

**Palaeontological Impact Assessment for the
proposed Modder East Operation slimes dam
expansion project, Benoni,
Gauteng Province**

Site Visit Report (Phase 2)

For

Prime Resources

28 March 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 Prime Resources, Parktown North, Johannesburg, 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 'M Bamford', with a horizontal line underneath.

Signature:

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed expansion of an existing tailings dam for the Modder East Operations (of Gold One Group), south of Benoni and Daveyton, East Rand, Gauteng. This expansion will be in either, or both, a westerly and northerly direction. The impact will be a permanent one as the tailings dam would remain in place once the mine has been closed.

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 very highly fossiliferous rocks of the Vryheid Formation (Ecca Group, Karoo Supergroup) that could preserve fossil plants of the *Glossopteris* flora. The site visit and walk down on 23rd March 2022 by palaeontologists confirmed that there were NO FOSSILS on the westerly site. The northerly site is ploughed, flat, with no rocky outcrops and no fossils. It is not known what occurs below the ground surface, therefore, a Fossil Chance Find Protocol should be added to the EMP. 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/drilling activities have commenced. As far as the palaeontology is concerned, the project should be authorised for either or both the westerly and northerly sites. There is no preference and no no-go area.

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1. Background

The Modder East Operations (of Gold One Group) is considering an expansion to their existing tailings dam, potentially in either, or both, a westerly and northerly direction. There are sensitivities associated with developing in both directions. The westerly site is close to a dense residential area but is not officially occupied, while the northerly site is an existing ploughed field. The impact will obviously be a permanent one as the tailings dam would remain in place once the mine has been closed

The Modder East gold mine is in the East Rand, Benoni south and south southwest of Daveyton and the existing slimes dam is central to the two options for expansion (Figures 1, 2).

A Palaeontological Impact Assessment was requested for the Modder East Operations 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: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
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 if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

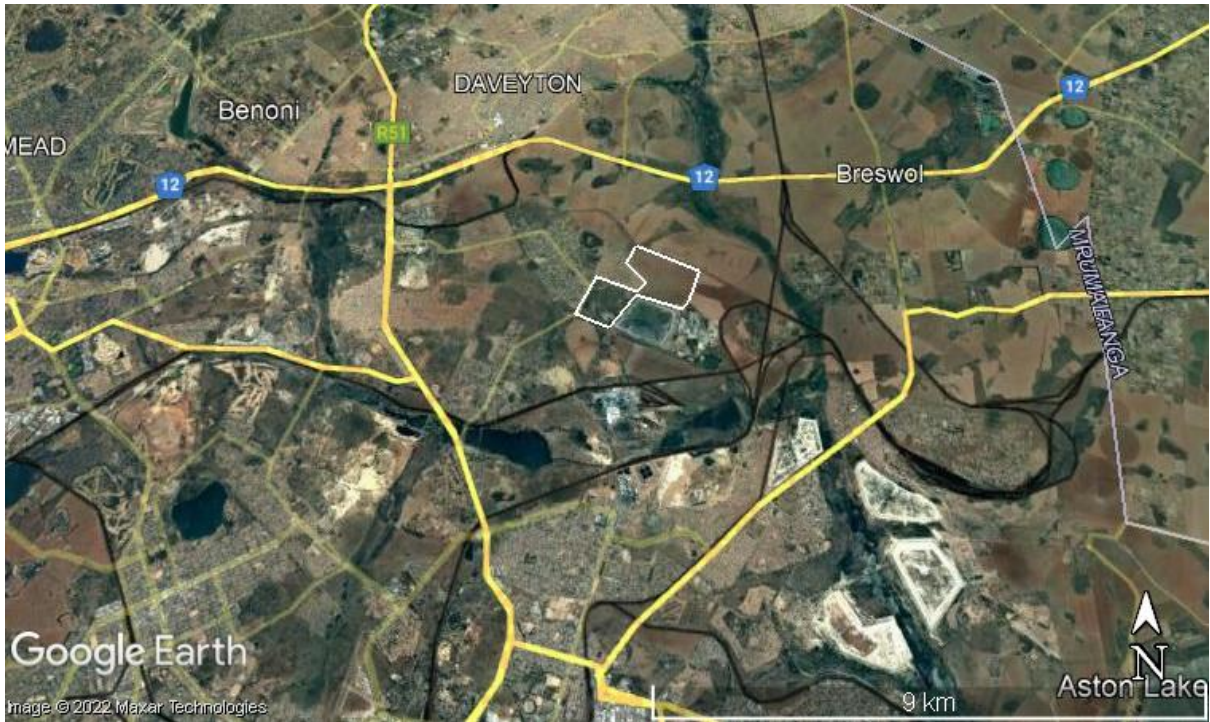


Figure 1: Google Earth map of the Modder East mine showing the relevant land marks.



