

Proposed telecommunications mast on Erf 1644, Calvinia, Namaqua District, Northern Cape

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EXECUTIVE SUMMARY

The overall palaeontological impact significance of the proposed telecommunication mast project at Calvinia, Northern Cape, is considered to be VERY LOW because (1) the Tierberg Formation (Ecca Group) mudrocks underlying the project footprint are generally of low palaeontological sensitivity, and are likely to be weathered near-surface; (2) the project footprint is very small and for the most part is already highly disturbed (urban context); (3) deep, voluminous excavations are not envisaged.

It is therefore recommended that, pending the exposure of significant new fossils during development, exemption from further specialist palaeontological studies and mitigation be granted for this development.

There are no objections on palaeontological heritage grounds to authorisation of the proposed agricultural development. Should any substantial fossil remains (e.g. vertebrate bones and teeth, shells, calcretised burrows) be encountered during excavation, however, these should be reported to SAHRA for possible mitigation by a professional palaeontologist. A tabulated Chance Fossil Finds protocol is appended to this report. These mitigation recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed development. A tabulated Chance Fossil Finds protocol is appended to this report.

1. PROJECT OUTLINE

It is proposed to erect a 25 m-high telecommunications mast and base station on Erf 1644, Calvinia Sportsgrounds, Dorp Street, Calvinia, Northern Cape (31°28'8.18" S, 19°46'12.63" E) (Fig. 1). The development will entail the clearance of a 56 m² area and excavations to a depth of 1.2 m. A desktop palaeontological heritage comment for the development has been requested by SAHRA in response to the Heritage Screener report submitted by CTS Heritage (2018).

2. GEOLOGICAL CONTEXT

The geology of the Calvinia area is outlined on 1: 250 000 sheet 3118 Calvinia (Council for Geoscience, Pretoria) (De Beer *et al.* 2002) (Fig. 2). The telecommunication mast footprint is underlain by basinal mudrocks of the Middle Permian **Tierberg Formation** (Ecca Group, Karoo Supergroup). In the Hantamsberge to the north of town the Ecca bedrocks are extensively intruded by major sills of the Karoo Dolerite Suite.

The Tierberg Formation is a thick, recessive-weathering, mudrock-dominated succession consisting predominantly of dark, often brown to grey, well-laminated, carbonaceous shales with subordinate thin, fine-grained sandstones (Viljoen 2005, Johnson *et al.*, 2006). The Tierberg shales are Early to Middle Permian in age and were deposited in a range of offshore, quiet water

environments below wave base. These include basin plain, distal turbidite fan and distal prodelta in ascending order (Viljoen 2005, Almond *in* Macey *et al.* 2011). Thin coarsening-upwards cycles occur towards the top of the formation with local evidence of soft-sediment deformation, ripples and common calcareous concretions. Thin water-lain tuffs (volcanic ash layers) are also known. A restricted, brackish water environment is reconstructed for the Ecca Basin at this time. Close to the contact with Karoo dolerite intrusions the Tierberg mudrocks are often baked to a dark grey hornfels with a reddish-brown crust (Prinsloo 1989).



Figure 1. Satellite image extracted from Heritage Screener (CTS 2018) showing the location of the proposed telecommunication mast in disturbed terrain on Erf 1644, Calvinia Sportsgrounds, Dorp Street, Calvinia.

