PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT

TWO EXISTING BORROW PITS ALONG THE DR2196, CLANWILLIAM MAGISTERIAL DISTRICT, WESTERN CAPE

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1. EXECUTIVE SUMMARY

It is proposed to re-excavate and extend two existing borrow pits along the DR2196, situated in the northern Cederberg region to the northeast of Clanwilliam, Western Cape. Both pits are excavated into mudrocks within the lower part of the Gydo Formation (Lower Bokkeveld Group) that is well known for its rich fossil heritage – especially shelly invertebrates and trace fossils – from the Early Devonian Period.

Well-consolidated (comparatively unweathered) mudrocks of the lowermost Gydo Formation in Pit DR2196/18.55/R/130 contain a range of shelly invertebrate fossils, including some uncommon bivalve genera and assemblages preserving palaeoecolgical information (*e.g.* possible trilobite moult assemblages). It is very likely that newly-excavated mudrocks from this pit will yield diverse faunas of well-preserved shelly fossils. The palaeontological sensitivity of this site is HIGH and it is therefore recommended that the developer should commission a professional palaeontologist *in good time* to record and sample fossil material from the pit during the early stages of excavation when abundant fresh (*i.e.* unweathered) mudrock is available for examination, and *before* most of this material is employed for road construction.

Pit DR2196/28.5/L/30 is excavated into interbedded sandstones and siltstones that lie stratigraphically well above the base of the Gydo Formation and are not high fossiliferous. Although occasional limestone nodules here contain well-preserved invertebrate fossils (*e.g.* encrusting bryozoan colonies), the level of bedrock exposure is poor and it is unlikely that substantial fossil remains can be obtained here in future. The palaeontological sensitivity of this site is LOW and no further studies or mitigation of palaeontological heritage are recommended in this case.

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 along the unsealed road DR2196 in the Clanwilliam Magisterial District, as well as to extend these pits. Pit DR2196/18.55/R/130 (31º 56' 44.9" S, 18º 57' 05.2" E) is located on the southern side of the unsealed road on Portion 7 of Farm Frederik's Dal 60 some 26.5 km NNE of Clanwilliam and 35.5 k SE of Klawer (Fig. 1, top). Pit DR2196/28.5/L/30 (32º 00' 27.0" S, 19º 01' 11.3" E) is situated along the eastern side of the road within the existing road reserve some 22 km NE of Clanwilliam and 5.4 km NW of Elizabethsfontein on Portion 10 of Farm Elizabethsfontein 59 (Fig. 1, bottom).

A previous desktop basic assessment of the two DR2196 pits by the author assessed their palaeontological heritage sensitivity as high due to the presence here of potentially fossiliferous sediments of the Lower Bokkeveld Group (Gydo Formation). A palaeontological field assessment of the pits as part of an HIA was requested by Heritage Western Cape (HWC Case Nos.

120130JL10 and 120130JL10, Interim Comment 15 February 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 13 August 2012.

3. GEOLOGICAL CONTEXT

3.1. Pit DR2196/18.55/R/130

The geology of the pit study area is shown on the bottom edge of 1: 250 000 geology sheet 3118 Calvinia (De Beer *et al.* 2002) (Fig. 3). The pit is situated at *c*. 190m amsl on the north-western edge of a small outlier of marine sediments of the **Gydo Formation** (**Dg**) (Lower Bokkeveld Group, Cape Supergroup), just above its lower contact with the sandstone-dominated succession of the Rietvlei Formation (uppermost Table Mountain Group). The Lower Bokkeveld succession here is capped by a small area of Gamka Formation sandstones (Dga) (Fig. 4). The prominent *krans* of Table Mountain Group rocks seen to the west (Kraaibosberg) is built of upfaulted quartzites of the Skurweberg Formation. On satellite images the narrow trace of a probable dolerite dyke runs WNW-ESE through the Gydo Formation outlier about 200m north of the pit. This is probably related to the same Early Jurasssic dyke swarm as the very long dolerite dyke with a similar trend that is clearly shown on the geological map some 4 km to the north (Fig. 3, Jd). It is unlikely that the Gydo Formation sediments have been thermally metamorphosed by these igneous bodies. The Brandewynrivier, a tributary of the Doring River drainage system, runs some 1.5 km to the northeast. Alluvium of a small north-east flowing tributary of the Brandewynrivier mantles the Cape Supergroup rocks just west of the study area.

