

# **PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT & RECOMMENDATION FOR EXEMPTION FROM FURTHER STUDIES & MITIGATION**

## **TWO EXISTING BORROW PITS ALONG THE MR268 NEAR MALGAS, OVERBERG DISTRICT MUNICIPALITY, WESTERN CAPE**

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### **1. EXECUTIVE SUMMARY**

Proposed extensions of two existing borrow pits (MR268/37.2/0.03L & MR00268/38.1/0.05R) near Malgas, Overberg District Municipality, will be excavated into mudrocks and impure sandstones of the Ceres Subgroup (Lower Bokkeveld Group) that elsewhere are well known for their rich fossil heritage – especially shelly invertebrates – from the Devonian Period.

However, the Bokkeveld sandstones exposed in this area are highly cleaved and weathered, and their palaeontological sensitivity is correspondingly very low. The Bokkeveld bedrocks are mantled with thick gravelly colluvial deposits of very low palaeontological significance. No fossil remains were recorded at either site during field assessment.

The palaeontological sensitivity of these two sites is rated as VERY LOW and no further palaeontological heritage studies or mitigation are recommended for these projects.

### **2. INTRODUCTION**

The Department of Transport, Western Cape, is applying to the Department of Mineral Resources for approval to exploit road material from two existing borrow pits adjacent to the MR268 dust road near Malgas, Overberg District Municipality, Western Cape.

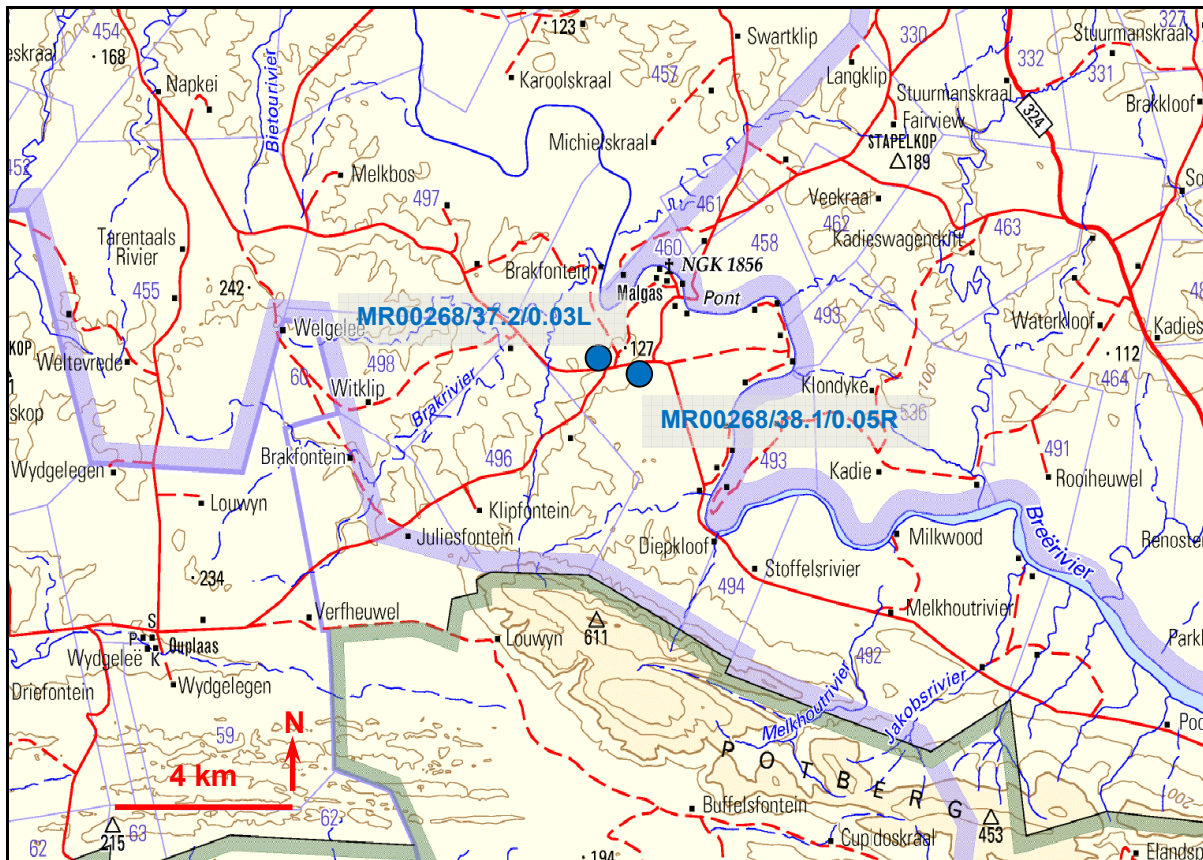
Pit MR268/37.2/0.03L is located just to the west of a cluster of farm buildings about 3 km southwest of Malgas and the Breede River (34°19'2.28" S 20°33'47.88" E; Farm Malgas) (Fig. 1). The pit is situated on the margin of agricultural lands in the rolling hilly *rûens* region of the Overberg at about 100m amsl. The site is on a gentle northwest-facing slope and close to the headwaters of a small NW-flowing tributary of the Breede River drainage system. The area of the proposed extended pit is about 6 500 m<sup>2</sup>. Two small earth dams are present on site (Figs. 3, 4). After exploitation the pit will be rehabilitated with stockpiled topsoil to create a stock and natural fauna watering pond.

