

RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES:

TWO PROPOSED PHOTOVOLTAIC ENERGY FACILITIES ON THE FARMS NAROEP (REMAINDER OF FARM NO. 45) AND HARAMOEP (REMAINDER OF FARM NO.53) NEAR AGGENEYS, NAMAQUA DISTRICT MUNICIPALITY, NORTHERN CAPE

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EXECUTIVE SUMMARY

The entire study area for the proposed Veld PV North and Veld PV South solar facilities near Aggenys, Northern Cape, as well as for the associated 132 kV grid connection to Aggenys Substation, is underlain by unfossiliferous Precambrian basement rocks. The bedrocks are largely covered by Late Caenozoic superficial sediments – alluvial sands and gravels, aeolian sands and calcretes – of low palaeontological sensitivity. Fossiliferous older alluvial deposits of the ancient (Miocene) Koa River Palaeo-valley that once flowed through this region of Bushmanland are unlikely to be impacted by the proposed development since they are probably deeply buried beneath younger sediments. The impact significance of the proposed solar facility and grid connection developments is rated as LOW; cumulative impacts in the context of other renewable energy developments in the Aggenys region are likewise rated as low. These ratings apply equally to the entire project footprint and there is accordingly no preference on palaeontological heritage grounds for any particular PV site or layout under consideration. There is no objection on palaeontological grounds to authorisation of the PV solar projects and grid connection.

It is recommended that, pending the discovery of substantial new fossil remains before or during construction, exemption from further specialist palaeontological studies and mitigation be granted for the proposed solar PV facilities as well as for the associated 132 kV grid connection to the Aggenys Substation. A Chance Fossil Finds Procedure for the construction phase is appended to this report.

1. OUTLINE OF THE PROPOSED DEVELOPMENT

It is proposed to develop two photovoltaic (PV) energy facilities of 75 MW generation capacity and associated infrastructure on two farms, Naroep (Remainder of Farm No. 45) and Haramoep (Remainder of Farm No.53) (Fig. 1). These farms are situated between 40 and 20 km north-west of Aggenys in the Namaqua District Municipality, Northern Cape. Two site alternatives are being assessed for the **Veld PV North project**: an original site on the remainder of Naroep 45 (centre point: S29° 00' 25" E 18° 34' 25") and a preferred site on the remainder of Haramoep 53 (centre point: S29° 08' 10" E 18° 37' 02"). The **Veld PV South project** will be situated on Haramoep 53 (centre point: S29° 07' 32" E 18° 39' 37"). All sites fall within the Springbok Renewable Energy Development Zone (REDZ). The shared grid connection from the PV sites to the national grid *via* the existing Aggenys Substation will comprise a 132 kV overhead powerline of c. 25 to 40 km in length that will run adjacent to an existing 200 kV powerline.

The main infrastructural components of the proposed PV projects include:

- Arrays of PV solar panels mounted on steel tracking mounts and footings;
- On-site substations;
- Internal cabling, laid underground when feasible;
- Internal access roads;
- Stormwater infrastructure;
- Temporary construction areas;
- Buildings, including an operations and maintenance building, a connection building, a control building and a guard cabin;
- Weather stations; and
- Perimeter fencing.

The present consolidated palaeontological heritage desktop comment for the three potential PV facility sites as well as the shared grid connection has been commissioned on behalf of the proponent by ASHA Consulting (Pty) Ltd (Contact details: Dr Jayson Orton ASHA, 40 Brassie Street, Lakeside, 7945. E-mail: jayson@asha-consulting.co.za. Tel: 021 788 1025. Cell: 083 272 3225. Website: www.asha-consulting.co.za).

