

## PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT

# DEVELOPMENT OF AN EXISTING BORROW PIT ON REMAINDER OF FARM 365 (ELIM BERG) ALONG THE DR1458 NEAR PRINCE ALFRED HAMLET, WITZENBERG DISTRICT, WESTERN CAPE

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## 1. EXECUTIVE SUMMARY

The existing DR01458/4.25/R/500 borrow pit and its proposed extension on the Remainder of Ceres Farm No. 365 (Elim Berg), situated approximately 6.5 km east of the village of Prince Alfred Hamlet, Witzenberg District, Western Cape, overlies Middle Devonian marine mudrocks of the Tra Tra Formation (Bokkeveld Group, Ceres Subgroup). This formation has yielded assemblages of shelly invertebrate fossils elsewhere in the Warm Bokkeveld region (e.g. Waboomberg / Theronsberg Pass area northeast of Ceres), but only sparse, small nuculid bivalves and possible vertical burrows are recorded from the Prince Alfred Hamlet area. Due to extensive chemical weathering of the bedrocks the palaeontological sensitivity of the study site is rated as LOW. Therefore, pending the discovery of substantial new fossil material such as shelly fossil, fish or plant remains, no further mitigation of fossil heritage for this borrow pit development is recommended.

## 2. INTRODUCTION

The Department of Transport, Western Cape, is applying to the Department of Mineral Resources for approval to exploit road material from and to extend an existing borrow pit located along unpaved road DR1458 that runs along the southern side of the Gydoberg – Waboomberg range near the town of Ceres in the Warm Bokkeveld region (Witzenberg District), Western Cape (Figs. 1 & 2). The existing large borrow pit **DR01458/4.25/R/500** (= Vidamemoria Pit No. 3) lies on the Remainder of Ceres Farm No. 365 (Elim Berg) approximately 6.5 km east of the village of Prince Alfred Hamlet. The pit is situated at around 575 m amsl on a gentle south-facing hill slope surrounded by agricultural land (33° 17' 57.7" S, 19° 24' 02.4" E) and is currently modified as a farm dam.

A previous desktop basic assessment of the borrow pit site by the author assessed its palaeontological heritage sensitivity as moderate due to the presence here of potentially fossiliferous sediments of the Lower Bokkeveld Group (Ceres Subgroup). A palaeontological field assessment of the pit site as part of an HIA was requested by Heritage Western Cape (HWC case 1932 – 2045 ref 120726TS26, Interim Comment 15 August 2012) 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: 3<sup>rd</sup> Floor, Guarantee House, 37 Burg Street, Greenmarket Square, Cape Town; tel: 021-424 8432; e-mail: Quahnita@vidamemoria.co.za). Fieldwork for this project was carried out on 2 December 2012.

