

**Palaeontological Impact Assessment for the
proposed Salvokop Bulk Water Line and
Servitude, Freedom Park, Pretoria,
Gauteng Province**

Desktop Study (Phase 1)

For

Spoor Environmental (Pty), Ltd

11 September 2022

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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 Spoor Environmental (Pty) Ltd, 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', with a horizontal line underneath it.

Signature:

Executive Summary

A Palaeontological Impact Assessment was requested for the construction of a bulk water supply pipeline for Salvokop Extension 5. The pipeline will run from the existing reservoir and to be constructed water reservoirs in the Freedom Park Precinct in a north-eastern direction towards Salvokop Extension 5.

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 siltstones, shales and quartzites of the Timeball Hill Formation (Pretoria Group, Transvaal Supergroup) that are about 2250 million years old, and on outcrops of diabase (volcanic so no fossils). None of the geological literature indicates the presence of any stromatolites but the Palaeotechnical Report for Gauteng Province does. Although there is an extremely small chance that stromatolites or microbialites (microbial features) are present, 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, environmental officer or other designated responsible person once excavations or drilling activities 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

A Palaeontological Impact Assessment was requested for the construction of a bulk water supply pipeline for Salvokop Extension 5. The pipeline will run from the existing reservoir and to be constructed water reservoirs in the Freedom Park Precinct in a north-eastern direction towards Salvokop Extension 5. The City of Tshwane Department of Water and Sanitation is the proposer. The project area is located on the western side of what is known as Salvokop and south of the old NZASM housing complex in the larger Freedom Park Precinct of the City of Tshwane (Figures 1-2).

The scope of work is for a bulk water pipeline that will supply water for the new Salvokop Extension 5 housing development, City of Tshwane, Gauteng Province. The total length of the pipeline will be approximately 350 m.

A Palaeontological Impact Assessment was requested for the Salvokop Bulk Water 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

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

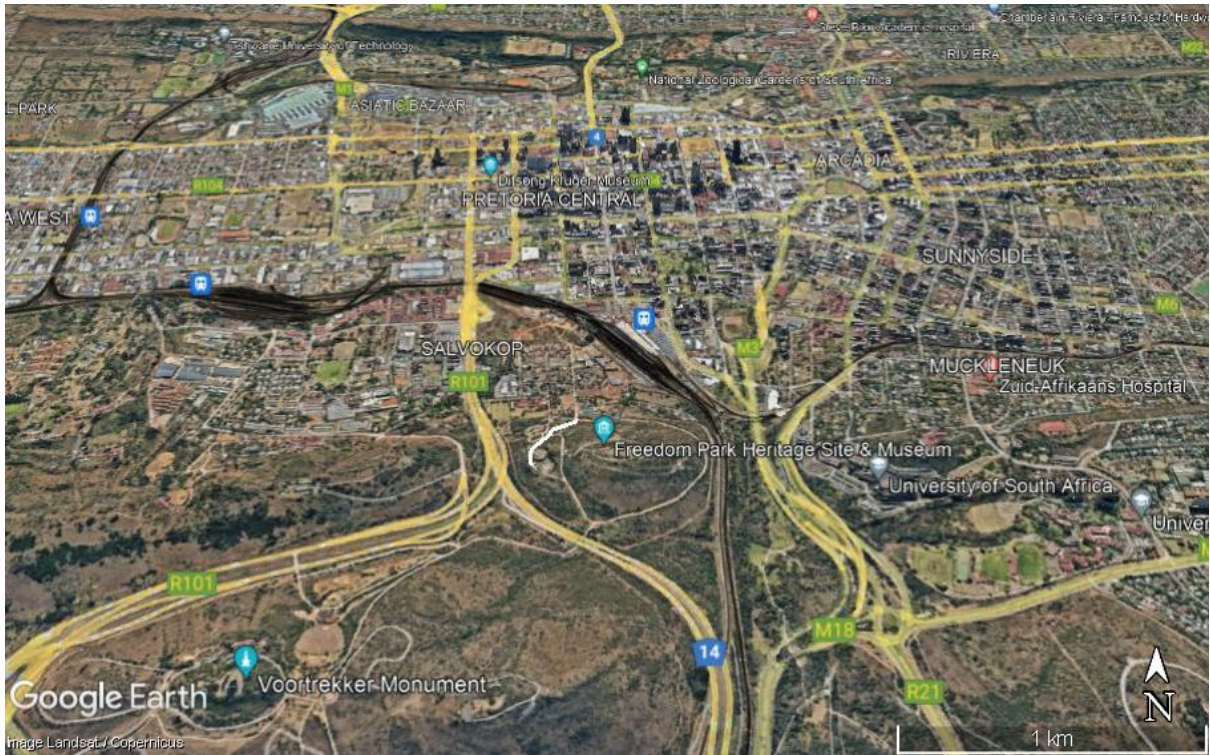


Figure 1: Google Earth map of the general area to show the relative land marks. The Salvokop pipeline project is shown by the white line (centre).