The large existing pit MR00268/38.1/0.05R on the farm Malgas 469 is situated at c. 90 m amsl on a gently east-sloping site some 2 km SSW of Malgas (Figs. 1 and 6; 34°18'59.76" S 20°34'33.24" E). It is initially proposed to exploit an area of some 21 000 m<sup>2</sup>, after which stockpiled soil will be used to create a grassy flood-water retention pond.

A previous desktop basic assessment of the two Malgas pit sites by the author assessed their palaeontological heritage sensitivity as moderate to high due to the presence in both instances of potentially fossiliferous mudrocks of the Lower Bokkeveld Group (Ceres Subgroup), with the caveat that the bedrock here is probably highly weathered. A palaeontological field assessment of the two pits as part of an HIA was requested by Heritage Western Cape (HWC case

ref. no. 120130NN19, Interim comment 15 February 2012) in accordance with the requirements of the National Heritage Resources Act, 1999 (Section 38).

The present palaeontological heritage field assessments and short report were accordingly commissioned by Vidamemoria Heritage Consultants, Cape Town (Address: 3<sup>rd</sup> Floor, Guarantee House, 37 Burg Street, Greenmarket Square, Cape Town; tel: 021-424 8432; e-mail: Quahnita@vidamemoria.co.za). These are Vidamemoria pit nos. 72 (MR00268/37.2/0.3L) and 73 (MR00268/38.1/0.05R) and NID ref. no. 56. Fieldwork for this project was carried out on 31 May 2012.



**Fig. 1. Extract from topographical sheet 3429 Riversdale (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the location of the two proposed borrow pit extensions MR00268/37.2/0.03L and MR00268/38.1/0.05R near Malgas, Overberg District Municipality, Western Cape (blue dots).**

### 3. GEOLOGICAL CONTEXT

As shown on the 1: 250 000 geological map 3420 Riversdale (Council for Geoscience, Pretoria; Malan *et al.* 1994) (Fig. 2) the gently hilly *rûens* region of the Overberg region near Malgas is largely underlain by marine sediments of the Early to Middle Devonian **Bokkeveld Group**. Both of the proposed new pit extensions will be excavated into mudrocks and subordinate impure sandstones (wackes) of the **Ceres Subgroup** (Lower Bokkeveld Group) in particular (**Dc**).

The Bokkeveld Group, the middle unit of the Cape Supergroup, is a thick (c. 1.5 to 3.5km) succession of fossiliferous sedimentary rocks which was deposited in shallow marine to coastal settings during the Early to Middle Devonian Period, about 400 to 375 million years ago. These

sediments accumulated on an area of continental shelf – the Cape Basin – which then lay towards the southern edge of the supercontinent Gondwana at moderately high palaeolatitudes (c. 70°S). Key accounts of Bokkeveld Group geology and sedimentology are given by Theron (1972), Tankard and Barwis (1982), Theron and Looek (1988), Theron and Thamm (1990), Theron and Johnson (1991), Broquet (1992) as well as Thamm and Johnson (2006). An outline of the Lower Bokkeveld Group rocks in the Riversdale sheet area is given by Malan *et al.* (1994). Due to extensive drift cover (alluvium, lag gravels, soils) as well as deep weathering and tectonic deformation, outcrops of fresh Bokkeveld bedrock are not available in this area. For these reasons, as well as the southwards thinning of key sandstone marker horizons, it has not proved possible to distinguish individual formations within the Ceres Subgroup for mapping purposes. However, two sandstone-dominated zones are differentiated on the 1: 250 000 geology map (stippled areas, Fig. 2). The Bokkeveld Group rocks in the study area are folded on both large and small scales and also transected by faults. As a consequence of the Cape-age folding and these faults, high levels of tectonic deformation are widespread in the southern Overberg region. Chemical weathering processes beneath an ancient coastal land surface (pediment), capped elsewhere in the Malgas area by cobbly alluvial gravels and silcretes, have been facilitated by tectonic cleavage development as well as high levels of groundwater movement through the fault zone. As a result, the originally dark mudrocks have been extensively altered, in some cases to white-weathering kaolinite (China clay), and impregnated with secondary iron / manganese minerals.

