

[Supplementary Information]
The earliest directly dated rock paintings from southern Africa: new AMS radiocarbon dates

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Here we provide a description of the sampling and measurement procedures used in the acquisition of radiocarbon dates from all of the sites investigated (Section A), along with the results particular to each of them (Sections B–D). As well as identifying the specific image(s) dated, Sections B–D include information on the overall nature of the rock art present at each site and on any additional research undertaken. Where sites have not been drowned by subsequent reservoir construction, specific details on site location have been omitted, following good practice among southern African rock art researchers in order to protect sites from potential vandalism. This information is available to *bona fide* researchers on request from the authors.

A. AMS radiocarbon dating of LSA rock paintings

A.1. Sampling strategy

Two different sampling strategies were used. The Botswana and Lesotho sites were in areas to be flooded by dam construction. Given the imminent destruction of the sites in

these areas, we sampled all black paintings that could be identified to subject. The South African sites are not currently threatened by any form of development. There we chose to sample paintings that are specifically of research interest given what is known about the art in the area.

A.2. Sample collection

An overriding constraint in collecting samples was the need to minimize damage to paintings. Wherever possible, samples were taken adjacent to already damaged parts of paintings to minimize the visual impact. Samples were taken so as to maintain the visual integrity of each image by not cutting its outline.

Analytical work consisted of two components: inorganic characterization of the paint to determine the nature of the pigment and of potential radiocarbon contaminants, and accelerator mass spectrometry (AMS) radiocarbon (^{14}C) dating of paint. It was thus necessary to collect two sub-samples for each image that we were attempting to date.

The sampling was conceived as a two-phase process: initial samples were taken for characterization and on the basis of the results of that work decisions could be made as to which were potentially viable for ^{14}C dating. Sampling proceeded in this manner in South Africa, but in Botswana and Lesotho, because of time constraints and the imminent destruction of the paintings, both types of samples were collected at the same time.

We undertook only inorganic characterization of paints. Samples for these analyses were small, approximately 0.5 mm^2 in area. Samples of this size made little visual impact on the paintings. These samples were collected wearing nitrile gloves and using a sterile scalpel blade, and were subsequently stored in gelatin capsules.

Samples for ^{14}C dating were taken using the same tools as for characterization. Scalpel blades and gloves were changed between each sample. Earlier samples were stored in clean aluminum foil. For ease of later work, we subsequently stored samples in glass tubes. The glass tubes had previously been cleaned in an ultrasonic bath with methanol and then baked overnight at 500°C to fully remove all traces of carbon components. Glass tubes were wrapped in aluminum foil and stored in individual zip-top plastic bags. These samples were larger in extent, approximately $1\text{--}2\text{ cm}^2$, depending on the thickness of the paint.

A.3. Characterization analysis

A multi-instrumentation protocol was selected to acquire all the information needed to characterize the pigment and its alterations through time. Samples, collected *in situ*, were analyzed unprepared and in cross-section. They were first observed with a microscope and then under a Scanning Electron Microscope (SEM). Analyses were carried out with SEM- X-rays Energy Dispersive Spectroscopy (SEM-EDS), Raman spectrometry, and Fourier Transform Infrared (FTIR) spectrometry. All these steps were undertaken on both

unprepared samples and samples in cross-section, apart from the FTIR spectroscopy analyses, which were only carried out on unprepared samples.

Microscopic observation was used to assess the homogeneity of the sample: mixture, one material, weathering layer on top of the paint layer, alteration/weathering/paint layer under the paint layer, etc. The use of cross-sections made it possible to see the “stratigraphy” of the sample (i.e. the different layers composing the paint) and thus to evaluate possible repainting or superpositioning of pigments.

The SEM-EDS analyses had two objectives: to observe the shape of the particles and to analyze the chemical elements making up the sample. At this step, it was possible to separate paintings composed of iron or manganese oxides from those composed of carbon. Moreover, the shape of the particles of carbon present allowed us to identify the kind of material used: long pieces with holes for charcoal, small balls for soot, flakes between 0.5 to 10 μm in diameter, for carbon blacks.

Following elemental analysis, molecular analysis was carried out to characterize alterations of the pigment and weathering products that might contaminate the radiocarbon samples. Raman spectroscopy was employed for the molecular characterization of both pigments and weathering products and enabled us to differentiate between carbon-based particles made of graphite (which have a Raman spectrum with only one peak centered about 1590 cm^{-1}) from those consisting of carbon black, soot or charcoal (which exhibit broad peaks centered at 1350 and 1590 cm^{-1}).

When using Raman spectroscopy, molecules of some weathering products, such as calcium oxalates, are difficult to excite with visible wavelengths. To overcome this problem and in order to complement the Raman analysis, we also undertook FTIR spectroscopy analysis. This technique proved to be particularly sensitive to the presence of calcium oxalates, humic acids, and calcium carbonates, all of which would otherwise have contaminated the radiocarbon samples and have affected the ^{14}C dates produced. Any such contamination therefore needed to be identified and quantified (Bonneau *et al.* 2011, in press).

Our SEM-EDS analysis was carried out with a JEOL 840-A SEM equipped with a PGT Avalon EDS at Laval University, Quebec City, Canada. An electron beam of 15kV was used and observations were performed with secondary electrons. Samples were observed on a carbon-stub with a gold-palladium coating. EDS analyses were performed with a 180s acquisition time.

Raman and FTIR spectroscopy analyses were carried out at the Laboratoire de Caractérisation des Matériaux, Université de Montréal, Canada. An InVia microspectrometer Raman was used with 514 nm and 785 nm lasers and x50 long-focal objectives. The Stingray system employed combined an FTIR spectrometer Digilab FTS7000e and a microscope IR UMA600. Analysis was carried out over a spectral range of 4000–750 cm^{-1} , with 128 scans at 2 cm^{-1} resolution.

Interpretations of spectra were undertaken using Grams and CrystalSleuth softwares, and the RRUFF Database (<http://rruff.info>), the IRUG Spectral Database (<http://www.irug.org/search-spectral-database>), and a personal database made on reference minerals from the geological collection of the Department of Earth and atmospheric Sciences, Université du Québec à Montréal.

Results obtained from this multi-instrumentation protocol provided information on the nature of the black pigment present in the samples analyzed (charcoal, carbon black, soot, etc.), its alterations (humic acids for example), and the nature and quantity of associated weathering products.

A.4. Material dated

All the samples selected for dating were black carbon-based paint. The characterization analysis determined whether black paints were carbon-based and the nature of that carbon, primarily whether it was carbon black or charcoal. Being able to distinguish between charcoal and carbon black pigments makes it possible to better interpret the dates obtained. If paint is made from charcoal, even though it is a carbon-based material, the date obtained will not provide the date of the paint manufacture, but the date of the death of the tree, and thus provide a *terminus post quem*. Errors may be introduced at two points here: firstly, old wood from a tree long since dead, or heart wood from an old tree, may be burned to form the charcoal, and secondly, old charcoal that may survive in rock shelters for long periods may be used in the paint. In either case dates older than paint manufacture would be obtained. On the contrary, carbon blacks are incomplete combustion products of organic compounds such as fat, grease, resin, plant sap, and so forth. Conversely, carbon black paints thus need to be produced by people shortly before use and are made of materials that are unlikely to survive for long periods before burning. That means that, at the scale of radiocarbon dating uncertainty, the date obtained will give the date of the painting.

All of the black paint samples analyzed, including those not dated, were carbon-based. All but two samples consisted of carbon black.

A.5. Sample preparation

Samples were prepared using a modified Acid-Base-Acid (ABA) protocol (Bonneau *et al.* 2011) as follows: HCl (1 M) for 20 minutes to 1 hour at 80 °C to eliminate calcium carbonates and calcium oxalates; NaOH (0.1 M) for 10 to 20 minutes at room temperature; and a further HCl step (1 M) for 30 minutes to 1 hour at 80 °C. Between each stage, the samples were washed with ultrapure Milli-Q™ water (Millipore Corp.). The pre-treatment protocol was adapted for each sample depending on the characterization results obtained.

Samples were subsequently frozen and dried using a VaCo 5 freezer-dryer for a minimum of 12 hours. Once dried, they were weighed, and, if large enough, an aliquot was collected for FTIR spectroscopic analysis in order to assess if any contaminant remained.

FTIR spectroscopy has a detection limit of 5% for most of the mineral and organic compounds. However, in the case of calcium oxalates, as they contained high rate of water, this detection limit is estimated around 2-3%. Only one sample presented calcium oxalates after pre-treatment and was accordingly rejected. Samples were weighed into clean tin capsules prior to combustion at 1000 °C in an elemental analyzer (EA) coupled to a gas source isotope ratio mass spectrometer (IRMS). The combusted samples yielded N₂ and CO₂, with a chemical trap used to remove water and any other contaminant gases present. The N₂ and CO₂ were separated in a GC column, using helium as a carrier gas (stream = 100 mL/min). 1/50th of the gas produced was directed into the IRMS for stable isotope measurements ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) using a CF-IRMS system. The remaining CO₂ was transferred to a reactor rig and collected cryogenically. The reactor rigs contained 2.0–2.5 mg of iron catalyst (<10 μm 99.9+% Fe powder, Sigma Aldrich) that had previously been out-gassed in the presence of 500 mbar H₂ at 450°C for 1 hour.

