

**ANNEXURE N2:
ARCHAEOLOGY STUDY BY
QUATERNARY RESEARCH SERVICES**



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For attention: Mr Andries van der Merwe

**Phase 2 Social & Environmental Impact Assessment for Rössing's Expansion Project:
Archaeological survey and assessment REVISED**

Introduction:

This report presents the results of an archaeological field survey of the Dome area of ML-28, Rössing Uranium Limited. The survey focussed on the proposed Tailings Disposal Site T3, covering the southern and south-western quadrants of the Dome, as instructed by Ninham Shand. The survey was extended into the north-eastern quadrant of the Dome to cover the proposed Ripios Site R2 (A + B). The extent of these development areas was indicated on annotated aerial photography supplied by Ninham Shand.

Instructions as to the extent of the survey were set out in Schedule 1 of the Sub-consultancy Agreement between Ninham Shand and QRS. Additional tasks included provision of a map of all archaeological sites within the Rössing mine licence and accessory works areas, identified to date. A consolidated gazetteer of sites is presented in Appendix 1, following the Dome survey results and assessment. In addition, the report is accompanied by GIS (shp) files for the consolidated site distribution. The known distribution of sites is illustrated in Figure 1, below.

The Dome survey is the fourth archaeological area survey carried out so far within ML-28. Detailed reports on the previous surveys have been submitted^α (to Rössing), together with digital survey data, GIS files, maps and imagery.

^α *Heritage Survey of the Rössing Uranium Limited Licence Area ML28.* Commissioned by Rössing Uranium Limited. QRS Job 72 (2006).

Archaeological assessment of exploration drilling on an ancient quarry site in ML 28. Commissioned by Rössing Uranium Limited. QRS Job 72, continued (2006).

Archaeological impact assessment of exploration drilling on an archaeological quarry in ML 28. Commissioned by Rössing Uranium Limited. QRS Job 72, continued (2006).

Archaeological assessment of SK Area in ML-28. Commissioned by Rössing Uranium Limited. QRS Job 72, continued (2007).

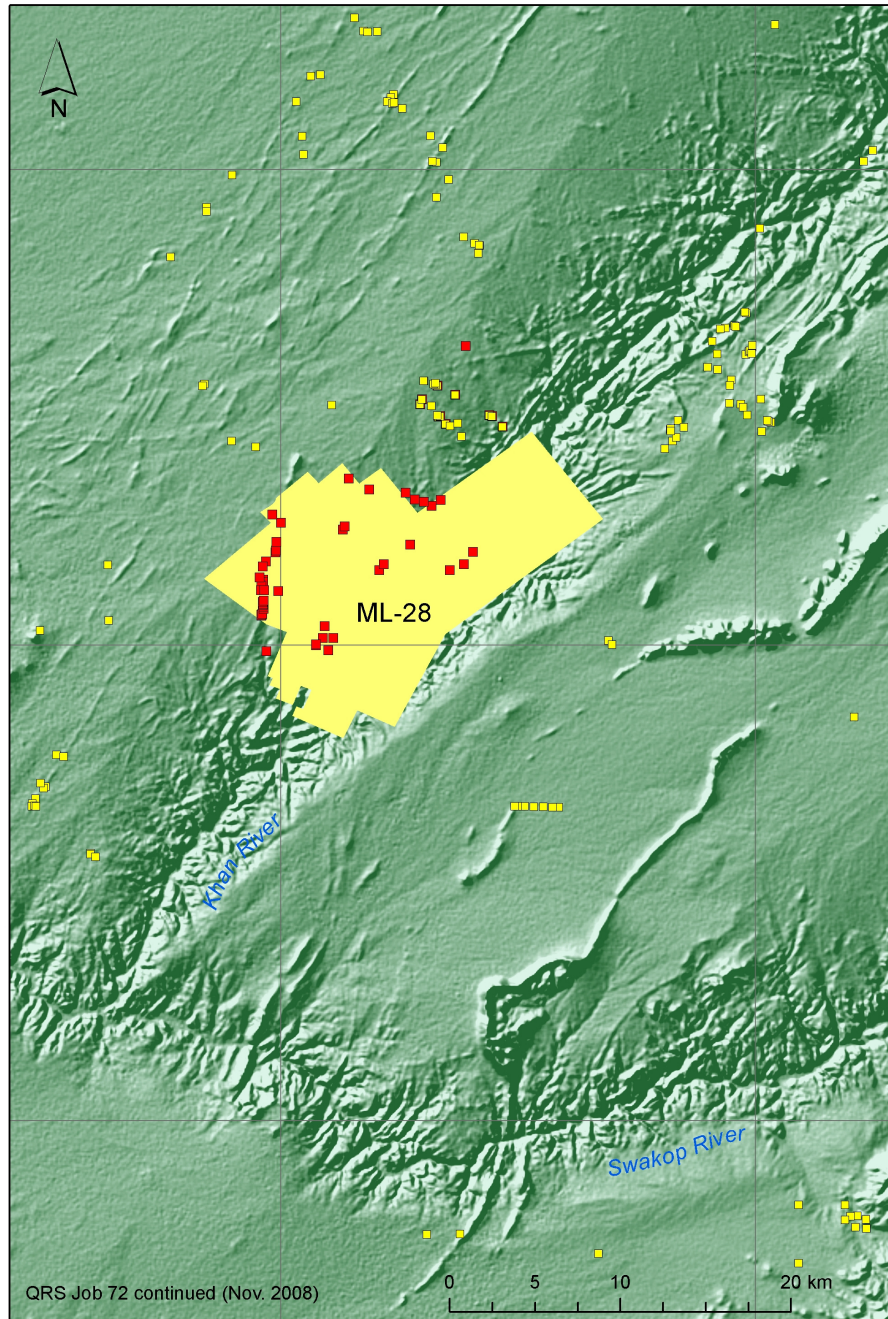


Figure 1: Generalized distribution of archaeological sites on ML-28 (red squares), with known distribution of archaeological sites in the surrounding area indicated by yellow squares.

