

Palaeontological Impact Assessment for the proposed Franschhoek Cableway, Western Cape Province

Desktop Study (Phase 1)

For

ACO Associates (Pty) Ltd

14 March 2023

Prof Marion Bamford

Palaeobotanist

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford

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

Experience: 34 years research and lecturing in Palaeontology

26 years PIA studies and over 350 projects completed

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by ACO Associates (Pty) Ltd, Cape Town, 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

Signature:

A handwritten signature in blue ink, appearing to read 'M Bamford', with a horizontal line underneath.

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed construction of a cableway on the mountain behind Franschhoek, Western Cape Province. Three land parcels will be affected: parts of Erf 1466, Erf 1467 and RE 23.

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 part of the proposed site lies on the highly sensitive Peninsular Formation (Table Mountain Group, Cape Supergroup) that might preserve trace fossils or invertebrate fossils of Ordovician age. 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 contractor, environmental officer or other designated responsible person once excavations or drilling for foundations and infrastructure have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

Expertise of Specialist.....	1
Declaration of Independence.....	1
1. Background.....	4
2. Methods and Terms of Reference.....	8
3. Geology and Palaeontology.....	8
i. Project location and geological context.....	8
ii. Palaeontological context.....	10
4. Impact assessment.....	11
5. Assumptions and uncertainties	13
6. Recommendation.....	13
7. References.....	13
8. Chance Find Protocol.....	14
9. Appendix A – Examples of fossils	15
10. Appendix B – Details of specialist.....	16
Figure 1: Google Earth map of the general area to show the relative land marks.	6
Figures 2-4: Google Earth Maps of the proposed development	7-8
Figure 5: Geological map of the area around the project site.....	8
Figure 6: SAHRIS palaeosensitivity map for the site	10

1. Background

The proposed construction of a cableway on the mountain behind Franschhoek in the Western Cape Province will require structures on three properties, Erf 1466 Haute Cabrière, Erf 1467 and RE 23 (Figures 1-4). No details of the project have been provided.

A Palaeontological Impact Assessment was requested for the Franschhoek Cableway 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