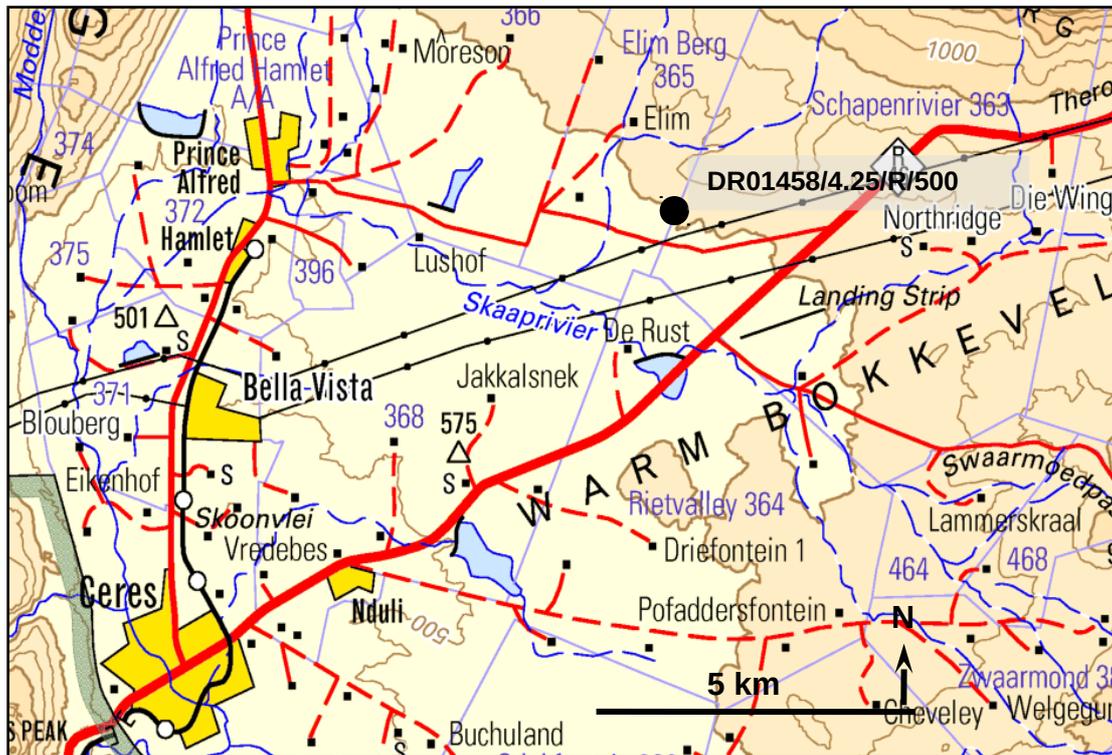


Fig.1. Extract from 1: 250 000 topographical sheet 3319 Worcester (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the location of the existing borrow pit site DR01458/4.25/R/500 along the DR1458 c. 6.5 km east of Prince Alfred Hamlet, Western Cape.

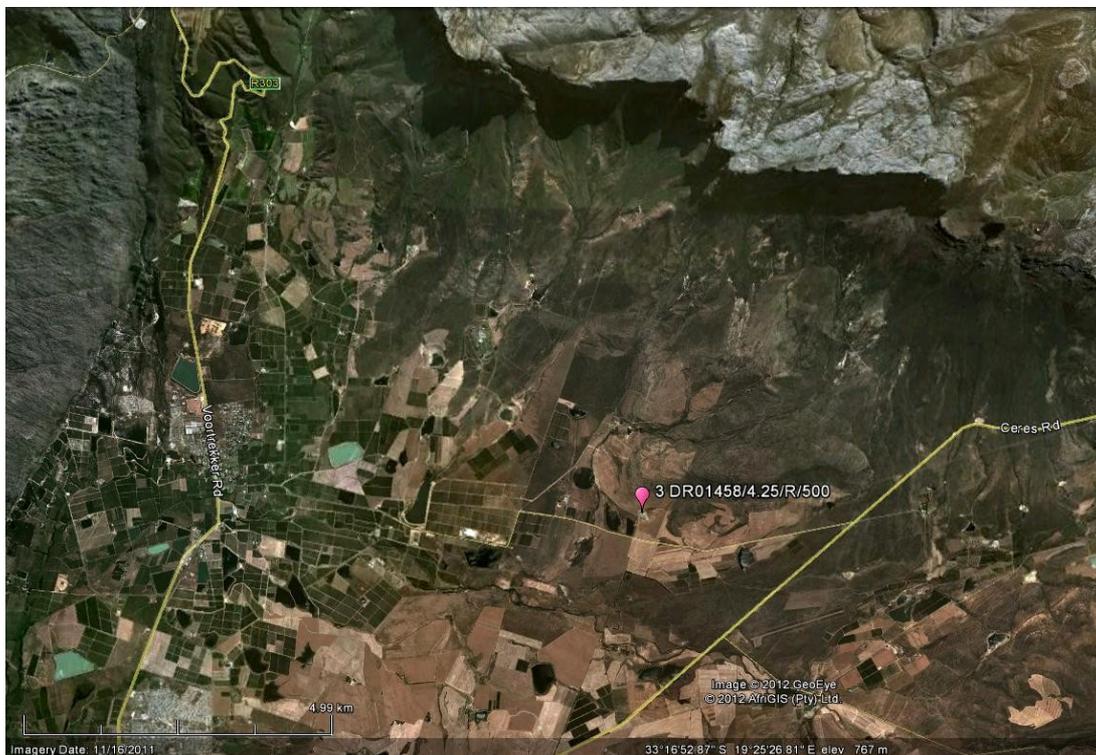
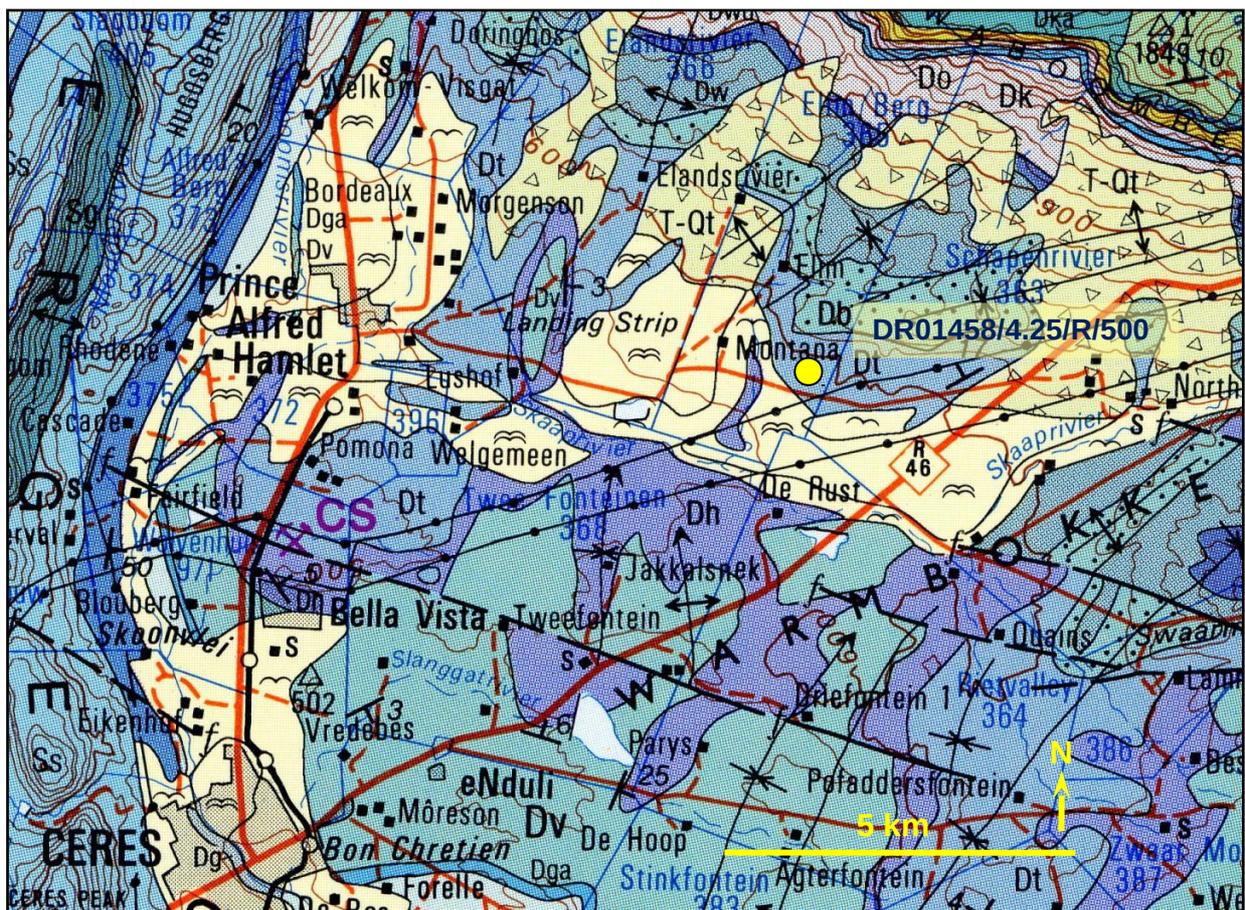


