

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



DESKTOP PALAEOONTOLOGICAL IMPACT ASSESSMENT

**Photovoltaic Solar Plant, Ekapa Minerals (Pty) Ltd, Kimberley,
Northern Cape Province**

Specialist report by:

Bruce Rubidge

Address: 20 Donkin Street
Graaff-Reinet
Tel: 072 575 7752
Email: bruce.rubidge@wits.ac.za

Subcontracted by environmental consultants

Lesley Keay

Address: Shangoni Management Services (Pty) Ltd.
PO Box 74726
Lynnwood Ridge
0040
Tel: 012 807 7036
Fax: 012 807 1014
Cell: 084 812 2133
Email: lesley@shangoni.co.za

DATE: 3 January 2023

EXECUTIVE SUMMARY

Bruce Rubidge was appointed by Shangoni Management Services (Pty) Ltd, on behalf of Ekapa Minerals, to undertake the palaeontological impact assessment process for the proposed development of a photovoltaic solar plant on the farm Dorsfontein 77, Kimberley, Northern Cape Province.

The entire study area is deeply underlain by mudrocks of the Permian Prince Albert Formation of the Ecca Group, and Jurassic Karoo dolerites of the Karoo Supergroup and more superficially by Quaternary calcrete of the Gordonia Formation.

The Karoo dolerite is a plutonic igneous rock and will not host fossils. The mudrocks of the Prince Albert Formation are known to host fossils from good outcrops in the southern part of the basin and the unconsolidated sediment of the Gordonia Formation (Kalahari sands) is of sedimentary origin and has the potential to host fossils, but this is unlikely. The entire study area is 240 ha, and most of this is underlain by dolerite. As the entire area has been previously disturbed by mining activity and is largely overgrown by vegetation it is unlikely that the proposed PV development will be a threat to palaeontological heritage.

This desktop study has indicated that no fossils are exposed, and if deep excavations are undertaken as a result of development, it could possibly expose fossil radiolarians, plants and possibly fish in the rocks of the Ecca Group and could create an opportunity for further study. It is thus recommended that, if in the unlikely event that fossils are exposed in the Permian Ecca Group or overlying Quaternary sediments, during the proposed development a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented (See Appendix A – CFP).

TABLE OF CONTENTS

1. Introduction and brief	4
2. Legislative Framework	5
3. Details of the study area	5
4. Geological Setting	6
5. Palaeontological Heritage	7
6. Methodology	7
7. Recommendations	7
8. Conclusion	9
9. Bibliography	9
10. Chance find protocol	10