Most of the samples selected for radiocarbon dating produced low carbon yields of between 0.046 and ~0.6 mg, and were dated as non-routine “very small graphite” AMS targets. Three other samples were large enough to be treated as routine “small graphite” targets (~0.8 mg C), and a further three gave “large graphite” (~1.6 mg C) targets. For “very small graphite” samples, a desiccant, magnesium perchlorate (Mg(ClO₄)₂), was added to the water trap of the reactor rigs, following a previously established protocol (Motuzaite-Matuzeviciute *et al.* 2013).

Graphitization followed, with the reduction of CO₂ in the presence of excess hydrogen (in the ratio of ~2.2 H₂:CO₂) and the iron powder, and heated at 560 °C for 6 hours to yield pure C (graphite) and water by cooling and condensing. The presence of the desiccant helped to draw out H₂O, and therefore optimized the conversion of CO₂ to graphite for the very small samples which are more sensitive to traces of water vapor that interfere with the graphitization reaction. This addition has previously been found to be necessary for the lowest yielding samples (i.e. those ≤ 0.5 mg C) (Motuzaite-Matuzeviciute *et al.* 2013). The resulting graphite was then pressed into aluminum targets and dated using the University of Oxford’s HVEE tandem AMS system (Bronk Ramsey *et al.* 2004; Staff *et al.* 2014). Conventional radiocarbon ages before present (BP) were calculated relative to the oxalic acid (HOXII) standard and normalized for isotopic fractionation (Stuiver & Polach 1977).

All ¹⁴C determinations were calibrated using the Southern Hemisphere SHCal13 calibration curve (Hogg *et al.* 2013) and OxCal v 4.2 software (Bronk Ramsey 2009).

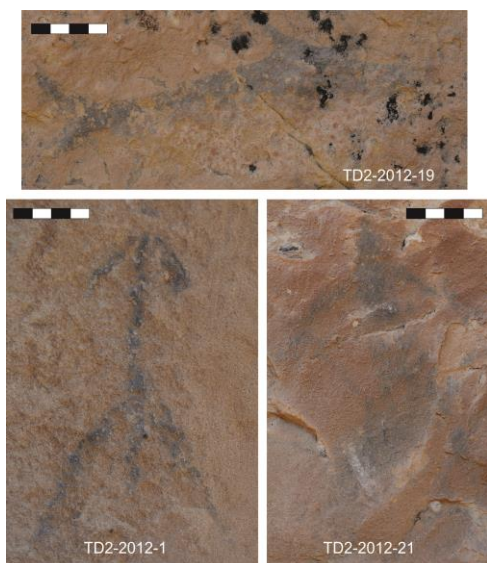
Section B. Botswanan sites

B.1. TD2

B.1.a. Fig. S1: Site photograph.



B.1.b. Fig. S2: Photographs of the sampled images: TD2-2012-1, TD2-2012-19 and TD2-2012-21 (Unless otherwise stated, one square on the figures corresponds to 1 cm).



B.1.c. Description of site and its rock art

This site was a large, north-facing shelter at 22°10'11.5"S, 28°37'21.3"E on the south bank of the Pepe River, located on the edge of the Makwale Hill (Fig. S1). The shelter was approximately 80 m in length. The site was first recorded as part of the cultural resources management program undertaken in conjunction with the development of the Thune Dam (Walker 2009). Paintings in red, white and black were distributed throughout the shelter and depicted a number of subjects including human beings, giraffe, domestic sheep, elephant, fish and baboons. The majority of the paintings are executed in the LSA fine-line tradition. There are also some finger-painted images that probably represent later use of the site. Many of the paintings in the site had been pecked, probably to remove paint for traditional medicinal purposes.

In addition to the paintings, approximately 100 thin vertical grooves had been ground into the rock. There was also one or more geometric forms ground into the shelter wall. The associations of these ground features are unclear.

TD2-2012-1 was collected from a human figure painted in black (Fig. S2). The sample was collected from across the painting. TD2-2012-19 was collected from forward of the tail along the dorsal line of a fish painted in black (Fig. S2). TD2-2012-21 was collected from the torso of a human figure painted in black (Fig. S2).

B.1.d. Comment on the possible association between the dated rock art and other archaeological remains

Archaeological deposits approximately 1.5 m deep occur in parts of the shelter. A test excavation of the shelter showed LSA stone artifacts and potsherds related to Farming Communities in the upper levels and LSA materials only in the lower levels (Thebe 2009). Unfortunately, no suitable material for radiocarbon dating was retrieved from the excavations so it is not possible to relate the paintings to the occupation deposits.

B.1.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at TD2 are provided in Table S1. Details of the sampling, analytical and measurement procedures followed are given in Section A.

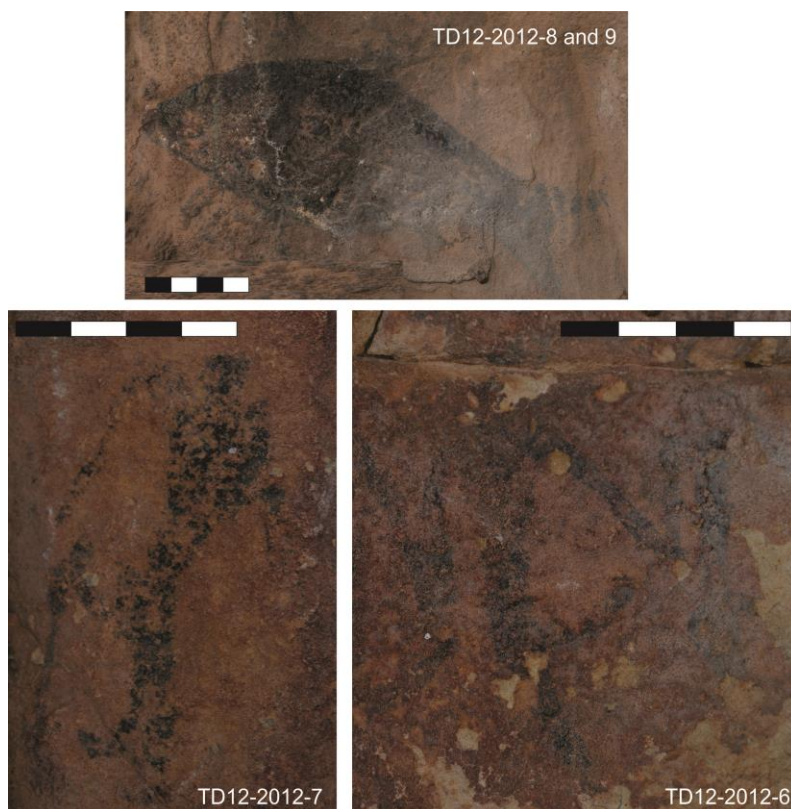
Table S1: Radiocarbon dates of painted images sampled at TD2, Botswana. Calibration was undertaken using the SHCal13 calibration curve. The “% of C” (Carbon) was given by EA-IRMS analysis conducted during combustion of the sample. The “Mass of sample combusted” is the quantity of sample introduced in a tin capsule for combustion.

Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
TD2-2012-01	OxA-X-2555-49	Carbon black	1.0	36.9	-25.0	1250 \pm 80	1276–962
TD2-2012-19	OxA-X-2555-48	Carbon black	4.2	5.4	-22.4	2130 \pm 90	2320–1878
TD2-2012-21	OxA-X-2555-47	Carbon black	2.1	5.23	-23.5	2960 \pm 160	3448–2751

B.2. TD12

B.2.a. No site photograph is available for this site.

B.2.b. Fig. S3: Photographs of the sampled images: TD12-2012-6, TD12-2012-7, TD12-2012-8 and TD12-2012-9.



B.2.c. Description of site and its rock art

TD12 was a small rock shelter on a rocky outcrop at 22°10'05.6"S, 28°40'56.6"E. It contained a few paintings, most prominent of which was a fish painted in black with red details. Also present were paintings of human beings, a giraffe and a kudu. A stone slab with cupules was present on the shelter floor.

TD12-2012-6 was collected from a human figure painted in black (Fig. S3). The sample was collected from across the painting. TD12-2012-7 was collected from a second human figure painted in black (Fig. S3). The sample was collected from across the painting. TD12-2012-8 was collected from behind the head along the dorsal edge of the black fish painting, while TD12-2012-9 was collected from behind the head along the ventral edge of the same image (Fig. S3).

B.2.d. Comment on the possible association between the dated rock art and other archaeological remains

There were no excavatable deposits in this shelter. A few LSA stone artifacts and some potsherds were noted on the surface, but none of diagnostic type.

B.2.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at TD12 are provided in Table S2. Details of the sampling, analytical and measurement procedures followed are given in Section A. TD12-2012-8 and TD12-2012-9 are two separate dated samples from the same painting. The date on TD12-2012-9 suffers from a large uncertainty because of a problem during the pressing of the AMS target. However, the two dates obtained are in close agreement. The two dates were combined giving a result of 3057 ± 30 BP, which calibrates to 3357–3180 cal. BP. This date is considered as the most probable for the fish figure.

Table S2: Radiocarbon dates of painted images sampled at TD12, Botswana. Calibration was undertaken using the SHCal13 calibration curve.

