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SOUTH AFRICAN HERITAGE
RESOURCES AGENCY
111 HARRINGTON STREET, CAPE TOWN, 8001

FOR OFFICIAL USE ONLY:
File No.:
Date received:
Date approved:
Applicant:
Site / Object:
Permit No.:

**APPLICATION FOR PERMIT:
HERITAGE OBJECTS**

(including export of archaeological and palaeontological material and meteorites)

Please note: Permit Applications expire one year after the date of receipt.

In terms of the National Heritage Resources Act of 1999 (Act No.25 of 1999), this application form must be completed by anyone applying for a permit to:

- (a) destroy, damage, disfigure or alter a heritage object or disperse a collection of heritage objects; or
- (b) carry out any work of restoration or repair of a heritage object; or
- (c) export a heritage object listed in the register of heritage objects held by SAHRA; or
- (d) export a type of heritage object as listed in the register of heritage objects and provisionally declared in the Government Gazette; or
- (e) trade in or sell for private gain:
 - (i) any category of wreck material or object; or
 - (ii) any other category of archaeological or palaeontological material or object; or
 - (iii) any meteorite.

Applicants are advised that without full details no permit may be issued.

A. APPLICANT'S DETAILS

1. Name and address of applicant* : **Dr. Curtis W. Marean, Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University, Tempe, AZ 85207 USA and Dias Museum, 1 Market Street, Mossel Bay 6500 South Africa**

**In the case of items accessioned in a museum collection, the curator of that collection must be the applicant*

Phone: **(H-USA) 001-480-396-8387** **(W-USA) 001-480-965-7796** **(Cell-RSA) 076-8906163** **Fax: (USA) (USA) 480-480.727.6570** **E-mail: curtis.marean@asu.edu**

Identity number of applicant: **208788907 (USA passport)**

2. Capacity of applicant. *Please circle the appropriate position :*

- Museum curator
- Archaeologist / Palaeontologist / Geologist
- Owner
- Agent for sale or auction
- Other*

** Please furnish extra relevant details on a separate sheet of paper (if new applicant)*

3. Name and address of owner/custodian: **None - while excavated archaeological material will be accessioned and housed at Iziko – South African Museum, Cape Town, the small sediment samples will not be accessioned as the sediment is ultimately destroyed.**

Phone: (H) (W) (Cell) N/A.....

FAX: E-mail: N/A.....

Identity number of applicant: N/A.....

B. DETAILS OF HERITAGE OBJECT(S)

4. Description and number of objects*: **Sediment samples for geological analysis. The sediment samples are taken as small scrapings from the sections and comprise about 1 teaspoon of sediment per 1 cm of vertical section targeting strategically specific portions of the sections. We wish to export these sediment samples from site PP5-6 and we estimate about 500 samples of 1 teaspoon each in a small plastic bag.**

..... *

Please supply full description & motivation on a separate sheet of paper.

5. Era / period / age / date of object(s): All are **Middle Stone Age dating between 48-90 ka**

6. Museum or University accession number: **N/A**

7. Museum or University loan number: **N/A**.....

8. For palaeontological and archaeological materials and meteorites give geographical situation of site / object:

Geographical situation of sites PP5-6

Magisterial district: **Mossel Bay** 1: 50 000 Map no. & name (or SAN chart): **3422AA**

Latitude & Longitude: **34.12.44S, 22.05.37E centroid** Recording method (GPS, Trig., Other): **GPS**.....

Farm Name and No.: **Boplaas, Erf 3438** Town: **Mossel Bay**

Nearest Town: **Mossel Bay**..... Street address & Erf #: **Boplaas, Erf 3438**

9. If it is a listed type or declared heritage object, the number and date of the notice in the Government Gazette: **N/A**.....

10. If it is a listed type or declared heritage object, the number of the object or type of object in the register of heritage objects: **N/A**.....

11. Present location of object(s): **recently excavated and stored at the Munro House (Mossel Bay Archaeology Project Laboratory) Diaz Museum in Mossel Bay**.....