Introduction and Brief

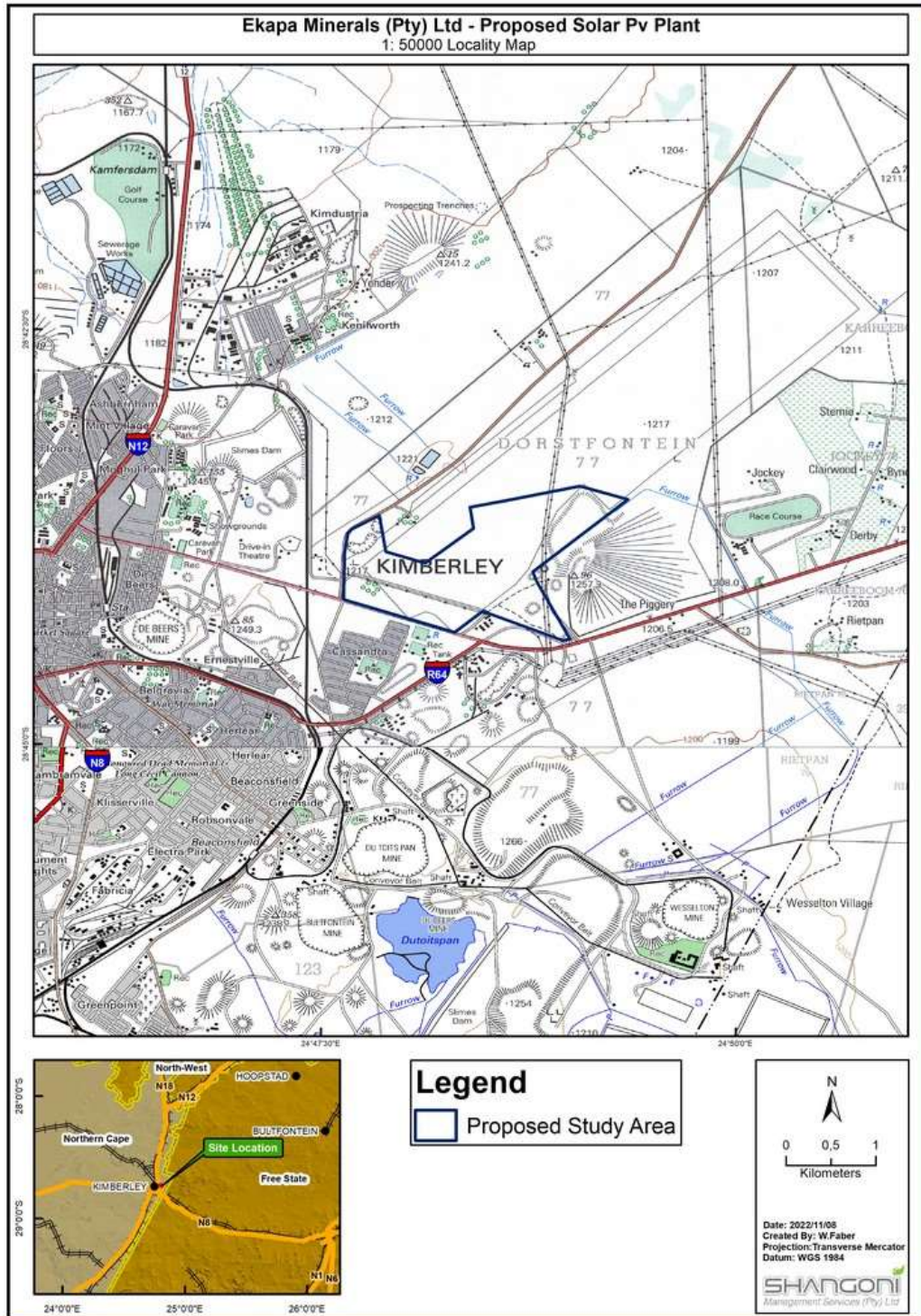


Figure 1: Topographic map (2824 DB) showing the position (area outlined in blue) of the proposed PV development on the farm Dorsfontein 77, Kimberley, Northern Cape Province.

A Palaeontological Impact Assessment was requested by Lesley Keay of Shangoni Management Services (Pty) Ltd., on behalf of Ekapa Minerals (Pty) Ltd. The proposed photovoltaic (PV) solar plant development will take place the farm Dorsfontein 77, Kimberley, Northern Cape Province (Figure 1). The proposed development comprises a total area of about 240 hectares. This report is part of a Heritage Impact Assessment to determine the effect that the proposed PV development will have on palaeontological heritage.

Legislative framework

The Department of Environment, Forestry and Fisheries (DEFF) through the National Environmental Management Act (NEMA Act 107 of 1998) requires that developers apply to the competent authority for Environmental Authorization of the proposed development as more than 1 hectare of indigenous vegetation is to be removed (Listing Notice 1 of the EIA regulations).

National Heritage is protected by the South African Heritage Resources Act (Act No 25) of 1999. Developers are required to submit development plans to SAHRA for approval. These plans must include documentation detailing the expected impact that the development will have on national heritage.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include:

- Geological sites of scientific or cultural significance.
- Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, material, meteorites and rare geological specimens.
- Objects with the potential to contribute to understanding South Africa's natural or cultural heritage.

Accordingly, a Heritage Impact Assessment (HIA) is required to assess the possible impacts of a proposed development on archaeological and palaeontological heritage. This report addresses the palaeontological aspects of the HIA as part of the Environmental Management Plan (EMP).

Details of the study area

The study area of the proposed PV development will take place on the farm Dorsfontein 77, Kimberley, Northern Cape Province (Figures 1 & 2). The site is situated close to, and north of, the R64 provincial road leading out of Kimberley toward Boshoff to the northeast. The study area is covered by the 1:50 000 topographic map 2824DB (Figure 1). The proposed development area covers about 240 ha.

