On line etching of bulk EH5 St. Mark's – Radiogenic and subsolar noble gases

Conference or Workshop Item

ON LINE ETCHING OF BULK EH5 ST. MARK'S - RADIOGENIC AND SUBSOLAR NOBLE GASES. H. Busemann[1], H. Baur[2], and R. Wieler[2], [1]Physics Institute, University of Bern, Switzerland [2]Isotope Geology, ETH Zürich, Switzerland.

Introduction: On line etching is very useful to analyse noble gas components such as "Q" or the solar wind [1, 2]. A bulk meteorite sample, however, has never been analysed by on line etching in order to characterise its complete noble gas inventory.

Experiment: The aim of this ongoing study is to analyse noble gases in a bulk sample of the EH5 chondrite St. Mark's by on line etching (conc. HF) and to compare the results with data for an acid-resistant residue of this meteorite [3]. The surprising discovery that phase Q contains - besides Q-gas - significant amounts of the subsolar component (5-7% of the total [4]) allows us to determine the subsolar isotopic (He-Ar) and elemental (He-Xe) composition. The subsolar Kr and Xe isotopic composition, however, is not well defined [5]. This experiment should provide such data. Furthermore, if the subsolar gas in the silicates should turn out to be identical to that in phase Q, this would suggest that both carriers trapped subsolar gas from a common *fractionated* reservoir (e.g. the early active Sun) rather than an originally *solar* composition [e.g. 6].

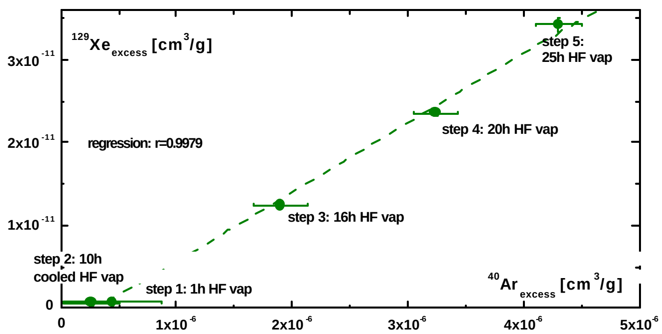

Fig. 1 : Radiogenic ^{129}Xe and ^{40}Ar in the first etch steps of bulk EH5 St. Mark's

Results: The first steps (<6% of the expected subsolar gas) show large excesses of radiogenic (rad) ^{40}Ar in addition to terrestrial and little subsolar gas. This agrees with the observation for EH4 Abee that the K-rich minerals in EH4 Abee do not contain trapped Ar [7]. Surprisingly, $^{40}Ar_{rad}$ and $^{129}Xe_{rad}$ correlate perfectly (Fig. 1). the ^{40}Ar/^{36}Ar and ^{129}Xe/^{132}Xe ratios exceed 3000 and 5, respectively. Neon is a mixture of cosmogenic Ne and trapped Ne with ^{20}Ne/^{22}Ne = 10.13±0.08 which suggests the presence of little subsolar Ne. Results of further steps will be discussed at the meeting.

One carrier for $^{40}Ar_{rad}$ and $^{129}Xe_{rad}$: The K-bearing minerals and the carrier of (inherited?) $^{129}Xe_{rad}$ are more easily soluble than enstatite, the carrier of subsolar gas. The correlated excesses suggest that $^{40}Ar_{rad}$ and $^{129}Xe_{rad}$ reside in a single mineral, e.g. in metal sulfides such as the HF-soluble K-rich djerfisherite, which has been observed in St. Mark's [8], or their alteration products. The etching conditions (HF vapor) might help to identify the host mineral of $^{129}Xe_{rad}$ in equilibrated E chondrites which would allow to date them by I-Xe *and* K-Ar.

References: [1] Busemann H. et al. (2000) *Meteorit. Planet. Sci., 35*, 949–973. [2] Heber V. S. et al. (2001) *AIP Conf. Proc., 598*, 387-392. [3] Busemann H. et al. (2002) *LPS, XXXIII*, #1462 (CD-ROM). [4] Patzer A. et al. (2001) *Meteorit. Planet. Sci., 36*, 947–961. [5] Ott U. (2002) *Rev. Min. Geochem., 46*. [6] Okasaki R. et al. (2001), *Nature, 412*, 795-798. [7] Bogard D. D. et al. (1983) *EPSL, 62*, 132-146. [8] Fuchs L. H. (1966) *Science, 153*, 166-167.