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## Stable Chlorine Isotope Reservoirs in Chondrites

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**STABLE CHLORINE ISOTOPE RESERVOIRS IN CHONDRITES.** J. C. Bridges<sup>1</sup>, D. A. Banks<sup>2</sup> and M. M. Grady<sup>1</sup>, <sup>1</sup>Dept. of Mineralogy, Natural History Museum, London SW7 5BD, UK (j.bridges@nhm.ac.uk), <sup>2</sup>Dept. of Earth Sciences, University of Leeds, Leeds LS2 9JT, UK.

**Introduction:** By analyzing the stable Cl-isotopes of halite from the Zag H-breccia and comparing the results with those from other chondritic materials we can provide new information about isotopes in the early Solar System. In particular Cl-isotope work may complement O-isotope studies. We show for the first time that substantial <sup>37</sup>Cl/<sup>35</sup>Cl fractionation exists between chondrite components.

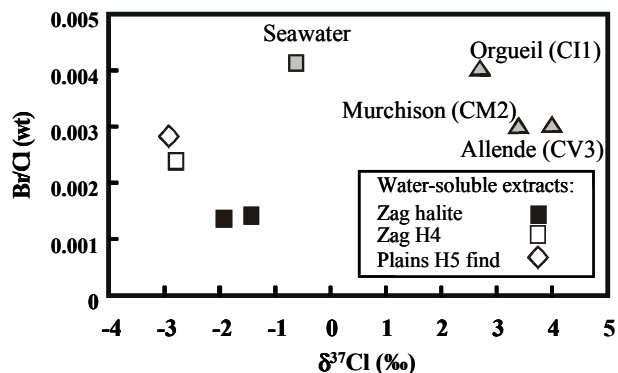
Zag halite crystallized from an evaporating brine at  $\ll 100^\circ\text{C}$  on the H-parent body [1,2]. The absence of clay alteration in olivine shows the rapid nature of this process which could have been started through melting of ice emplaced onto the planetesimal surface [1].

**Techniques:** Water soluble extracts were prepared from halite and H4 matrix from Zag (extract was primarily dissolved halite). Analysis of <sup>37</sup>Cl/<sup>35</sup>Cl was carried out by TIMS. To further characterise brine compositions halogen values were determined by ion chromatography [3]. Extracts were also analysed from the CM2 fall Murchison (Br/Cl ratio only) and H5 find Plains.  $\delta^{37}\text{Cl}$  is relative to SMOC.

**Results and discussion:** Zag halite and the silicate extract have light Cl-isotopic values compared to bulk carbonaceous chondrites [4] (Fig. 1). The Br/Cl ratios of the halite samples are slightly less than that of Orgueil. Evaporation fractionates Cl-isotopes by  $\leq 0.4\%$  relative to a parent brine [5] suggesting that Zag isotope ratios are close in value to an initial reservoir. Pore fluid fractionation and crystallization of clays can also act to fractionate Cl-isotopes towards light values [5] but there is no sign of such extensive fluid activity in Zag [1].

The higher Br/Cl ratios of extracts from the Plains find suggest that terrestrial adsorption of halogens acts to increase Br/Cl ratios. This might also be expected to alter the  $\delta^{37}\text{Cl}$  values but adsorption of aerosols tends to increase  $\delta^{37}\text{Cl}$  [6], so the influence of terrestrial alteration is currently uncertain. However, the Zag halite was sampled pure so terrestrial contamination can be ruled out for it [1,2].

In the absence of any obvious mechanism to fractionate the Cl-isotopes during fluid activity, the difference in  $\delta^{37}\text{Cl}$  between whole carbonaceous chondrites and our water soluble extracts suggests that there were at least 2 distinct reservoirs with  $\delta^{37}\text{Cl} \sim -1$  to  $-2\%$  (ice/parent body brine) and  $\delta^{37}\text{Cl} \sim 2.5$  to  $4\%$  (chondrite silicate solids). These reservoirs might be related to <sup>16</sup>O-poor fluids and <sup>16</sup>O-rich solids on parent bodies [7].



**Fig. 1.** Br/Cl (wt) vs.  $\delta^{37}\text{Cl}$  (‰). Water soluble extracts (this study): Zag halite (2 samples from 1 grain); Zag (H4 matrix); Plains (H5 find). Terrestrial seawater [3]. Whole chondrite pyrolysis, Br/Cl ratios for 3 carbonaceous chondrites [4,8].

**References:** [1] Bridges J. C. and Grady M. M. (2000) *Meteoritics & Planet. Sci.*, 35, A33. [2] Whitby J. et al. (2000) *Science*, 288, 1819-1821. [3] Banks D. A. et al. (2000) *GCA*, 64, 1785-1789. [4] Magenheim A. J. et al. (1995) *EPSL*, 131, 427-432. [5] Ransom B. et al. (1995) *Geology*, 23, 715-718. [6] Eggenkamp H. G. M. et al. (1995) *GCA*, 59, 5169-5175. [7] Bridges J. C. et al. (1999) *GCA*, 63, 945-951. [8] Dreibus G. et al. (1979) in *Origin and Distribution of the Elements*, Pergamon.