12. Please supply a photograph or drawing of object(s) destined for permanent export with a suitable scale.
N/A

C. DETAILS FOR APPLICATION TO EXPORT

13. Name and address of person/institution to whom it is being exported :

14. **Dr. Eugene Smith, Associate Chair and Professor of Geology, Department of Geoscience, University of Nevada at Las Vegas, 4505 S. Maryland Pkwy, Las Vegas, NV 89154-4010**

Phone: (H) (W) **(01)(702) 895-3971**

Fax: E-mail **gene.smith@unlv.edu**

14. Please indicate whether for permanent or temporary export and reasons for export:

Temporary Export: For: Identification Analysis Dating Restoration Exhibition Sale Other*

Permanent Export: For: Identification Analysis Dating Restoration Exhibition Sale Other*

* Please circle relevant words and supply full description on a separate sheet of paper.

- 15. Please supply documentation indicating the present condition of the object. **N/A**
- 16. Please supply written undertaking of South African cultural institution that the object will be returned in the same condition. **N/A**
- 17. In the case of temporary export, for what period will the object be exported?:
From: N/A **To: N/A**

D. DETAILS FOR APPLICATION TO DESTROY, DAMAGE, DISFIGURE, ALTER OR DISPERSE

18. Reason for application (Please supply full motivation): Our goal is to search the sediments for micro-tephra crystals (volcanic shards) that result from volcanic eruptions for the purpose of initiating a tephrochronology study at Pinnacle Point and searching for the impact of the Toba mega-volcanic eruption. Tephrochronology is a stratigraphic method for correlating and dating sedimentary sequences in the archaeological and geological record. The technique has recently been reviewed (Lowe 2010), and we draw on that summary for this description. Tephrochronology requires geochemical finger-printing of volcanic sediments such as tephra crystals or shards using various geochemical techniques. Volcanic eruptions have distinct chemical signatures that allow precise correlation, so tephra found at PP5-6 will be assigned or excluded from Toba with high confidence. The sediment samples must be hand-searched and picked under microscope by a trained technician for the extremely small but diagnostic micro-tephra crystals. Once identified and isolated, these crystals can then be subjected to geochemical analysis to identify the volcanic source of the eruption. If our analysis is successful, this could result in a major advance in geochronology of South African MSA sites, as well as positive identification of the Toba mega-volcanic eruption.

It is well-known that the Toba mega-eruption was a massive volcanic event (Chesner et al. 1991; Rampino and Self 1993) that is recorded in other global records such as the Greenland ice cores (Zielinski et al 1996). This event has been argued to be relevant to human origins, perhaps causing widespread fast and resource-damaging climate and environmental change that may have suppressed human population numbers (Ambrose 2003). Toba has never been securely identified in African terrestrial records. To test the hypothesis that Toba caused population suppression, we must first show that Toba had an impact on African terrestrial environments and that begins by identifying its presence. Toba is dated to between 74-71 ka by potassium-argon and argon-argon techniques. In Bar-Matthews et al. 2010 we identified a sharp pulse of climate and environmental change in well dated speleothem records at this time. Following up on that result, we then carefully examined petrographic thin sections of the sediments from PP5-6 from appropriate time intervals. This proved to be successful – we identified several micro-tephra crystals in the thin sections from the appropriately-aged sediments (see Figure 1). These cannot be analysed appropriately for geochemistry while in such small amounts and in thin section, so we now must sample loose sediment through the sections, hand-pick the samples under the microscope, and isolate sufficient crystals for analysis.

If the shards are not from Toba then it is highly likely that they derive from Antarctica where volcanic events through the Quaternary were common (Castellano et al. 2004). If this is the case, then their presence

alone will allow unprecedented precise correlation between South African archaeological sites, resulting in a major advance in chronology.

This analysis will be done in collaboration with Dr. Eugene Smith who will lead the sediment and geochemical analysis. Dr. Smith is a volcanologist with extensive field and laboratory experience with volcanic sediments and tephra analysis. The original identifications of the micro-tephra crystals in thin section were done by SACP4 project geologist Dr. Panagiotis Karkanas. Dr. Smith independently confirmed the tephra identify of these crystals after being shown images of the thin sections by Marean. His laboratory in the Department of Geoscience at University of Nevada at Las Vegas (UNLV) is fully equipped to handle the sampling. Most of the geochemical analysis that will be required can be done under his supervision at UNLV. He has prior experience in sample selection for argon-argon dating, and connections to the appropriate labs, to facilitate the direct dating if this becomes feasible. A sample of Dr. Smith's extensive publication record follows this section.