Background:

The archaeological survey of the Dome was carried out in the same way as all previous area surveys: the area was covered on foot, leaving out ground that was already heavily disturbed by earthmoving machinery. All archaeological occurrences were described according to accepted criteria, and their positions fixed by hand-held GPS. The sites were assessed according to standard ranking of significance and vulnerability (see Appendix 2), as well as the methodology for assessment devised by Ninham Shand.

The Dome area is extremely rugged, as is most of ML-28 in the deeply dissected zone between the Namib penneplain and the floor of the Khan River valley. The previous area surveys showed that archaeological sites were mainly concentrated around resource anomalies and significant topographic features, such as dolerite dykes, on the penneplain. Very few archaeological sites were found in the dissected zone, which is poor in water and for the most part without vegetation.

As with previous surveys of adjacent ground, the Dome survey yielded evidence of wild grass seed gathering and honey harvesting. Wild grass seed gathering was a particularly important part of hunter-gatherer subsistence strategies in the Namib during the second millennium AD. The archaeological and ecological characteristics of this practice are well documented (see Appendix 3). Although the sites themselves are of minor importance, a permit is required from the National Heritage Council if the sites are to be damaged or destroyed.

The Dome survey:

Five archaeological sites, as described below, were located during the Dome survey. The relatively small size of the four seed digging sites, as well as the fact that they were quite widely spaced, indicates that the Dome area was peripheral to the main focus of seed digging in this area.

The largest concentration of seed digging sites in the area is located approximately 10km due north, in the near vicinity of a reliable waterhole situated among prominent granite outcrops. Usually, the main focus of seed digging is limited to within a radius of 4km from such sites, and this further suggests that the Dome was a peripheral area. The evidence of honey robbing at the fifth site is consistent with the presence of the seed diggings as both activities would have been timed for the mid- to late summer months.

QRS 72/53

Site coordinates: Lat. -22.46099 Long. 15.05196
Setting: hill saddle, deeply weathered bedrock
Description: seed digging, approximately 1m diameter
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

QRS 72/54

Site coordinates: Lat. -22.45777 Long. 15.05437
Setting: hilltop, deeply weathered bedrock
Description: seed digging, approximately 1.3m diameter
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

QRS 72/55

Site coordinates: Lat. -22.42018 Long. 15.06566
 Setting: hilltop, deeply weathered bedrock
 Description: seed digging, approximately 1.2m diameter
 Records: site notes, locality data
 Significance rating: 1
 Vulnerability rating: 4

QRS 72/56

Site coordinates: Lat. -22.44758 Long. 15.06811
 Setting: hilltop, deeply weathered bedrock
 Description: seed digging, approximately 1m diameter
 Records: site notes, locality data
 Significance rating: 1
 Vulnerability rating: 4

QRS 72/57

Site coordinates: Lat. -22.42386 Long. 15.07052
 Setting: overhang on porphyry outcrop
 Description: honey scaffold base cairn
 Records: site notes, locality data
 Significance rating: 1
 Vulnerability rating: 4

Assessment:

The sites described in the previous section are all of low archaeological significance: seed digging sites are extremely common on the edge of the Namib, occasionally reaching local densities in excess of 600/km². As explained above, the archaeological evidence of seed digging is well documented and the present sites are therefore not considered as valuable to our understanding of the regional archaeology.

If the plans to develop a waste rock dump or other facility on the Dome do materialize, the sites will in all likelihood be destroyed. Their local landscape context will almost certainly be disrupted. In the assessment table below, the impact is taken as uniform across the Dome landscape, although the extent of impact is noted on a site-by-site basis, as being local. The magnitude of impact is assumed to affect the entire site; duration of impact is taken as long term.

It is important to note that the significance of the impact is treated as very low, following the Ninham Shand rating.

| Site QRS 72/n | 53 | 54 | 55 | 56 | 57 |
|---------------|----------|----------|----------|----------|----------|
| Extent | local | local | local | local | local |
| Magnitude | very low | very low | very low | very low | very low |
| Duration | long | long | long | long | long |
| SIGNIFICANCE | very low | very low | very low | very low | very low |
| Probability | prob. | prob. | prob. | prob. | prob. |
| Confidence | certain | certain | certain | certain | certain |
| Reversibility | irrev. | irrev. | irrev. | irrev. | irrev. |

Considering the probability of impact and its associated confidence, this is entirely dependent on the project design. In this case the information provided by Rössing via Ninham Shand is taken to indicate that the impact will almost certainly occur. Impacts on archaeological sites are always irreversible.

Mitigation:

Although no mitigation of the sites will be required, the developer is required to have a permit from the National Heritage Council before a recorded archaeological site can be destroyed. The attached permit application form (Appendix 4) should be submitted to the Director, Ms Erica Ndalikokule, together with this report.

I hope this assessment meets with your approval and look forward to your further instructions.

Yours sincerely

A handwritten signature in black ink, appearing to read 'J. Kinahan', written over a faint, light-colored rectangular stamp or watermark.

John Kinahan PhD MSAIE & ES

Partner

Encls.

Appendix 1:

Consolidated gazetteer of archaeological sites

QRS 72/1

Site coordinates: Lat. -22.46598 Long. 14.99084
Setting: Crest of dolerite ridge.
Description: Sparse surface scatter approximately 400m² extent and <0.2 objects/m² density; yellow-brown chert flakes, with some hydrothermal vein quartz and ostrich eggshell fragments.
Records: Site notes; position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/2

Site coordinates: Lat. -22.46707 Long. 14.99088
Setting: Crest of dolerite ridge; in between sheltering boulders, and adjacent to survey beacon (white concrete pillar with black post and vanes, but not Trig. Survey).
Description: Surface scatter approximately 400m² extent and <0.2 objects/m², with localized density >25 objects/m²; yellow-brown chert flakes in primary context as flaking site; associated with some crystalline quartz and ostrich eggshell fragments. Scatter is predominantly LSA, but includes single MSA blade flake in brecciated chert (cf. QRS 72/26).
Records: Site notes, position data, site photograph; C14 sample (see results for QRS 72/002 Beta 217089); detailed plot of 3m² scatter, including raw material sample QRS 72/002 for ICP analysis.
Significance rating: 3
Vulnerability rating: 2

Figure 12: Setting of typical chert scatter site on crest of dolerite dyke, QRS 72/2

QRS 72/3

Site coordinates: Lat. -22.46902 Long. 14.98975
Setting: Crest of dolerite ridge, as previous.
Description: Isolated core fragment, probably derived from previous.
Records: Site notes, position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/4

Site coordinates: Lat. -22.47153 Long. 14.98948
Setting: Gravel outwash fan on northern side of dolerite ridge, with well developed stream beds leading into south-westerly drainage.
Description: Earth embankment with drainage culvert made from steel drums and iron sheet, with dry-stone construction; breached by storm-water flow. The embankment is part of the narrow-gauge track bed from Arandis siding to Khan Mine.