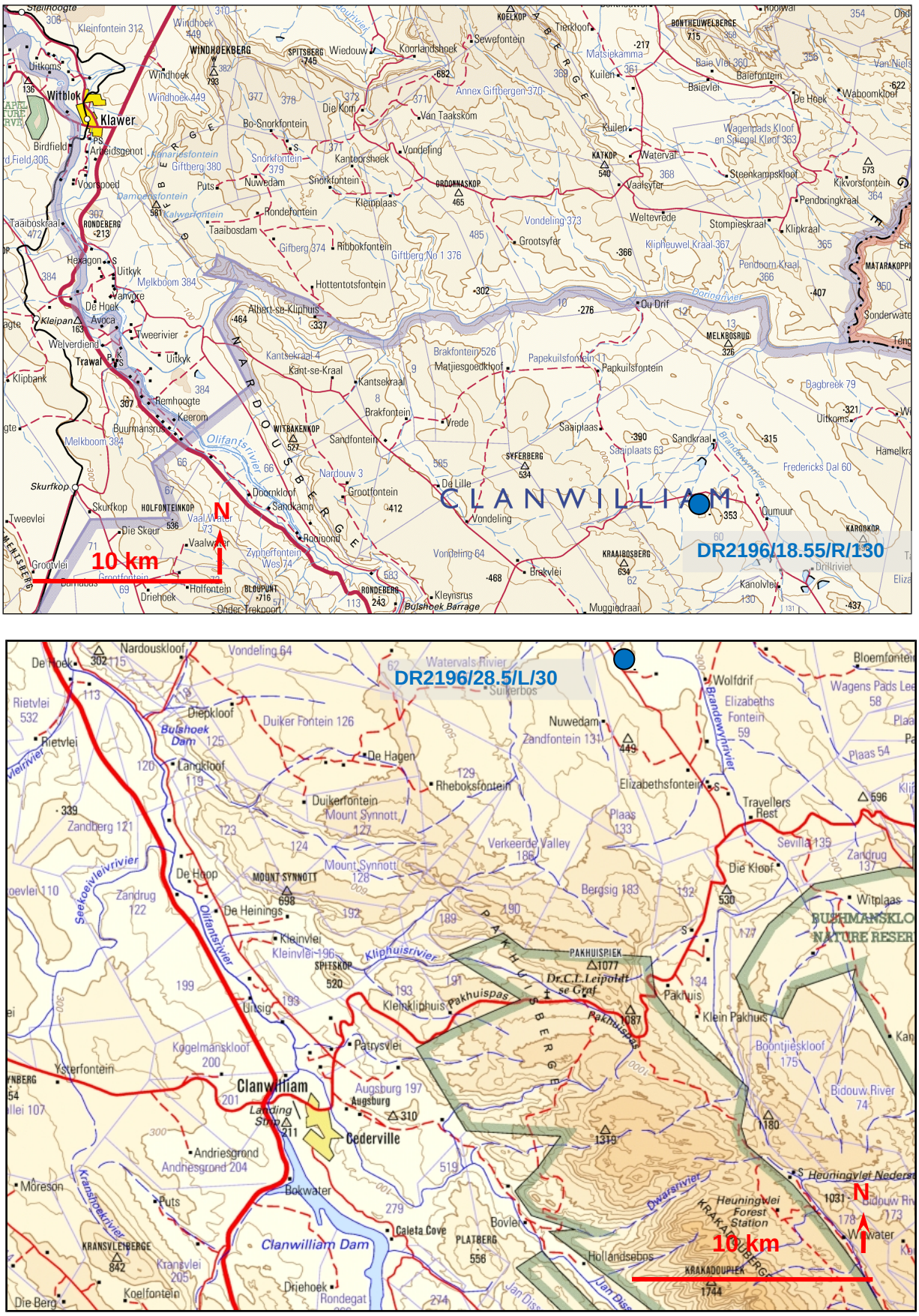

Fig. 1. Extracts from topographical sheets 3118 Calvinia (above) and 3218 Clanwilliam (below) (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the approximate location of the two DR2196 borrow pits in the Clanwilliam Magisterial District, Western Cape (blue dots).

