

UNIVERSITY OF THE  
WITWATERSRAND,  
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## DESKTOP PALAEOONTOLOGICAL IMPACT ASSESSMENT

### Shishen Iron Ore Mine Expansion Project, Northern Cape Province

*Specialist report by:*

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**DATE: 26 August 2022**

## **EXECUTIVE SUMMARY**

Bruce Rubidge was appointed by Shangoni Management Services (Pty) Ltd to undertake a desktop palaeontological impact assessment for the proposed expansion of the Sishen Iron Ore Mine on the farms RE 545 of Lylyveld; Portion 11 of Sacha 458; RE 461 of Sekgame; Portions 16 and 21 of Sishen 543; Portions 19, 21,22, 25, 27 of Sishen 543; Portion 2 of 541 Gamagara, Kathu, Northern Cape Province.

The entire study area is deeply underlain by rocks of the Precambrian Transvaal Supergroup and more superficially by Quaternary calcrete and alluvial deposits. Transvaal Supergroup rocks of the study area were deposited in the Prieska Sub-Basin comprising the Gaap and overlying Postmasburg groups. The rock formation affected by the proposed expansion development is the Wolhaarkop Formation of the Asbestos Hills Subgroup (Ghaap Group). Most of the study area is covered by superficial Tertiary calcretes and wind-blown deposits of the Quaternary Kalahari Formation.

The Wolhaarkop Formation comprises mainly Precambrian chert breccia which is not known to host fossils. This is overlain by unconsolidated Tertiary and Quaternary sediments and it is very unlikely that any fossils will be present.

The unconsolidated sediments of the Kalahari Formation could potentially also host fossils, but as these are unconsolidated deposits this is improbable. These sediments are in turn underlain by Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup which are not known to host fossils. It is thus recommended that, on palaeontological grounds, the development should proceed. If in the unlikely event that fossils are exposed in the overlying Kalahari Formation 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).

