NEW INSIGHTS TO THE FORMATION AND CRYSTALLIZATION HISTORY OF GROUP IIC IRON METEORITES. H. Tornabene, R.D. Ash, C.D. Hilton, and R.J. Walker; Department of Geology, University of Maryland, College Park, Maryland, 20742, USA (rjwalker@umd.edu)

Introduction: The IIC "magmatic" iron meteorite group ostensibly consists of eight members. Early study of the group characterized it as having moderate Ni and volatile siderophile element abundances, compared with other magmatic irons [1]. Recent studies of genetic isotopes, based on nucleosynthetic variations for certain elements (e.g., Mo, W), have shown that the group is enriched in both ^{94}Mo and ^{95}Mo, consistent with the group being of the carbonaceous chondrite (CC) genetic type [2]. Further, those IIC irons that have been examined are characterized by larger positive ^{183}W nucleosynthetic anomalies than other CC group irons, and the IIC meteorite Wiley has been reported to have an even larger positive ^{183}W anomaly [3] than the other IIC meteorites. Collectively, the previously reported siderophile element abundances and the complexities in genetic isotope compositions make this group worthy of additional study.

Samples: The IIC group consists of: Ballinoo, Cratheús (1950), Kumerina, Perryville, Salt River, Darinskoe, Unter Mässing and Wiley. Samples of Ballinoo, Kumerina, Perryville, Salt River and Wiley were obtained from the Smithsonian Institution, National Museum of Natural History, USA. Unter Mässing was obtained from the Senckenberg Forschungsinstitut und Naturmuseum, Germany, and Cratheús (1950) (and the IVA iron Pará de Minas) was obtained from the Museu Nacional/UFRJ, Brazil. A piece of Cratheús (1950) was also provided by the Field Museum, USA. We anticipate obtaining a piece of Darinskoe in the near future to complete the collection.

Methods: Siderophile element concentrations were obtained by laser-ablation using a *New Wave* UP213 ultraviolet laser coupled to a *Thermo Finnigan Element 2* inductively coupled plasma mass spectrometer at UMd. High precision highly siderophile element (HSE; Re, Os, Ir, Ru, Pt, Pd) data were also obtained by isotope dilution coupled with standard separation and mass spectrometric techniques [e.g., 4]. For this, Os concentrations and ^{187}Os/^{188}Os ratios were determined using thermal ionization mass spectrometry, and the other HSE were measured by ICP-MS.

Results: A CI normalized plot of highly siderophile elements (HSE) (**Fig. 1**) reveals that most IIC irons are characterized by relatively flat, similarly shaped patterns. The greatest variations in concentrations are found for Re and Os. Variations in Re/Os are reflected in ^{187}Os/^{188}Os ratios ranging only from 0.12418 (Ballinoo) to 0.12748 (Salt River). There is little crossing of patterns for most of the group, consistent with these meteorites being related by modest crystal-liquid fractionation from the same melt. The two exceptions to this are the patterns for Wiley, and the sample of Cratheús obtained from the Field Museum. For reasons discussed below, we conclude these are not group IIC iron meteorites.

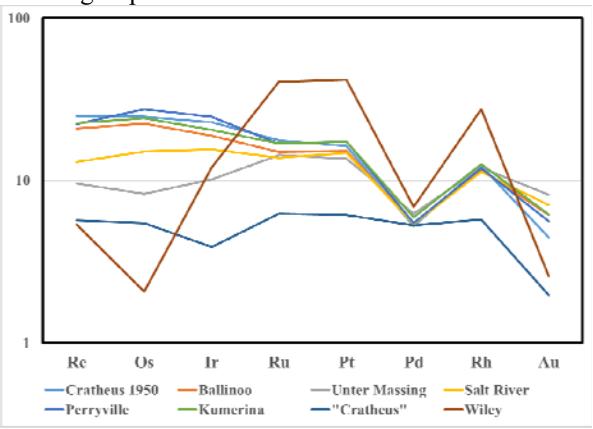

Figure 1. CI normalized highly siderophile element data for IIC irons. Elements are arranged from left to right in order of decreasing 50% condensation temperature. Note that the patterns for Wiley and the Field Museum "Cratheus" differ substantially from the remaining IIC irons, including Cratheús (1950) from the Museu Nacional.

The CI chondrite normalized patterns for a larger suite of siderophile elements, including only the *bona fide* IIC irons, are shown in **Figure 2**. In this figure elements are also arranged from highest 50% condensation temperature to lowest, from left to right. These six IIC irons are characterized by similar, relatively flat CI chondrite normalized siderophile element patterns. However, multi-valent elements V, Cr and Mn show major depletions, and Mo and Cu show much more muted depletions.

