Trace element analysis of iron meteorites by ICP-MS

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Trace element measurements of iron meteorites provide important information on the processes of formation and crystallisation of asteroid cores, and forms the basis of the classification scheme whereby the number of iron meteorite parent bodies can be determined. Most existing trace element data for iron meteorites were carried out using instrumental or radiochemical neutron activation. These methods allow measurement of 10-15 trace elements in iron meteorites, but are time-consuming and expensive. Recently, attempts have been made to measure trace element concentrations in iron meteorites using inductively coupled plasma mass spectrometry [1-3]. Advantages of ICP-MS analysis include low detection limits for most elements, simple sample preparation and short analysis times. A disadvantage of quadrupole ICP-MS analysis is that molecular interferences, especially those involving Fe which makes up ~90% by weight of most iron meteorites, prevent accurate analysis of several important elements, in particular Ge.

We developed methods to remove Fe from sample solutions using ion exchange, and use a desolvating nebuliser sample introduction system to reduce other solution-based interferences. Samples are dissolved in 8M HNO_3 and loaded directly onto Eichrom TRU-spec resin. ^{56}Fe can be reduced by 2-3 orders of magnitude, with close to 100% recovery of most other elements, excepting Nb, Ta, Th, U, Ti, which are retained on the resin. Measurements are carried out using a Thermo X-Series2 quadrupole ICP-MS equipped with a collision cell and Aridus desolvating introduction system.

Our new method allows rapid, accurate measurement of not only the highly siderophile trace elements (including Os if solutions are not heated) and transition metals, but also many non-siderophile elements. These are not routinely measured in iron meteorites because of their very low abundance, but could nevertheless provide important new insights into the oxygen fugacity at the time of accretion and the original size of iron meteorite parent bodies.

[1] M. D'Orazio *et al*.. (2003) *Geostandards Newsletter* **27**, 215–225. [2] A. J. Campbell *et al*.. (1997) *Anal. Chem*. **71**, 939-946. [3] T. McCoy *et al*.. (2011) *Geochem. Cosmochim. Acta* **75** , 6821-6843.

Research on carbon isotopic evolution of pyrolysis methane and its dynamics

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In order to understand the genesis of coalbed methane (CBM) as a new energy, closed-system pyrolysis experiments were performed on coals with different maceral compositions and maturities and a peat representing original coal-forming material at different heating rates, and the carbon isotopic evolution of pyrolysis methane and the carbon isotopic dynamic characteristics of CBM from Qinshui Basin were studied. It was found that the carbon isotopic compositions and evolutional history of pyrolysis methane were closely relevant to many factors, such as the properties and coalification levels of coal, initial evolution level of source rocks and heating rate and so on. The correlation between the carbon isotopic compositions of pyrolysis methane and lg(Ro) was suggested. At the same time, the carbon isotopic evolutional history of methane from the Upper Paleozoic coal seam in Qinshui Basin and and its coalbed methane genesis were determined. The results show that the CBM formed by coal with low initial evolution level and high exinite content and under conditions of high heating rate has relatively light carbon isotopic composition. The carbon isotopic compositions of pyrolysis methane from the studied samples at different heating rates were positively correlated with lg(Ro). The carbon isotopic evolution history of methane generated from the Upper Paleozoic coal in Qinshui basin was that $\delta^{13}C$ values of pyrolysis methane from Taiyuan and Shanxi Formation coals and peat in Yangcheng region have a tendency to becoming heaver with burial history, reached to the heaviest at K1 end, and then did not change. The comparative study of the carbon isotopic dynamics of pyrolysis methane showed that peat has lighter isotopic composition than coals. The carbon isotopic composition comparison of CBM from Permian system in Yangcheng region of Qinshui basin with that obtained by this experiments indicated that the carbon isotopic compositions in Yangcheng region is similar to those of CBM evolved from early Cretaceous to now, reflecting that the CBM in Yangcheng region has the feature of staged gas accumulation. Therefore, the carbon isotopic dynamics of methane is an effective method for studying CBM genesis.

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