Figure 2: Google Earth Map of the proposed Salvokop Bulk Water pipeline and servitude (red outline on white).

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 include 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

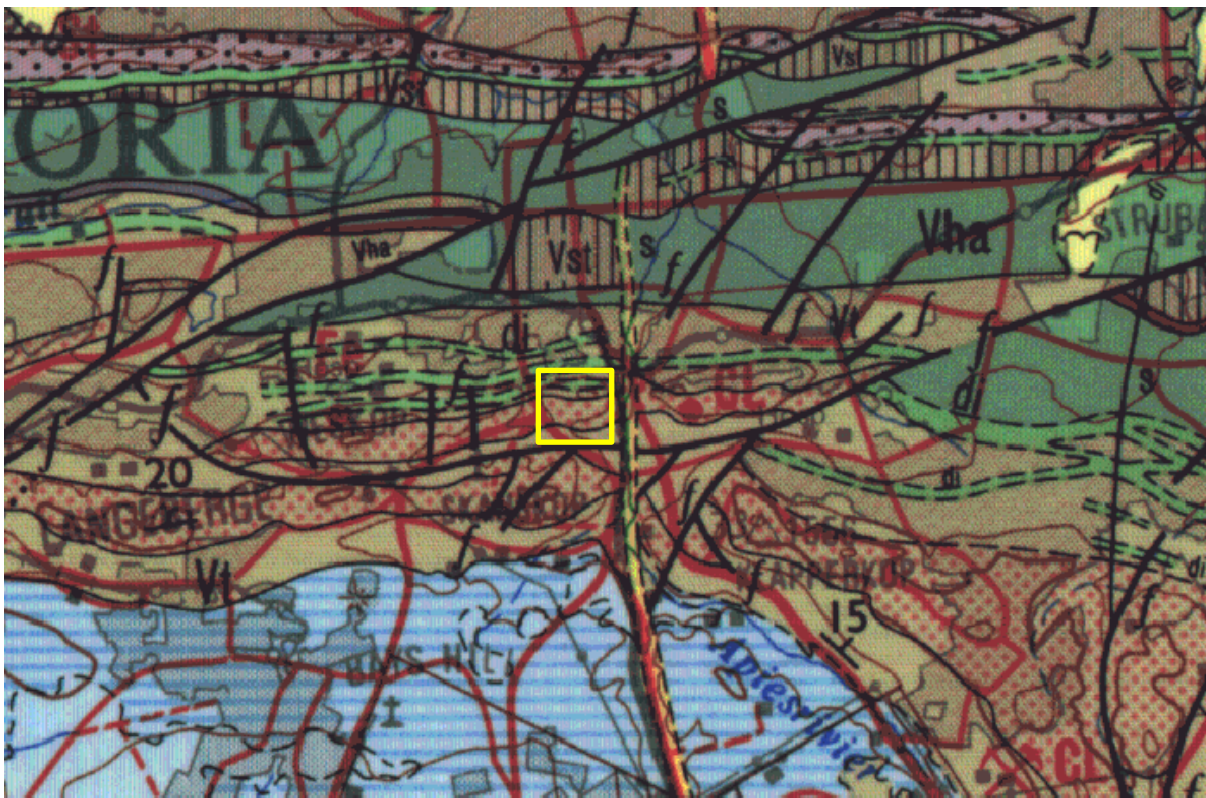


Figure 3: Geological map of the area around the Salvokop reservoir and proposed pipeline indicated within the yellow rectangle. Abbreviations of the rock types are

explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2528 Pretoria.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Johnson et al., 2006; Zeh 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	Alluvium, sand, calcrete	Quaternary, ca 1.0 Ma to present
Vdi	Diabase	Intrusive volcanic dykes and sills	Post Transvaal SG
Vst	Strubenkop Fm, Pretoria Group, Transvaal SG	Shale, in places ferruginous	Ca 2242 Ma
Vha	Hekpoort Fm, Pretoria Group, Transvaal SG	Volcanic rocks	Ca 2224 Ma
Vt	Timeball Hill Fm Pretoria Group, Transvaal SG	Shale, siltstone, conglomerate in places; dotted = Quartzite	Ca 2316 – 2266 Ma
Vmd	Malmani SG, Chuniespoort Group, Transvaal SG	Dolomite, chert	Ca 2585 – 2480 Ma

The project lies in the Transvaal Basin of the Transvaal Supergroup where only a few of the many formations are present. Considerably younger Quaternary alluvium and sands occur in river valleys.

