XENON ISOTOPE COMPOSITION OF SHERGOTTITE RBT 04262. J. A. Cartwright, R. Burgess, S. A. Crowther and J. D. Gilmour. SEAES, Williamson Building, Oxford Road, University of Manchester (julia.cartwright@postgrad.manchester.ac.uk)

Introduction: The noble gases provide a unique tool for planetary research as they are inert, ubiquitous and have many isotopes. Their extreme depletion in solid phases permits relatively straightforward detection of processes causing small variations or anomalies in isotopic abundances, such as radioactive decay.

Previous research on Martian meteorites has identified distinct xenon (Xe) components [1-5]. These components are thought to represent separate Martian reservoirs, including those similar to the Martian atmosphere, Martian interior ("solar" – consistent with solar composition) and additional interior components affected by varying amounts of fission [1-6].

We report the first Xe isotope ratios for the Martian shergottite RBT 04262.

By investigating the noble gases trapped within RBT 04262, we hope to establish the type of components present and compare these to results from other shergotite meteorites Shergotty (reanalysed from [5]) and EET 79001 (lithology B). This will increase the understanding of the meteorite's origin and processes affecting its formation within Mars. This research forms part of a consortium study of RBT 04262 (Anand et al. this conference).

Sample description: Martian meteorite RBT04262 is one of a pair of coarse grained shergottites recovered from the Roberts Massif area of Antarctica in 2004 [7]. RBT 04262 can be classed as olivine phyric (also known as picritic) in terms of its major element and trace element chemistry [7-8]. However, there are strong similarities in REEs with shergottites Shergotty, Zagami and Los Angles, (although RBT 04262 shows lower values) suggesting that RBT 04262 is an olivine cumulate basaltic shergottite [8]. EET 79001 lithology B also belongs to the basaltic shergottite group and is depleted in light REEs when compared to the rest of the group [9]. As described in Table 1, RBT 04262 is dominantly composed of pyroxene ($Wo_{3-20}En_{62-52}Fs_{35-30}$ - $Wo_{29-40}En_{50-41}Fs_{21-19}$), olivine ($Fo_{67-54}$) and maskelynite ($An_{47-59}$), with Cr-rich spinels, sulphides and oxides also present [7-8]. Maskelynite has formed by the shock conversion of plagioclaise feldspar . In contrast, the dominant phase in Shergotty and EET 79001 lithology B is pyroxene, with olivine rarely occurring within mesostasis [10]. These pyroxene crystals may be aligned due to flow or by settling [10]. As RBT 04262 is an olivine cumulate [8], all three meteorites may be related by settling processes within a magma chamber.

Mineral	Composition [8]	Colour	Prop.
Pyroxene (Pigeonite/ augite)	$Wo_{3-20}En_{62-52}Fs_{35-30}$/ $Wo_{29-40}En_{50-41}Fs_{21-19}$	Yellow/ Brown/ Green	72%
Olivine	Fo_{67-54}		
Maskelynite (plagioclaise)	An_{47-59}	Trans-parent glass	25%
Spinel	Cr rich	Black	3%

Table 1: *RBT 04262 mineral descriptions. Colours described relate to those seen in mineral separate analysis, and proportion has been estimated by weight. Prop. stands for proportion.*

Methodology: An 100mg chip of RBT 04262 was partially crushed in ultra clean lab conditions, and its component minerals were physically separated by hand picking grains under a binocular microscope into olivine-pyroxene (yellow/brown/green), maskelynite (transparent glass) and spinel (black) (Table 1).

It was not possible to distinguish between olivine and pyroxene under the microscope due to their similarity in colour. As shown in Table 1, the spinel minerals make up a small fraction of the total.

Five mineral separates of RBT 04262 were analysed on the RELAX instrument (Refrigerator Enhanced Laser Analyser for Xenon), an ultra sensitive mass spectrometer based in the University of Manchester [11], in order to determine xenon isotopic ratios and concentrations. The samples were laser step heated under vacuum until melting, and the gas emitted from each step was analysed and recorded using the data analysis programme associated with RELAX. A description of the samples analysed in RELAX is shown in Table 2.

Samples of Shergotty and EET 79001 were separated using a similar method, as described by [5, 12].

Results and Discussion: All separates were significantly more gas-rich than the corresponding samples from the basaltic Shergottites, with ^{132}Xe concentrations approaching 10^{-10} cm^3 STP g^{-1}, significantly higher than those observed in our previous analyses.

