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

PROPOSED EXTENSION OF A BORROW PIT BETWEEN LAINGSBURG & MERWEVILLE, LAINGSBURG DISTRICT, WESTERN CAPE (FARM KOEËLFONTEIN 59)

John E. Almond PhD (Cantab.)
***Natura Viva* cc,**
PO Box 12410 Mill Street,
Cape Town 8010, RSA
naturaviva@universe.co.za

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1. EXECUTIVE SUMMARY

The proposed extension of the existing borrow pit site MR00374/24.5/0.2L on Farm Koeëlfontein 59 along the MR374 dust road between the N1 and Merweville in the Koup region of the Great Karoo (Laingsburg District, Western Cape) will be excavated into potentially fossiliferous fluvial sediments of the Abrahamskraal Formation (Lower Beaufort Group) as well as overlying thick alluvial outwash deposits that are of very low palaeontological sensitivity.

Given the paucity of fossil material observed during field assessment of available exposures of Beaufort Group bedrocks close to the pit site, the palaeontological sensitivity of the pit site is assessed as LOW. While it is possible that vertebrate and other fossil remains may be exposed during excavation of the pit area, the anticipated low density of fossil material subsurface does not warrant special mitigation measures or further studies.

No further palaeontological heritage studies or mitigation are recommended for this project.

2. INTRODUCTION

The Department of Transport, Western Cape, is applying to the Department of Mineral Resources for approval to exploit road material from an existing borrow pit on the Farm Koeëlfontein 59, some 40 km southwest of Merweville in the Koup region of the Great Karoo (Laingsburg District, Western Cape). The site lies just to the north of the MR374 dust road that runs between the N1 trunk road and the small town of Merweville (Fig. 1). The terrain here is typical semi-arid Karoo *veld* with rocky ridges and valleys drained by intermittently flowing water courses. The existing pit MR00374/24.5/0.2L on Farm Koeëlfontein 59 is located at about 745m amsl on the northern flank of an east-west rocky ridge and 150 m south of a small, intermittently flowing water course (32°58'10.56" S 21°18'14.04" E) (Fig. 3).

A previous desktop basic assessment of the the pit site by the author assessed its palaeontological heritage sensitivity as high due to the presence here of potentially fossiliferous sediments of the Lower Beaufort Group (Abrahamskraal Formation). A palaeontological field assessment of the pit sites as part of an HIA was requested by Heritage Western Cape (HWC case ref. no. 111124JB48, Interim comment 1 December 2011) in accordance with the requirements of the National Heritage Resources Act, 1999 (Section 38).

The present palaeontological heritage field assessment and short report were accordingly commissioned by Vidamemoria Heritage Consultants, Cape Town (Address: 3rd Floor, Guarantee

House, 37 Burg Street, Greenmarket Square, Cape Town; tel: 021-424 8432; e-mail: Quahnita@vidamemoria.co.za). This is Vidamemoria pit no. 111 (MR00374/24.5/0.2L) and NID ref. no. 43. Fieldwork for this project was carried out on 2 June 2012.

