

RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES:

Proposed Wildebeest Karoo photo-voltaic solar power plant on Farm Wildebeest Vlake No. 51, Victoria West, Northern Cape Province

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1. OUTLINE OF DEVELOPMENT

The company Green Sky Solar (Pty) Ltd is proposing to develop a 10 - 12 MW photovoltaic solar power plant on an area of less than 20 hectares on Farm Wildebeest Vlake No. 51. This farm is situated approximately 30 km northeast of Victoria West, Northern Cape, and lies just to the northwest of the railway line and road between Hutchinson and De Aar (Fig. 1). Two alternative sites for the proposed PV plant are under consideration (Fig. 2). The proposed Wildebeest Karoo Solar Power Plant would consist of modules of photovoltaic (PV) solar panels covering a footprint area of < 20 ha. The PV panels would be mounted in concrete pedestals to be cast on top of any outcropping rock or set into the ground. Associated infrastructure entails internal access roads, underground or surface cables, a small sub-station and a short overhead transmission line. Existing gravel farm roads on the property would be upgraded and used to access the site during the construction phase. No new access roads are planned.

Since it overlies potentially fossiliferous bedrocks of the Abrahamskraal Formation (Beaufort Group, Karoo Supergroup), specialist comment on the potential palaeontological heritage impacts of the proposed development has been requested by SAHRA. The present study has accordingly been commissioned on behalf of the client by Withers Environmental Consultants (Pty) Ltd., P.O.Box 6118, Uniedal 7612.

A short site visit to the Wildebeest farm area was made on 28th January, 2012.

2. GEOLOGICAL BACKGROUND

The geology of the study area is shown on 1: 250 000 sheet 3122 Victoria West (Fig. 3; Le Roux & Keyser 1988). The area is largely underlain at depth by fluvial sediments of the Mid to Late Permian **Abrahamskraal Formation** (Lower Beaufort Group, Karoo Supergroup) that are extensively intruded here by dykes of the Early Jurassic **Karoo Dolerite Suite** (Johnson *et al.* 2006, Duncan & Marsh 2006). Satellite images (Fig. 2) and field studies show that the Beaufort Group bedrocks are largely mantled by dolerite scree, down-wasted gravels (clasts mainly of dolerite and Beaufort sandstone, some showing well-developed patina of desert varnish, with minor calcrete and hornfels; Fig. 6), calcrete, orange-brown sandy soils and silty alluvium of probable Late Quaternary to Recent age, with very little surface exposure of the potentially fossiliferous Beaufort Group mudrocks. Low ridges of Beaufort sandstones, including sheet-like, ripple cross-laminated crevasse splay sandstones, occur in some areas. Intraformational mudflake conglomerates (Fig. 4) and ferruginous carbonate lenses (*koffieklip*, Fig. 5) here were examined for

reworked bones, teeth and plant material, but without success. In flat-lying areas the alluvium is half a meter or more in thickness, as shown for example by open aardvark excavations.

