GLASS INCLUSIONS IN THE AUBRITE NWA 1235

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Introduction: NWA 1235 is an aubrite with some unique features. It contains exotic sulphur-bearing minerals with unusual compositions (e.g., polymineralic sulfide inclusions -troilte + FeS-MgS-MnS + oldhamite) and phlogopite [1]. It is also unusual in its high abundance of glass-bearing inclusions (GIs) hosted by enstatite.

Results: GIs are primary, randomly distributed in the host, or oriented sub-parallel to cleavage planes. The shapes of the inclusions vary from rounded to euhedral (e.g., controlled by the host's crystal symmetry), with sizes that do not exceed 20 µm. Some GIs show a high glass/bubble ratio. The major element composition of GIs is characterized by high contents of SiO_2 (~80 wt%), Al_2O_3 (~13 wt%), Na_2O (~2 wt%) and K_2O (~3 wt%), and very low contents (< 0.5 wt%) of CaO, MgO, FeO and MnO. These inclusions resemble those previously reported for other aubrites [2-4]. Trace element abundances in glasses of GIs are low and fractionated. The refractory elements (Y and HREE) are depleted (~0.01 to 0.1 x CI) relative to the very refractory Sc (2-4 x CI). Chalcophile refractory elements (under reducing conditions), such as Nb and Ti, have also low abundances (~0.01 x CI). The moderately volatile chalcophile elements (V, Cr and Mn), show decreasing abundances with increasing volatilities (V~ 0.3 x CI; Mn~ 0.06 x CI). The volatile elements are highly enriched (Na~ 10 x CI; K and Rb~ 100 x CI).

The high abundance of potassium in the GIs poses a problem if aubrites are seen as igneous cumulate rocks. The silicate liquids coexisting with plagioclase need to have low normative orthoclase contents [4]. However, this in not what we observe. The liquids trapped during crystallization of enstatite are very rich in K and Rb. Both ions are too large to be accommodated in the lattice of pyroxene. The highly variable glass/bubble ratios of the primary GIs suggest formation of the host enstatite in a gas-rich environment (nebular?). If so, variations in the abundances of the refractory elements (e.g., Sc and REE) in glasses could be directly related to the presence, within enstatite, of polymineralic sulfide inclusions containing oldhamite. Although oldhamites from aubrites are enriched in Sc (~5-15 x EH chondrites), its abundance is much lower than that of the the REE (150-450 x EH chondrites) [5].

GIs from the enstatite chondrite (EC) Happy Canyon have a chemical composition (Si-Na-K-rich) similar to those observed in GIs from NWA 1235. They are also primary in origin, with shapes controlled by the host's crystal symmetry. This observation suggests that a similar mechanism was involved in the formation of GIs in enstatites from ECs and aubrites.

References: [1] Lorenz C. et al. 2003. Abstract # 1211, 34th Lunar & Planetary Science Conference; [2] Fuchs L.H. 1974. *Meteoritics.* 9, 342; [3] Varela M.E. et al. 1998. *Meteoritics & Planetary Science*, 1041-1051; [4] Fogel R.A. 1998. Abstract #1972, 29th Lunar & Planetary Science Conference; [5] Lodders K. et al. 1993. *Meteoritics*, 538-551.