

Palaeontological Impact Assessment for the proposed Golden Mole Mall on Farm 372 JR, Pretoria East, Gauteng Province

Desktop Study (Phase 1)

For

Eco-Elementum (Pty) Ltd

19 February 2022

Prof Marion Bamford

Palaeobotanist

P Bag 652, WITS 2050

Johannesburg, South Africa

Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf
Experience: 33 years research and lecturing in Palaeontology
25 years PIA studies and over 300 projects completed

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Eco-Elementum (Pty) Ltd, Pretoria, 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, appearing to read 'MKBamford', written over a horizontal line.

Signature:

Executive Summary

A Palaeontological Impact Assessment was requested by PHRAG for the proposed Golden Mole Mall on portions 218 and 220 of Farm Tweefontein 372 JR, Lombardy East (East Pretoria), Gauteng Province.

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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the very highly sensitive rocks of the Silverton Formation (Pretoria Group, Transvaal Supergroup) that could have trace fossils such as stromatolites. Therefore, 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 developer/ environmental officer/ other designated responsible person once excavations/drilling/ activities have commenced. As far as the palaeontology is concerned, the project should be authorised because the impact on the palaeontological heritage is low.

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1. Background

The Gauteng Provincial Heritage Resources Agency (PHRAG) has requested a palaeontological Impact assessment for the proposed Golden Mole Mall on Portions 218 and 220 of the Farm Tweefontein 372 JR within the City of Tshwane Metropolitan Municipality in the Gauteng Province.

The study area is located to the east of Pretoria, approximately 17 km east-southeast of the Pretoria CBD. The area demarcated for the construction of the Golden Mole Mall is approximately 3.56 ha (Figures 1, 2). Leoprop (Pty) Ltd was granted authorisation by the Gauteng Department of Agriculture and Rural Development (GDARD) on the 22nd of July 2014 with reference GAUT 002/10-11/E0082 for the application for environmental authorisation for the proposed township establishment: Leoprop on portion 220 of the farm Tweefontein 372JR, situated towards the east of Pretoria with an access road to the township from the Struben / Graham Road (Lynnwood Road Extension) intersection.

- The authorisation has subsequently been extended for a further 5 years on the 09th of April 2018.
- Cumacor Investments (Pty) Ltd has purchased the property as well as all the development from Leoprop (Pty) Ltd and therefore the amended Environmental Authorisation must also be transferred to Cumacor Investments as the new applicants/developer.
- The current intention is to extend the approved shopping centre complex across the neighbouring property that recently has been acquired by the applicant but not covered under the current Environmental Authorisation.
- During the most recent engagement with the City of Tshwane and his Department as part of the MTO Town and Regional Planners': Township Application, a revised Conservation Area has been developed to ensure adequate protection of the Juliana's Golden Mole habitat ensuring ecological connectivity around the site, also including the now proposed Phase II extension of the Development.
- Subsequently the Township application has been approved on 07 May 2021 by the City of Tshwane. The revised Conservation Area that has been planned ensures enhanced protection of the Juliana's Golden Mole habitat whilst ensuring ecological connectivity around the site, also including the now proposed Phase II extension of the Development. This enhanced connectivity is crucial to the survival of the species as it would now allow for free movement and connectivity to the larger Bronberg population which was not previously possible.

A Palaeontological Impact Assessment was requested for the Golden Mole Mall 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 desktop 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).

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
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 1
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
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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
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