Fig. 2. Google earth© satellite image of the study area in the foothills of the Gydoberg – Waboomberg range to the east of Prince Alfred Hamlet, showing the location of the DR01458/4.25/R/500 borrow pit study area (Vidamemoria pit no.3).

### 3. GEOLOGICAL HERITAGE

The geology of the Warm Bokkeveld region near Ceres, Western Cape, is outlined on 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) and is shown here in Fig. 3. A short geological sheet explanation has been published by Gresse and Theron (1992). Two previous palaeontological assessments in the area to the east of Prince Alfred Hamlet have been submitted by Almond (2009a, 2010).

The **DR01458/4.25/R/500** borrow pit site is underlain by mudrock-dominated sediments of the **Tra Tra Formation (Dt, Bokkeveld Group, Ceres Subgroup)** that were deposited on the offshore continental shelf in Middle Devonian (Eifelian) times as well as by a thick overlying mantle of alluvial and colluvial rocks. Details of the sedimentology and palaeontology of the Tra Tra succession are provided by Theron *et al.* (1991), Gresse and Theron (1992) and more recently by Almond (2009b).



**Fig. 3. Extract from 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) showing location of the DR01458/4.25/R/500 borrow pit study site in the Warm Bokkeveld region east of Prince Alfred Hamlet. The pit sites overlies potentially fossiliferous mudrock-dominated successions of the Tra Tra Formation (Dt, dark blue) (Lower Bokkeveld Group / Ceres Subgroup).**

The original borrow pit has been modified as a dam. Most of the Bokkeveld bedrock as well as the heaped-up spoil material is now highly weathered (Fig. 4), although small exposures of fresher sedimentary rock are visible in erosion gullies. This comprises hackly-weathering grey-green massive siltstone which does not appear to be markedly cleaved. Deep chemical weathering of probable Tertiary age is shown by kaolinitisation and ferromanganese mineral veining in some areas (Fig. 5). The Bokkeveld bedrocks are mantled by 30 cm or more of orange-brown gravelly and silty colluvial deposits and soil. Higher-lying ground just to the north of the borrow pit site is built by the sandstone-dominated Boplaas Formation that stratigraphically overlies the Tra Tra

succession. A tributary of the Skaaprivier originating on the upper slopes of the Waboomberg runs c. 0.75 km west of the borrow pit site.

