

PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT

EXISTING BORROW PIT ALONG THE DR1457 ROAD NEAR TOUWSRIVIER, WORCESTER DISTRICT, WESTERN CAPE

John E. Almond PhD (Cantab.)

Natura Viva cc,

PO Box 12410 Mill Street,

Cape Town 8010, RSA

naturaviva@universe.co.za

January 2013

1. EXECUTIVE SUMMARY

The existing DR01457/8.7/L/1200 borrow pit situated on Portion 1 of Farm Klipfontein No. 6 about 10.3 km NNE of Touwsrivier, Worcester District, Western Cape, is excavated into Early Carboniferous mudrocks of the Kweekvlei Formation (upper Witteberg Group) as well as overlying alluvial and colluvial sands and gravels of probable Quaternary to Recent age. No fossil remains were recorded from either the Kweekvlei succession or superficial sediments at the study site and its palaeontological heritage sensitivity is assessed as LOW. No further studies or mitigation of palaeontological heritage for this borrow pit project are recommended

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 along the unsealed DR1457 road in the Pienaarskloof area to the northeast of Touwsrivier, Western Cape. Pit **DR01457/8.7/L/1200** (= Vidamemoria Pit. No. 197) on Portion 1 of Farm Klipfontein No. 6 (Worcester District) is situated at about 830 m amsl on the southeastern footslopes of a low koppie in a valley between the Bontberg Range and Bierkraal se Rante. It lies approximately 1.6 km WNW of Nooitgedag farmstead, 10.3 km NNE of Touwsrivier and 7 km north of the N1 trunk road (33° 14' 32.8" S, 20° 04' 03.4" E) (Figs. 1 & 2).

A previous desktop basic assessment of the pit by the author assessed its palaeontological heritage sensitivity as medium to high due to the presence here of potentially fossiliferous sediments of the Kweekvlei Formation (Witteberg Group). A palaeontological field assessment of the pit as part of an HIA was requested by Heritage Western Cape (HWC case 1922 - 2012 ref 120726TS32, Interim Comment 8 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: 3rd 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 30 December 2012.