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

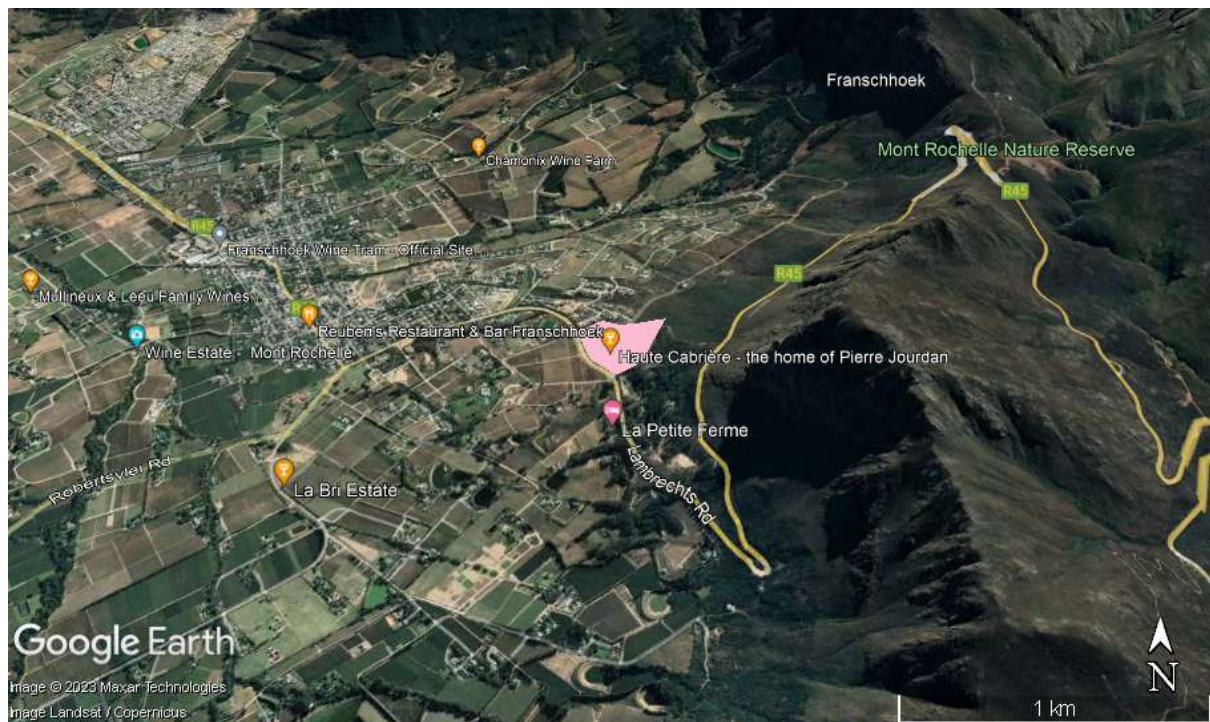


Figure 1: Google Earth map of the general area to show the relative land marks. The proposed Franschhoek Cableway properties are shown by the pink polygon.



Figure 2: Google Earth Map of the proposed Erf 1466 land parcel for part of the Franschhoek Cableway development of with the section shown by pink polygon.



Figure 3: Google Earth Map of the proposed Erf 1467 land parcel for part of the Franschhoek Cableway development of with the section shown by pink polygon.



Figure 4: Google Earth Map of the proposed RE 23 land parcel for part of the Franschhoek Cableway development of with the section shown by pink polygon.

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

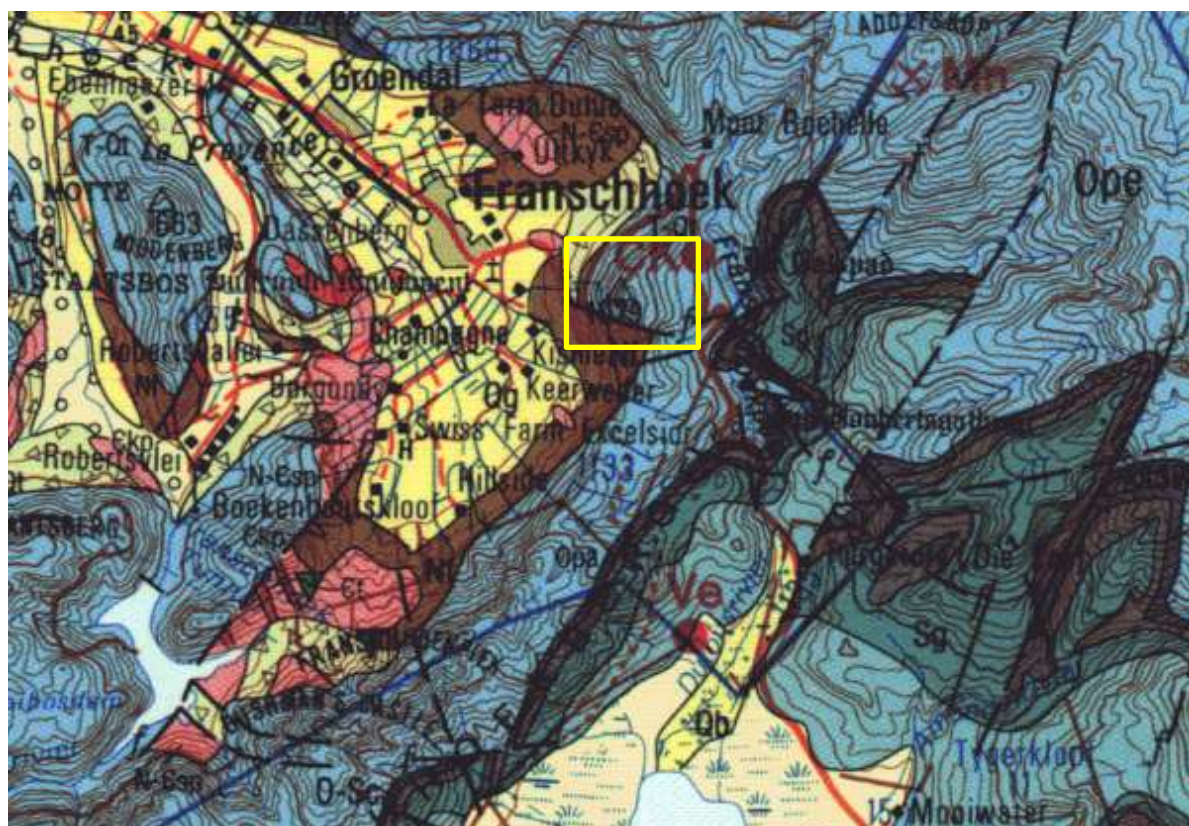


Figure 5: Geological map of the area around the Franschhoek Cableway indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 3319 Worcester.