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.

Making up the lower Pretoria Group are the Rooihoogte Formation, 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).

Overlying the Rooihoogte Formation is the **Timeball Hill Formation** which is composed of thick shales and subordinate sandstones that were deposited in a fluvio-deltaic basin-filling sequence (Eriksson et al., 2006). A number of facies are included in this formation. At the base is black shale facies associated with subsurface lavas and pyroclastic rocks of the Bushy Bend Lava Member. Above these are rhythmically interbedded mudstones/siltstones and fine-grained sandstones that have been interpreted as turbidite deposits (Eriksson et al., 2006). These fine-grained sediments grade up into the medial Klapperkop Quartzite Member that has been interpreted as fluvio-deltaic sandstones which fed the more distal turbidites (ibid). Above this is an upper shale member and rhythmite facies. In the east of the Transvaal Basin the Upper Timeball Hill shales have undergone extensive soft-sediment deformation caused by the onset of tectonic instability that led to the eventual fan deposits of the Boshhoek Formation and the flood basalts of the Hekpoort Formation (ibid).

The **Hekpoort Formation** is composed of subaerial lavas that intruded into the Boshhoek sandstones. These basaltic-andesitic lavas are thickest in the south of the Transvaal basin, thinning to the west and thinnest in the northeast (Eriksson et al., 2006).

During the Quaternary period sediments eroding from the older sandstones and shales were transported along watercourses and have been deposited in low energy environments. They are difficult to date and to determine the source because they are often reworked and eventually washed downstream, eventually to the sea.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Timeball Hill Formation with diabase in the north.

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). After a hiatus of about 80 Myr, the second cycle (Duitschland, Rooihogte and Timeball Hill Formations) occurred under glacial influence. The stromatolites in the Timeball Hill Formation are questionable but they are present in the Duitschland Formation (Schröder et al., 2016). The third cycle after a brief hiatus, represented by the rest of the Pretoria Group, was deposited in a shallow embayment and represented by carbonates.

Carbonates (not necessarily stromatolites) are reported from the upper Silverton Formation, the Houtenbeck and Vermont Formations. From the Magaliesberg Formation there have been several reports of microbial features. No fossils are recorded from the Rayton Formation, and the upper Pretoria Group rocks are not listed in the Palaeotechnical report for Gauteng (Groenewald et al., 2014), however the rocks are quartzites and shales like the underlying members of the Pretoria Group. Since Parizot et al., (2005) first recorded microbial mat features from the Magaliesberg Formation north of Pretoria, a number of other occurrences have been reported in this formation (Bosch and Eriksson, 2008; Eriksson et al., 2012).

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.

Microbialites (sensu Burne and Moore, 1987) are organo-sedimentary deposits formed from interaction between benthic microbial communities (BMCs) and detrital or chemical sediments. In addition, microbialites contrast with other biological sediments in that they are generally not composed of skeletal remains. Archean carbonates mostly consist of stromatolites. These platforms could have been the site of early O₂ production on our planet. Stromatolites are the laminated, organo-sedimentary, non-skeletal products of microbial communities, which may have included cyanobacteria, the first photosynthetic organisms to produce oxygen. Another type of trace fossil has been termed Microbially-induced sedimentary structures (MISS sensu Noffke et al., 2001) or simply 'fossil mats' (sensu Tice et al., 2011). These include swirls, rip-ups, crinkled surfaces and wrinkles that were formed by the mucus extruded by littoral algae or

microbes and bound together sand particles. Davies et al. (2016) caution against the assumption that all such structures are microbially induced unless there is additional evidence for microbes in the palaeoenvironment.

Nonetheless, stromatolites and microbialites are accepted as trace fossils of algal colonies. MISS could be microbially or abiotically formed. The oldest stromatolites have been recorded from the Barberton Supergroup that was deposited between 3.55 to ca. 3.20 Ga, and stromatolites still form today in warm, shallow seas (Homan, 2019).



Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Salvokop bulk water pipeline 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.