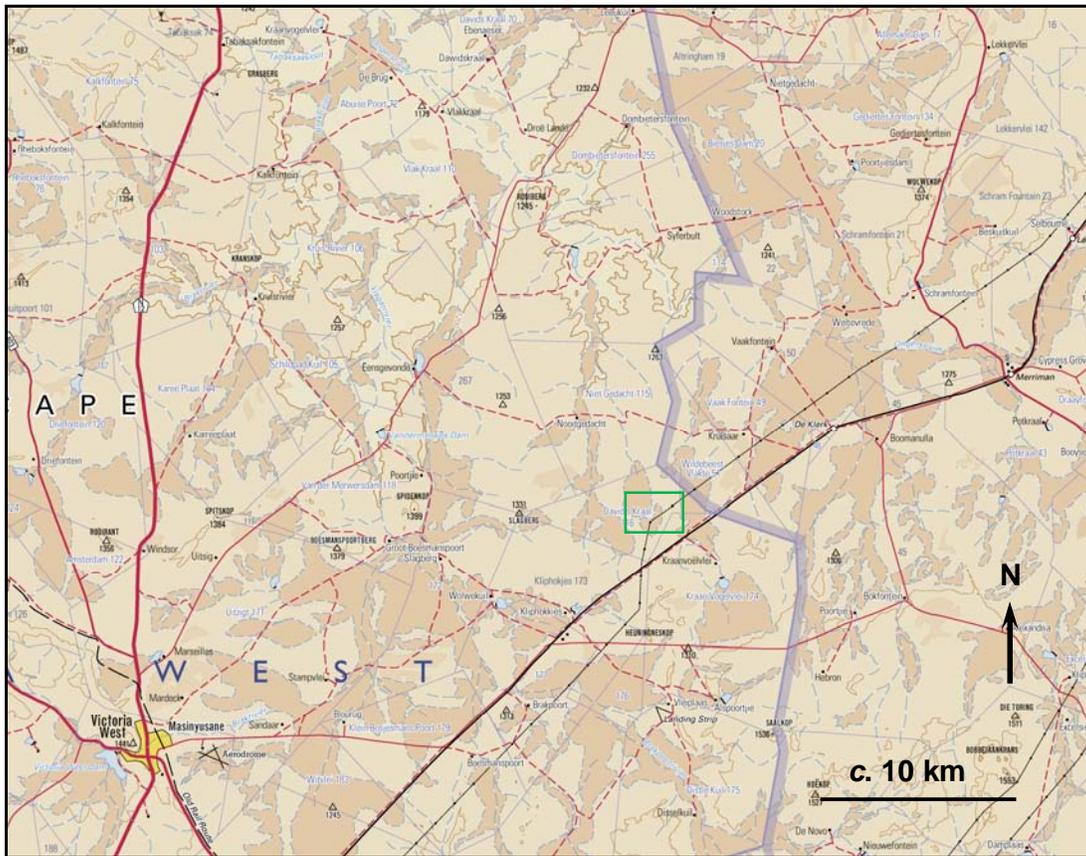


Fig. 1. Extract from 1: 250 000 map 3122 Victoria West showing location of the study area on Farm Wildebeest Vlakke No. 51, c. 30 km northeast of Victoria West, Northern Cape Province (Map courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray).

