

PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT

EXISTING BORROW PIT ALONG THE OP5960 ROAD IN THE KOO REGION, MONTAGU DISTRICT, WESTERN CAPE

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1. EXECUTIVE SUMMARY

The small, recently established OP05960/1.3/L/100 pit, located in the Koo region about 35 km northwest of Montagu, Western Cape, is excavated into mudrocks of the Early Devonian Voorstehoek Formation (Lower Bokkeveld Group). The marine sediments contain sparse moulds of molluscs, trilobites and articulate brachiopods but most specimens are compromised by weathering and tectonic cleavage development.

The palaeontological sensitivity of the site is correspondingly low and, 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 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 a small existing, recently established borrow pit along the unsealed road OP6960 in the Koo region (Montagu District). Pit OP05960/1.3/L/100 (33° 38' 33.0" S, 19° 46' 48.7" E) on farm Biesiespol No. 42 Montagu is situated about 35 km northwest of the town of Montagu, Western Cape (Figs. 1 & 2).

A previous desktop basic assessment of the pit by the author assessed its palaeontological heritage sensitivity as high due to the presence here of potentially fossiliferous sediments of the Voorstehoek Formation (Lower Bokkeveld Group, Ceres Subgroup). A palaeontological field assessment of the pit as part of an HIA was requested by Heritage Western Cape (HWC Case Ref. 111124JB43, 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). Fieldwork for this project was carried out on 19 August 2012.

