



Clumped isotope temperatures from secondary carbonates in loess: comparability of different preparation methods of snail shells and earthworm biospheroids

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Quantitative reconstruction of temperature remains the major focus and challenge of paleoclimate research, especially in the terrestrial realm. This study is aimed at testing the usefulness of Δ_{47} of earthworm's biospheroids (EBS) as a temperature proxy by comparing the EBS-derived T_{47} values to those obtained from previously studied land snails. For this purpose, the Dunaszekcső loess record in southern Hungary has been selected, which is an extensively studied section with a high resolution ^{14}C chronology [1,2,3], revealing stadial-interstadial variations in sedimentation rates.

Sixteen samples were collected in 10 cm resolution from the loess layers between 850-770 cm and 695-615 cm representing the GI-5.1 (30.6-30.8 ka) and GI-3.1 (27.5-27.8 ka) periods and surrounding stadials [4]. The associated temperature was calculated previously between 8-15 °C [4] based on the clumped isotope compositions of mollusc shells of these layers.

The impact of sample preparation methods on Δ_{47} values of secondary carbonates is unknown and is a potential concern. To test this, two different sample preparation methods were applied on *Trochulus hispidus* shells recovered from the mentioned loess layers: 1) treatment in 1 m/m% HCl solution and 2) treatment with 3 m/m% H_2O_2 solution under vacuum and in ultrasonic bath in ultrapure water. The reconstructed temperatures based on the Δ_{47} values of the snail shells typically fell between 7-15 °C (HCl pretreatment) and 9-14 °C (H_2O_2 pretreatment), in very good agreement with previous published land snail T_{47} data [4]. The average temperatures obtained from biospheroids reveal the same stadial-interstadial temperature pattern previously reconstructed by molluscs. The mean T_{47} values of the two pretreatment methods are within the expected temperature range derived from the snail shells.

Clumped isotope analysis was also performed on biospheroid samples from the same layers, and the calculated temperatures were compared with those obtained from snail shells by Újvári et al. [4]. To demonstrate that the biospheroid carbonates from the same layers are of the same age as the examined molluscs, we performed radiocarbon dating on the biospheroids. Our primary goal is to investigate whether the Δ_{47} compositions are affected by the so-called vital effect and to what extent the formation of biospheroid carbonates is influenced by these kinetic effects. To achieve this goal, a long-term experiment is going on. We perform climate chamber experiments [5,6,7] at temperatures of 8, 11 and 15 °C. Other variables, including relative humidity, CO₂ concentrations and the stable isotope compositions of diet and spray liquid are also controlled. The first results will be presented.

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