Outside the two small dams, bedrock exposure within the MR00268/37.2/0.03L pit study area is minimal due to extensive cover by reddish-brown gravelly colluvial soils (Fig. 3). Surface gravels consist mainly of Bokkeveld wackes, siltstone and vein quartz. Steeply and variably dipping, thin-bedded greyish-green wackes and laminated siltstones are exposed in the margins of the more easterly dam on site (Figs. 4 & 5). The Bokkeveld beds here are affected by intensive folding as well as a well-developed tectonic cleavage.

The large existing MR00268/38.1/0.05R pit near Malgas is excavated into reddish-brown, gravelly colluvial superficial deposits; Bokkeveld bedrock is not exposed even in the floor of the pit, so the gravels must be several meters thick (Figs. 6, 7). The gravel clasts consist of vein quartz, Bokkeveld wackes and occasional Table Mountain Group quartzite boulders *plus* minor silcrete and ferricrete; the latter locally contain large cubical pseudomorphs after pyrite (Fig. 8).

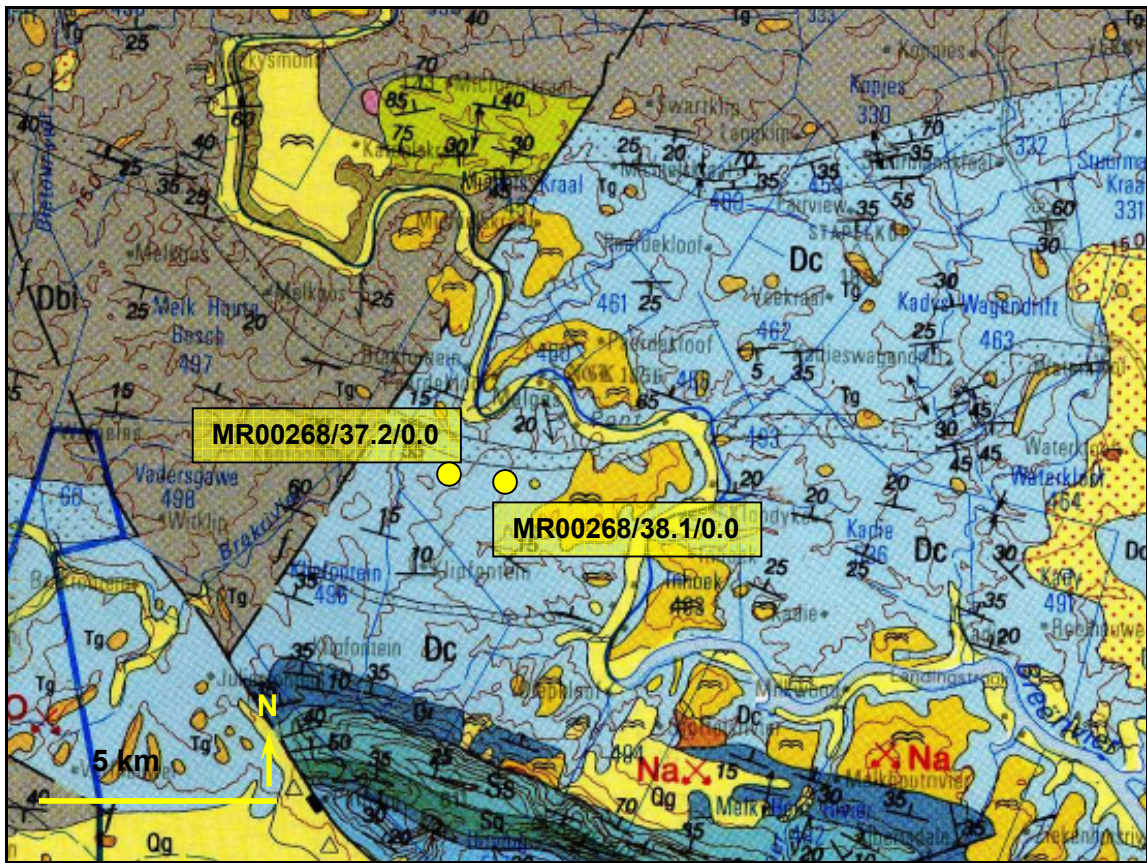


Fig. 2. Extract from 1: 250 000 geology sheet 3420 Riversdale (Council for Geoscience, Pretoria) showing the approximate location of the two proposed borrow pit extensions near Malgas, Overberg District Municipality (yellow dots). The pits are both excavated into marine sediments of the Lower Bokkeveld Group / Ceres Subgroup (Dc, pale blue).