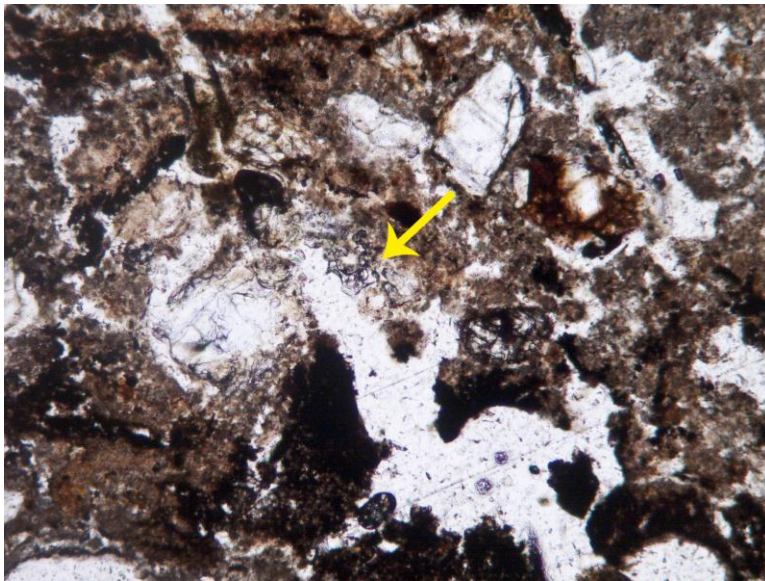


Figure 1. Micro-tephra crystal (shard) in a thin section from PP5-6. The shard is indicated with the yellow arrow. It is the small glass-like inclusion with a "melted" character. It is nearly transparent and has bubbles and u-shaped outer surface.

References

Stanley H. Ambrose. Did the super-eruption of Toba cause a human population bottleneck? Reply to Gathorne-Hardy and Harcourt-Smith. *J.hum.Evol.* 45 (3):231-237, 2003.

E. Castellano, S. Becagli, J. Jouzel, A. Migliori, M. Severi, J. P. Steffensen, R. Traversi, and R. Udisti. Volcanic eruption frequency over the last 45 ky as recorded in Epica-Dome C ice core (East Antarctica) and its relationship with climatic changes. *Global and Planetary Change* 42 (1-4):195-205, 2004.

Miryam Bar-Matthews, Curtis W. Marean, Zenobia Jacobs, Panagiotis Karkanas, Erich C. Fisher, Andy I. R. Herries, Kyle S. Brown, Hope M. Williams, Jocelyn Bernatchez, Avner Ayalon, and Peter J. Nilssen. A high resolution and continuous isotopic speleothem record of paleoclimate and paleoenvironment from 90 to 53 ka from Pinnacle Point on the south coast of South Africa. *Quaternary Science Reviews* 29:2131-2145, 2010.

C. A. Chesner, W. I. Rose, A. Deino, R. Drake, and J. A. Westgate. Eruptive history of Earth's largest Quaternary caldera (Toba, Indonesia) clarified. *Geology* 19:200-203, 1991.

Lowe, David. J. Tephrochronology and its application: A review. *Quaternary Geochronology* 6: 107-153, 2010.

Michael R. Rampino and Stephen Self. Climate-Volcanism Feedback and the Toba Eruption of ~74,000 Years Ago. *Quaternary Research* 40 (3):269-280, 1993.

Martin A. J. Williams, Stanley H. Ambrose, Sander van der Kaars, Carsten Ruehlemann, Umesh Chattopadhyaya, Jagannath Pal, and Parth R. Chauhan. Environmental impact of the 73 ka Toba super-eruption in South Asia. *Palaeogeography, Palaeoclimatology, Palaeoecology* 284 (3-4):295-314, 2009.

