

MARALLA WIND ENERGY FACILITY NEAR SUTHERLAND, NORTHERN CAPE & WESTERN CAPE: PALAEOONTOLOGICAL HERITAGE

Maralla West WEF

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1. Geological Context

The Maralla West Wind Energy Facility (WEF) project area is situated in semi-arid, hilly to mountainous terrain of the Klein-Roggeveldberge region in the southwestern part of the Great Karoo, just below the Komsberg Escarpment (Fig. 1). The area extends either side of the dust road leading to the Komsberg Pass some 40 km SSE of Sutherland and lies within the Northern Cape. The geology of the Maralla West WEF study area is outlined on the 1: 250 000 geology sheet 3220 Sutherland (Council for Geoscience, Pretoria; Theron 1983, Cole & Vorster 1999) (Fig. 2). Geologically it lies on the gently folded northern margin of the Permo-Triassic Cape Fold Belt (CFB) and is dominated by bedrocks of the Karoo Supergroup (Johnson *et al.* 2006). Only one mappable bedrock unit is represented within the study area, *viz.* fluvial and lacustrine mudrocks and sandstones of the **Abrahamskraal Formation (Lower Beaufort Group / Adelaide Subgroup)** of Middle Permian age (Pa, pale green in Fig. 2). Intrusions of the Karoo Dolerite Suite have not been mapped in this area. Levels of bedrock exposure in the Klein-Roggeveldberge region are generally very low due to the pervasive mantle of **Late Caenozoic superficial deposits** such as alluvium, colluvium (scree, hillwash), surface gravels, pedocretes (*e.g.* calcrete) and soils as well as karroid bossveld vegetation. Most of these deposits are of Quaternary to Holocene age.

2. Palaeontological heritage

The Great Karoo is world-famous for its rich record of terrestrial vertebrates and other fossils from the Permian, Triassic and Early Jurassic Periods in Gondwana (MacRae 1999, McCarthy & Rubidge 2005). The fossil record of the Klein-Roggeveld region is very poorly known by Karoo standards but our knowledge has been in recent years through several palaeontological impact assessments in the area (*e.g.* Almond 2015a, 2015b, 2015c, 2015d). The Lower Beaufort beds in the study area belong to the middle part of the very thick (*c.* 2.5 km) Abrahamskraal Formation succession – predominantly the Koornplaats Member. A range of fossil tetrapod (*i.e.* four-limbed vertebrate) remains have been discovered from this stratigraphic level in the Klein-Roggeveldberge and adjacent Mordenaarskaroos regions (Loock *et al.* 1995, Almond 2015d and refs. therein). These earliest diverse terrestrial vertebrate faunas of the Main Karoo Basin are assigned to the late Middle Permian *Tapinocephalus* Assemblage Zone (Smith & Keyser 1995, Day & Rubidge 2010, Smith *et al.* 2012). They are characterised by a range of therapsid (“mammal-like reptile”) subgroups such as dicynodonts and dinocephalians as well as large-bodied pareiasaur reptiles (Fig. 3). Other important fossil groups include large temnospondyl amphibians, bony fish, freshwater bivalves, various invertebrate and vertebrate trace fossils (*e.g.* tetrapod trackways and burrows, lungfish aestivation burrows) as well as sparse vascular plants of the *Glossopteris* Flora. The wide spectrum of Late Caenozoic superficial sediments overlying the Palaeozoic and Mesozoic bedrocks in the study area are generally fossil-poor. Important bones, teeth and horn cores may occasionally be found in better-consolidated Quaternary alluvial deposits, while finer-grained sediments and calcretes may contain fossilised burrows (*e.g.* termitaria), freshwater molluscs and plant root casts.

3. Palaeontological heritage assessment

All South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils may not be collected, damaged or disturbed without a permit from the relevant Provincial Heritage Resources Agency (in this case SAHRA). The construction phase of the proposed WEF will entail extensive surface clearance as well as excavations into the superficial sediment cover and underlying bedrock. The development may adversely affect potential fossil heritage within the study area by destroying, damaging, disturbing or permanently sealing-in fossils preserved at or beneath the surface of the ground that are then no longer available for scientific research or other public good. Such impacts on fossil heritage are generally direct, negative and of permanent effect (non-reversible). The planning, operational and decommissioning phases of the WEF are unlikely to involve further adverse impacts on local palaeontological heritage. A combined desktop and field-based palaeontological heritage assessment of the Maralla West WEF project area has been commissioned by WSP | Parsons Brinckerhoff, Environment & Energy, Africa for this alternative energy project.