Discussion: The pattern for the Field Museum Cratheús is very similar to that of some group IVA iron meteorites, suggesting that it is likely Cratheús (1931), a IVA iron. We presume the sample in the Field Museum was mislabeled as Cratheús (1950) at some point in its history. Buchwald [4] reported some

confusion and irregularities in the naming and provenance of these two Brazilain meteorites named Cratheús. We obtained what is likely the true piece of Cratheús (1950) from E. Zucolotto (Museu Nacional) who suggested that Cratheús (1931) might actually be the IVA meteorite Pará de Minas. She provided us with a piece of that meteorite from the same collection for comparison. It has a siderophile element pattern that is essentially identical to the Cratheús sample obtained from the Field Museum (not shown), consistent with her interpretation of commonality for Cratheús (1931) and Pará de Minas.

Wiley provides further evidence for confusion in the identification of IIC irons. It has similar Ir, Ga, Ge and Ni to the other IIC irons [1]. This explains why it was classified as a IIC iron. However, the HSE pattern for Wiley strongly diverges from the other IIC irons except for Ir and Pd. Although its Re and Os concentrations could be accounted for as a result of extensive crystal-liquid fraction from a melt that generated the other IIC irons, its Ir, and especially Ru and Pt abundances are not consistent with this type of model. Our results suggest that Wiley is unlikely to have formed from the same parental melt as the other IIC. The discrepant HSE pattern, coupled with the enrichment in ^{183}W, relative to other IIC irons reported by [3], strongly suggests that Wiley is not a IIC iron, and that it formed on a different parent body. If this interpretation is correct, then there are only seven identified group IIC irons, assuming that the classification of Darinskoe proves correct.

References: [1] Wasson J.T. (1969) *Geochim. Cosmochim. Acta* **33**, 859-876. [2] Poole et al. (2017) *EPSL* **473**, 215-226. [3] Kruijer T.S. et al. (2017) *PNAS* **114**, 6712–6716. [4] McCoy et al. (2011) *Geochim. Cosmochim. Acta* **75**, 6821-6843. [5] Buchwald (1975) **2**, 511.

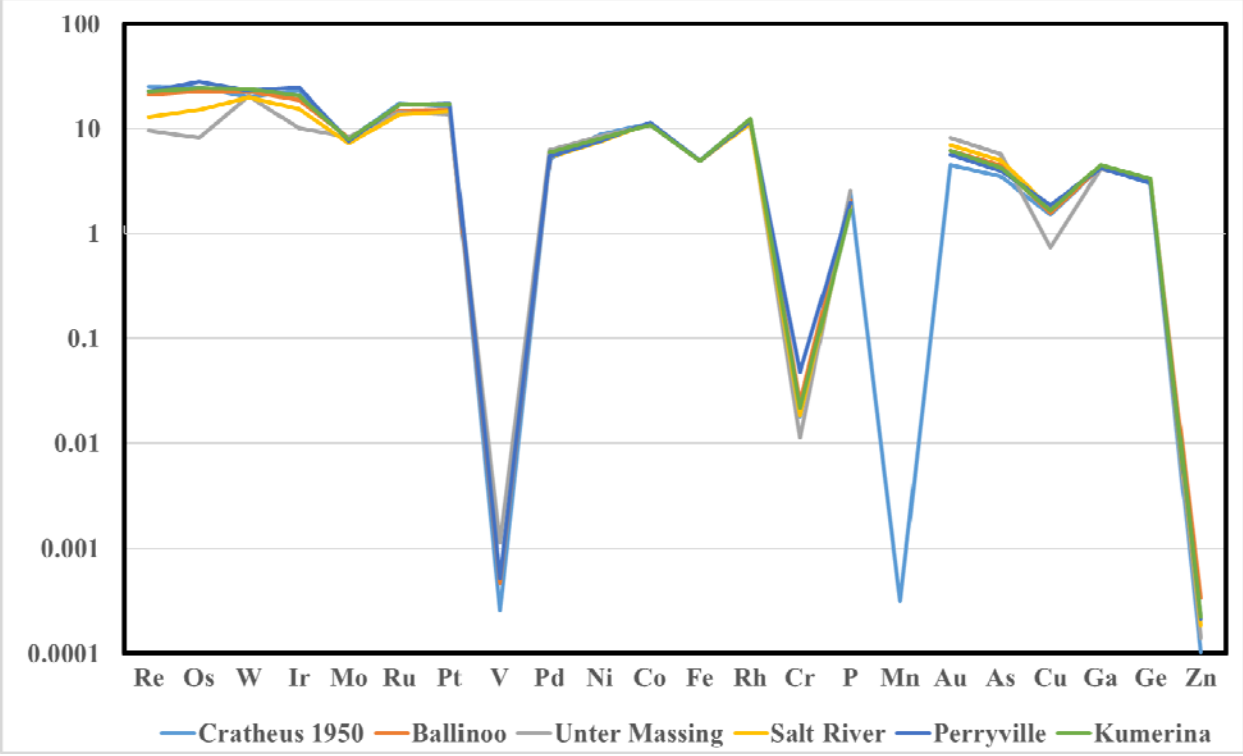

Figure 2. CI chondrite normalized plot of siderophile elements for the six *bona fide* IIC iron meteorites examined by this study