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# 重庆芙蓉洞洞穴沉积物δ13C、δ18O特征及意义

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摘要：

利用重庆芙蓉洞内各种新老沉积物的δ13C、δ18O以及对洞穴内的滴水、池水和洞外泉水的长期观测结果，发现芙蓉洞内的次生沉积物中氧同位素变化整体一致，处于稳定温度下(16℃)的平衡分馏状态。而且洞内滴水和池水的氧同位素也相当一致，反映了外界大气降水中氧同位素的年平均状态。芙蓉洞内各种沉积物中碳同位素变化范围很大，从0‰~-11‰均有分布。由于芙蓉洞内各种滴水以及池水中溶解无机碳(DIC)的δ13C变化约在-8‰~-11‰，显著偏轻于部分洞穴沉积物中的δ13C。通过研究从洞穴滴水到形成次生化学沉积物这个过程中的可能影响洞穴沉积物中碳同位素变化的因素，例如：洞穴温度、滴水高度和速率、CO2脱气、生物作用、矿物同质异相转换等，同时参考芙蓉洞内连续生长达37 ka的FR5石笋的碳同位素记录，发现以上可能的影响因素都不能完全解释芙蓉洞内次生沉积物中碳同位素的异常偏重现象。虽然芙蓉洞内广泛存在文石与方解石共存的次生沉积物，但是综合分析表明这些沉积物的氧同位素处于平衡分馏状态，可以用来进行古气候研究。不过在利用石笋碳同位素解释古环境变化时需要慎重，特别是在讨论由文石或文石—方解石混合构成的次生沉积物时。

关键词：重庆芙蓉洞 洞穴沉积物 氧碳稳定同位素 平衡分馏

# The δ13C and δ18O Features and Their Significances of Speleothems in Furong Cave, Chongqing, China

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Abstract:

We have monitored δ18O and dissolved inorganic carbon (DIC) δ13C values of dripwater of Furong Cave, Chongqing, between from Oct., 2005, to June, 2007. We also measured δ18O and δ13C for other cavewaters, surface waters, and carbonate deposits collected from the cave and surrounding area. The data results show that stalagmites in this cave were deposited in oxygen isotopic equilibrium with its parent solution under relatively constant cave temperatures. The δ18O values of drip waters from different seasons are relatively constant, and the newly deposited carbonates from different sites in the cave are nearly consistent. This means that the drip δ18O and stalagmite δ18O reflect the oxygen isotopic composition of weighted annual mean δ18O of the local rainfall. The δ13C of these newly deposited carbonates varies from 0‰~-11‰, whereas the DIC δ13C in drip and pool water varies from -8‰~-11‰. In addition, many stalagmite samples from this cave show strongly enriched δ13C values, being much heavier than the δ13C value of drip waters. The authors focus on the influencing factors on the δ13C of speleothems by discussing all possible variables, such as cave temperature, dripping rate and height, degassing of CO2, evaporation, biological activity, and polymorphic transformation of aragonite and calcite. However, none of the fore mentioned factors could explain the anomaly heavy δ13C of speleothems in Furong Cave. Although it is common that speleothem in Furong Cave contains both aragonite and calcite in different proportions, these speleothems are still in equilibrium fractionation for oxygen isotopes and can be used for reconstruction of paleoclimate. It should be cautious to use the δ13C as a proxy to interpretation the evolution of paleoenvironment before we clearly understand the controlling factors of δ13C in a karst dynamic system, especially when speleothems contain aragonite.

Keywords:Furong cave speleothems oxygen and carbon stable isotopes equilibrium fractionation。

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