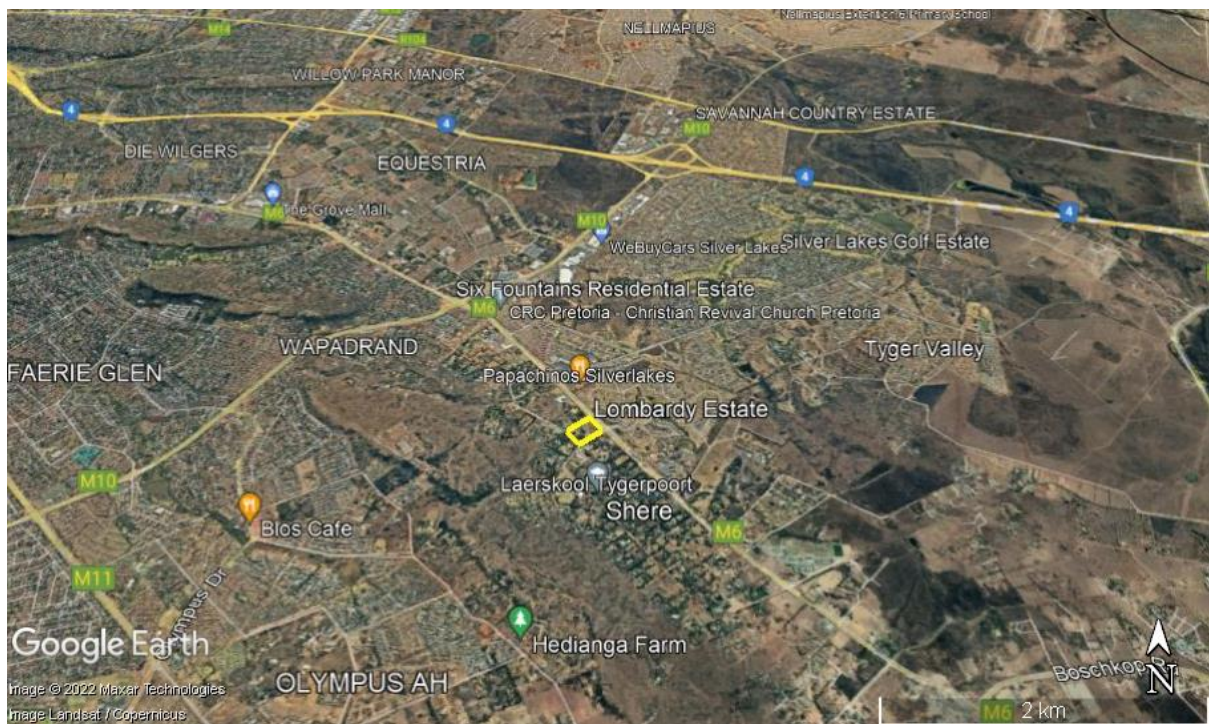


Figure 1: Google Earth map of the general area around the site to show the relative land marks. The Golden Mole Mall site is indicated within the yellow rectangle.