Records: Site notes, photographs and position data. See survey file QRS 72/004 for detailed terrain model data showing excavation of embankment material and other features.

Significance rating: 2

Vulnerability rating: 2

QRS 72/5

Site coordinates: Lat. -22.47152 Long. 14.99133

Setting: As previous, on earth embankment.

Description: Dump of coach bolts and $\frac{3}{8}$ inch hexagonal bolts, with broken horse shoe. Transverse strips of iron rust scale on the embankment indicate the positions of steel track sleepers.

Records: Site notes, photographs and position data.

Significance rating: 1

Vulnerability rating: 1

QRS 72/6

Site coordinates: Lat. -22.47187 Long. 14.99873

Setting: As previous, on earth embankment.

Description: Crest of embankment.

Records: Site notes, photographs and position data.

Significance rating: 1

Vulnerability rating: 1

QRS 72/7

Site coordinates: Lat. -22.45145 Long. 14.9972

Setting: One south-east side of dolerite ridge.

Description: Stone post anchors of hut/windbreak making semi-circular arrangement c.2m diameter, with opening oriented north-west. The four anchors are clusters of 5-10 medium size stones average 0.2m diameter. No associations noted.

Records: Site notes, photographs and position data.

Significance rating: 1

Vulnerability rating: 1

QRS 72/8

Site coordinates: Lat. -22.45059 Long. 14.9974

Setting: Edge of dolerite ridge.

Description: Surface scatter of shards from 19th/early 20th century green glass bottle, with kick-up and hand made mouth.

Records: Site notes and position data; collected neck section of bottle.

Significance rating: 1

Vulnerability rating: 1

QRS 72/9

Site coordinates: Lat. -22.44599 Long. 14.99767

Setting: Crown of small dolerite kopje.

Description: Surface scatter of shards from 19th/early 20th century brown earthenware/stone ware flask/jug. Fabric is biscuit brown glazed outside, pale cream within; narrow mouth. Some ostrich eggshell found on same site, but probably not associated

Records: Site notes and position data; collected two stamped shards.
Significance rating: 1
Vulnerability rating: 1

QRS 72/10

Site coordinates: Lat. -22.45635 Long. 14.99217
Setting: Dolerite ridge (Note: survey beacon on this position is not Trig.).
Description: Dispersed surface scatter of yellow-brown chert flaking debris, with some hydrothermal vein quartz.
Records: Site notes and position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/11

Site coordinates: Lat. -22.50295 Long. 15.02495
Setting: Panner Gorge, above Khan River.
Description: Camp used by geologist Nash in 1950's. Ruins of stone and mortar ?storage building, and white square painted on rock-face, apparently used as a movie screen. The site is now used as a picnic spot.
Records: Site notes and position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/13

Site coordinates: Lat. -22.50054 Long. 15.01861
Setting: Massive chert outcrop exposed by incision of Panner Gorge and tributaries.
Description: The chert is exposed mainly on the northern and north-western slopes of a narrow gap between schist outcrops. There is a dense talus scatter with many flaked nodules and several clearly identifiable flaking areas.
Records: Site notes and position data; photographs, and raw material sample QRS 72/013 for ICP analysis.
Significance rating: 3
Vulnerability rating: 3 (in the event that development work in the "SH" prospecting area extends to the western side of Panner Gorge).

QRS 72/14

Site coordinates: Lat. -22.50003 Long. 15.01868
Setting: Large isolated boulder in streambed as above.
Description: Dense surface scatter of stone artefact flaking debris on southern side over approximately 400m² with densities of 1-10 objects/m².
Records: Site notes and location data.
Significance rating: 2
Vulnerability rating: 2 (in the event that development work in the "SH" prospecting area extends to the western side of Panner Gorge).

QRS 72/15

Site coordinates: Lat. -22.46484 Long. 14.98887
Setting: Streambed.
Description: Shuttered concrete bridge supports for narrow gauge railway to Khan Mine from Arandis siding.

Records: Site notes and location data.
Significance rating: 2
Vulnerability rating: 1

QRS 72/16

Site coordinates: Lat. -22.45897 Long. 14.99051
Setting: Gravel outwash fan
Description: Endpoint of narrow gauge railway embankment.
Records: Site notes and location data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/17

Site coordinates: Lat. -22.43953 Long. 15.03259
Setting: Quartzite schist ridge on northern side of RUL tailings dam.
Description: Semi-circular stone windbreak orientated SW-NE; external diameter perpendicular to orientation 2.6m, parallel to orientation 2.2m. No associations noted.
Records: Site notes, location data and photograph.
Significance rating: 2
Vulnerability rating: 3 (area designated for tailings dam extension)

QRS 72/18

Site coordinates: Lat. -22.43785 Long. 15.03374
Setting: Quartzite schist ridge on northern side of RUL tailings dam.
Description: As above, but no measurements.
Records: Site notes and location data.
Significance rating: 2
Vulnerability rating: 3 (area designated for tailings dam extension)

QRS 72/19

Site coordinates: Lat. -22.50354 Long. 14.9924
Setting: Khan Mine
Description: Octagonal tower on outcrop above ?mine manager's house; to use as GIS reference point.
Records: Site notes regarding assessment, photographs and location data.
Significance rating: 3
Vulnerability rating: 3