**Fig. 3.** View westwards across the study area for pit MR00268/37.2/0.03L near Malgas. Note lack of bedrock exposure due to extensive cover by gravelly colluvial silty sand.



**Fig. 4.** Small exposure of steeply south-dipping Ceres Subgroup wackes (impure sandstones) and siltstones on the margins of the easternmost dam within the MR00268/37.2/0.03L pit study area.



**Fig. 5. Detail of thin-bedded, tectonically cleaved Ceres Subgroup wackes seen in previous illustration (Hammer = 27 cm).**



**Fig. 6. View towards the southwest across large existing pit MR00268/38.1/0.05R near Malgas, with Potberg Range (Table Mountain Group) in the background.**



**Fig. 7.** Detail of gravelly superficial deposits in pit area, somewhat concentrated near-surface by downwasting processes (Hammer = 27 cm).



**Fig. 8.** Ferricrete clast from superficial gravelly deposits showing large cubical pseudomorphs after pyrite crystals (Scale in cm and mm).

#### 4. PALAEOLOGICAL HERITAGE

The lower part of the **Bokkeveld Group** in the Western Cape (Ceres Subgroup *plus* lowermost Bidouw Subgroup) is known for its rich fossil assemblages of shallow marine invertebrates of the Malvinokaffric Faunal Province of Gondwana (Cooper 1982, Oosthuizen 1984, Hiller & Theron 1988, Theron & Johnson 1991, MacRae 1999, Almond *in De Beer et al.* 2002, Thamm & Johnson 2006, Almond 2008). Key fossil groups here include trilobites, brachiopods, various subgroups of molluscs (bivalves, gastropods, nautiloids *etc*), and echinoderms (starfish, brittle stars, crinoids, carpoids, sea cucumbers *etc*), with several minor taxa including corals, conulariids, tentaculitids and rare fish remains, among others (Almond 1997, Anderson *et al.* 1999). These shelly fossil assemblages – generally preserved as impressions or moulds, but occasionally in the Gydo Formation also embedded within phosphatic or siliceous nodules – are especially abundant within the mudrock-dominated units such as the Gydo, Voorstehoek and Waboomberg Formations in their more distal (offshore) outcrop areas. Thin lenticles of shelly debris, known as *coquinas*, have been concentrated by storm activity and mainly consist of disarticulated specimens.

No shelly fossils were observed during the field studies of Lower Bokkeveld Group sandstones and mudrocks in the Swellendam area, some 30 km NNW of Malgas, by Almond (2010a, 2010b). Malan *et al.* (1994) only record lycopod (clubmoss) and psilophyte plant impressions, indeterminate trace fossils and occasional crinoid moulds within sandstones of the Ceres Subgroup in the Riversdale sheet area. The rarity of Bokkeveld fossil records here may be attributed to several factors, notably:

- deep chemical weathering of sediments beneath the “African Surface” which has obliterated fossil moulds;
- intensive tectonic deformation of the Bokkeveld succession, with pervasive cleavage formation within the normally fossiliferous mudrocks (*N.B.* Most fossils are preserved and seen on bedding planes, which are rarely exposed here, rather than secondary cleavage planes which cut across fossil-rich layers);
- the extensive mantle of drift deposits (including lag gravels, soil and pedocretes) covering the Bokkeveld bedrock

No shelly or trace fossils were observed at either of the two MR268 pit sites near Malgas during field assessment.

**The palaeontological sensitivity of these two sites is rated as VERY LOW.**

#### 5. CONCLUSIONS & RECOMMENDATIONS

Proposed extensions of two existing borrow pits (MR268/37.2/0.03L & MR00268/38.1/0.05R) near Malgas, Overberg District Municipality, will be excavated into mudrocks and impure sandstones of the Ceres Subgroup (Lower Bokkeveld Group) that elsewhere are well known for their rich fossil heritage – especially shelly invertebrates – from the Devonian Period.

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## 6. ACKNOWLEDGEMENTS

Ms Quahnita Samie of Vidamemoria Heritage Consultants, Cape Town, is thanked for commissioning this specialist study and for kindly providing the necessary background information. I am grateful to Madelon Tusenius for assistance and companionship in the field.

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## 8. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Assessment Practitioners – Western Cape).

## **Declaration of Independence**

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed borrow pit project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



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