

**DESKTOP PALAENTOLOGICAL ASSESSMENT FOR THE
PROPOSED TOWNSHIP TO BE SITUATED ON PORTION
3 OF THE FARM DOORNPAN NUMBER 193 IP, NEAR
VENTERSDORP, NORTHWEST PROVINCE**

FOR

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Declaration of Independence

This report has been compiled by Dr Alan Smith (Pr. Sc. Nat.) of Alan Smith Consulting, Durban. The views expressed in this report are entirely those of the author, if not then the source has been duly acknowledged. No other interest was displayed during the decision making process for the Project.

Specialist: Dr Alan Smith

Signature: 

EXECUTIVE SUMMARY

It is proposed to develop a township on the Remainder of Portion 3 of the farm Doornpan Number 193 IP, near Ventersdorp, Northwest Province.

The proposed development is mainly on Dolomite. This rock contains stromatolite fossils, but these are very common, and although important to the story of life on Planet Earth and Astrobiology, are not individually of importance.

Should caverns or caves be encountered, sinkholes become possible and development will be stopped in these areas. These features should have been/ will be picked up by the Geotechnical Survey. Such sites can then be demarcated for future paleontological investigation with respect to possible hominid fossils.

Other sedimentary rock units that may be present are Precambrian in age and not fossiliferous.

The chance of finding significant fossils is very low, but not zero. For this reason a “Chance Find Protocol” has been inserted.

1. BACKGROUND AND PROPOSED PROJECT

Alan Smith Consulting has been appointed to undertake a Desktop Palaeontological Assessment for the proposed township establishment to be situated on the Remainder of Portion 3 of the farm Doornpan Number 193 IP (*Figure 1*), near Ventersdorp, Northwest Province. The project area is approximately 88.46 Hectares in total extent, which is expected to yield approximately 842 stands.



Figure 1: Location of the proposed project (RE/3/193), near Ventersdorp, Northwest Province. Source map GoogleEarth.

2. GEOLOGY

Ventersdorp is located on the margin of the Vredeport Dome, the largest (about 200 km across) preserved impact crater preserved on Earth. This event took place at 2.02 Ga (billion years ago).

The geology underlying the proposed township on Farm Doornpan is illustrated in **Figure 2**). It is dominated by the Oaktree Formation (part of the Transvaal Supergroup's Malmani Subgroup) comprises dark chert and dolomite. Chert is composed of silica and dolomite is a calcium-magnesium limestone.

The Malmani (dolomite) Subgroup formed on the edge of an ancient sea 2.5-2.6 Ga (billion years ago) (Erickson and Altermann, 1998). **Figure 2** shows an extract from the Wes-Rand 2626 1: 250 000 Geological Map.