Geological Setting

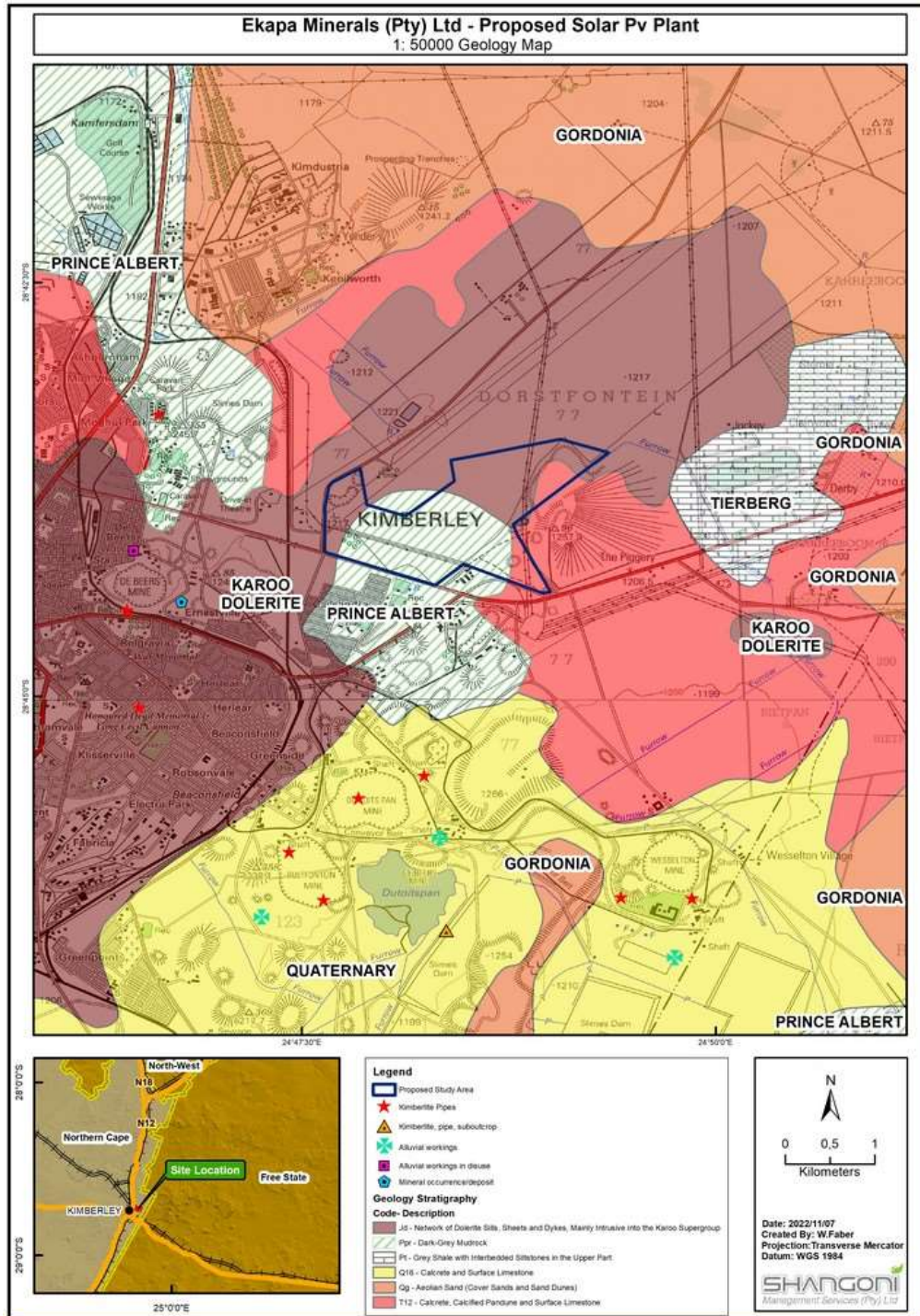


Figure 2: Geological map (2824 Kimberley) showing the position of the study locality on the farm Dorsfontein 77, Kimberley, Northern Cape Province (blue outlined areas) in relation to the regional geology.

Based on the 1:250 000 geological sheet, 2824 Kimberley (Figure 2), the study area is deeply underlain by mudrocks of the Permian Prince Albert Formation of the Eccca Group, and Jurassic Karoo dolerites of the Karoo Supergroup and more superficially by Quaternary calcrete of the Gordonia Formation (Figure 2&3).

Palaeontological Heritage

The Karoo dolerite, which covers more than half of the study area is a plutonic igneous rock and will not host fossils. The mudrocks of the Prince Albert Formation are known to host fossils of fish and radiolarians from good outcrops in the southern part of the Karoo basin, but have not yet been reported in the Kimberley area. The unconsolidated sediment of the Quaternary Gordonia Formation, which covers a very small area on the eastern side, is also of sedimentary origin and has the potential to host fossils, but this is unlikely as the sediment is unconsolidated and fossils have not yet been reported from this formation.

The entire study area is about 240 ha, and most of this is underlain by dolerite. As the entire area has been previously disturbed by mining activity and is largely overgrown by vegetation it is unlikely that the proposed PV development will be a threat to palaeontological heritage.

