

不同实验条件对早新生代沉积物有机碳同位素的影响

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中文摘要:利用沉积物中有机质碳同位素相对丰度变化重建古环境、古植被已成为有效的方法和手段,然而由于实验方法、所用仪器及测试环境不同,使有机碳同位素测量结果与真实值之间存在较大偏差。对于年代较老地层的样品来说,影响其有机质碳同位素的因素更为复杂,而实验条件的研究相对较少,从而限制了有机碳同位素在老地层中的应用。为此,我们以早新生代沉积物为对象,针对实验材料、不同仪器和实验温度等可能影响实验结果的因素进行了系统的对比实验分析。结果表明:(1)PC离心管在低温环境下对样品 $\delta^{13}\text{C}$ 值无影响,与利用玻璃烧杯的结果没有差别。(2)EA-IRMS在线技术整体比MAT-252离线技术 $\delta^{13}\text{C}$ 值高2%~4%,氧化温度和仪器测试环境的不同是导致偏差的关键。(3)对于老地层样品来说,850℃的氧化温度不能使其完全氧化,平行样品结果的重现性较差,说明样品氧化没有达到稳定状态,随着氧化温度的升高, $\delta^{13}\text{C}$ 值有偏正的趋势;1020℃能使其完全氧化,平行样品测试结果重现性较好,达到稳定状态。(4)含石膏样品进行测试时,应注意及时去除石膏加热时产生的水汽,以减少水汽的不利影响。

中文关键词:[有机碳同位素](#) [条件实验](#) [沉积物](#)

The Influences of Different Experimental Conditions on Organic Carbon Isotopes of Early Cenozoic Sediments

Abstract:The carbon isotope composition of organic matter has become an effective method and means in the reconstruction of paleoclimate and paleovegetation. However, because experimental methods, instruments and testing environments are different, there exists remarkable deviation between the measured $\delta^{13}\text{C}$ values and the true values. As for the older strata sample, the factors affecting the $\delta^{13}\text{C}$ values of organic matter are more complex, and the study of the experimental conditions is relatively insufficient, thus restricting the application of the $\delta^{13}\text{C}$ of organic matter to the old strata. In view of such a situation, the authors took the early Cenozoic sediments as the study object and made a comparative study and analysis of the experimental materials, apparatuses and temperatures. Some conclusions have been reached: (1) PC centrifuge tube has no influence on sample $\delta^{13}\text{C}$ values in a low temperature environment, and there exists no difference in experimental result between the use of PC centrifuge tube and the use of glass beaker. (2) The EA-IRMS $\delta^{13}\text{C}$ values are higher than MAT-252 $\delta^{13}\text{C}$ values by 2% - 4%, and the difference of the instrument test environments and the oxidation temperatures seems to be the key factor causing the deviation. (3) As for the old strata samples, the oxidation temperature of 850℃ cannot cause complete oxidation, and the repeated sample results show rather poor reproducibility, implying that the oxidation fails to reach a steady state; along with the increase of temperature, the $\delta^{13}\text{C}$ values tend to become positive; the temperature of 1020℃ can result in complete oxidation, and the repeated sample results show fairly satisfying reproducibility, suggesting arriving at a steady state. (4) When gypsum samples are tested, we must pay attention to removing water vapor, thus reducing the adverse effect of water vapor.


keywords:[organic carbon isotopes](#) [conditional experiments](#) [sedimentary rock](#)

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