Identifying and Dating Pigment Deposits on the Blombos Cave Calcite Roof

Our Ref:

an agency of the
Department of Arts and Culture

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CaseID: 16348

Date: Tuesday March 28, 2023

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

Project Objectives and Background In 2009 a red-coloured substance was detected on a portion of the calcite roof at Blombos Cave. Small samples of the pigment were collected (Fig. 1) and samples of the calcite were removed from the roof for testing at the University of Bergen. In preliminary tests in 2011 on microscopic samples the red substance appears to be pigment (ochre - Iron oxide). In-situ examination and 3D photography of this section of the roof seem to show that the pigment was applied to the roof perhaps during a period when the cave was occupied during the LSA or the MSA. In 2011 we attempted to date when the pigment was applied to the roof using U- Th. The results were inconclusive but favoured a younger date post 2ka. We were also not able to determine whether there was a layer of calcite overlying the pigment or vice versa.The project at this stage was halted. Several novel dating methods for rock art have since been developed and tested including AMS dating of carbonates (see Bonneau et al below) and accurate U-Th dating using laser ablation. We now wish to thin section and date the roof samples that we have in our Cape Town laboratory in collaboration with Dr Warren Sharp, Berkeley Geochronology Center, California, with Prof. David Pearce, Wits University and Dr Adelphine Bonneau, Oxford University. We wish to therefore apply for an export permit for these Blombos Cave roof samples (Table 1) to be sent to Prof. Henshilwood at the University of Bergen (UiB), Norway Date Samples 28.12.2010 Roof sample 1 (E4a) 28.12.2010 Roof sample 2 (D4a) 14.12.2011 Samples 1, (PH5), session 5 14.12.2011 Sample 2, (PH1), session 1 14.12.2011 Sample 3, (PH6), session 6 25.03.2009 Sample 4, Crumbs to SEL. Table 1. Blombos Cave roof samples requested for export 1. Methodology i. Thin sectioning of roof samples at UiB and analysis of pigment. Conducted by Prof. Henshilwood at University of Bergen The roof samples will initially be thin sectioned in our geoscience's laboratory at UiB to determine whether there is a clear stratigraphy relating to the deposits of calcite and pigment. From these thin sections we will analyse the red stains using FTIR spectroscopy and SEM-EDS microanalysis to ensure the 'pigment' is not naturally growing iron-based minerals/substances. A detailed recording of the individual layers followed by a detailed characterization of the paint layer at different points will be carried out. This detailed characterization will also be conducted on the roof samples that we have without red stains. Once this

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examination is completed then some of the thin sections will be sent to Prof. Sharp at the Berkeley Geochronology Center, California and to Dr Adelphine Bonneau, Oxford University ii. U-Th dating- Conducted by Dr Warren Sharp – Berkeley Geochronology Center, California. The thin sections will be sampled using laser ablation and then U-Th dated. This will bracket the age of the Blombos pigments. With modern ICP mass spectrometry, Berkeley will obtain U-Th dates with percent-level precision on circa 1 mg of typical cave carbonate, making sampling from such micro-stratigraphic contexts feasible. Each visually distinct carbonate layer above and below the ochre will be sampled. This will test whether U-Th ages preserve stratigraphic order, assessing their reliability, and bracketing the ochre's age as closely as possible. iii. 14C ages of thin sections – Conducted by Dr Adelphine Bonneau, University of Oxford, Dr Ruth Ann Armitage at Eastern Michigan University Comparing the U-Th ages with 14C ages derived from the pigments themselves will be highly informative since the assumptions and limitations of the two techniques are quite distinct. Since the effective range of 14C is limited to c. 50 ka, however, only U- Th dating could resolve ochre ages contemporaneous with the cave's MSA occupation. Although 14C dating may be applied on calcite crusts, it may also be applied to other components in and/or surrounding the paint layer. The detailed characterization is the only way to know what is present and what can be used or not. Samples of these same thin sections will be sent from Oxford to Dr Ruth Ann Armitage at Eastern Michigan University. Using a DART-MS she will determine if organic substances are still present in the paint and whether they can be dated. A plasma oxidation system will be used to extract organic compounds for 14C dating, on top of a conventional extraction for AMS 14C dating.

Dear Prof Henshilwood,

Your request for an extension of permit ID 3396 is noted. This letter serves as confirmation of an extension of permit 3396 until 31 March 2024. Please note that a final permit report, accompanied by a confirmation letter from the curator confirming of return of the material, is due on 31 March 2024.

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/570035

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.