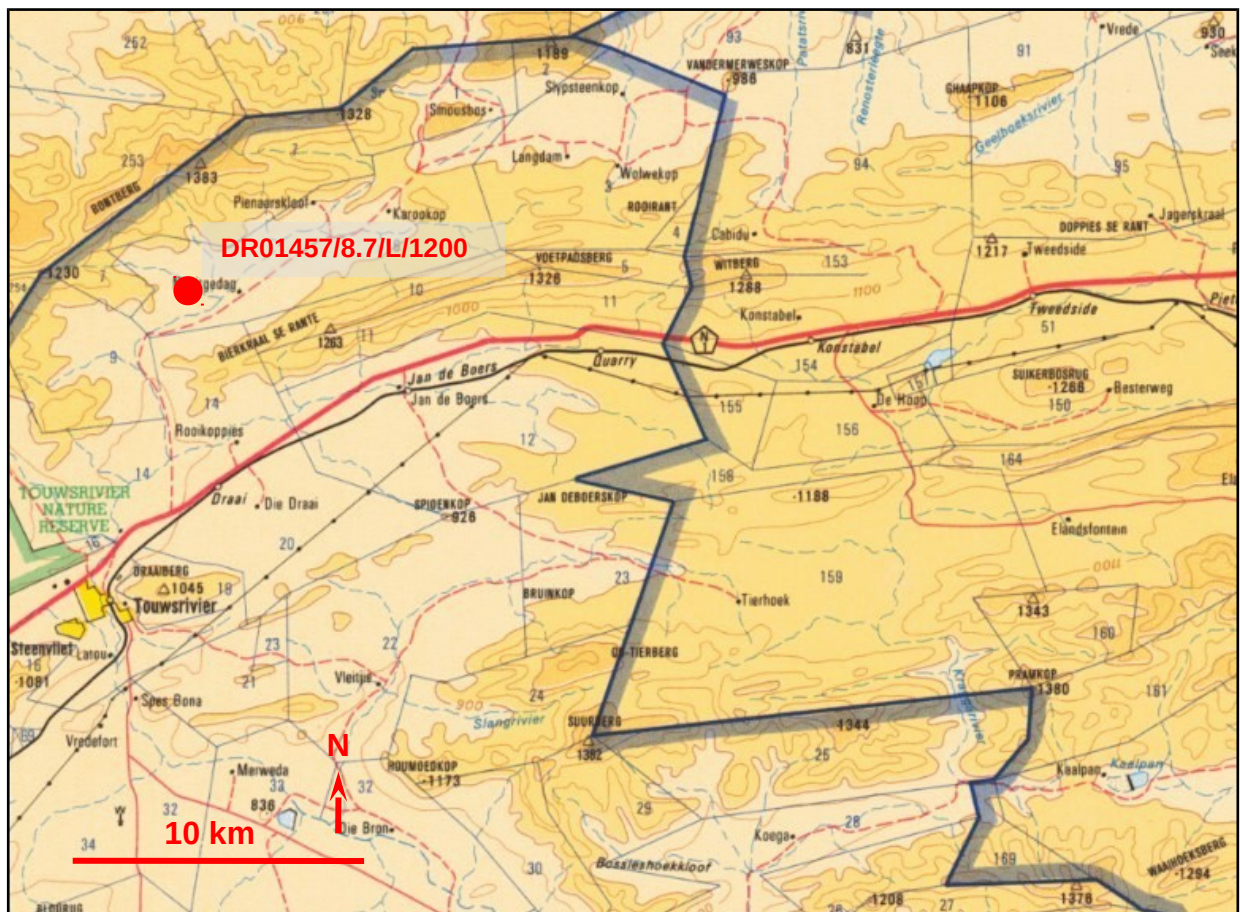


Fig.1. Extract from topographical sheets 3320 Ladismith (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the approximate location of the existing pit DR01457/8.7/L/1200 located in a stream valley between the Bontberg Range to the NW and Bierkraal se Rante to the SE, approximately 10.3 km NNE of Touwsrivier.