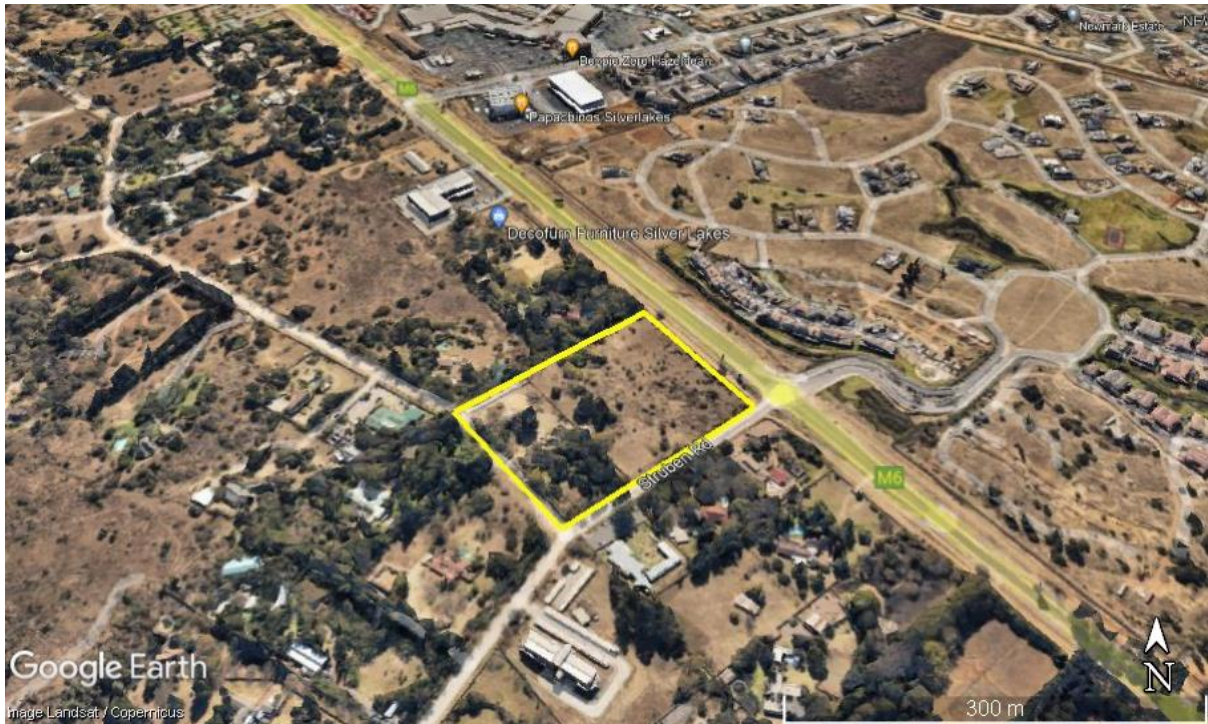


Figure 2: Google Earth Map of the proposed Golden Mole Mall on Portions 218 and 220 of Farm Tweefontein 372 JR, Pretoria East, with the section shown by the yellow outline.

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 (*not applicable to this assessment*);
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

The project lies in the central part of the Transvaal Basin that comprises rocks and sediments of the Palaeoproterozoic Transvaal Supergroup.

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. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

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. The top of the Chuniespoort Group has the Penge Formation and the Deutschland Formation.

Making up the lower Pretoria Group are the Timeball Hill Formation and the Boshhoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the Dwaalheuwel conglomerates, siltstone and sandstone (not present here). A hiatus separates the Strubenkop Formation slates and shales from the overlying quartzites of the Daspoort Formation. Upper Pretoria Group formations are the **Silverton**, Magaliesberg, Vermont, Lakenvalei, Nederhorst, Steenkampsberg and Houtenbek Formations

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).

Within the Silverton Formation is the lower Boven Shale Member, Machadorp Volcanic Member and upper Lydenburg Shale Member. The lower shales are alumina-rich and best represented in the eastern part of the Transvaal Basin. Shallow subaqueous eruptives formed the tholiitic basalts and then the tuffaceous shales that are high in CaO-MnO-MgO formed the Lydenburg Member (Eriksson et al., 2006). The Silverton Formation has been interpreted as a high-stand facies tract that reflected the advance of an epeiric sea onto the Kaapvaal Craton from the east, so the Daspoort Formation would represent a lowstand facies tract or a transgressive systems tract (ibid).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Silverton Formation, most probably the basal Boven Shale Member. It has been interpreted as a high-stand facies tract that reflects the advance of an epeiric sea onto the Kaapvaal Craton from the east, and therefore the underlying Daspoort Formation would represent a low-stand facies tract or a transgressive systems tract (Eriksson et al., 2006). There is consensus in the geological literature that the Silverton Formation environment was a high energy one with shallow to deep water shales being deposited as sub-storm wave-base pelagic deposits, within an epeiric embayment on the Kaapvaal Craton (Eriksson et al., 2002, 2006, 2012; Frauenstein et al., 2009; Lenhardt et al., 2020). Several sub aqueous dykes and volcanic eruptions have also been recorded (Lenhardt et al., 2020). The formation is dated between 2202 and 2253 Ma (Zeh et al., 2020) and this is too old for any body fossils so the only fossils were microscopic algae and bacteria which if preserved, are in the form of the trace fossils such as stromatolites or microbial mats. There are no records of such trace fossils in the Silverton formation although they are present in the overlying Magaliesberg Formation.

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.

