

# **Palaeontological Impact Assessment for the proposed Protea Glen Ext 1 Township on Erf 25268, Gauteng Province**

## **Site Visit Report (Phase 2)**

**For**

**Beyond Heritage**

**22 October 2022**

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## **Expertise of Specialist**

The Palaeontologist Consultant: Prof Marion Bamford

Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf

Experience: 33 years research; 25 years PIA studies

## **Declaration of Independence**

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Beyond Heritage, Modimolle, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

A handwritten signature in blue ink that reads "M Bamford". The signature is written in a cursive style and is positioned above a horizontal line.

Signature:

## **Executive Summary**

A Palaeontological Impact Assessment was requested for the continuance of construction for residential township development on erf 25268 Protea Glen Ext 1, City of Johannesburg Metropolitan Municipality, Gauteng.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the potentially fossiliferous Malmani subgroup (Transvaal Supergroup) that might contain trace fossils such as stromatolites. The site visit and walk through by a palaeontologist confirmed that the site was highly disturbed and there were NO FOSSILS on the surface or eroded areas. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, developer, environmental officer or other designated responsible person once excavations for foundations or amenities have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

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# 1. Background

Cosmopolitan Projects Johannesburg (Pty) Ltd is applying for the continuance of construction for a residential township development on Erf 25268 Protea Glen Ext 1, City of Johannesburg Metropolitan Municipality, Gauteng. The development is for the approximately 5.61 hectares. The existing site is located to the northeast of Wild Chestnut Street, Protea Glen (Figures 1-2).

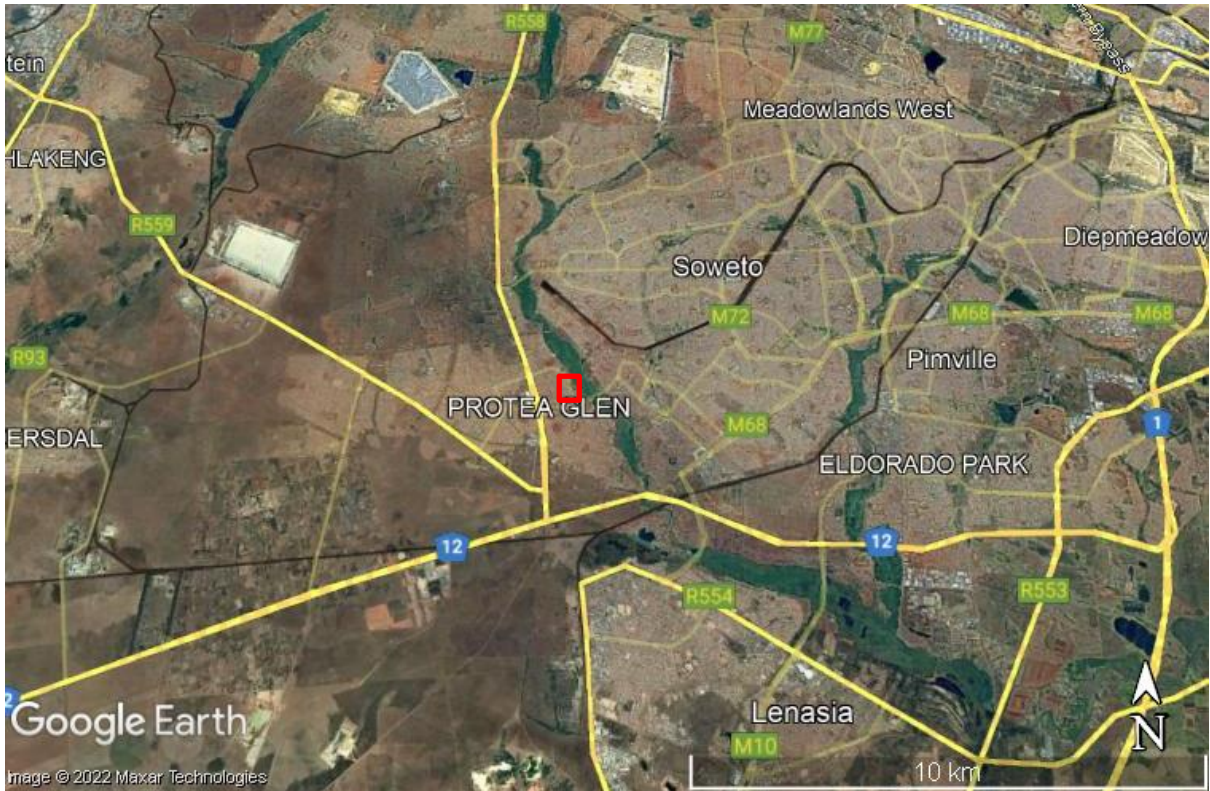
ISQUARE was requested by Cosmopolitan Projects Johannesburg (Pty) Ltd to inform the Department that they have purchased the property and will be continuing with construction. The clearance letter, dated 9 December 2009, stated that the proposed activity was not listed in terms of the Environmental Impact Assessment Regulations, 2006 and therefore did not legally require environmental authorisation from the Department. The property was owned initially by Township Realtors and although it is not clear exactly when commencement started, evidence of some structures is clearly visible from Google from June 2013 with no additions since then.