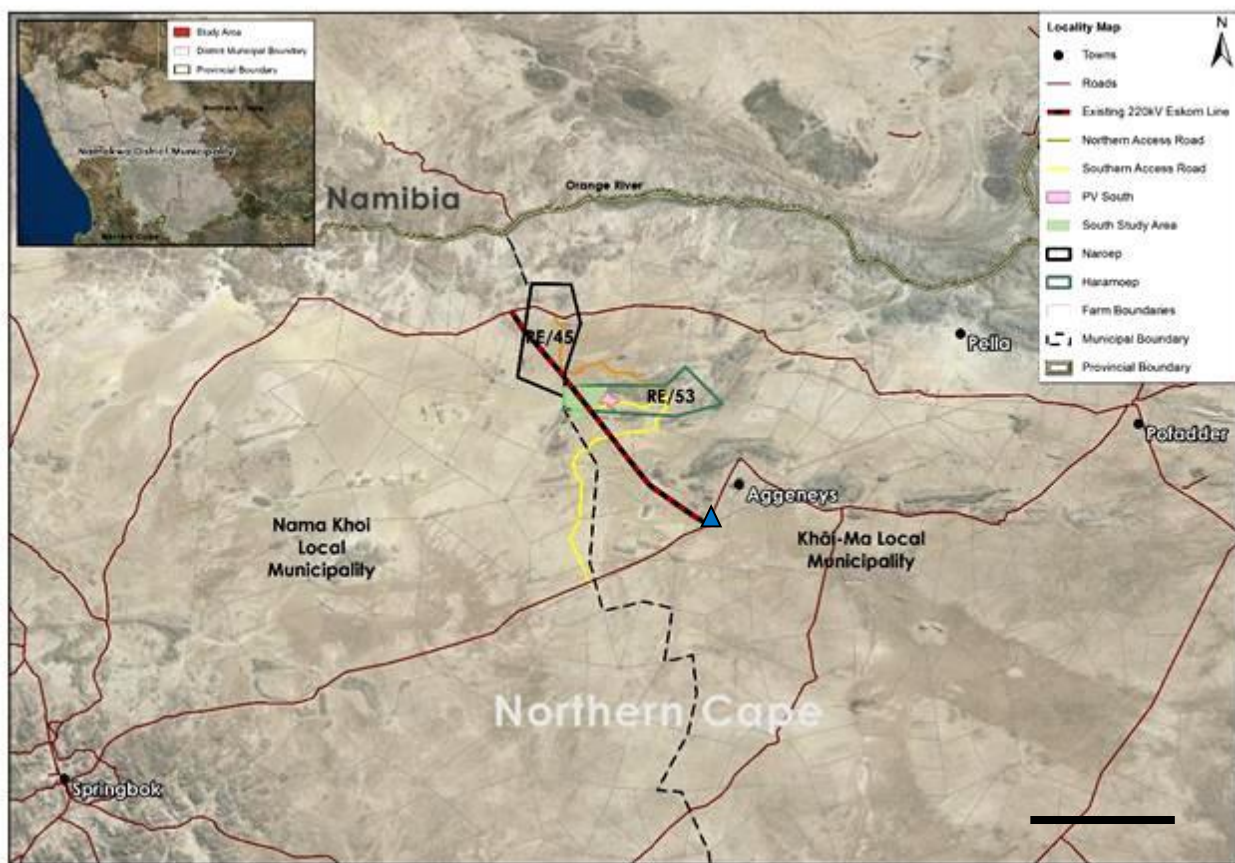


Figure 1. Satellite image of the Aggeneys region of the Northern Cape Province showing the location of the farms Naroep (Remainder of Farm No. 45) and Haramoep (Remainder of Farm No.53) where the proposed Veld PV North and Veld PV South solar energy projects will be situated. Also shown are the principle access roads to the sites (yellow, orange) and the c. 25-40 km - long 132 kV grid connection (red line) from the PV sites to the existing Aggeneys Substation (blue triangle) (Map provided by Aurecon). Scale bar = c. 20 km.