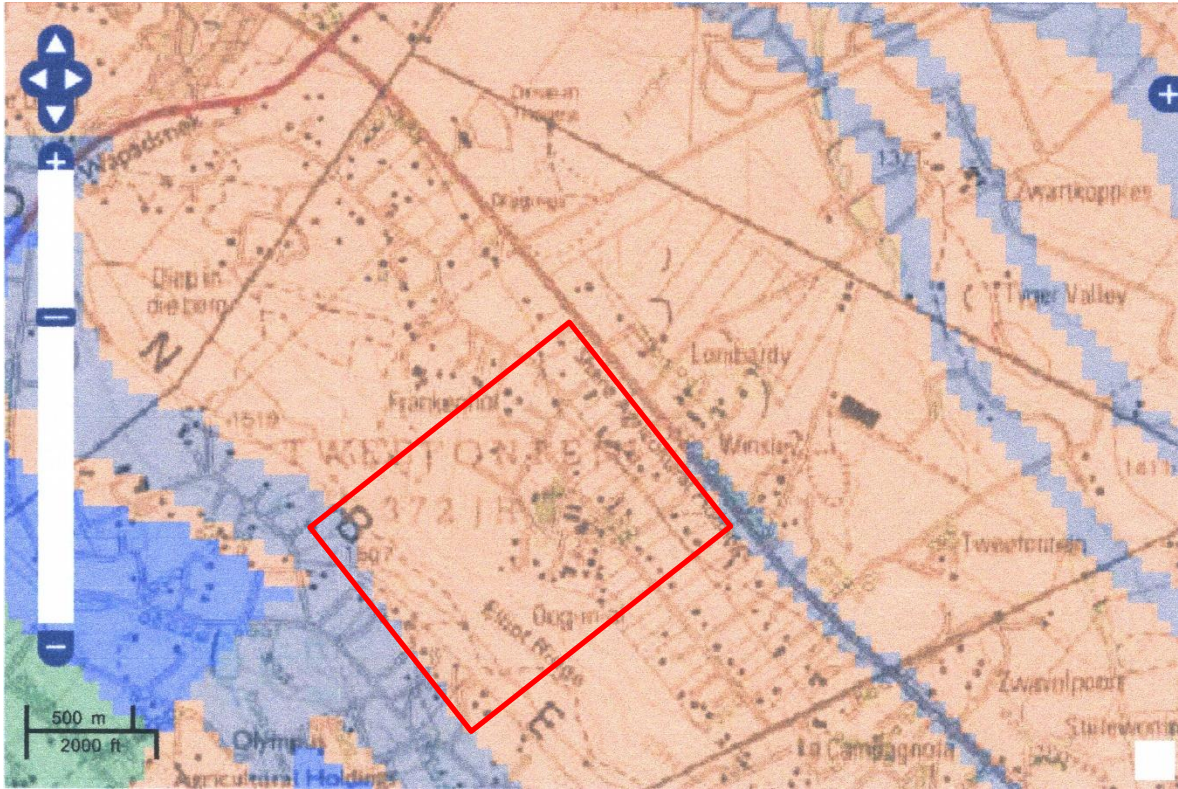


Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Golden Mole Mall on Farm Tweefontein 372 JR shown within red yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as highly sensitive (orange) so a desktop study is required and is presented here.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

Table 3a: Criteria for assessing impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.

	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	H	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 3b: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	H	-
	M	-
	L	Soils do not preserve fossils; so far there are no records from the Silverton Fm of trace fossils such as stromatolites in this region so it is very unlikely that fossils occur on the site. The impact would be negligible
	L+	-
	M+	-
	H+	-
	DURATION	L
M		-
H		Where manifest, the impact will be permanent.
SPATIAL SCALE	L	Since the only possible fossils within the area would be trace fossils in the dolomites, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	H	-
	M	-
	L	It is extremely unlikely that any fossils would be found in the loose soils and sands that cover the area or in the rocks of the Silverton Fm that will be excavated, therefore, 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 much too old to contain body fossils but there could be trace fossils of microbes. Since there is a small chance that fossil stromatolites from the Silverton Formation 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 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 do not contain fossil plant, insect, invertebrate and vertebrate material but they might contain trace fossils such as stromatolites. The overlying soils and sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is very unlikely that any fossils would be preserved in the Silverton Formation or in the overlying soils and sands of the Quaternary. There is a very small chance that trace fossils such as stromatolites may occur below ground in the Silverton Formation dolomites so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, developer or other responsible person once excavations for foundations and amenities have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low therefore, as far as the palaeontology is concerned the project should be authorised.

7. References

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

Eriksson, P.G., Altermann, W., Catuneanu, O., van der Merwe, R., Bumby, A.J., 2001. Major influences on the evolution of the 2.67–2.1 Ga Transvaal basin, Kaapvaal craton. *Sedimentary Geology* 141–142, 205–231.

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.

Lenhardt, N., Bleeker, W., Ngwa, C.N., Aucamp, T., 2020. Shallow marine basaltic volcanism of the Machadodorp Member (Silverton Formation, Pretoria Group), Transvaal Basin, South Africa — An example of Paleoproterozoic explosive intraplate volcanic activity in an epeiric embayment. *Precambrian Research* 338, 105580. <https://doi.org/10.1016/j.precamres.2019.105580>

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.

Zeh, 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/mining commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (stromatolites, plants, insects, bone, coal) 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 5). 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 PHRAG or SAHRA permit must be obtained. Annual reports must be submitted to PHRAG and 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 PHRAG and 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 fossil stromatolites.

