

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED AROAMS  
PROSPECTING RIGHT PROJECT, WITHOUT BULK SAMPLING, NEAR AGGENEYS,  
NORTHERN CAPE PROVINCE**

**Prepared for:**

Environmental Impact Management Services (PTY) Ltd

30 May 2016

Prepared by

**BANZAI ENVIRONMENTAL (PTY) LTD**

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## **EXECUTIVE SUMMARY**

Black Mountain Mining (PTY) Ltd., appointed Environmental Impact Management Services (PTY) Ltd (EIMS) as the independent environmental consulting firm to assist in preparing and submitting, an Environmental Authorisation Application, Basic Assessment Report, Environmental Management Programme as well as an integrated and Affected Party Consultation, in support of a Prospecting Right Application. According to the National Heritage Resources Act (Act No 25 of 1999, section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to assess the impact of the mine and operation of the mining on the palaeontological resources.

The broader area near Aggeneys is underlain by the Mid-Proterozoic (Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province (Bushmanland Group) as well as Cenozoic superficial deposits. The Proterozoic granite-gneiss basement rocks of the Namaqua-Natal Metamorphic Province do not contain any fossils because they are igneous in origin or too highly metamorphosed and their palaeontological sensitivity is similarly low. The low palaeontological sensitivity of the Cenozoic superficial deposits can be attributed to the scarcity of fossil heritage in these deposits. In Palaeontological terms the significance is thus rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.

Thus, the proposed Aroams prospecting right project, may be authorised as the whole extent of the development footprint is not considered as sensitive in terms of palaeontological resources.

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## **1 INTRODUCTION**

Banzai Environmental was appointed by EIMS to conduct the Palaeontological Impact Assessment (PIA) for the proposed Aroams Prospecting Right Project. The Prospecting Right application area is situated, near the Black Mountain-Gamsberg base metal mines. The proposed prospecting activity area is located on Portion 1 of Aroams 57, approximately 8 kilometres northeast of the town of Aggeneys and 48 kilometres west-south-west of the town of Pofadder in the Namaqualand Magisterial District and is approximately 3838.7102Ha in extent.

The area to be prospected in is within ore trucking distance of Black Mountain Mining's existing concentrator plant at Aggeneys. Black Mountain Mining at Aggeneys is presently the only operational mine in the district.

### **1.1 Project Description (Information Provided By EIMS)**

Black Mountain Mining (Pty) Ltd is applying for a prospecting right in order to establish if economically viable mineral deposits exist within the area for the following ferrous and base metals: Copper-, Lead-, Manganese, Nickel, Molybdenum and Zink Ore as well as the precious metals gold and silver. The Bushmanland Group (Namaqua-Natal Metamorphic Province) geological formation will be targeted.

No bulk sampling work will be carried out during the prospecting program. Initial prospecting will be carried out by the company itself, utilizing its own in-house geologists to conduct and oversee the work. Drilling will be outsourced to a local drilling company.