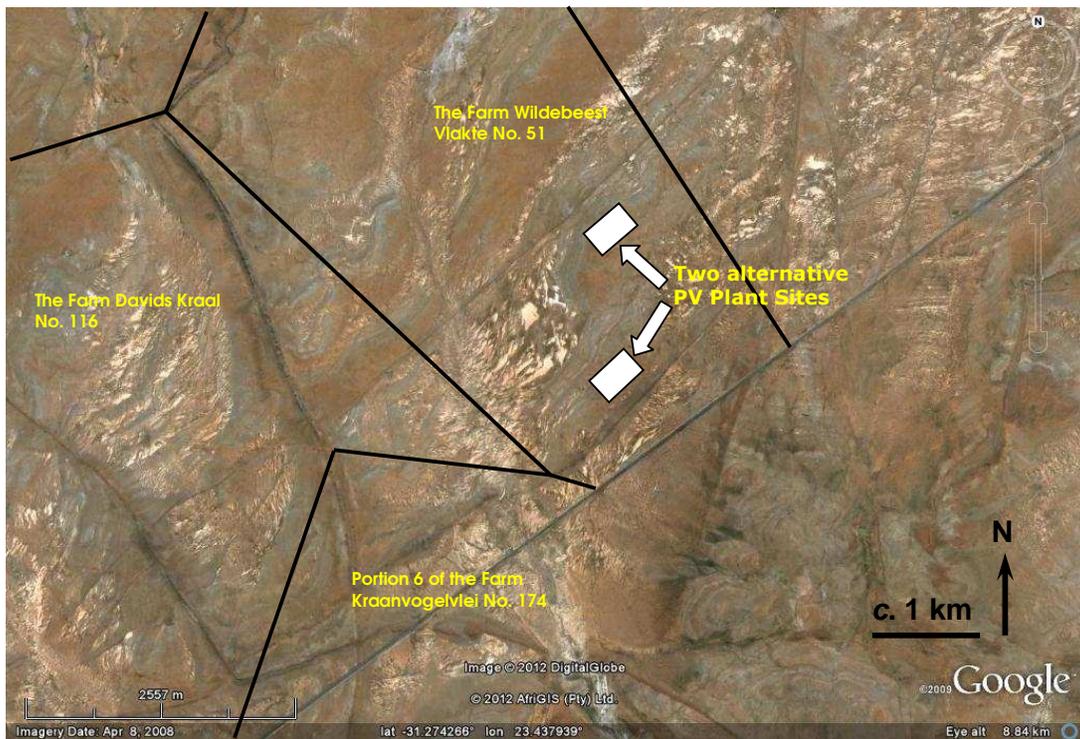


Fig. 2. Google Earth© satellite image of the study area on Wildebeest Vlak No. 51 on the north-western side of the railway line, showing two alternative sites for the proposed PV3 plant project. The region is criss-crossed by prominent-weathering dolerite dykes while Beaufort Group bedrocks are largely mantled by dolerite colluvium (scree, gravels) and superficial sediments. Image kindly provided by Withers Environmental Consultants (Pty) Ltd.

