**Applicant (name and affiliation): this is usually the museum curator:**

David Morris, McGregor Museum

**Applied for (principal researcher):**

Michael Chazan, University of Toronto, University of the Witwatersrand

**Participants with affiliations, email addresses, phone numbers (& their role):**

Uranium Lead Dating—Dr. Don Davis, Department of Earth Science, Univeristy of Toronto, 22 Russell Street, Toronto, Ontario, Canada.

Micromorphology—Prof. Francesco Berna, Department of Archaeology, Simon Fraser University, Education Building 9613, 8888 University Dr., Burnaby, BC V5A 1S6; Prof. Paul Goldberg, Department of Archaeology, Boston University, 675 Commonwealth Avenue # 347, Boston, MA 02215, USA.

Isotopes—Dr. Michaela Ecker, Institut für Ur- und Frühgeschichte, Christian-Albrechts-Universität, Johanna-Mestorf-Straße 2-6 D - 24118 Kiel, Germany; Prof. Dr Hervé Bocherens

Fachbereich Geowissenschaften – Biogeologie, Universität Tübingen, Hölderlinstr. 12, 72074 Tübingen.

Histology—Dr. Liora Kolska Horwitz, National Natural History Collections, Berman Building, The Hebrew University, E. Safra-GIvat Ram Campus, Jerusalem 9190401, Israel

The material will be couriered to the appropriate institutions in October 2019 by Michael Chazan.

Return:

Sediment samples will not be returned and will be curated for the duration of analysis in host institutions. Micromorphology blocks will be returned to the McGregor Museum at the end of analysis. All other samples will be returned to the McGregor Museum by Dec. 1, 2020.

**Institution incl. address that currently hosts the object:**

McGregor Museum, Kimberley

**Facility incl. address at which the experiment will be done:**

See listing above

**Table of objects or upload file:**

See attached files

**Site including age at which object was found:**

Wonderwerk ESA

**Time frame:**

Transport to \_\_List of facilities above: October 2019

Return date: \_\_\_Decemeber 2020 except for sediment samples that will be curated in the foreign labs.

**Aim/rationale:**

 Excavation 1 at Wonderwerk Cave preserves a unique sequence spanning the entire Earlier Stone Age. Developing a robust absolute chronology for this sequence will provide an essential timescale for the region. Research on faunal materials provides an opportunity to develop insight into the ecological context of human evolution

**Methodology (short):**

1

Sediment isotopes **(WW EXP19.1)**-- All sediment samples will be processed in the Leibniz Laboratory für Altersbestimmung und Isotopenforschung in Kiel by trained staff. Health and safety procedures conforming to relevant local & national guidelines and legislation are followed. On arrival in the Leibniz Laboratory, the sediment will be air dried at 60°C for 48h and then homogenized. Approximately 6g of homogenized dry sediment will be extracted for total lipids with a mixture of dichloromethane and methanol (DCM:MeOH) in an Accelerated Solvent Extractor. Lipids will be partitioned using column chromatography with activated silica gel. The saturated hydrocarbon fraction containing the n-alkanes will be obtained by column chromatography and in the following analysed in a mass spectrometer.

Micromorphology **(WW EXP19.2 and 3)—**Blocks of sediment are embedded in resin and then used to prepare microscopic thin sections. These thin sections are then analysed to understand site formation processes. At SFU micro-FTIR is applied to determine minerology. A number or rock samples are also being exported for petrographic analysis.

Bone and OES isotopes **(WW EXP19.4 and 5)**—All samples will be processed in the isotope laboratory in the biogeology research group at the University of Tuebingen for chemical analysis with the goal of deriving stable isotopic signatures that will inform interpretations of past climatic variables. The carbon (CO2) and oxygen (H2O) isotopic composition of the bone, eggshell, and enamel (teeth) specimens will provide information on the plants and drinking water consumed by the animals. Sediment samples are also being exported to test for potential contamination of the specimens by isotopes present in the surrounding sedimentary matrix.

Microfuana **(WW EXP19.6)**—For taphonomic analysis using the methodology developed in Fernandez Jalvo and Avery 2015.

Radiocarbon dating **(WW EXP19.7)**—Samples will be prepared with ultrafiltration and analysed at an AMS facility.

Uranium/Lead **(WW EXP19.8)**- Uranium/Lead dating is effective in dating the age of formation of speleothems. Preliminary research by Robin Pickering demonstrates that this method works at Wonderwerk. Following up on Pickerings results the goal is to analyse a robust sample from well provenienced samples from the new excavations at Wonderwerk. Twenty eight samples will be exported to the University of Toronto, Department of Earth Science, Jack Slatterly lab. Following analysis all samples will be returned to the McGregor Museum for permanent curation.

OES Histology **(WW EXP 19.9)**—To explore new methods for studying the relationship of OES histology to paleoclimate.

**Confirmation/permit by museum**: Attached

**Damage/destructive analysis?**

All sediment analyses are destructive.

Uranium Lead dating requires embedding of speleothems and preparation of thin sections, the same is true for micromorphology.

C14 dating and isotope analysis of fauna is minimally destructive. All samples will be photographed before sampling.

**Statement why this study cannot be done in South Africa:** Lack of necessary equipment and expertise.