A Palaeontological Impact Assessment was requested for the Protea Glen housing project. To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a site visit and walkthrough (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6).

	<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:</b>	<b>Relevant section in report</b>
ai	Details of the specialist who prepared the report,	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A

	<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:</b>	<b>Relevant section in report</b>
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Sections 6, 8
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A



**Figure 1: Google Earth map of the proposed Protea Glen Ext 1 housing development showing the relevant landmarks.**



**Figure 2: Google Earth map for the Protea Glen Ext 1 housing area (pink). Map supplied by iSquare.**

## 2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance, as is the case here;
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

## 3. Geology and Palaeontology

### i. Project location and geological context



**Figure 3: Geological map of the area around Protea Glen. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand.**



Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006; Eriksson et al., 2006; She et al., 2020). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary sands	Sand, alluvium, soil	Last ca 1 Ma
Pe	Ecca Group, Karoo SG	Shales, sandstone, mudstone, coal seams	Early Permian Ca 290=280 Ma
Vmd	Malmani SG, Chuniespoort Group, Transvaal SG	Dolomite, chert	Palaeoproterozoic Ca 2585 – 2480 Ma
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale	<2618 Ma
Rk	Klipriviersberg Group, Ventersdorp SG	Mafic lava, tuff, amygaloidal or porphyritic in places	2791 – 2779 Ma
Rt	Turffontein Subgroup, Central Rand Group, Witwatersrand SG	Quartzite, conglomerate, shale	Ca 2970 – 2714

The site is in the southern part of the Transvaal Basin where the Transvaal Supergroup sequence of rocks overlies the Ventersdorp Supergroup that is predominantly volcanic, and the Witwatersrand Supergroup that is mostly sedimentary (Figure 3).

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences.

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. Underlying the Malmani Subgroup is the Black Reef Formation.

The Transvaal sequence has been interpreted as three major cycles of basin infill and tectonic activity with the first deep basin sediments forming the Chuniespoort Group, the second cycle deposited the lower Pretoria Group, and the sediments in this area are from the interim lowstand that preceded the third cycle. These sediments were deposited in shallow lacustrine, alluvial fan and braided stream environments (Eriksson et al., 2012).

The **Black Reef Formation** is below the Transvaal Supergroup (Eriksson et al., 2006) or is considered as being included in the basal Transvaal Supergroup (Zeh et al., 2020). It is composed of quartz arenites that are relatively mature and lesser amounts of mudrocks and conglomerates. It is a widespread but relatively thin sheet sandstone with a series of fining-upward sequences (Eriksson et al., 2006) that have been interpreted in a number of ways. One model indicates fluvial setting followed by shallow marine epeiric setting and the other model a purely fluvial setting (Eriksson et al., 2006)

The **Malmani Subgroup** is up to 2000m thick and has been divided into five formations based on the composition of cherts, stromatolites, limestones and shales. Due to the lack of outcrop with distinguishing facies, this subgroup has not been divided into Formations in this part of the basin.

