POSSIBLE MASS INDEPENDENT OXYGEN ISOTOPE FRACTIONATION IN THE MESOSTASIS OF A SEMARKONA GROUP A1 CHONDRULE Lyon I. C.[1], Saxton J. M.[1], Sears D. W. G.[2], Symes S.[3], and Turner G.[1] [1]Department of Earth Sciences, University of Manchester, Manchester M13 9PL, UK., [2]Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, Arkansas 72701, USA, [3]SN4 NASA Johnson Space Center, Houston Texas 77058, USA.

Introduction: We have measured the oxygen isotope distribution of mesostasis and olivine grains within a large group A1 chondrule from the Semarkona LL3.0 chondrite [1]. Some data from this study have been reported previously [2]. The chondrule in this study is unusual for its size (about 800 µm), for its large amount of mesostasis and, most importantly, compositional zoning in the mesostasis [1]. Outer regions of the mesostasis of this chondrule are enriched in Na and other volatiles and depleted in refractories. Matsunami *et al.* suggested that volatiles lost from the chondrule during formation had recondensed into the chondrule during cooling.

Experimental: We analyzed the same chondrule as Matsunami *et al.*, but as it appeared on the opposing cut face. The apparent diameter of the chondrule in our section was only 400 µm, although it showed similar properties to the opposing half. Oxygen isotope analyses were made with the Manchester Isolab 54 ion microprobe [3]. Measured $\delta^{17}O$ and $\delta^{18}O$ values are shown in figure 1.

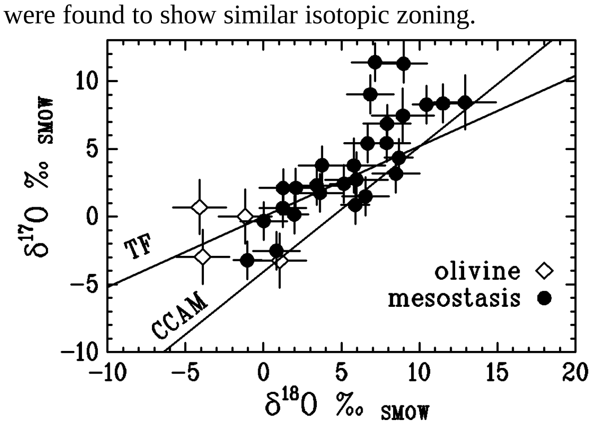
Discussion: The considerable isotopic heterogeneity of this chondrule cannot be ascribed to precursor heterogeneity because group A1 chondrules were totally melted during formation. The isotopically heavy mesostasis, compared with the phenocrysts, implies exchange with an ^{16}O-poor reservoir; consistent with the observations of two previous research groups who studied density separates from a range of UOCs (but not Semarkona) [4,5]. In contrast, that the mesostasis is isotopically lighter at the rim than in the core implies exchange with an ^{16}O-rich reservoir, consistent with [6] who studied size sorted chondrules from Dhajala.

The simplest interpretation of these data requires interaction with two external reservoirs; the first one (step 1) with $(Dt)^{1/2}$~mm, and the second (step 2) having $(Dt)^{1/2}$~30µm. It is convenient to consider the possibilities according to whether the exchange events take place prior to ('nebular') or after ('parent body') accretion.

Both step 1 and step 2 parent body: This requires two volatile reservoirs, with different $\Delta^{17}O$ on the parent body. A single water reservoir having a distinct isotopic composition to the silicates was proposed to explain the oxygen isotopic systematics of CM-CO-CK meteorites [6], but it is not clear whether two isotopically distinct, volatile reservoirs could be preserved on the parent body.

Step 1 nebular, Step 2 parent body: Step 2 involves a *low* $\Delta^{17}O$ reservoir, inconsistent with evidence which indicates a water reservoir with *high* $\Delta^{17}O$ (required to form magnetite on the Semarkona parent body [7]).

Both step 1 and step 2 nebular: In this scenario, the chondrule encounters external (gas) reservoirs of different isotopic composition. It could have been transported between different reservoirs whilst cooling, or have been subsequently heated (perhaps on the periphery of a second chondrule forming event). Alternatively, the chondrule forming event could have been the source of mass independent fractionation [8] : we postulate that ^{16}O may have been lost from the chondrule at high temperature (along with volatiles), and the ^{16}O-enriched external reservoir exchanged with the chondrule rim on cooling. The present data do not firmly distinguish between these two possibilities, but we note that the second explanation requires fewer assumptions concerning the external reservoirs; the case for it would be strengthened if many chondrules were found to show similar isotopic zoning.



Acknowledgements: We are grateful to Prof A. E. Fallick for O-isotope measurements of glass standards and PPARC and NSF for financial support.

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