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Stable oxygen and carbon isotope characteristics in speleothems from Southern Africa – how good are they?

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Much remains to be understood about the interaction between the African climate system, its surrounding ocean-atmosphere climate variability and the global climate system. A better understanding of the regional climate evolution is crucial for understanding global climate dynamics and issues surrounding environmental change throughout Africa and a prerequisite for increasing climate forecasting capabilities for the region. As part of developing this understanding, a longer term perspective that reaches beyond the information available from instrumental records is required.

Speleothems are frequently abundant in southern Africa. Quite a few records are now available, reporting significant changes in climate and environmental conditions over longer and shorter time scales. Conclusions are mainly based on the stable isotopic composition of the speleothems. The interpretation of the stable isotope data is, however, not always straight-forward, since many processes contribute to the observed signal in the speleothem and these processes may influence the signal differently at different spatial and temporal scales. For example was the Makapansgat speleothem oxygen isotope record, originally interpreted as being generally determined by shifts in atmospheric circulation pattern (Lee-Thorp et al. 2001, Holmgren et al. 2003), recently challenged and re-interpreted by Partin et al. (2008) to reflect annual rainfall amounts. Historically, less attention has been paid to the stable carbon isotope composition in speleothems. Today, an increasing number of studies demonstrate the potential of stable carbon variations as providing additional information on climate and environment. Measured variations can be a function of the amount of C3 versus C4 vegetation, vegetation cover and soil biological activity, bedrock proportion, rainfall amount and the drip rate.

Clearly the multitudes of plausible processes behind the isotopic composition of speleothems in southern Africa (as well as elsewhere) are a challenge to firm conclusions. However, the need for more globally well dispersed terrestrial palaeoclimatic records; the strong advantages of speleothems to provide precise ages and the empirical experience of successful solutions in previous speleothem research, encourage us to continue research on speleothems from southern Africa. If the understanding of the forcing mechanisms behind measured variables in speleothems can be increased, then there is a great potential for retrieving good climate records from the sub-continent, since the availability of caves containing speleothems is fairly frequent. Available speleothem research from southern Africa will be summarised and potentials and constraints will be discussed.

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