## ii. Palaeontological context

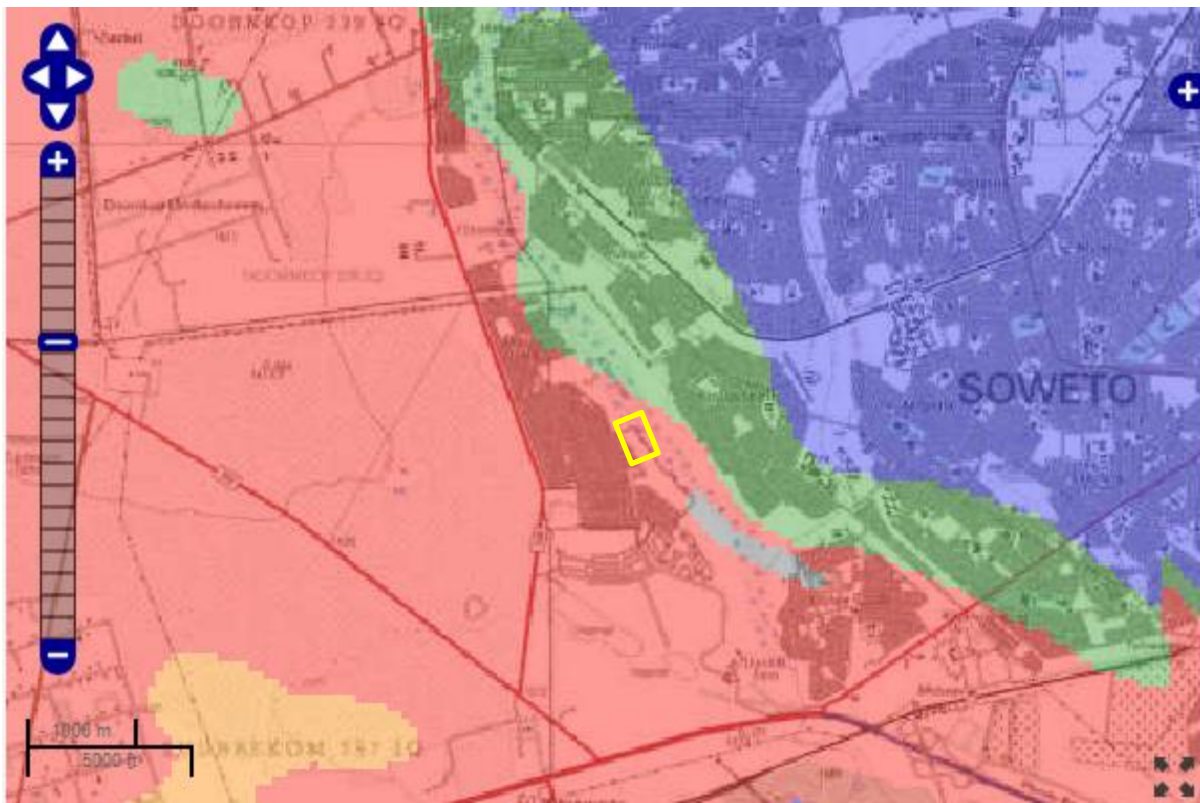
The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Malmani Subgroup.

The Transvaal Supergroup sequence of sedimentary and volcanic rocks has been interpreted as having undergone three cycles of tectonically controlled basin subsidence and infilling with clastic deposits from the west and northwest. The first cycle (Chuniespoort Group) was a shallow seaway in a marine environment where the carbonate platform (Malmani Subgroup) was deposited and has a variety of limestones and dolomite (Erikson et al., 2012). The different lithofacies represent different depths of formation of carbonates, for example, intertidal zone, high energy zone and shallow subtidal deposits are limestone and dolomite, with flat domes and columnar stromatolites being formed in the intertidal zone. In the high energy zone oolites, oncolites and ripples were formed, while in the deep tidal zone elongated stromatolitic mounds were formed (Truswell and Eriksson, 1973; Eriksson and Altermann, 1998).

