NOBLE GASES IN REFRACTORY INCLUSIONS FROM THE NORTHWEST AFRICA 10235 CV3 CHONDRITE: SEARCHING FOR PRESOLAR SIGNATURES

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Introduction: Refractory calcium-aluminum rich inclusions (CAIs) are the first solids formed in the solar system. They are thus essential records of the distribution of solids in the early protoplanetary disk and their isotopic analysis allows to shed light on the distribution of nucleosynthetic anomalies in the early solar system [*e.g.*, 1]. However, it remains unclear if CAIs contain well-preserved presolar grains or if they simply directly condense from gas carrying nucleosynthetic anomalies [2]. Noble gases are excellent tools to detect the presence of presolar grains, the carriers of nucleosynthetic anomalies measured in meteorites [*e.g.*, 3]. A recent study reports the detection of presolar grains in by measuring noble gases in one fine-grained inclusion, Curious Marie, contained in the CV3 Allende meteorite [4]. After correction for cosmogenic and fissiogenic additions, neon, krypton and xenon isotopic compositions showed a contribution from the presolar G component whose carrier is likely silicon carbide (SiC), by analogy with previous studies [3]. A more recent study by another group analyzed noble gases in five CAIs originally contained in the Allende and Axtell CV3 chondrites [5]. Results did not allow to identify the presence of presolar grains suggesting that not all CAIs contain SiC either because they never incorporated them or because CAI formation process or late alteration on the parent-body destroyed the presolar grains. In this study, we isolated CAIs from the Northwest Africa 10235 CV3 chondrite. We measured the elemental and isotopic composition of neon, argon, krypton and xenon in an attempt to further search for the presence of presolar grains in refractory inclusions hosted by carbonaceous chondrites.

Sample & Methods: Northwest Africa 10235 (NWA 10235) is a CV3 chondrite [6]. It contains abundant CAIs and large chondrules embedded in a brown matrix (~40% vol.). The largest refractory inclusions have been located by 3D tomography of a pluri-cm sized piece of the meteorite. The meteorite was then cut in slices and CAIs were manually separated. Dental tools were used to remove any remaining matrix material present on the sample's surfaces. Noble gases contained in CAIs were extracted by stepwise laser heating (one low and one high temperature steps until complete melting of the sample was observed) and analysed by static noble gas mass spectrometry with a Noblesse (Ametek/Cameca) multi-collector instrument.

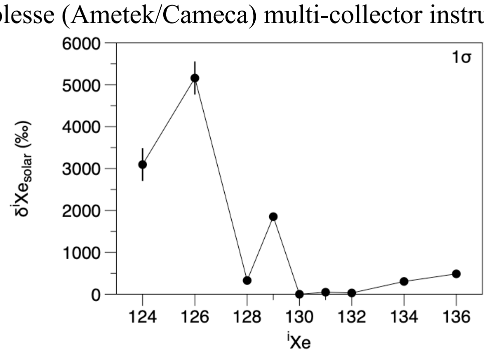

Figure 1: Isotopic composition of xenon released during the high temperature extraction of a CAI from the NWA 10235 meteorite. Isotopic ratios are expressed with the delta notation which corresponds to a difference in permil relative to the isotopic composition of solar xenon (SW-Xe, [7]). There are significant cosmogenic excesses clearly visible on $^{124-128}$Xe. The high ^{129}Xe/^{130}Xe ratio reflects radiogenic excess of ^{129}Xe from the decay of now extinct ^{129}I. Excesses of fission-derived xenon are visible on ^{134,136}Xe/^{130}Xe ratios.

Results: CAIs analysed in this study contain significant amounts of cosmogenic and fissiogenic gases, making the detection of primordial trapped gases extremely challenging. For neon, most data cluster close to the average cosmogenic end-member for chondrites and only few extraction steps reveal the presence of a ^{22}Ne-rich component, which could come correspond to presolar Ne-G or, more likely, from ^{22}Ne-rich cosmogenic neon produced in Na-rich phases. The isotopic ratios of argon reveal the presence of both cosmogenic and radiogenic argon. Krypton shows elevated ^{78,80}Kr/^{84}Kr ratios, signing the presence of cosmogenic krypton. The isotopic composition of xenon corresponds to a mixture of trapped xenon, cosmogenic xenon (high ^{124,126}Xe/^{130}Xe ratios), fissiogenic xenon (high $^{131-136}$Xe/^{130}Xe) and radiogenic (high ^{129}Xe/^{130}Xe ratio) (Fig. 1). During the presentation, attempts at correcting xenon isotope ratios for cosmogenic and fissiogenic contributions in order to identify the nature of the trapped primordial component will be discussed. **References:** [1] Trinquier A. et al. 2007. *The Astrophysical Journal* 655:1179–1185. [2] Burkhardt C. et al. 2019. *Geochimica et Cosmochimica Acta* 261:145–170. [3] Lewis R. S. et al. 1994. *Geochimica et Cosmochimica Acta* 58:471–494. [4] Pravdivtseva O. et al. 2020. *Nature Astronomy* 4:617624. [5] Nakashima D. et al. 2021. LPSC LII, Abstract #1944. [6] Bouvier A. et al. 2017. *Meteoritics & Planetary Science* 52:2284. [7] Meshik A. et al. 2020 *Geochimica et Cosmochimica Acta* 276:289–298.