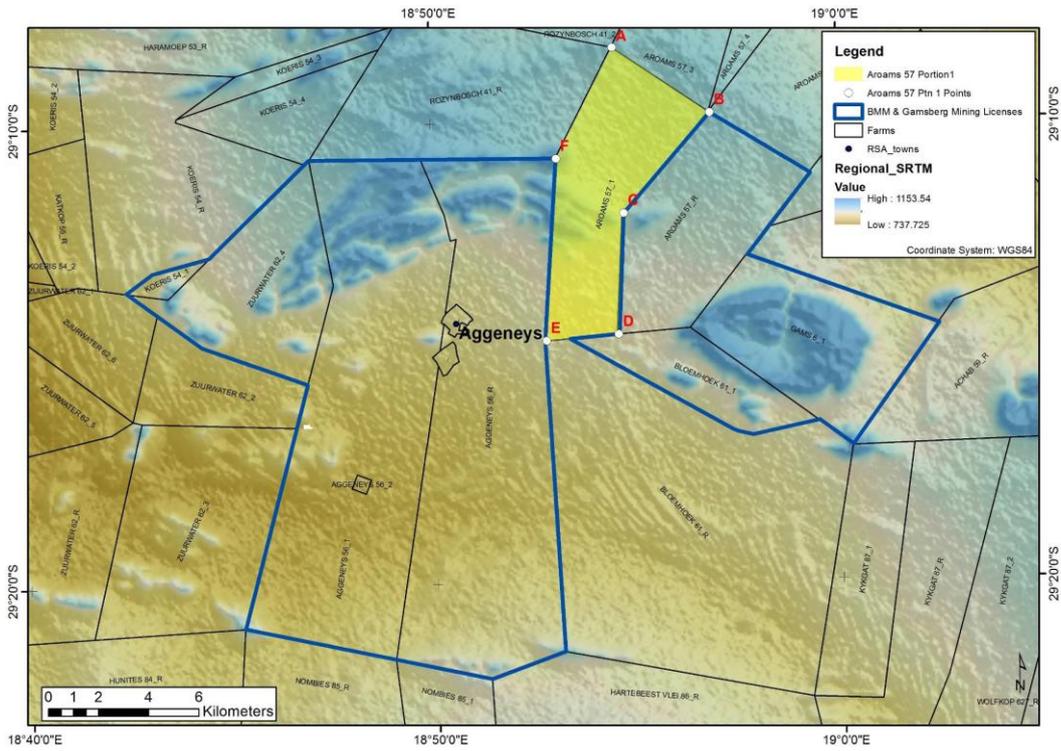
The project will consist off several phases and the different phases and timeframes of the prospecting envisaged are by their nature, dependant on the results obtained during the preceding phases of prospecting. The project will use both non-invasive and invasive prospecting techniques.

#### **1.1.1 Non-Invasive Prospecting Techniques**

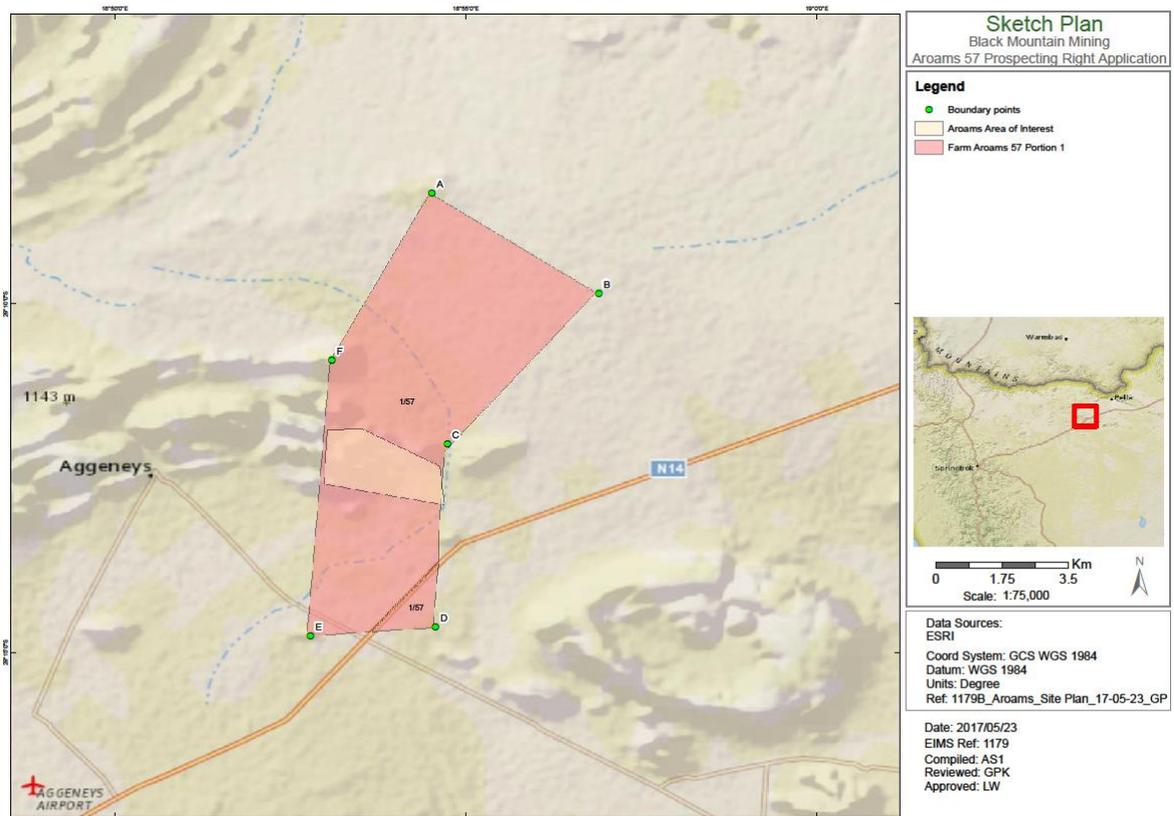
- Desktop Study/Literature Review.
- Geological Field Mapping/Semi-Ground Geophysical Mapping.
- Compilation, Interpretation and Modelling of Data.
- Detailed Ground Geophysical Survey on individual positively mineralized targets to define possible extent.
- Analytical Desktop Pre-Feasibility Study.