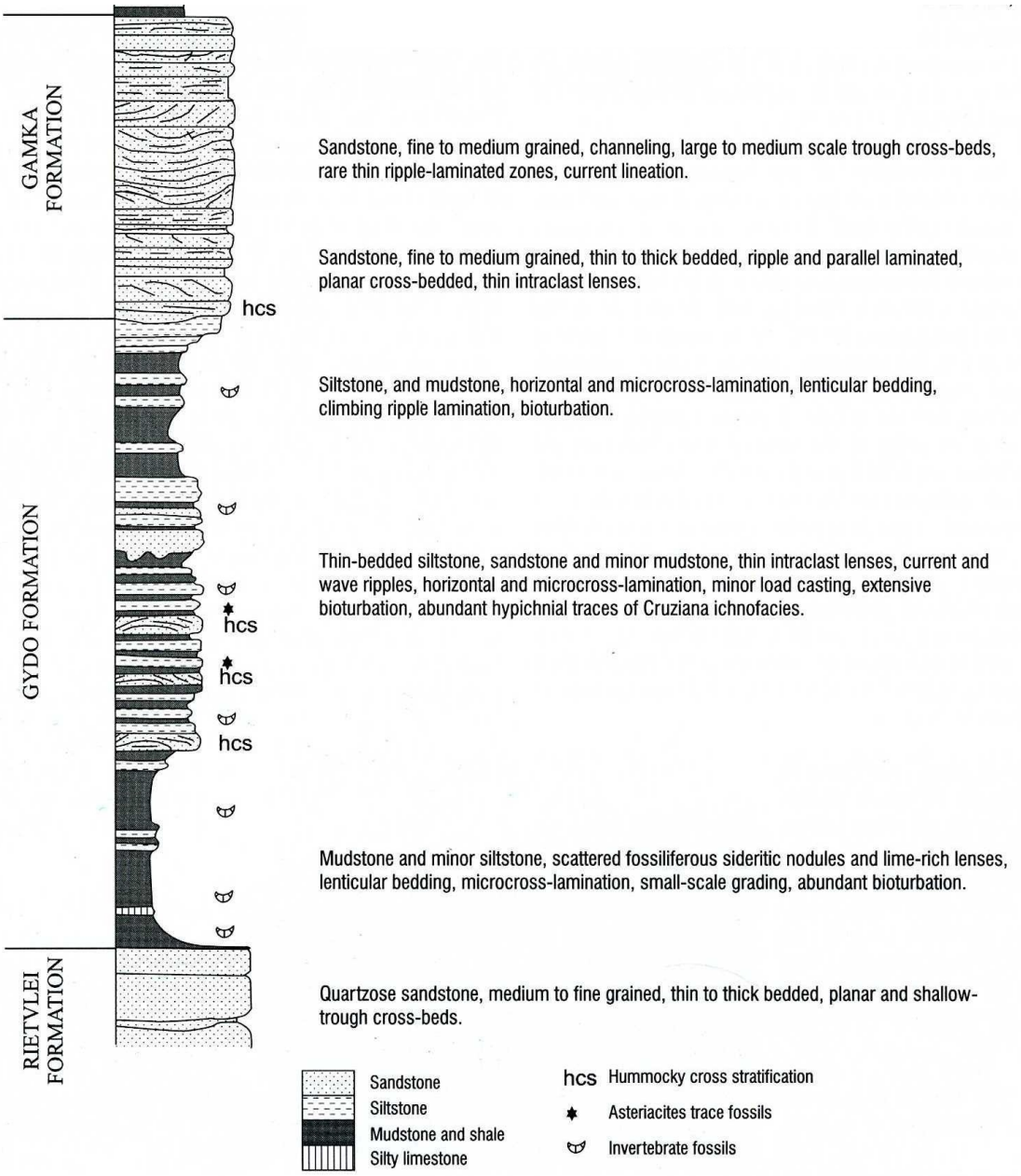

Fig. 2. Schematic section through the lower Bokkeveld Group (Ceres Subgroup) succession in the northern outcrop area (Modified from De Beer *et al.* 2002). Both the borrow pits concerned here are excavated into the lowermost mudrock-dominated beds shortly or well above the basal contact with the Rietvlei Formation (top of Table Mountain Group).

The **Gydo Formation** is a shallow to marine siliciclastic shelf succession of Emsian or Early Devonian age, some 400 million years old (Theron 1999, Theron & Johnson 1991, Thamm & Johnson 2006). In its northern outcrop area it reaches thicknesses of about 130 m (Botterkloof Pass section) and consists of a clearly upward-coarsening, shallowing succession of dark grey to black mudrocks, fine-grained sandstones and medium-grained wackes (dark, impure sandstones). These sedimentary rocks were deposited in a cool shallow seaway, the Agulhas Sea, on the south-western margins of Gondwana some 400 million years ago. Offshore mudrocks were deposited in quiet, deeper waters and may be massive or well-laminated. Pyrite-rich horizons indicate episodes of anoxia at or shortly below the sea floor. Near-shore sandstones were laid down in more

turbulent settings and often show the influence of major storms (*e.g.* well-developed wave ripples, hummocky cross-stratification, mudflake breccio-conglomerates). The Gydo Formation is consistently the most fossil-rich formation within the Bokkeveld Group (Section 4). The overlying sandstone-dominated **Gamka Fm** (**Dga**) is more resistant weathering and forms a steep cliff or *kranz* at the top of the plateau above the borrow pit.

The sedimentology of the northern outcrop area of the Gydo Formation has been briefly described by Theron *in* De Beer *et al.* (2002) and a schematic column is shown in Fig. 2. Both borrow pits covered by this report are excavated into the basal mudrock-dominated to heterolithic succession (*c*. 40 m thick) of the formation which is characterised by various diagenetic nodules, some of which are fossiliferous. Large (up to 60cm across), subrounded, boulder-sized concretions of brownish, slightly ferruginous carbonate are common within the pit area (Fig. 6). Mudrock material exploited in the floor of the pit and bulldozed into heaps comprises hackly-weathering dark grey to grey-green siltstones that are moderately fresh and coherent.

Stream exposures in the scarp on the eastern side of the pit show well-developed coarsening – upwards profiles with increasing predominance of thin-bedded, wave-rippled and HCS tempestite sandstones that build the heterolithic, sandstone-dominated middle portion of the Gydo succession here (Figs. 4 & 5). The intact hill slopes surrounding the existing borrow pits are mantled with coarse colluvial gravels up to a meter or more thick (mainly angular clasts of Bokkeveld wackes) and skeletal, often reddish-brown, ferruginous soils (Fig. 7). The gravel clasts vary from angular to subrounded and consist mainly of poorly sorted Bokkeveld *wackes* (*i.e.* impure sandstones).