**Stromatolites** are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved,

and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.



**Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Protea Glen Ext 1, Erf 25268 housing development shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.**

### iii. Site visit observations

The site visit and walk through showed that the area has abandoned and partially built housing units in the central part. The rest of the area is highly disturbed and has leaking water and sewage in several parts. For health and safety reasons these parts were avoided. The open areas are used for various social functions or as a dumping ground for refuse.

Although the grassland vegetation is quite thick, especially in the natural wetland margin and in the induced wetlands from leakage, it was possible to see the ground in other parts. No dolomite outcrops and no stromatolites were seen and it appears that the recent river alluvium has accumulated over the years. NO FOSSILS were seen at all. Refer to Figures 5-7 for the detailed observations and site photographs.



**Figure 5: Protea Glen Ext 1 Site photographs. A-B – views north and south along the western border to the site. C-D – views alongside the partially built structures showing disturbance and dumped rubbish. No dolomite and no fossils seen.**



**Figure 6: Site photographs for Protea Glen Ext 1. A – rubbish dumped inside the site area. B-C - Culvert and drainage line with water – not natural as this was before the rainy season. D – Close to eastern border looking west towards the building – note high degree of disturbance and no rocks, no dolomite and no fossils.**



**Figure 7: Site photographs for Protea Glen Ext 1. A-B – northern section is also very disturbed and there are old excavations, pipes and powerlines. C-D - southern section with some bare ground exposed showing soils and alluvium and no rocky outcrops. No Fossils.**

## 4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table :

**Table 3a: Criteria for assessing impacts**

<b>PART A: DEFINITION AND CRITERIA</b>		
<b>Criteria for ranking of the SEVERITY/NATURE of environmental impacts</b>	<b>H</b>	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	<b>M</b>	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	<b>L</b>	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	<b>L+</b>	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	<b>M+</b>	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	<b>H+</b>	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
<b>Criteria for ranking the DURATION of impacts</b>	<b>L</b>	Quickly reversible. Less than the project life. Short term
	<b>M</b>	Reversible over time. Life of the project. Medium term
	<b>H</b>	Permanent. Beyond closure. Long term.
<b>Criteria for ranking the SPATIAL SCALE of impacts</b>	<b>L</b>	Localised - Within the site boundary.
	<b>M</b>	Fairly widespread – Beyond the site boundary. Local
	<b>H</b>	Widespread – Far beyond site boundary. Regional/ national
<b>PROBABILITY (of exposure to impacts)</b>	<b>H</b>	Definite/ Continuous
	<b>M</b>	Possible/ frequent
	<b>L</b>	Unlikely/ seldom

**Table 3b: Impact Assessment**

<b>PART B: Assessment</b>		
<b>SEVERITY/NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	Alluvium and soils do not preserve plant fossils; so far there are no records from the Malmani Subgroup[of trace fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	<b>L+</b>	-
	<b>M+</b>	-

<b>PART B: Assessment</b>		
	<b>H+</b>	-
<b>DURATION</b>	<b>L</b>	-
	<b>M</b>	-
	<b>H</b>	Where manifest, the impact will be permanent.
	<b>L</b>	Since the only possible fossils within the area would be trace fossils such as stromatolites from the Malmani Subgroup in the dolomites, the spatial scale will be localised within the site boundary.
<b>SPATIAL SCALE</b>	<b>M</b>	-
	<b>H</b>	-
	<b>L</b>	-
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	It is extremely unlikely that any fossils would be found in the loose sand that will be excavated. Nonetheless, a Fossil Chance Find Protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were NO FOSSILS in the project footprint. Furthermore, the material to be excavated is soil and this does not preserve fossils. Since there is an extremely small chance that trace fossils from below ground may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

## 5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and some do contain trace fossils such as stromatolites. The site visit and walk through by a palaeontologist confirmed that there are no rock exposures, dolomite or stromatolites visible on the surface or in the eroded area. The sands and alluvium of the Quaternary period would not preserve fossils.

