**Export permits**

Please note an export permit must be linked to an object or site that has to be created on SAHRIS! If the object/site you want to work on has not been created yet, you would need to do so. Thanks!

The proposal should include (you can fill these in below):

* a list of participants (name, affiliation, phone no, email addresses) and how they are involved;
* the name and address of the facility, including address, it is being scanned at;
* name and address of the museum/university department that currently hosts the object;
* names of the responsible person(s) during transport and while the fossil is at the facility;
* the period/time frame during which the fossil(s) will be outside the country;
* detailed information on the fossil(s), especially as it is a "unique" specimen;
* detailed information on the research project behind it & methodology including expected outcomes (i.e., the reason for export);
* the written confirmation of the institution that currently hosts the object that the object may be used as proposed and be returned in good condition;
* should there be any damage/destructive analysis (e.g., coating for higher resolution) undertaken, this needs to be stated in detail;
* Statement why this study cannot be done in South Africa.

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

Dr. Bernhard Zipfel. Evolutionary Studies Institute, University of the Witwatersrand, 1 Jan Smuts Ave, Braamfontein, Johannesburg, 2000.

**Applied for (principal researcher):**

Prof. Shaw Badenhorst. Evolutionary Studies Institute, University of the Witwatersrand, 1 Jan Smuts Ave, Braamfontein, Johannesburg, 2000.

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

Joséphine Gigon. Beta Analytic Inc, 4985 SW, 74th Ct, Miami, Florida, 33155, United States. [jgigon@betalabservices.com](mailto:jgigon@betalabservices.com). +49 30 166 385 166. She is the contact person at this commercial dating facility.

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

Evolutionary Studies Institute, University of the Witwatersrand, 1 Jan Smuts Ave, Braamfontein, Johannesburg, 2000.

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

Beta Analytic Inc, 4985 SW, 74th Ct, Miami, Florida, 33155, United States.

**Table of objects or upload file:**

|  |  |  |
| --- | --- | --- |
| **Provenience** | **Bed** | **Description** |
| Rear Section. O = 24” | 10 | Long bone flake fragment lacking any morphology, and is thus unidentifiable |
| Rear Section. O = 24” | 10 | Long bone flake fragment lacking any morphology, and is thus unidentifiable |
| CH/16-22, CoH2477 | 11 | Molar fragment of cow |
| CoH2480 | 11 | Lower molar fragment of cow |
| Surface | 11 | Rib fragment of mammal |

**Time frame:**

Selection of samples: August 2023.

Courier of samples: September 2023.

Analyses: October – December 2023.

Return of samples: January – February 2024.

**Aim/rationale:**

The Cave of Hearths (CoH), located in the Makapan Valley in the Limpopo Province close to the modern town of Mokopane, has long been an influential site to trace the evolution of hominins in southern Africa (Mason 1969; 1988, McNabb and Sinclair 2009). Apart from some earlier investigations, excavations were initiated in the 1940s and continued into the 1950s (Mason 1969). The CoH yielded *in situ* Acheulian (Early Stone Age; ESA) occupation in Beds 1 to 3. The ESA beds have been dated to between 780 000 and 500 000 years ago using palaeo-magnetism dating (Herries and Latham 2009). The CoH also has an extensive Middle Stone Age (MSA) occupation, found in Beds 4 to 9. The presence of lithics from the Pietersburg Industry places the MSA at the CoH in the MSA I and II, dating to between 128 000 and 75 000 (Wurz 2013). The site also has Later Stone Age (LSA), Iron Age and historical occupations in Beds 10 and 11. The presence of Oakhurst-style lithics in the LSA bed suggest an age between 12 000 and 7000 years ago (Lombard et al. 2012), and the ceramic style may suggest an occupation during the Early Iron Age (AD 400 – 900, Huffman 2007). The material from the surface likely relates to the siege of 1854 (Mason 1969, 1988).

Few archaeological sites in South Africa have such an extensive and successive occupations by hominins over millennia. The earlier radiocarbon dates (Mason 1969) vastly underestimated the time depth of the occupations, and these dates are no longer accepted (cf. Wadley 2015). The imprecise dating of the CoH beds remains a serious constraint. Despite the site’s importance in earlier discussions on the evolution of hominins in South Africa, it has largely been excluded from archaeological debates on the ESA and MSA in particular due to the imprecise dating (Wadley 2015). At many other sites, each time period show variation in terms of material culture, and without more precise dates, the artefacts (fauna, lithics, human remains, ceramics, bone tools, etc) from the CoH remain limited in their study-potential. Moreover, due to the lack of precise dating, little remains known about the palaeoenvironment of the Makapan Valley. For example, there are indications that the rainfall was higher during certain times in the past. The presence of lechwe (*Kobus leche*) in Beds 7 and 9 indicate that during the MSA, much higher rainfall were experienced in the region (Maloka 2021). Bed 5 also contains waterworn lithics, which may suggest a wetter time (Mason 1988). However, it is currently impossible to reconstruct the palaeoenvironment in more detail due to the lack of precise dates.

With my collaborators from the University of York (UK), we have already been given permission to sample zebra teeth from each bed for amino-acid racemization dating. We are waiting for the results of this analysis. This is a new method that are being applied, and with this proposal, I am proposing to obtain additional dates for the CoH.

I am requesting to use 5 bone specimens from the Later Stone Age, Iron Age and historical beds for radiocarbon dating. I propose sending 5 bones (all non-fossilised) to the Beta Analytic Laboratory (USA) for radiocarbon dating. Dating by Beta Analytic is quick and efficient, as this is a commercial facility. Only 5 grams of bone is required for dating. For teeth, the entire tooth will be send, and the remains returned to the collection after dating

**Methodology (short):**

The specimens will be send using a courier to this commercial dating laboratory. Only 5 grams of bone is required for dating.

Radiocarbon (carbon 14) is an isotope of the element carbon that is unstable and weakly radioactive. The stable isotopes are carbon 12 and carbon 13. Carbon 14 is continually being formed in the upper atmosphere by the effect of cosmic ray neutrons on nitrogen 14 atoms. It is rapidly oxidized in air to form carbon dioxide and enters the global carbon cycle. Plants and animals assimilate carbon 14 from carbon dioxide throughout their lifetimes. When they die, they stop exchanging carbon with the biosphere and their carbon 14 content then starts to decrease at a rate determined by the law of radioactive decay. Radiocarbon dating is essentially a method designed to measure residual radioactivity.

**Confirmation/permit by museum**: Curator letter

**Damage/destructive analysis? (if yes, explain in detail)**

Yes. Small amounts of bone and teeth are required.

**Statement why this study cannot be done in South Africa:**

This commercial dating facility is quick and efficient for dating purposes.