XENON ISOTOPIC STUDIES OF AQUEOUS ALTERATION IN FINE-GRAINED ALLENDE CAIs.
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Introduction: I-Xe studies of dark inclusions (DIs) [1, 2], coarse- and fine-grained Ca, Al-rich inclusions (CAIs) [1, 3, 4], chondrules and matrix [5] from the oxidized CV3 chondrite Allende revealed the complexity of its alteration history (Fig.1).

High-resolution step-wise pyrolysis of the *Curious Marie* Allende CAI demonstrated that the I-Xe system survived intact in two different mineral phases, contrary to what was previously observed for other fine-grained Allende CAIs [1], and indicating that aqueous alteration affected them to different degrees. The fission composition in low-temperature extractions was consistent with Xe from ^{244}Pu while Xe from neutron-induced fission of ^{235}U resided in the high-temperature release peak. Isotopic analyses of Xe, Kr and Ne in *Curious Marie* also revealed the presence of *s*-process nucleosynthetic products in this CAI, indicating that presolar SiC have been incorporated into fine-grained CAIs in the Allende carbonaceous chondrite at the time of their formation, and have survived parent body processing [6].

Curious Marie is an extremely altered U-depleted fine-grained CAI, characterized by a group II rare earth elements (REE) pattern with extensive replacement of high-T phases by low-T alteration products [7]. To investigate if the characteristics revealed by the noble gas studies are unique to *Curious Marie*, we extended our I-Xe study to 11 fine-grained Allende CAIs. Here we present our initial results for 4 of them.

Experimental: All samples of CAIs for the noble gas analyses were extracted from the inner parts of the inclusions avoiding rims. They were sealed under vacuum and irradiated together with the Shallowater standard at the Missouri University Research Reactor (MURR), receiving ≈ 2×10^{19} n/cm^2.

Xe was released in step-wise heating extractions. Its composition was measured by high transmission ion-counting mass spectrometry [8] with sensitivity for ^{132}Xe of 5. 9×10^{-16} cm^3 STP/count.

Results: Xenon in all Allende CAIs analyzed here is dominated by radiogenic I-derived ^{129*}Xe (Table 1). Although the ^{129*}Xe concentrations vary by a factor of ~20, reflecting the difference in mineralogical compositions, the closure times of the I-Xe system in these samples are consistent within the uncertainties. I-Xe system in FG-FT-4 and FG-FT-13, the samples with high iodine content, appears to be preserved in both, the low- and high-T phases. The closure times for a high-T phase (not shown in the Table 1) are ~ 1Ma after Shallowater, similar to what was reported for *Curious Marie* [4] (Fig.1), but with high uncertainty.

Table 1. Concentrations of Xe components and I-Xe ages of the fine-grained Allende CAIs shown relative to Shallowater (4562.4 ± 0.2 Ma [9]). Abbreviations stand for: tr – trapped; fis – ^{244}Pu and/or ^{235}U fission.

sample	$^{132}Xe_{tr}$	$^{132}Xe_{fis}$	$^{129*}Xe$	I-Xe age, Ma
	$\times10^{-10}$ cm^3 STP/g			
CM [4]	0.93	0.31	345	
irradiated with thermal neutrons for I-Xe dating				
CM [4]	0.86	0.44	334	-1.4 ± 0.2 (high-T) -3.2 ± 0.7 (low-T)
FG-FT-4	2.45	0.27	130	-3.0 ± 0.6 (low-T)
FG-FT-13	0.64	0.26	164	-3.5 ± 0.5 (low-T)
FG-FT-25	0.78	0.28	31	-2.8 ± 0.4 (low-T)
FG-FT-27	0.22	0.66	17	-3.6 ± 0.4 (low-T)

A cosmogenic contribution to ^{128}Xe due to neutron capture on ^{127}I is expected to be present in all CAIs studied here. Based on the difference in slopes of the ^{129}Xe/^{132}Xe versus ^{128}Xe/^{132}Xe isochrones for the irradiated and unirradiated *Curious Marie*, this corresponds to ~ 0.1% contribution to ^{128}Xe from the cosmogenic component, making its effect on the resulting I-Xe ages negligible.

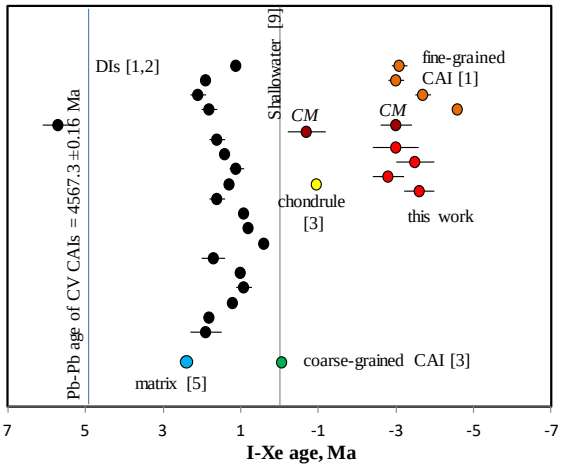

Figure 1. I-Xe ages of the various Allende components. *CM* is for *Curious Marie* [4].