Highly folded, pale grey, grey-green and grey-brown silty mudrocks of the lowermost Tra Tra Formation were previously inspected in a trench just west of the Lushof Dam Wall on adjacent farm Elandsrivier 366 (33° 18' 02.0" S, 19° 21' 33.7" E) by Almond (2009a, 2010). The sediments here are well-laminated with some bioturbation (burrowing) and abundant secondary mineralisation (small ferruginous nodules) suggesting high levels of chemical weathering.



**Fig. 4.** View towards the NW of the weathered greyish-green mudrocks of the Tra Tra Formation and overlying reddish-brown colluvial soils along the northern edge of the existing DR01458/4.25/R/500 borrow pit site.



**Fig. 5. Deep chemical weathering of the near-surface Tra Tra mudrocks indicated by kaolinitisation (creamy areas) and veining with rusty-hued ferromanganese minerals (Hammer = 33 cm).**

#### **4. PALAEOONTOLOGICAL HERITAGE**

Shelly fossils from the **Tra Tra Formation** (Dt, Middle Devonian / Eifelian) in the Worcester and adjacent Ladismith sheet areas are generally scarce (Gresse & Theron 1992, Theron *et al.*, 1991, Table III, Almond 2009b). The only area in the Western Cape where diverse marine invertebrate assemblages have been recorded from this unit is on or near the Wageboomberg / Theronberg Pass near Ceres (Oosthuizen 1984, Gresse & Theron 1992). Fairly abundant, well-preserved shelly assemblages have recently been recorded from borrow pits within the lowermost Tra Tra Formation on the Sanbona and Anysberg Nature Reserves in the western Klein Karoo (Almond 2009b, unpublished observations 2011). Fossils moulds here are fairly well preserved and comprise a small range of bivalves (*Palaeoneilo*, *Nuculites* and unidentified forms), plectonotid bellerophontids, orbiculoid inarticulate brachiopods, occasional articulate brachiopods, disarticulated crinoids, tentaculitids and simple, horizontal, mudlined, secondarily mineralised burrows.

The only fossils recorded from the DR01458/4.25/R/500 borrow pit site near Prince Alfred Hamlet are scattered to locally concentrated, disarticulated to semi-articulated nuculid bivalves of the genus *Nuculites* (Fig. 6). The palaeontological sensitivity of the Bokkeveld bedrocks here is rated as LOW due to high levels of chemical weathering. However, exposure of fresh mudrock following renewed exploitation of the borrow pit might well yielded further shelly fossils since the bedrock here is uncleaned.

Curious vertical to oblique tubular structures (c. 0.5 cm diameter) with an intermittent mineral infill (possibly gypsum) are common within the Tra Tra siltstones (and some sandstones) on the adjacent farm Elandsrivier 366 and *might* possibly represent fossil burrows, but their biogenic origin is very uncertain (Almond 2009a, 2010).



**Fig. 6. Clumps of semi-articulated nuculid bivalves (*Nuculites*) within uncleved siltstones of the Tra Tra Formation in borrow pit DR01458/4.25/R/500 near Prince Alfred Hamlet (Scale in mm).**

## **5. CONCLUSIONS & RECOMMENDATIONS**

The existing DR01458/4.25/R/500 borrow pit and its proposed extension on the Remainder of Ceres Farm No. 365 (Elim Berg), situated approximately 6.5 km east of the village of Prince Alfred Hamlet, Witzenberg District, Western Cape, overlie Middle Devonian marine mudrocks of the Tra Tra Formation (Bokkeveld Group, Ceres Subgroup). This formation has yielded assemblages of shelly invertebrate fossils elsewhere in the Warm Bokkeveld region (e.g. Waboomberg / Theronsberg Pass area northeast of Ceres), but only sparse, small nuculid bivalves and possible vertical burrows are recorded from the Prince Alfred Hamlet area. Due to extensive chemical weathering of the bedrocks the palaeontological sensitivity of the study site is rated as LOW. Therefore, pending the discovery of substantial new fossil material such as shelly fossil, fish or plant remains, no further mitigation of fossil heritage for this borrow pit development is recommended.

## **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 also very grateful to Ms Madelon Tusenius for logistical support and assistance with these borrow pit projects.

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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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