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## Introduction and Brief

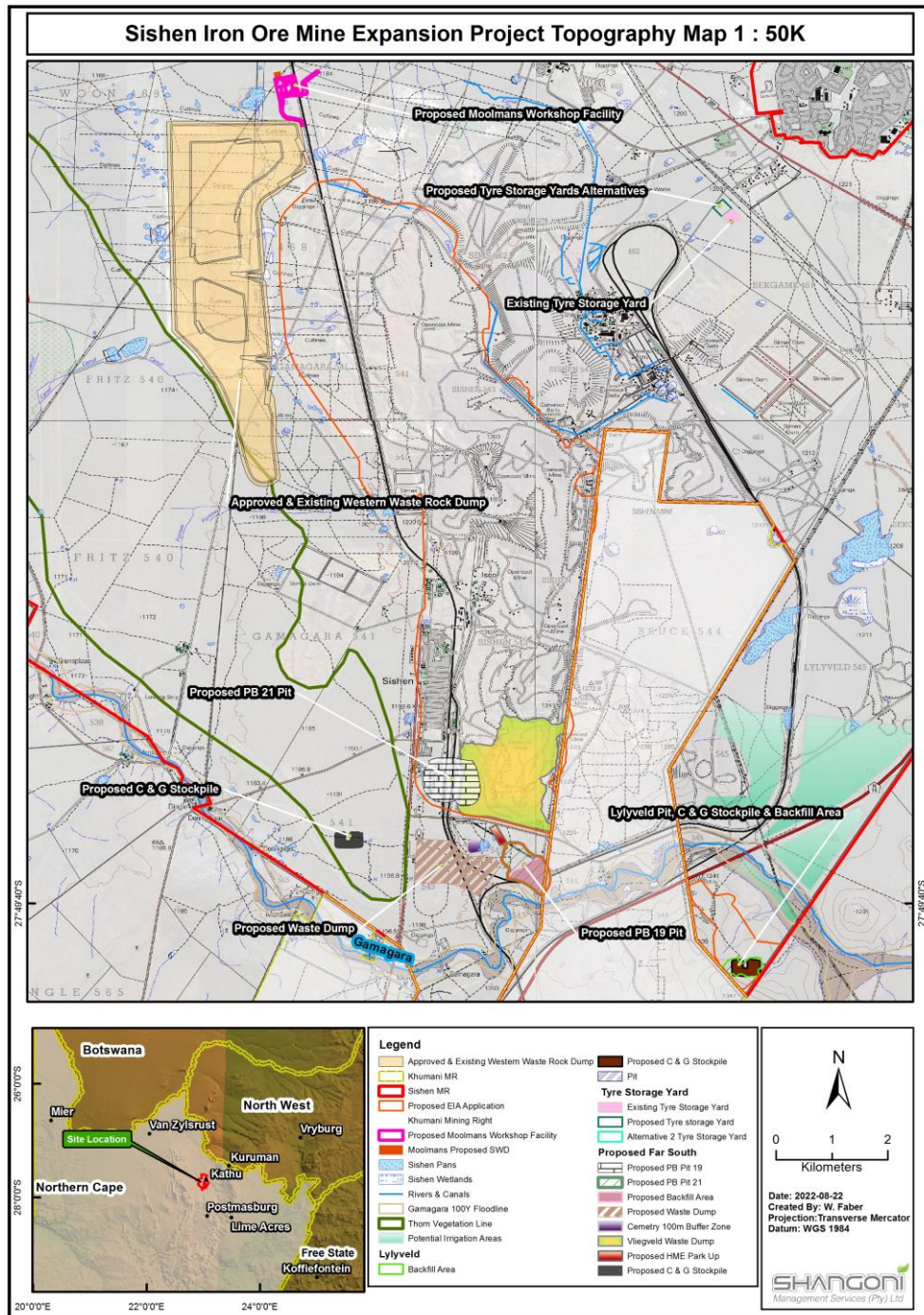


Figure 1: Topographic map (2722) showing the position (areas outlined in thin orange line and pink infill) of the proposed Sishen mining expansion on RE 545 of Lylyveld; Portion 11 of Sacha 458; RE 461 of Sekgame; Portions 16 and 21 of Sishen 543; Portions 19, 21, 22, 25, 27 of Sishen 543; Portion 2 of 541 Gamagara.

A Palaeontological Impact Assessment was requested by Lee-Anne Fellowes of Shangoni Management Services (Pty) Ltd. The proposed expansion of the existing pit, pushback 19 and 21, expansion of the current approved Lyleveld pit, C&G stockpile area, haul roads, and development of a new workshop (Moolmans) which will include a stormwater dam for collection of clean water (Figure 1). The proposed development expansion comprises a total area of about 250 hectares. This report is part of a Heritage Impact Assessment to determine the effect that the proposed expansion of the Sishen Iron Ore Mine 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.

National Heritage is protected by the South African Heritage Resources Act (Act No 25) of 1999. Developers are required to submit development plans to the South African Heritage Resources Agency “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 expansions of the Sishen Iron Ore Mine will take place as follows: Pit on RE 545 of Lylyveld; Moolmans workshop facility on portion 11 of Sacha 458; Tyre Storage Yard on RE 461 of Sekgame; Pit on Portions 16 and 21 of Sishen 543; Reroute telephone line, pipeline and road network on portions 19 and 25 of Sishen 543; pushback of Pit 19 on portions 21 and 22 of Shishen 543; Proposed Pit 21 on RE of Sishen 543; proposed waste rock dump on portion 27 of Sishen 543; HME Parkup on portion 27 of Sishen 543; C & G Stockpile on Portion 2 of 541 Gamagara

