fragmentation on the acapulcoite-lodranite parent body is provided by lodranite breccia NWA 4478 [1] and pairings (NWA 4875, NWA 4933). Additionally, two equilibrated chondrites (Monument Draw and Yamato 74063) have been identified with affinities to acapulcoites [2]. This latest specimen establishes that multiple lithologies are present within a complex fragmental regolith on this parent body.

Figure 1. *Cut face of NWA 5782 stone. Scale is in inches. Photo © B. Reed.*

Petrography: NWA 5782 is a polymict breccia of subrounded to subangular clasts set in a cataclastic matrix. The predominant clasts (65 vol.%) are ***acapulcoites*** with polygonal texture (mean grain size 0.23 mm) composed of olivine ($Fa_{8.7\text{-}13.3}$; FeO/MnO = 17-27), orthopyroxene ($Fs_{9.0\text{-}14.1}Wo_{2.1\text{-}3.0}$), clinopyroxene ($Fs_{4.8\text{-}7.5}Wo_{45.7\text{-}47.9}$), metal and Fe sulfide. Protogranular to polygonal-textured ***lodranites*** (mean grain size 0.75 mm, 35 vol. %) are composed of olivine ($Fa_{8.6\text{-}13.7}$; FeO/MnO = 16-18), orthopyroxene ($Fs_{12.7\text{-}13.7}Wo_{2.8}$), clinopyroxene ($Fs_{4.6}Wo_{46.7}$), chromite, metal and Fe sulfide. Minor components are ***HED-like fragments*** of augite host ($Fs_{19.5}Wo_{42.8}$; FeO/MnO = 24) with exsolution lamellae of orthopyroxene ($Fs_{40.7}Wo_{4.1}$; FeO/MnO = 32), and ***fine-grained assemblages*** (mean grain size 0.09 mm) of forsterite ($Fa_{3.1}$), enstatite ($Fs_{2.8}$), metal, pentlandite and Fe sulfide (5.8 wt.% Ni).

Figure 2. *Plane polarized light image (width 23 mm) showing large acapulcoite clasts in a dark matrix (containing debris from different lodranites)*

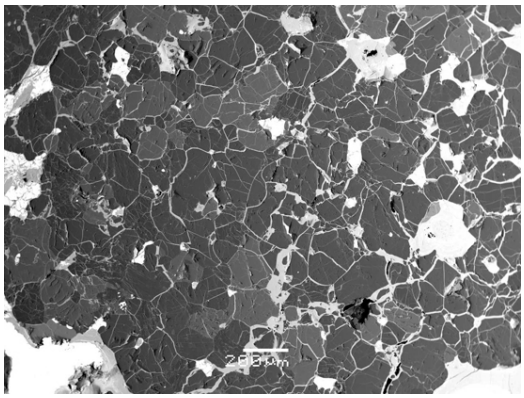

Figure 3. *BSE image of acapulcoite clast (medium gray = olivine; darker gray = orthopyroxene; white = metal; light gray veins = secondary goethite)*

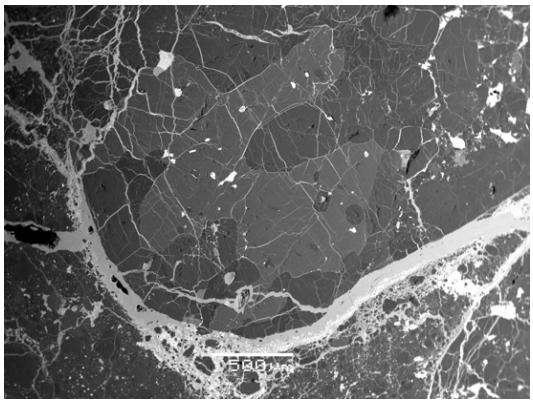

Figure 4. *BSE image of small lodranite clast composed mainly of olivine (medium gray) and orthopyroxene (darker gray) with minor metal and chromite. Lighter gray veins are secondary (mostly goethite).*

