I-Xe RECORD OF AQUEOUS ALTERATION IN CK MAGNETITES.

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Introduction: Magnetite is one of the first products formed in carbonaceous chondrites during aqueous alteration, providing a valuable timeline for metamorphic changes on carbonaceous chondrite parent bodies [1]. Based on the I-Xe ages of CI Orgueil, CM Murchison and CVs Bali, Kaba, Mokoia and Vigarano [2, 3], aqueous alteration in carbonaceous chondrites started early, ~ 3.5 Ma after formation of CV CAIs [4].

Here we present data for magnetites separated from the CK chondrites of different metamorphic grades.

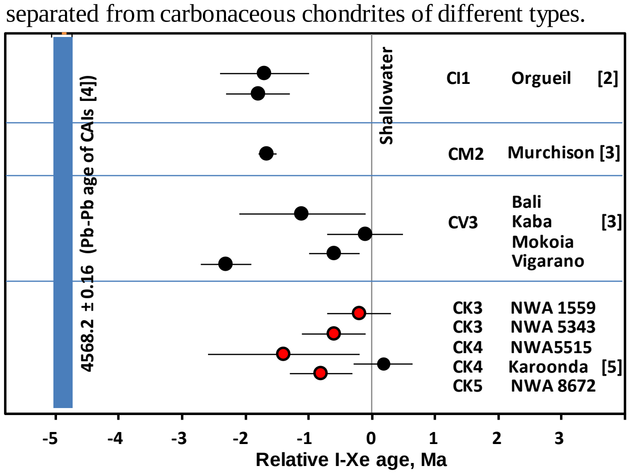
Experimental: Eight CK meteorites were selected for this study (Table 1). The majority experienced S2 degree shock; the degree of weathering warried from W1 to W3. The samples were finely ground and stirred with a saturated NaOH solution for 8 days at 60°C. This procedure demonstrated to yield magnetic fractions that are at least 90% pure [5]. The resulting magnetite separates and the absolute age standard Shallowater aubrite [6] were irradiated with 2×10^{19} thermal neutrons/cm^2 to convert ^{127}I into ^{128}Xe. Xe was released in 17-18 temperature steps; its isotopic composition was measured using high-transmission mass-spectrometry.

CK Metorite	Type	W, S	Mag, %	I-Xe age, Ma	^{i}Xe×10^{-10}, cm^3 STP/g		
					^{129*}Xe	^{132}Xe$_{tr}$	^{132}Xe$_{fs}$
Hart	3	W2/3, S2	2.6	–	0.52	12.93	0.21
NWA 6047	3	W3, S2	–				
NWA 1559	3	W2, S2	3.9	0.2 ± 0.5	4.60	3.16	1.12
NWA 5956	3	W1, S2	1.2	–	0.21	3.92	0.03
NWA 5343	3		4.5	0.6 ± 0.5	1.70	1.08	0.10
NWA 5515	4	md, min	15.8	1.4 ± 1.2	1.47	0.64	0.05
NWA 8672	5	Low, S2	9.3	0.8 ± 0.5	2.39	0.87	0.06
NWA 8670	6	Low, S2	8.6	–	0.46	0.27	0.07

Table 1. I-Xe ages and concentrations of Xe components in magnetites, separated from CK chondrites (tr – trapped; fs – U-fission; * – I-derived; † - moderate; †† - minimal).

Results: Only CK3 NWA 6047 failed to yield magnetite separate; for the metamorphic grade 4-6 samples, the amounts of separated magnetite is higher than those for the CK3s. Concentration of trapped ^{132}Xe in the analyzed samples appears to decrease with increasing metamorphic grade, although it varies by more than order of magnitude for CK3s. CK3s Hart and NWA5956 lost more than 90% of their ^{129*}Xe, most likely due to a shock experienced after decay of ^{129}I. CK6 NWA 8670 failed to yield an isochron since the release profiles of I-derived ^{128*,129*}Xe and trapped ^{132}Xe correlate. This could be due to the metamorphic processes that lead to the loss and subsequent redistribution of the trapped and I-derived Xe in this largely recrystallized CK6. Four CK magnetites provided well-defined isochrones (Figure 1, red symbols), corresponding to the I-Xe ages that agree within the uncertainties. These ages are also in agreement with the previously reported I-Xe age of CK4 Karoonda [5]. It seems that the I-Xe system in these samples recorded the onset of aqueous alteration and was not affected by thermal metamorphism up to degree 6.

Figure 1. I-Xe ages (relative to Shallowater) of magnetites separated from carbonaceous chondrites of different types.



I-Xe ages of CKs studied here indicate that CV3s and CKs experienced alteration almost simultaneously, consistent with the single stratified parent body origin.

References: [1] Krot A. N. et al. 2006. Meteorites and the early solar system II (eds. Lauretta & McSween, Jr.). The Univ. of Arizona press. [2] Pravdivtseva O. et al. 2018. *Geochimica et Cosmochimica Acta* 227:38–47. [3] Pravdivtseva O. et al. (2013) *LPS XLIV*, Abstract #3104. [4] Connelly J. N. et al. 2012. *Science* 338:651–655. [5] Lewis R. S. & Anders E. 1975. *Proc. National Academy of Sci.* 72:268–273. [6] Pravdivtseva O. et al. 2017. *Geochimica et Cosmochimica Acta* 201:320–330.