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PALAEONTOLOGICAL IMPACT ASSESSMENT REQUESTED IN TERMS OF SECTION 38 OF THE NATIONAL HERITAGE RESOURCES ACT NO 25/1999 FOR THE MINING RIGHT ON THE REMAINING PORTION OF THE FARM JACOBSFONTEIN (PLAAS 503 / WERDA) NEAR POSTMASBURG IN THE NORTHERN CAPE PROVINCE

Prepared by

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DECLARATION OF INDEPENDENCE

AHSA is an independent consultancy: I hereby declare that I have no interest, be it business, financial, personal or other vested interest in the undertaking of the proposed activity, other than fair remuneration for work performed, in terms the National Heritage Resources Act (No 25 of 1999).

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EXECUTIVE SUMMARY

The proposed mining activity is to take place on the Farm Jacobsfontein 503 (also known as Werda), 30km and 7km south of Daniëlskuil and Lime Acres respectively. The western part of the farm is underlain by the 2.4 billion year old Early Proterozoic banded ironstone of the Daniëlskuil Formation (Asbestos Hills Subgroup, Ghaap Group), while to the east significantly rich palaeontological stromatolitic biotas (microbial mounds, columns and sheets) and microfossil assemblages of Late Archaean to Early Proterozoic Rand Campbell Subgroup (Ghaap Group), 2.6 to 2.4 billion years old have been recorded from underlying sediments in this area. No fossils have so far been formally confirmed from the Daniëlskuil Formation, although microfossils are likely to be present within chert sediments in this unit.

Caution is therefore advised and in the event of discovery of significant finds during mining operations, the Environmental Control Officer (ECO) must take immediate steps to safeguard them *in situ*; SAHRA will be alerted as soon as possible so that appropriate intervention can be taken by a professional palaeontologist.

1. INTRODUCTION

The Van Wyk Diamonds Pty Ltd is applying for a mining right on the farm Jacobsfontein 503 (Werda) near Daniëlskuil in the Hay Local Municipality, Z.T. Mgcawu District Municipality, Northern Cape Province (Fig 1). The farm is located 30km south of Daniëlskuil and 40km southeast of Postmasburg as the crow flies. The report is a palaeontological impact assessment required in terms of the National Heritage Resources Act (No 25 / 1999) and forms the basis of measures which must be to protect fossils of heritage value which are likely to be affected by the mining operations.