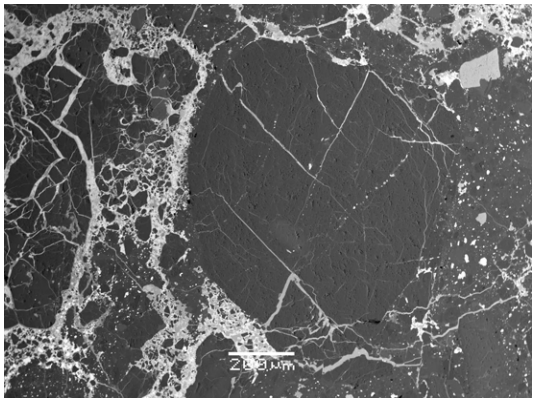

Figure 5. *BSE image of HEDOD-like clast composed mainly of clinopyroxene with enclosed orthopyroxene.*

Oxygen Isotopes: Replicate analyses of an acid-washed, metal-bearing sample of NWA 5782 by laser fluorination gave, respectively: $\delta^{18}O$ = 3.24, 3.03; $\delta^{17}O$ = 0.53, 0.66; $\Delta^{17}O$ = -1.172, -0.936 per mil. These data plot on the trend for acapulcoites and lodranites established by previous analyses [1, 3, 4, 5] – see Figure 6. Future work will entail coring extraction and analysis of different clasts from this specimen to assess their compatibility with the established correlation [3] between Fa content of olivine and oxygen isotopic compositions in acapulcoites and lodranites. A sample of lodranite NWA 5210 (see below) gave, respectively: $\delta^{18}O$ =3.89; $\delta^{17}O$ = 1.05; $\Delta^{17}O$ = -0.993 per mil.

References: [1] Irving A. et al. (2007) *70th Met. Soc. Mtg.*, #5129 [2] McCoy T. et al. (1996) *GCA* **60**, 2681-2708 [3] Rumble D. et al. (2005) *68th Met. Soc. Mtg.*, #5138 [4] Irving A. et al. (2007) *Lunar Planet. Sci.* **XXXVIII**, #2254 [5] Greenwood R. et al. (2007) *Lunar Planet. Sci.* **XXXVIII**, #2163.

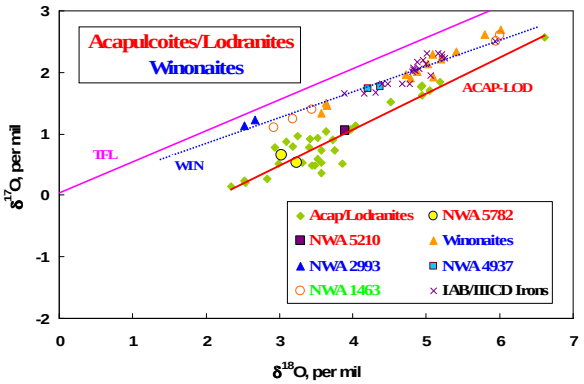

Figure 6. *Oxygen isotopic compositions of acapulcoites, lodranites, winonaites and related meteorites (laser fluorination data from [1, 3-5] and this work).*

Another Lodranite – NWA 5210: In contrast to NWA 5782, one of the freshest lodranite specimens found recently in Northwest Africa is a protogranular aggregate (mean grainsize 0.82 mm) of orthopyroxene (42 vol.%, $Fs_{14.6}Wo_{2.7}$; FeO/MnO = 19), olivine (40 vol.% $Fa_{13.4}$; FeO/MnO = 24), diopside (5 vol.%, $Fs_{8.2}Wo_{47.3}$, 1.53 wt.% Cr_2O_3), plagioclase (3 vol.%, $An_{26.3}Or_{2.7}$), metal (7.1 wt.% Ni) and troilite.

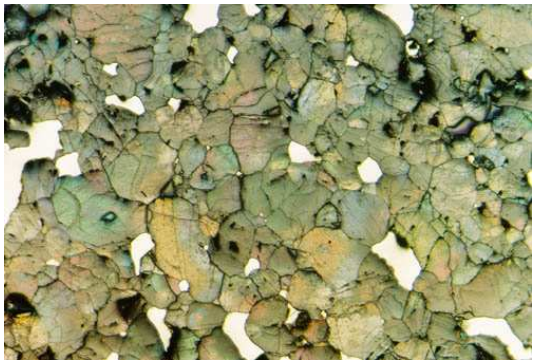

Figure 7. **(above)** *Combined plane polarized and reflected light image of NWA 5210 showing olivine and pyroxene (colors) and metal (white), width 7 mm;* **(below)** *Cross-polarized light image, width 9 mm.*