Are radicals the carriers of D in IOM?

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Traditionally, the large D enrichments in IOM have been taken to indicate that the IOM or its precursors formed in the cold protosolar molecular cloud. However, in a series of papers, focused primarily on EPR studies of Orgueil, Murchison and Tagish Lake, it has been argued that the IOM grains formed in the warm inner Solar System and the D enrichments are the result of exchange with D-rich H_3^+ that formed at ~40 K [e.g., 1]. In this model, a significant fraction of the D is associated with highly exchangeable biradicals and biradicaoids concentrated in clusters that are associated with D-rich hotspots. There are a number of potential problems with this model: the abundance and deuteration of H_3^+ is expected to be low in disks [2], and ice coatings and negative charge on the grains may hinder IOM-H_3^+ exchange. Also, there is not the expected correlation between radical concentration and D enrichment in IOM in the published data.

We have analyzed by EPR IOM from a suite of 10 CMs, 3CRs, Orgueil and four lithologies from Tagish Lake that cover the range of petrologic types in these groups. As in earlier work, we find low T_1T_2 values, consistent with clustering of radicals, and temperature dependent radical concentrations, consistent with the presence of biradicaloids, although we have not ruled out other possible mechanisms for producing these phenomena. However, we find a much narrower range of radical concentrations and, despite almost a factor of four range in D/H, we see no overall correlation between radical concentration and D/H. Alteration may have modified the IOM, but radical concentrations only correlate with petrologic type in Tagish Lake, where they increase with increasing aromaticity and decreasing D/H. Our preliminary results appear to be inconsistent with the model of [1].

[1] Delpoux *et al*. (2011) *GCA* **75**, 326-336. [2] Cleeves *et al*. (2014) *Science* **345**, 1590-1593.