

Determination of trace elements in sedimentary rock samples by Inductively Coupled Plasma mass spectrometry

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In the gas oil exploration area, there are more than C, H, O, N, S elements in the rock samples. Some macroelement and microelement also exist. It's important to use the content of elements and the ratio variation judging the sedimentary environment, resuming the ancient water medium and ancient salinity.

A method for the determination of trace elements in sedimentary rock was proposed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The ICP-MS (Agilent 7500a) running conditions: RF power 1350W; Carrier gas flow rate 1.2L/min; Spray chamber temp 2°C; Sample flow rate 0.1ml/min; Sample depth 7mm.

In the determination of the method, we analyse 30 elements including trace elements and rare earth elements. The sample was dissolved in mixed acids with pressurized sample digestion and an appropriate amount of mannitol was added to prevent boron from volatilization. The detection limits of the method for the elements were 0.0001-0.003mg/L. The method has been applied to the determination of these elements in National Standard Reference Materials including GBW 07105-GBW 07108. The results obtained were in agreement with the certified values with recovery of 90.3%-110% and precision of less than 5% RSD(n=3).

So this technique has a lot of advantages, such as high accuracy and precision, low limit, and high analytic speed, etc. We draw a conclusion that using ICP-MS, we can get satisfactory results.

Isotope fractionation of Hg during volatilization and photoreduction in freshwater

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The knowledge on isotope fractionation of mercury (Hg) during different biogeochemical processes is crucial for tracking the source and pathway of Hg in the environment. Volatilization and photoreduction, the two important processes leading to the degassing of Hg from surface water into atmosphere, were investigated in our study. Volatilization was simulated by reducing Hg(II) using SnCl₂ and collecting volatilized Hg(0) vapor in trapping solutions (316 μM KMnO₄, 0.9 M H₂SO₄). Photoreduction was conducted by exposing natural water with elevated Hg concentration to sunlight. Isotope ratios of Hg in both gaseous and aqueous phases in both processes were characterized by MC-ICP/MS.

The fractionation of Hg isotopes in volatilization experiments followed a typical Rayleigh model with lighter isotopes enriched in the volatilized phase and heavier isotopes in the dissolved phase. Fractionation factors of 1.00044 and 1.00047 were determined from two independent experiments. Only mass dependent fractionation was found during volatilization. However, photoreduction yielded both mass dependent and mass independent fractionations of Hg isotopes in our study. Higher enrichment of odd-number isotopes (¹⁹⁹Hg and ²⁰¹Hg) versus even-number isotopes (²⁰⁰Hg and ²⁰²Hg) were found in the aqueous phase (unreduced Hg). Our current results also suggest larger fractionation of Hg isotopes in photoreduction than in volatilization, which allows differentiation of Hg undergoing different processes. Further investigations will be focusing on the pattern and cause of mass independent fractionation of Hg during photoreduction and fractionation by photoreduction with simultaneous volatilization.