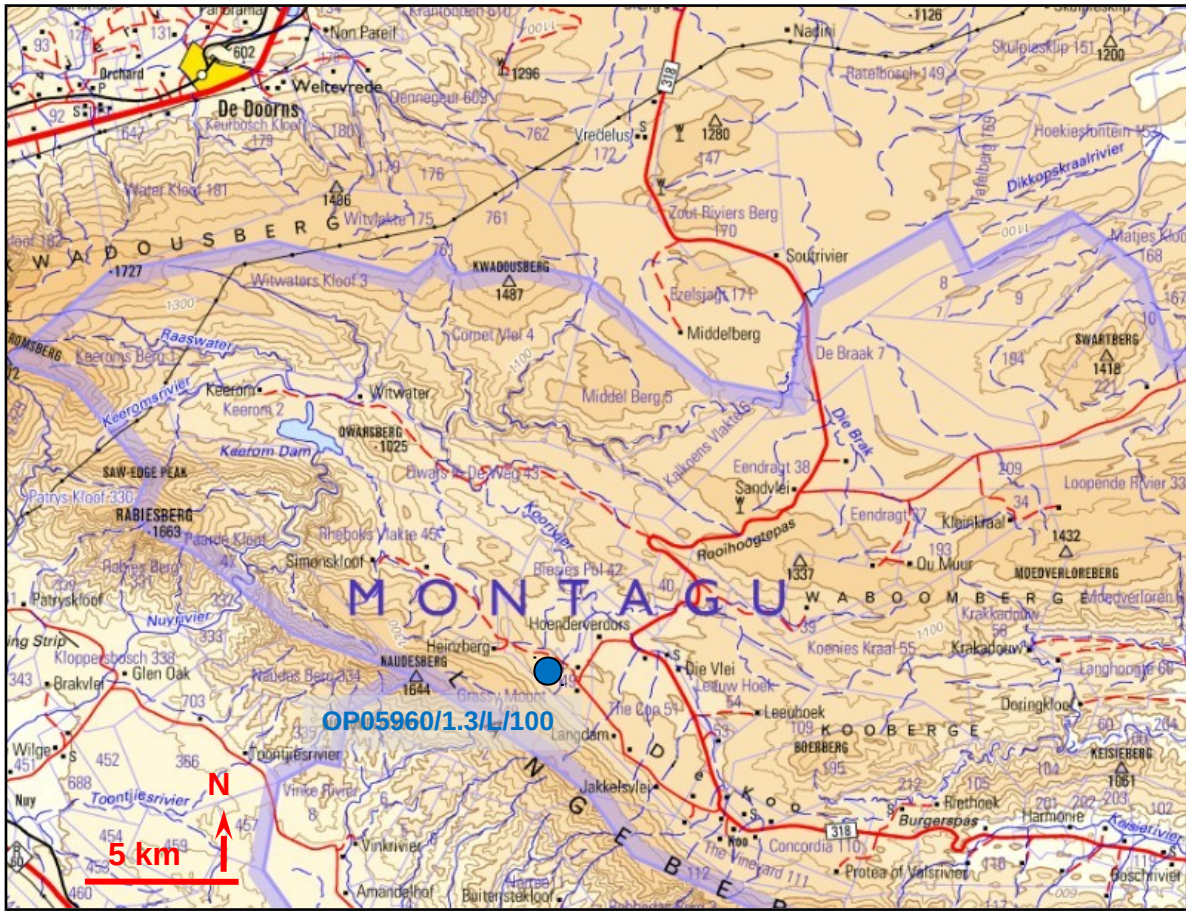


Fig.1. Extract from topographical sheets 3119 Worcester (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the approximate location of the existing pit OP05960/1.3/L/100 located in the Koo region c. 35 km NW of Montagu, Western Cape (blue dot).



Fig. 2. 2010 Google earth© satellite image of the study area showing the location of the new OP05960/1.3/L/100 pit on the south side of the OP5960 (yellow arrow) on the farm Biesiespol No. 42 Montagu. The pit has only recently been established. The yellow scale bar = c. 1 km.

3. GEOLOGICAL HERITAGE

The geology of the Koo study area near Montagu is shown on 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) and is shown here in Fig. 3. A short sheet explanation has been published by Gresse & Theron (1992; see also the older 1: 125 000 Worcester- Hermanus map and sheet explanation by De Villiers *et al.* 1964).

The newly established, small OP05960/1.3/L/100 pit is situated on a gentle, north-facing hill slope (a possible pediment surface) at about 960m amsl on the north-eastern flanks of the Langeberg range in the elevated, hilly Koo region of the Western Cape (Figs. 2, 4). The pit is excavated into marine mudrocks of the **Voorstehoek Formation (Dv, Lower Bokkeveld Group / Ceres Subgroup)** of Early Devonian (Eifelian) age. The sedimentology of this unit has been briefly described by Gresse and Theron (1992) and in more detail by Theron (2003). It comprises an upward-coarsening, shallowing succession of grey-green and grey mudrocks that are increasingly interbedded with wave-rippled wackes (impure sandstones) of tempestite origin towards the top. The Voorstehoek Formation is about 90m thick near Touwsrivier, some 40 km northeast of the study area.

The Bokkeveld Group rocks in the Koo region are folded into a major west-east trending syncline whose axis runs along along the Koosberg Range (Fig. 3). In pit OP05960/1.3/L/100 the Voorstehoek bedrocks are only poorly exposed (Fig. 4). They comprise grey-green to dark grey, mottled weathered mudrocks with well-developed cleavage seen locally. Small ferruginous diagenetic concretions are common. The Bokkeveld bedrocks are mantled with reddish brown silty to gravelly colluvial deposits (Fig. 5).

Fig. 4. View south-eastwards across the existing OP05960/1.3/L/100 borrow pit. Note that little *in situ* bedrock is exposed here.



Fig. 5. Reddish-brown, silty colluvial deposits with fine surface gravels mantling the Bokkeveld Group mudrocks along the southern edge of the pit.

