TRACE ELEMENS IN AND ON METEORITIC DIAMONDS: S. Merchel, B. Spettel and U. Ott, Max-Planck-Institut für Chemie, D-55020 Mainz, Germany (merchel@mpch-mainz.mpg.de).

Introduction: Although diamond was the first mineral phase identified as of presolar origin and moreover is the most abundant one in meteoritic matter, its origin has remained enigmatic. Trace element abundances are low, and so far, only Te and the noble gases Kr and Xe show possibly diagnostic isotopic patterns [1,2] indicative of a supernova origin. Major overabundances are observed for isotopes abundantly produced by r-process nucleosynthesis because they have precursors with magic neutron numbers N=50 and N=82. Hence measurement of heavy trace elements of mostly r-process origin associated with magic N=126 would help to shed further light on the origin of the diamonds; they may also bear on the suggestion of different r-process sources [3]. Unfortunately, those are noble metals, and elements like Os, Pt and especially Ir to a significant degree survive the chemical treatments employed during diamond extraction [4].

Experimental and Results: Recently we started on a program for a "faster and better" chemical isolation of presolar grains. First results showed our new procedure to be not only "faster" [5], but also "better", as far as contamination of diamonds with SiC is concerned [5,6]. To check the abundance of heavy trace elements we have now investigated diamond separates prepared by different methods from the Allende and Murchison meteorites by instrumental neutron activation analysis (INAA). Preliminary results are plotted in Fig. 1. For comparison data of Lewis et al. [4] for a diamond separate from Allende are also shown. For several elements including Fe, Co, Ni, Se, Sb, La, Sm, Hf, Os improved data will be available by the time of the meeting.

Discussion: Murchison residues generally have lower trace element concentrations than those from Allende. The abundance of iridium in the classically prepared [7] Allende residue (244 ppm) is similar to the one reported in [4] (300 ppm) whereas for the three other residues significantly lower values were determined (51, 18, and 2.5 ppm). The low Ir concentrations and the correspondingly low activities enabled us to determine or give upper limits for many more elements than in previous INAA analyses.

If we take the approximate straight line defined in Fig. 1 by the heavy noble gases as a measure for the expected abundance of trace elements indigenous to the diamonds, it follows that in the case of Ir the major part is still extraneous, a fact consistent with the observation by INAA that its isotopic composition is solar within ~5 %. For some of the other heavy elements, e.g. platinum, however, we are already at a level that detailed isotopic analyses should be feasible. For the rest we are working on further purification.

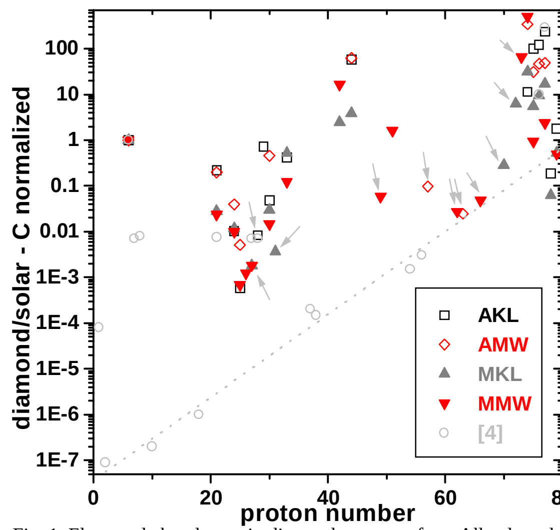

Fig. 1: Elemental abundances in diamond separates from Allende and Murchison (normalized to carbon and solar abundances). AKL and MKL: Allende and Murchison diamond residues, prepared by variant of "classical" method [7]. AMW and MMW: prepared by "faster" chemistry [5]. Arrows: upper limits only.

Acknowledgments: We thank A. Besmehn and C. Sudek for the "classical" samples (AKL, MKL) and assistance in preparing AMW and MMW.

References: [1] Richter S. et al. (1998) *Nature, 391*, 261–263. [2] Lewis R. S. et al. (1987) *Nature, 326*, 160–162. [3] Qian Y.-Z. et al. (1998) *Astrophys. J. 494*, 285–296. [4] Lewis R. S. et al. (1991) *Meteoritics, 26*, 363–364. [5] Merchel S. and Ott U. (1999) *MAPS, 34*, A81. [6] Besmehn A. et al. (2000) *LPS XXXI*, Abstract #1544. [7] Amari S. et al. (1994) *GCA, 58*, 459–470.