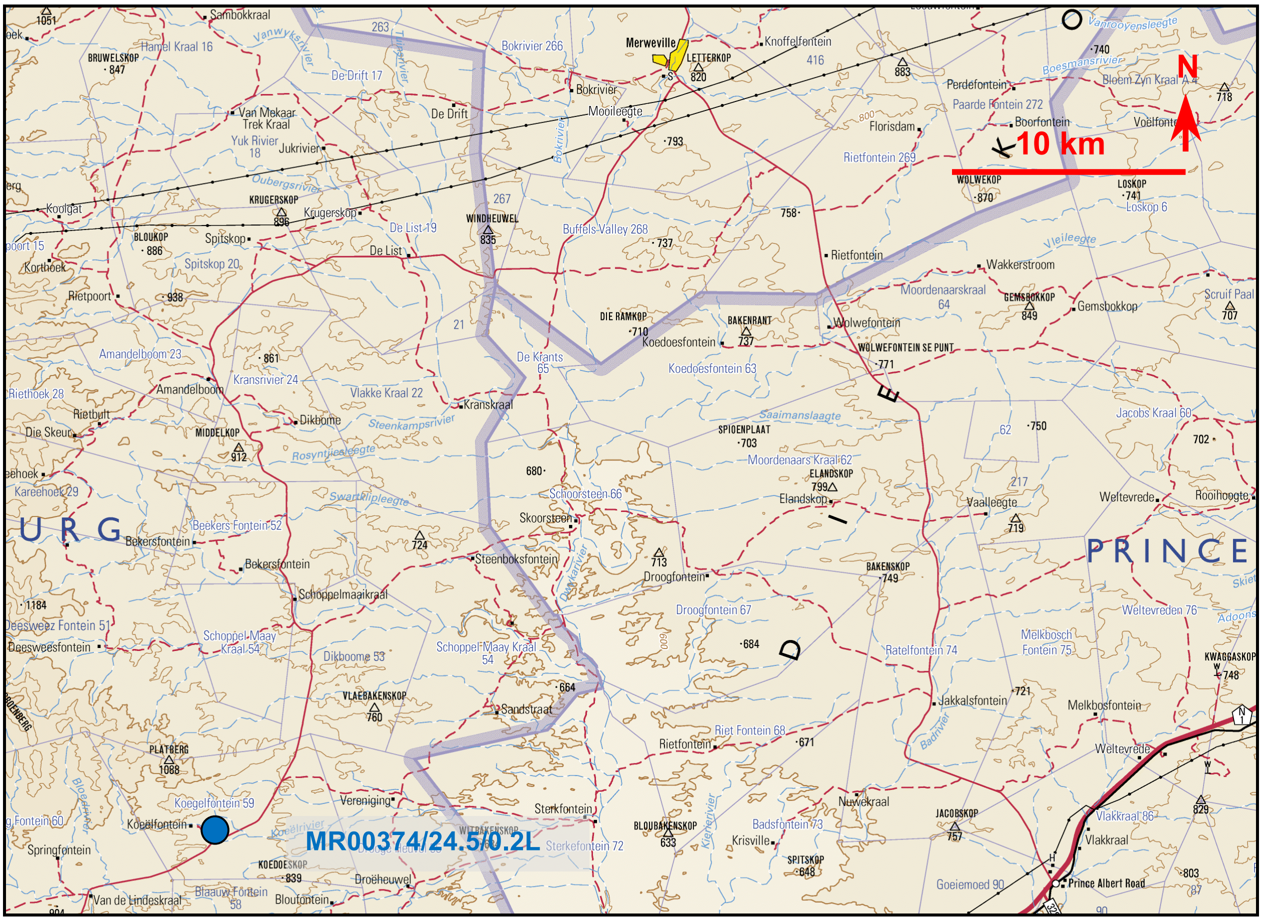

Fig. 1. Extract from topographical sheet 3220 Sutherland (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the location of the the existing borrow pit site MR00374/24.5/0.2L along the MR374 dust road linking the N1 trunk road and Merweville, Laingsburg District, Western Cape (blue dot).

3. GEOLOGICAL CONTEXT

The geology of the study area is shown on 1: 250 000 sheet 3220 Sutherland (Fig. 2) (Theron 1983, Cole & Vorster 1999). It is underlain by continental sedimentary rocks of the **Abrahamskraal Formation** (**Pa**) (Lower Beaufort Group / Adelaide Subgroup, Karoo Supergroup) of Middle Permian age. The Abrahamskraal succession consists of a wide range of fluvial deposits, including river channel sandstones and minor intraformational breccio-conglomerates, well-bedded floodplain mudrocks with common pedocrete horizons (ancient soils) and sheet-like crevasse splay sandstones, as well as more localized playa lake deposits (*e.g.* laminated mudrocks) (Rossouw & De Villiers 1952, Johnson & Keyser 1979, Smith & Keyser 1995, Loock *et al*., 1994, Johnson *et al*., 2006).

A thickness of several meters of fine gravelly alluvial outwash, sourced from a stream valley to the west, is exposed in the existing borrow pit MR00374/24.5/0.2L on Farm Koeëlfontein 59 (Fig. 4). The surrounding veld is mantled with poorly-sorted surface gravels (mainly fine-grained Beaufort Group sandstones) that have been modified by downwasting and sheet wash processes (Fig. 3). These superficial deposits overlie a pediment of Abrahamskraal Formation bedrock that is nowhere

exposed in the pit area. However, good exposures of steeply north-dipping grey-green and purple-brown overbank mudrocks as well as channel sandstones are seen in road cuttings along the MR374 some 100 m south of the pit site (Fig. 3).