Two olivine-pyroxene separates released xenon consistent with a single component having $^{129}Xe/^{132}Xe$ ~ 0.97, consistent with fractionated terrestrial air. A similar component dominated the other two olivine-pyroxene separates, but step heating revealed a second component with elevated $^{129}Xe/^{132}Xe$ approaching 1.04 (Fig. 1). This second component is consistent with a small amount of Martian atmosphere being present, but also with the presence of significant amounts of Martian interior xenon. In this respect the olivine-pyroxene separate is reminiscent of the equivalent mineral separate from EET 79001. The maskelynite separate displayed increasing $^{129}Xe/^{132}Xe$ with temperature, qualitatively similar to the behaviour of similar separates in the other shergottites but not approaching the same elevated $^{129}Xe/^{132}Xe$ ratios. Once again, the elevated ratios are consistent with the presence of either martian interior xenon or martian atmospheric xenon.

The simplest explanation for these data is that this meteorite acquired significant quantities of xenon from the terrestrial atmosphere during its terrestrial lifetime. These have almost completely overprinted the martian signature, which was originally broadly similar to that of the basaltic shergottites Shergotty and EET 79001 Lith. B.

Further work: Further unirradiated mineral separates will be analysed on RELAX to obtain more data. Moreover, mineral separates have been sent off for irradiation, and on their return they will be analysed on RELAX and on the MS1 noble gas mass spectrometer, based at the University of Manchester, providing further Xe isotopic ratios, argon (Ar) isotopic ratios (trapped, K-derived and cosmogenic components) as well as halogen (Cl, Br and I) information.

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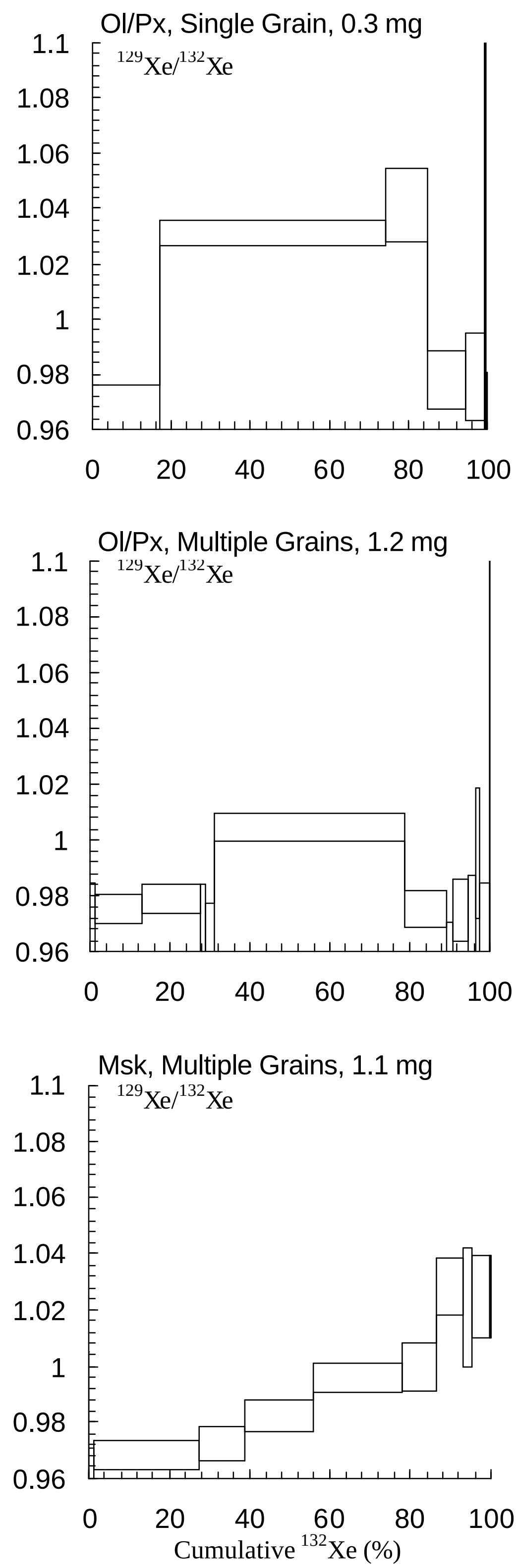

Fig. 1 *Step release diagrams from analyses of RBT 04262 mineral separates.*