In terms of palaeontological sensitivity the outcrop area of the Lower Beaufort Group is generally considered to be high because of its rich record of Permian vertebrates and plants (MacRae 1999, McCarthy & Rubidge 2005, Almond & Pether 2008a, 2008b, SAHRIS website). The Late Caenozoic superficial deposits (alluvium *etc*) are generally of low sensitivity but may also be locally high (e.g. fossil mammals).

A four-day field assessment of the Maralla study area carried out in February 2016 will inform the EIA phase for this project. Fieldwork has indicated that fossil material such as vascular plants (equisetalean ferns, reworked woody debris), rare and fragmentary vertebrate remains (possibly amphibian) and a small range of invertebrate and vertebrate trace fossils are present within the Karoo Supergroup bedrocks. However, unique, scientifically-important fossils are very scarce indeed here, even where bedrock exposure levels are locally high. No highly-sensitivity palaeontological no-go areas have been identified within the Maralla West WEF study area.

It is concluded that impacts on palaeontological heritage resources are *probable* but will only be *moderately severe* since (1) highly significant fossil sites are unlikely to be affected and (2) in many cases these impacts can be mitigated. The overall impact significance of the Maralla West WEF is rated as VERY LOW in terms of palaeontological heritage resources. This assessment applies to the entire Maralla West project area, including access roads and alternative transmission line connections to the Eskom grid. Cumulative impacts inferred for the various alternative energy developments in the Klein-Roggeveld region between Matjiesfontein and Sutherland are likewise assessed as low.

Mitigation of chance fossil finds reported by the ECO would involve the recording, sampling and / or collection of chance fossil finds and associated geological data by a professional palaeontologist during the construction phase of the development. The palaeontologist concerned with potential mitigation work would need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection) (SAHRA 2013).

4. Key references

ALMOND, J.E. 2015a. Proposed Soetwater Wind Farm near Sutherland, Namaqua District Municipality, Northern Cape Province. Palaeontological heritage assessment: combined desktop & field-based study, 57 pp. Natura Viva cc.

ALMOND, J.E. 2015b. Komsberg East Wind Energy Facility near Sutherland, Laingsburg District, Western Cape. Palaeontological scoping assessment: combined desktop and field-based study, 51 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2015c. Komsberg West Wind Energy Facility near Sutherland, Laingsburg and Sutherland District, Western and Northern Cape. Palaeontological scoping assessment: combined desktop and field-based study, 55 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2015d. Proposed Gunstfontein Wind Energy Facility near Sutherland, Karoo Hoogland Local Municipality, Northern Cape Province. Palaeontological heritage assessment: combined desktop & field-based study, 62 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008a. Palaeontological heritage of the Western Cape. Interim SAHRA technical report, 20 pp. Natura Viva cc., Cape Town.

ALMOND, J.E. & PETHER, J. 2008b. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

COLE, D.I. & VORSTER, C.J. 1999. The metallogeny of the Sutherland area, 41 pp. Council for Geoscience, Pretoria.

DAY 2013. Middle Permian continental biodiversity changes as reflected in the Beaufort Group of South Africa: a bio- and lithostratigraphic review of the *Eodicynodon*, *Tapinocephalus* and *Pristerognathus* assemblage zones. Unpublished PhD thesis, University of the Witwatersrand, Johannesburg, 387 pp plus appendices.

DAY, M. & RUBIDGE, B. 2010. Middle Permian continental biodiversity changes as reflected in the Beaufort group of South Africa: An initial review of the *Tapinocephalus* and *Pristerognathus* assemblage zones. Proceedings of the 16th conference of the Palaeontological Society of Southern Africa, Howick, August 5-8, 2010, pp. 22-23.

JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., WICKENS, H. DE V., CHRISTIE, A.D.M., ROBERTS, D.L. & BRANDL, G. 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria.

LOOCK, J.C., BRYNARD, H.J., HEARD, R.G., KITCHING, J.W. & RUBIDGE, B.S. 1994. The stratigraphy of the Lower Beaufort Group in an area north of Laingsburg, South Africa. *Journal of African Earth Sciences* 18: 185-195.