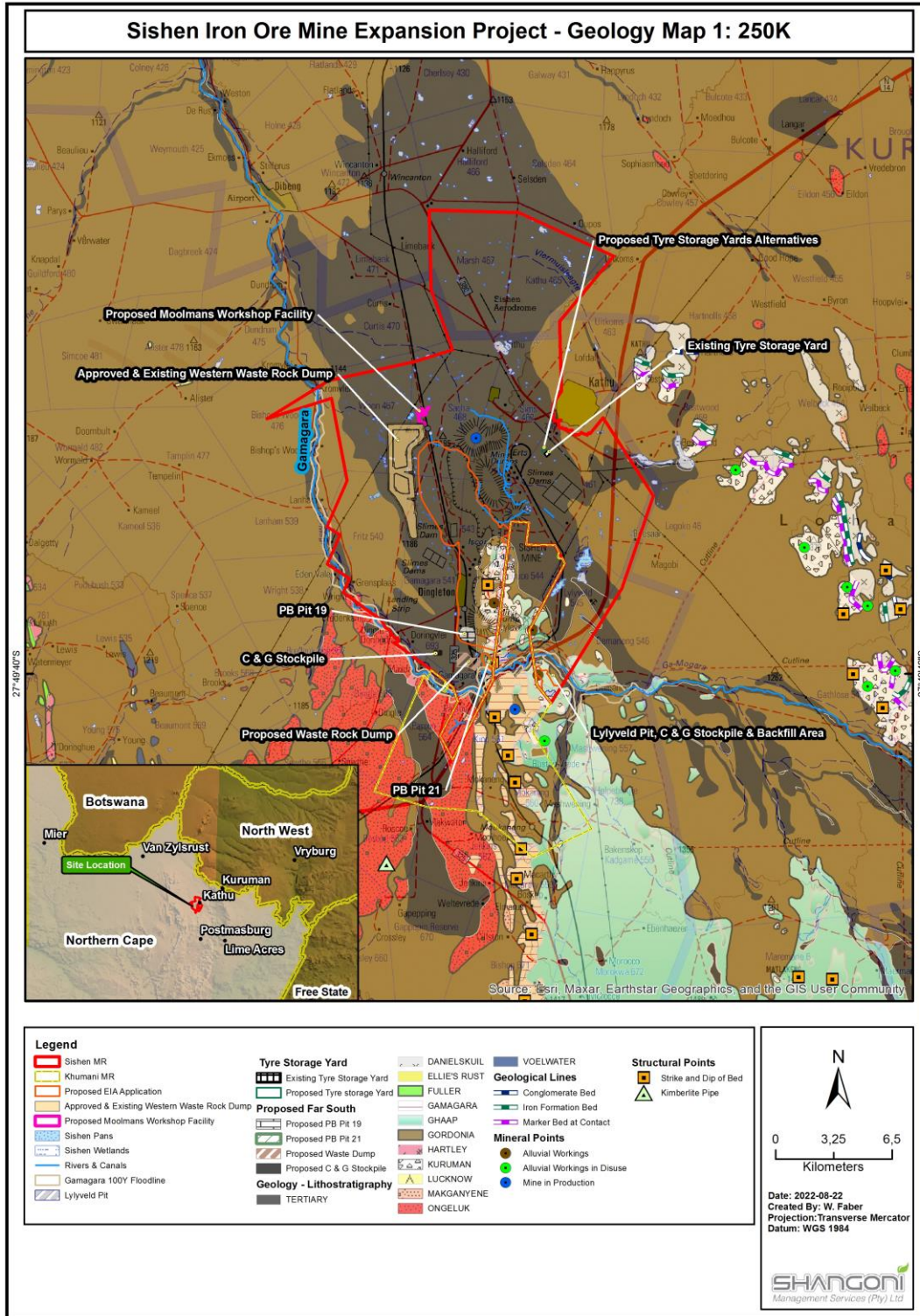


Figure 2: Geological map (2722 Kuruman) showing the position of the study area (areas outlined in thin orange line and pink infill) in relation to the regional geology.