2. GEOLOGICAL BACKGROUND

The project area for the proposed PV solar facilities and associated grid connection lies within a highly arid region of Bushmanland between the N14 trunk road near Aggeneys and the Orange / Gariiep River, Northern Cape Province. The terrain here, situated between 700 and 870 m amsl, features numerous rocky Inselbergs built of resistant-weathering basement rocks emerging through a sea of sandy to gravelly superficial sediments of Late Caenozoic age. The region is traversed by numerous shallow sandy water courses, tributaries of the Orange River, and also features the buried palaeo-channel of the Koa River. This is a defunct southern tributary of the ancient Orange River that flowed through the area to the west of Aggeneys in Miocene times, some 15 million years ago (Malherbe *et al.* 1986, De Wit 1999, Partridge *et al.* 2006).

The geology of the PV facility project areas near Aggeneys, Northern Cape, is shown on adjoining 1: 250 000 geological sheets 2918 Pofadder and 2818 Onseepkans (Council for Geoscience, Pretoria) (Agenbacht 2007, Moen & Toogood 2007) (Fig. 2). The entire area is underlain at depth by highly metamorphosed or igneous Precambrian basement rocks of the **Namaqua-Natal Province**. These bedrocks are of Precambrian (Mid-Proterozoic) age and are entirely unfossiliferous (Cornell *et al.* 2006, Almond & Pether 2008). As clearly seen on satellite images, the Precambrian basement rocks within all three PV project footprints under consideration are largely overlain by a range of mostly unconsolidated superficial sediments of Quaternary to recent age that are broadly included within the **Kalahari Group** (Thomas 1981, Haddon 2000, Partridge *et al.* 2006). These include Quaternary to Recent sands and gravels of probable braided fluvial or sheet wash origin, as well as the veneer of downwasted surface gravels and colluvial (rocky scree) deposits that are not indicated separately on the geological maps. The youthful superficial sediments are locally overlain by unconsolidated aeolian (*i.e.* wind-blown) sands of the Quaternary **Gordonia Formation** (Kalahari Group) (orange linear-crested dunes on satellite images). A large calcrete outcrop area is traversed by the main access road to the PV sites from the N14 in the south. More consolidated alluvial sediments and pedocretes (*e.g.* calcrete) are probably associated with older water courses and pans. The precise route of the Koa River Palaeo-valley in relation to the PV project footprint is unclear, especially towards the north (*cf* blue dashed line in Figure 2). It is likely that sectors of the southern access road, the 132 kV grid connection as well as one or both of the Veld PV North study sites lie within the palaeo-valley. However, any relict Miocene alluvial deposits along this sector of the palaeo-valley are likely to be deeply buried beneath younger superficial deposits and will not be directly impacted by the proposed developments.

3. PALAEOONTOLOGICAL HERITAGE

The igneous and metamorphic **basement rocks** of the Namaqua-Natal Metamorphic Province are entirely unfossiliferous and will not be treated further here.

An important Early to Middle Miocene vertebrate faunule has been recorded from alluvial deposits (gravels, grits and lenses of sand, clay) of the southern portion of the **Koa River Palaeo-valley** system at Bosluis Pan, some 50 km SSW of Aggeneys. The fossil fauna has been dated to 15-16 Ma and is reviewed by Senut *et al.* (1996; see also Malherbe *et al.* 1986, De Wit 1999, Partridge *et al.* 2006, Agenbacht 2007, Almond *in* Macey *et al.* 2011). It includes rare bones, tusks, molars and numerous tooth fragments of *Gomphotherium*, a four-tusked, browsing proboscidean with characteristic rounded (mastodont) tooth cusps. There are also crocodile teeth and tortoise shell fragments, as well as remains of grazing elephant shrews, giraffids, bovids, a rhinocerotid and air-breathing catfish. However, fossiliferous fluvial sediments have not yet been recorded from the

northern sector of the Koa River Valley near Aggeneys itself, including the present Namaqua PV study area; if present here, they are likely to be deeply buried beneath younger superficial sediments (e.g. younger alluvium, aeolian sands) and will not be directly impacted by infrastructure such as the proposed PV solar sites, access roads, underground cables and associated transmission lines. It is noted that this potentially palaeontologically-sensitive palaeo-valley feature is not picked up on the SAHRIS palaeosensitivity map due to the overlying mantle of lower-sensitivity Kalahari Group sediments.

