Oxygen isotope evidence for the origin of HEDs and Angrites

Conference or Workshop Item

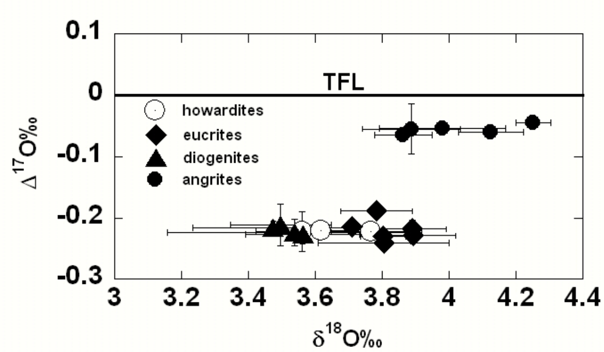
OXYGEN ISOTOPE EVIDENCE FOR THE ORIGIN OF HEDs AND ANGRITES. R C Greenwood[1],I A Franchi[1],A Jambon[2] [1]PSSRI, Open University, Milton Keynes, MK7 6AA, U.K. [2]Laboratoire MAGIE, Université Pierre et Marie Currie, CNRS UMR 7047 case 110, 4 place Jussieu, 75252 Paris Cedex 05 France.

Introduction: HEDs and angrites represent distinct suites of mafic igneous rocks formed early in the history of the Solar System [1]. Despite their mineralogical and chemical differences both groups have similar O-isotope compositions [2]. To examine the origin of HEDS and angrites we have undertaken a high-precision study of their O-isotope systematics.

Experimental Techniques: Oxygen isotope analyses were undertaken by infrared laser-assisted fluorination [3]. Samples were fused prior to fluorination. O_2 was analyzed using a Micromass Prism III dual inlet mass spectrometer. Precision is ±0.04‰ for $\delta^{17}O$, ±0.08‰ for $\delta^{18}O$ and ±0.025‰ for $\Delta^{17}O$ [3]. Meteorites studied: *Diogenites:* Bilanga (4), Johnstown (4), Shalka (2), Tatahouine (2), *Eucrites:* Pasamonte (5), Juvinas (2), Padvarnika (2), Sioux County (2), Stannern (2), Moore County (2), *Howardites:* Kapoeta (2), Pavlovka (2), Molteno (2), *Angrites:* Angra dos Ries (4), LEW 86010*(2), D'Orbigny*(2), NWA 1296* (2). (all falls except as indicated by an asterisk, number of replicate analyses in brackets).

Results: Angrites and HEDs plot as distinct groups (Fig 1) and define single mass fractionation lines ($\Delta^{17}O$ = –0.056±0.007 for angrites and –0.220±0.012 for HEDs). Previous studies have indicated that Angra dos Reis has an O-isotope composition indistinguishable from HEDs [2]. Using two distinct sub-samples we have found it to have a $\Delta^{17}O$ value of –0.065±0.009 and plots in the angrite field (Fig. 1). Eucrites and diogenites plot at either end of the HED array (Fig. 1), while howardites occupy a more central position. The large error bars for $\delta^{18}O$ reflect the inhomogeneous, coarse-grained nature of HEDs, with diogenites having grain sizes in excess of 5cm [1].

Discussion: Experimental work indicates that either an angritic or eucritic melt can be produced from a chondritic parent simply by partial melting under differing conditions of oxygen fugacity [1]. Thus a single asteroid might be capable of producing both the HEDs and angrites. However, O-isotope data indicates that this is highly unlikely and that both suites must come from distinct parent bodies. Furthermore, as both fall on well-defined mass fractionation lines only a single parent body per group is required. Finally, in contrast to recent suggestions [4], O-isotope data presented here clearly demonstrates that Angra dos Ries **is** an angrite.



References: [1] Mittlefehldt D. W. et al (1998) in *Planetary Materials,* Papike J.J.(ed). [2] Clayton R. N. and Mayeda T.K. (1996) *GCA, 60,* 1999-2017. [3] Miller M.F. et al. (1999) *Rapid Commun. Mass Spectrom. 13,* 1211-1217. [4] Mittlefehldt et al. (2002) *Meteorit. Planet. Sci.,37,*345-369.