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Using tracers in the semi-arid vadose zone of the Stampriet Basin, southern Africa: insights into the origin and fate of nitrate, and challenges for hydrostratigraphies.

Abi Stone (1) and Andi Smith (2)

(1) University of Manchester, School of Environment, Education and Development, Geography, United Kingdom (abigail.stone@manchester.ac.uk), (2) British Geological Survey, Keyworth, Nottingham, United Kingdom

The vadose zone contains chemical tracers that can be utilised to provide insights into groundwater quality and to understand rates of recharge to the groundwater table. In doing the latter, a chloride mass balance (CMB) approach can also be applied to provide a novel archive for tracking changes in palaeomoisture availability and land-use change (a hydrostratigraphy within a vertical profile) (Scanlon et al., 2010; Stone and Edmunds, 2016). This poster presents two aspects of chemical tracers in the vadose zone of the Stampriet Basin in the southwest Kalahari in southern Africa.

The first half of this poster presents data on nitrate anion concentrations (Stone and Edmunds (2014) and two further sets of data), alongside δ15N and δ18O isotopic data to investigate the origin and fate of nitrate in this region. The Stampriet Basin is one of a number of high-nitrate concentration groundwater regions in semi-arid southern Africa, and consumption of this high-nitrate groundwater is a serious environmental issue with deleterious implications for both human and animal health. This research aims to understand the connection between the production of nitrate in the vadose zone via nitrogen cycling processes in dryland sediment and the presence of high nitrate in deep groundwater. This will provide vital insight for local communities that rely on this groundwater source.

The second half of this poster presents results using the CMB approach to produce hydrostratigraphies, which could provide a valuable climatic proxy record in an environment where preservation of proxies for palaeorainfall and moisture balance are notoriously scarce. The research design targets 10 profiles (collected over three field seasons) at sites that appeared to meet the assumptions of the approach and three profiles close to a dryland pan that were predicted not to be suitable.

References

Scanlon, B.R., Mukerhjee, A., Gates, J., Reedy, R., Sinha, A.K., 2010. Groundwater recharge in natural dune systems and agricultural ecosystems in the Thar Desert region, Rajasthan, India. Hydrogeology Journal 18, 959–972.

Stone, A. E. C., Edmunds, W. M. (2014) Naturally-high nitrate in unsaturated zone sand dunes above the Stampriet Basin, Namibia. Journal of Arid Environments 105, 41-51.

Stone, A. E. C., Edmunds, W. M. (2016) Unsaturated zone hydrostratigraphies: A novel archive of past climates in dryland continental regions. Earth Science Reviews 157, 121-144.