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

McCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.

SMITH, R.M.H. & KEYSER, A.W. 1995. Biostratigraphy of the *Tapinocephalus* Assemblage Zone. Pp. 8-12 in Rubidge, B.S. (ed.) Biostratigraphy of the Beaufort Group (Karoo Supergroup). South African Committee for Stratigraphy, Biostratigraphic Series No. 1. Council for Geoscience, Pretoria.

SMITH, R., RUBIDGE, B. & VAN DER WALT, M. 2012. Therapsid biodiversity patterns and paleoenvironments of the Karoo Basin, South Africa. Chapter 2 pp. 30-62 in Chinsamy-Turan, A.

(Ed.) Forerunners of mammals. Radiation, histology, biology. xv + 330 pp. Indiana University Press, Bloomington & Indianapolis.

THERON, J.N. 1983. Die geologie van die gebied Sutherland. Explanation of 1: 250 000 geological Sheet 3220, 29 pp. Council for Geoscience, Pretoria.

THERON, J.N., WICKENS, H. DE V. & GRESSE, P.G. 1991. Die geologie van de gebied Ladismith. Explanation of Sheet 3320. 99 pp. Geological Survey / Council for Geoscience, Pretoria.

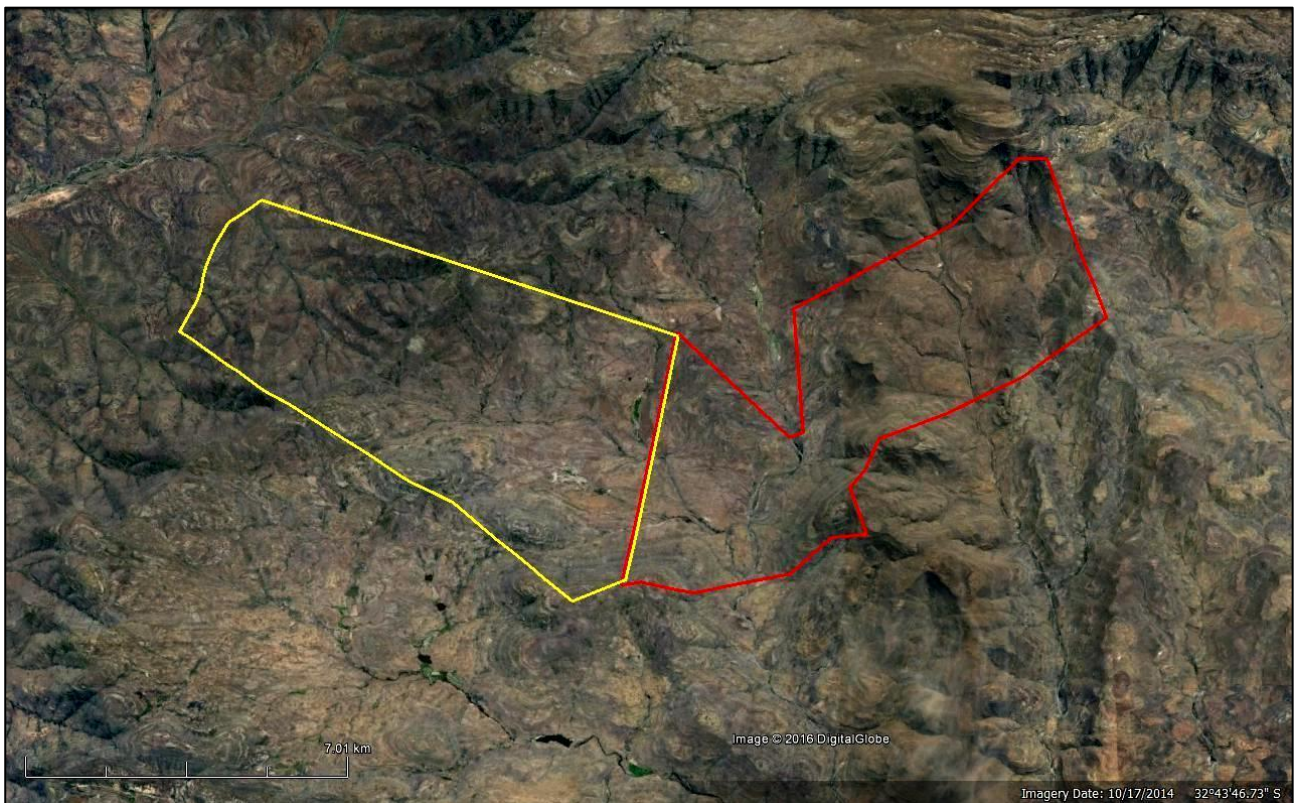


Figure 1. Google earth© satellite image of the Maralla West WEF study area (yellow polygon) and the Maralla East WEF study area (red polygon), located at the foot of the Komsberg Escarpment c. 40 km northwest of Laingsburg, Western Cape.