### **1.1.2 Invasive Prospecting Techniques**

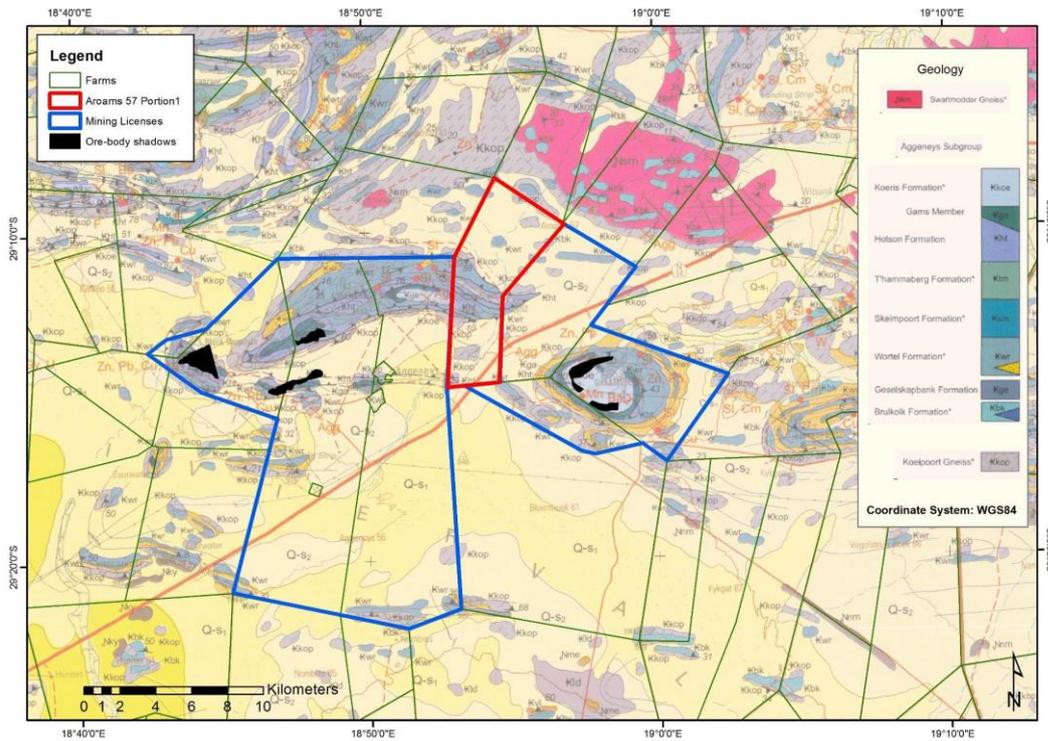
- Exploration Boreholes.
- Boreholes to confirm continuity of mineralization and potential deposit size.
- Resource Definition Drilling.
-



**Figure 1.** Location of the proposed Aroams prospecting project, on portion 1 of Aroams 57, Northern Cape Province in relation to the Black Mountain Mining and Gamsberg Mining licenses. (Map provided by EIMS).



