**XENON RELEASE BY THE IN-VACUUM ETCHING OF AEROGEL: IMPLICATIONS FOR THE STUDY OF NOBLE GASES IN COMET WILD 2 STARDUST.**

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**Introduction:** Comets may have delivered water to Earth, replenished the terrestrial planets' atmospheres after impact-loss or contributed to the "late veneer" [e.g., 1-3]. Noble gases can test these ideas, but the cometary trapped noble gas inventory is still poorly constrained. Helium and Ne have been identified in "Stardust", captured in aerogel collectors and returned from comet Wild 2 [4-5], but cometary Xe is constrained chiefly through analyses of bona-fide cometary interplanetary dust [6,7].

Adsorbed terrestrial components hamper the characterization of heavy noble gases in aerogel [8] making extraction by step-wise heating [5] unsuitable. In-vacuo etching potentially allows surface-correlated adsorbed terrestrial Xe and Xe in cometary silicates to be released separately. Here, we report a first etch experiment on terrestrial aerogel that has elucidated the experimental conditions required to separate the components.

**Experimental:** The all-Au and Pt "CSSE" (closed-system step etching) line developed at ETH Zurich [9-10] was attached to Manchester's high-sensitivity resonance-ionization mass spectrometer RELAX [11]. Aerogel (~60 µg) had been baked at 80 ºC and pumped at $\sim 10^{-9}$ mbar for several days, and ~0.3 ml of conc. HF was used for the chemical, low temperature destruction of the aerogel. Acid and procedural Xe blanks were negligible. In total $2 \times 10^{-7}$ $cm^3/g$ $^{132}Xe$ has been released in 16 steps (1–15 min., HF at –196, –70, 20 ºC) – a final step is yet to be completed.

**Results and discussion:** The large Xe release under mild etch conditions contrasts with the only 0.4–2.6 % of even $^4He$ released over 2-8 *hours* of etching of bulk SW-rich meteorites [12]. This indicates the feasibility of CSSE to separate terrestrial and cometary Xe in Stardust aerogel. The $^{132}Xe$ concentration released by CSSE is comparable to the $0.1–7.4 \times 10^{-7}$ $cm^3/g$ observed in aerogel in [8]. The enormous adsorption capacity of aerogel is also illustrated by a comparison with the $\sim 8 \times 10^{-8}$ $cm^3/g$ $^{132}Xe$ trapped in silicate smoke condensing at a Xe partial pressure 80 times higher than in air [13]. Adopting the Ne trapping efficiency of ~3% relative to Xe [13] we expect $\sim 5 \times 10^{-9}$ $cm^3/g$ $^{20}Ne$ from air in our aerogel. Neon in smokes may include trapped Ne rather than adsorbed Ne alone so this is only an upper limit. This estimated incorporated $^{20}Ne$ is still only ~1 % of the $^{20}Ne$ reported for Stardust within aerogel [5], if roughly considering the total areas of the extracted aerogel samples.

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