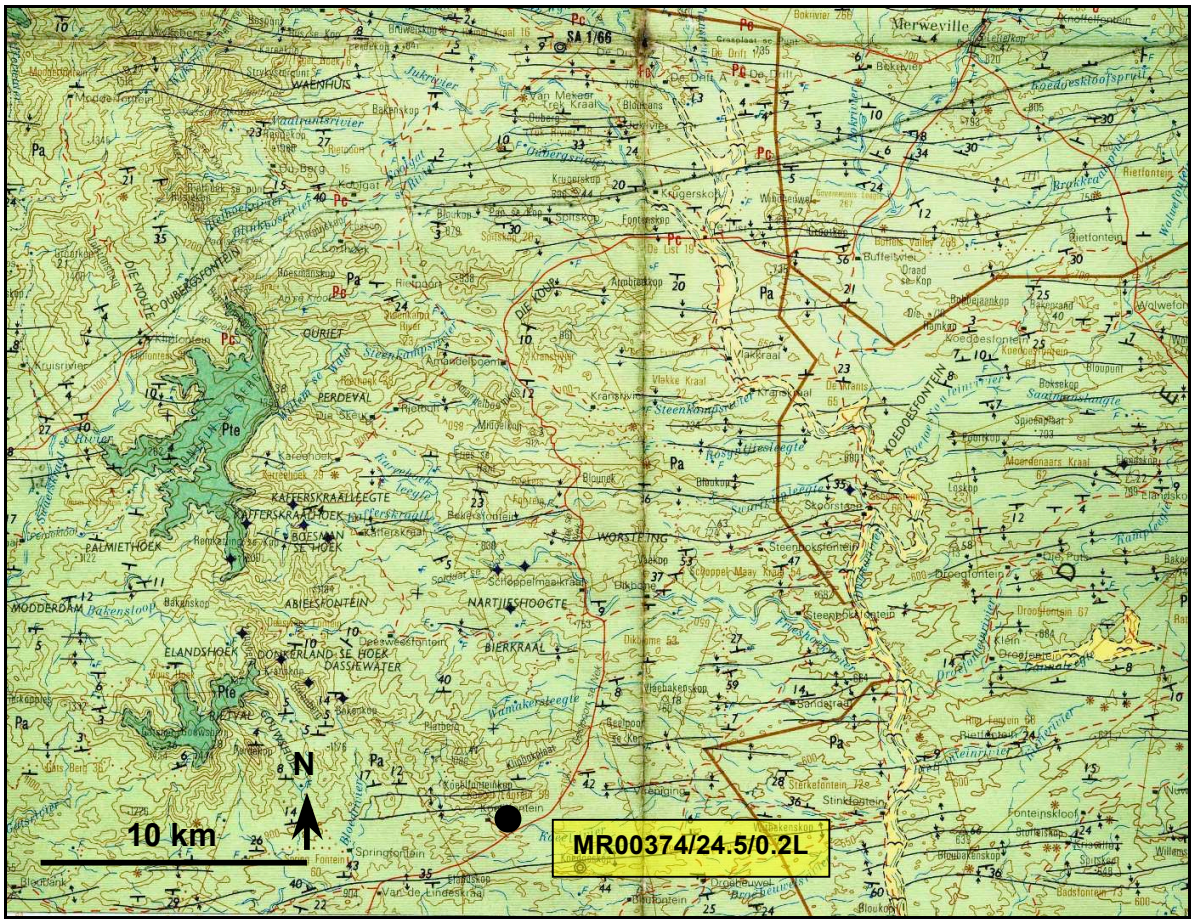

Fig. 2. Extract from 1: 250 000 geology sheet 3220 Sutherland (Council for Geoscience, Pretoria) showing location of the existing MR00374/24.5/0.2L borrow pit study site along the MR374 between the N1 and Merweville (town shown on the NE edge of map). The pit will be excavated into the Abrahamskraal Formation (Adelaide Subgroup, Lower Beaufort Group) (Pa, yellow-green) and overlying superficial deposits. The map indicates several vertebrate fossil sites of the *Tapinocephalus* Assemblage Zone, especially to the northwest of the pit site (diamond symbols).