G. A. Zielinski, P. A. Mayewski, L. D. Meeker, S. Whitlow, and M. S. Twickler. A 110,000 - Yr Record of Explosive Volcanism from the GISP2 (Greenland) Ice Core. *Quaternary Research* 45:109-118, 1996.

Selected Publications by Dr. Eugene Smith

Smith, E., Honn, D., and Johnsen, R., 2010, Volcanoes of the McCullough Range, southern Nevada, in Umhoefer, P.J., Beard, L.S., and Lamb, M.A., eds., *Miocene Tectonics of the Lake Mead Region, Central Basin and Range: Geological Society of America Special Paper 463*, p. 203–219, doi: 10.1130/2010.2463(09).

Conrad, C.P., Wu, Benjun, Smith, E.I., Bianco, Todd, Tibbetts, Ashley, 2010, Shear-Driven Upwelling Induced by Lateral Viscosity Variations and Asthenospheric Shear: A Mechanism for Intraplate Volcanism: *Physics of the Earth and Planetary Interiors*, doi: 10:1016/j.pepi2009.10.101.

Honn, D.K. and Smith, E.I., 2008, The mid-Miocene Wilson Ridge Pluton and River Mountains Volcanic Section, Lake Mead Area of Nevada and Arizona: Linking a Volcanic and Plutonic Section, in Duebenforfer, E.M., and Smith, E.I., *Geological Society of America Field Guide II: Field Guide to Plutons, Volcanoes, Faults, Reefs, Dinosaurs, and Possible Glaciation in Selected Areas of Arizona, California, and Nevada: Geological Society of America Field Guide 11*, p. 1-20.

Smith, E.I., Conrad, C.P., Plank, T., Tibbetts, A., Keenan, D., 2008, Testing Models for Basaltic Volcanism: Implications for Yucca Mountain, Nevada: *American Nuclear Society, Proceedings of the 12th International High-Level Radioactive Waste Management Conference*, p. 157-164.

Ho, C.-H., Smith, E.I., and Keenan, D.L., 2006, Hazard Area and Probability of Volcanic Disruption of the Proposed High-Level Radioactive Waste Repository at Yucca Mountain: *Bulletin of Volcanology*, v. 69, no. 2, p. 117-123.

Smith, E.I. and Bennett, K., 2006, The Panther Creek Volcano, Yellowstone National Park: *Yellowstone Science*, v. 14, no. 1, p. 5-12.

19. Name and address of person who will do the work: **Dr. Eugene Smith, Associate Chair and Professor of geology, Department of Geoscience, University of Nevada at Las Vegas, 4505 S. Maryland Pkwy, Las Vegas, NV 89154-4010**

20. Destination of objects to be dispersed: N/A

21. For what period will the permit be required?:
From 20 June 2012. To 19 June 2013.

E. DETAILS FOR APPLICATION TO TRADE IN OR SELL FOR PRIVATE GAIN

22. Reason for application (Please supply full motivation): N/A

23. Address from which items will be sold or traded: N/A

24. Destination of items to be traded or sold : N/A

25. For what period will the permit be required?:
From N/A To N/A

I, Curtis W. Marean

.....
undertake strictly to observe the terms, conditions, restrictions, regulations and guidelines, under which the Council may issue the permit to me.


Signature: **Place:** Arizona State University

(Signature of Applicant. Note: if neither the applicant nor the Institution qualifies as the owner then a letter of approval from the owner must be included in the documentation)

Date:19 May, 2012.....

Where the object(s) reside in a public institution:

I, **Head of**.....
(South African institution/ responsible department, where the applicant is based)
hereby state that I support the application.

Signature:..... **Date:**.....

Additional Information

B. DETAILS OF HERITAGE OBJECT(S)

4. Description and number of objects*: (Continued from above)

Small baggies of sediment sample as described above.

C. DETAILS FOR APPLICATION TO EXPORT

14. Please indicate whether for permanent or temporary export and reasons for export: (continued from above)

Export is permanent as the small sediment samples may be destroyed in the process.