

Evidence and significance of water bridges in smectite of source rocks

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With the aim to examine the role of water in the organo-smectite interaction of source rocks, we study clay minerals from drill cores using situ DRIFT. DRIFT spectra, recorded at room temperature, are characterized by a C=O stretch of COOH at 1720 cm⁻¹ and a -OH stretch of H₂O at 3130 cm⁻¹. With heating further intensities of these bands decrease gradually, and frequencies are shifted towards lower wave numbers. After heating the samples at 400°C they almost disappear. The evolution of the interlayer water is accompanied by significant changes in the location and shape of the C=O. This observation indicates that COOH groups are bonded to water molecules by hydrogen bonds and water molecules are bridges between COOH groups and smectite.

In subtracting spectra every 50°C (from 50 to 600°C), the ratio of H₂O Peak area to that of COOH tends to be a constant under temperature of 250°C to 400°C, while under 250°C it varies irregularly. It is well known that adsorption water on smectite surface and interlayer free water dehydrate under 250°C, and structure water dehydrate above 600°C, therefore water retained under temperature of 250°C -400°C in complexes is water bridge. The reasonable explain for the constant of $\Delta H_2O/\Delta COOH$ ratio is that when water bridges are broken, water and acids associated with water molecules are expelled from smectite interlayer together. This validate the water bridge exists between acids and smectite further. Besides cationic polarization, water bridge form hydrogen bonds with acids, so it is higher in stability than surface adsorption water and interlayer free water, which leads to water bridge retaining in interlayer up to 400°C. As a result, the expelled temperature of interlayer acids delay, in other words, these acids are preserved well in <400°C temperature range. We suggest water bridges plays an important role in the organic matter preservation in source rocks, and have a great influence on hydrocarbon generation.

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References

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Zn isotopes in chondritic components

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Zn isotopic compositions (expressed as $\delta^{66}\text{Zn}$ in ‰ vs. JMC stdt) measured with high precision with MC-ICPMS have been reported in recent years that show variations of around 0.3‰ for whole rocks (WR) of Carbonaceous Chondrites (CC) and up to 2‰ for Ordinary Chondrites. The three isotopic ratios (66/64, 67/64, 68/64) vary linearly with mass difference, and define a common isotopic fractionation line with terrestrial samples. Zn was derived from an initially homogeneous reservoir. Although not the only answer, the common trend observed for CCs and UOCs in diagrams such as $\delta^{66}\text{Zn}$ vs. elemental ratios (e.g. Cr/Zn; Luck *et al.* 2005) could be explained as a mixture between two major reservoirs: one represented by the "matrix" with heavy Zn (around 0.5‰), and another related to chondrules (or alternatively refractory material, in CVs) characterized by light Zn.

Results are presented for constituents separated mechanically from Allende and Murchison (matrix, chondrules, aggregates), and sequential acid leachings from CIs. Preliminary data show chondrule (including rim) from Allende to be similar to WR. Sequential acid leachings were performed on Ivuna, starting from dilute Acetic Acid to HCl to concentrated HNO₃/HF following works on Cr (Rotaru *et al.* 1992) and Zr (Schönbächler *et al.* 2005) isotopes. Labile or easily-dissolved fractions seem to carry "normal" Zn (i.e. similar to WR; 0.4-0.5 ‰) while more acid-resistant material point to light Zn. It seems that for Zn – like for Cr and Zr isotopes – at least some isotopic heterogeneities have been retained in CIs.

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