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

Symbol	Group/Formation	Lithology	Approximate Age
Q, Qg	Quaternary	Alluvium, sand, calcrete	Quaternary ca 1.0 Ma to Present
Ss	Skurweberg Fm, , Nardouw Subgroup, Table Mountain Group, Cape SG	Sandstone (thick bedded)	Silurian
Sg	Goudini Fm, , Nardouw Subgroup, Table Mountain Group, Cape SG	Sandstone (red, brown)	Silurian
O-Sc	Cedarberg Fm, Table Mountain Group, Cape SG	Shale, siltstone (Soom shale)	Ordovician
Opa	Pakhuis Fm., Table Mountain Group, Cape SG	Diamictite, sandstone	Ordovician
Ope	Peninsular Fm, Table Mountain Group, Cape SG	Sandstone	Ordovician
Og	Graafwater Fm, Table Mountain Group, Cape SG	Sandstone, siltstone, shale	Ordovician
Op	Piekenierskloof Fm, Table Mountain Group, Cape SG	Sandstone, conglomerate	Ordovician
Nt	Tygerberg Fm, Malmesbury Group	granites	
€t	Plutons	Granites	Precambrian

The project lies in the Western Cape where the basal Cape Supergroup rocks unconformably overlie the much older basement granites. In the river valleys much younger sands and alluvium have been deposited over the older rocks.

The Cape Supergroup comprises a series of siliciclastic sediments that were deposited in a passive margin basin and is underlain by Cambrian rocks of the Saldanian Orogeny and Pan African depositional cycles. It is overlain by the Karoo Basin sequence (Thamm and Johnson, 2006). Representing some 170 million years of earth history, and up to 10km of strata, the Cape Supergroup has since been deformed by the Cape Orogeny. It extends along the southern Cape coast for about 1000km (ibid). There are three major subdivisions, the basal Table Mountain Group, Bokkeveld and Witteberg Groups ranging from the Early Ordovician (ca 500 Ma) to the Early Carboniferous (ca 330 Ma). The subgroups and formations differ slightly between the western and eastern regions.

The Table Mountain Group is sandstone dominated and was deposited in shallow marine, glacial and fluvial environments. No subgroup name is given to the basal formations but the upper formations, Silurian to Devonian, are grouped into the Nardouw Subgroup. Five formations are recognised in the Ordovician component of this Group and west of ca 21°E are from the base upwards, the Pieknierskloof, Graafwater, Peninsula, Pakhuis and Cedarberg Formations. East of 21° only three formations are recognised, namely the Sardinia, Peninsula and Cedarberg Formations.

The Nardouw Subgroup comprises three formations, with the basal Goudini and Skurweberg Formations. The upper formation west of 21°E is known as the Rietvlei Formation, and to the east as the Baviaanskloof Formation.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 7. The site for development is partly in the highly sensitive rocks of the Table Mountain Group of the basal Cape Supergroup, in particular on the Peninsula Formation.