QRS 72/20

Site coordinates: Lat. -22.48486 Long. 14.98986
Setting: Saddle on dolerite ridge.
Description: Thin scatter of chert flaking debris, on ground disturbed by heavy vehicles.
Records: Site notes and location data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/21

Site coordinates: Lat. -22.48428 Long. 14.99016
Setting: Dolerite ridge, upper slopes on south-eastern side

Description: Outcropping bed of calcite and brecciated chert, whitish cream in colour. Possible small quarry site; some ostrich eggshell.
Records: Site notes, location data and raw material sample QRS 72/21 for ICP analysis.
Significance rating: 1
Vulnerability rating: 1

QRS 72/22

Site coordinates: Lat. -22.48437 Long. 14.98991
Setting: Dolerite ridge, north-easterly continuation of previous feature.
Description: Dispersed artefact flaking area, yellow-brown chert ie not same raw material as previous site.
Records: Site notes, position data, site photograph; C14 sample (see results for QRS 72/022 Beta 217090); raw material sample QRS 72/022 for ICP analysis.
Significance rating: 3 (due to potential analysis results)
Vulnerability rating: 1

QRS 72/23

Site coordinates: Lat. -22.484 Long. 14.9902
Setting: Dolerite ridge, north-easterly continuation of previous feature.
Description: Localized scatter of flaked yellow-brown chert with ostrich eggshell.
Records: Site notes and position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/24

Site coordinates: Lat. -22.48131 Long. 14.99112
Setting: Dolerite ridge, north-easterly continuation of previous feature.
Description: Localized scatter of flaked yellow-brown chert.
Records: Site notes and position data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/25

Site coordinates: Lat. -22.48009 Long. 14.99104
Setting: Dolerite ridge, north-easterly continuation of previous feature. Site on north side of ridge, below crest.
Description: Thin surface scatter ostrich eggshell, no stone artefact associations.
Records: Site notes and location data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/26

Site coordinates: Lat. -22.47932 Long. 14.99062
Setting: Dolerite ridge, north-easterly continuation of previous feature. Site on north side of ridge, below crest.
Description: Surface scatter of stone artefact debris, yellow-brown chert. Includes one MSA flake with heavily patinated arises (cf. QRS 72/2).
Records: Site notes and location data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/27

Site coordinates: Lat. -22.47872 Long. 14.99066
Setting: Saddle in same dolerite ridge as previous.
Description: Localized artefact flaking scatter yellow-brown chert, over approximately 500m² with densities of 25 objects/m².
Records: Site notes and location data.
Significance rating: 2 (due to relatively high object density)
Vulnerability rating: 2 (due to some vehicle disturbance)

QRS 72/28

Site coordinates: Lat. -22.47772 Long. 14.99044
Setting: Dolerite ridge, north-easterly continuation of previous feature.
Description: Dense localized artefact scatters of up to 50 objects/m². The site may be continuous with the previous. There is some outcropping chert on the site itself (as well as some nodules in the soil) but the material appears micro-crystalline, in contrast to the cryptocrystalline texture of preferred flaking material on other sites in this distribution.
Records: Site notes and location data.
Significance rating: 2-3
Vulnerability rating: 3 (due to presence of vehicle tracks)

QRS 72/29

Site coordinates: Lat. -22.47683 Long. 14.99093
Setting: Dolerite ridge, north-easterly continuation and probable end-point of previous feature.
Description: More or less continuous artefact flaking scatter. If combined with QRS 72/26 to 29, the scatter would have a linear extent of about 280m. Generally disturbed, mainly by off-road vehicle traffic.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/30

Site coordinates: Lat. -22.43599 Long. 15.00022
Setting: Summit of dolerite ridge.
Description: Localized artefact debris scatter, chert and hydrothermal vein quartz.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/31

Site coordinates: Lat. -22.41273 Long. 15.03573
Setting: Limestone/marble ridge, south-western talus slope.
Description: Low density surface scatter of artefact debris, yellow-brown chert.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/32

Site coordinates: Lat. -22.38026 Long. 15.08304
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache diggings, with manuport dolerite hammer stone.
Records: Site notes, photograph and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/33

Site coordinates: Lat. -22.37997 Long. 15.08386
Setting: Dolerite core-stone outcrop.
Description: Rhino rubbing facets.
Records: Site notes, photograph and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/34

Site coordinates: Lat. -22.38402 Long. 15.08678
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/35

Site coordinates: Lat. -22.41852 Long. 15.04653
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/36

Site coordinates: Lat. -22.42714 Long. 15.0793
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/37

Site coordinates: Lat. -22.42398 Long. 15.08428
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/38

Site coordinates: Lat. -22.42487 Long. 15.07541

Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/39

Site coordinates: Lat. -22.37373 Long. 15.0733
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/40

Site coordinates: Lat. -22.37104 Long. 15.07433
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/41

Site coordinates: Lat. -22.43171 Long. 14.99558
Setting: Gravel plains.
Description: Narrow gauge railway siding at Arandis; disturbed by subsequent earthworks.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/42

Site coordinates: Lat. -22.36398 Long. 15.08257
Setting: Outcropping porphyritic granite.
Description: Two small, south-facing rock shelters, each about 2.5m high at the dripline. No stratified deposit, but thin surface scatter artefact debris in hydrothermal vein quartz and hornfels. Note that no yellow-brown chert recorded at these sites or the ?related harvester ant seed cache diggings (cf. QRS 72/46).
Records: Site notes, locality data, photographs and seed pestle collected.
Significance rating: 2-3 (focal sites for seed cache diggings)
Vulnerability rating: 2 (due to use by campers)

QRS 72/43

Site coordinates: Lat. -22.36865 Long. 15.09195
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/44

Site coordinates: Lat. -22.37934 Long. 15.10989
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/45

Site coordinates: Lat. -22.37982 Long. 15.1112
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/46

Site coordinates: Lat. -22.38543 Long. 15.1168
Setting: Outcropping granite porphyry.
Description: South-facing shelter with very thin talus scatter. Note that the scatter does not contain any yellow-brown chert (cf. QRS 72/42).
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/47