**Figure 2.** Location of the proposed Aggeneys Aroams prospecting project on portion 1 of Aroams 57, Northern Cape Province. Map provided by EIMS.



**Figure 3.** General geology of the proposed Aroams prospecting project on portion 1 of Aroams 57, Northern Cape Province. Map provided by EIMS.

## **2 LEGISLATION**

### **2.1 GENERAL MANAGEMENT GUIDELINES**

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
  - (a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
  - (b) the construction of a bridge or similar structure exceeding 50m in length;
  - (c) any development or other activity which will change the character of a site;-
    - (i) exceeding 5 000 m<sup>2</sup> in extent; or
    - (ii) involving three or more existing erven or subdivisions thereof; or
    - (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    - (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA.SAHRA;
  - (d) the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent; or
  - (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Cultural Heritage in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Environmental Impact Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

### **SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999**

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to

the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

- No person may, without a permit issued by the responsible heritage resources authority—
  - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
  - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
  - trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
  - bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
  - serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order; and/or
  - carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary.

### **3 Objective**

According to the SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports' the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources; and
- To make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is thus to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA) and the EIA Report, to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; fossil sensitivity map; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area on a desktop level. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of the palaeontological sensitivity of the rocks and the nature and scale of the development itself (extent of new bedrock excavated).

If rocks of moderate to high palaeontological sensitivity are present within the study area, a Phase 1 field-based assessment by a professional palaeontologist is necessary. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.

When specialist palaeontological mitigation is suggested, it may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is still exposed and available for study. Mitigation usually involves the careful sampling, collection and recording of fossils as well as relevant data concerning the surrounding sedimentary matrix. Excavation of the fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. With appropriate mitigation, many developments involving bedrock excavation will have a *positive* impact on our understanding of local palaeontological heritage.

## **4 GEOLOGICAL AND PALAEOLOGICAL HISTORY**

### **4.1 GEOLOGY**

The proposed Aroams prospecting project on portion 1 of Aroams 57, Northern Cape Province is in mountainous terrain. The mountains raise some 100m above the plain and are capped by massive white quartzite. The development footprint is underlain by the

