Geophysical Research Abstracts
Vol. 21, EGU2019-11215, 2019
EGU General Assembly 2019

Application of δ^{18}O of land snail shells in environmental reconstruction – theory and praxis

Ola Kwiecien (1), Alessandra Negri (2), V. Caputo Barucchi (2), and Keith Prufer (3)

(1) Ruhr-University Bochum, Sediments & Isotope Geology, Geosciences, Bochum, Germany (ola.kwiecien@rub.de), (2) Università Politecnica delle Marche, Ancona, Italy, (3) University of New Mexico, Albuquerque, USA

In recent years land snails' shells became common material used in paleoclimate reconstruction. Lately more and more studies attempt to extract quantitative information from shells' carbonate (e.g.: Eagle et al., 2013; Gosh et al., 2017; Zanchetta et al., 2017). In the isotopic (δ^{18}O and δ^{13}C) composition of its aragonite shell, the snail records a snapshot of the environmental conditions prevailing throughout its life. The carbon isotopic composition of the shell ($\delta^{13}C_s$) reflects mainly the snail diet. The oxygen isotopic composition of the shell ($\delta^{18}O_s$) reflects the ambient temperature of its formation and the oxygen isotopic composition of environmental water ($\delta^{18}O_w$), which in turn depends on precipitation amount, moisture source, humidity and atmospheric temperature (Balakrishnan and Yapp, 2004). So much about the theory.
In praxis taking all these factors into account is often impractical if not impossible, especially for ancient samples, hence most interpretative approaches simplify equations and take at least one of the parameters as constant. To complicate the matter even further, snails are not active all year long, they estivate when it is too hot and dry (>27°C) and hibernate when it is too cold (<10°C). Snails are nocturnal animals and are most active during and after heavy rainfalls. Also, the ecology and habitat of a chosen species might bias its isotopic composition.
Here we review different analytical approaches and highlight pros and cons of bulk and sequential shell sampling. Further, using examples of modern and ancient shells from Italy and Belize we discuss the pitfalls of making incorrect assumptions (e.g. constant formation temperature, or neglecting evaporation) and suggest a conceptual algorithm for optimising the interpretation of $\delta^{18}O_s$ in terms of precipitation and temperature changes.

References

Balakrishnan and Yapp, 2004, *Geochimica and Cosmochimica Acta* 68(9), pp. 2007–2024
Eagle et al., 2013, *PNAS* 110(22), pp. 8813-8818
Gosh et al., 2017, *Geochemistry, Geophysics, Geosystems* 18, pp. 3758–3770
Zanchetta et al., 2017, *Palaeogeography, Palaeoclimatology, Palaeoecology,* 485, pp. 236-246