Site coordinates: Lat. -22.343 Long. 15.09748
Setting: Weathered granite hill slopes.
Description: Harvester ant seed cache digging site.
Records: Site notes and locality data.
Significance rating: 1
Vulnerability rating: 1

QRS 72/48

Site coordinates: Lat. -22.49652 Long. 15.02755
Setting: Weathered granite outcrop with deep gully erosion.
Description: Extensive chert quarry with clear artefact debris scatters visible within talus.
Records: dGPS site map, GIS files, site notes, locality data, photographs and limited surface collection.
Significance rating: 3
Vulnerability rating: 3

QRS 72/49

Site coordinates: Lat. -22.49029 Long. 15.02311
Setting: Small outcrop of chert at foot of low spur.
Description: Discrete quarry and flake preparation area.
Records: Site notes and locality data.
Significance rating: 2

Vulnerability rating: 1

QRS 72/50

Site coordinates: Lat. -22.46101 Long. 15.08904

Setting: West side of overhanging granite outcrop with small cavities developed on minor fractures.

Description: Cairn of loosely packed rock associated with fragments of woody material, evidently the remains of a honey scaffold. The state of the wood fragments and the absence of preserved soot marks indicate that the nest was last robbed more than a century ago. Similar sites have been described elsewhere in the Central Namib

Records: Site notes, photograph (below) and locality data.

Significance rating: 1

Vulnerability rating: 5

QRS 72/51

Site coordinates: Lat. -22.45133 Long. 15.10123

Setting: Northern slope of low granite outcrop situated in watershed of SK area drainage. The slope is formed by a broad pediment covered by coarse rock talus. Minor quartz veins are exposed in the weathered material, contributing numerous fist-sized and smaller fragments to the talus.

Description: Several quartz fragments show evidence of cortex removal and preliminary flaking concentrated in an area of about 5m². Object density within this area does not exceed 10 pieces/m². No typologically diagnostic pieces were noted and the age of the site is unknown.

Records: Site notes and locality data.

Significance rating: 1

Vulnerability rating: 5

QRS 72/52

Site coordinates: Lat. -22.45783 Long. 15.09643

Setting: Narrow saddle between parallel streams.

Description: Dispersed remains of a single hunting blind structure. No other archaeological remains were noted on the site, which is heavily disturbed by evidence of a ca. 1970's driller's camp, including tent pegs, v-belt fragments and iron scrap.

Records: Site notes and locality data.

Significance rating: 1

Vulnerability rating: 5

QRS 72/53

Site coordinates: Lat. -22.46099 Long. 15.05196

Setting: hill saddle, deeply weathered bedrock

Description: seed digging, approximately 1m diameter

Records: site notes, locality data

Significance rating: 1

Vulnerability rating: 4

QRS 72/54

Site coordinates: Lat. -22.45777 Long. 15.05437

Setting: hilltop, deeply weathered bedrock
Description: seed digging, approximately 1.3m diameter
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

QRS 72/55

Site coordinates: Lat. -22.42018 Long. 15.06566
Setting: hilltop, deeply weathered bedrock
Description: seed digging, approximately 1.2m diameter
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

QRS 72/56

Site coordinates: Lat. -22.44758 Long. 15.06811
Setting: hilltop, deeply weathered bedrock
Description: seed digging, approximately 1m diameter
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

QRS 72/57

Site coordinates: Lat. -22.42386 Long. 15.07052
Setting: overhang on porphyry outcrop
Description: honey scaffold base cairn
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 4

Appendix 2

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Archaeological Impact Assessment: Client Information Sheet # 4 Significance and Vulnerability Ranking of Archaeological Finds

The evaluation and ranking of site significance and vulnerability is an essential component of archaeological impact assessment. QRS has developed an approach to significance and vulnerability estimation that combines accepted international practice^α with the results of more than 80 field surveys we have carried out in Namibia and elsewhere.

Our standard procedure involves an estimate of the archaeological value and the risk of damage, using ordinal scales of zero to five. These separate values can be combined as a significance and vulnerability index, e.g. 3/2, 4/0. The same data are used in the preparation of archaeological sensitivity maps and predictive models which form the empirical basis of our time and cost estimates for archaeological field surveys.

It is important to realize however, that such estimates have a degree of subjectivity. For this reason, we estimate significance with specific reference to the value of the site as a component of the Namibian archaeological record, while our estimation of vulnerability refers primarily to the potential consequences of the development project under consideration.

SIGNIFICANCE RANKING

- 0 no archaeological significance
- 1 disturbed or secondary context, without diagnostic material
- 2 isolated minor find in undisturbed primary context, with diagnostic material
- 3 archaeological site forming part of an identifiable local distribution or group
- 4 multi-component site, or central site with high research potential
- 5 major archaeological site containing unique evidence of high regional significance

VULNERABILITY RANKING

- 0 not vulnerable
- 1 no threat posed by current or proposed development activities
- 2 low or indirect threat from possible consequences of development (e.g. soil erosion)
- 3 probable threat from inadvertent disturbance due to proximity of development
- 4 high likelihood of partial disturbance or destruction due to close proximity of development
- 5 direct and certain threat of major disturbance or total destruction

QRS has adopted the practice of identifying the specific research value of archaeological sites documented in the course of field surveys. This means that we evaluate the likely research benefits of more detailed investigations on sites of high significance, or local site clusters of potential research importance. We indicate the immediate benefits in terms of sequence resolution or yield of comparative material and present this in the form of an expected research dividend. Similarly, we evaluate the consequences of damage or destruction as an expected loss of research dividend. These estimates form part of our proposals for mitigation of impacts.

^α e.g. Banning, E. B. (2002) *Archaeological Survey*. Manuals in Archaeological Method, Theory, and Technique. Kluwer Academic, New York.

