

### LOW-Ni IVA IRONS DEPLETED IN VOLATILES BY IMPACT REHEATING?

T.J. McCoy<sup>1</sup>, C.M. Corrigan<sup>2</sup>, J.I. Goldstein<sup>3</sup>, J. Yang<sup>3</sup>, R.J. Walker<sup>4</sup>, R.D. Ash<sup>4</sup>, W.F. McDonough<sup>4</sup> and N.L. Chabot<sup>2</sup>.  
<sup>1</sup>Smithsonian Institution, Washington, DC 20560-0119 USA (mccoyt@si.edu) <sup>2</sup>Applied Physics Laboratory, Laurel, MD, 20723 <sup>3</sup>Univ. of Massachusetts, Amherst, MA 01003 <sup>4</sup>Univ. of Maryland, College Park, MD 20742 USA.

**Introduction:** Ungrouped iron meteorites may record the processes of condensation, fractional crystallization, oxidation and impact on a larger set of asteroids than the 13 iron groups. Alternatively, these processes may have acted to produce outliers that have not been previously recognized as from the same asteroidal cores. We have previously [1] discussed EET 83230 as a high-Ni member of group IVA. Here we discuss the meteorites Nedagolla and Santiago Papasquero (SP) as low-Ni members of group IVA that lost volatile siderophiles via impact reheating.

**Results:** Several volatile-poor ungrouped irons are similar to group IVA, but more depleted in Ga and Ge. Among these, SP and N'Goureyima fall on the IVA Ir-Ni trend, suggesting a possible link to group IVA. PGE abundances for N'Goureyima refute such a link. In contrast, SP exhibits PGE abundances consistent with a low-Ni IVA iron and similar to Nedagolla, for which such an origin was previously suggested [2].

SP and Nedagolla share a history of impact reheating [3]. Nedagolla exhibits a dendritic structure formed by rapid (0.02°C/s) cooling from a melt and secondary microstructural features formed by reheating to ~750°C for several hours [4]. SP lacks a Widmanstätten pattern, instead exhibiting a polycrystalline mass of kamacite ~100 microns in diameter with amoeba-shaped taenite. Structurally, it is similar in many respects to Fuzzy Creek [5] and Babb's Mill (Troost's Iron) [6], both of which were shock reheated to ~500-600°C.

**Discussion:** PGE concentrations and modeling of highly siderophile element abundances for Nedagolla [2] and SP are suggestive of a link to group IVA. Further, they require that, if linked to IVA, these irons formed by crystallization from the core during the first ~20-40% of core solidification [2]. Early crystallization might also explain the P-poor nature of SP.

If SP and Nedagolla crystallized early in the IVA core, why are they so depleted in volatile siderophiles? Impact reheating and remelting, which was common in group IVA, might cause volatile loss. Unlike [7], we suggest that this reheating and volatile loss was a localized process. A clue to volatile loss in Ni-poor IVA irons might be the correlation of cooling rate with Ni concentration, consistent with cooling in an ~300 km, inwardly-crystallized core with virtually no silicate mantle [8]. In such a model, low-Ni IVA irons would be nearest the surface, most likely to experience remelting and reheating, and could most easily lose their volatile siderophiles to space. Such a scenario might explain why the low-Ni SP and Nedagolla are highly depleted in Ga and Ge, while the similarly shock-reheated, but deeply-buried (even after impact) high-Ni Fuzzy Creek is not.

**References:** [1] Corrigan C.M. et al. (2005) *MAPS* **40**, A34. [2] Walker R.J. et al. (2005) *LPSC* 36, #1313. [3] Buchwald V.F. (1975) *Handbook of Iron Meteorites*. [4] Miyake G.T. and Goldstein J.I. (1974) *GCA* **38**, 747-748. [5] Yang J. et al. (2006) *LPSC* 37, #1308. [6] Yang J. et al. (2007) *LPSC* 38, #1417. [7] Wasson J.T. and Richardson J.W. (2001) *GCA* **65**, 951-970. [8] Yang J. et al. (2007) *Nature* **446**, 888-891.