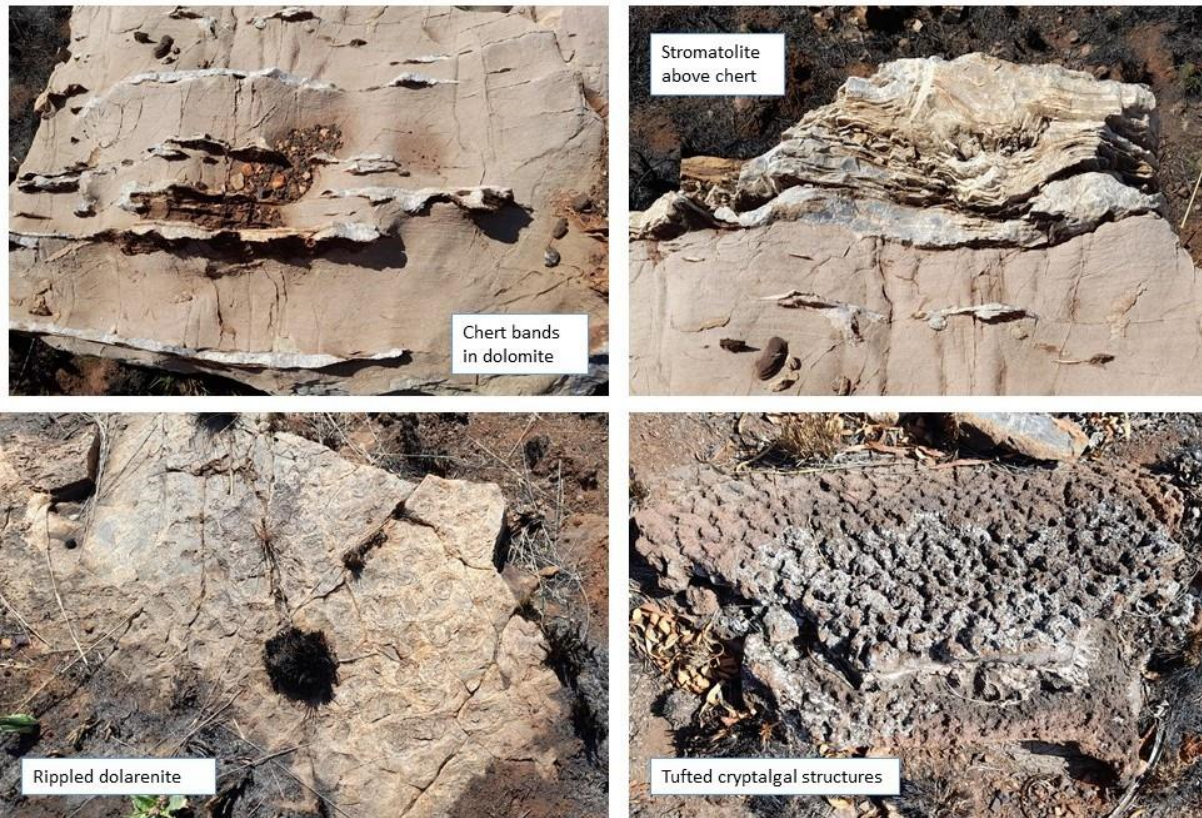


Figure 5: Photographs of different types of stromatolites in dolomite (from the Malmani Subgroup).

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD January 2022

I) Personal details

Surname : **Bamford**
First names : **Marion Kathleen**
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
Telephone : +27 11 717 6690
Fax : +27 11 717 6694
Cell : 082 555 6937
E-mail : marion.bamford@wits.ac.za ;
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.
NRF Rating: C-2 (1999-2004); B-3 (2005-2015); B-2 (2016-2020); B-1 (2021-2026)

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	13	0
Masters	11	3
PhD	11	6
Postdoctoral fellows	15	1

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 45 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 *Open Science UK*: 2021 -
Review of manuscripts for ISI-listed journals: 30 local and international journals
Reviewing of funding applications for NRF, PAST, NWO, SIDA, National Geographic,
Leakey Foundation

x) Palaeontological Impact Assessments

Selected from the past five years only – list not complete:

- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klippoortjie 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
- Lielifontein 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

xi) Research Output

Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 160 articles published; 5 submitted/in press; 10 book chapters.

Scopus h-index = 30; Google scholar h-index = 35; -i10-index = 92

Conferences: numerous presentations at local and international conferences.