

Proposal for dating analysis of the post 50 000 year old occupation layers at Klipdrift Shelter

Our Ref:



an agency of the
Department of Arts and Culture

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CaseID: 18036

Date: Wednesday April 13, 2022

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Letter

In terms of Section 32(19) of the National Heritage Resources Act (Act 25 of 1999)

Attention: Prof. Christopher Henshilwood
Evolutionary Studies Institute
University of Witwatersrand
Private Bag 3

Overview We are requesting permission to export 7 organic (charcoal and bone) samples collected from the Middle Stone Age site of Klipdrift Shelter (KDS) for radiocarbon (via accelerator mass spectrometry - AMS) dating by Beta Analytic in Miami, Florida, United States of America <https://www.radiocarbon.com/>. The aim of this research is to provide ages for the upper occupation layers that have not been dated using other radiometric dating methods. These upper units include the terminal layers of occupation of Klipdrift Shelter. The youngest layer (layer PAN/PAO) that has been dated (using single-grain optically stimulated luminescence - OSL) dates to ~50 ka (thousand years ago) (Henshilwood et al. 2014). The base of the Klipdrift Shelter sequence dates to ~ 71 ka. The layers containing artefacts belonging to the Howiesons Poort technotradition (HP) at KDS date to between 65.5 ± 4.8 ka to 59.4 ± 4.6 ka. Based on observations during excavation and material analysis of the less than 50 ka old material, it is not clear what the ages of these deposits are. They do not contain cultural artefacts indicative of a specific technotradition, although sample sizes are currently quite small. A pilot study on ancient DNA (aDNA) preservation at KDS (Meyer, HWC REPORT Number: CASE #:19100205AS1114E) found that no aDNA was preserved in the older than 50 ka layers, but aDNA was recovered from one of the younger layers (layer PAM). This differential preservation might be related to age, as younger materials are more likely to have better preservation (Meyer, personal communication). Thus the layers above the HP at KDS could potentially be of any age, even relatively recent, for which radiocarbon dating is particularly suited as it falls into the age range of the method. Analyses of micromammals (NEL, HWC permit number: CASE #: 20092306SB1102E) from the post 50 ka layers show distinct differences in species (and therefore rainfall seasonality) between certain layers, suggesting that considerable time had passed between deposition of certain of the upper layers. It is imperative to establish the time period represented in order to better interpret current materials and inform future excavation strategies. Samples were collected during the 2018 excavation season. Methodology "The Accelerator Mass Spectrometry (AMS) technique for radiocarbon dating accounts for a substantial number of the analysis requests Beta Analytic receives each day. There can be considerable advantages to using the AMS technique in many dating applications, making it

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possible to extend radiocarbon dating into many new areas of research. AMS also permits applications in important situations that cannot be dated by the radiometric dating technique. Beta Analytic has been providing routine AMS radiocarbon dating services to the international scientific community since 1983. The company routinely delivers AMS radiocarbon dating results within 14 business days. AMS Lab Procedure The AMS measurement is done on graphite produced by hydrogen reduction of the CO₂ sample over a cobalt catalyst. The CO₂ is obtained from the combustion of the sample at 800°C+ under a 100% oxygen atmosphere. The CO₂ is first dried with methanol/dry ice then collected in liquid nitrogen for the subsequent graphitization reaction. The identical reaction is performed on reference standards, internal QA samples, and backgrounds to ensure systematic chemistry. The analytical result (“BP” or “pMC”) is obtained by measuring sample C¹⁴/C¹³ relative to the C¹⁴/C¹³ in Oxalic Acid II (NIST-4990C) in one of Beta Analytic’s multiple in-house particle accelerators using SNICS ion source. Quality assurance samples are measured along with the unknowns and reported separately in a “QA report“. The radiocarbon dating lab requires results for the QA samples to fall within expectations of the known values prior to accepting and reporting the results for any given sample. The AMS result is corrected for total fractionation using machine graphite d¹³C. The d¹³C reported for the sample is obtained by different ways depending upon the sample material. Solid organics are sub-sampled and converted to CO₂ with an elemental analyzer (EA). Water and carbonates are acidified in a gas bench to produce CO₂. Both the EA and the gas bench are connected directly to an isotope-ratio mass spectrometer (IRMS). The IRMS performs the separation and measurement of the CO₂ masses (44, 45, and 46) and calculation of the sample d¹³C.”

Dear Prof Christopher S. Henshilwood and Dr Karen L. van Niekerk,

Thank you for your application to permanently export five charcoal and two bone samples from Klipdrift Shelter for AMS analysis at Beta Analytic, Miami, Florida.

SAHRA has reviewed the application and has decided to approve it.

We wish you every success with this project.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

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Ragna Redelstorff, PhD
Heritage Officer
South African Heritage Resources Agency

Phillip Hine
Manager: Archaeology, Palaeontology and Meteorites Unit
South African Heritage Resources Agency

ADMIN:

Direct URL to case: <https://sahris.sahra.org.za/node/593173>

Terms & Conditions:

1. This approval does not exonerate the applicant from obtaining local authority approval or any other necessary approval for proposed work.
2. If any heritage resources, including graves or human remains, are encountered they must be reported to SAHRA immediately.
3. SAHRA reserves the right to request additional information as required.