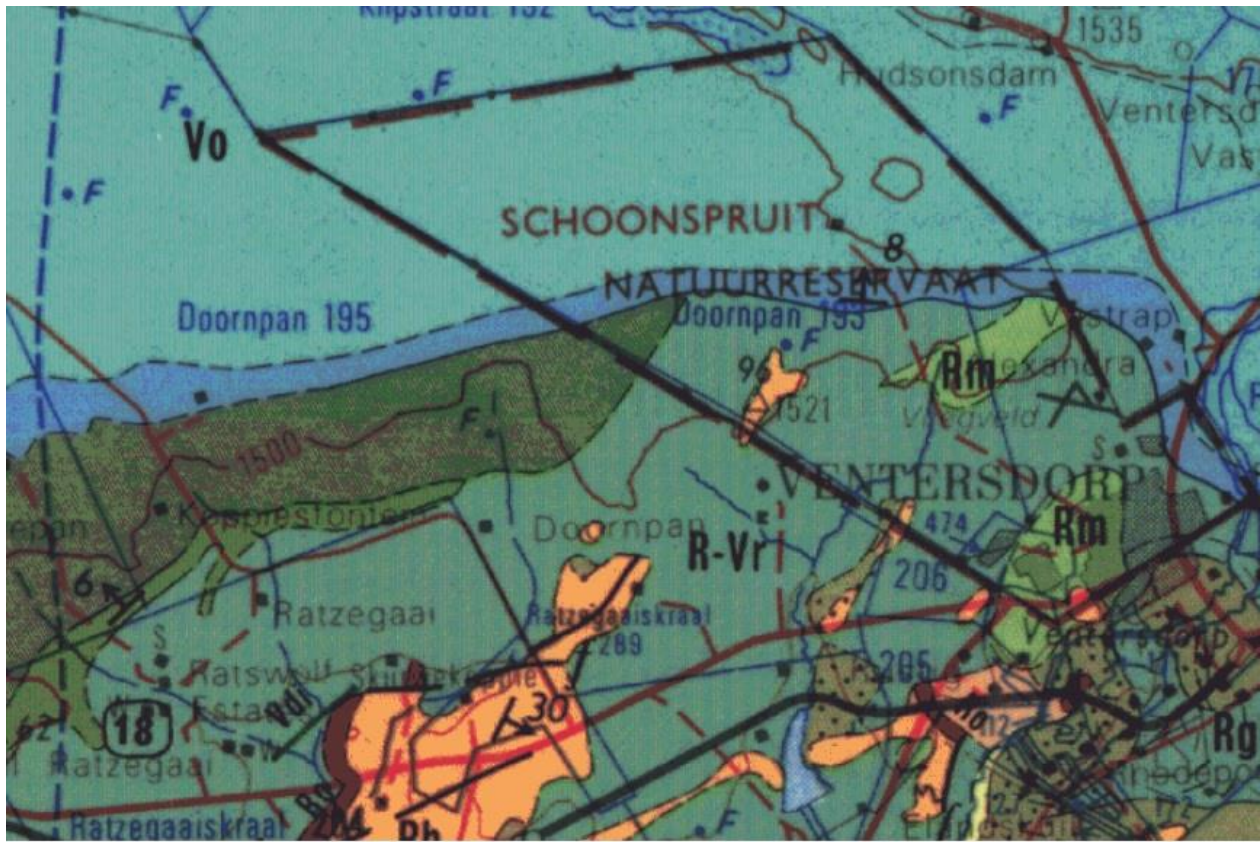


Figure 2: Extract from the Wes-Rand 2626 1: 250 000 scale Geological Map. In Doornpan 195, the light blue is the Oaktree Formation of Malmani (dolomite) Subgroup, the darker blue the Black Reef Group, the dark green (Bothaville Formation) and the light green the Rietgat Formation (R-Vr). The former two lithologies are a part of the Ventersdorp Super Group and are not fossiliferous.

The Black Reef Group comprises quartzite, conglomerate and shale. The Bothaville Formation comprises quartzite, greywacke and conglomerate. The Rietgat Formation comprises amygdaloidal lava, tuff and agglomerate, which is all igneous rock and not fossiliferous.

3. PALAEOLOGY

The Swart Reef, Bothaville and Rietgat Formations are of Precambrian age which predates the onset of multi-cellular organisms. No fossils have been reported from these rocks.

According to the Sahrís Palaeosensitivity Map the Oaktree Formation (part of the Malmani Subgroup) is zoned red, indicating it to be highly sensitive (*Figure. 3*).

Cave Environments

The Malmani (dolomite) Subgroup being composed of carbonate is prone to dissolution by ground water and the creation of caverns. Early hominid fossils are known from such caves, such as the 414 to 236 Ka (thousand years old) *Homo naledi* from the Rising Star Cave. Hominid fossils are **Extremely Important Palaeontological Material** (Dirks et al., 2020).

Due to the possible presence of caverns, the Malmani Subgroup is prone to sinkholes because of cavern roof collapse. However such areas should already have been found and zoned unsuitable for construction by the Geotechnical Survey Report. In this case I am assuming that this area has been competently geotechnically investigated and zoned for construction, so the presence of sinkholes/ caves will already have been assessed. Should caves or sinkholes be encountered building will be stopped in any event.



Figure 3: The SAHRIS Palaeosensitivity map of the proposed development area. Doornpan 195 is mostly red (Oaktree Formation), with the green strip being Black Reef and the blue.

Stromatolites

The Malmani Subgroup, part of the Transvaal Supergroup, contains stromatolites which are 2.5-2.6 Ga (billion years old). Stromatolites are laminated limestone structures (*Figures 4 & 5*). Cyanobacteria construct these biomes (fossil reefs called stromatolites) which are the earliest fossils in the geological column. Cyanobacteria are photosynthetic. They absorb carbon dioxide from the atmosphere and sequester it as carbonate biomes. These single-celled organisms probably originated before 4 Ga, much earlier than multi-celled life (600 million years old).

The earliest known stromatolites are 3.45 Ga (billion years old), found in Australia (Allwood et al., 2006). Other examples include the 3.4 Ga and 3.0 Ga stromatolites from Nondweni and the White Mfolozi in KwaZulu-Natal, South Africa (Xie et al., 2012; Siayi et al., 2016). Stromatolites occur throughout the geological column but are commonest in the Precambrian and can still be found growing today (Smith et al., 2020). Stromatolite occurrences are important in terms of general palaeontology and astrobiology, but individual stromatolites are not. Stromatolites are trace fossils and are very common within the Malmani Dolomite

Cyanobacteria photosynthesize (use light to produce energy) and in the process convert carbon dioxide into oxygen and water. These organisms were responsible for building the oxygen atmosphere on planet Earth (Homan, 2019) and can still be found growing on rocky coastlines today (Smith and Uken, 2003). Although stromatolite growth commenced before 3.4 Ga, it only became common at the time when the sediment, which would become lithified to form the Malmani Subgroup, was accumulating within a palaeo-ocean.



Figure 4: Example of large stromatolite reef from the Malmani Subgroup (4-5m across and 2-3m high) in a roadside outcrop (Photo: L Guastella).



Figure 5: Example of smaller scale Malmani Subgroup stromatolite structure from the Malmani Subgroup, note coin for scale (Photo: L Guastella).

4. CHANCE FIND PROTOCOL

As this site includes areas flagged red on the SAHRIS PalaeoSensitivity Map (Fig. 2), a “Chance Find Protocol” is recommended.

In the case of any unusual finds, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist. Contact **The Cradle of Humankind** (tel: 014 577 9000) for assistance.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.
3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.
4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.

5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.
6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.
7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.
8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.
9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.

5. CONCLUSIONS & RECOMMENDATIONS

The proposed development is mostly on the Malmani Subgroup dolomite. This rock contains stromatolite fossils, but these are very common, and although important to the story of Earth, are not individually important.

Should caverns or caves be encountered development will be stopped in these areas. These sites can then be demarcated for future investigation.

6. REFERENCES

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7. DETAILS OF SPECIALIST

Dr Alan Smith

Private Consultant: Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091

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Honorary Research Fellow: Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban.

Role: Specialist Palaeontological Report production

Expertise of the specialist:

- PhD in Geology (University of KwaZulu-Natal), Pr. Sc. Nat., I.A.H.S.
- Expert in Stromatolites. MSc on Stromatolites of Etosha Pan and eight refereed articles (6 are international).
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- Scientific Research experience includes: Fluvial geomorphology, palaeoflood hydrology, Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published more than 50 journal articles with +416 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.
- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.
- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De

Doornpan Proposed Township Development: Desk-Top PIA

Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.