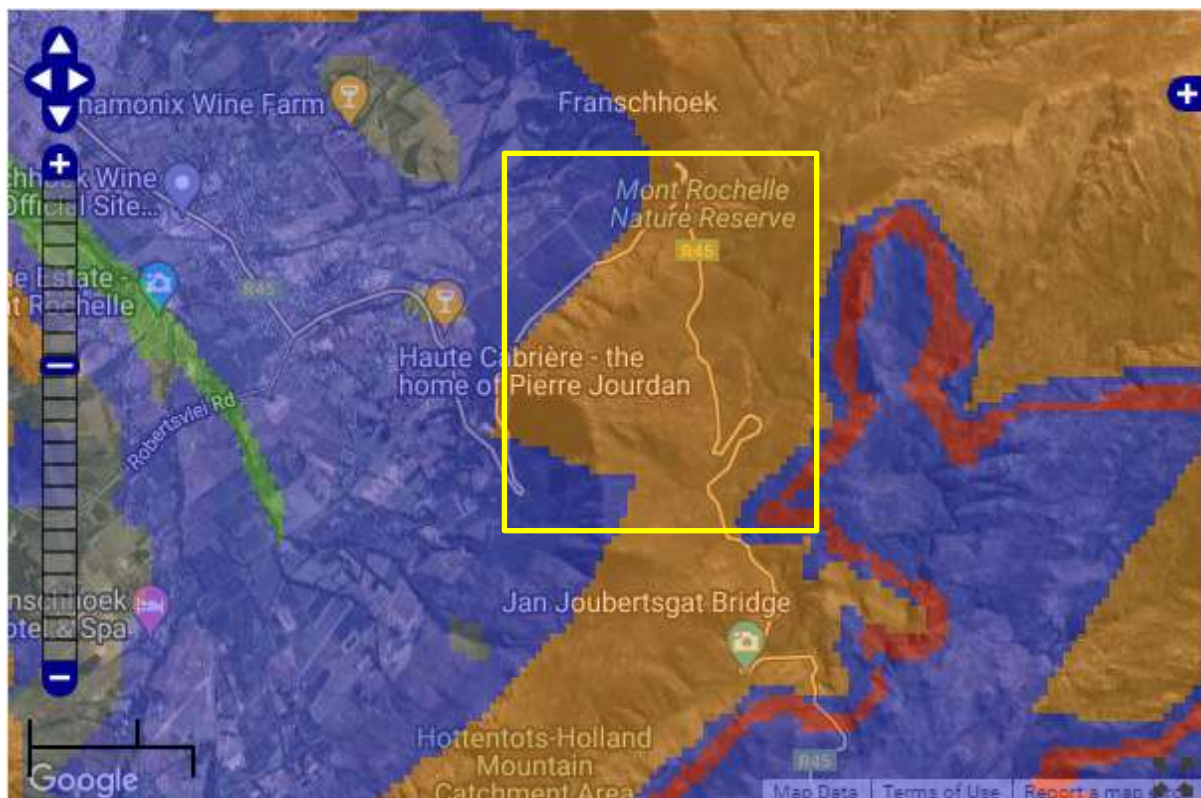


Figure 7: SAHRIS palaeosensitivity map for the site for the proposed Franschhoek Cableway shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The time period of the Ordovician – Silurian – Devonian (about 485 – 350 Ma) is when the first terrestrial plants, bony fish and insects evolved and spread on the land, from precursors in the seas. The Cape Supergroup represents this period, and although southern Africa (in the middle of Gondwanaland) was positioned over or close to the South Pole, and was covered by a series of ice sheets (Visser, 1989; Isbell et al., 2012), some of the fine-grained shallow water and marginal mudstones and siltstones have fossils preserved within them (Plumstead, 1969; Theron, 1972; MacRae, 1999; Thamm and Johnson, 2006; Penn-Clarke et al., 2018). With the repeated cycles of sealevel rise and fall and resulting shifts from marine to shoreline to fluvial and delta settings and back again, there is a complex series of environments with the resident faunas.

The Ordovician lower **Table Mountain Group** preserves trace fossils, and invertebrates such as brachiopods, trilobites, eurypterids, conodonts and chitinozoans. There are records of invertebrate fossils, known as the Malvinokaffric Faunal Assemblage, in the Silurian – early Devonian upper Nardouw Subgroup and the whole of the Bokkeveld Group, while the Witteberg Group has records of fish and plants as well as invertebrates such as brachiopods, bivalves, gastropods and trilobites. More recent research has shown that the Malvinokaffric fauna of Gondwanaland (Bokkeveld Group) is somewhat different from the northern hemisphere fauna (Penn-Clarke et al., 2018b).

