HOW DO HIGH-Ni IRONS FORM? T. J. McCoy[1], C. M. Corrigan[1], J. Yang[2] and J.I. Goldstein[2]. [1]Dept. of Mineral Sciences, Smithsonian Institution, Washington DC 20560-0119 USA. [2] Univ. of Massachusetts, Amherst, MA 01003 USA.

Introduction: Iron meteorites preserve diverse chemical compositions and metallographic textures, reflecting igneous history and subsequent cooling. Four processes – condensation, oxidation, fractional crystallization, and impact – have been invoked to explain the range of iron meteorite compositions. We focus on the chemical fingerprint produced by these processes and how they interacted to form a range of high-Ni irons.

Processes: *Condensation:* Incomplete condensation could produce high-Ni metal (≤19 wt.% Ni), which subsequently melts to form high-Ni cores. Enriched in Ni and refractory siderophiles, it is depleted in volatile siderophiles (Ga, Ge) [1].

Oxidation: Oxidation produces high-Ni concentrations, by converting Fe^0 to oxidized iron [1], as well as depletions in readily-oxidized elements (e.g., W, Cr, P), probably by reaction between chondritic metal and water during heating and melting.

Fractional Crystallization: Fractional crystallization produces higher Ni irons and distinct compositional trends that can be modeled using experimental partition coefficients. [2]

Impact: Impact might produce partial melting or reduction of chondritic precursors [3-4] during melting or devolatilization.

Products: High-Ni irons include a broad array of types:

Milton-South Byron Trio: Enriched in Ni, with moderate Ga and Ge concentrations, and depletions in W, Mo, Fe, and P, the composition primarily reflects oxidation rather than condensation, with evidence for fractional crystallization [5].

IVB-Tishomingo: The Ni-rich IVB irons (~16-18 wt.% Ni) and Tishomingo (~33 wt.% Ni) are depleted in volatile siderophiles and readily-oxidized elements. Both likely formed via incomplete condensation followed by oxidation (more extensive in the case of Tishomingo) and fractional crystallization (particularly for the IVB irons) [6] on two separate parent bodies.

IVA: While incomplete condensation might explain the high-Ni (8-12 wt.%) and volatile depletion, impact must have occurred during the formation of IVA irons [3,7,8]. [7,8] explain a correlation between Ni and cooling rate through fractional crystallization of a core stripped of its mantle and devolatilized by impact. Localized devolatilization on the IVA parent body might also produce some ungrouped iron meteorites [9].

IAB: The highest-Ni irons (≤60 wt.% Ni) occur in group IAB, where oxidation likely played a minimal role and impact must have played a significant role [4]. One must either invoke selective impact melting perhaps with crystal segregation [4] or fractional crystallization [10], although partitioning in complex C-P-S-rich melts is inadequately known to model such a process.

Conclusions: Recent work has increased our ability to fingerprint some of the processes in the formation of high-Ni irons (e.g., oxidation), although much remains to fully understand the roles of fractional crystallization and impact in IVA and IAB.

References: [1] Kelly and Larimer (1977) GCA 41, 93. [2] Walker et al. (2008) GCA 72, 2198. [3] Wasson et al. (2006) GCA 70, 3149. [4] Choi et al. (1995) GCA 59, 593. [5] Reynolds et al. (2006) MAPS 41, A147. [6] Corrigan et al. (2005) *LPSC XXXVI*, #2062. [7] Yang et al. (2007) Nature 446, 888. [8] Yang et al. (2008) GCA, in press. [9] McCoy et al. (2007) MAPS 42, 5044 [10] Kracher (1982) GRL 9, 412.