The fossil record of the **Kalahari Group** and related Late Caenozoic superficial deposits is generally sparse and low in diversity. The **Gordonia Formation** dune sands (Q-s1 in Fig. 2) were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks (including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. *Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (e.g. *Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. *Corbula*, *Unio*), and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes of the **Mokolanen Formation** (T-c in Fig. 2) might also contain local concentrations of trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways, especially in areas associated with ancient wetlands. Older unconsolidated to semi-consolidated sandy to gravelly **alluvial deposits** along major drainage lines (Q-s2 in Fig. 2) might contain remains of Pleistocene mammals (e.g. teeth, bones, horn cores; cf Klein 1984) but these are likely to be very sparse and fragmentary.

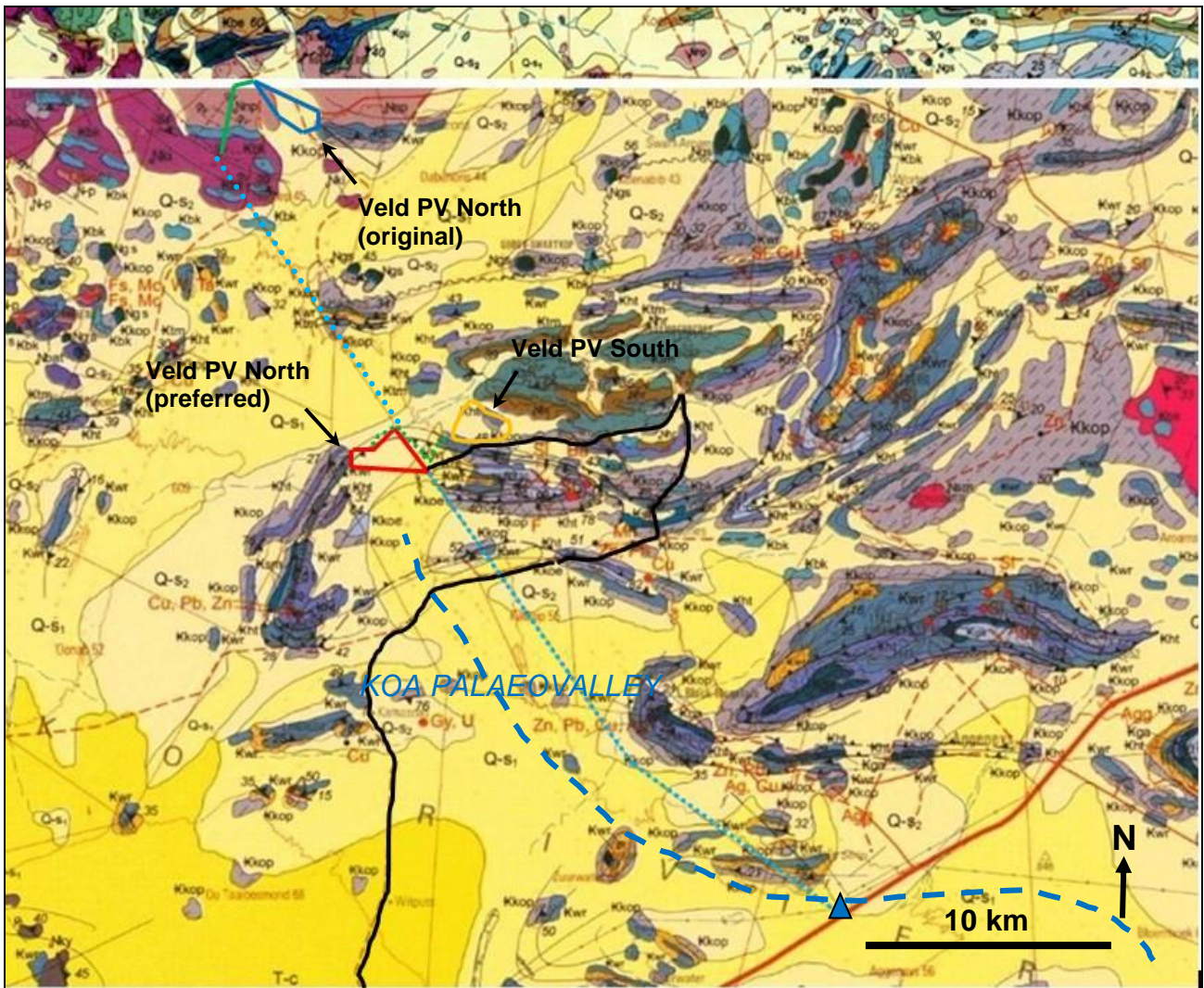


Figure 2. Extracts from adjoining 1: 250 000 geological map sheets 2918 Pofadder and 2818 Onseepkans (Council for Geoscience, Pretoria) showing the location of the three sites under consideration for the proposed Veld PV North and Veld PV South solar energy projects on the farms Naroep (Remainder of Farm No. 45) and Haramoep (Remainder of Farm No.53) near Aggeney's, Northern Cape. Also shown is the main access road from the south (black line) and the proposed new 132 kV grid connection route (blue and green dotted lines) to the existing Aggeney's Substation close to the N14 trunk road (blue triangle).

The PV project areas in the Aggeney's region are underlain at depth by unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province, including a wide range of highly metamorphosed sediments and intrusive igneous rocks. Within the PV project footprints the basement rocks are largely mantled by Late Cenozoic superficial deposits of the Kalahari Group. These include red aeolian (wind-blown) sand of the Gordonia Formation (Q-s1, medium yellow), calcrete hardpans (T-c, dark yellow), surface gravels as well as alluvial sands and gravels (Q-s2, pale yellow). (*N.B.* Several of these superficial deposits are not mapped at 1: 250 000 scale). The overall palaeontological sensitivity of the entire study area is rated as LOW. The blue dashed line shows the *approximate* course of the Miocene Koa River Palaeo-valley, a defunct tributary of the Orange River. Any relict fossiliferous Miocene deposits associated with the palaeo-valley are likely to be deeply buried beneath later superficial deposits of low palaeontological sensitivity.

