IODINE-XENON RECORD OF THE EARLY SHOCK EVENTS ON THE CHELYABINSK LL5 CHONDRITE PARENT BODY.

O. Pravdivtseva[1], A. Meshik[1], V. Grokhovsky[2], [1]McDonnell Center for the Space Sciences and Physics Department, CB 1105, Washington University, Saint Louis, MO 63130, USA(olga@physics.wustl.edu); [2]Institute of Physics and Technology, Ural Federal University, Ekaterinburg 620002, Russia.

Introduction: The Chelyabinsk LL meteorite consists of three distinct lithologies [1,2], indicative of genomict breccia. A light-colored lithology is LL5 material that has experienced thermal metamorphism and subsequent shock at levels near S4. The second lithology is a shock darkened LL5 material in which the darkening is caused by melt and metal-troilite veins along grain boundaries. The third lithology is an impact melt breccia that formed at ~1600°C. The U-Pb [3,4], Pb-Pb [5], Rb-Sr [6,7], Sm-Nd [1,7,8], Ar-Ar [7,9,10] and K-Ar [7] data for Chelyabinsk indicate a complex history of impacts and heating events. Here we present results of the I-Xe study of Chelyabinsk.

Results: The Xe isotopic composition was measured by step-wise pyrolysis in a fragment of Chelyabinsk chondrule, and in the light (Ch-L) and dark (Ch-D) Chelyabinsk lithology samples, neutron-irradiated for I-Xe dating alongside the absolute age standard Shallowater aubrite.

Table 1. Concentrations of Xe components in the Chelyabinsk samples (tr – trapped; fis – U-fission; * – I-derived).

Sample	mg	$^{i}Xe\times10^{-10}$, cm^3 STP/g			
		$^{132}Xe_{tr}$	$^{132}Xe_{fis}$	$^{129*}Xe$	$^{128*}Xe$
Ch-L	17.4	0.10	0.02	0.25	0.92
Ch-D	28.6	0.80	0.05	0.22	0.89
chondr.	6.8	0.89	0.04	0.33	1.20

I-Xe system in all Chelyabinsk samples exhibits effects of shock-induced disturbance, resulting in the I-Xe isochrones and subsequent relative ages that are defined with high uncertainties. Release profiles of radiogenic $^{128,129}Xe$ in Ch-L indicate presence of two distinct iodine carrier phases characterized by simultaneous closure of the I-Xe system at 4557.1 ± 0.8 Ma (relative to Shallowater age of 4562.4 ± 0.2 Ma [11]), consistent with shock resetting rather than slow cooling after the early metamorphism on the parent body (Fig.1a). Release profiles of $^{128,129*}Xe$ in the Chelyabinsk chondrule also suggest two iodine-carrier phases, although the low-temperature one is disturbed up to 1250°C (Fig.1c). I-Xe ages of Ch-L and chondrule agree within the uncertainties. The I-Xe system in these two samples was most probably reset by the same event, but it affected them to a different degree, possibly due to the smaller grain sizes in the Chelyabinsk chondrules compared to the grain sizes in its matrix. The I-Xe system in Ch-D was reset ~ 11.6 Ma later by a higher energy shock event resulting in the redistribution of radiogenic Xe from the low temperature carrier phase and in influx of trapped Xe component. I-Xe systematics in Chelyabinsk are compatible with previously reported data for the dark and light lithologies from the LL6 St Séverin chondrite [12], suggesting common parent body origin.

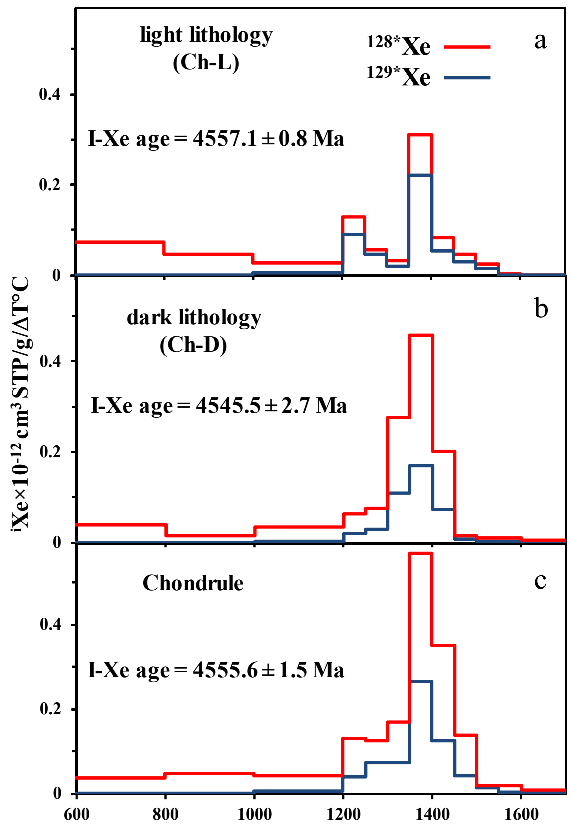

Figure 1. Release profiles of $^{128*,129*}Xe$ in the Chelyabinsk samples. Absolute I-Xe ages are calculated relative to Shallowater [11].

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