From the SAHRIS map above the area is indicated as highly sensitive (orange) and this applies to the Timeball Hill Formation quartzites that might preserve microbial features according to the Palaeotechnical report for Gauteng (Groenewald et al., 2014). From the geology, however, this seems highly unlikely. Diabase (grey) is an intrusive volcanic rock and does not preserve fossils.

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	Quartzites do not preserve fossils; so far there are no records from the Timeball Hill Fm of microbial trace fossils in this region so it is very unlikely that fossils occur on the site. The impact would be negligible
	L+	-
	M+	-

PART B: Assessment		
	H+	-
DURATION	L	-
	M	-
	H	Where manifest, the impact will be permanent.
	L	Since the only possible fossils within the area would be microbial trace fossils in the quartzites, the spatial scale will be localised within the site boundary.
SPATIAL SCALE	M	-
	H	-
	L	-
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 quartzites 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 either much too old to contain fossils and of the wrong kind. Since there is an extremely small chance that trace fossils of microbes 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 only some contain microbial trace fossils, fossil plant, insect, invertebrate and vertebrate material. The 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 extremely unlikely that any fossils would be preserved in the quartzites of the Timeball Hill Formation (Pretoria Group, Transvaal Supergroup) or in the sands and soils of the Quaternary. There is a very small chance that trace fossils may occur in the quartzites and shale lenses of the Timeball Hill Formation 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 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

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<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 must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, plants, insects, bone or 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 trace fossils such as stromatolites or microbially features (trails, curls, rip-ups, mudcracks) trace fossils in the dolomites, limestones, shales and mudstones (for example see Figures 5-6). 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 contractor or 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. Trace fossils, 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 Transvaal Supergroup.