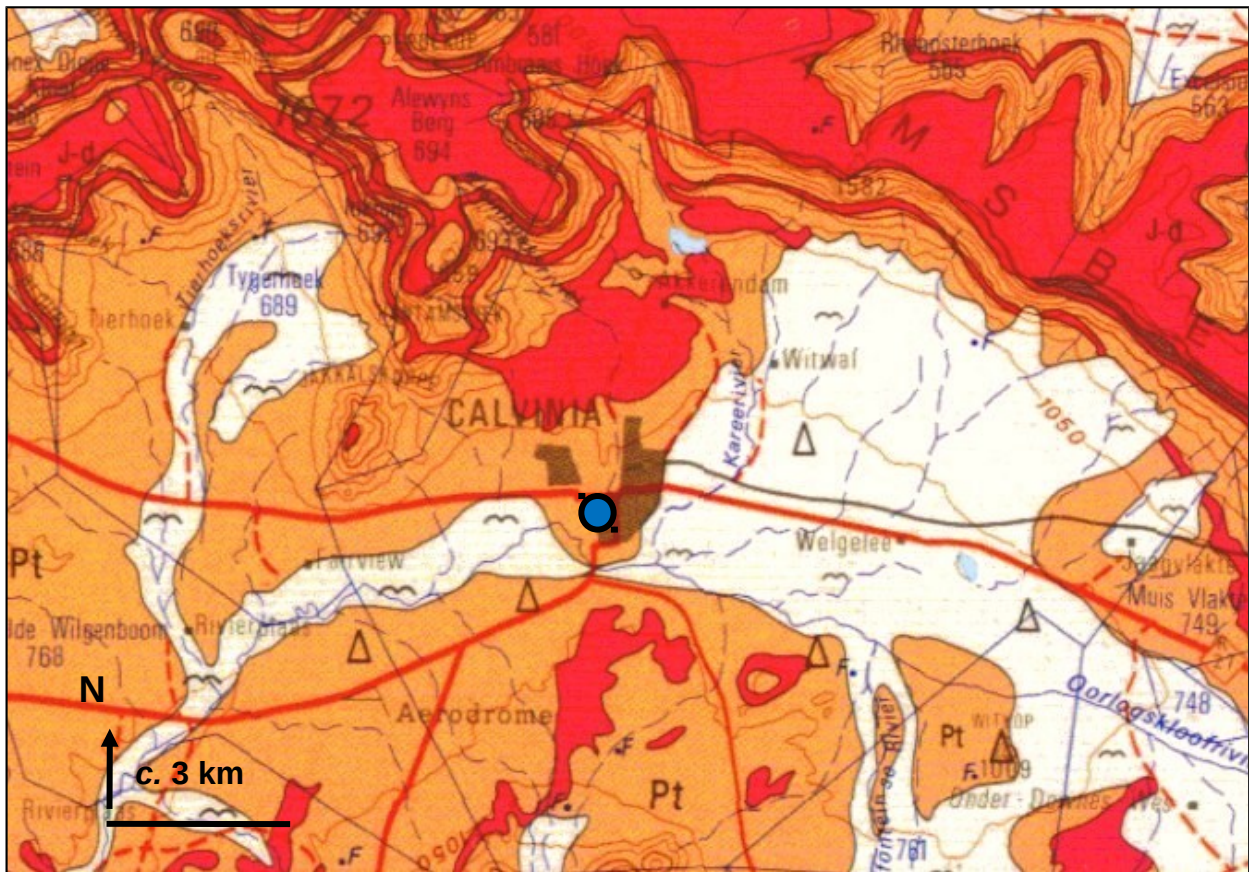


Figure 2. Extract from 1: 250 000 geology Sheet 3118 Calvinia (Council for Geoscience, Pretoria) showing the approximate location of the proposed telecommunications mast at Calvinia (blue circle). The project area is underlain by basinal mudrocks of the Middle Permian Tierberg Formation (Ecca Group, Karoo Supergroup) (Pt, orange).

3. PALAEOLOGICAL HERITAGE

The fossil record of the Tierberg Formation in the the Main Karoo Basin has been reviewed in detail by Almond *in* Macey *et al.* (2011). Rare body fossil records include disarticulated microvertebrates (e.g. fish teeth and scales) from calcareous concretions and allochthonous plant remains (leaves, petrified wood). The latter become more abundant in the upper, more proximal (prodeltaic) facies of the Tierberg succession (e.g. Wickens 1984). Prinsloo (1989) records numerous plant impressions and unspecified “fragmentary vertebrate fossils” within fine-grained sandstones in the Britstown sheet area; the latter may in fact be misidentified concretionary material. Dark carbonaceous Ecca mudrocks are likely to contain palynomorphs (e.g. pollens, spores, acritarchs). The commonest fossils by far in the Tierberg Formation are sparse to locally concentrated assemblages of trace fossils that are often found in association with thin event beds (e.g. distal turbidites, prodeltaic sandstones) within more heterolithic successions. A modest range of ten or so different ichnogenera have been recorded from the Tierberg Formation (See Almond *in* Macey *et al.* (2011)). Among these distinctive broad (3-4 cm), strap-shaped, horizontal burrows with blunt ends and a more-or-less pronounced transverse ribbing occur widely within the Tierberg mudrocks. They have been described as “fucoid structures” by earlier workers by analogy with seaweeds, and erroneously assigned to the ichnogenera *Plagiogmus* by Anderson (1974) and *Lophoctenium* by Wickens (1980, 1984). Examples up to one metre long were found in Tierberg mudrocks near Calvinia in 1803 by H. Lichtenstein, who described them as “eel fish”. These are among the first historical records of fossils in South Africa (MacRae 1999). These as yet unnamed burrows are infilled with organized arrays of faecal pellets. Microbial mat textures, such as

Kinneyia, also occur in these offshore mudrocks but, like the delicate grazing traces with which they are often associated, are generally under-recorded.

The palaeosensitivity of the Tierberg Formation may be locally high (e.g. plant- and trace fossil-rich horizons) but is generally low. Many of the fossil remains here are of widely-occurring forms within the extensive outcrop area of the formation.

4. CONCLUSIONS & RECOMMENDATIONS

The overall palaeontological impact significance of the proposed telecommunication mast development at Calvinia is considered to be VERY LOW because:

- The Tierberg Formation mudrocks underlying the project footprint are generally of low palaeontological sensitivity, and are likely to be weathered near-surface;
- The project footprint is very small and for the most part is already highly disturbed (urban context);
- Deep, voluminous excavations are not envisaged.

It is therefore recommended that, pending the exposure of significant new fossils during development, exemption from further specialist palaeontological studies and mitigation be granted for this development.

There are no objections on palaeontological heritage grounds to authorisation of the proposed 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. A tabulated Chance Fossil Finds protocol is appended to this report.

These mitigation recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed development.

Please note that:

- All South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils cannot be collected, damaged or disturbed without a permit from SAHRA;
- The palaeontologist concerned with potential mitigation work will 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);
- All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies developed by HWC (2016) and SAHRA (2013).

5. KEY REFERENCES

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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, Gauteng, KwaZulu-Natal, Mpumalanga, Northwest and Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has been 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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CHANCE FOSSIL FINDS PROCEDURE: Proposed telecommunications mast on Erf 1644, Calvinia	
Province & region:	NORTHERN CAPE, Namaqua District
Responsible Heritage Resources Authority	SAHRA (Contact details: P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502)
Rock unit(s)	Tierberg Formation (Ecca Group, Karoo Supergroup)
Potential fossils	Trace fossils, plant fossils including petrified wood, rare microvertebrate remains (e.g. fish bones, teeth)
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.