Figure 2: Google Earth map of the proposed westerly and northerly sites for expansion of the Modder East Operations mine shown within the white 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, 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 the Modder East Operations mine within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Johnson et al., 2006; McCarthy et al., 2006). 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	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm, Eccca Group, Karoo SG	Shales, sandstone, coal	Early Permian, Middle Eccca
C-Pd	Dwyka Group, Karoo SG	Tillites, diamictite, sandstone, mudstone	Late Carboniferous to Early Permian
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale, basalt	Ca 2650 – 2640 Ma
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert	Ca 2750 – 2650 Ma
Rt	Turfontein Subgroup, Central Rand Group, Witwatersrand SG	Conglomerate, quartzite	Ca 2750 Ma

The site lies in the Transvaal Basin that has exposures of the basal members of the Transvaal Supergroup, and overlies the older rocks of the Witwatersrand Supergroup. Unconformably overlying the Transvaal Supergroup rocks are the much younger basal members of the Karoo Supergroup as this is the northern margin of the Main Karoo Basin. Along the rivers and watercourses are recent deposits of sand and alluvium, of late Quaternary age (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. 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.

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa (Visser, 1986, 1989). Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the **Dwyka Group**. They comprise tillites, diamictites, mudstones, siltstones and sandstones that were deposited as the basin filled. This group has been divided into two formations with Elandsvlei Formation occurring throughout the basin and the upper Mbizane Formation occurring only in the Free State and KwaZulu Natal (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the west and central part are the following formations, from base upwards: Prince Albert Formation, Whitehill Formation, Collingham Formation, Laingsburg / Ripon Formations, Tierberg / Fort Brown Formations, and Waterford Formation. In Gauteng, the Free State, Mpumalanga and KwaZulu Natal, from the base upwards are the Pietermaritzburg Formation, **Vryheid Formation** and the Volksrust Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

Overlying the Ecca Group are the rocks of the Beaufort Group that has been divided into the lower Adelaide Subgroup for the Upper Permian strata, and the Tarkastad Subgroup for the Early to Middle Triassic strata. As with the older Karoo sediments, the formations vary across the Karoo Basin. The Stormberg Group forms the upper part of the Karoo sediments. Large exposures of Jurassic dolerite dykes occur throughout the area. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption.

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 and Vryheid Formation (red in the SAHRIS map) that are very highly sensitive for palaeontology. There is a narrow band in the centre of moderately sensitive Dwyka Group rocks.

Stromatolites, trace fossils of algal colonies, could occur in the Malmani Subgroup. They would appear as finely laminated domes in the dolomite.

The Dwyka Group could preserve transported and usually fragmented fossils of the *Glossopteris* flora, and some invertebrates, but these are rare and have not been recorded from the Transvaal.

The Vryheid Formation has extensive coal seams of Early Permian age. Although coal is formed from buried peat that is altered over time by high temperatures and pressures, the original plants that made the peat are not recognisable. The carbonaceous shale bands and lenses between the coal seams are more likely to preserve impressions of the plants. They are typical plants of the *Glossopteris* flora that includes leaves, seeds, reproductive structures and wood of *Glossopteris*, as well as other plants such as lycopods, sphenophytes, ferns and early gymnosperms.

In the Highveld and Witbank coal fields there are five to six coal seams, with No 4 being made up of two seams close together. The uppermost seam, No 5, is on average more than 10m below the ground surface. It is overlain by soils then shales and siltstone or interbedded shale and sandstone (Snyman, 1998). There are no coal mines in this part of the Vryheid Formation but the sediments overlie the much deeper gold reserves, in this locality the Modderfontein East mine. Gold ore is in the Witwatersrand Supergroup that is non-fossiliferous because it is too old and has been metamorphosed (McCarthy, 2006).

