NITROGEN IN INDIVIDUAL CHONDRULES OF UNEQUILIBRATED ORDINARY AND ENSTATITE CHONDRITES

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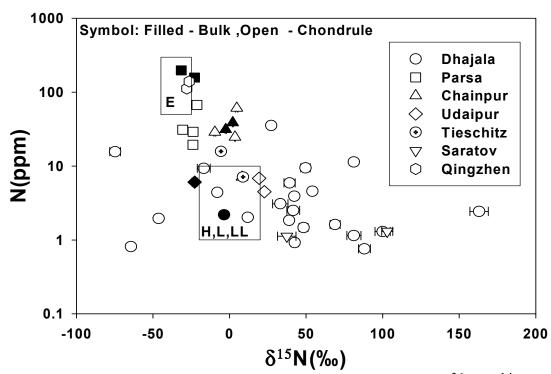
In our continueing effort to understand the nitrogen systematics in chondrules [1], we analysed chondrules from unequilibrated chondrites belonging to the classes H (Tieschitz, Udaipur, Dhajala), L (Saratov), LL (Chainpur) and E (Parsa, Qingzhen). Chondrules were hand picked from gently disaggregated bulk samples and any adhering matrix material has been removed by microscopic inspection and ultrasonic cleaning. From chondrules that are large (≥ 1mg), a split is taken for texural, mineralogical and chemical characterisation. Gas extraction was done by laser heating and nitrogen and noble gases have been analysed as earlier detailed [2]. Here, we focus on the nitrogen results. The $\delta^{15}N$ values discussed here have been corrected for cosmogenic contribution, based on the $^{21}Ne_c$ [3], and hence correspond to trapped N component(s).

In the case of ordinary chondrites, both the N contents and $\delta^{15}N$ values of the chondrules show a wide range, and in general, are different from their respective host chondrites. For example, in Dhajala wherein more than 20 chondrules have been analysed, N contents show a range of 0.8 to 35 ppm while $\delta^{15}N$ show a range of –74 to +171 ‰, as against the bulk meteorite values of 2 to 4 ppm N with $\delta^{15}N$ of 0.4 to –3.6 ‰. However, in the case of E chondrites, though the N contents of chondrules differ from the bulk meteorite, their $\delta^{15}N$ values fall in the range of bulk E chondrites. This clearly suggests that the precursors of chondrules from enstatite and ordinary chondrites could be different, as indicated by oxygen isotopes [4]. In a plot of N Vs. $\delta^{15}N$ (Fig.), the spread of $\delta^{15}N$ values for UOC chondrules, and a
narrow clusterring around the bulk meteorite values for UEC is clearly seen.



Similar to the N contents, the elemental ratio ($^{36}Ar/^{14}N$) also shows a wide range among chondrules, and (in general) lower values in chondrules as compared to the bulk meteorite (for UOC). This seems to suggest that the major carrier phases of N and Ar (noble gases) are not the same in UOC chondrules. On the other hand, in E chondrites, both the chondrules and the bulk meteorite have comparable (but lower than in UOC) values of ($^{36}Ar/^{14}N$). This could be due to N being present in inorganic form in both the bulk and (most probably) the chondrules of E chondrites. Microscopic and EPMA investigations on chondrule splits of UOC have revealed the presence of metal-sulphide (MS) rich rims and/or the presence of MS blobs in the interior of chondrules, that showed large deviation from the bulk meteorite ($^{36}Ar/^{14}N$) value. The chondrules without rims and/or with interiors mostly devoid of MS phases have shown a much narrow range in the ($^{36}Ar/^{14}N$) ratio. If MS phases dominantly host Q-Ar [5], the proportion of MS in a chondrule might be a key factor in the observed variability of the ($^{36}Ar/^{14}N$) ratio.

References: [1] Murty S.V.S. and Mahajan R.R. (2003) *MAPS* **38**, A20; [2] Mahajan R.R. and Murty S.V.S. (2003) *Proc. Ind. Acad. Sci. (EPS)* **112**, 113-127; [3] Mathew K. and Murty S.V.S. (1993) *Proc. Ind. Acad. Sci. (EPS)* **102,** 415-437; [4] Clayton R.N. (1993) *Annu. Rev. Earth Planet. Sci.* **21**, 115-149; [5] Vogel N. et al. (2004) *MAPS* **39**, 117-135.