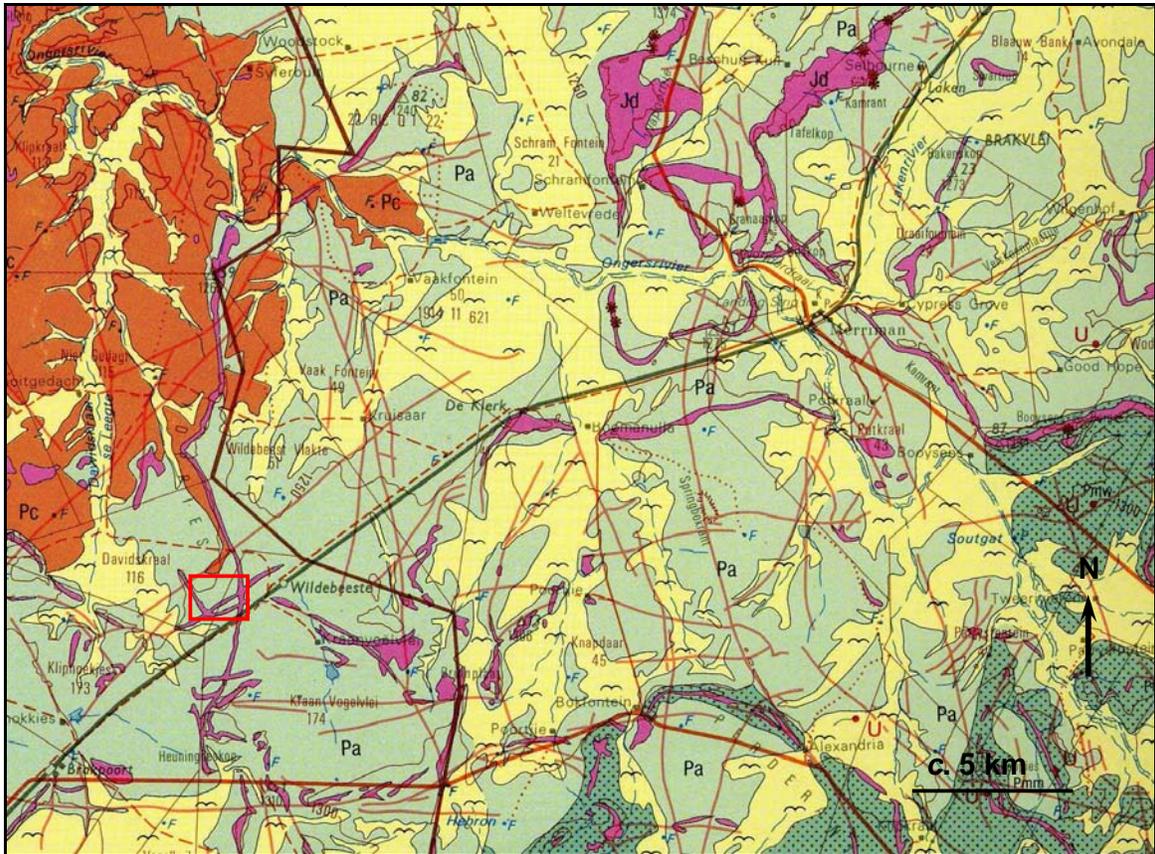


Fig. 3. Extract from 1: 250 000 geological map 3122 Victoria West (Council for Geoscience, Pretoria) showing approximate location of the study area on Farm Wildebeest Vlakte No. 51 (red rectangle), close to the Hutchinson – De Aar railway line. Geological units represented in this area are the Late Permian Abrahamskraal Formation (Pa pale green), Early Jurassic intrusive dykes of the Karoo Dolerite Suite (Jd, pink), and Late Caenozoic alluvium (yellow with “flying bird” symbol).



Fig. 4. Inclined bedding planes of Lower Beaufort Group sandstone showing thin mudflake conglomerates, apparently without associated reworked bone (Hammer = 30 cm).



Fig. 5. Ferruginous carbonate lenticle within a Lower Beaufort Group sandstone (Hammer = 30 cm). Concentrations of plant material and secondary uranium mineralisation is sometimes associated with such *koffieklip* concretions elsewhere in the Karoo Basin.



Fig. 6. Typical downwasted surface gravels (sandstone, dolerite, hornfels, calcrete) within the Wildebeest PV Plant study area (Hammer = 30 cm).

3. PALAEOLOGICAL HERITAGE

The overall palaeontological sensitivity of the Beaufort Group sediments in general is high to very high (Almond & Pether 2008). These continental sediments have yielded one of the richest fossil records of land-dwelling plants and animals of Permo-Triassic age anywhere in the world (e.g. MacRae 1999, Rubidge 2005, McCarthy & Rubidge 2005). Any Abrahamskraal Formation fossil assemblages in the broader study region northeast of Victoria West probably belong to the Late Permian *Pristerognathus* Assemblage Zone (Smith & Keyser 1995).

Due no doubt in large part to the extensive cover of younger superficial sediments, which are themselves of very low palaeontological sensitivity, no body fossils were observed during fieldwork at the study site. A single vertebrate fossil, possibly a bone-containing coprolite or regurgitate, was found on the NW-facing slopes of a ridge some c. 8.5 km NE of the study area (Fig. 7). Thin, ripple cross-laminated sheet sandstones of probable crevasse splay origin display a small range of horizontal to oblique cylindrical burrows on their upper surfaces (Fig. 8). Some of the cm-wide scratch burrows are attributable to the ichnogenus *Scoyenia* and were probably generated by arthropods or oligochaete worms in moist, firm sediments on the flood plain or around a playa lake.

The Karoo Dolerite Suite intrusions are unfossiliferous, and the superficial sediments mantling the bedrocks are at most very sparsely fossiliferous. Subrounded pieces of silicified wood that have been reworked out of the underlying Beaufort Group are occasionally found among the surface gravels in the region. No fossils were seen within these younger surface sediments during the field visit.



Fig. 7. Concentration of angular bone fragments embedded within Abrahamskraal Formation siltstones – possibly part of a carnivore coprolite (fossil dropping) or regurgitate (Scale in mm). Specimen recorded c. 8.5 km NE of the study site (31° 14' 47.4" S, 23° 30' 19.2" E).

