On the origin of marine gas hydrates: Systematics of iodine and I-129 in pore waters

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The large-scale occurrence of gas hydrates in marine sediments has attracted increased attention over the last decade, but the origin of methane remains a major open question associated with these hydrocarbons. Iodine is a strongly biophilic element and has one long-lived cosmogenic isotope, ^{129}I. The half-life of this isotope is 15.7 Ma, giving it a dating range of about 80 Ma. A strong enrichment of iodine (and, to a lesser degree, of bromine) has been observed in pore waters associated with gas hydrates, which suggests that the ^{129}I system can be used for the dating of iodine in these fluids. We report here new results from two ODP legs, Peru Margin (ODP 201) and Hydrate Ridge (ODP 204) and compare them to earlier investigations of pore fluids collected from the hydrate field at the Nankai Trough (Fehn et al., 2003), and from Blake Ridge, ODP 164 (Fehn et al., 2000). In all of these cases, ages found for the iodine in the pore waters are considerably older than the ages of the sediments hosting the pore waters and the gas hydrates. Most of the ages range between 25 and 55 Ma, in some cases giving quite uniform ages for a set of samples (i.e. Blake Ridge), while showing considerable variation in other cases. The results suggest that iodine and, by association, methane is not derived in-situ, but from organic material much older than the host sediments. The distribution of isotopic values in specific cases reflects the history of advection and mixing between advected and resident iodine.

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A search for nucleosynthetic tellurium isotope anomalies in carbonaceous chondrites

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Tellurium has eight stable nuclides, which are a mixture of *p*-process, *s*-process and *r*-process components. As such, Te is well suited for the study of nucleosynthetic processes. Here we report Te isotopic compositions of leachates of the carbonaceous chondrites Orgueil (CI), Murchison (CM) and Allende (CV). Nucleosynthetic anomalies in leachates of carbonaceous chondrites were found for ^{54}Cr, ^{40}K, Mo isotopes, and ^{96}Zr [6] - [10]. In contrast, Fe and Se isotopes show no anomalies for similar leachates [11,12]. Bulk chondrites, iron meteorites and leachates of Allende measured by TIMS and MC-ICPMS display isotopic homogeneity in Te [1] - [5]. In this study the samples were sequentially leached with reagents of increasing strength ([5] - [11]) namely: 2.5 % acetic acid, 50 % acetic acid, 4 M HNO_3, 6 M HCl, 3 M HCl – 13.5 M HF, and conc. HF – HNO_3 in a bomb. All measurements were performed by MC-ICPMS.

For all three samples, the majority of the Te (> 85%) was found in the 6 M HCl and the 4 HNO_3 leachates. The isotopic composition of Te was determined for the $HNO_{3,}$ HCl and HCl–HF leachates of all three meteorites and for the 50 % acetic acid leachate of Orgueil. The Te isotope data obtained for the HNO_3 leachates of Murchison and Orgueil show small positive deviations in the abundances of the isotopes ^{128}Te and ^{130}Te. However, these positive deviations are barely resolvable given the analytical uncertainties and thus require confirmation with additional analyses. Because both ^{128}Te and ^{130}Te are *r*-process only isotopes, the positive anomalies are in accord with previously identified *r*-process signatures of Mo and Zr in leachates of carbonaceous chondrites [9,10].

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