4. CONCLUSIONS & RECOMMENDATIONS

The igneous and metamorphic Precambrian basement rocks underlying at depth the Veld PV North and Veld PV South project areas as well as the associated 132 kV grid connection to Aggeneys Substation are entirely unfossiliferous. The Late Caenozoic aeolian sands, calcretes and stream gravels of the Kalahari Group mantling the older bedrocks within the greater part of the project footprint are generally of low palaeontological sensitivity, although occasional concentrations of fossil material (e.g. mammalian bones and teeth, trace fossils) might occur here. Any potentially fossiliferous older (Miocene) alluvial deposits of the ancient Koa River Palaeo-valley that flowed through this region some 15 million years ago are unlikely to be impacted by the PV developments since they would be deeply buried beneath younger superficial sediments.

The palaeontological sensitivity of the entire study area for the proposed Namaqua PV solar facilities is rated as LOW to VERY LOW. No fossil sites have, to the author's knowledge, been recorded here hitherto (*cf* Agenbacht 2007, Moen & Toogood 2007). Significant impacts on any subsurface fossils within the PV solar study areas, the 132 kV grid connection and associated infrastructure are not anticipated since deep excavations into potentially fossiliferous sediments are not involved. This assessment applies equally to all PV solar facility site options, on-site substation sites, grid connections and access roads under consideration. There is no preference on palaeontological heritage grounds to any specific layout option, including site alternatives for the PV facilities. Given the general low to very low palaeosensitivity of this region of Bushmanland as well as the very large outcrop area of the Kalahari Group sediments involved, cumulative impacts on palaeontological heritage due to several proposed or authorised renewable energy and other developments near Aggeneys are rated as LOW (*cf* several previous palaeontological assessments by the author listed in the References).