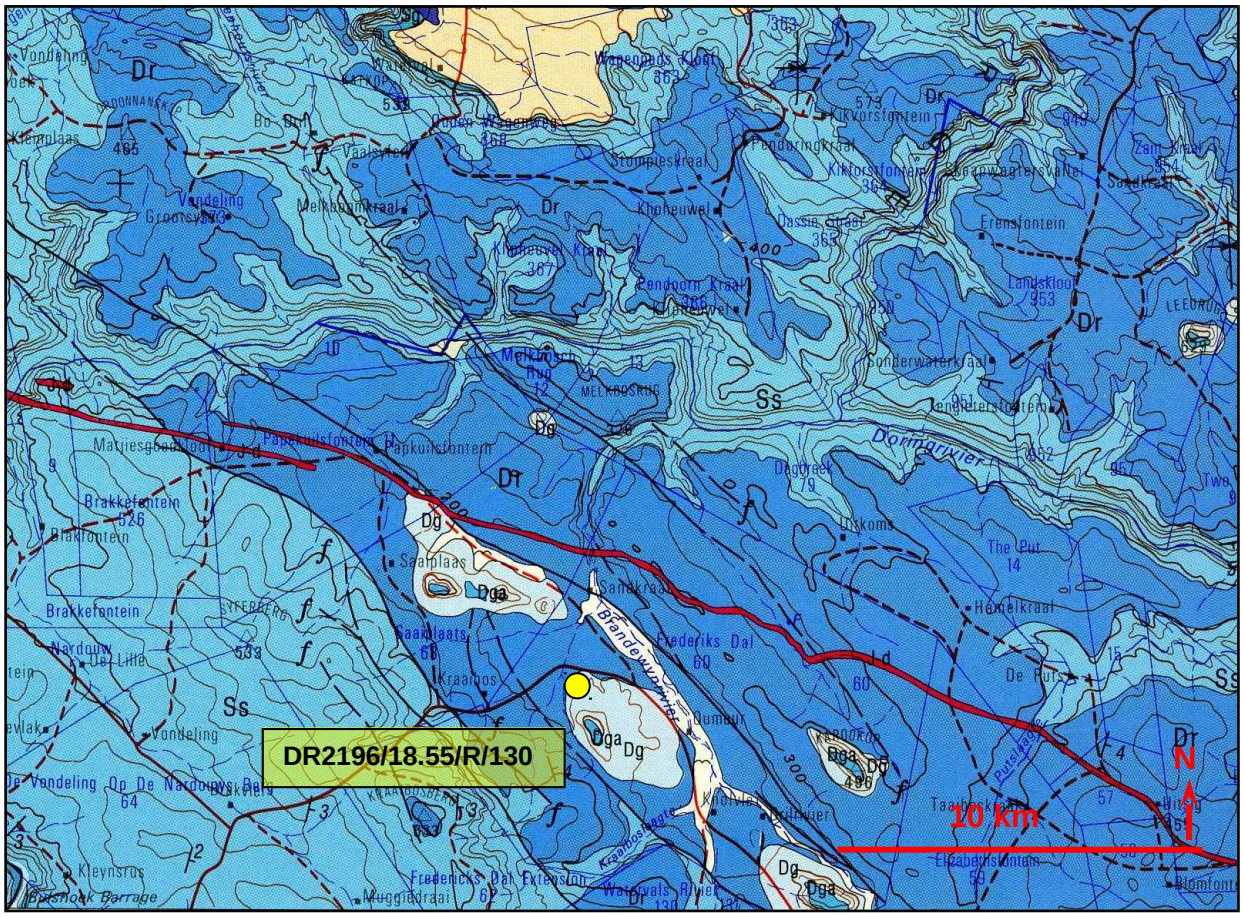

Fig. 3. Extract from 1: 250 000 geology sheet 3118 Calvinia (Council for Geoscience, Pretoria) showing location of the DR2196/18.55/R/130 borrow pit along the DR2196 dust road 26.5 km NNE of Clanwilliam. The existing pit is excavated into offshore marine mudrocks of the Early Devonian Gydo Formation (Dg, pale blue-grey) at the base of the Bokkeveld Group.

Fig. 4. View towards the SSE across pit DR2196/18.55/R/130, excavated into lowermost Gydo Formation mudrocks. The plateau above is built of a sandstone-dominated package within the middle Gydo Formation. The koppie behind is capped by Gamka Formation sandstones.

Fig. 5. Coarsening-upwards (shallowing) marine succession of the lower Gydo Formation exposed at pit site DR2196/18.55/R/130.

Fig. 6. Boulder-sized ferruginous carbonate concretions excavated from lowermost Gydo Formation mudrocks at pit site DR2196/18.55/R/130 (Hammer = 27 cm). These concretions appear to be unfossiliferous.

Fig. 7. Thick gravelly and sandy colluvial deposits mantling the Bokkeveld Group mudrocks at pit site DR2196/18.55/R/130.

3.1. Pit DR2196/28.5/L/30

The geology of the study area is shown on 1: 250 000 geology sheet 3218 Clanwilliam, for which a revised sheet explanation has yet to be published (A very short explanation is printed on the sheet map) (Fig. 8). The existing DR2196/28.5/L/30 pit, which now extends some 800-900m along the eastern side of the DR2196 north of Elizabethsfontein farmstead at *c*. 250m amsl, has already been partially rehabilitated. The bedrocks have been largely covered with poorly-sorted gravelly colluvial material and reworked excavated bedrock so exposure is very limited (Fig. 10), precluding an accurate assessment of the palaeontological heritage occurring here. The pit is excavated into a heterolithic (interbedded) succession of wackes and dark grey to grey-green silty mudrocks within the lower part of the Gydo Formation succession (See general remarks concerning the Gydo Formation in the northern Cederberg region given above). The Gydo has a faulted contact here with the Rietvlei Formation, the upfaulted uppermost Table Mountain Group sandstones forming higher ground immediately to the southwest. Given the abundance of sandstones at road level in the pit area, the excavated material comes from well above the base of the Gydo Formation. The mid Gydo sandstone package is visible as a prominent ridge on the hillslopes to the east (Fig. 9).