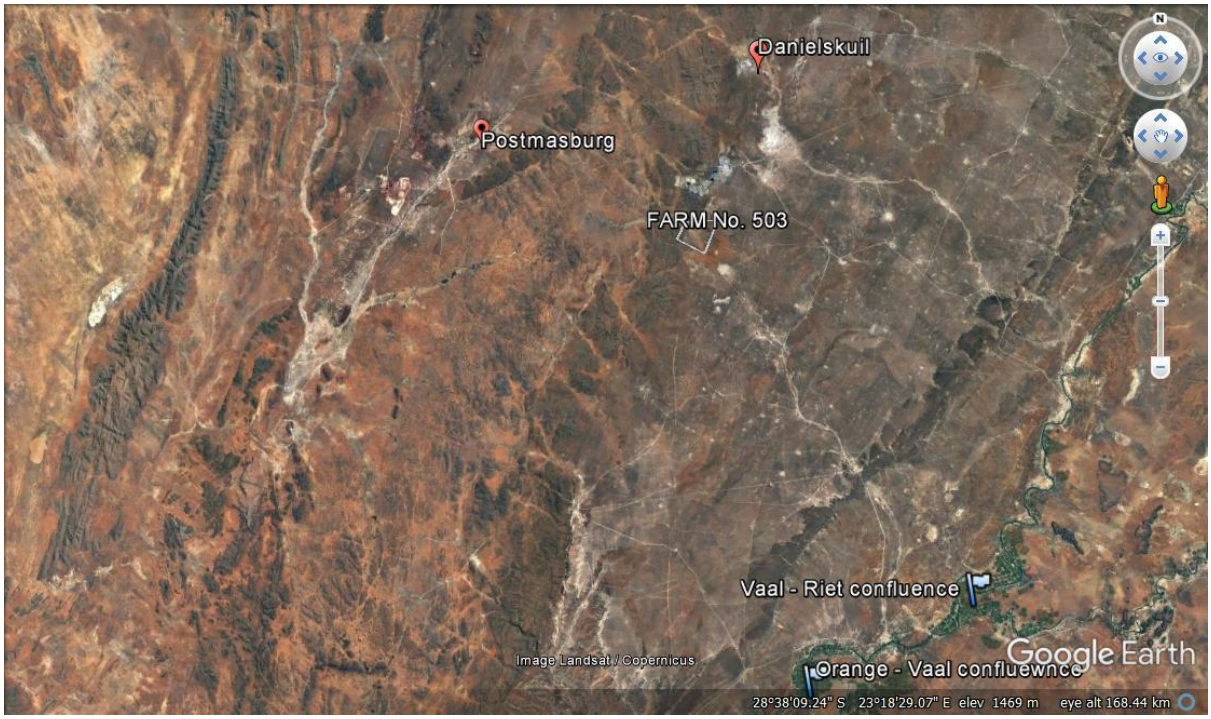

Fig 1. Google-Earth locality map.

1.1. Importance of fossils

Fossils are important from a scientific perspective because they provide evidence for understanding evolution and past environments. There has been heated debate concerning the theory of evolution and over many centuries the church in Europe was conservative and at the front in opposition to theories that over long periods of time life forms have changed. Scientists use fossils to reconstruct body types of plants and animals that no longer exist and put together a "tree of life" to describe the evolutionary relationships between organisms. In the geological provenance in

which fossils are found there lies a “natural museum” in which a few ancient organisms have been preserved. Fossilization is a relatively rare process, yet it nevertheless provides a surprisingly important window into the past and has allowed scientists to put together a picture of the history of life on earth.

The fossil record is better understood if it is placed in a geologic timeframe. The oldest fossils are 3.8 billion years old. But in this long timeline multicellular organisms with skeletons appeared only 580 million years ago.[1]

2. LEGAL FRAMEWORK

This palaeontological impact assessment is guided by the National Heritage Resources Act (No 25 / 1999). In Section 3 terms of the Act heritage resources are defined and protected under the rubric of National Estate which encompasses a no of things including:

(e) geological sites of scientific or cultural importance;

(f) archaeological and palaeontological sites.

In terms of Section 35 (4) of the same act *No person may, without a permit issued by the responsible heritage resources authority—*

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

2. APPROACH AND METHODOLOGY

2.1. Details of specialist

Joseph Chikumbirike is a palaeontologist and member of the Association of Southern African Professional Archaeologists, Palaeontological Society of South Africa (PSSA), and employed as lecturer in the School of Humanities (Heritage) at Sol Plaatje University.

2.2. General approach for palaeontological impact studies

[1] http://sciencing.com/importance-fossils-2470.html (Consulted 25 April 2016); https://www.msnucleus.org/membership/html/k-6/rc/pastlife/6/rcpl6_1a.html (Consulted 25 April 2016)

The potentially fossilferous rock units (groups, formations) found within the study area are determined from geological and palaeontological sensitivity maps. Furthermore several palaeontological impact studies have been conducted in the general area (see references) which confirm the author's own field experience and knowledge of specimen collections at the University of the Witwatersrand where he was a student.

3. GEOLOGICAL CONTEXT

To the west the study area is underlain by Early Proterozoic (c. 2.4 billion year old) banded iron formation of the Daniëlskuil Formation (Asbestos Hills Subgroup, Ghaap Group).This succession forms the upper part of the Late Archaean to Early Proterozoic Ghaap Group of the Griqualand West Basin, Prieska Sub-basin. ((Almond 2013). To the east and south of Lime Acres the area falls within the Campbell Rand Subgroup of the Ghaap Group. This is a thick a very thick (1.6 -2.5 km) carbonate layer of dolomites, dolomitic limestones and cherts with minor tuffs that was deposited on the shallow submerged shelf of the Kaapvaal Craton roughly 2.6 to 2.5 billion years ago. A range of shallow water facies, often forming depositional cycles reflecting sea level changes, are represented here. They include stromatolitic limestones and dolomites, oolites, oncolites, laminated calcilutites, cherts and marls, with subordinate siliclastics (shales, siltstones) and minor tuffs (Almond 2012a & b, 2013, McCarthy & Rubidge, 2005). The Campbell Rand succession has been subdivided into a series of formations, some of which were previously included within the older Schmidtsdrift Formation or Subgroup (Eriksson, et. al., 2006). Exposure levels of these rocks are often very low due to their solubility and low resistance to weathering (Almond, 2012b). The outcrop area of chert-rich subunits is often largely covered in down wasted, siliceous rock rubble (Almond, 2012a). These sedimentary rocks units belong to the Precambrian Age.

