PARENT BODY PROCESSING IN CO CHONDRITES RECORDED BY NOBLE GASES.

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Introduction: Carbonaceous chondrites experienced varying degrees of parent body alteration [1,2], the intensity of which can be assessed using noble gases. Recently, we studied in detail the effects of aqueous alteration on noble gases in CM, CY and CR chondrites [3-5], where subsequent heating was observed in the noble gases in a subset of CMs [3]. Here we report an initial examination of CO chondrites to add to these studies. Ultimately, we will provide concentrations and isotopic compositions for the most pristine members of each meteorite group examined, which will enable a comparison of the noble gas carrier phases (including phase Q, presolar grains and an Ar-rich carrier that is susceptible to aqueous alteration [e.g., 3]) and how they varied in materials that accreted at different heliodistances. They may be used for modeling of noble gas inventories of the terrestrial planets. Starting from these initial compositions, it is also possible to use noble gases to determine the degree of aqueous alteration experienced by a given sample, e.g., in the case of CMs [3]. CO chondrites experienced rather limited aqueous alteration. However, they experienced thermal alteration, as parameterized in their petrologic sub-classifications from type CO 3.00 (e.g., Dominion Range DOM 08006 [6]) to CO 3.8 (e.g., Isna), which should be discernable also in their noble gas compositions.

Experimental and Samples: This study includes a large number of CO samples from the Antarctic icefields Miller (MIL, 10 samples) and Dominion Range (13 new samples and DOM 08006). The procedures for the analysis of typically ~20 mg bulk COs are described in [7], and the data reduction and cosmic ray exposure (CRE) age determination [8] follows methods outlined in [3, 9]. Technical problems and laboratory lockdowns have yet prevented the analysis of a second sample suite so far.

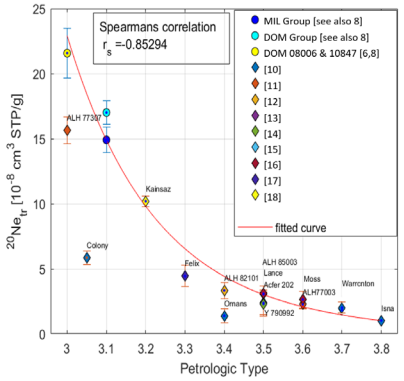

Fig. 1 (left): Trapped Ne concentrations in CO chondrites as function of their petrologic type. Average values for new COs from the MIL and DOM icefields are labelled in the top rows.

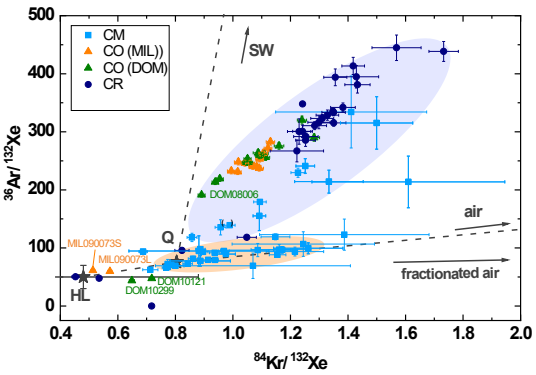

Fig. 2 (right): Trapped Ar/Xe vs. Kr/Xe ratios as detected in the DOM and MIL COs compared with data for CMs [3] and CRs [5].

Results and Discussion: Noble gases and CRE ages are particularly suited to determining pairing or the presence of misclassified samples as discussed in [8]. We focus here on the trapped noble gases. Fig. 1 shows that the trapped Ne, mostly carried by presolar grains, correlates inversely with the petrographic type. Colony may be affected by strong terrestrial weathering [19]. An Ar-rich component has been shown to decrease with increasing aqueous alteration in the CMs [3] and CRs [5]: This component is still abundantly present in the examined anhydrous CO3s (Fig. 2), supporting the view that all these carbonaceous chondrite classes incorporated the same mixture of pristine materials into their matrix [e.g., 20], and parent body processing such as melting of ices led to the partial loss or degassing of a fraction of the Ar-Xe carrying phases in type 1 and 2 carbonaceous chondrites.

References: [1] Huss G.R. et al. (2006) in *Meteorites and the Early Solar System II* 567-586. [2] Brearley A.J. (2006) in *Meteorites and the Early Solar System II* 587-624. [3] Krietsch D. et al. (2021) *Geochim. Cosmochim. Acta* in press. [4] King A.J. et al. (2019) *Geochemistry* 79: 125531. [5] Busemann H. et al. (2021) *Lunar Planet. Sci. Conf.* 52: #2718. [6] Davidson J. et al. (2019) *Geochim. Cosmochim. Acta* 265: 259-278. [7] Riebe M.E.I. et al. (2017) *Meteorit. Planet. Sci.* 52: 2353-2374. [8] Righter K. et al. (2021) *84th Annual Meeting of the Meteoritical Society*, this vol. [9] Mertens C.A.K. et al. (2021) *Lunar Planet. Sci. Conf.* 52: #2098. [10] Scherer P. and Schultz L. (2000) *Meteorit. Planet. Sci.* 35: 145-153. [11] Herpers U., et al. (1990): *Workshop on differences between Antarctic and non-Antarctic Meteorites* 46-48. [12] Wieler R. et al. (1985) *Lunar Planet. Sci. Conf.* 16: 902-903. [13] Takaoka N. et al. (1981) *Polar Res.* 20: 264. [14] Nagao K. and Matsuda J. (1986) *Antarct. Meteorites* 11: 131-132. [15] Pätsch M. et al. (2001) *Lunar Planet. Sci. Conf.* 32: #1526. [16] Bartoschewitz R. et al. (2010) *Meteorit. Planet. Sci.* 45: 1380-1391. [17] Mazor E. et al. (1970) *Geochim. Cosmochim. Acta* 34: 781-824. [18] Alaerts L. et al. (1979) *Geochim. Cosmochim. Acta* 43: 1421-1432. [19] Rubin A.E. et al. (1985) *Meteoritics* 20: 175-196. [20] Alexander, C.M.O'D. (2019) *Geochim. Cosmochim. Acta* 254: 277-309.