Export/sampling 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!
BENOIT Julien

Applied for (principal researcher):
BENOIT Julien

Participants with affiliations, email addresses, phone numbers (& their role):
1) BENOIT Julien, Evolutionary Sciences Institute, University of the Witwatersrand (Johannesburg), julien.benoit@wits.ac.za, 0797896503.

Role: Bring the material to the synchrotron facility and conduct research on the material

The material will be **hand-carried** to European Synchrotron Radiation Facility (Grenoble, France) in September and October 2015 by BENOIT Julien and brought back by _____ (leave blank if same person as above).
____NA_____ (name) will be involved with the __NA___ (e.g., transport/scanning) of objects and _____
(whatever else).

Description of the material
Each of the skulls we aim to scan have been prepared (i.e., removed from the surrounding sediment) except for inaccessible parts (i.e., interior cavities). The sample list consists of:

1) AM4550, Dinocephalia, young Moschops capensis, from Albany Museum (Grahamstown, South Africa). Size (mm): 225x180x150. This is a rare specimen, consisting of a complete skull of a young representative of this, otherwise, common fossil species.

2) NMQR1702, Biarmosuchia, Lemurosaurus sp., National Museum (Blemfontein, South Africa). Size (mm): 137x70x77. In addition to this specimen, only one skulls of this species is known.
3) SAM-PK-11112: Biarmosuchia, nov. sp., Iziko Museum (Cape Town, South Africa). Size (mm): 149x130x112. This skull belongs to a yet undescribed species.
4) WB123: Biarmosuchia, Hipposaurus sp., Council for Geosciences (Pretoria, South Africa). Size (mm): 197x73x108. This skull is awaiting description.

Institution incl. address that currently hosts the object:

AM4550: Albany Museum, Grahamstown, 6139, South Africa.
NMQR1702: National Museum, 36 Aliwal St, Bloemfontein, 9301, South Africa.
SAM-PK-11112: Iziko Museum of Natural History, 25 Queen Victoria St, Cape Town, 8001, South Africa.
WB123: Council for Geoscience, 280 Pretoria St, Pretoria, 0184, South Africa

Facility incl. address at which the experiment will be done:
European Synchrotron Radiation Facility, 71 Avenue des Martyrs, 38000 Grenoble, France

Table of objects or upload file:

- Autorization from the above mentioned institutions (x4)
- Research project

Site including age at which object was found:

Late Permian Karoo (-206 millions of years).

Time frame:
Transport to European Synchrotron Radiation Facility (Grenoble, France) via Paris (France) :
Transport: 30 September 2015; Return date: 17 October 2015

Aim/rationale:
The objective is to bring the four skulls of mammal-like reptiles (Therapsida) to the highly powerful and accurate synchrotron scanning facility in Grenoble (France) in order to CT-scan them and obtain the best pictures of the inside of these specimens. The ultimate aim is to produce a 3D digital model of their fossil brain (endocranial cast) and to measure, for the first time, the size of the brain in our therapsid ancestors with a software (Aviso 8.0 VSG software). The reason I need a permit is because the scan will take place at the European Synchrotron Radiation Facility, 71 Avenue des Martyrs, 38000 Grenoble, France. This project was approuved by the scientific commity of the ESRF, and the scan is schedulded in between the 30th of September and the 17th of October 2015.

Methodology (short):
Brain evolution is a central matter in mammalian paleobiology. The braincase in mammals is characteristically more voluminous than in most vertebrates, and their brains have a neocortical sheet which is absent in reptiles and birds. Using endocranial casts (i.e. internal cast of the braincase) researchers have been able to trace the evolution of brain size in vertebrates backward in the fossil

record. But in therapsids (also known as mammal-like reptiles, the closest extinct relatives of mammals) the braincase was typically enclosed by a membrane (the dura mater) or cartilage rather than bone. As this soft tissues are rarely preserved in the fossil record, attempts to measure brain size in therapsids result more in approximations than true estimations. Nevertheless, some barely studied therapsid subgroups, the Biarmosuchia and Dinocephalia, do possess a densely ossified braincase and must have had a fully ossified braincase like in extant mammals. The objective of this survey is thus to scan the braincase of a middle-sized dinocephalian and three biarmosuchians in order to obtain, for the first time, a reliable measurement of brain size in one of our premammalian forerunners. We expect that the ossification of the membrane surrounding the brain is preserved. If so, this structure would be very thin, which, in addition to the thickness and density of the skull roof, justifies to the use of highly powerful and accurate synchrotron scanning.

Confirmation/permit by museum (Attached?): See attachment

Damage/destructive analysis? (if yes, explain in detail) No

Statement why this study cannot be done in South Africa:
The size of the specimens, their density, and the small size of the structure I aim to see require a wide scanning beam with highly powerful and accurate X-rays. This is only possible with synchrotron scanning. Such facility does note exist in South Africa.