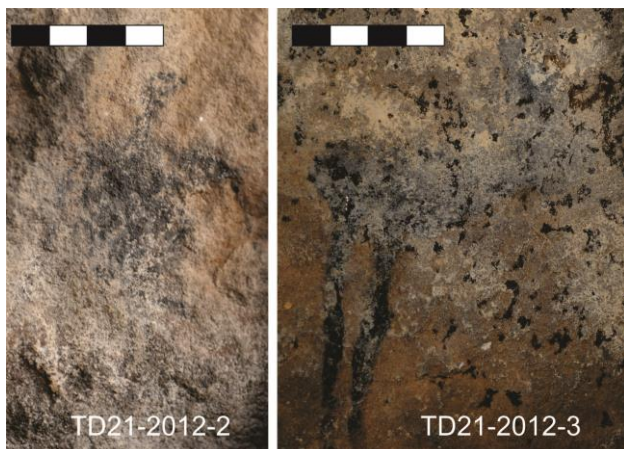
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
TD12-2012-6	OxA-X-2555-46	Carbon black	0.6	8.0	-25.3	4500 \pm 260	5723–4420
TD12-2012-7	OxA-X-2555-45	Carbon black	2.1	5.2	-25.8	2500 \pm 100	2754–2332
TD12-2012-8	OxA-29182	Carbon black	13.2	5.0	-17.3	3060 \pm 30	3343–3284 (19.1%) 3274–3105 (72.2%) 3096–3077 (4.2%)
TD12-2012-9	OxA-X-2543-6	Carbon black	12.8	6.9	-18.4	2580 \pm 390	3593–1712

B.3. TD21

B.3.a. Fig. S4: Site photograph.



B.3.b. Fig. S5: Photographs of the sampled images: TD21-2012-2 and TD21-2012-3.



B.3.c. Description of site and its rock art

TD21 was located at 22°11'07.1"S, 28°40'52.7"E, and for most of its length consisted of a small overhang with a relatively low vertical face (Fig. S4). At its western end the shelter was deeper and contained several large fallen rocks. Paintings of antelope, sheep and human figures were present in both parts of the shelter. Some paintings had been pecked, probably in the course of removing paint for traditional medicine.

TD21-2012-2 was collected from the head and shoulders of a human figure painted in black (Fig. S5). TD21-2012-3 was collected from the legs of a human figure painted in black (Fig. S5). Both images were located in the deeper part of the shelter.

B.3.d. Comment on the possible association between the dated rock art and other archaeological remains

There were no excavatable deposits in this shelter. A few LSA stone artifacts were present on the shelter floor, but too few to attribute to a particular industry. A cluster of stones in the western part of the shelter may represent the remains of a grain bin base associated with post-2000 BP Farming Communities.

B.3.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at TD21 are provided in Table S3. Details of the sampling, analytical and measurement procedures followed are given in Section A.

Table S3: Radiocarbon dates of painted images sampled at TD21, Botswana. Calibration was undertaken using the SHCal13 calibration curve.

Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
TD21-2012-2	OxA-X-2555-44	Carbon black	16.8	0.4	-26.7	2580 \pm 130	2923–2906 (0.6%) 2891–2327 (94.8%)
TD21-2012-3	OxA-X-2555-43	Carbon black	2.1	2.2	-25.1	2630 \pm 230	3325–3296 (0.6%) 3253–2147 (94.5%) 2126–2109 (0.3%)

Section C. Lesotho sites

C.1: ARALI71

C.1.a. Fig. S6: Site photograph.



C.1.b. Fig. S7: Photograph of the sampled image.



C.1.c. Description of site and its rock art

ARAL171 lay on the north bank of the Phuthiatsana River in the Berea District section of the Metolong Dam's catchment close to the village of Ha Seeiso at 29°19'49"S, 27°47'29"E (Fig. S6). The site measured 30 m in length and 10 m in maximum depth and preserved the images of at least 19 human figures, all executed in the LSA fine-line tradition. Seven of the individuals shown were depicted wearing skin cloaks (*karosses*). The paintings were first recorded by the Analysis of the Rock Art of Lesotho (ARAL) Project in 1979 (Smits 1983) and did not appear to have deteriorated significantly between then and their documentation by the Metolong Cultural Heritage Management Project in 2008–2011, when they were judged to be in poor to fair condition (Mallen 2011). The paintings at ARAL171 were traced, photographed, and described as five panels. The sample dated was removed from the shoulders of a faded human figure painted in black with red legs in Panel B (Fig. S7).

C.1.d. Comment on the possible association between the dated rock art and other archaeological remains

ARAL171 contained no excavatable deposits. A small assemblage of 19 stone artifacts on its surface and from an erosion gully along the front of the shelter provided minimal evidence of hunter-gatherer occupation. A single thumbnail scraper was the only diagnostic find, and indicates that the assemblage may belong to the recently defined Final LSA technocomplex (Lombard *et al.* 2012). Although not diagnostic as individual finds, a small sized single-platform core, and a single end-scraper recorded at ARAL171, are also common feature of Final LSA assemblages. It is thus likely that this assemblage dates to some time within the last 4,000 years, broadly consistent with the dated rock panel.

C.1.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at ARAL171 are provided in Table S4. Details of the sampling, analytical and measurement procedures followed are given in Section A. This date was obtained on a charcoal painting, which means that it can only be considered to be a maximum age.

Table S4: Radiocarbon date of the painted image sampled at ARAL171, Lesotho. Calibration was undertaken using the SHCal13 calibration curve.

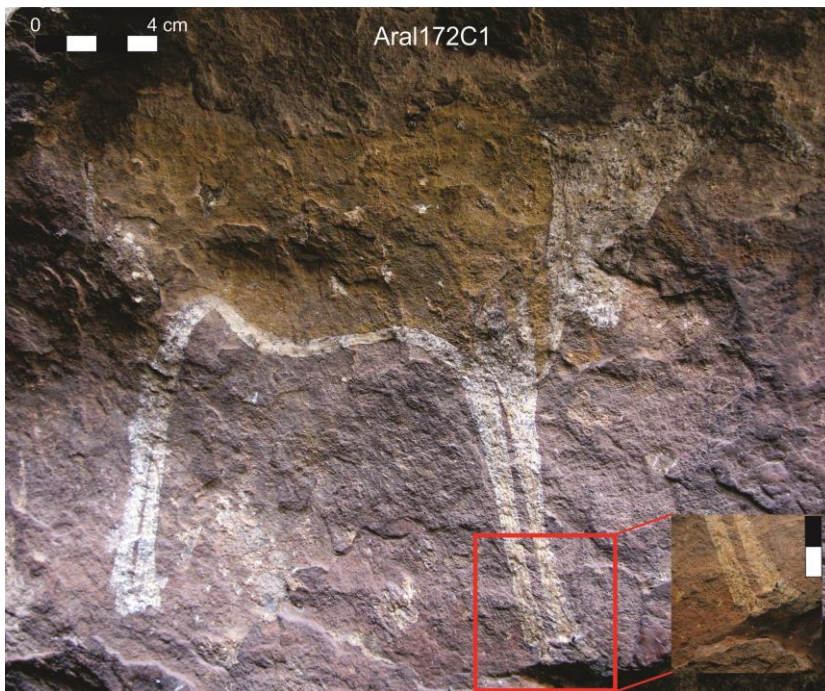
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
ARAL171-C1	OxA-X-2470-50	Charcoal	0.4	15.1	-22.3	1210 \pm 90	1274–927

C.2: ARAL172

C.2.a. Fig. S8: Site photograph.



C.2.b. Fig. S9: Photograph of the sampled image.



C.2.c. Description of site and its rock art

ARAL172 was a small (39 x 17 m) rock shelter on the south bank of the Phuthiatsana River at 29°19'49''S, 27°47'40''E in the Maseru District section of the Metolong catchment. A small stone stock pen was present within the site, which has also been used recently by local initiation schools (Fig. S8). The site's rock art comprised several eland and human images and was recorded as a series of six panels. Most of the images were

judged to be in poor or poor-to-fair condition, except for those in Panel E, which comprised two eland and a single human figure in excellent condition. For this reason, this panel was removed from the site in April 2012 before the impoundment of the Metolong Dam began and has been retained for safekeeping by Lesotho's Department of Culture. The human figure in Panel C was also rather better preserved and depicted someone clapping, a posture associated with Bushman healing dances (Lewis-Williams & Pearce 2004). Black paint from one of the front hooves of one of the eland in Panel E was selected for radiocarbon dating (Fig. S9).

C.2.d. Comment on the possible association between the dated rock art and other archaeological remains

Stone artifacts were visible at the surface of the site in sufficient quantity to suggest that further archaeological investigation would be warranted. Two test pits were therefore excavated here in July 2010. Test Pit 1, close to the dripline, produced a series of *in situ* deposits, while Test Pit 2, located immediately below the well-preserved images of rock art Panel E, did not. Two radiocarbon dates were obtained from Test Pit 1: that from Context 004 closest to the surface is modern in age and likely reflects recent Basotho use of the site (50 ± 20 BP; UGAMS-11592). Lower down, however, a date of 980 ± 20 BP (UGAMS-11593) was obtained from Spit 3 of Context 006. Using the SHCal13 curve, this date calibrates at 95.4% to 916–795 cal. BP. The associated artifact assemblage overwhelmingly emphasized the use of cryptocrystalline silica and was dominated by scrapers, followed by adzes, in its formal tool component. Three fragmentary backed microliths and a possible unfinished blank for a pressure-flaked point (Mitchell 1999) were also recovered. Together, this combination of characteristics identifies a Final LSA assemblage (Lombard *et al.* 2012). Pottery found in this excavation appears to have an origin in Late Farming Community traditions rather than being of hunter-gatherer origin and the few sherds found as deep as Context 006 may have been displaced from further up.