## 6. Recommendation

Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS of any kind even though trace fossils such as stromatolites have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the dolomites of the Malmani Subgroup so a Fossil Chance Find Protocol should be added to the EMPr. If fossils



are found by the environmental officer or other responsible person once excavations and drilling have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample. The area is highly disturbed by previous abandoned buildings and infrastructure such as pipes and culverts. Furthermore it is alongside a shallow valley with a wetland so is likely to have accumulated silt and alluvium over centuries so no rocks are likely to be near the surface,

## 7. References

Beukes, N.J., 1987. Facies relations, depositional environments and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbellrand Subgroup, Transvaal Supergroup, southern Africa. *Sedimentary Geology* 54, 1-46.

Beukes, N.J., 1980. Stratigrafie en lithofacies van die Campbellrand-Subgroep van die Proterofitiese Ghaap-Groep, Noordkaapland. *Transactions of the Geological Society of South Africa* 83, 141-170.

Cowan, R., 1995. *History of Life*. 2nd Edition. Blackwell Scientific Publications, Boston. 462pp.

Eriksson, P.G., Altermann, W., Hartzler, F.J., 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R., Lenhardt, N., 2012. A case study of microbial mats-related features in coastal epeiric sandstones from the Palaeoproterozoic Pretoria Group, Transvaal Supergroup, Kaapvaal craton, South Africa; the effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred palaeoenvironment. *Sedimentary Geology* 263, 67-75.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. *Geological Society of southern Africa, Annexure to Volume LXXII*. 72pp + 25 plates.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. *Geological Society of southern Africa, Annexure to Volume LXXII*. 72pp + 25 plates.

Schröder, S., Beukes, N.J., Armstrong, R.A., 2016. Detrital zircon constraints on the tectonostratigraphy of the Paleoproterozoic Pretoria Group, South Africa. *Precambrian Research* 278, 362 – 393.

Sumner, D.Y., Beukes, N.J., 2006. Sequence stratigraphic development of the Neoproterozoic Transvaal carbonate platform, Kaapvaal Craton, South Africa. *South African Journal of Geology* 109, 11-22.