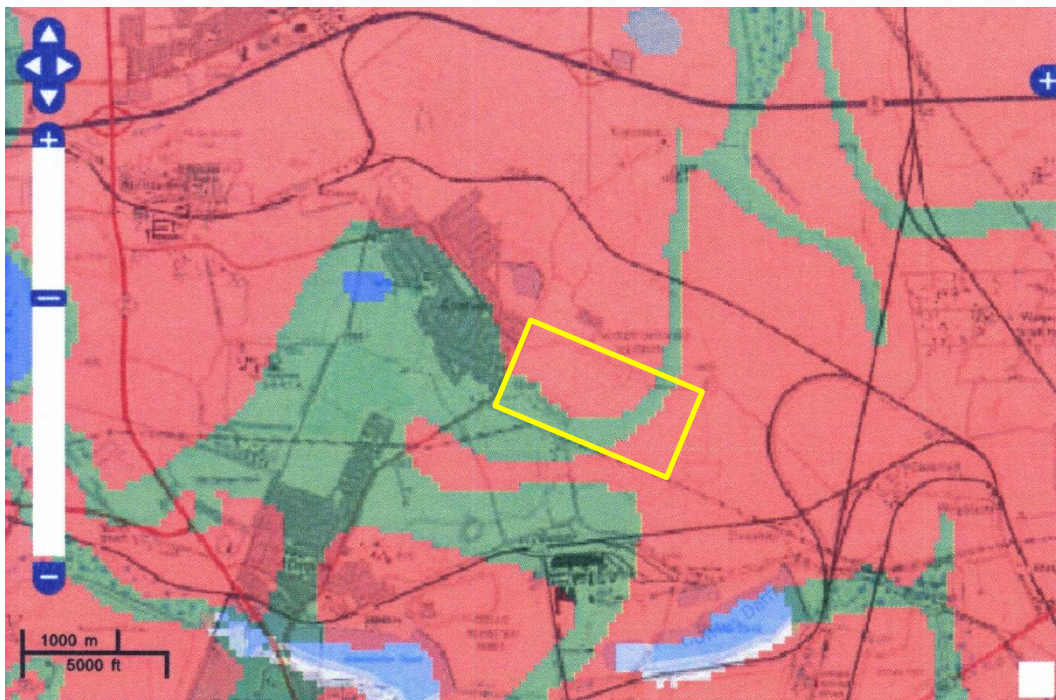


Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Modder East Operations tailings dam expansion shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as very highly sensitive (red) so a site visit was carried out and is reported herein.

iii. Site visit observations



Figure 5: Annotated Google Earth map for the site stops and observations (refer to Table 3).

Table 3: Site observations, GPS points (Figure 5) and relevant figures

GPS	Observations	Figures
Northerly section	Ploughed field so not walked through because no rocky outcrops were visible from the road. Dolomite outcrops would be expected in the most easterly part but not was evident	
Pal 1 S26°11'12.20622" E28°26'40.51669"	From the entrance the area is relatively flat and highly disturbed with tall grass and weeds. Sandy to gravelly soils are visible. No rocky outcrops and no fossils	6 A-D
Pal 2 S26°11'17.78661" E28°26'36.13048"	Farther into the site the topography is the same – flat and no rocky outcrops. Tall vegetation attests to deep soils. No fossils	6 E-F
Pal 3 S26°11'09.78515" E28°26'18.93594"	Very disturbed areas with old equipment, parking areas and red soils visible, Weeds are very prolific. No rocky outcrops and no fossils were seen	7 A-D



Figure 6. Site photographs.



Figure 7.

4. Impact assessment

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

Table 4a: 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 4b: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	H	-
	M	-
	L	Soils and sands do not preserve plant fossils; so far there are no records from the Malmani Subgroup of stromatolites or from the Dwyka Group and Vryheid Fm of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-

PART B: Assessment		
	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 stromatolites in the dolomite or fossil plants from the <i>Glossopteris</i> flora in the shales, 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 sand that will be covered by a tailings dam. Fossils may occur below ground but will not be disturbed (just buried).. 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 of any age or kind in the project footprint. Furthermore, the project will be adding materials to the surface, not excavating. Since there is a small chance that fossils 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 do contain trace fossils or fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on 23rd March by palaeontologists confirmed that there are no fossils visible on the surface. The soils and sands 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 algal traces (stromatolites) or of plants of the *Glossopteris* flora even though fossils 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 small chance that fossils may occur in below the ground surface in the dolomites of the Malmani Subgroup or the shales of the Vryheid 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 and drilling have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact to the fossil heritage would be low, therefore, as far as the palaeontology is concerned, the project should be authorised for either or both the westerly and northerly sites. There is no preference and no no-go area.