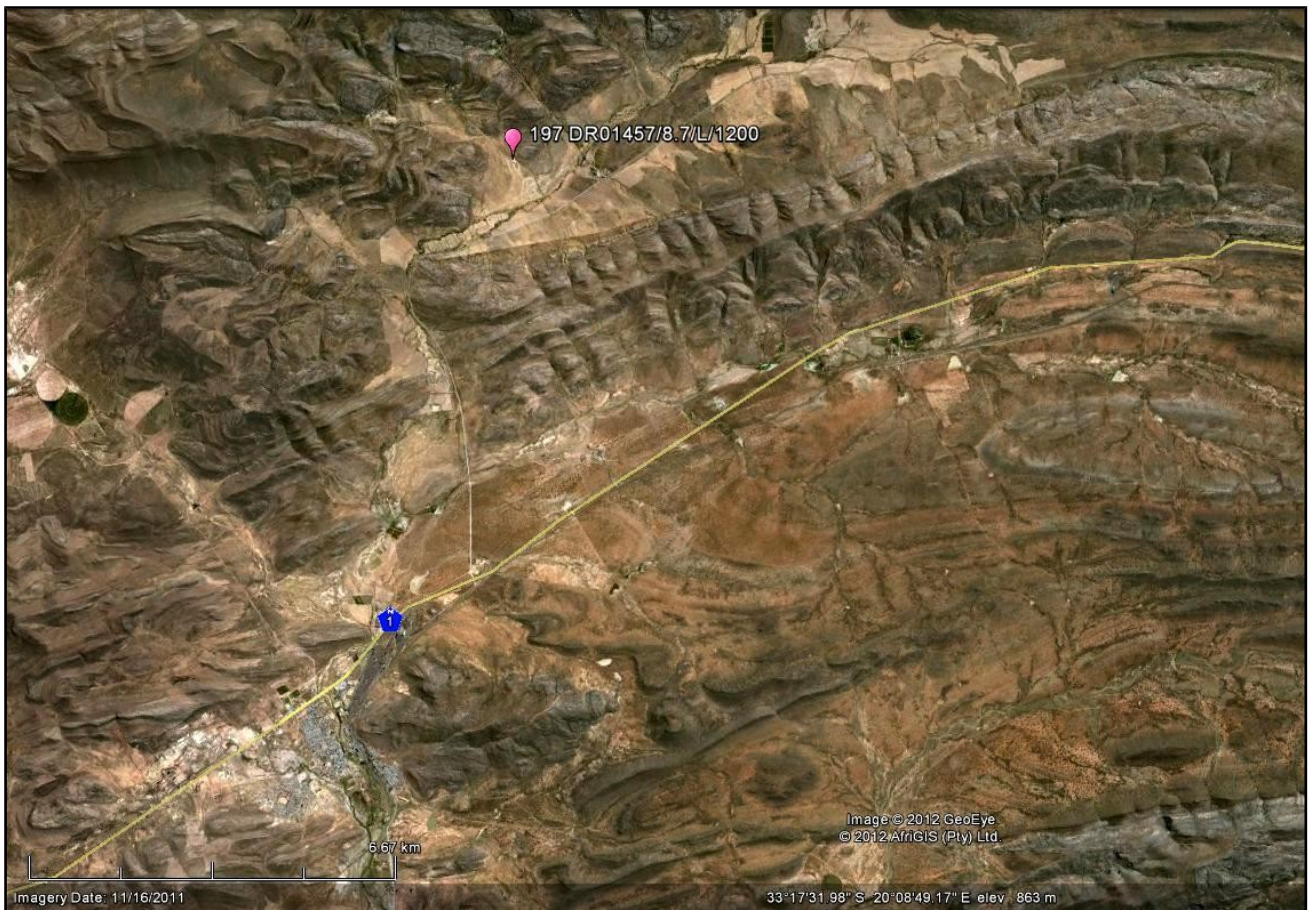


Fig. 2. Google earth© satellite image of the study area showing the location of the existing DR01457/8.7/L/1200 pit (Vidamemoria Pit No. 197) in a stream valley between the Bontberg Range to the NW and Bierkraal se Rante to the SE, approximately 10.3 km NNE of Touwsrivier.

3. GEOLOGICAL HERITAGE

The geology of the study region to the NNE of Touwsrivier, Western Cape, is outlined on 1:250 000 geology sheet 3320 Ladismith (Council for Geoscience, Pretoria) and is shown here in Fig. 3. A short geological sheet explanation has been published by Theron *et al.* (1991). The borrow pit study area lies towards the axis of an elongate WSW – ENE trending megasyncline within the Cape Fold Belt whose outer limbs (e.g. Bontberg, Bierkraal se Rante ranges) are formed of lower Witteberg Group rocks and which is cored by glacial rocks of the Dwyka Group.

The small existing borrow pit **DR01457/8.7/L/1200** is excavated into Early Carboniferous mudrocks of the **Kweekvlei Formation (Ck, upper Witteberg Group, Lake Mentz Subgroup)** as well as into thick overlying alluvial sediments deposited by a small south-flowing stream issuing from the Bontberg range (yellow area in Fig. 3). The sandstone *koppie* to the northeast of the borrow pit and of its proposed easterly extension is underlain by the stratigraphically overlying Floriskraal Formation of the Witteberg Group (Fig. 4). This latter unit will not be directly impacted by the proposed borrow pit development, but colluvial gravels within the proposed extension are in part derived from downwasted Floriskraal sandstone material.

Recent accounts of the geology of the upper Witteberg Group succession are given by Broquet (1992), Johnson *et al.* (2006), Thamm and Johnson (2006), and for the Ladismith sheet area by Theron *et al.* (1991). The Kweekvlei Formation in the Koue Bokkeveld region to the west is approximately 30 m thick but thicknesses of 100 to 150 m are reported for the Ladismith sheet

area. It consists essentially of an upward-coarsening, shoaling succession of dark grey micaceous mudrocks with an increasing proportion of thin-bedded sandstones towards the top. Dominant sedimentary structures include horizontal, lenticular, flaser and wavy lamination, with storm-generated hummocky cross-stratification occurring within thicker, well-sorted sandstones in the uppermost part of the succession. The Kweekvlei Formation represents a laterally extensive, non-marine sedimentary package recording a major post-glacial flooding event following the latest Devonian Gondwana glaciation (Almond *et al.* 2002).