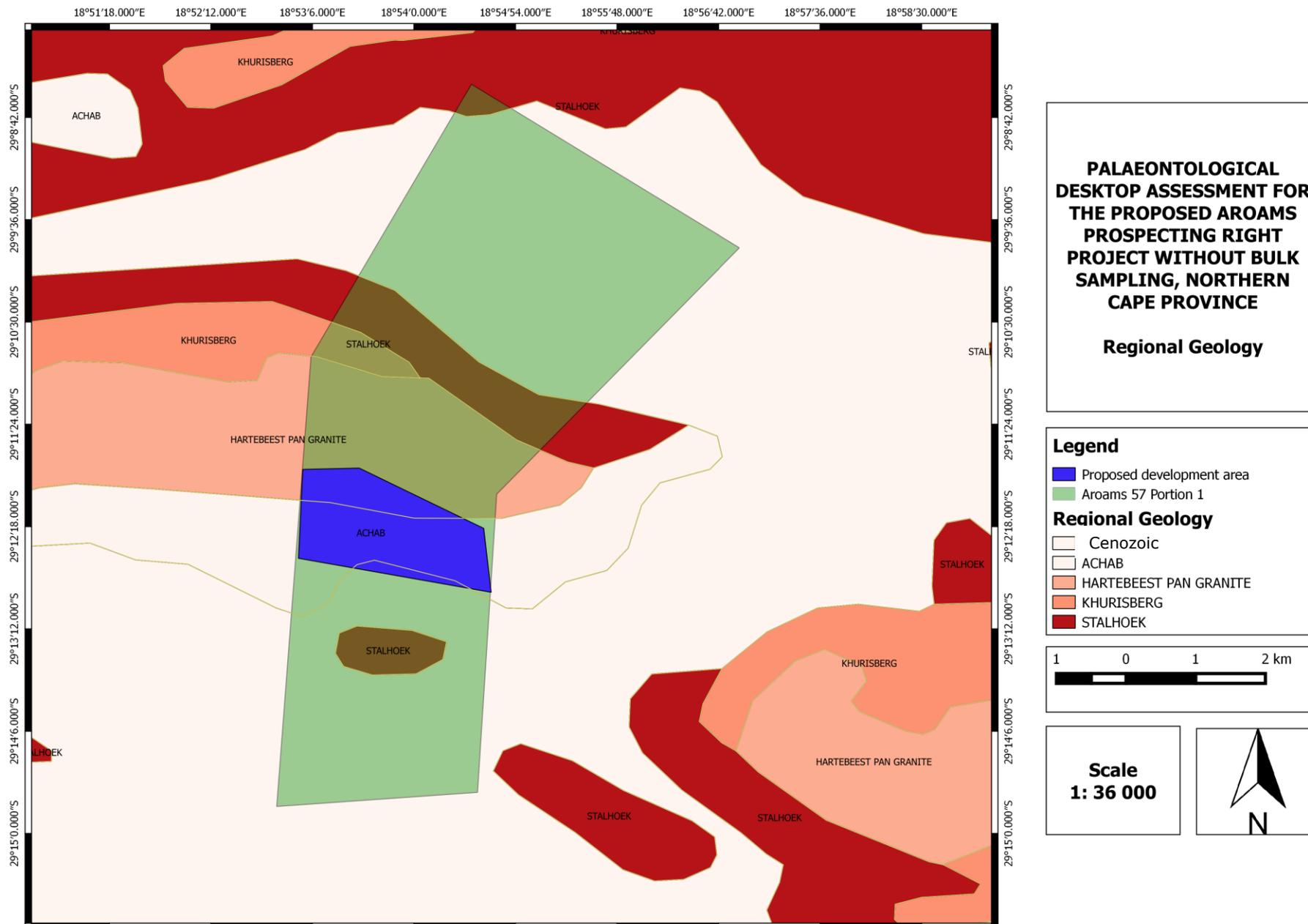
Mid Proterozoic (Mokolian) basement rocks of the **Namaqua-Natal Metamorphic Province (Bushmanland Group)** and **Cenozoic superficial deposits** (Fig 4). The Namaqua-Natal Province is primarily highly metamorphosed sediments and volcanic rocks (e.g. gneisses, schists, quartzites, amphibolites) plus major granitic and gabbroic (norite) intrusions, which are dated between 2050 and 1000 Ma (million years ago; Cornell et al., 2006). The prospecting right development footprint falls in the Achab Suite and Hartebeest pan granite (Keimoes Suite), while the rock successions on the Aroams 57 farm consists of intrusive Stalhoek and Khurisberg Subgroup.

Various types of superficial deposits of Late Caenozoic (Miocene to Pliocene to Recent) age occur throughout the Karoo Basin (Partridge *et al.* 2006). In palaeontological terms the Quaternary superficial deposits have been relatively neglected. They contain pedocretes (e.g. calcretes), colluvial slope deposits, down wasted surface gravels, river alluvium, wind-blown sands as well as spring and pan sediments. Hill slopes are usually covered with a layer of colluvium or slope deposits (for example sandstone and dolerite scree).

#### **4.2 PALAEOLOGY**

The Proterozoic granite-gneiss basement rocks of the **Namaqua-Natal Metamorphic Province** do not contain any fossils because they are igneous in origin or too highly metamorphosed (Almond & Pether 2008), and their palaeontological sensitivity is correspondingly low (Almond & Pether 2008, Almond 2008).

Late Caenozoic superficial deposits may occasionally contain important fossil biotas, e.g. bones, teeth and horn cores of mammals as well as reptiles remains. Non-marine molluscs (bivalves and gastropods), ostrich egg shells, trace fossils (for example calcretised termitaria, coprolites), and plant remains such as peats or palynomorphs in organic-rich alluvial horizons. In pan sediments siliceous diatoms have been recovered. These fossil assemblages are mostly sparse, low in diversity, and occur over a wide geographic area; hence the palaeontological sensitivity of the deposits within the study region is rated as low.