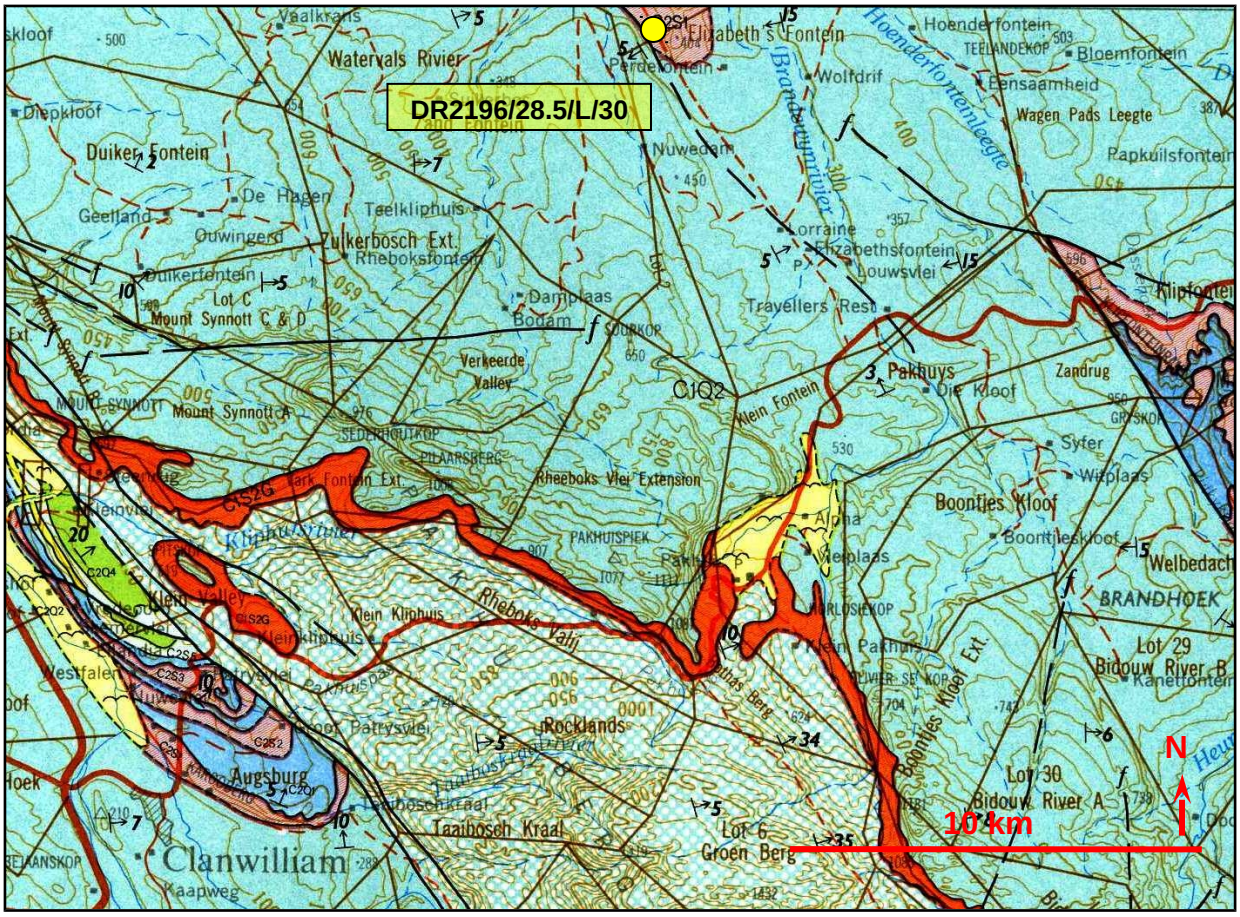

Fig. 8. Extract from 1: 250 000 geology sheet 3218 Clanwilliam (Council for Geoscience, Pretoria) showing location of the DR2196/28.5/L/30 borrow pit along the DR2196 dust road north of Elizabethsfontein, Clanwilliam District Municipality. The pit is excavated into offshore marine mudrocks of the Early Devonian Gydo Formation (C2S1, pink) at the base of the Bokkeveld Group.

Fig. 9. Gydo Formation succession building the koppie just to the east of the study pit DR2196/28.5/L/30 near Elizabethsfontein. The pit is excavated into heterolithic beds towards, but not right at, the base of the Gydo succession.

Fig. 10. View SE along the extended roadside borrow pit DR2196/28.5/L/30 (largely rehabilitated). Note lack of bedrock exposure and abundance of ripped-up blcks of Gydo siltstone and wackes.

4. PALAEONTOLOGICAL HERITAGE

The lower part of the **Bokkeveld Group** in the Western Cape (Ceres Subgroup *plus* lowermost Bidouw Subgroup) – and in particular the **Gydo Formation** - 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, bryozoans 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, limestone 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.

Fossils from various localities in the Gydo Formation within the northern Cederberg study region have been treated by Oosthuizen (1984), Almond in De Beer *et al.* (2002) and Almond (2008), among others. Of particular note are rich trace fossil assemblages of the shallow marine *Cruziana* ichnofacies from heterolithic, tempestite-dominated successions within the Gydo and Voorstehoek Formations (Almond 1998) and rare fish remains such as acanthodian fin spines from the Clanwilliam area (Almond 1997, Anderson *et al.* 1999).