4. PALAEOLOGICAL HERITAGE

The fossil record of the mudrock-dominated Voorstehoek Formation (Dv, Eifelian) has been summarised by Oosthuizen (1984), Almond *et al.* (1996), Gresse and Theron (1992), Theron (2003) and Almond (2008, 2010). Generally fossil assemblages in this unit are much sparser and less diverse than in the underlying Gydo Formation, and they are correspondingly less well known. Abundant trace fossil assemblages in the northern outcrop area attest to the presence of a flourishing invertebrate fauna at the time (Almond *in* De Beer *et al.*, 2002). Abundant shelly fossils are recorded from mudrocks in the lower half of this stratigraphic unit in the southwestern outcrop area including the Warm Bokkeveld, Matroosberg and Theron's Pass region (Theron 1972, Oosthuizen 1984, Gresse & Theron 1992, Theron 2003).

Voorstehoek shelly fossils have often been concentrated by storm winnowing and currents into thin shelly lenses or *coquinas*. Fossil biotas are dominated by shelly invertebrates such as trilobites, articulate brachiopods, crinoids, ophiuroids, bivalves, bellerophontid “gasteropods”, orthocone nautiloids, and problematic conical-shelled groups such as hyolithids and tentaculitids (Theron 1972, Oosthuizen 1984, Gresse & Theron 1992, Theron 2003, Almond 2008). Heterolithic, tempestite-dominated successions within the Voorstehoek Formation, especially in its northern outcrop area, have yielded rich shallow marine trace fossil assemblages of the *Cruziana* Ichnofacies (Almond 1998, Almond *in* De Beer *et al.* 2002, Theron 2003, Almond 2008).

The fairly impoverished Voorstehoek fossil assemblages are dominated by brachiopods and molluscs, with rarer echinoderms, trilobites, gastropods and nautiloids (Theron 2003). Fossils are often concentrated in thin coquinas and are usually but far from invariably disarticulated due to current action, notably by storm waves in nearshore sediments. Mudrocks often show high levels of bioturbation, *i.e.* churning by burrowing, sediment-feeding invertebrates such as homalonotid trilobites, nuculid bivalves, bellerophontid gastropods and other, unidentified invertebrate taxa. Remobilisation and re-suspension of soupy shelf muds may have limited or excluded larval settling and / or feeding by suspension-feeding taxa such as crinoids and brachiopods that are poorly represented in many offshore Voorstehoek fossil assemblages (Almond *et al.* 1996). Occasional thin, dense fossil *Lagerstätte* dominated by fully-articulated echinoderms (brittlestars, starfish, carpoids *etc*) are recorded from lower Bokkeveld mudrock units of the Warm Bokkeveld, Hex River Valley region and further east (Theron 1972, Oosthuizen 1984, Jell & Theron 1999). These so-called “starfish beds” are attributed to *obrution* or sudden smothering of benthic invertebrates by storm re-suspended muds and provide useful, albeit biased “snapshots” of offshore marine life on the Early Devonian seabed.

Only sparse, poorly preserved moulds of invertebrate fossils were recorded in pit OP05960/1.3/L/100 (Figs. 6 and 7). The moulds are generally tectonically distorted and secondarily ferruginised, so identification of the remains is difficult to impossible. Taxa recognised here include moderately large, elongate bivalves (possibly *Orthonota*), articulated trunk segments of small trilobites (probably *Pennaia*), and the articulate brachiopods *Australoecoelia* and chonetids. Due to weathering and cleavage development in the Bokkeveld mudrocks, the palaeontological sensitivity of this pit site is considered to be LOW.



Fig. 6. Poorly preserved internal mould of a bivalve (possibly *Orthonota*), approximately 6 cm long, associated with strongly ribbed small brachiopods (probably *Australoecoelia*).



Fig. 7. Unidentifiable ferruginised and distorted mould of a shelly fossil (scale in cm).

5. CONCLUSIONS & RECOMMENDATIONS

The small, recently established OP05960/1.3/L/100 pit is excavated into mudrocks of the Early Devonian Voorstehoek Formation (Lower Bokkeveld Group). The marine sediments contain sparse moulds of molluscs, trilobites and articulate brachiopods but most specimens are compromised by weathering and tectonic cleavage development.

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6. ACKNOWLEDGEMENTS

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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 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.



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