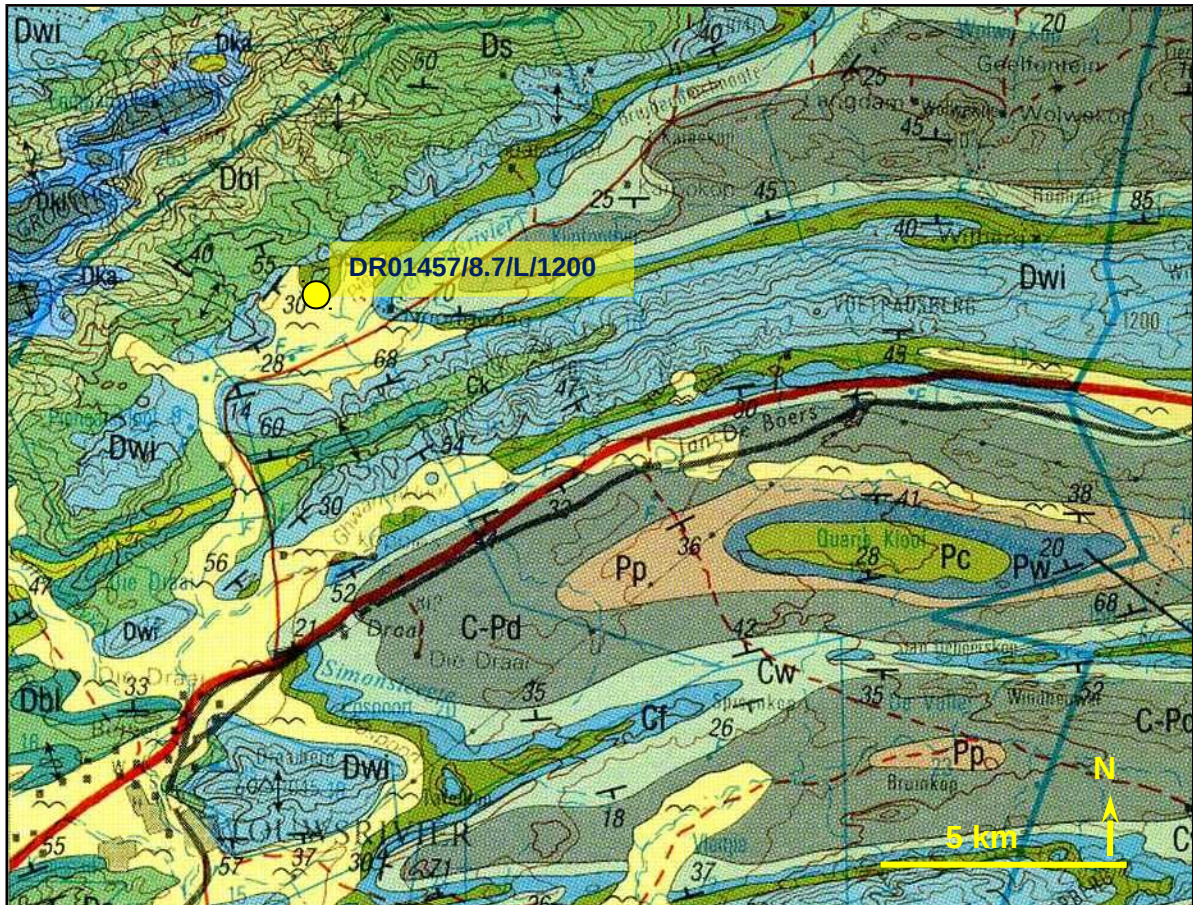


Fig. 3. Extract from 1: 250 000 geology sheet 3320 Ladismith (Council for Geoscience, Pretoria) showing location of the DR01457/8.7/L/1200 borrow pit c. 10.3 km northeast of Touwsrivier, Western Cape. The pit is excavated into mudrocks of the Kweekvlei Formation (Gk, dark green) within the upper part of the Witteberg Group (Lake Mentz Subgroup) as well as into the overlying alluvial sediments (pale yellow).

The distinctive massive weathering to medium-bedded, lilac to brownish-grey, impure, micaceous, poorly-sorted sandstones exposed in the stream bed running through the pit site (Fig. 5) are latest Devonian glacially-related debris flow deposits that characterise the Witpoort / Kweekvlei contact zone (Almond *et al.* 2002). These “Potdeksel Member” beds are generally unfossiliferous, although isolated plant stem fragments have been reported along the southern Karoo margins near Laingsburg (Almond, unpublished. obs.).

Gently dipping, thinly-bedded to laminated, lilac, greyish-green to brown-weathering, micaceous silty mudrocks of the Kweekvlei Formation are well exposed in the low cliff face along the northeastern edge of the existing pit (Fig. 6). The Witteberg bedrocks are cut intermittently by narrow calcrete infilled veins. They are overlain by thin orange-brown soils and poorly-sorted, downwasted colluvial gravels that are largely derived from the Floriskraal sandstone exposures upslope to the east.

Much of the pit floor is occupied by an alluvial terrace built of one metre or more of poorly-consolidated sand and gravels that have been deposited by the drainage system flowing from the north (Fig. 4). The gravels are mainly composed of angular to subrounded, brown-weathering sandstones (probably derived from the Floriskraal Formation) with subordinate quartzite, vein quartz and ferricrete material.