It is therefore recommended that, pending the discovery of significant new fossils remains before or during construction, exemption from further specialist palaeontological studies and mitigation be granted for the proposed Veld PV North and Veld PV South solar facilities on Naroep (Remainder of Farm No. 45) and Haramoep (Remainder of Farm No.53) near Aggeneys, Northern Cape as well as for the associated 132 kV grid connection to the existing Aggeneys Substation.

Should any substantial fossil remains (e.g. mammalian bones and teeth) be encountered during construction, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, *i.e.* The South African Heritage Resources Agency, as soon as possible (Contact details: SAHRA. 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. A Chance Fossil Finds Procedure for the Aggeneys study region is appended to this report.

5. KEY REFERENCES

- AGENBACHT, A.L.D. 2007. The geology of the Pofadder area. Explanation of 1: 250 000 geology sheet 2918. 89 pp. Council for Geoscience, Pretoria.
- ALMOND, J.E. 2008a. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.
- ALMOND, J.E. 2008b. Palaeozoic fossil record of the Clanwilliam sheet area (1: 250 000 geological sheet 3218). Unpublished report for the Council for Geoscience, Pretoria, 49 pp. (To be published by the Council in 2009).
- ALMOND, J.E. 2011. Proposed Sato Energy Holdings (Pty) Ltd photovoltaic project on Portion 3 of Farm Zuurwater 62 near Aggeneys, Northern Cape Province. Recommended exemption from further specialist palaeontological studies or mitigation, 7 pp. Natura Viva cc.
- ALMOND, J.E. 2012. Proposed 75 MW solar facility on Farm Zuurwater 62 (Portions 2 & 3) near Aggeneys, Northern Cape Province. Recommended exemption from further specialist palaeontological studies or mitigation, 6 pp. Natura Viva cc.
- ALMOND, J.E. 2013a. Proposed wind energy facility and associated infrastructure on Namies Wind Farm (Pty) Ltd near Aggeneys, Northern Cape Province. Palaeontological heritage assessment: desktop study, 16 pp. Natura Viva cc.
- ALMOND, J.E. 2013b. Proposed upgrade & repair of water supply infrastructure, Onseepkans, Northern Cape. Recommended exemption from further palaeontological studies, 6pp. Natura Viva cc.
- ALMOND, J.E. 2014. Three proposed Mainstream wind energy facilities and a solar energy facility on Farms 209 and 212 near Pofadder, Northern Cape. Palaeontological heritage basic assessment: desktop study 19 pp. Natura Viva cc, Cape Town.
- ALMOND, J.E. 2015. Proposed Sol Invictus 600 MW solar PV development on Portion 5 of Farm Ou Taaisbosmond 66 near Aggeneys, Northern Cape Province. Palaeontological heritage desktop assessment, 7 pp. Natura Viva cc, Cape Town.
- ALMOND, J.E. 2016. Letsoai and Enamandla Solar Energy Facilities on Farm Hartebeestvlei near Aggeneys, Northern Cape: palaeontological heritage, 7 pp. Natura Viva cc, Cape Town.
- ALMOND, J.E. 2017. Proposed Aggeneis-Paulputs 400 kV Transmission Powerline and Substation Upgrades, Namaqua & Siyanda Districts, Northern Cape Province. Palaeontological heritage assessment: desktop study, 19 pp. Natura Viva cc, Cape Town.
- ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.
- CORNELL, D.H. et al. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp 325-379. Geological Society of South Africa, Johannesburg & Council for Geoscience, Pretoria.