C.2.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at ARAL172 are provided in Table S5. Details of the sampling, analytical and measurement procedures followed are given in Section A. Given that this date was obtained on a very small amount of carbon ($<100 \mu\text{g}$) it should be treated with some caution, though its late Holocene age is fully consistent with that of most of the other Metolong samples.

Table S5: Radiocarbon date of the painted image sampled at ARAL172, Lesotho. Calibration was undertaken using the SHCal13 calibration curve.

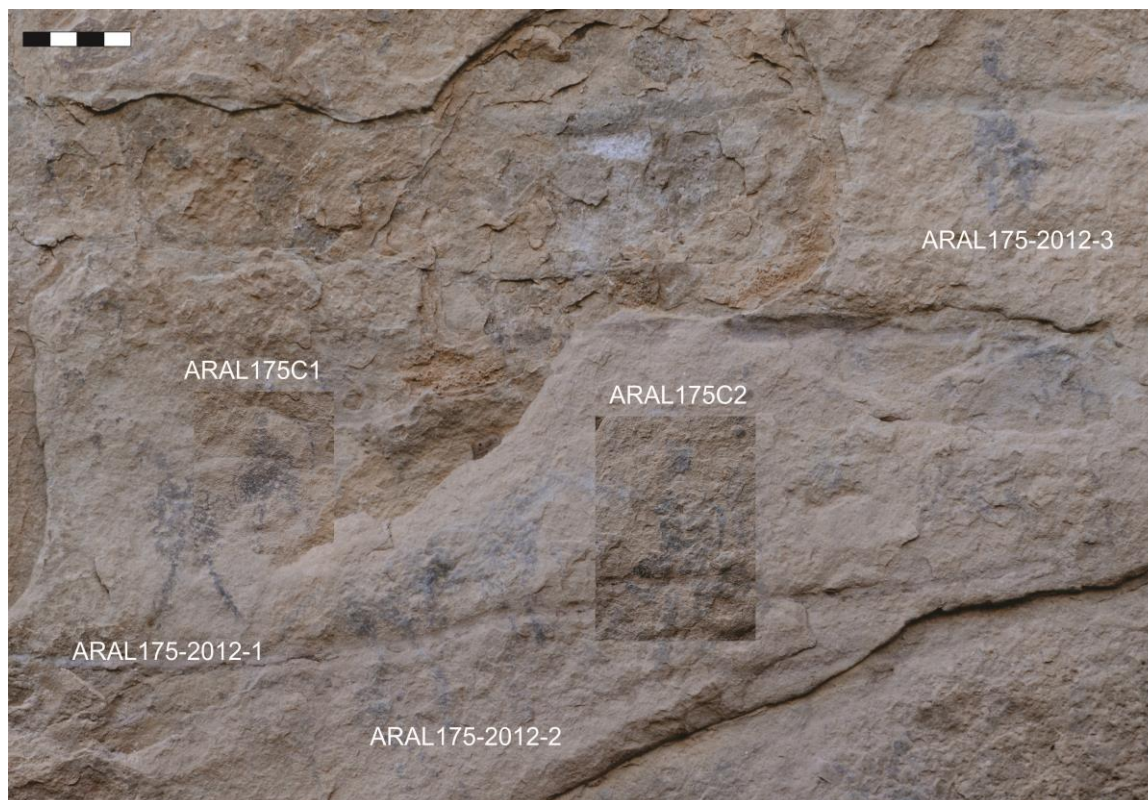
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
ARAL172-C1	OxA-X-2479-37	Carbon black	0.5	2.1	n/a ¹	1700 \pm 310	2326–965

C.3: ARAL175

C.3.a. Fig. S10: Site photograph.



C.3.b. Fig. S11: Photograph of the sampled images.



¹ Sample was too small for a proper $\delta^{13}\text{C}$ determination.

C.3.c. Description of site and its rock art

ARAL175, known to some local residents as Lepoqong and in the rest of the archaeological literature as Ha Makotoko after a nearby village, was by far the largest rock-shelter in the Metolong catchment (Fig. S10). With an area of about 820 m² behind the dripline, it lay on the south bank of the Phuthiatsana River at 29°19'32"S, 27°48'17"E. Several small livestock enclosures were present, but there was no evidence that recent Basotho groups had inhabited the site.

Despite its large size, the shelter preserved relatively little rock art. Seven small panels were recorded, all but two of which can be confidently assigned to the LSA fine-line tradition. One of the remaining panels, which included a number of horses, must be of nineteenth/twentieth-century date and is attributable to recent Basotho residents of the area. These images were in fair condition, as opposed to the poor quality of most of the others in the site. Another panel (Panel F) was poorly preserved and cannot with confidence be attributed to the fine-line tradition, although this is the most likely attribution. The single eland in Panel E, painted using the shaded polychrome technique, was, on the other hand, judged to be in very good condition. For this reason it was removed for safekeeping in April 2012 and is now housed by Lesotho's Department of Culture. Panel C also comprised a single eland, and Panel A a headless human figure and one animal. The remaining two panels were more complex: Panel B included seven animals, one a feline, along with four running/dancing human figures with white dots on their bodies, while Panel D comprised an abstract orange motif and three hartebeest shown with legs extended as if running. Though certainly invested with supernatural power by previous Bushman inhabitants of Lesotho (McGranaghan *et al.* 2013, cf. Mitchell 1993), hartebeest are a relatively rare component of the region's rock art (Vinnicombe 1976: 204).

Five samples were selected for dating. All the samples analyzed came from black-painted figures in the northeastern end of the rock-shelter in Panel F (Fig. S11).

C.3.d. Comment on the possible association between the dated rock art and other archaeological remains

ARAL175 preserved extensive archaeological deposits. Initial excavations in 1989 (Mitchell 1993) demonstrated that these included a sequence of early Holocene assemblages, associated with a rich faunal and charcoal record, attributable to older and younger phases of the Oakhurst technocomplex and dated to between 10,000 and 8,400 BP. Above these a culturally sterile body of silt was covered with looser deposits containing stone artifacts of late Holocene age, assignable to the Final LSA (Lombard *et al.* 2012). Renewed excavations ahead of the impoundment of the Metolong Dam have confirmed, but also significantly amplified, this picture (Mitchell & Arthur 2010, 2014). Firstly, they have identified the presence of the terminal Pleistocene Robberg Industry. And secondly, they have shown that before the Last Glacial Maximum the site was

occupied on multiple occasions by makers of post-Howiesons Poort Middle Stone Age artifacts during Marine Isotope Stage 3.

The late Holocene artifact assemblages from Ha Makotoko are not *in situ*. Their older component is distributed through a sequence of loose, gritty sand and fine eolian silt that appears to have taken considerable time (perhaps several millennia) to accumulate and no distinct features (such as hearths) were recognizable within these layers. Final LSA artifacts also occur at and immediately below the surface of the site's deposit, but here they are mixed with bovine and caprine dung inclusions of patently recent (nineteenth/twentieth-century) age. Nevertheless, it is to these late Holocene occurrences that the site's dated rock paintings likely relate. Moreover, the consistency of the radiocarbon dates obtained for these paintings (see below), all of which fall within the second millennium AD after calibration, argues in favor of this having been the period when most, if not all, of the final LSA assemblage at ARAL175 was deposited. Conversely, oral histories for the area indicate that the first Basotho villages were set up there in the 1860s, though the area may have been used for hunting and other purposes for at least a generation before then. As a result, we can discount the mid-nineteenth- and the twentieth-century calibrated date ranges in the table below since hunter-gatherers will not have been present in the area after the 1830s.

C.3.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at ARAL175 are provided in Table S6. Details of the sampling, analytical and measurement procedures followed are given in Section A. Sample ARAL175-C2 was big enough to be split into two samples, thus allowing two dates in close agreement to be obtained. These dates were combined giving a result of 420 ± 56 BP, which calibrates to 538–315 cal. BP. Two of the samples (ARAL175-C1 and ARAL175-C2) produced relatively broad calibrated ranges, but there is nevertheless broad agreement between the dates from all five sampled figures. Historical evidence also constrains the likely age of some of the samples since Bushman hunter-gatherers were absent from the Metolong catchment after the mid-nineteenth century. Those calibrated ranges that can be excluded on these grounds are italicized.

Table S6: Radiocarbon dates of painted images sampled at ARAL175, Lesotho.
Calibration was undertaken using the SHCal13 calibration curve.