Fig. 4. View northeastwards across the DR01457/8.7/L/1200 borrow pit whose floor is largely mantled by sandy and gravelly alluvium (foreground) (Hammer = 33 cm). Kweekvlei Formation mudrocks form the cut face at the back of the pit while Floriskraal Formation sandstones build the low *koppie* in the background.



Fig. 5. Massive, lilac-hued, poorly sorted sandstones exposed in the stream bed at the base of the Kweekvlei Formation (Hammer = 33 cm). These are glacially-related debris flow deposits marking the Devonian / Carboniferous boundary (“Potdeksel Member”).

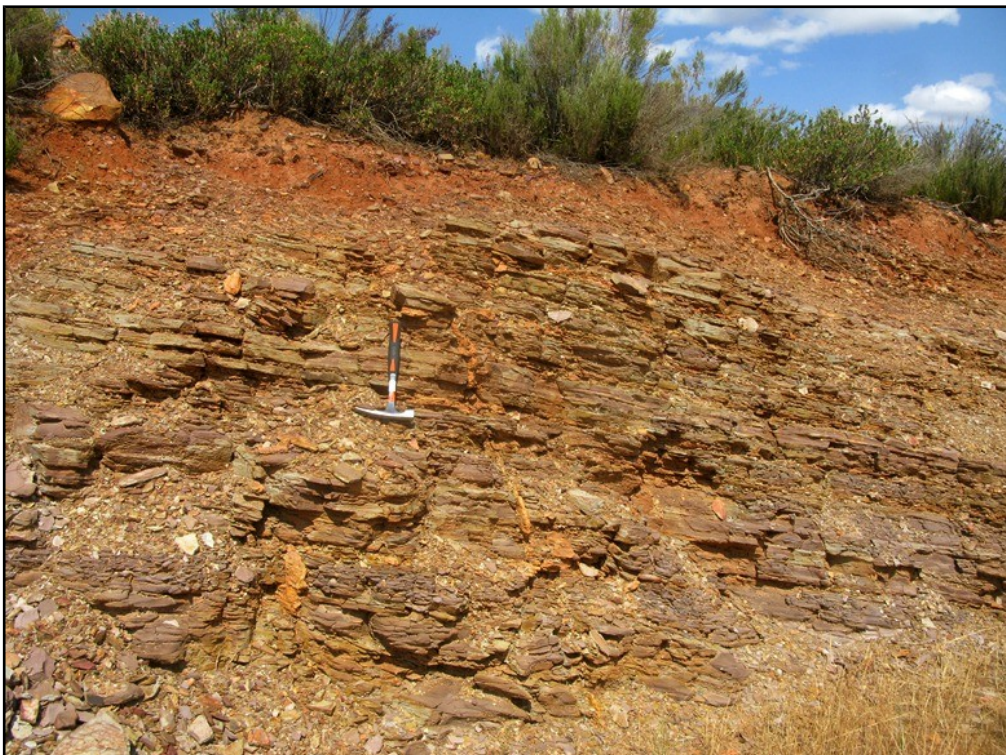


Fig. 6. Thinly-bedded mudrocks of the Kweekvlei Formation, cut here by occasional thin calcite-infilled fractures (Hammer = 33 cm).

4. PALAEOLOGICAL HERITAGE

The fossil record of the Kweekvlei Formation has been briefly reviewed by Almond (2008). Dark, post-glacial mudrocks of the Kweekvlei Formation in the southern Cederberg (e.g. Karoopoort, Skitterykloof, Kaffirskraal, Koue Bokkeveld) and elsewhere contain sparse to abundant low diversity trace fossil assemblages, notably *Teichichnus* and horizontal back-filled burrows, especially in the upper, silty to sandy parts of the upward shoaling succession (Almond 1998a, 1998b). Transported fragments of vascular plants, preserved in some cases within nodules, are also found in the upper Kweekvlei (Anderson & Anderson 1985, Evans 2005, J.C. Loock pers. comm., J. Almond pers. obs.). Simply branched, leafless woody stems, some of them with fine striations, have been provisionally assigned to the problematic genus *Praeramunculus*. This is possibly a propteridophyte (McLoughlin & Long 1994) or a progymnosperm (Gess & Hiller 1995). Lycopods are referred to the genus *Archaeosigillaria*. Fish fossils referred to the Kweekvlei by Anderson and Anderson (1985) are misassigned, although fish remains may indeed be present here. Restricted salinities, low temperatures at high palaeolatitudes and perhaps also bottom anoxia may be implicated in the paucity of body and trace fossils within this post-glacial mudrock unit (cf Broquet 1992, Almond 1998b). Attempts to isolate organic-walled microfossils from black mudrock facies towards the base of the formation have so far proved unsuccessful.