Fig. 3. View southwards across the existing MR00374/24.5/0.2L borrow pit study site showing banked up alluvial outwash around the margins of the pit. Note downwasted surface gravels of Beaufort Group sandstone in the foreground and exposures of steeply dipping Abrahamskraal Formation beds in the road cutting in the background.

Fig. 4. Banked up fine-grained, gravelly alluvial outwash on the margins of the existing pit MR00374/24.5/0.2L. Abrahamskraal Formation bedrocks are not exposed in the pit floor due to thick superficial sediment cover.

4. PALAEONTOLOGICAL HERITAGE

Apart from the uppermost 50m or so of beds directly underlying the Poortjie Member sandstones, the Abrahamskraal Formation has been assigned in biostratigraphical terms to the *Tapinocephalus* Assemblage Zone, dated to around 266-260 Ma (Rubidge 1995, 2005). The fossil biota of the *Tapinocephalus* Assemblage Zone, with particular reference to the biostatigraphically important tetrapod fauna, has been reviewed by Smith and Keyser *in* Rubidge (1995) as well as in earlier works by Rossouw and De Villiers (1952), Boonstra (1969), Keyser and Smith (1979) and others (See also MacRae, 1999 for a well-illustrated popular account). Many individual fossil localities are indicated on published geological maps such as 1: 125 000 sheet 198 Merweville, 1: 250 000 sheets 3222 Beaufort West and 3220 Sutherland, as well as maps in Keyser & Smith (1979) and Loock *et al*. (1995) (See diamond symbols in Fig. 2).

The fauna of the *Tapinocephalus* Assemblage Zone is dominated by two groups of large-bodied tetrapods. The dinocephalians are primitive therapsids that include the large-bodied, thick-skulled herbivorous or omnivorous tapinocephalids (*e.g. Moschops*) as well as much rarer carnivorous anteosaurs (*Anteosaurus*). Pareiasaurs are a group of heavily-armoured herbivores belonging to the primitive reptile subgroup, the Captorhinida (*e.g. Bradysaurus*). Some 18 genera and 30 species of dinocephalians alone have been described from this assemblage zone. However, many of these taxa are based on very incomplete or deformed material, and ongoing research is likely to whittle down their true biodiversity to more realistic levels, particularly when ontogenetic variation and sexual dimorphism are taken into account). Other important tetrapod taxa represented in the same Lower Beaufort Group assemblages are (c) two groups of carnivorous therapsids, the therocephalians and gorgonopsians, the former of which are quite common and diverse; (d) small-bodied herbivorous dicynodonts, including some primitive toothed genera as well as the long-ranging *Diictodon*, (e) rare varanopid pelycosaurs (primitive synapsids, *e.g. Elliotsmithia*), biarmosuchians (primitive therapsids), the tortoise-like captorhinid *Eunotosaurus*, and large, crocodile-like temnospondyl amphibians (*Rhinesuchus*). Since the brief faunal review by Smith and Keyser *in* Rubidge (1995), a number of new tetrapod taxa have been described from the Abrahamskraal Formation, notably by Professor Bruce Rubidge of the BPI (Wits University, Johannesburg) and colleagues. Concentrations of transported plant debris are sometimes associated with uranium minerals within the Abrahamskraal sandstones. These plant-rich zones are often also enriched in ferruginous carbonate forming a dark brown rock locally known as *koffieklip* (Cole *et al.* 1998).

No fossil material was recorded from pit site MR00374/24.5/0.2L on Farm Koeëlfontein 59 or nearby roadcuttings through the Abrahamskraal Formation. The alluvial outwash gravels exposed in the pit are of very low palaeontological sensitivity.

5. CONCLUSIONS & RECOMMENDATIONS

The proposed extension of the existing borrow pit site MR00374/24.5/0.2L on Farm Koeëlfontein 59 along the MR374 dust road between the N1 and Merweville in the Koup region of the Great Karoo (Laingsburg District, Western Cape) will be excavated into potentially fossiliferous fluvial sediments of the Abrahamskraal Formation (Lower Beaufort Group) as well as overlying thick alluvial outwash deposits that are of very low palaeontological sensitivity.

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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.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**