7. References

- Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodrum of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.
- 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.
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- 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.
- Visser, J.N.J., 1986. Lateral lithofacies relationships in the glaciogene Dwyka Formation in the western and central parts of the Karoo Basin. *Transactions of the Geological Society of South Africa* 89, 373-383.
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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 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 Figures 8-9). 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 and Vryheid Formation.

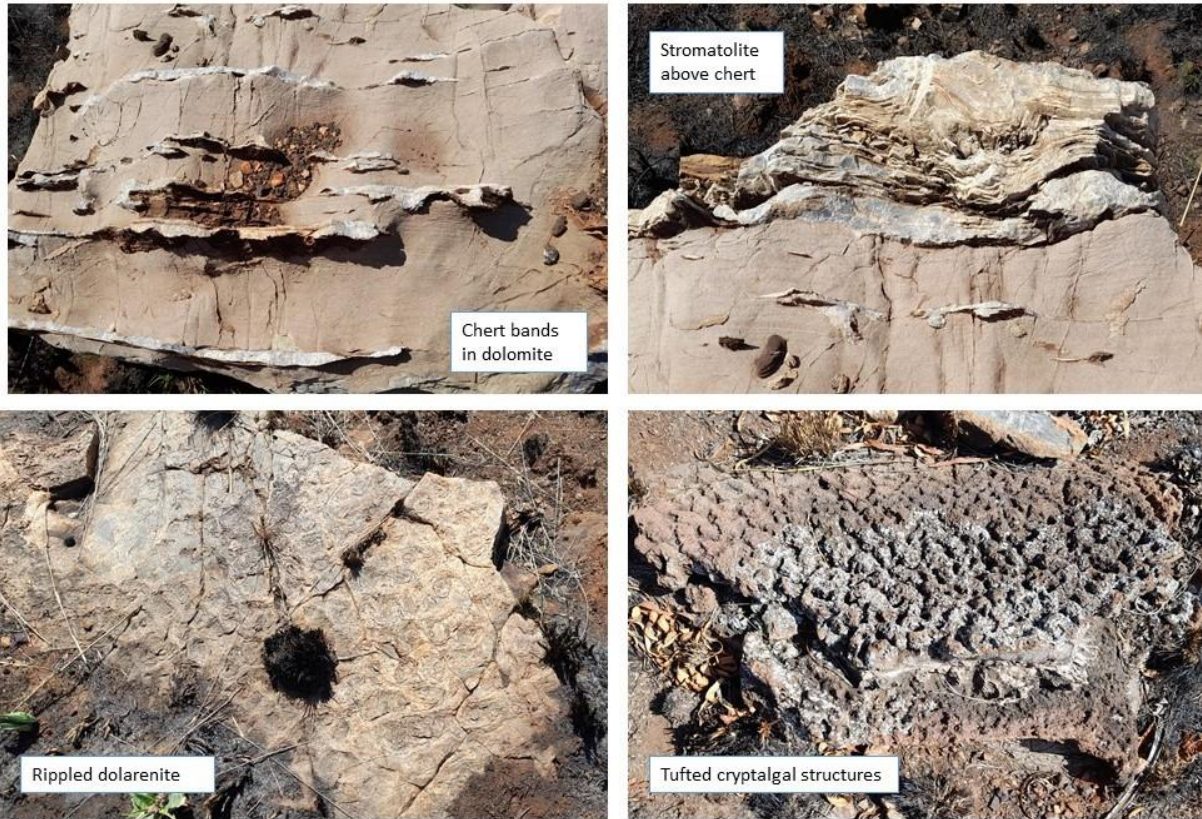


Figure 8: Photographs of different types of dolomite, and stromatolites.