Exposures of limestone and banded ironstone deposits have been seen on this farm and its neighbour to the west (Figs 2-4)).

Fig 2. Photo showing some banded ironstone in the area (photo: E. Matenga).

Fig 3. Photo showing sedimentary layers on the slope of the ridge on Jacobsfontein 503 (photo: E. Matenga).

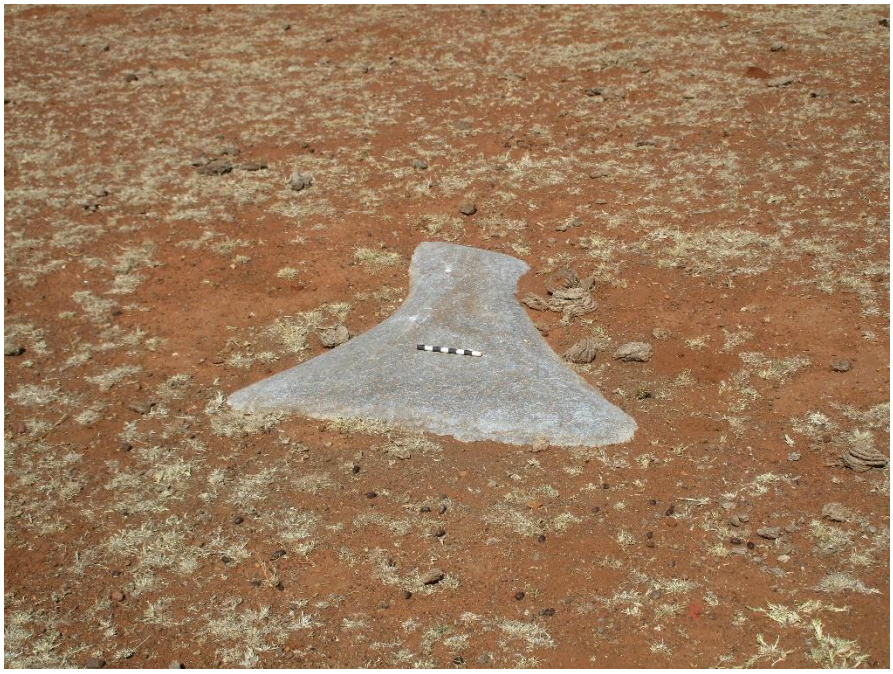

Fig. 4. Limestone outcropping on the northern part of the farm (photo: E. Matenga)

4. PALAEONTOLOGICAL CONTEXT

The Campbell Rand Subgroups is characterised by shallow shelf and intertidal sediments of the carbonate-dominated lower part of the **Ghaap Group** and are known to contain rich fossil biota of stromatolites or microbially-generated, finely-laminated sheets, mounds and branching structures (Almond 2013, p17). Some stromatolite occurrences in the locality of Daniëlskuil. Some of the oldest known (2.6 Ga) fossil microbial assemblages with filaments and coccoids have been recorded from stromatolitic cherty limestones at Lime Acres (Almond 2013, p 17)

Fig 3. Photo showing a possible fossil imprint found below a banded ironstone ridge on the Farm Werda (photo: E. Matenga).

So far no fossils have been formally confirmed from the Early Proterozoic (*c*. 2.4 billion year old) banded iron formation of the Daniëlskuil Formation although this remains a high possibility (see Fig 3) (Almond 2013, p1).

5. CONCLUSION AND RECOMMENDATIONS

The Campbell Rand Subgroup has previously yielded well preserved stromatolites as well as filamentous microfossils. The palaeontological sensitivity of the area is may thus be rated as moderate to high with likelihood of good material around in the area under study. It is therefore recommended that during prospecting and mining the environmental control officer should be aware of the possibility to strike important fossils and a plan put in place to periodically monitor all major excavations

If major fossil finds are discovered, they should be safeguarded preferably *in situ*, a report made to SAHRA so that appropriate mitigation by an expert can be considered and implemented. A **Fossil Finds Procedure** is appended to this report (Annexure A). These recommendations must form part of the environmental management plan (EMP) to be implemented during the mining phase.

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