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.
	L	Quickly reversible. Less than the project life. Short term

Criteria for ranking the DURATION of impacts	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	River sands and volcanic rocks do not preserve fossils; so far there are no records from the Table Mountain Group of plant or animal fossils in this region but there might be trace fossils or marine invertebrates but 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 and invertebrate fossils in the sandstones of the Peninsular Fm, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	H	-
	M	It is extremely unlikely that any fossils would be found in the loose soils and sands that cover the area, but possible in the sandstones of the Peninsular Fm, a Fossil Chance Find Protocol should be added to the eventual EMPr.-
	L	

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 but some might have trace fossils or invertebrate fossils. Since there is a small chance that fossils from the Peninsular 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 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 trace fossils or invertebrate fossils although none has been reported from this site. It is possible that they occur in the rocks below the soils. 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 river sands and alluvium of the Quaternary. There is a small chance that trace fossils or invertebrate fossils may occur in the sandstones of the Ordovician Peninsular Formation (Table Mountain Group, Cape Supergroup) so a Fossil Chance Find Protocol should be added to the EMP. If fossils are found by the developer, environmental officer 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, so as far as the palaeontology is concerned, the project should be authorised.

7. References

Almond, J.E., Pether, J. 2008. Palaeontological Heritage of the Western Cape; interim report. SAHRA Report. 23pp.

Isbell, J.L., Henry, L.C., Gulbranson, E.L., Limarino, C.O., Fraiser, F.L., Koch, Z.J., Ciccioli, P.I., Dineen, A.A., 2012. Glacial paradoxes during the late Paleozoic ice age: Evaluating the equilibrium line altitude as a control on glaciation. *Gondwana Research* 22, 1-19.

Penn-Clarke, C.R., Rubidge, B.S., Jinnah, Z.A., 2018a. High palaeolatitude environmental change during the early to middle Devonian: insights from Emsian-Eifelian (lower-middle Devonian) siliciclastic depositional systems of the Ceres Subgroup (Bokkeveld Group) of South Africa. *Journal of Sedimentary Research*, 88, 1040–1075.

Penn-Clarke, C.R., Rubidge, B.S., Jinnah, Z.A., 2018b. Two hundred years of palaeontological discovery: Review of research on the Early to Middle Devonian Bokkeveld Group (Cape Supergroup) of South Africa. *Journal of African Earth Sciences* 137, 157-178.

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.

Thamm, A.G., Johnson, M.R., 2006. The Cape Supergroup. 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 443 – 460.

Theron, J.N., 1972. The Stratigraphy and Sedimentation of the Bokkeveld Group. D.Sc. Thesis (unpublished). University of Stellenbosch, South Africa, p. 175.

Visser, J.N.J., 1989. The Permo-Carboniferous Dwyka Formation of southern Africa: deposition by a predominantly subpolar marine icesheet. *Palaeogeography, Palaeoclimatology, Palaeoecology* 70, 377-391.

8. Chance Find Protocol

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

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, invertebrate fossils fragmentary plants or insects) 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 7). 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 or environmental officer then a 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 or invertebrates 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, HWC must be notified and if necessary a permit must be obtained. Annual reports must be submitted to HWC 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 HWC 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 fossils from the Table Mountain Group