**Figure 4.** The surface geology of the proposed Aroams prospecting project, on portion 1 of Aroams 57, Northern Cape Province. The development footprint is underlain by the Namaqua-Natal Metamorphic Province (Bushmanland Group), and Cenozoic deposits.

## **5 GEOGRAPHICAL LOCATION OF THE SITE**

The Aroams Prospecting Right application area is located between 3km and 12km northeast of the town of Aggeneys, near the Black Mountain-Gamsberg base metal mines. The terrain varies from flat lying plains with poor outcrop of granitic gneiss and slivers of meta-sediments in the south and north to mountainous terrain in the centre.

## **6 METHODS**

### **6.1 ASSUMPTIONS AND LIMITATIONS**

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g.* of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

## **7 FINDINGS AND RECOMMENDATIONS**

The broader area near Aggeneys is underlain by the Mid Proterozoic (Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province (Bushmanland Group), and Cenozoic superficial deposits. The Proterozoic granite-gneiss basement rocks of the Namaqua-Natal Metamorphic Province do not contain any fossils because they are igneous in origin or too highly metamorphosed and their palaeontological sensitivity is

similarly low. The low palaeontological sensitivity of the Cenozoic superficial deposits can be attributed to the scarcity of fossil heritage in this deposits. In Palaeontological terms the significance is thus rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.

Thus, the proposed Aroams prospecting right project, may be authorised as the whole extent of the development footprint is not considered as sensitive in terms of palaeontological resources.

## **8 IMPACT TABLE**

The project phases are Planning, Construction, and Operational as well Decommissioning.

During the Planning phase there will be no impact on the palaeontological heritage in the development footprint thus no impacts will be discussed. There will only be Palaeontological Impacts in the Construction and Operational phases. These impacts will be similar for both phases and will be handled as the same.

### **8.1 METHOD OF ASSESSING IMPACTS:**

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

**Determination of Environmental Risk:** The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\begin{aligned}
 C &= (E+D+M+R)/4 \times N \\
 &= (2+5+2+5)/4 \times -1 \\
 &= 13/4 \times -1 \\
 &= -3.25
 \end{aligned}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 1:

Table 1: Criteria for determination of impact consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes

		are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 2.

Table 2: Probability scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P = -3.25 \times 1 = -3.25$$

**Table 3:** Sensitivity ratings and weighting

Sensitivity Rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1	
Low/Poor	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	0	
High	The proposed development will negatively influence the current status of the feature.	+1	
Very High	The proposed development will negatively significantly influence the current status of the feature.	+2	

Notes:

1. Must provide scored shapefile for entire study area (i.e. every section of the study area must have a score).
2. Must include a written descriptor in the layer regarding the reasons for the equivalent ranking- i.e. must include description of identified spatial point source sensitivities.

Impact Name	Loss of fossil heritage				
Alternative	Alternative 1				
<b>Environmental Risk</b>					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	1	1
Extent	2	2	Reversibility	5	5
Duration	5	5	Probability	1	1
Environmental Risk (Pre-mitigation)					-3.25
Mitigation Measures					
<i>Insert this once pasted into report</i>					
Environmental Risk (Post-mitigation)					-3.25
Degree of confidence in impact prediction:					High
<b>Impact Prioritisation</b>					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
Low: Where the impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
<b>Final Significance</b>					<b>-3.25</b>

**Mitigation Measures:** Should fossil remains be discovered in the Cenozoic Superficial deposits during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional paleontologist

## 9 REFERENCES

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JOHNSON, M.R, ANHAUSSER, C.R and THOMAS, R.J. (Eds.) (2006). *The Geology of South Africa*. Geological Society of South Africa: Johannesburg: Council for Geoscience, Pretoria: Geological Society of South Africa, 691pp.

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PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.). The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

## **10 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR**

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty years and has been conducting Palaeontological Impact Assessments since 2014. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 11 years.

## **11 DECLARATION OF INDEPENDENCE**

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the

public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;

- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

#### Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

#### **PALAEONTOLOGICAL CONSULTANT:**

Banzai Environmental (Pty) Ltd

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