Archaeology of seed gathering in the Namib Desert
JOHN KINAHAN

Contribution to joint paper with M. Smith & S. Calogero, provisionally titled:

The ecological and social dimensions of wild seed exploitation in the deserts of the southern hemisphere

Intended for: *Journal of Arid Environments*

In the arid western parts of Namibia, wild grass seed is an important supplement to the diet of subsistence pastoralists (Sullivan 1999). Some seed is gathered directly from the stalks of desert grasses, but most is obtained by excavating the nests of harvester ants. The seed is separated from the grit by winnowing in a flat wooden tray over a sheet of canvas. Ground or whole, seed is used to make porridge, and sometimes beer, fermented with wild honey. Seed gathering and processing is primarily a women's activity among modern Khoekhoegowab-speaking communities, the last traditional practitioners of what was once a widespread practice along the margins of the Namib Desert.

The first archaeological evidence of grass seed exploitation in Namibia is dated to the late first millennium and early second millennium AD (Kinahan 1986). Summer encampments of nomadic pastoralists are well preserved in the Namib Desert as temporary aggregations of stone hut circles representing clearly discernible household groups. Each household centred on one or possibly two complex, lobed hut structures, incorporating storage cells and central hearth features. Surrounding these, and oriented towards them, were smaller, simple huts and cooking shelters. The simple huts were exclusively associated with grinding equipment, including pottery and stone pestles, suggesting a gender-based spatial patterning.

Throughout the dry-lands of southern Africa, pottery is associated with nomadic pastoralist settlements and occasional hunter-gatherer sites dating to within the last two millennia (Mitchell 2002). The evidence from the Namib Desert is, however, unequivocal in showing that pastoralists used pottery largely for the exploitation of wild plant foods. Indeed, it appears that pottery had no direct function in the technology of stock-keeping (Kinahan 2001). By the end of the first millennium AD Namib Desert pottery had acquired a distinctive bag-shaped design which remained consistent into early colonial times. As pastoralism declined and collapsed in the aftermath of historic contact, pottery became scarce, and vessels from recent sites often show evidence of careful repair, using vegetable fibre, gum and sometimes, wire.

Seed gathering appears to have become increasingly important during the last five hundred years and the most detailed evidence is from the more recent sites. Whereas the earlier sites show that seed gathering formed but part of a fully developed nomadic pastoral economy, the more recent sites indicate that livestock ownership had declined, being replaced by a dependence on wild game and a heavy reliance on wild grass seed. The pastoral sites have yielded evidence of indigenous trade in pottery, metalwork and ivory, indicative of wealth in livestock. However, during the last three centuries the emphasis of trade shifted to contacts with visiting ships, and this accelerated the collapse of pastoralism, apparently adding to the numbers of impoverished people on the margins of the pastoral economy (Kinahan 2000).

Among rural people in the northwest of Namibia, there is a stigma attached to seed gathering because it carries connotations of poverty and dependence on low status foods (pers. obs). The archaeological evidence suggests differently, that during the last one thousand years seed digging developed as a highly specialized and very successful adaptation to the Namib environment. This evidence seems to have eluded previous studies which were primarily focussed on stone artefact typology, and although there was some investigation of plant and animal exploitation, attention was limited to material recovered in the course of rock shelter excavations (e.g. Wadley 1979, 1984). The main evidence of seed digging, described in detail below, is not found in excavation, but in the form of small areas of disturbed ground, usually within 4 – 5km of base-camp sites at remote and ephemeral water sources in the desert.

Before describing the archaeological evidence it is necessary to briefly sketch the environmental setting in which the sites occur, and to outline the severe ecological constraints that operated on seed digging as a subsistence activity. The reason for this is that seed digging in the desert depends almost entirely on the availability of water from shallow rain catchments in exposed bedrock. Such water lasts too short a time to gather seed germinated by the same rainfall event. Consequently, desert rainfall events allowed people to visit remote locations and exploit harvester ant caches of seed from rainfall events in previous years. Seed gathering therefore combined practical knowledge of rainfall and ecological response mechanisms in a hyper-arid environment, under the constraint of density-dependent dynamics (Kinahan 2005).

Like other tropical arid regions, western Namibia is characterized by high temporal variation in rainfall (Tyson 1986). Because temporal variability is negatively correlated with mean annual rainfall, the amount of precipitation is essentially unpredictable. By way of illustration, the foot of the escarpment forming the eastern margin of the Namib receives between 100 and 150mm per annum, with a variation of about 86%, while on the Atlantic coast 150km to the west, mean annual rainfall is less than 50mm (received mainly as fog), and variation is approximately 280%. Inland precipitation is brought by isolated convective storms that move over the landscape in an almost random fashion, adding a high degree of spatial variability to the Namib Desert rainfall regime (Henschel et al 2005).

There is a well documented relationship between rainfall patterns and the local abundance of plants and animals in the Namib (e.g. Seely & Louw 1980; Hamilton 1985). Green swathes marking the tracks of storm clouds over the desert are a common sight, and it is this grassland productivity response that is of primary interest here. Seely (1978) determined the relationship of grass standing crop to annual rainfall, and the zero intercept of grass germination has been demonstrated to lie at 11mm rainfall received within a period of one week (Günster 1992). Although grass biomass does not under these conditions correlate with average annual rainfall, it is a reliable indicator of rainfall initiating the germination event of a particular stand of grass cover.

Grasses of the genus *Stipagrostis* predominate on the Namib plains (Henschel et al 2005), and two species, *S. ciliata* (Desf.) De Winter, and *S. uniplumis* (Lichtenst. ex Roemer & Schultes) De Winter, are of particular importance. Colonies of harvester ants, commonly *Messor tropicorum* Wheeler, form an important part of the desert grassland environment. The ants gather fallen seed at the end of the growing period and store it within their nests, at a depth of up to one metre below ground surface. Ant populations respond rapidly to rainfall events and where sufficient rain has fallen to sustain grass cover over several years the activity of the ants results in highly visible networks of pathways leading to nest entrances which in turn are marked by large

accumulations of seed husks.

Ethnographic studies in the Namib (du Pisani 1983; Steyn & du Pisani 1984) have documented the human exploitation of wild grass seeds in considerable detail, and Sullivan (1999) has shown that traditional use of this resource follows an empirically-based understanding of both grassland responses to rainfall events, and the population dynamics of harvester ants. This ethno-biological knowledge system also includes a detailed folk taxonomy which discriminates to species level, using both physical and, in the case of the ants, behavioural characters. Considering this, Sullivan (1999) suggests that the practice of seed gathering must have developed over a long period, with the implication that it cannot have arisen only in recent times as a strategy of survival under conditions of economic stress.