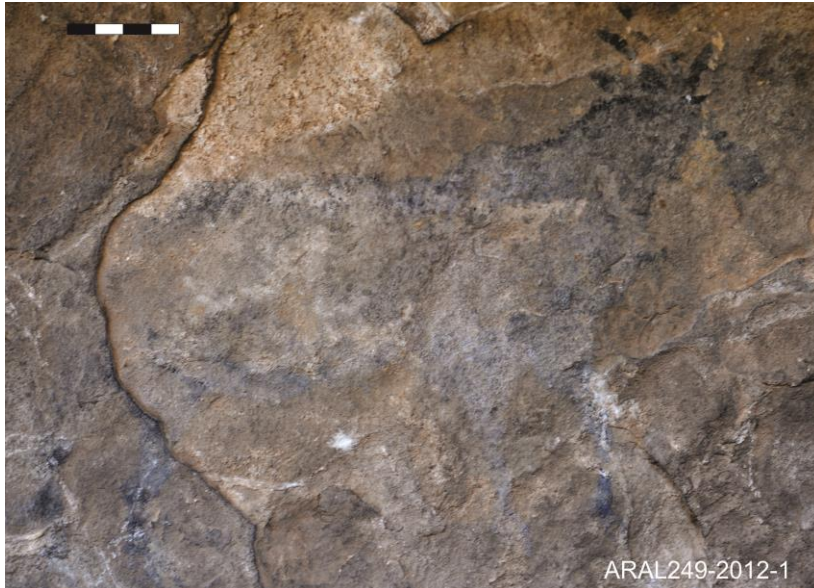
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
ARAL175-C1	OxA-X-2479-49	Carbon black	2.1	14.2	-24.3	300 \pm 65	495–250 (74.6%) 229–140 (19.5%) 113–105 (0.4%) 84–72 (0.7%) 18–12 (0.3%)
ARAL175-C2	OxA-X-2470-48	Carbon black	1	14.9	-24.1	390 \pm 70	516–291
ARAL175-C2	OxA-X-2495-27	Carbon black	0.7	64.7	-22.9	470 \pm 90	630–601 (2.7%) 564–300 (92.7%)
ARAL175-2012-2	OxA-X-2555-39	Carbon black	0.4	68.4	-25.4	410 \pm 130	635–594 (2.5%) 569–239 (80.5%) 231–138 (9.2%) 114–102 (0.6%) 92–68 (1.3%) 25–present (1.3%)
ARAL175-2012-3	OxA-X-2555-26	Carbon black	0.1	27.4	-22.9	575 \pm 75	664–460
ARAL175-2012-1	OxA-X-2555-40	Carbon black	0.7	42.5	-24.6	760 \pm 120	905–855 (4.8%) 844–518 (90.6%)

C.4: ARAL249

C.4.a. Fig. S12: Site photograph.



C.4.b. Fig. S13: Photograph of the sampled image.



C.4.c. Description of site and its rock art

This site lay in the central part of the catchment impounded by the Metolong Dam at 29°19'10"S, 27°49'17"E, directly below Ha Masakale village. The shelter was situated on the north bank of the Phuthiatsana River, only 300 m upstream of the large rock shelter, Ntloana Tšoana (Mitchell 1993), and measured 91 m² (Fig. S12). Only a single painted image, of a large eland, was present. Painted in the LSA fine-line tradition, its condition when documented in 2008–2011 was judged to be fair. The sample was taken from the eland's head (Fig. S13).

C.4.d. Comment on the possible association between the dated rock art and other archaeological remains

ARAL249 contained no archaeological deposits or surface finds. However, excavations at Ntloana Tšoana, on the opposite bank of the river (Mitchell & Arthur 2010, 2012), identified a broadly equivalent hunter-gatherer occupation dated to 650±20 BP (UGAMS-8973). The date was retrieved from an *in situ* hearth found on the surface of a 2 m deep fluvial silt deposit. A small flaked stone assemblage and a few fragments of animal bone associated with this hearth confirm a hunter-gatherer authorship, but provide little opportunity for making any further connections with the dated rock art from ARAL249. A well-stratified sequence existed beneath the fluvial silts at Ntloana Tšoana dating to the terminal Pleistocene and early Holocene, with additional Middle Stone Age deposits below these (Mitchell & Steinberg 1992; Jacobs *et al.* 2008; Mitchell & Arthur 2010).

C.4.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at ARAL249 are provided in Table S7. Details of the sampling, analytical and measurement procedures followed are given in Section A.

Table S7: Radiocarbon date of the painted image sampled at ARAL249, Lesotho. Calibration was undertaken using the SHCal13 calibration curve.

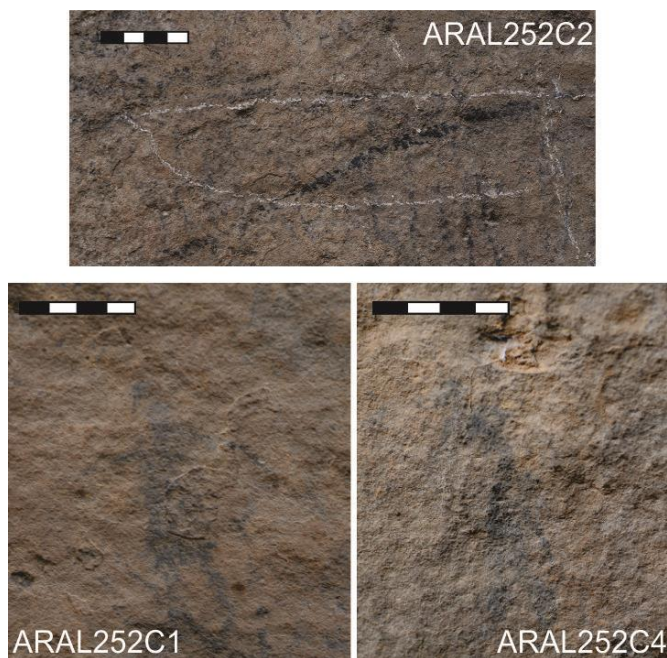
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
ARAL249-2012-1	OxA-X-2555-24	Carbon black	4	3.6	-24.9	770 \pm 90	897–890 (0.4%) 883–873 (0.6%) 803–540 (94.4%)

C.5: ARAL252

C.5.a. Fig. S14: Site photograph.



C.5.b. Fig. S15: Photograph of the images sampled.



C.5.c. Description of site and its rock art

ARAL252 is situated in the upper end of Metolong Dam Catchment at 29°19'70"S, 27°50'16"E, on the north bank of the small Sephiri River, a tributary of the Phuthiatsana. Although a wide shelter, measuring some 26 m, the depth behind the dripline was only 2.2 m and the maximum height just 1.73 m (Fig. S14). Despite its small size, ARAL252 had the largest and most complex set of images of any painted site in the Metolong catchment. Nine separate panels were recorded, though the condition of all the panels was judged to be poor. Panel A comprised two eland torsos. Panel B contained a group of 23 humans, nearly all facing outwards and touching an oversized shield with one hand; three further shields were present and some of the humans had animal heads. Panel C comprised a further eight humans and shields, a quadruped and a possible bag with tassels. Panel D included 18 human figures in a variety of positions, including bending over forwards and backwards, as well as four quadrupeds; one of the humans was shown wearing a plumed outfit. Panel E comprised a single eland torso and Panel F an abstract motif and other remnants of paint. Panel G consisted of a further 21 human figures and a small quadruped, Panel H of two eland, one human and a row of long and short lines; and Panel I of eight eland, six running human figures, a further six elaborately painted individuals in a row and an animal-headed figure with hooves and horns bent over at the waist.

Several of the images present at this site can be related explicitly to the behavior of shamans entering altered states of consciousness. They include representations of humans with animal-like features (therianthropes), thought to depict the harnessing of the power of spirit animals or transformation into these animals, of individuals bending forward at

the waist, lying flat on their back and flying. Others are shown with their hands in the air as if dancing.

The presence among the paintings at this site of more than twenty men painted with shields and some appearing to be equipped with assegais (spears) and knobkerries (wooden sticks with large round heads) is of interest since these arms relate to a mode of warfare historically attested among Bantu-speaking Farming Communities rather than Bushmen, for whom the bow-and-arrow was the typical weapon of choice. At least these images may therefore postdate the initial establishment of Farming Communities on the Highveld Grassland Biome of the southern African interior. This process is best attested archaeologically after *c.* 300 cal. BP (Vogel & Fuls 1999), but had probably begun some 150–200 years earlier in the northeastern corner of the Free State Province in South Africa, followed by small-scale expansion southward along the Caledon Valley, into which the Phuthiatsana River drains (Mitchell & Whitelaw 2005).

Positioned above the men with shields are an H-shaped horse symbol in white, some other possible horses, and at least four rows of black vertical lines, the longest row of which measures over 3 m in length. A similar arrangement is known from two other rock shelters at Metolong, one of which, like ARAL252, was used until recently by Basotho girls' initiation schools. The fact that horses were only introduced to Lesotho in the early nineteenth century suggests that all of these images may be of nineteenth/twentieth-century date and that they were made by Basotho occupants of the area. Their presence at a site with many LSA paintings, some of which have a clear shamanistic content, and the fact that they do not overprint the latter may nevertheless point to a degree of continuity in the site's use as a ritual focus. The radiocarbon date obtained from a fine-line image at ARAL252 may imply that that continuity extended over many hundreds of years.

Dating of four samples was attempted at ARAL252. Three were black human figures, one shown bending forward at the waist, and the fourth a vertical black line. Due to an insufficiency of carbon one of the samples could not be successfully dated and the reliability of the determinations obtained from the other three is uncertain. ARAL252-C1 (Fig. S15) and ARAL252-C2 (Fig. S15) came from Panel H, while ARAL252-C4, a black human figure (Fig. S15), came from Panel G.

C.5.d. Comment on the possible association between the dated rock art and other archaeological remains

Only a few, undiagnostic stone artifacts were present within ARAL252 and they thus provide no meaningful basis for a comparison with the result obtained from dating one of the images in Panel C reported below.