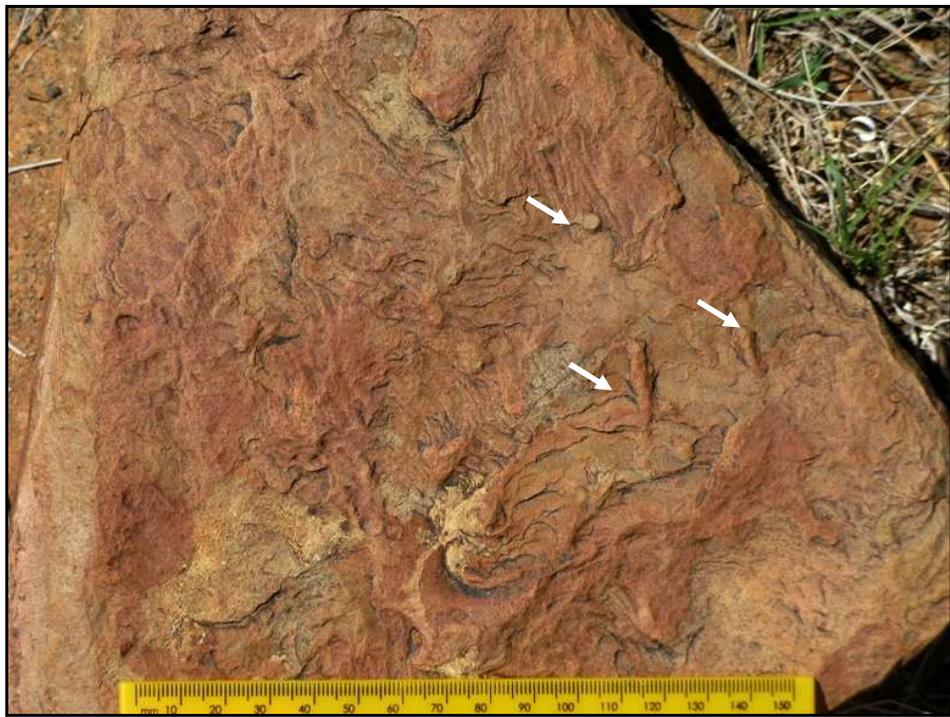


Fig. 8. Ripple cross-laminated Abrahamskraal sandstone showing poorly-preserved horizontal and oblique burrows (arrows) of the arthropod ichnogenus *Scoyenia*.

4. CONCLUSIONS & RECOMMENDATIONS

The construction of the proposed PV solar power plant is not considered to pose a serious threat to local fossil heritage because:

- Substantial, deep bedrock excavations are not envisaged during the construction phase;
- The alternative sites under consideration are very small (< 20 ha);
- There is minimal bedrock exposure in the study area, especially as far as the potentially fossiliferous Beaufort Group mudrocks are concerned;
- The fossil content of the Beaufort Group sediments may have been compromised by thermal metamorphism during dolerite intrusion.

It is therefore recommended that, pending significant new fossil discoveries within the development footprint, exemption from further specialist palaeontological studies and mitigation is granted for this alternative energy development.

Should any substantial fossil remains (e.g. vertebrate bones and teeth, petrified wood) be encountered during excavation, however, these should be reported to SAHRA for possible mitigation by a professional palaeontologist.

5. REFERENCES

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

DUNCAN & MARSH 2006. The Karoo Igneous Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 501-520. Geological Society of South Africa, Marshalltown.

LE ROUX, F.G. & KEYSER, A.W. 1988. Die geologie van die gebied Victoria-Wes. Explanation to 1: 250 000 geology Sheet 3122, 31 pp. Council for Geoscience, Pretoria.

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.

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. Pp. 461- 499 in Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (eds.) The geology of South Africa. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria.

RUBIDGE, B.S. 2005. Re-uniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust. 27th Du Toit Memorial Lecture. South African Journal of Geology 108, 135-172.

SMITH, R.M.H. & KEYSER, A.W. 1995. Biostratigraphy of the *Pristerognathus* Assemblage Zone. Pp. 13-17 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.

6. 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 as well as Limpopo, Free State and Gauteng for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (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 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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