Methodology

A desktop study referring to the 1:250 000 Council for Geoscience Geological map 2824 Kimberley as well as satellite imagery revealed that more than half of the study area to the north is underlain by Jurassic dolerite of the Karoo Supergroup. The southerly part of the study area is deeply underlain by Permian rocks of the Prince Albert Formation of the Eccca Group. Toward the east these sedimentary rocks are overlain by unconsolidated calcretes of the Quaternary Gordonia Formation (Figure 3). Because most of the study area is underlain by dolerite which is a plutonic rock and will not host fossils, and the southern portion of the study area, which is covered by sedimentary rocks has previously been disturbed by mining activity a desktop Palaeontological Impact Assessment was undertaken to identify possible sensitive fossil occurrences, assess the significance of possible fossil occurrences, comment on the impact of the proposed development, and to make mitigating recommendations.

The fact that most of the study area is underlain by volcanic rock and there is thick covering of disturbed Quaternary sediment and grassveld covering the entire study area means that a field study will not yield anything of palaeontological significance.

A Chance Find Protocol (CFP) is presented in Appendix A.

Recommendations

Most of the study area is underlain by plutonic Jurassic dolerite of the Karoo Supergroup. The southern part is underlain by mudrocks of the Prince Albert Formation of the Eccca Group (Karoo Supergroup) which is known to host fossils in the southern

part of the Karoo Basin. This is overlain by unconsolidated sand of the Quaternary Gordonia Formation which has the potential to host fossils. This is unlikely as fossils have not yet been reported from the unconsolidated sand of the Gordonia Group. As the entire study area is either covered by grassveld or has been disturbed by previous mining activity it is unlikely that the PV development will affect palaeontological heritage.



Figure 3: Photographs of the study area to show the disturbed surface from previous mining activity and covering by Quaternary sediment which in turn is heavily vegetated.

In any development there is always the slight possibility that sedimentary rocks could contain fossils. In the unlikely event that fossils are exposed in the Permian mudrocks of the Eccia Group or in the Quaternary sediments of the Gordonia Formation it will create a unique opportunity to explore the area for fossils. It is thus recommended that if fossils are exposed by construction activities, a qualified palaeontologist must be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

Conclusion

The proposed PV development will take place on the farm Dorsfontein 77, Kimberley, Northern Cape Province. The entire study area is deeply underlain by mudrocks of the Permian Prince Albert Formation of the Ecca Group, and Jurassic Karoo dolerites of the Karoo Supergroup and more superficially by Plio-Pleistocene unconsolidated sands of the Gordonia Formation.

As this study area is of low palaeontological sensitivity it is extremely unlikely that fossils will be exposed as a result of the development. From a palaeontological perspective, the proposed development should proceed but, if fossils are uncovered in the sedimentary rocks of the Permian Karoo Supergroup or the Quaternary Gordonia Group in the course of construction activities, the developer must immediately call in a qualified palaeontologist to assess the situation and, if necessary, undertake excavation of the fossils (See Appendix A – Chance Find Protocol).

Bibliography

- Catuneanu O., Wopfner H., Eriksson P.G., Cairncross B & Rubidge B.S., Smith, R.M.H., and Hancox P.J. 2005. The Karoo basins of south-central Africa. *Journal of African Earth Sciences*, 43, 211-253.
- Johnson M.R., van Vuuren C.J., Visser J.N.J., Cole, D.I., Wickens H.deV., Christie A.M., Roberts D.L. & Brandl G. 2006. Sedimentary rocks of the Karoo Supergroup. *In: Johnson MR, Anhaeusser and Thomas RJ (Eds). The Geology of South Africa.* Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. 361-500.
- Mac Rae C. 1999. *Life etched in stone: fossils of South Africa.* The Geological Society of South Africa, Johannesburg, pp 305.
- McCarthy TS., & Rubidge BS. 2005. *The story of Earth and Life – a southern African perspective on the 4.6 billion year journey.* Struik Publishers, Cape Town. pp 333.
- Partridge TC., Botha GA., & Haddon IG. 2006. Cenozoic deposits of the interior. *In: Johnson MR, Anhaeusser and Thomas RJ (Eds). The Geology of South Africa.* Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. pp. 585-604.
- Pelser A. 2021. Phase 1HIA report for the De Heus Mixed Use Development located on portion 15 of the farm Bultfontein 128. Unpublished report for AB Enviro Consult.
- SAHRA. 2013. Minimum standards: palaeontological component of heritage impact assessment reports. South African Heritage Resources Agency, Cape Town. pp15.

