Export/sampling permits

Please note an export permit must be linked to an object that has to be created on SAHRIS! If the object you want to work on has not been created yet, you would need to **create an ObjectID**.

Required documents:
- For export of material from KZN, Eastern Cape or Western Cape that involves destructive analysis, the **destructive sampling permit** from the respective Heritage Authority must be submitted;
- A consent letter from the accessioning institution.

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 analysed 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. Gerrit Dusseldorp
University of Johannesburg and Leiden University
Faculty of Archaeology, Leiden University
2300 RA Leiden, The Netherlands
+31715272428
g.l.dusseldorp@arch.leidenuniv.nl

Applied for (principal researcher):
Andrew Carr, School of Geography, Geology and the Environment, University of Leicester, University Road, Leicester, LE1 7RH, UK

Participants with affiliations, email addresses, phone numbers (& their role):
1) Dr. Gerrit Dusseldorp
University of Johannesburg and Leiden University
Faculty of Archaeology, Leiden University
2300 RA Leiden, The Netherlands
+31715272428
g.l.dusseldorp@arch.leidenuniv.nl
Role: Project leader

2) Andrew Carr, School of Geography, Geology and the Environment, University of Leicester, University Road, Leicester, LE1 7RH, UK
+44 (0) 116 2523851
asc18@le.ac.uk
Role: Stable isotope analysis, lipid extraction and analysis

The material will be **Couried with DHL** to the School of Geology, Geography, and Environment, University of Leicester (facility/institution) in November 2018 (month, year) by Gerrit Dusseldorp (name of person responsible for transport) and brought back by _____ (leave blank if same person as above).
Dr. Andrew Carr (name) will be involved with the Sample preparation and analysis (e.g., transport/scanning) of objects and
_____
(whatever else).

Institution incl. address that currently hosts the object:
KwaZulu-Natal Museum 237 Jabu Ndlovu Street
Pietermaritzburg South Africa

Facility incl. address at which the experiment will be done:
School of Geography, Geology and the Environment, University of Leicester, University Road, Leicester, LE1 7RH, UK

Table of objects or upload file:
See attached Sahris excel table

Site including age at which object was found:
Umhlatuzana, samples from Pleistocene sediments dating to ~50 000 – 10 000 years ago

Time frame:
Transport to School of Geology Geography and Environment: November 2018
Return date: _____ (date)

Aim/rationale:
31 loose sediment samples will be analyzed for 1) their bulk stable carbon isotope ($\delta^{13}C$) compositions and depending on preservation circumstances 2) their extractable lipid content and lipid stable isotope composition (compound specific stable isotope analysis). The goal of this work is to provide a palaeoecological/palaeoclimatological context for the site occupation. The $\delta^{13}C$ data will provide insights into ecological change around the site, based on the distinct isotopic compositions of (C_4) grasses and (C_3) shrubs/trees. The lipid extraction will allow an assessment of the input of plant (and potentially animal) derived biomarkers to the site sediments. Analyses of the compositions of the lipids will provide insights into changing inputs/ecology around the site, while if preserved in sufficient quantity, analyses of leaf wax lipids for their stable hydrogen isotope compositions (leaf wax dD) will also provide new insights into the palaeohydrological evolution of the site. The goal is to combine this information to provide a better environmental context for the site, which we anticipate will span a significant section of the last glacial cycle.

Methodology (short):

For bulk carbon isotope analysis, several tens of grams of loose sediment will be washed in dilute hydrochloric acid to remove carbonates, then freeze-dried and homogenized in a ball mill. Then, several tens of milligram sub-sample will be weighed into tin cups and combusted in an elemental analyzer. The resulting CO_2 will be analyzed via continuous-flow isotope ratio monitoring mass spectrometry to obtain the total organic carbon content and its delta value in reference to the $^{12}C/^{13}C$ ratio.
For lipid extraction 10-20 g of dry sediment will be placed in an accelerated solvent extractor (ASE) and lipids extracted using a mix of methanol and dichloromethane. The resulting extract will then be cleaned and separated via column chromatography. The compositions of the resulting apolar and polar lipid extracts will be analyzed via gas chromatography mass spectrometry (GC/MS). The isotopic composition of individual compounds, if present in sufficient quantities, will be determined via compound specific stable isotope analysis using a Thermo Delta V Plus mass spectrometer.

Confirmation/permit by museum (Attached?):
See letter from museum attached.

Damage/destructive analysis? (if yes, explain in detail)
Yes – the samples are initially required to be homogenized via crushing in a ball mill. For bulk carbon isotope analysis, the sample is then acid treated as well. The solvent-extracted residues remaining after ACE will be retained and would still be suitable for other analyses (e.g. analysis of insoluble organic matter fractions), but will also have been homogenized in a ball mill (i.e. crushed to a fine powder).

Statement why this study cannot be done in South Africa:
The stable isotope and biomarker laboratories at Leicester are cutting-edge facilities that focus primarily on the analysis of environmental samples, with an emphasize analyses of climatic change, palaeoclimatic change and archaeology research. To our knowledge, such a facility is not available in South Africa. Particularly, the Thermo Delta V Plus system (installed 2016) is, to our knowledge, generally unavailable at most institutions as it is a relatively new instrument. We have found it offers significant advantages for compound specific analysis, both in terms of analytical precision and the lower limits of detection (i.e. it is suitable for samples with a low biomarker yield). The latter is likely an issue at this site. The analysis and data interpretation will be supported by experts in organic geochemistry who oversee the management and research in this lab. Both Carr and the director of this lab (Arnoud Boom) have a long standing interest and expertise in the application of these methods in southern Africa, which will support interpretation of the results.