No fossils were recorded within the Kweekvlei Formation bedrocks nor within the overlying superficial deposits (alluvium, colluvium) at borrow pit site DR01457/8.7/L/1200.

5. CONCLUSIONS & RECOMMENDATIONS

The existing DR01457/8.7/L/1200 borrow pit situated on Portion 1 of Farm Klipfontein No. 6 about 10.3 km NNE of Touwsrivier, Worcester District, Western Cape, is excavated into Early Carboniferous mudrocks of the Kweekvlei Formation (upper Witteberg Group) as well as overlying alluvial and colluvial sands and gravels of probable Quaternary to Recent age. No fossil remains were recorded from either the Kweekvlei succession or superficial sediments at the study site and its palaeontological heritage sensitivity is assessed as LOW. No further studies or mitigation of palaeontological heritage for this borrow pit project are 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.

7. REFERENCES

- ALMOND, J.E. 1998a. Early Palaeozoic trace fossils from southern Africa. Tercera Reunión Argentina de Icnología, Mar del Plata, 1998, Abstracts p. 4.
- ALMOND, J.E. 1998b. Trace fossils from the Cape Supergroup (Early Ordovician – Early Carboniferous) of South Africa. *Journal of African Earth Sciences* 27 (1A): 4-5.
- ALMOND, J.E. 2008. Palaeozoic fossil record of the Clanwilliam Sheet area (1: 250 000 geological sheet 3218), 42 pp. Report produced for the Council for Geoscience, Pretoria.
- ALMOND, J., MARSHALL, J. & EVANS, F. 2002. Latest Devonian and earliest Carboniferous glacial events in South Africa. Abstracts, 16th International Sedimentological Congress, RAU, Johannesburg, pp 11-12.
- ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Western Cape. Interim SAHRA technical report, 20 pp. Natura Viva cc., Cape Town.
- ANDERSON, J.M. & ANDERSON, H.M. 1985. Palaeoflora of southern Africa. Prodrum of South African megaflores, Devonian to Lower Cretaceous, 423 pp, 226 pls. Botanical Research Institute, Pretoria & Balkema, Rotterdam.
- BROQUET, C.A.M. 1992. The sedimentary record of the Cape Supergroup: a review. In: De Wit, M.J. & Ransome, I.G. (Eds.) Inversion tectonics of the Cape Fold Belt, Karoo and Cretaceous Basins of Southern Africa, pp. 159-183. Balkema, Rotterdam.
- GESS, R.W. & HILLER, N. 1995. A preliminary catalogue of fossil algal, plant, arthropod, and fish remains from a Late Devonian black shale near Grahamstown, South Africa. *Annals of the Cape Provincial Museums (Natural History)* 19: 225-304.
- GRESSE, P.G. & THERON, J.N. 1992. The geology of the Worcester area. Explanation of geological Sheet 3319. 79 pp, tables. Council for Geoscience, Pretoria.
- JOHNSON, M.R., THERON, J.N. & LOOCK, J.C. 2006. Witteberg Group. South African Committee for Stratigraphy, Catalogue of South African Lithostratigraphic Units 9: 47-49. Council for Geoscience, Pretoria.
- MACRAE, C. 1999. Life etched in stone. Fossils of South Africa. 305pp. The Geological Society of South Africa, Johannesburg.
- McLOUGHLIN, S. & LONG, J.A. 1994. New records of Devonian plants from southern Victoria Land, Antarctica. *Geological Magazine* 131: 81-90.
- THAMM, A.G. & JOHNSON, M.R. 2006. The Cape Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 443-459. Geological Society of South Africa, Marshalltown.
- THERON, J.N. & LOOCK, J.C. 1988. Devonian deltas of the Cape Supergroup, South Africa. In: McMillan, N.J., Embry, A.F. & Glass, D.J. (Eds.) Devonian of the World, Volume I: Regional syntheses. Canadian Society of Petroleum Geologists, Memoir No. 14, pp 729-740.
- THERON, J.N., WICKENS, H. DE V. & GRESSE, P.G. 1991. Die geologie van die gebied Ladismith. Explanation of geological Sheet 3320, 99 pp. Council for Geoscience, Pretoria.

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 AHP (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