Smith, RMH., Rubidge, BS., Day, MO. & Botha, J. 2020 Introduction to the tetrapod biozonation of the Karoo Supergroup. *South African Journal of Geology*, 123, 131-140.



Bruce Rubidge PhD, FGSSA, FRSSA, Pr Sci Nat
3 January 2023

APPENDIX A – CHANCE FIND PROTOCOL (CFP)

It is noted that following the findings of this desktop Palaeontological Impact Assessment it is unlikely that fossils will be recovered as a result of the photovoltaic plant development. The following procedure is required if fossils are exposed by excavations.

1. If fossils are exposed by excavation in unconsolidated Quaternary deposits or in the mudrocks of the underlying Permian Ecca Group they must be inspected by the environmental officer or designated person.
2. If fossils are noted in the unconsolidated Quaternary deposits of the Gordonia Formation or in the mudrocks of the underlying Ecca Group (includes bones, insects or plants) a suitably qualified palaeontologist must be approached for a verdict.
3. Fossil material displaced by excavation should be placed in a protected area, in this way development activities will not be held up.
4. Appropriate photographs of the fossils which have been noted should be sent to a qualified palaeontologist for a verdict on how to proceed. This may require a site inspection and excavation by the palaeontologist.
5. Fossils that are deemed to be of good quality or of scientific importance by the palaeontologist must be removed and curated in a recognised palaeontological museum collection where they can be made available for further study.
6. Before fossils are removed from the site a collecting permit must be obtained from SAHRA, and the required permitting procedures and requirements must be followed.
7. If the fossil material is deemed by the registered palaeontologist (as a result of photographic evidence or a site visit) to not be worthy of excavation and curation in a museum collection, the material will not be removed.
8. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered by a registered palaeontologist. This will require routine collecting protocols involving descriptive, diagrammatic and photographic

recording of fossils and exposures. The fossils and appropriate contextual samples will be processed to create an archive collection.

9. Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed palaeontologist has investigated the find.
10. Should no fossils be discovered in the process of development and excavations have been completed, no further monitoring will be required.
11. Any site visits by a registered palaeontologist and/or excavation of fossil material required, will be undertaken at the cost of the developer.

Table 1: Determination of potential impacts

Environmental Component	Activity	Impact Description	Reversibility	Irreplicable loss	Phase	Pre-mitigation			Mitigation type	Post- Mitigations		
						Probability	Magnitude	Significance		Probability	Magnitude	Significance
Palaeontology	The construction of the Ekapa Minerals PV Plant project	During the Impact Assessment, it was found that half of the study area is underlain by Jurassic dolerite which is an igneous rock and will not host fossils. The rest is underlain by mudrocks of the Permian Prince Albert Formation of the Eccca Group and unconsolidated sand of the Quaternary Gordonia Formation. These sedimentary rocks could potentially host fossils, but as the rocks of the Eccca group are overlain by young alluvial deposits and are not exposed it is unlikely that the construction a PV plant will damage fossils. Fossils are unlikely in the unconsolidated sands of the Gordonia Formation. It is thus extremely unlikely that fossils will be affected by the proposed PV developments.	Not reversible	No	Construction	1	1	L	Avoid / Manage	1	1	L

Table 2: Measures to rehabilitate the environment affected by the proposed project

Aspect affected	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome	Standard to be achieved	Time period for implementation
Palaeontology	The construction of the Ekapa Minerals PV Plant project	During the Impact Assessment, it was found that half of the study area is underlain by Jurassic dolerite which is an igneous rock and will not host fossils. The rest is underlain by mudrocks of the Permian Prince Albert Formation of the Eccca Group and unconsolidated sand of the Quaternary Gordonia Formation. These sedimentary rocks could potentially host fossils, but as the rocks of the Eccca group are overlain by young alluvial deposits and are not exposed it is unlikely that the construction a PV plant will damage fossils. Fossils are unlikely in the unconsolidated sands of the Gordonia Formation. It is thus extremely unlikely that fossils will be affected by the proposed PV developments.	Construction	Avoid / Manage	<p>If fossils are exposed by construction activities, a qualified palaeontologist must be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented.</p> <p>This will require routine collecting protocols involving descriptive, diagrammatic, and photographic recording of fossils and exposures. The fossils and appropriate contextual samples will be processed to create an archive collection.</p> <p>Should a major <i>in situ</i> occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed palaeontologist has investigated the find.</p>	L	<p>Following SAHRA legislation.</p> <p>Fossils discovered need to be removed and protected by a Palaeontologist and curated in a palaeontology collection in a South African museum.</p>	Construction