

**Stable carbon and oxygen isotope compositions of modern land snails along a precipitation gradient in East Asian monsoon region of China**

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The stable oxygen and carbon isotope compositions ( $\delta^{18}\text{O}_{\text{shell}}$  and  $\delta^{13}\text{C}_{\text{shell}}$ ) of land snail shells, which were widely preserved in Chinese loess strata, have a potential to reconstruct the past East Asian monsoon change. To assess the possibility of using this approach for quantitative reconstruction of the climate, modern snail samples along a rainfall gradient (178mm–1403 mm) in the monsoon region of east-central China were analyzed for isotope compositions.

$\delta^{18}\text{O}_{\text{shell}}$  and  $\delta^{13}\text{C}_{\text{shell}}$  were shown to be able to record some local environmental and climatic information. Relationships were observed between  $\delta^{18}\text{O}_{\text{shell}}$  and climate factors, that is, mean annual precipitation ( $\delta^{18}\text{O}_{\text{shell}} = -0.003\text{MAP} - 1.0792$ ,  $r = -0.64$ ,  $p < 0.05$ ,  $n = 22$ ) and mean annual temperature ( $\delta^{18}\text{O}_{\text{shell}} = -0.2543\text{MAT} + 0.0799$ ,  $r = 0.67$ ,  $p < 0.05$ ,  $n = 22$ ) in certain monsoon rainfall routes, indicating that the  $\delta^{18}\text{O}_{\text{shell}}$  can record some monsoonal climate information. However,  $\delta^{18}\text{O}_{\text{shell}}$  as a rainfall proxy still needs caution, because a variety of local factors, such as evaporation, air mass trajectory, terrain and local atmospheric circulation, can potentially affect the  $\delta^{18}\text{O}_{\text{shell}}$ . The relationships between  $\delta^{13}\text{C}_{\text{shell}}$  with precipitation and temperature ( $\delta^{13}\text{C}_{\text{shell}} = -0.0046\text{MAP} - 7.2633$ ,  $r = 0.75$ ,  $p < 0.001$ ,  $n = 26$ ;  $\delta^{13}\text{C}_{\text{shell}} = -0.3995\text{MAT} - 5.3996$ ,  $r = 0.66$ ,  $p < 0.001$ ,  $n = 26$ ) are consistent with that from a previous study [1] in which snail samples were also collected in the East Asian monsoon region. This reinforces the reliability of  $\delta^{13}\text{C}_{\text{shell}}$  as a climate indicator in response to monsoon variability. Synchronous variation trends in the carbon isotope compositions of shell, body tissues and environmental plants were observed along the rainfall gradient, indicating that the  $\delta^{13}\text{C}_{\text{shell}}$  was mainly controlled by the ingested plants, whose  $\delta^{13}\text{C}$  values were controlled by precipitation and temperature. In addition, the snails in the present study can be roughly classified into three categories: forest snails in the Eastern Plain, grassland snails in the Chinese Loess Plateau and mountain snails in Qinbamountainous. We found that different snail species in separate ecosystem patterns show significantly distinct carbon and oxygen isotope compositions and may exhibit different response to climate change. This is helpful for using snails to reconstruct the climate quantitatively in certain eco-region.

[1] Bao et al. (2018) *Geochim. Cosmochim. Acta* **228**, 42-61.