C.5.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at ARAL252 are provided in Table S8. Details of the sampling, analytical and measurement procedures followed are given in Section A. The three dates were all obtained on less than 100 µg of carbon, implying a

large possibility of contamination and resulting in large uncertainties on the dates obtained. Moreover, sample ARAL252-C2 was made of charcoal, which means that the date obtained is only a *terminus ante quem*. Further dates must therefore be sought before accepting that the paintings at this site are indeed older than any of the others we have dated at Metolong.

Table S8: Radiocarbon dates of painted images sampled at ARAL252, Lesotho. Calibration was undertaken using the SHCal13 calibration curve.

Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
ARAL252-C1	OxA-X-2479-34	Carbon black	2.4	0.2	n/a	5300 \pm 2000	13579–1591
ARAL252-C2	OxA-X-2479-35	Charcoal	0.4	2.6	n/a	5700 \pm 1000	9003–4226 (95.3%) 4201–4177 (0.1%)
ARAL252-C4	OxA-X-2479-36	Carbon black	2.7	0.4	n/a	2640 \pm 390	3691–3659 (0.4%) 3649–1806 (94.8%) 1772–1748 (0.3%)

Section D. South African sites

D.1. RSA CHAI

D.1.a. Fig. S16: Site photograph.



D.1.b. Fig. S17: Photograph of the sampled image.



D.1.c. Description of site and its rock art

RSA CHA1 is approximately 20 m long, but only a few meters deep (Fig. S16). The painted panels comprise two vertical rock faces, almost at right angles to each other. Both faces are densely painted, with the images extending both vertically and horizontally over most of the rock face. The site contains 424 individual figures. The majority of these are depictions of eland and human figures, although a wide variety of other subjects are depicted (Lewis-Williams & Blundell 1998: 94–96 for a discussion of the art in the site). All paintings in the site form part of the LSA fine-line tradition. Sample CHA1-C1 was collected from the black hoof of one of the forelegs of a shaded polychrome eland (Fig. S17).

D.1.d. Comment on the possible association between the dated rock art and other archaeological remains

The floor of the shelter is covered with large rocks, probably those that collapsed to form the overhang. There is some collapsed stone walling in its northern end. The nature and associations of the walling are unclear. No other artefacts were noted in the site. At this stage, meaningful comparisons cannot therefore be made with the paintings.

D.1.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA CHA1 are provided in Table S9. Details of the sampling, analytical and measurement procedures followed are given in Section A.

Table S9: Radiocarbon date of the painted image sampled at RSA CHA1, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

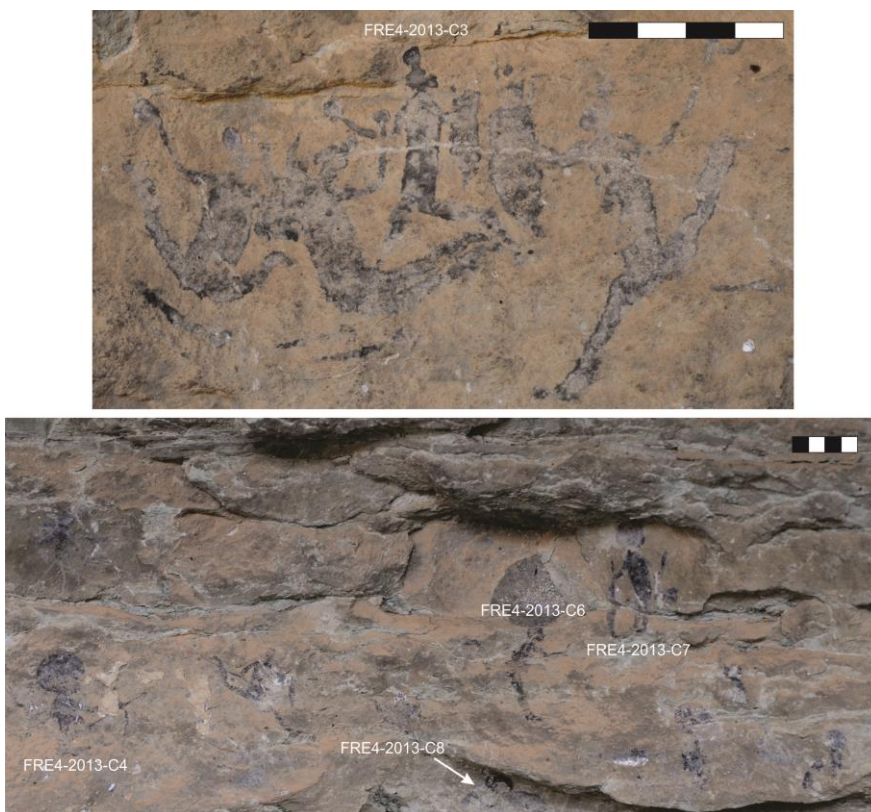
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
CHA1-C1	OxA-X-2590-20	Carbon black	2.8	2.5	-24.6	2590 \pm 110	2848–2352

D.2. RSA FRE4

D.2.a. Fig. S18: Site photograph.



D.2.b. Fig. S19: Photographs of the sampled images.



D.2.c. Description of site and its rock art

RSA FRE4 is a small rock shelter of about 15 m in overall length, although it is ‘bent’ around the corner of a drainage line in the side of a valley. The floor of half the shelter is covered with large boulders, partly overlying a stream. The other half of the shelter consists of a narrow ledge of rock caused by collapse of rock out of a sheer face. It is in this part of the shelter that the dated paintings are found. There are small numbers of paintings scattered throughout the site. Preservation of paintings is variable, although most are in reasonably good condition. All of the paintings are of the LSA fine-line tradition. The dated paintings come from two groups of human figures holding iron-bladed spears and axes and knobkerries. Paintings of cattle are present elsewhere in the shelter.

FRE4-2013-C3 was collected from the body of a human figure painted in black. The figure holds a knobkerrie and a shield (Fig. S19). This is the only date we succeeded in obtaining from the first group of human figures. FRE4-2013-C4 was collected from the head of a human figure painted in black. The figure holds a bow and arrow and has a hunting bag with further arrows on its back (Fig. S19). This figure is part of the second group of human figures. FRE4-2013-C6 was collected from the body of a human figure painted in black in the second group (Fig. S19). FRE4-2013-C7 was collected from the body of a human figure painted in black that forms part of the second group. The figure holds in one hand an iron bladed axe and in the other what is probably an iron bladed spear (Fig. S19). FRE4-2013-C8 was collected from the head and body of a human figure painted in black, also part of the second group. The figure holds an iron bladed axe (Fig. S19).

D.2.d. Comment on the possible association between the dated rock art and other archaeological remains

There are no other archaeological remains present in this site.

D.2.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA FRE4 are provided in Table S10. Details of the sampling, analytical and measurement procedures followed are given in Section A. The dates are in line with the period in which iron-working Farming Communities were present in lower-lying parts of the Eastern Cape Province to the east of the Maclear area; excavations and surface-collected ceramics document their presence in areas of the former Transkei below 1000 m asl from around 1500 cal. BP (Huffman 2004; Mitchell & Whitelaw 2005). The single calibrated age range that can be excluded using historical evidence for the absence of Bushman hunter-gatherers from the area after the late nineteenth century is italicized.

Table S10: Radiocarbon dates of painted images sampled at RSA FRE4, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

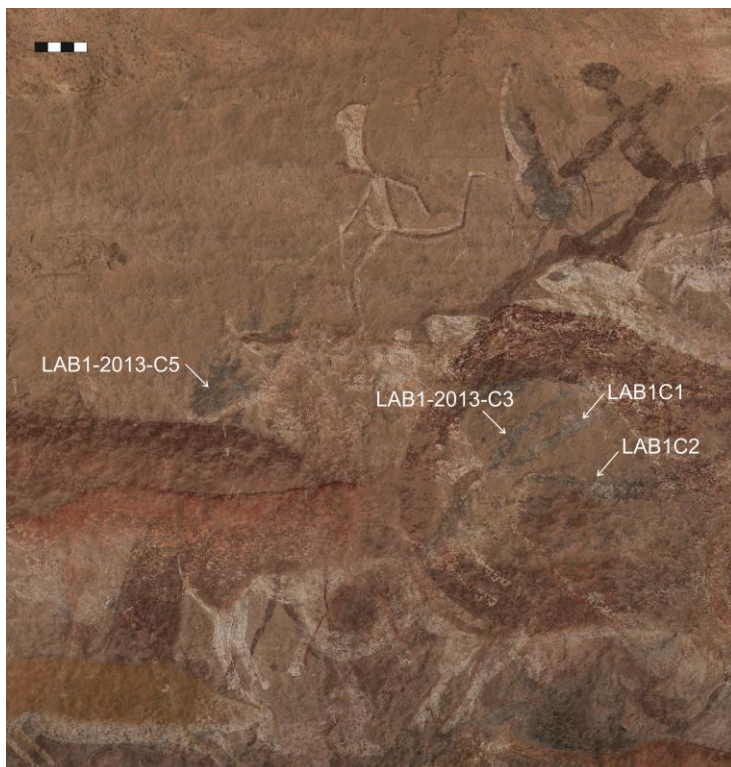
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
FRE4-2013-C3	OxA-X-2555-72	Carbon black	1.5	3.2	-39.5	1160 \pm 140	1297–768
FRE4-2013-C4	OxA-X-2555-21	Carbon black	1.2	5.5	-41.8	770 \pm 100	903–865 (3.0%) 815–531 (92.4%)
FRE4-2013-C6	OxA-X-2555-20	Carbon black	0.9	14.0	-35.0	510 \pm 90	641–590 (9.60%) 572–318 (85.8%)
FRE4-2013-C7	OxA-X-2555-19	Carbon black	1.4	7.8	-36.8	290 \pm 90	494–134 (85.1%) 119–58 (6.8%) 28–present (3.6%)
FRE4-2013-C8	OxA-X-2555-18	Carbon black	0.3	12.7	-43.4	1420 \pm 140	1561–977

D.3. RSA LAB1

D.3.a. Fig. S20: Site photograph.