4.1. Fossil heritage at Pit DR2196/18.55/R/130

This pit has been recently re-excavated so that fairly abundant fresh (comparatively unweathered), coherent Gydo mudrocks are available for fossil collection (albeit limited during the field visit due to ponding up of rainwater within the deeper pit areas). Natural moulds of shelly invertebrate fossils occur commonly within the mudrocks, but nodular fossil preservation was (unexpectedly) not seen; rich, well-preserved fossils within phosphatic nodules have been previously collected by the author at the farm Oumuur just a few kilometres to the east (Map Fig. 1; collections of the Council for Geoscience, Bellville). Taxa observed here include:

- Trilobites such as abundant *Burmeisteria* (juvenile as well as adult specimens, enrolled and extended individuals), occasional *Pennaia*, *Bainella*. Concentrations of burmeisteriid exoskeletal elements (cephala, pygidia *etc*) may reflect mass-moult-mate events rather than hydrodynamic sorting (Figs. 12F, 13).
- A wide range of bivalves, especially nuculoids like *Nuculites*, *Palaeoneilo*, possible *Nuculana*, but also less common forms such as *Grammysioidea*, *Pleurodapis*, and an unidentified elongate-shelled form (possibly *Orthonota* or *Solemya*) (Figs. 12A to 12E);
- Locally abundant *Plectonotus* bellerophontids and the gastropod *Holopea*;
- Rare tentaculitids.

These mudrock assemblages are mainly composed of deposit-feeding taxa that may have dominated soft muddy bottoms in the Early Devonian Agulhas Sea. Most fossils occur as isolated moulds, but occasional thin sheet-like sandy coquinas (one-shell thick) are also observed (Fig. 14). Fossil taxa within these coquinas are generally small-sized and include articulate brachiopods (choenetids, *Australoceolia*, possible *Cryptonella*), crinoid columnals, nuculitids, tentaculitids and disarticulated trilobite thoracic sclerites. These coquinas were generated during storm events and clearly sample exotic filter-feeding communities not represented in the surrounding mudrocks.

Various indeterminate horizontal burrows, often picked out by ferruginous secondary minerals, are common within the mudrock facies. Other ichnogenera observed are locally abundant tubular *Phycosiphon* and *Lophoctenium*. Float blocks of middle Gydo wackes show *Cruziana* ichnofacies

trace fossils on their soles, including *Rusophycus rhenana* burrows attributable to Burmeisteriid trilobites.

Given the good preservation of the fossil material and the variety of taxa represented (including rarer bivalve genera) the palaeontological sensitivity of this site is rated as HIGH and formal sampling by a professional palaeontologist of the fossil assemblages here before further excavation of road material is recommended.

4.2. Fossil heritage in Pit DR2196/28.5/L/30

Very few fossils were observed within the disturbed material (colluvial material *plus* reworked rock waste from the pit) that now mantles the borrow pit area following rehabilitation. They include:

- Rare trilobite fragments (indeterminate);
- Nuculid bivalves such as *Nuculites*, *Palaeoneilo*;
- Concentrations of small echinoderm ossicles (subgroup uncertain);
- Occasional phosphatic nodules containing the trilobite *Burmeisteria* as well as a dark grey limestone concretion containing an articulated crinoid stem with a branched encrusting colony (Fig. 11). This last specimen is of research interest since bryozoans are comparatively rare, delicate fossils within the Lower Bokkeveld Group and here one can see possible evidence of an epizoan lifestyle that may be an adaptation to the lack of firm substrates on the muddy sea bed (*N.B.* It is unclear if the crinoid host was alive or dead at the time of encrustation. In general, crinoid stem columnals fall apart soon after death). Well-articulated crinoids with intact arms and calyces embedded within a comparable dark limestone concretion are recorded from Singkop just south of Wuppertal in the northern Cederberg.

Given the relatively high stratigraphic horizon excavated in this pit, well above the base of the Gydo Formation, the palaeontological sensitivity of the site is MODERATE to LOW.