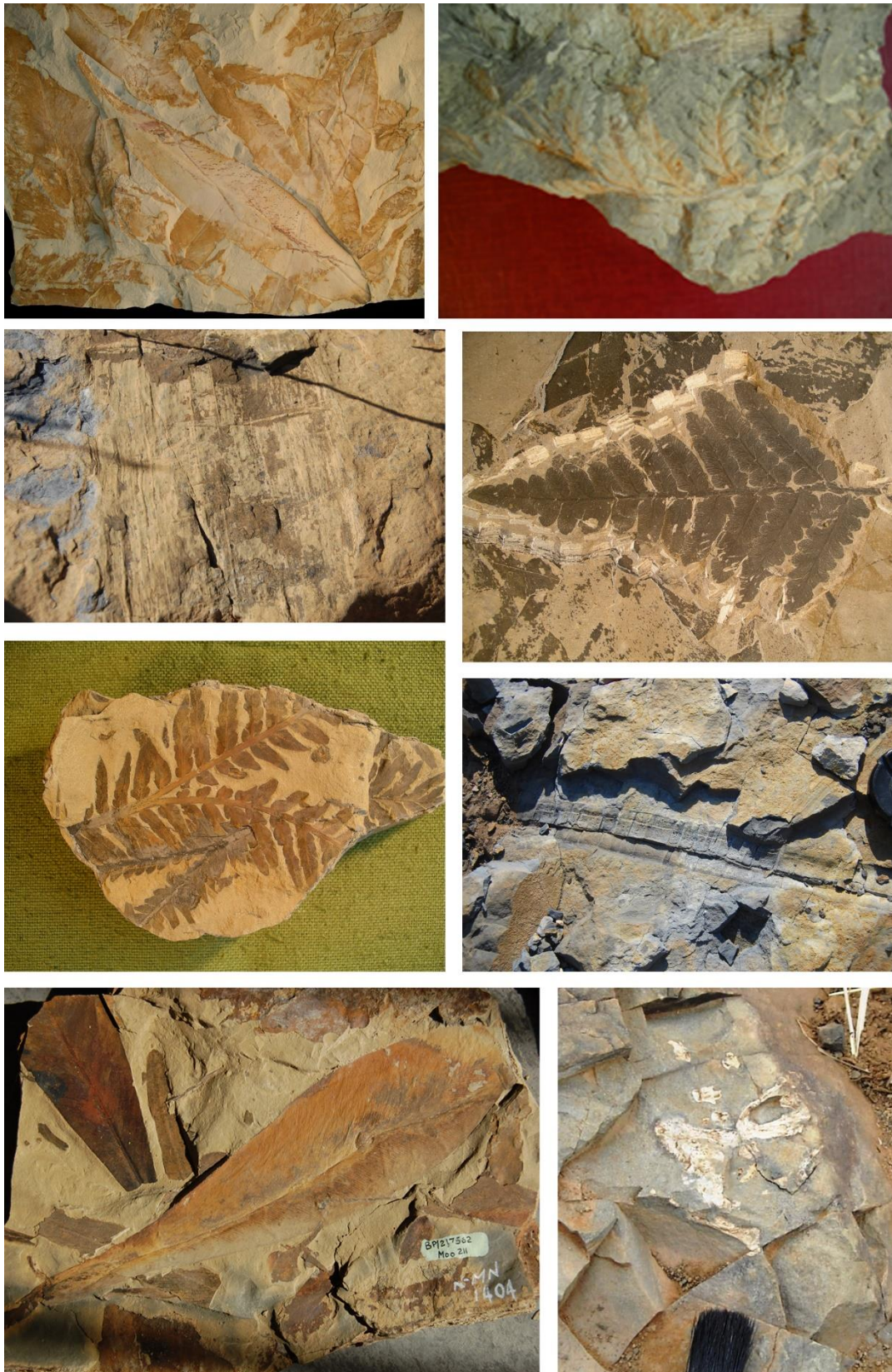


Figure 9: Photographs of fossil plants of the *Glossopteris* flora.

10. Appendix B – Details of specialists

Marion Bamford (PhD) **Short CV for PIAs – Jan 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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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.

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	12	4
PhD	11	4
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 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 = 36; i10-index = 95

Conferences: numerous presentations at local and international conferences.

Mr Frederick Tolchard Brief Curriculum Vitae – March 2022

Academic training

BA Archaeology – University of the Witwatersrand, graduated 2015

BSc (Honours) Palaeontology – University of the Witwatersrand, 2017 with distinction

MSc Palaeontology – University of the Witwatersrand, 2018 – 2019. Graduated 2020 with Distinction

PhD Palaeontology – Wits – 2020 - current

Field Experience

Honours Fieldtrip – Karoo biostratigraphy – April 2017

Research fieldwork – Elliot Formation with Prof Choiniere – April 2018, Nov 2018; April 2019; Sept 2021

Publications

Tolchard, F., Nesbitt, S.J., Desojo, J.B., Viglietti, P.A., Butler, R.J. and Choiniere, J.N., 2019.