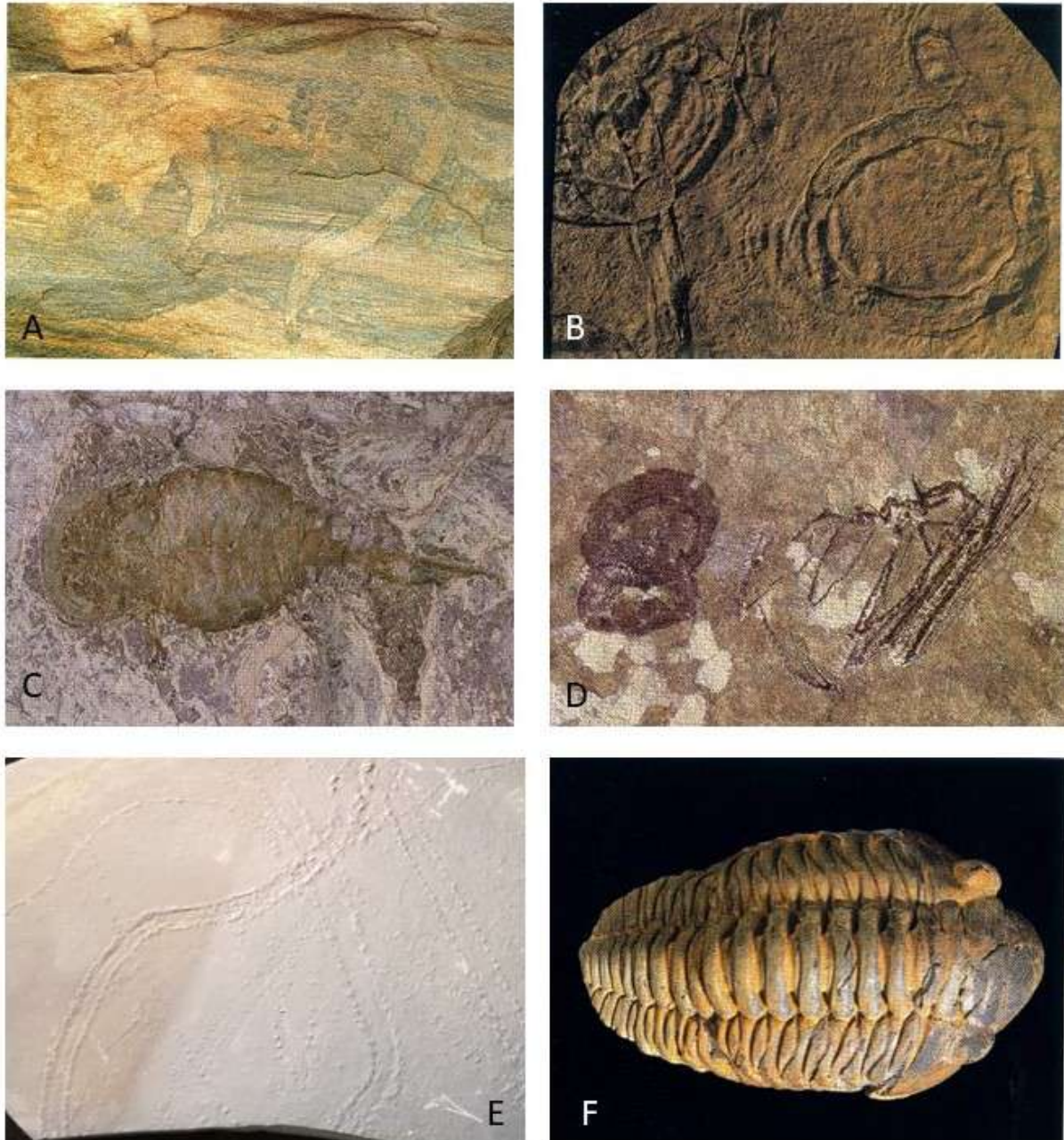


Figure 7: Photographs of invertebrate fossils and trace fossils or trackways from the Table Mountain Group (Cape Supergroup).

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD January 2023

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

Telephone : +27 11 717 6690
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

v) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	13	0
Masters	13	3
PhD	13	7
Postdoctoral fellows	14	4

vi) 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.

vii) 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: 30 local and international journals

viii) Palaeontological Impact Assessments

25 years' experience in PIA site and desktop projects

- Selected from recent projects only – list not complete:
- 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 2022 for AHSA
- Wolf-Skilpad-Grassridge OHPL 2022 for Zutari
- Iziduli and Msenge WEFs 2022 for CTS Heritage
- Hendrina North and South WEFs & SEFs 2022 for Cabanga
- Dealesville-Springhaas SEFs 2022 for GIBB Environmental
- Vhuvhili and Mukondelei SEFs 2022 for CSIR
- Chemwes & Stilfontein SEFs 2022 for CTS Heritage
- Equestria Exts housing 2022 for Beyond Heritage

- Zeerust Salene boreholes 2022 for Prescali
- Tsakane Sewer upgrade 2022 for Tsimba
- Transnet MPP inland and coastal 2022 for ENVASS
- Ruighoek PRA 2022 for SLR Consulting (Africa)
- Namli MRA Steinkopf 2022 for Beyond Heritage

ix) **Research Output**

Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 170 articles published; 5 submitted/in press; 14 book chapters.

Scopus h-index = 30; Google Scholar h-index = 39; -i10-index = 116 based on 6568 citations.

Conferences: numerous presentations at local and international conferences.