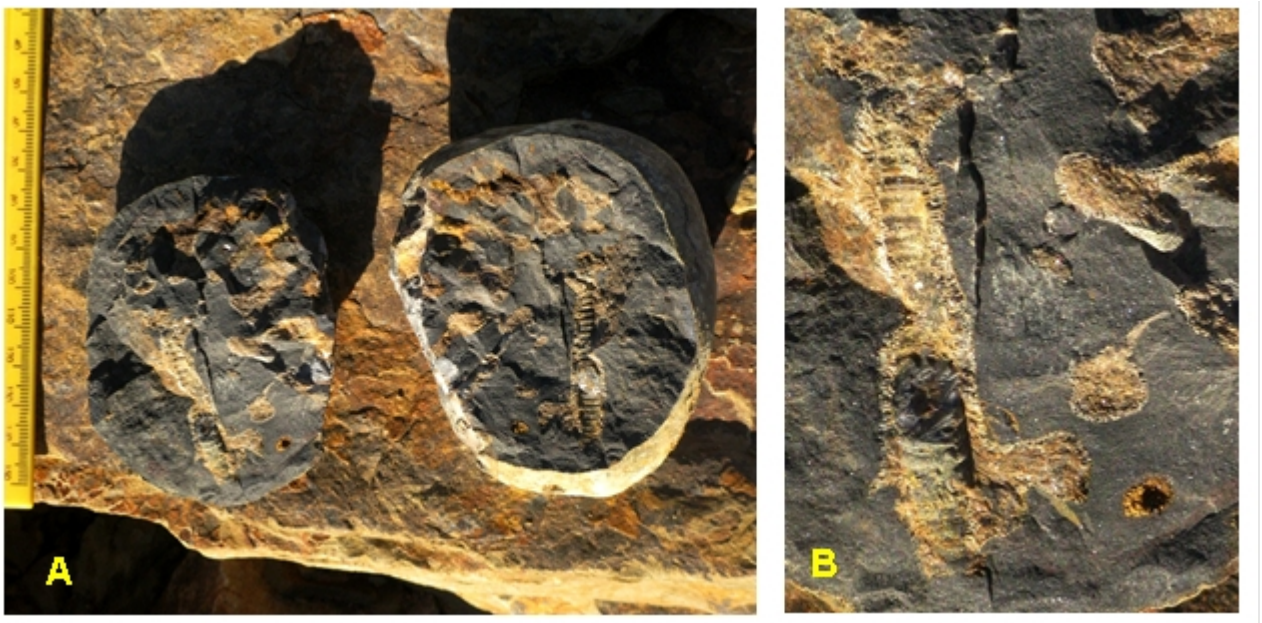

Fig. 11. Part and counterpart of a limestone nodule containing an articulated crinoid stem encrusted by a branching bryozoan colony (Scale in cm and mm). Detail shown on right.

Fig. 12. Shelly fossil moulds from lowermost Gydo Formation mudrocks in Pit DR2196/18.55/R/130, shown at various magnifications. These include: (A) the nuculid bivalve *Nuculites* (3 cm across), (B) internal and external moulds of the nuculid bivalve *Nuculites* (shells *c*.3 cm across), (C) the bivalve *Grammysioidea* (3 cm across), (D) semi-articulated valves of an elongate-shelled bivalve, possibly *Orthonota* (shells 7 cm across), (E) the bivalve *Pleurodapis* (3.25 cm across), and (F) cephalon and articulated thoracic segments of the homalonotid burrowing trilobite *Burmeisteria* (cephalon 7 cm across).

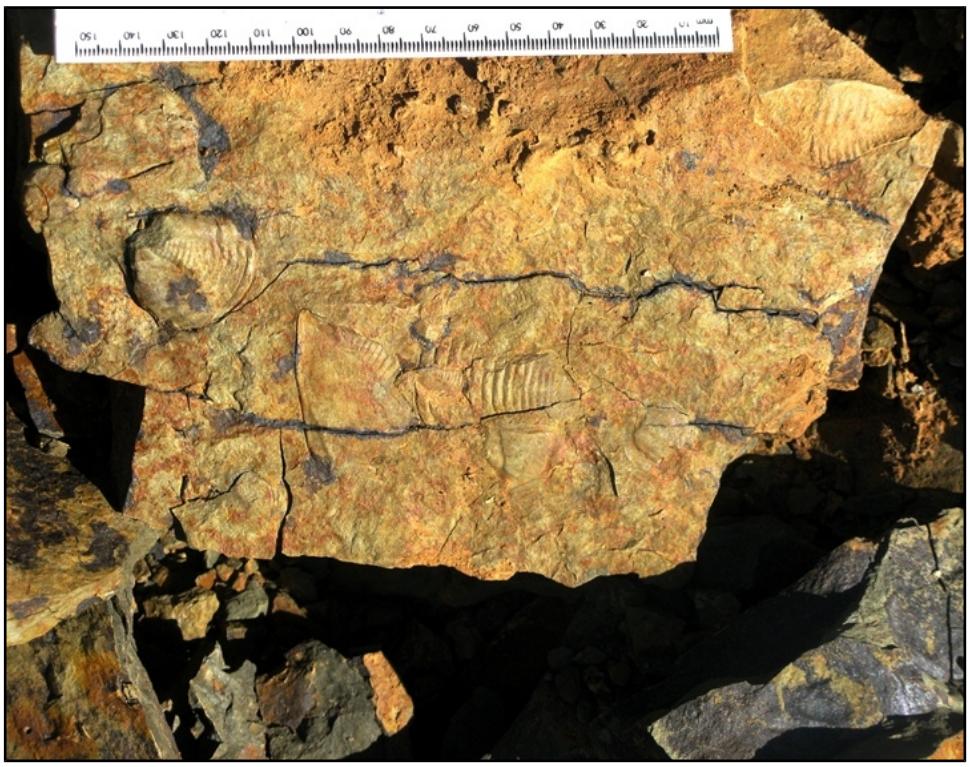

Fig. 13. Bedding plane concentration of skeletal elements (mainly pygidia) of the trilobite *Burmeisteria* (scale in mm and cm) – probably moulted exoskeletons – in Pit DR2196/18.55/R/130.