(Figures 1 & 2). The site is situated northwest of the N14 highway between Sishen and Kathu. The study area is covered by the 1:50 000 topographic map 2722 (Figure 1). The proposed development area covers about 250 hectares.

## **Geological Setting**

Based on the 1:250 000 geological sheet, 2722 Kuruman (Figure 2), the study area is deeply underlain by rocks of the Precambrian Transvaal Supergroup and more superficially by Quaternary calcrete and alluvium. The rocks of the Transvaal Supergroup in the study area were deposited in the Prieska Sub-Basin comprising the Gaap and overlying Postmasburg groups. In the Prieska Sub-basin the Ghaap Group comprises (in stratigraphic order) the Schmidtsdrif, Campbell Rand, and Asbestos Hills subgroups. The rock formation affected by the proposed expansion development is the Wolhaarkop Formation of the Asbestos Hills Subgroup (Ghaap Group) which comprises mainly chert breccia. Most of the study area is covered by superficial Tertiary calcretes and wind-blown deposits of the Quaternary Kalahari Formation. (Figure 3).

## **Palaeontological Heritage**

The Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup are not known to host fossils. The overlying unconsolidated Tertiary-Quaternary sediments of the Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. It is thus extremely unlikely that fossils will be found in the study area and be affected by the proposed expansion developments.

## **Methodology**

Inspection of the geological map (2722 Kuruman) and additional supplied geological information indicates that the study area is deeply underlain by Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup. This in turn is overlain by unconsolidated Tertiary and Quaternary sediments which cover most of the study area (Figure 3). Because the sediments and rocks of the study area are not known to contain fossils 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.

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

## **Recommendations**

The Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup which are not known to host fossils and the unconsolidated sediments of

the overlying Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. As the area is of low palaeontological sensitivity it is thus recommended that, on palaeontological grounds, the development should proceed.

In this development there is always the slight possibility that isolated overlying younger deposits could contain fossils. In the unlikely event that fossils are exposed in the alluvial Quaternary deposits it will create a unique opportunity to explore the area for fossils. It is thus recommended that if fossils are exposed as a result of development 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 (See Appendix A – CFP). 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 the South African Heritage Resources Agency (SAHRA).



*Figure 3: Photographs of the study area show the covering of Tertiary - Quaternary sediments which are heavily vegetated.*

### **Conclusion**

The proposed enhancement of the existing Sishen Iron Ore mine comprises the proposed expansion of the existing pit, pushback 19 and 21, development of an existing mine comprises expansion of the current approved Lyleveld pit, C&G stockpile area, haul roads, increasing the height of the existing approved Western Waste Rock dump,



and development of a new workshop (Moolmans) which will include a stormwater dam for collection of clean water.

The area is underlain by Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup which are not known to host fossils and the unconsolidated sediments of the overlying Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. 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 Tertiary - Quaternary overburden 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**

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26 August 2022

## **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 residential and light industrial units development. The following procedure is required if fossils are exposed by excavations.

1. If fossils are exposed by excavation in unconsolidated Quaternary deposits they must be inspected by the environmental officer or designated person.
2. If fossils are noted in the unconsolidated Quaternary sands (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 Sishen expansion project	During the Impact Assessment, it was found that the Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup are not known to host fossils. The overlying unconsolidated Tertiary-Quaternary sediments of the Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. It is thus extremely unlikely that fossils will be found in the study area and be affected by the proposed expansion 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 Sishen expansion project	During the Impact Assessment, it was found that the Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup are not known to host fossils. The overlying unconsolidated Tertiary-Quaternary sediments of the Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. It is thus extremely unlikely that fossils will be found in the study area and be affected by the proposed expansion developments.	Construction	Avoid / Manage	<p>If fossils are exposed by excavation in the Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup they must be inspected by the environmental officer or designated person.</p> <p>If fossils are discovered a registered palaeontologist must be contacted to capture and systematically document the finding. 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