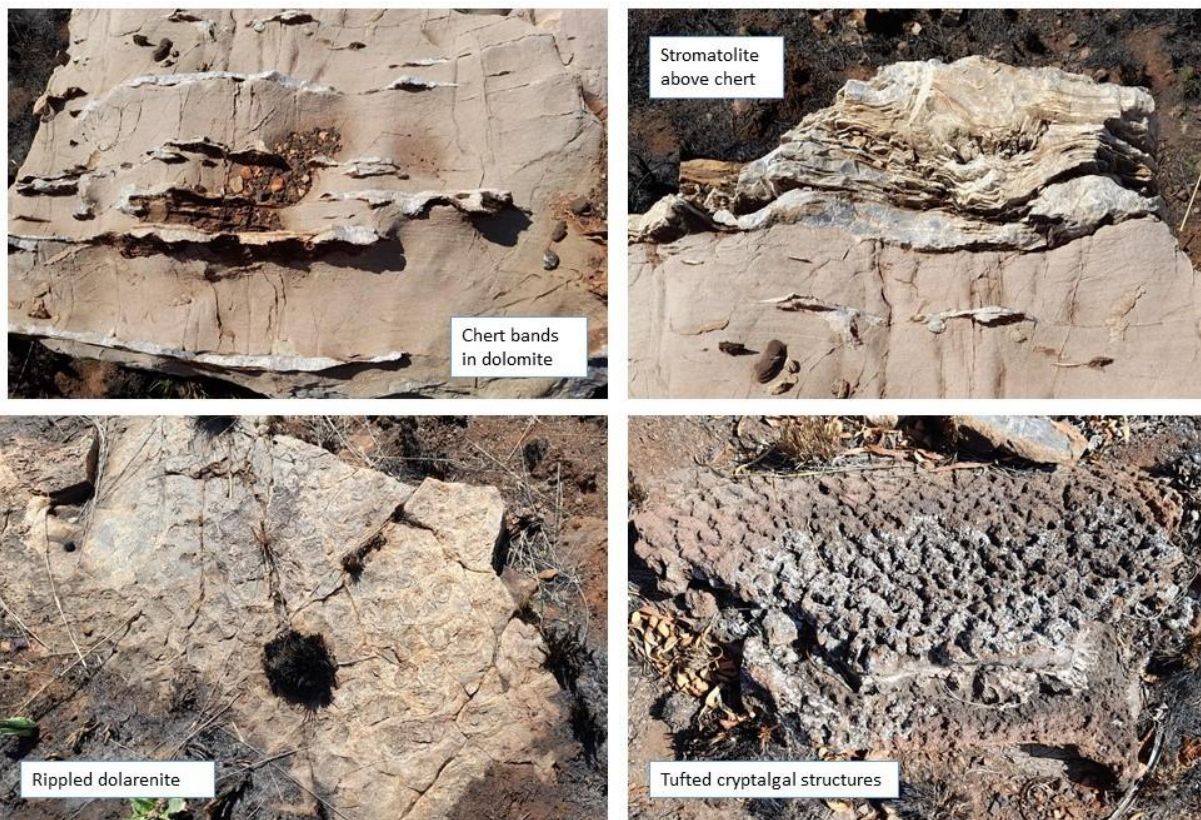
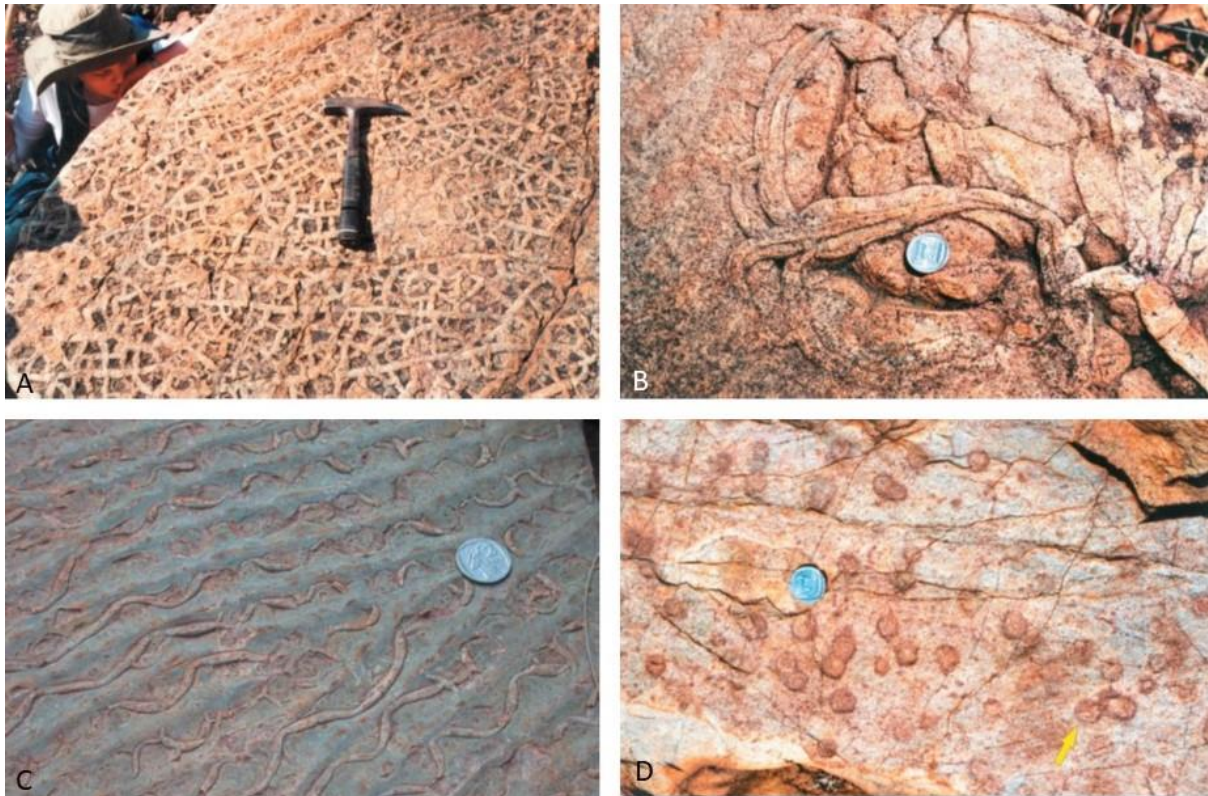


Figure 5: Photographs of different types of stromatolites and microbial features from the Transvaal Supergroup.



Magaliesberg Fm trace fossils, near Pretoria (all from Bosch & Eriksson, 2008): A – cracks,. B – sinuous structure, C – *Manchuriphycus*, D – circular structures. R1 coin for scale.

Figure 6: Photographs of microbial features from the Magaliesberg Formation (in Bosch and Eriksson, 2008)

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD June 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
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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	12	2
PhD	13	4
Postdoctoral fellows	15	2

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:

- 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
- Wolf-Skilpad-Grassridge Eskom line for Zutari
- Iziduli and Msengi WEFs, Eastern Cape for CTS Heritage
- Dealesville Springhaas SEFs for ASHA

xi) Research Output

Publications by M K Bamford up to June 2022 peer-reviewed journals or scholarly books: over 165 articles published; 5 submitted/in press; 12 book chapters.

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

Conferences: numerous presentations at local and international conferences.