The material culture of seed gathering and processing is well represented in ethnographic accounts and there are direct parallels in the recent archaeological record. For example, the winnowing tray, or *goub*, still in use today is usually carved from the soft wood of various *Commiphora* species. Shavings of soft wood have been recovered from several archaeological contexts in the Namib (Kinahan 1990; 2001), and in every instance appear to have been made with a narrow spoke-shave blade. Trimming scars on winnowing trays also suggest a tool of this nature, and a discarded iron blade found on a late-nineteenth century seed gathering base-camp site was probably used for this purpose (Kinahan 2008).

Today, winnowing trays are used in conjunction with “small upper and large, flat, lower millstones” (Sullivan 1999: 7). On archaeological sites in the Namib, stone pestles and lower grindstones, or querns, are very common, indicating that this was the preferred mode of food preparation. In some parts of the desert the pestles are made from quartzitic schist, which occurs in natural blanks with a tabular shape (Kinahan 2001). The pestles are most worn at the broadest end and appear therefore to have been held in a vertical position, as for pounding. These tabular pestles are associated with portable querns of quartzite and schist while in other parts of the Namib, the pestles are fist-sized or slightly larger river pebbles, which are most often associated with grinding surfaces on small outcrops of granite, near waterholes (e.g. Kinahan & Kinahan 2006).

The archaeology of seed gathering in the Namib goes beyond material culture and folk knowledge to indicate the ecological and social dimensions of this practice. Where evidence of seed gathering is found as part of the nomadic pastoral economy of this region it appears to be restricted to the more optimal parts of the desert, where water sources are generally reliable and pasture both accessible and abundant, given adequate rains. However, most of the evidence of recent seed gathering is in marginal areas that do not appear to have been used by nomadic pastoralists. It therefore appears that while seed gathering was an integral component of the pastoral economy, it was a mainstay of more recent desert communities who lacked the security of wealth in livestock.

Current field research on the gravel plains of the central Namib, between the Khan and !Khuseb Rivers, reveals a consistent pattern in the distribution of seed gathering sites and their association with particular terrain conditions. This, in turn, identifies the most important environmental constraints on seed gathering. The spatial relations of different kinds of sites within the distribution pattern add a further, social dimension, showing that the gender-based divisions previously noted in the layout of individual settlements, are also expressed on a wider, landscape scale.

Turning first to the general distribution of seed gathering sites on the gravel plains, it is apparent that the highest density of sites occurs on the eastern margins of the desert, at the foot of the interior escarpment. This is the area with the lowest annual rainfall variation; it has consequently the most likelihood of successive rainfall events within a single rainy season, and over successive years. The area concerned is approximately 100km in width, ranging from 500 to 1000m above mean sea level, and its western margin lies about 100km inland from the Atlantic coast. The terrain is characterized by extensive calcrete gravel plains, incised by a network of shall drainage systems, and punctuated by isolated granite outcrops and *inselbergen*.

Harvester ant nests that have been disturbed in the course of seed gathering are a highly visible feature of the gravel plains. Ant nests tend to occur on coarse, well drained substrate, and the ants particularly favour ground with flat slabs of schist or calcrete beneath which to locate their storage chambers. Nests that have been opened to retrieve the seed cache are surrounded by broken rock, including tell-tale slabs of with calcrete encrustations, overturned on the surface. Manuports of dolerite or other hard rock are also found on seed digging sites, where they have been used to break up rock surrounding the nest. Seed diggings are also notable for the fact that they do not occur in isolation: local densities vary between 300 and 600 diggings per square kilometre on the eastern margins of the desert.

Because of its enduring visibility, the evidence of seed digging represents an accumulation of visits within the last five hundred years. Although the seed caches are also an attractive and valuable source of food for rodents and a range of other animals, the evidence is that human disturbance was the most significant factor. The characteristic indications of human disturbance are however confined to ant nests within reach of water, usually in the form of temporary rainwater pools. As a consequence, only a relatively small part of the total grass seed resource would have been accessible to people. Surveys indicate that the area covered by seed gathering was limited by distance from water, and in the field, human disturbance at ant nests is therefore a reliable indicator of a base-camp site within a distance of less than 5km.

Base-camp sites are located either on the margins of large *inselbergen* or among isolated granite core-stones and outcrops. Water supplies at these sites generally exist as shallow subsurface accumulations in drainage channels, especially where these are intersected by barriers in the form of dolerite dykes, or as pools in weathered hollows on the exposed surface of outcropping granite. Both sources rely entirely on direct local rainfall, in the absence of which no water would be available to sustain seed digging in that area. The volume of subsurface water held against natural rock barriers is difficult to estimate, although these sources are in any case short-lived. Water held in rock hollows, or basins (cf. Twidale 1988), sometimes exceeds ten cubic metres, and ponds several times larger are also occasionally found. Such accumulations are subject to rapid evaporation, if the ratio of surface area to volume is especially large. Deep crevices on fracture planes sometimes hold water for up to a year, but water supplies at these sites do not generally last longer than about two months.

The base-camp itself is usually located within about 500m of the water source, and sometimes much closer. Site location criteria also include natural shelter behind or among large boulders, with adjacent open ground for the positioning of huts and other structures. Particularly favoured were sites that fulfilled these criteria while also providing a topographic vantage point. In the central Namib the location of base-camp sites is highly predictable, although the appearance and layout of the site varies. Stone hut remains seldom number more than ten, and these will often incorporate rock shelters and large boulders. In addition to the huts, base-camp sites often include hollow cairn structures that may have served as storage places for grass seed.

