

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



Palaeosciences Centre, East Campus, 1 Jan Smuts Avenue, Braamfontein, Johannesburg
Private Bag 3, WITS 2050, Johannesburg, SOUTH AFRICA Tel: 011 717 6672

Shaw.Badenhorst@wits.ac.za

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Dr. Heidi Fourie
Curator: Karoo Palaeontology

I am hereby applying for destructive sampling of the extinct cave bear (*Ursus spelaeus*) skull housed in the Karoo Palaeontology collection.

Background

Cave bears are extinct bears that lived in Europe during the Pleistocene. They went extinct by about 24 000 years ago. A skull of a cave bear is kept by the Karoo Palaeontology section. The specimen is part of a collection purchased in 1897 from Germany containing European fossil specimens (Fourie 2008). The label is identical to those in use by the K.S. Mineralien-Niederlage zu Freiberg company between 1880 and 1920 (Grundmann 1986). According to the label, the cave bear skull is from Hohle Stein, Nürremberg, Germany.

Hohle Stein in Nürremberg, Germany is a world heritage site. In 1861, geologist and palaeontologist Oskar Fraas initiated excavations at the site, specifically to look for cave bear remains. Moreover, the site has yielded some of the oldest decorative art pieces in the world, dating to between 35 000 and 41 000 years ago. It is possible that the cave bear was collected and sold by Oskar Fraas, and that it dates back to the same period as the decorative art.

Description

The specimen is the skull of the extinct cave bear *Ursus spelaeus*. The skull is complete, but has the following portions missing: the frontal bone, the nasals, and the right zygomatic process of the temporal bone and the zygomatic process of the malar bone, as well as part of the articular groove of the temporal bone. Six teeth are present: canines, 2nd molar and 3rd molar (all left and right sides). The tips of the canines have worn flat. The molars are heavily worn with no central islands visible, representing Stage 4 wear (see Andrews & Turner 1991). The specimen is from an old individual (Grandal-d'Anglade & Vidal Romani 1997). Measurements of other skulls (Grandal-d'Anglade & López-González 2005) as well as the width of the canine indicate that the specimen is a male.

Destructive Sampling Request

The cave bear offers a unique opportunity to investigate the age, history, sex and trophic level of this individual, and to compare that to data from other cave bears from Europe. Permission have already been granted to sample the teeth of the specimens for isotope analyses using a micro-drill for calcium and strontium measurements. This will allow for a reconstruction of the trophic levels of the cave bear. This analysis is still underway. Moreover, the skull has been CT-scanned at the University of the Witwatersrand, and an Honours project is underway using the scans. This latter study will reconstruct the brain volume of the cave bear, and investigate the relationship between brain volume and body mass in bears. The student will submit his project in November 2021 for examination.

With this application, I am requesting permission to remove 6-8 grams of bone from the damaged frontal bone for AMS (accelerator mass spectrometry) dating. This dating method only requires a small amount of bone, and is more accurate than conventional radiocarbon dating. It is also well suited for samples below 50 000 years of age. If permission is granted, the skull will be sampled at the University of the Witwatersrand, and the dating sample will be send to the Beta Analytic Testing Laboratory in Miami, Florida, USA, using a courier service. This is a commercial dating facility. The facility only requires 4 grams of bone, but I will sample slightly more to ensure a date can be obtained. If the dating is successful, it will provide important context data for interpreting the isotopic and scan data to reconstruct the lifeways of cave bears.

Output and Costs

The following outputs will be generated from this destructive sampling request (and the previous approved request):

- An Honours project for Mr. Tandile Voyiya.
- A paper in a peer-reviewed journal on the relationship between brain volume and body mass.
- A paper in a peer-reviewed journal describing the following data: the measurements, age and isotopic analyses.

All this information can be used by DNMNH for a potential temporary display.

All costs will be covered by Shaw Badenhorst for the dating and courier.

Permissions

I have contacted the South African Heritage Resources Agency (SAHRA), and since the specimen is not South African, it does not fall within the heritage act of South Africa. As a result, I do not require a permit from SAHRA.

References

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