海水溶解磷酸盐氧同位素组成的测定

点此下载全文

引用本文：卢阳阳,郑珍珍,尹希杰,陈志刚,蔡毅华,刘广山,黄奕普.2012.海水溶解磷酸盐氧同位素组成的测定[J].地球学报,33(6):961-966.

DOI：10.3975/cagsb.2012.06.16

作者	单位	E-mail
卢阳阳	厦门大学海洋与地球学院	luyangyang1826@163.com
郑珍珍	厦门大学海洋与地球学院	chzhg@xmu.edu.cn
尹希杰	国家海洋局第三海洋研究所, 海洋与海岸地质环境开放实验室	
陈志刚	厦门大学海洋与地球学院	
蔡毅华	厦门大学海洋与地球学院	
刘广山	厦门大学海洋与地球学院	
黄奕普	厦门大学海洋与地球学院	

基金项目:由国家自然科学基金(编号: 11075221, 41006072, 40706033)

中文摘要:生物磷酸盐和水分子间的氧同位素分馏主要受温度和生物活动控制, 因此磷酸盐氧同位素组成既可以测量古温度又可以示踪磷循环。近年来磷酸盐氧同位素研究受到较多除了传统的生物体磷灰石古温度测量外, 这些研究大多是关于磷循环的。磷酸盐的氧同位素组成可以示踪海洋中磷的源区和生物对磷的利用效率。由于海水的组成十分复杂, 测量前对样品进行富集、分离和纯化处理。目前, 加州大学(Santa Cruz)Paytan教授和耶鲁大学Blake教授的实验室已建立了海水溶解磷酸盐氧同位素的测量方法, 二者各有优缺点。我们结这两种方法的优点, 并对一些步骤进行了改进, 建立了海水溶解磷酸盐氧同位素组成的测量方法。通过向海水样品中加入NaOH, 形成Mg(OH)2来富集海水中的PO43-, 也可同时除去杂质离子和溶解有机质; 通过将PO43-转化为CePO4沉淀来进一步除去杂质离子, 然后用阳离子交换树脂除Ce3+, 再通过阴离子交换树脂柱来除溶解有机质。最后将磷酸盐转换为AgO4沉淀, 在1350℃裂解Ag3PO4, 产生的O2和石墨反应形成CO用IRMS测定。结果显示富集、分离和纯化过程可以获得纯的Ag3PO4颗粒, 不会产生PO43-的氧同位素分馏。测量Ag4用量仅为0.3 mg, 标准偏差在±0.2‰~±0.3‰之间。

中文关键词:海水 溶解磷酸盐 氧同位素 方法

The Measurement of Oxygen Isotope Composition of Dissolved Inorganic Phosphate in Seawater

Abstract:The oxygen isotope fractionation between biogenic phosphate and water is primarily controlled by temperature and biological activity, so the oxygen isotope composition of phosphate (δ18OP) has been used to measure the paleotemperature and trace phosphorus biogeochemical cycles. Recently the study of δ18OP has attract much attention. In addition to traditional biogenic apatite paleotemperature measurements, the studies are mostly concentrated on the phosphorus cycle. δ18OP of dissolve inorganic phosphate (DIP) is an effective proxy for tracing sources and biogeochemical cycle of phosphorus. Seawater composition is very complex, so the seawater sample must be separated and purified before the δ18OP measurement. Professor Paytan of University of California (Santa Cruz), and Professor Blake of Yale University have established their respective δ18OP measurement methods of seawater DIP, but the two method have their respective advantages and disadvantages. The authors combine the advantages of the two methods and modified some procedures to establish an improved δ18OP measurement method of seawater DIP. In this method, DIP in water samples is concentrated through Mg(OH)2-PO4 co-precipitation, which can exclude a portion of the dissolved organic material (DOM) and interfering ions; then the resulting solution is converted to CePO4 precipitate to further separate Pi from dissolved salts, especially Cl-, and subsequently the solution is purified through a batch mode cation r to remove Ce3+ from the solution and through anion resin column treatment to remove the dissolved organic material. Phosphate is converted to silver phosphate ultimately which is in turn pyrolitically decomposed to CO at 1350℃ and δ18O is analyzed with continuous-flow isotope ration mass spectrometry (IRMS). The results show that this