‘Rauisuchian’ material from the lower Elliot Formation of South Africa: Implications for late Triassic biogeography and biostratigraphy. *Journal of African Earth Sciences*, 160, 103610.

Viglietti, P.A., McPhee, B.W., Bordy, E.M., Sciscio, L., Barrett, P.M., Benson, R.B.J., Wills, F., Tolchard, F., Choiniere, J.N., 2020. Biostratigraphy of the Scalenodontoides Assemblage Zone (Stormberg Group, Karoo Supergroup), South Africa. *South African Journal of Geology* 123, 239-248.

Tolchard F., Kammerer C., Butler R.J., Abdala F., Hendrickx C., Benoit J., Choinière J.N. (2021.) A very large new trirachodontid from the Triassic of South Africa and its implications for Gondwanan biostratigraphy. *Journal of Vertebrate Paleontology*. DOI: 10.1080/02724634.2021.1929265.

PIA fieldwork projects

2018 May – Williston area – SARAO project, Digby Wells

2018 September – Lichtenburg PVs – CTS Heritage

2018 November – Nomalanga farming – Digby Wells

2019 January – Thubelisha coal – Digby Wells
2019 March – Matla coal – Digby Wells
2019 March – Musina-Machado SEZ – Digby Wells
2019 June – Temo coal – Digby Wells
2019 September – Makapanstad Agripark – Plantago
2020 January – Hendrina, Kwazamakuhle – Kudzala
2020 February – Hartebeestpoort Dam - Prescali
2020 March – Twyfelaar Coal mine – Digby Wells
2020 March – Ceres Borrow Pits – ACO Associates
2020 March – Copper Sunset Sand – Digby Wells
2020 October – Belfast loop and Expansion – Nsovo
2020 October – VLNR lodge Mapungubwe – HCAC
2020 November – Delmore Park BWSS - HCAC
2020 December – Kromdraai commercial – HCAC
2021 January – Welgedacht Siding – Elemental Sustainability
2021 March – Shango Kroonstad – Digby Wells
2021 May – Copper Sunset sand mining – Digby Wells
2021 August – New Largo Pit – Golder
2021 August – Khutsong Ext 8 housing, Carletonville, for Afzelia
2021 September – Lichtenburg PV facility – CTS Heritage
2021 October – Ogies South MR – beyondgreen
2021 October – Nooitgedacht Colliery MR – Shangoni
2022 January – Sigma PVs Sasolburg – CTS Heritage
2022 March – Taaibosch Puts PVs – CTS Heritage
2022 March – Driefontein mine revised infrastructure – Amber Earth

Bailey M. Weiss CV

March 2022

I am currently enrolled as a PhD student, at the University of the Witwatersrand, Johannesburg. I completed my Masters degree at the University of the State (UFS), on: *Bone microanatomy of Anomodontia (Synapsida: Therapsida) from the Karoo Basin of South Africa*. This project was supervised by Dr Jennifer Botha (National Museum, Bloemfontein) and Co-Supervised by Dr Alexandra Houssaye (Muséum national d'Histoire naturelle, Paris). I completed my BSc honours degree in which I completed a research project entitled: *Limb bone histology of theropod dinosaurs from the Early Jurassic of South Africa*. This project was supervised by Dr Jennifer Botha. I majored in Genetics and Zoology for my BSc degree. I have worked as an Osteohistology Technician at the National Museum, Bloemfontein, as well as a Laboratory Assistant at the UFS. I have been on two Palaeontological field trips one with the National Museum in the Balfour and Katberg Formations. The other with the University of the Witwatersrand in the Lower Elliot Formation of South Africa.

Qualifications

BSc – Majors: Genetics and Geology - University of the Free State – 2018
BSc Honours – Palaeontology – University of the Free State – 2019

MSc – Palaeontology – University of the Free State – graduated 2021.
PhD – Palaeontology – University of the Witwatersrand – registered 2022.

PIA fieldwork Experience

July 2021 – Sannaspos PV Facility, Free State for CTS Heritage
October 2021 – Beatrix Mine-Theunissen Eskom powerline for 1World
March 2022 – Taaibosch Puts PV – for CTS Heritage
March 2022 – Driefontein Mine infrastructure – AmberEarth
March 2022 – Transnet MPP Access routes, inland and coastal - ENVASS

References:

Dr Jennifer Botha, Head of Palaeontology, National Museum, Bloemfontein
jbotha@nasmus.ac.za

Prof Jonah Choiniere, Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg
Jonah.choiniere@wits.ac.za