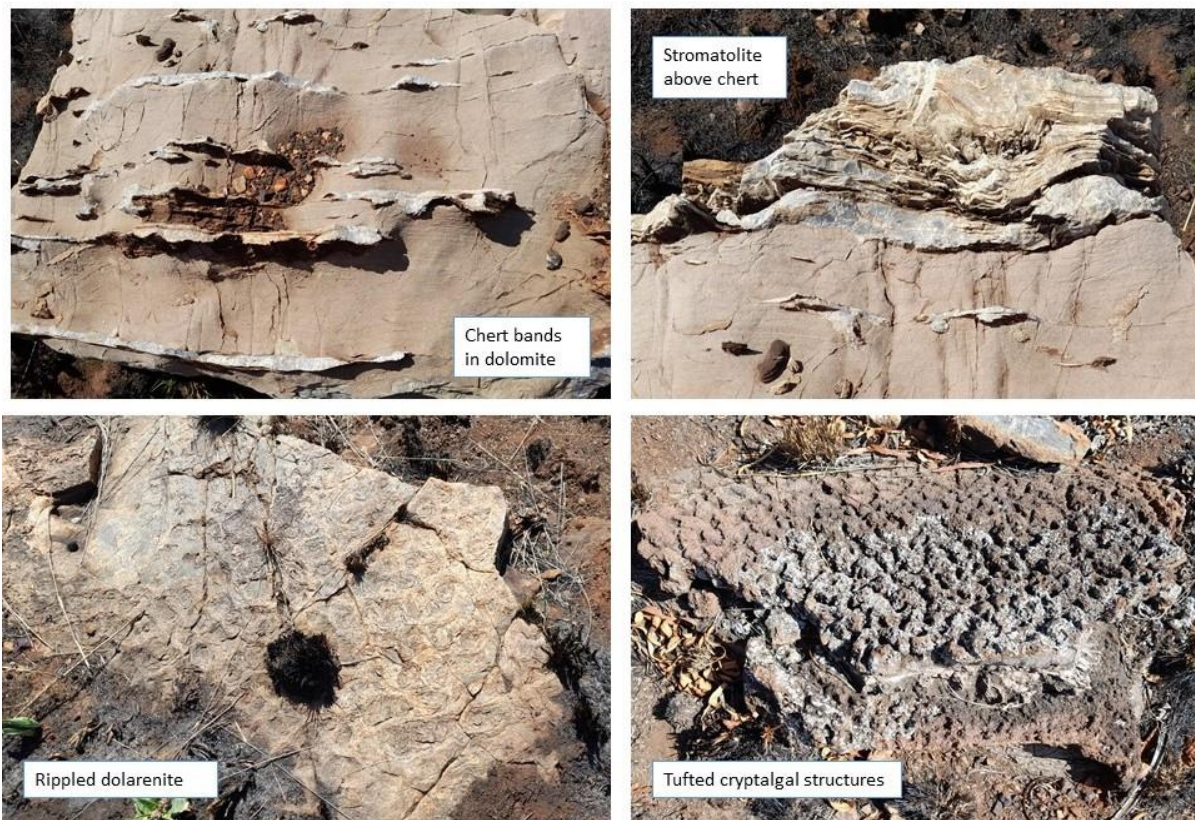
A., Wilson, A.H., Gerdes, A., 2020. Zircon U-Pb-Hf isotope systematics of Transvaal Supergroup – Constraints for the geodynamic evolution of the Kaapvaal Craton and its hinterland between 2.65 and 2.06 Ga. *Precambrian Research* 345, 105760. <https://doi.org/10.1016/j.precamres.2020.105760>

## 8. Chance Find Protocol

### **Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.**

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 8). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

## 9. Appendix A – Examples of fossils from the Malmani Subgroup



**Figure 8: Photographs of dolomite and stromatolites as seen in the field.**

## 10. Appendix B – Details of specialists

### **Marion Bamford (PhD)**

#### **Short CV for PIAs – July 2022**

##### **I) Personal details**

Present employment: Professor; Director of the Evolutionary Studies Institute.  
Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa

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marionbamford12@gmail.com

## ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.

1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.

1986-1989: PhD in Palaeobotany. Graduated in June 1990.

## iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer

1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

## iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa

Royal Society of Southern Africa - Fellow: 2006 onwards

Academy of Sciences of South Africa - Member: Oct 2014 onwards

International Association of Wood Anatomists - First enrolled: January 1991

International Organization of Palaeobotany – 1993+

Botanical Society of South Africa

South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016

SASQUA (South African Society for Quaternary Research) – 1997+

PAGES - 2008 –onwards: South African representative

ROCEEH / WAVE – 2008+

INQUA – PALCOMM – 2011+onwards

## vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	11	0
Masters	14	1
PhD	11	6
Postdoctoral fellows	12	2

## viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year

Biology III – Palaeobotany APES3029 – average 25 students per year

Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology;

Micropalaeontology – average 12 - 20 students per year.

## ix) Editing and reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor

Guest Editor: Quaternary International: 2005 volume

Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –

Associate Editor: Cretaceous Research: 2018-2020

Associate Editor: Royal Society Open: 2021 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

**x) Palaeontological Impact Assessments**

Selected from recent project only – list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for Enviropro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe
- Glosam Mine 2021 for AHSA

**Xi) Research Output**

Publications by M K Bamford up to July 2022 peer-reviewed journals or scholarly books: over 165 articles published; 5 submitted/in press; 10 book chapters.

Scopus h-index = 30; Google Scholar h-index = 36; -i10-index = 95

Conferences: numerous presentations at local and international conferences.