

SAHRA Export Permit Application- David Morris (MaGregor Museum, South Africa) & Liora Kolska Horwitz (The Hebrew University, Israel)

16th August 2014

Samples from the Earlier Stone Age (Excavation 1, Strata 5 to 12) and Middle Stone Age (Excavation 2, Stratum 2) from Wonderwerk Cave (Northern Cape) for Isotope Analysis 2014

The interior of southern Africa is a key region for the study of human evolution, but has few long, well-dated climate and environmental proxy records that can be compared with cultural sequences and with broader global climate records. Sparse, discontinuous and/or poor chronologically resolved data hinder construction of reliable environmental sequences. This project is focused on the site of Wonderwerk Cave, which provides a long sequence spanning almost 2 million years of prehistory. Wonderwerk Cave is located at the edges of the Kalahari, an area which is known to have been sensitive to past climate shifts such as increasing aridity, or the expansion of the winter rainfall belt. This project aims to reconstruct the palaeoclimate and palaeoenvironment of South Africa's interior through analysis of the stable light isotopes of the Wonderwerk Cave faunal material. In turn, this record will allow us to evaluate how archaic, and later modern, humans adapted to changing environmental circumstances in this region and more broadly to compare it with other regions in Africa.

Stable isotope analysis is a well-established method used for constructing proxy palaeoclimate and palaeoenvironmental records. Oxygen and carbon light stable isotopes in faunal tooth enamel can reveal changes in relative humidity, in the diet of animals as well as the distribution of C₃ and C₄ grasses. We started this project with a highly successful pilot project, measuring oxygen and carbon stable isotopes in ostrich eggshell (OES) from Wonderwerk Cave. Subsequently, we started to build a second independent line of proxy evidence by measuring $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in herbivore enamel from the Holocene deposits of Excavation 1 at Wonderwerk. The results will provide greater resolution of the Later Stone Age environment, both in the surrounds of the site as well as in the arid interior of southern Africa as a whole. Drawing from our experience with the Holocene material, we plan to extend the dataset into the Pleistocene layers from the same site.

To date, two papers and a poster have been presented at international conferences based on the preliminary results, and one paper is has been submitted for publication (see below).

We request permission to export samples of 140 teeth from large herbivores, including grazers, browsers and mixed-feeders from Excavation 1, Strata 5-12 (Earlier Stone Age) and Excavation 2, Stratum 2 (Middle Stone Age) of Wonderwerk Cave. These samples

form part of the DPhil thesis research of Ms. Michaela Ecker, at University of Oxford, under the supervision of Prof. Julia Lee-Thorp.

Prior to sampling, the teeth will be carefully documented for taxonomic identification, measurements, descriptions and photographs. This sample size will allow us statistically robust analysis of changes between cultural units. Sampling will include collecting about 8mg material per tooth with a drill at the Florisbad Quaternary Research Station, Bloemfontein, South Africa. Samples will then be sent by courier to the Research Laboratory for Archaeology and the History of Art, University of Oxford, UK, for further analysis. Standard pretreatment protocols for carbon and oxygen light stable isotope analysis will be used on the powdered samples, followed by acid hydrolysis to produce clean CO₂ for isotope ratio determinations in an isotope ratio mass spectrometer. The sampling and measurement has to take place in the UK as the pretreatment chemicals and the machine measurement there are free and ready to use through Michaela Ecker's status as DPhil research student at the University of Oxford. Since the analyses are destructive, no samples will be returned to South Africa.

Papers Presented Associated with this Project

- Ecker, M., Botha-Brink J., Lee-Thorp, J.A., and Horwitz L.K. 2014. Ostrich eggshell as a source of palaeoenvironmental information for the arid interior of South Africa. Paper presented at Conference: *"From Past To Present Changing Climates, Ecosystems and Environments of Arid Southern Africa. A Tribute to Louis Scott."* Bloemfontein, South Africa, 7-11th July.

- Ecker, M. and Lee-Thorp, J.A. 2014. Environmental Change In The Arid Interior: A Case Study From Wonderwerk Cave, Northern Cape, South Africa. *14th Pan-African Archaeological Association* conference, University of Witwatersrand, South Africa, 13th-16th July.

Poster Presented

Ecker, M., Lee-Thorp, J.A., Rossouw L. and Scott L. 2013. New results for palaeoenvironment and vegetation change from Wonderwerk Cave, South Africa. *3rd European Society for Human Evolution*, Vienna, Austria, 20-21 September.

Papers In Press

Lee-Thorp, J.A. and Ecker, M. in press. Holocene environmental change at Wonderwerk Cave, South Africa: Insights from stable light isotopes in ostrich egg shell. *African Archaeological Review* (Special Issue on Wonderwerk Cave).