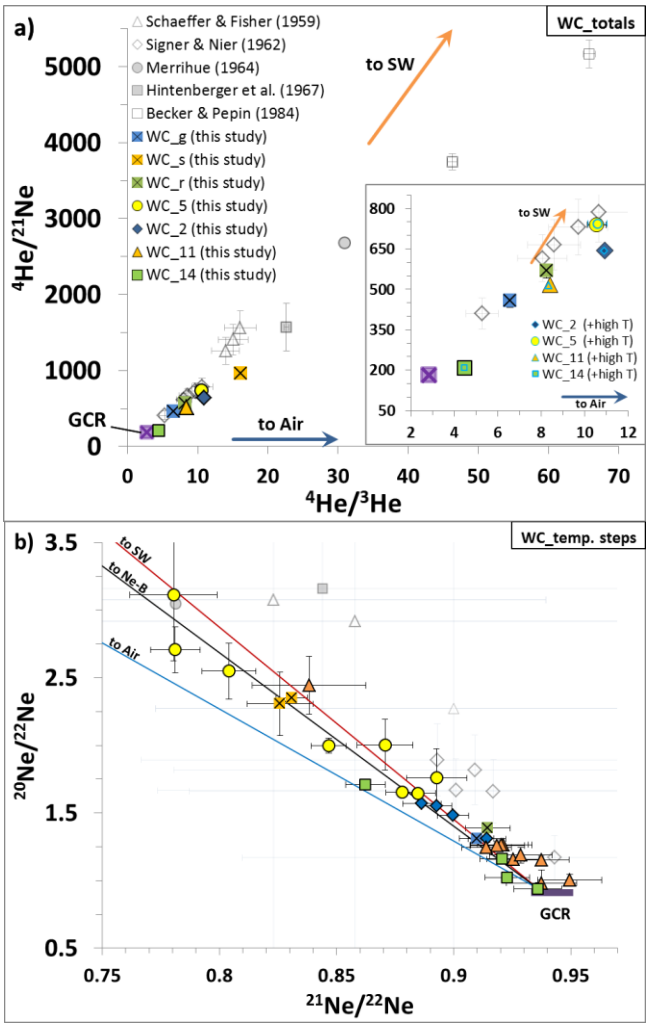
SOLAR NOBLE GASES IN THE WASHINGTON COUNTY IRON METEORITE: SOLAR WIND IRRADIATION OF EARLY FORMED PLANETESIMALS AND IMPLICATIONS FOR SOLAR NOBLE GASES IN EARTH´S CORE.

M. Vogt[1], J. Hopp[1], W.H. Schwarz, U. Ott[1], M. Trieloff[1], [1]Institut für Geowissenschaften, Klaus-Tschira-Labor für Kosmochemie, Universität Heidelberg, Im Neuenheimer Feld 234-236, 69120 Heidelberg, Germany (mario.trieloff@geow.uni-heidelberg.de).

Introduction: The iron meteorite Washington County was reported to host solar type noble gases of unknown origin, possibly distributed in the bulk metal [1-6]. If solar type helium and neon were partitioned into metal during metal-silicate fractionation from a possible chondritic precursor protolith, this would have profound implications for early planetesimal irradiation and the possible presence of solar type noble gases in planetary cores, particularly as source of terrestrial mantle noble gases [7,8].

Samples and methods: While previous studies report noble gas bulk measurements on samples with partially unknown sample location within the meteorite, our present study aimed at identifying the distribution of solar gases, i.e., if they were associated with distinct phases (e.g., kamacite, high- and low-Ni taenite, schreibersite, chromite), or if they were preferably located close to the fusion crust or in the interior parts. Besides two randomly distributed bulk samples (WC_g, WC_r) and a schreibersite separate (WC_s), we analysed 4 samples from a 3 cm long slab starting from the fusion crust to the interior. One of these samples was subjected to a high resolution stepheating schedule comprising 25 temperature extractions between 600-1800°C, each of which was analysed for He, Ne, Ar and Xe isotopic compositions.



Results and discussion: The stepwise degassing schedule yielded two distinct release peaks related to schreibersite (at 1100°C) and metal (at 1420°C), so it was possible to adjust heating schedules of other samples to separate these two phases. Fig. 1a shows $^4He/^{21}Ne$ versus $^4He/^3He$. Our and previous data (only totals are shown here) plot between a composition depleted in ^4He ascribed to cosmogenic (GCR) He and Ne in iron meteorites, and solar wind (SW) composition characterised by a large excess in ^4He (which can neither be due to admixing of air or radiogenic ^4He). In a classical Ne 3 isotope plot (Fig. 1b), data rather point to mixing between GCR and SW, only very few data are compatible with the GCR-air mixing line (WC-14). However, atmospheric contamination seems to be a more severe problem in the case of argon and xenon.

Conclusions and summary: All data points indicate similar mixing relationships independent of phase (metal, schreibersite) or sample location. Although solar gases are not uniformly distributed, they occur throughout the bulk meteorite indicating incorporation during metal formation. During terrestrial core formation, solar type noble gases may have been incorporated into Earth´s core from metal of predifferentiated planetesimals.

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