ZINCIAN BREZINAITE AND OTHER RARE MINERALS IN TWO CUMULATE-TEXTURED AUBRITES FROM NORTHWEST AFRICA.

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Introduction: The fact that eight of the 20 or so known aubrites are witnessed falls probably reflects the inherent instability of these highly reduced achondrites in terrestrial weathering environments. The first *bona fide* aubrites to be found in Northwest Africa, NWA 4799 and NWA 5217, are relatively unweathered and contain distinctive accessory mineral phases. [We emphasize that the very large Al Haggounia paleo-meteorite from southern Morocco is NOT an aubrite, but instead an anomalous EL3 chondrite, as discussed in detail on the following website:
http://www4.nau.edu/meteorite/Meteorite/Al_Haggounia.html.
New analyses of kamacite in some of this material show that it contains 0.65-1.10 wt. % Si, which is typical [1] for EL3 chondrites.]

Northwest Africa 4799: Numerous small pebble-like stones with minor rusty staining represent a breccia consisting of larger angular to rounded clasts (some showing igneous cumulate texture) in a matrix of smaller grains. The dominant mineral is enstatite ($En_{99.5}Fs_{0.1}Wo_{0.4}$) with lesser amounts of interstitial albite (some in graphic intergrowths with a silica polymorph), kamacite (Fe 92.1, Ni 4.5, Si 3.4 wt. %), Ti-Cr-bearing troilite, oldhamite, niningerite, Ti-bearing daubreelite, schreibersite, and rare perryite (P-bearing Ni-Fe silicide), some of which exsolved along (111) planes of kamacite. Enstatite grains exhibit polysynthetic twinning indicating inversion from former clinoenstatite.

Northwest Africa 5217: This fine to medium-grained (<1.2 mm) unbrecciated, cumulate-textured stone with preferred orientation of euhedral to subhedral enstatite is fresher than NWA 4799, and composed predominantly of enstatite ($En_{99.4}Fs_{0.2}Wo_{0.4}$) with interstitial kamacite (Ni 5.8 – 6.6, Si 3.9 – 4.5 wt. %), troilite (Cr 2.68, Ti 3.38 wt. %), daubreelite, zincian brezinaite (S 46.0, Cr 54.1, Zn 2.1 wt. %), oldhamite (S 38.7, Ca 59.2, Cr 1.4, Mn 1.2 wt. %), alabandite, niningerite, caswellsilverite (S 45.3, Cr 38.4, Na 14.7, Fe 0.7 wt. %), graphite, sodic plagioclase ($An_{17}Or_{3.7}$) and a silica polymorph. Schöllhornite ($Na_{0.3}CrS_2.H_2O$; S 46.0, Cr 37.3, Fe 1.1 wt. %) is present as a weathering product of caswellsilverite.

Discussion: The high temperature igneous cumulate characteristics of NWA 4799 and 5217 are unique among aubrites. Moreover, the complex mineralogy of NWA 5217 is remarkable and distinctive. Because these aubrites appear to be igneous cumulates and not derived from shock melts, they likely formed in a fairly large parent body rather than a small asteroid (such as main belt E asteroids and the NEO E asteroid 3103 Eger [2]).

References: [1] Keil K. 1968. *JGR* 73 : 6945-6976; Zhang Y. et al. 1995. *JGR* 100: 9417-9438. [2] Clark B. et al. 2004, *JGR* 109: E02001, 11 p.