Composition of fission Xe component in the studied CAIs is consistent with a mixture of ^{244}Pu-fission and neutron-induced fission of ^{235}U. Contribution from ^{238}U is negligible, compare to the ^{235}U-n-iduced fission. The composition of fission Xe varies among the studied CAIs indicating variable ^{244}Pu and U content. Plutonium is carried by a low-T mineral phase, while uranium is present in both low- and high-T phases. The fission compositions for the samples with highest and lowest Pu/U ratios are shown in Figure 2. ^{136}Xe is always over represented in the neutron irradiated samples due to neutron capture on live ^{135}Xe ($T_{1/2}$ = 9.10 h) (^{235}U*, Fig.2), thus, the higher ^{136}Xe/^{134}Xe ratios are characteristic of the samples with higher U content (Fig. 2,3).

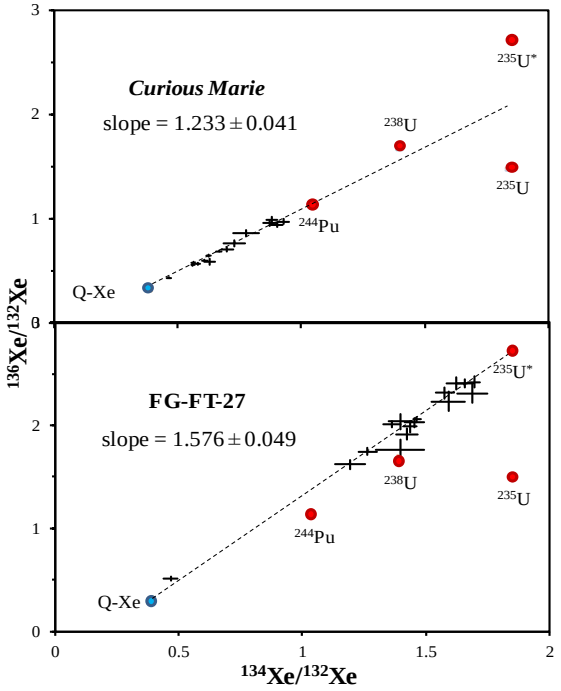

Figure 2. Fission compositions in the Allende CAIs *Curious Marie* and FG27.

Variable *s*-process contributions were observed in all samples, supporting presence of SiC in fine-grained Allende CAIs [6].

Conclusion: Although aqueous alteration affected the studied fine-grained Allende CAIs to different degrees, the I-Xe system in these samples closed simultaneously within experimental uncertainties

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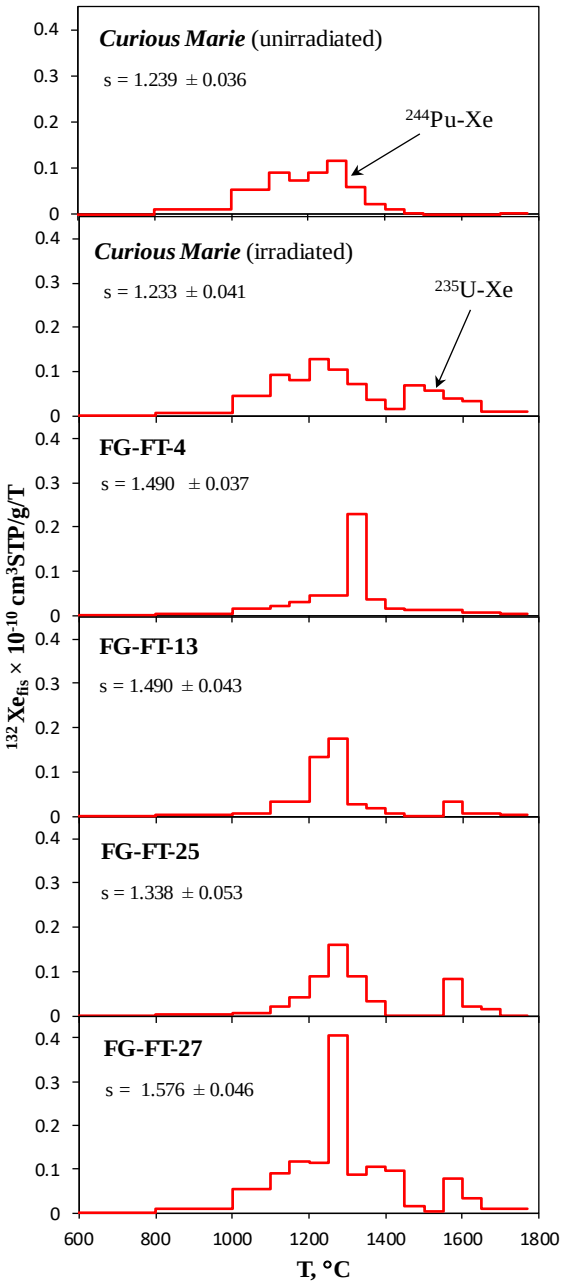

Figure 3. Release profiles of the fission xenon component in the fine-grained Allende CAIs compared to the previously reported [4] *Curious Marie* data. S stands for slope of the ^{136}Xe/^{132}Xe versus ^{134}Xe/^{132}Xe correlation line (Fig.2).