D.3.b. Fig. S21: Photograph of the sampled images.



D.3.c. Description of site and its rock art

RSA LAB1, also known as ‘Storm Shelter’, is a rock shelter approximately 80 m in length and of variable height and depth (Fig. S20). It has a northeasterly aspect. Paintings are scattered throughout the shelter, although the best-preserved panel, about 5 m long, containing the majority of paintings, is at the northern end of the shelter (Blundell & Lewis-Williams 2001). This main panel consists of 231 individual paintings of a variety of subjects, although dominated numerically by depictions of human beings and eland antelope. The dates we report are all from this main panel.

The majority of paintings form part of the LSA fine-line tradition. Some paintings in the site may relate to the last Bushmen in the area during the historical period (Blundell 2004), while other, distinct paintings may have related to autonomous raiding groups during the historical period (Mallen 2008).

LAB1-C1 was collected from the horn of a painting of an eland antelope. LAB1-C2 was collected from the black back-line of the same painted eland. LAB1-2013-C3 was collected from the second horn of the same painted eland. LAB1-2013-C5 was collected from the face of a second painted eland in close proximity to the first (Fig. S21).

D.3.d. Comment on the possible association between the dated rock art and other archaeological remains

The floor of the shelter contains deposits, although the surface has been seriously disturbed by livestock. Many LSA tools are washing out at the drip line, but have not, so far, been identified to a particular industry. The remains of a circular stone structure are at the center back of the shelter. The age and associations of the stone structure are unclear. At this stage, meaningful comparisons cannot be made with dated paintings in the site.

D.3.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA LAB1 are provided in Table S11. Details of the sampling, analytical and measurement procedures followed are given in Section A. LAB1-C1 and LAB1-C2 are samples from the same painted eland. The calibrated date ranges, however, do not overlap. Upon further investigation, we found that the section of the eland backline from which sample LAB1-C2 was collected overlay an earlier black painting; this superpositioning could be clearly seen under light microscopy on a cross section of paint. We therefore consider this determination to be unreliable. To clarify the matter, we collected a third sample from the same painting, from the second horn (LAB1-2013-C3). Unfortunately, when calibrated, this determination also fails to overlap with that obtained from LAB1-C1. It does, however, overlap with LAB1-C2, which we believe to be incorrect. We are certain that no calcium oxalate remained in any of these samples after pre-treatment and therefore attribute these incompatibilities to the small amount of carbon available for dating LAB1-C1 and LAB1-C2. Given the larger sample size, we conclude that LAB1-2013-C3 best dates the eland in question.

Table S11: Radiocarbon dates of painted images sampled at RSA LAB1, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
LAB1-C1	OxA-25960	Carbon black	6.6	0.8	-27.7	2040 \pm 120	2308–2220 (6.5%) 2212–1705 (88.9%)
LAB1-C2	OxA-25961	Carbon black	6.2	1.6	-24.5	1620 \pm 90	1700–1646 (5.3%) 1625–1305 (90.1%)
LAB1-2013-C3	OxA-X-2555-17	Carbon black	8.8	1.5	-32.8	1530 \pm 90	1585–1266 (94.2%) 1210–1189 (1.2%)
LAB1-2013-C5	OxA-X-2555-16	Carbon black	7.3	1.4	-34.9	2690 \pm 100	2998–2428 (95.0%) 2392–2381 (0.4%)

D.4. RSA LAB7

D.4.a. Fig. S22: Site photograph.



D.4.b. Fig. S23: Photograph of the sampled image.



D.4.c. Description of site and its rock art

RSA LAB7 is a rock shelter of about 30 m in overall length. It is located in dense bush, just above the level of a stream (Fig. S22). There are many paintings in the shelter, although most of those located low on the wall have been rubbed and severely damaged by livestock. Paintings in higher positions are in better condition. All of the paintings are of the LSA fine-line tradition.

LAB7-2013-C1 was collected from the area behind the head of a large (approximately 70 cm) painting of an elephant (Fig. S23). LAB7-2013-C2 was collected from an area one-third of the way along the back of the same image.

D.4.d. Comment on the possible association between the dated rock art and other archaeological remains

Many stone artifacts are currently washing out at the drip line of this shelter. They appear to be of LSA origin, but have not been attributed to a particular industry. Several small pieces of black, thin-walled pottery were noted. At other sites in the area this type of pottery has been linked to LSA communities and dates to within the last 2000 years

(Opperman 1987). There were in addition two small fragments of red pottery probably related to Farming Communities. Some probable grindstones are also visible on the surface. Two small (approximately 2 m across) stone enclosures are situated near either end of the shelter. The nature and associations of these enclosures are unclear. At this stage, meaningful comparisons cannot be made with dated paintings in the site.

D.4.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA LAB7 are provided in Table S12. Details of the sampling, analytical and measurement procedures followed are given in Section A. The two dates from samples collected on the same elephant are in close agreement. They were combined giving a result of 136 ± 17 BP, which calibrates to 273–10 cal. BP.

Table S12: Radiocarbon dates of painted images sampled at RSA LAB7, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

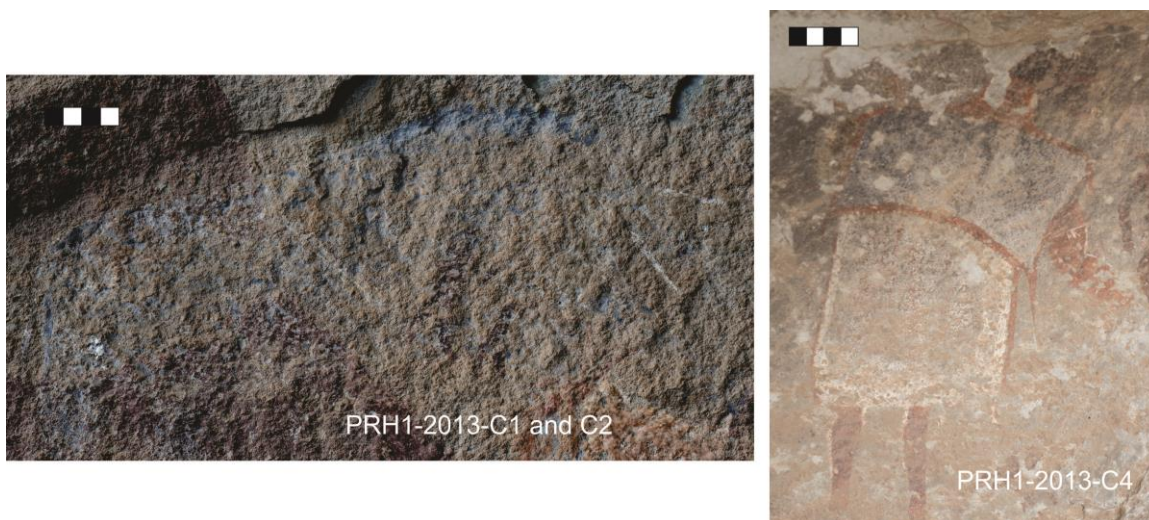
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
LAB7-2013-C1	OxA-28977	Carbon black	44.2	8.6	-25.6	147 ± 23	263–222 (20.5%) 147–present (74.9%)
LAB7-2013-C2	OxA-28978	Carbon black	22.4	12.1	-25.1	124 ± 23	254–225 (13.8%) 143–present (81.6%)

D.5. RSA PRHI

D.5.a. Fig. S24: Site photograph.



D.5.b. Fig. S25: Photographs of the sampled images.



D.5.c. Description of site and its rock art

RSA PRH1 is a large rock shelter, the main section being 15 m long, up to 10 m deep and up to 8 m high, with smaller depressions along the back wall (Fig. S24). Most of the floor of the shelter is covered in large blocks of rock. A large *Podocarpus* (yellowwood) tree grows in the middle of the shelter. Most of the paintings in the site are confined to the eastern side of the shelter. All of the paintings are of the LSA fine-line tradition.

PRH1-2013-C1 was collected from the hindquarters of a large (approximately 50 cm) painting of an elephant in gray-colored paint, while PRH1-2013-C2 was collected from the top of the head of the same image (Fig. S25). PRH1-2013-C4 was collected from the upper torso of a human figure painted in red, white and black (Fig. S25).

D.5.d. Comment on the possible association between the dated rock art and other archaeological remains

The upper levels of the deposit across most of the shelter (between the rocks) have been destroyed by livestock. In protected areas, deposits with well-preserved plant material (particularly *Watsonia* sp.) are visible. Many stone and some wooden artefacts are visible on the surface. All observed material is consistent with the LSA, but has not been assigned to a particular industry. At this stage, meaningful comparisons cannot be made with dated paintings in the site.