Apart from hut structures and related features, base-camp sites are characterized by evidence for a diversity of activities, including butchery, cooking and stone artefact manufacture. Faunal remains recovered from these sites include Jameson's red rock rabbit *Pronolagus randensis*, Hartmann's mountain zebra *Equus zebra zebra* and Springbok *Antidorcas marsupialis* (Kinahan 2008). Several base-camp sites in the Namib are located near to elaborate systems of stone built game drives and hunting blinds (Kinahan & Kinahan 2006). These structures appear to represent a hunting strategy that would have effectively compensated for the small number of hunters, although it is possible that different seed gathering base-camps carried out communal hunts.

In marked contrast to the base-camp sites are small rock shelters and other sites that formed part of the seed gathering pattern. These are situated up to 5km from the base-camp, and in areas with large numbers of ant nests showing evidence of human disturbance. Rock shelters in this situation are characterized by pestles and quern stones, with occasional storage cairns. They are also characterized by a lack of stone artefact flaking debris and evidence of butchery and food preparation. As a rule, the sites have no hearths and no evidence of sustained occupation. There is usually no water source within several kilometres. These sites seem to be exclusively associated with seed gathering and were probably used by women rather than men.

The general pattern of archaeological evidence related to seed gathering appears therefore as follows: most of the late second millennium sites lie along the eastern margins of the Namib where rainfall variability is lowest and where suitable rainwater catchments exist, mainly in areas of outcropping granite. Base-camp sites in the granite terrain appear to have been occupied for short periods, of less than two months, by small groups of between ten and twenty people. Hunting, as well as honey harvesting would have been carried out by men, while groups of women were engaged in gathering grass seed over an area of about 50km². The archaeological signature of seed gathering is only revealed by a landscape approach; previous investigations employing the conventional single site framework (e.g. Albrecht et al 2001; Sandelowsky 1977; Smith & Jacobson 1995) failed to notice evidence of seed gathering in this region.

Radiocarbon dates for seed gathering sites are insufficient as yet to indicate clear patterning within the last one thousand years. However, there is an unconfirmed clustering of dates in the mid-second millennium AD. This phenomenon corresponds with the florescence of nomadic pastoralism in the Namib and might therefore appear as paradoxical. On the other hand, pastoralism in the Namib was economically coupled with indigenous copper production in the pre-colonial period and later with trade in exotic goods obtained through sale of livestock to visiting ships. This suggests that livestock in excess of the owner's management capacity were converted into goods of equivalent value that could be redeemed at another time (Kinahan 2001).

Following this model, the Namib pastoral economy would have generated wealth in the centre and poverty at the fringes. The widespread appearance of seed digging in parts of the Namib that were unsuitable for herding is therefore a predictable consequence of the model. The archaeology of nomadic pastoralism in the Namib also shows evidence of economic collapse in the nineteenth century, prior to direct colonial rule. The evidence suggests that unequal exchange based on exotic goods from outside the livestock economy contributed to its instability and made it vulnerable to the usual risks of drought, raiding and disease (Kinahan 2000).

The most recent archaeological evidence of seed gathering in the central Namib is consistently associated with late nineteenth century material, commonly cans for preserved food used by the German colonial forces. Germany acquired Namibia as a colonial possession in 1884 (Bley

1996), but in 1897 the outbreak of the *Rinderpest* effectively wiped out the livestock economy, including most draught animals (Schneider 1994). This disastrous event would have reduced pastoralists in the Namib to the economic status of hunter-gatherers, represented by the second and most recent pulse of seed gathering in the desert. (body of text: 3036 words)

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APPLICATION FOR PERMIT FOR WORKS AND ACTIVITIES

In terms of Section 48(1) of the National Heritage Act (Act 27 of 2004)

CONDITIONS & INSTRUCTIONS

1. This application is subject to a fee of N\$150,00
2. The receipt issued serves as a reference when making enquiries.
3. Allow for processing time of at least 7days.
4. Foreign film crews must submit an accreditation permit from Ministry of Information & Broadcasting
5. Works and construction type activities will be subject to an EIA requirement at applicant's expenses
6. Instructions for Completion:
 - Section A – All Applicants
 - Section B – ONLY Applications for research, export & transportation of materials
 - Section C – ONLY Applications for works, leisure and other activities
 - Section D – All Applicants – relevant sections only

A. APPLICANT DETAILS

1. Name and address of applicant

- 1.1 Full Name and Designation of the Head of Responsible Organisation

- 1.2 Full Name & Details of Researcher, Contractor, Person in Charge of the Proposed Works /Activities

2. Academic qualifications, skills & competencies of person in charge mentioned under 1.2 above. Include current occupation where relevant.

3. Previous permits issued in Namibia _____

4. Period for which permit is required: From _____ to _____

5. Date by which permit is required _____

B. RESEARCH, EXPORT & TRANSPORTATION

6. Indicate whether this is an Application for:

Temporary Export

Permanent Export

Local Transportation

7. Name & address of Namibian institutions presently housing the material

6. Name & Address of local/foreign institution to which the material will be exported.

7. Description of material to be exported/transported. Indicate number of items & accession numbers given by the Namibian institutional from which their are on loan.

8. Description of the site (cave, rock shelter, grave, structure, midden, open surface site etc or Geological formation from which material originates.

9. Geographic Location (farm, village, settlement, town, region, magisterial district, constituency, GPS coordinates) of material.

10. Reason for transportation of materials (identification, exhibition etc)

C: WORKS, LEISURE & OTHER ACTIVITIES

11. Geographic Location & Address (farm, village, settlement, town, region, magisterial district, constituency, GPS coordinates) of the site, protected object or place where works or activities are proposed.

12. Detail description of the nature of works, activities for which permit is applied for (e.g. excavation, construction, filming etc) *(Attach additional and supporting information in the space on the form is not enough.)*

D: UNDERTAKINGS BY APPLICANTS

13. I _____ the Head of _____
Hereby undertake to strictly observe the terms and conditions under which the National Heritage Council may issue the permit.

Signature _____ Date _____

14. I _____ the Head of _____
_____, Institution where material to be exported/transported is currently housed, do hereby state that I support / do not support the application.

Signature _____ Date _____

15. I _____ the Head of _____
_____, Institution to which material will be exported hereby undertake that the material will be returned to Namibia during the period indicated in point 4 above.

Signature _____ Date _____