- DE WIT, M.C.J. 1990. Palaeoenvironmental interpretation of Tertiary sediments at Bosluispan, Namaqualand. *Palaeoecology of Africa and the surrounding islands* 21: 101-118.
- DE WIT, M.C.J. 1993. Cainozoic evolution of drainage systems in the north-western Cape. Unpublished PhD thesis, University of Cape Town, Cape Town, 371 pp.
- DE WIT, M.C.J. 1999. Post-Gondwana drainage and the development of diamond placers in western South Africa. *Economic Geology* 94: 721-740.
- DE WIT, M.C.J. & BAMFORD, M.K. 1993. Fossil wood from the Brandvlei area, Bushmanland as an indication of palaeoenvironmental changes during the Cainozoic. *Palaeontologia africana* 30: 81-89.
- DE WIT, M.C.J., MARSHALL, T.R. & PARTRIDGE, T.C. 2000. Fluvial deposits and drainage evolution. In: Partridge, T.C. & Maud, R.R. (Eds.) *The Cenozoic of southern Africa*, pp.55-72. Oxford University Press, Oxford.
- HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) *The Cenozoic of southern Africa*, pp. 173-181. Oxford University Press, Oxford.
- KLEIN, R.G. 1984. The large mammals of southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) *Southern African prehistory and paleoenvironments*, pp 107-146. Balkema, Rotterdam.
- MACEY, P.H., SIEGFRIED, H.P., MINNAAR, H., ALMOND, J. AND BOTHA, P.M.W. 2011. The geology of the Loeriesfontein Area. Explanation to 1: 250 000 Geology Sheet 3018 Loeriesfontein, 139 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.
- MALHERBE, S.J., KEYSER, A.W., BOTHA, B.J.V., CORNELISSEN, A., SLABERT, M.J. & PRINSLOO, M.C. 1986. The Tertiary Koa River and the development of the Orange River drainage. *Annals of the Geological Survey of South Africa* 20, 13-23.
- 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.
- MOEN, H.F.G. & TOOGOOD, D.J. 2007. The geology of the Onseepkans area. Explanation to 1: 250 000 geology Sheet 2818, 101 pp. Council for Geoscience, Pretoria.
- PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa*, pp. 585-604. Geological Society of South Africa, Marshalltown.
- SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.
- SENUT, B., PICKFORD, M., WARD, J., DE WIT, M., SPAGGIARI, R. & MORALES, J. 1996. Biochronology of the Cainozoic sediments at Bosluis Pan, Northern Cape Province, South Africa. *South African Journal of Science* 92: 249-251.

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, R.J., THOMAS, M.A. & MALHERBE, S.J. 1988. The geology of the Nossob and Twee Rivieren areas. Explanation for 1: 250 000 geology sheets 2520-2620. 17pp. Council for Geoscience, Pretoria.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press, Cambridge.

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, Limpopo, Northwest, Mpumalanga, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has previously 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.



Dr John E. Almond,
Palaeontologist, *Natura Viva* cc

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| CHANCE FOSSIL FINDS PROCEDURE: Veld PV North and Veld PV South solar facilities on Naroep (Remainder of Farm No. 45) and Haramoep (Remainder of Farm No.53) plus associated 132 kV grid connection near Aggeneys, Northern Cape | |
| Province & region: | Northern Cape, Namaqua District Municipality |
| Responsible Heritage Resources Authority | SAHRA , 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za |
| Rock unit(s) | Late Caenozoic alluvium along water courses and calcrete hardpans |
| Potential fossils | Bones, teeth and horn cores of mammals, freshwater molluscs, calcretised termitaria and other trace fossils |
| ECO protocol | 1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary. |
| | 2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering) |
| | 3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation • Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume |
| | 3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation |
| | 4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer. |
| 5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority | |
| Specialist palaeontologist | Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards. |