D.5.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA PRH1 are provided in Table S13. Details of the sampling, analytical and measurement procedures followed are given in Section A. The two samples listed here both come from the same painted elephant. Their calibrated date ranges are comparable, although as the calibration curve at this time is

fairly flat this results in quite large calibrated date ranges. The two dates were combined giving a result of 406 ± 20 BP, and a bimodal range on calibration: 512–453 (89.5%) and 349–335 (5.9%) cal. BP. Our third sample from this site, PRH1-2013-C4, retained a few calcium oxalates after pre-treatment and was therefore unable to deliver a reliable result.

Table S13: Radiocarbon dates of painted images sampled at RSA PRH1, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

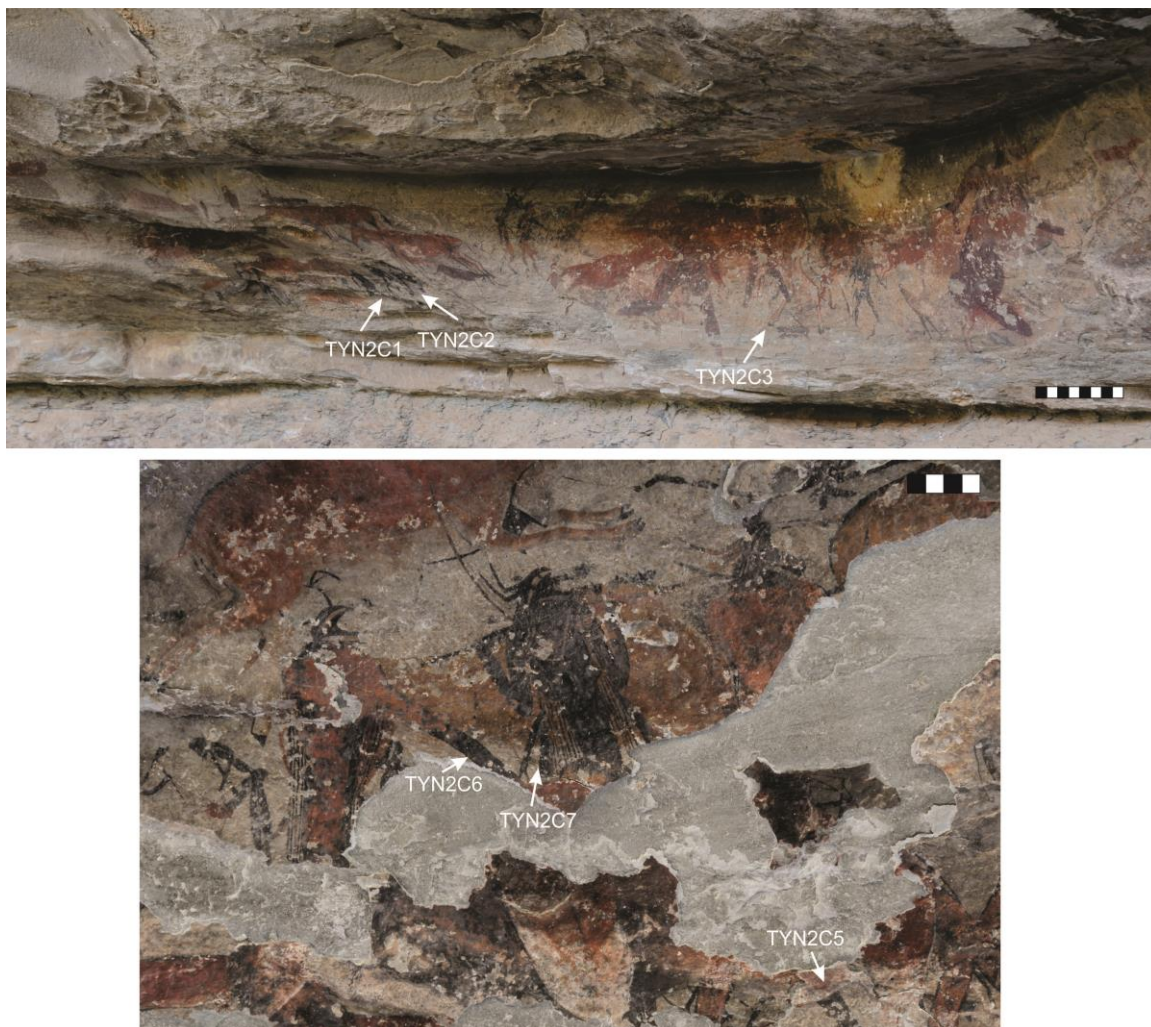
Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
PRH1-2013-C1	OxA-28980	Carbon black	14.8	16.4	-23.7	447 ± 23	509–449 (87.9%) 355–338 (7.5%)
PRH1-2013-C2	OxA-29186	Carbon black	6.3	17.9	-23.1	308 ± 35	452–351 (50.9%) 342–280 (41.9%) 203–195 (0.8%) 167–155 (1.8%)

D.6. RSA TYN2

D.6.a. Fig. S26: Site photograph.



D.6.b. Fig. S27: Photographs of the sampled images.



D.6.c. Description of site and its rock art

RSA TYN2 is a rock shelter approximately 25 m long, 3 m high and 6 m deep. It has a southerly aspect. Paintings are scattered throughout the shelter, although the majority are clustered into two panels towards the center of the shelter. The majority of paintings form part of the LSA fine line tradition. There are, in addition, some paintings attributed to the Type 3 tradition (Mallen 2008).

The more eastern of the two central panels is now undergoing severe spalling (Pearce 2010). To date, 192 painted flakes of rock have been collected from beneath this panel. Unfortunately, none contains a complete painted image and in most cases the painted areas cannot be recognized as parts of particular subjects, nor can any of them be matched to paintings remaining on the shelter wall. Samples RP/2009/003/13, RP/2009/003/14 and RP/2009/003/29 were collected from three of these flakes. The paint on these flakes cannot, with confidence, be attributed to particular subjects.

TYN2-C1 (Fig. S27) was collected from the lower torso of a human figure painted in black. TYN2-C2 was collected from the lower torso of a second human figure painted in black. TYN2-C3 was collected from the black hoof of a painted eland. TYN2-C5 was collected from a short diagonal black line that is the remains of the leg of a human figure that has almost completely flaked off from the shelter wall. TYN2-C6 was collected from the arm of a red and black painted human figure, partly flaked away from the rock surface. TYN2-C7 was collected from a bag hanging from a black painted human figure immediately next to the figure from which TYN2-C6 was collected.

D.6.d. Comment on the possible association between the dated rock art and other archaeological remains

Many stone artefacts are visible on the surface of the deposit in this shelter. All of these that were observed are consistent with the LSA, but have not been assigned to a particular industry. At this stage, meaningful comparisons cannot be made with dated paintings in the site.

D.6.e. Radiocarbon dating results

Results of the radiocarbon dating of rock art at RSA TYN2 are provided in Table S14. Details of the sampling, analytical and measurement procedures followed are given in Section A. RP/2009/003/13, RP/2009/003/14 and RP/2009/003/29 from painted flakes differ from the other dates reported here in that the sampling was done under laboratory conditions. These three determinations were made in the course of our pilot study, and have been published previously (Bonneau *et al.* 2011). The calibrated dates reported here vary slightly from those given in 2011 because they have been calibrated using the SHCal13 curve (Hogg *et al.* 2013), whereas the originally reported calibration was done using the SHCal04 curve (McCormac *et al.* 2004).

Table S14: Radiocarbon dates of painted images sampled at RSA TYN2, South Africa. Calibration was undertaken using the SHCal13 calibration curve.

Sample identification	AMS laboratory code	Material dated	% of C	Mass of sample combusted (mg)	$\delta^{13}\text{C}$ (‰) relative to PDB	Conventional ^{14}C age BP ($\pm 1 \sigma$)	Calibrated age BP (95.4% range)
RP/2009/003/13	OxA-X-2370-29	Carbon black	5.0	17.7	-25.3	2072 \pm 28	2081–2074 (1.0%) 2060–1919 (94.4%)
RP/2009/003/14	OxA-X-2370-30	Carbon black	8.7	6.1	-24.1	2100 \pm 40	2148–1926
RP/2009/003/29	OxA-X-2370-31	Carbon black	8.4	4.9	-23.6	2083 \pm 32	2093–1920
TYN2-C1	OxA-25962	Carbon black	2.3	6.8	-24.6	2390 \pm 140	2748–2080 (94.9%) 2073–2060 (0.6%)
TYN2-C2	OxA-25963	Carbon black	1.8	9.9	-25.7	2500 \pm 130	2841–2827 (0.4%) 2795–2298 (91.4%) 2260–2177 (3.4%) 2169–2162 (0.2%)
TYN2-C3	OxA-25964	Carbon black	8.4	1.5	-24.8	2080 \pm 90	2306–2231 (6.8%) 2207–1820 (87.9%) 1765–1754 (0.6%)
TYN2-C5	OxA-25965	Carbon black	1.6	11.8	-23.5	1940 \pm 90	2050–1607
TYN2-C6	OxA-25966	Carbon black	3.3	10.8	-24.2	1900 \pm 90	2002–1586
TYN2-C7	OxA-25967	Carbon black	1.1	6.4	-26.2	2290 \pm 110	2699–2633 (3.3%) 2617–2587 (1.3%) 2539–1998 (90.6%) 1947–1941 (0.2%)

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