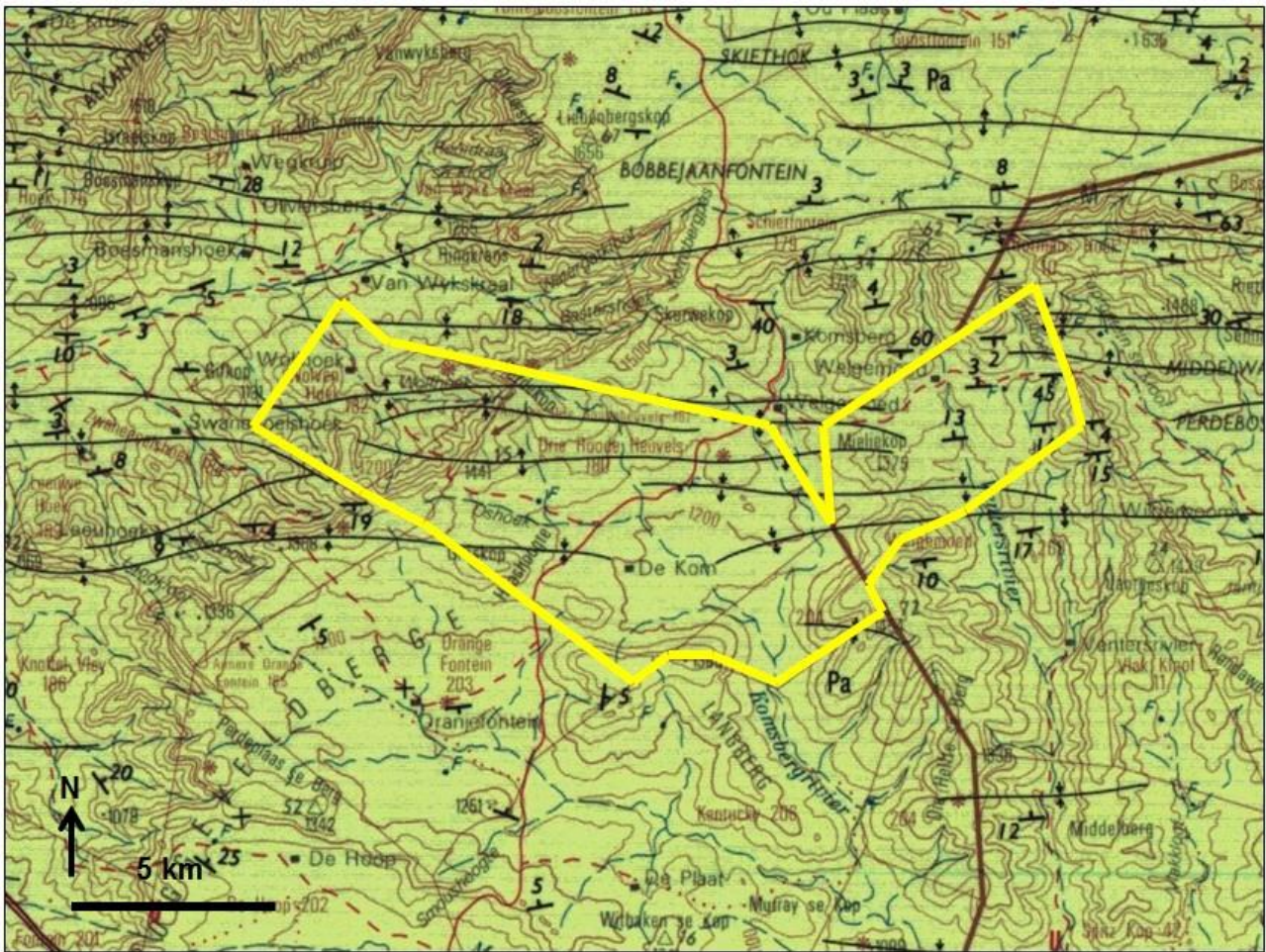


Figure 2. Extract from the 1: 250 000 scale geology sheet 3220 Sutherland (Council for Geoscience, Pretoria, 1999) showing the location of the proposed Maralla WEF study area, c. 40 km SSE of Sutherland, Western and Northern Cape Province (yellow polygon). The study area is entirely underlain by Middle Permian sediments of the Abrahamskraal Formation, Lower Beaufort Group (Pa, pale green). Note several west-east trending fold axes (black lines) in the northern part of the study area and the absence of Karoo dolerite intrusions here.

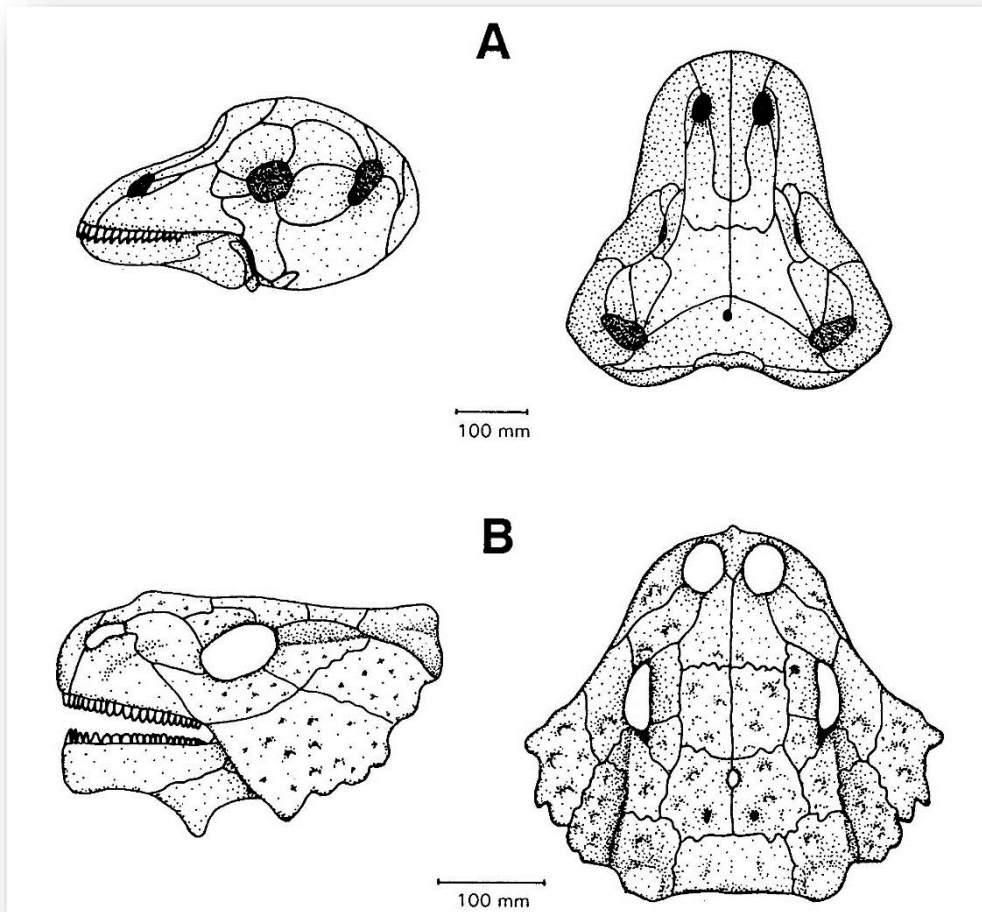


Figure 3 Skulls of two key large-bodied tetrapods of the *Tapinocephalus* Assemblage Zone: A – the dinocephalian therapsid *Tapinocephalus*; B – the pareiasaur reptile *Bradysaurus* (From Smith & Keyser 1995b).



Figure 4. Lower Beaufort Group sandstone palaeosurface on Welgemoed 268 showing a partially-exposed temnospondyl amphibian trackway, including scalloped median trail impressions. The same surface also preserves amphibian floating or swimming trails (Scale = c. 15 cm).

5. 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, Limpopo, Northwest and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as 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 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 development 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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