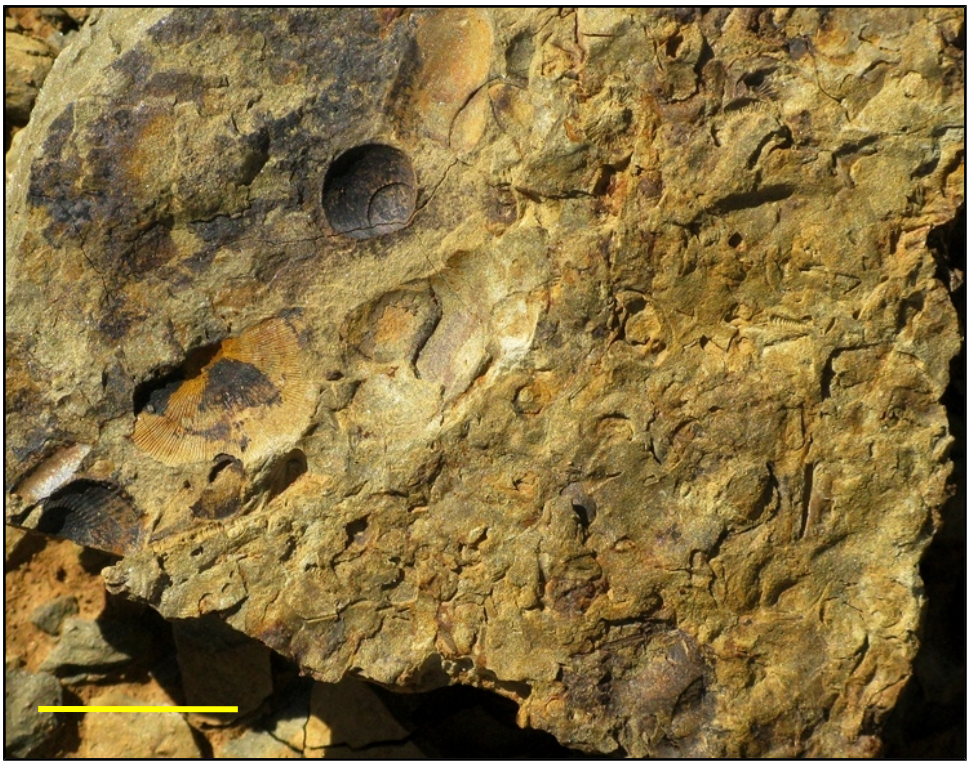

Fig. 14. Thin, sheet-like shelly coquina in Pit DR2196/18.55/R/130 with disarticulated remains of brachiopods (*e.g.* chonetids), tentaculitids, preserved on sandstone bedding plane (Scale bar = 2 cm).

5. CONCLUSIONS & RECOMMENDATIONS

Both the DR2196 pits under consideration are excavated into mudrocks of the lower Gydo Formation that is well known in the northern Cederberg region for its rich fossil heritage – especially shelly invertebrates and trace fossils – from the Early Devonian Period.

Well-consolidated (comparatively unweathered) mudrocks of the lowermost Gydo Formation in Pit DR2196/18.55/R/130 contain a range of shelly invertebrate fossils, including some uncommon bivalve genera and assemblages preserving palaeoecological information (*e.g.* possible trilobite moult assemblages). It is very likely that newly-excavated mudrocks from this pit will yield diverse assemblages of well-preserved shelly fossils. It is therefore recommended that the developer should commission a professional palaeontologist *in good time* to record and sample fossil material from the pit during the early stages of excavation when abundant fresh (*i.e.* unweathered) mudrock is available for examination, and *before* most of this material is employed for road construction.

Pit DR2196/28.5/L/30 is excavated into interbedded sandstones and siltstones that lie stratigraphically well above the base of the Gydo Formation and are not high fossiliferous. Although rare limestone nodules here contain well-preserved invertebrate fossils, the level of bedrock exposure is poor and it is unlikely that substantial fossil remains can be obtained here in future. No further studies or mitigation of palaeontological heritage are recommended in this case.

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. 1997. Fish fossils from the Devonian Bokkeveld Group of South Africa. Stratigraphy. African Anthropology, Archaeology, Geology and Palaeontology 1(2): 15-28.

ALMOND, J.E. 1998. 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. 2005. Geology of the Gamkaberg-Rooiberg Conservation Area, Little Karoo, 255pp. Unpublished report for Cape Nature, Natura Viva cc., Cape Town.

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.

ANDERSON, M.E., ALMOND, J.E., EVANS, F.J. & LONG, J.A. 1999. Devonian (Emsian-Eifelian) fish from the Lower Bokkeveld Group (Ceres Subgroup), South Africa. Journal of African Earth Sciences 29: 179-194.

COOPER, M.R. 1982. A revision of the Devonian (Emsian – Eifelian) Trilobita from the Bokkeveld Group of South Africa. Annals of the South African Museum 89: 1-174.

DE BEER, C.H., GRESSE, P.G., THERON, J.N. & ALMOND, J.E. 2002. The geology of the Calvinia area. Explanation to 1: 250 000 geology Sheet 3118 Calvinia. 92 pp. Council for Geoscience, Pretoria.

HILLER, N. & THERON, J.N. 1988. Benthic communities in the South African Devonian. In: McMillan, N.J., Embry, A.F., & Glass, D.J. (Eds.) Devonian of the World, Volume III: Paleontology, Paleoecology and Biostratigraphy. Canadian Society of Petroleum Geologists, Memoir No. 14, pp 229-242.

JELL, P.A. & THERON, J.N. 1999. Early Devonian echinoderms from South Africa. Memoirs of the Queensland Museum 43: 115-199.

MACRAE, C. 1999. Life etched in stone. Fossils of South Africa. 305pp. The Geological Society of South Africa, Johannesburg.

OOSTHUIZEN, R.D.F. 1984. Preliminary catalogue and report on the biostratigraphy and palaeogeographic distribution of the Bokkeveld Fauna. Transactions of the Geological Society of South Africa 87: 125-140.

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. 1972. The stratigraphy and sedimentation of the Bokkeveld Group. Unpublished DSc thesis, University of Stellenbosch, 175pp, 17pls.

THERON, J.N. 1999. Lithostratigraphy of the Gydo Formation (Bokkeveld Group). SACS Lithostratigraphic Series No. 33, 1-11. Council for Geoscience, Pretoria.

THERON, J.N. & JOHNSON, M.R. 1991. Bokkeveld Group (including the Ceres, Bidouw and Traka Subgroups). Catalogue of South African Lithostratigraphic Units 3: 3-5.

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
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