Palaeontological Impact Assessment for the proposed SiVEST Roos Solar PV Cluster, west-southwest of Belfast, Mpumalanga Province

CTS22_353_SiVEST_Roos Solar PV Cluster

Site Visit Report (Phase 2)

For

CTS Heritage

21 March 2023

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 34years research; 26 years PIA studies
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 CTS Heritage, Simonstown, 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: 

Executive Summary

A site visit (Phase 2) Palaeontological impact Assessment was completed for the proposed SiVEST Roos Solar PV Cluster. The proposed site is adjacent to the N4 highway, on Farm Roodekrans 457IS, Mpumalanga Province.

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

The proposed site lies on non-fossiliferous Jurassic dolerite and on potentially very highly sensitive rocks of the Vryheid Formation (Ecca Group, Karoo Supergroup) that could preserve impressions of fossil plants of the *Glossopteris* flora. The site visit and walk through by the palaeontologists on 13-14 March 2023 confirmed that there are NO FOSSIL PLANTS of the *Glossopteris* flora present on the surface. The area has a gently rolling topography with flatter parts, and open with secondary grassland, rare exotic trees. Most of the area appears to have been cultivated previously or cleared for grazing. It is unknown if there are fossils below the ground surface, 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, developer, environmental officer or other designated responsible person once excavations or drilling activities have commenced.

Since the impact will be low to moderate, as far as the palaeontology is concerned, the project should be authorised provided that any fossils found are rescued and that SAHRA is notified.

Table of Contents

1. Background

A site visit (Phase 2) Palaeontological impact Assessment was completed for the proposed development of the Roos Solar PV Cluster on Farm Generaalsdraai 423. The site is just to the north of the N4 highway, about 10km west-southwest of the town of Belfast, Mpumalanga Province (Figures 1-3). This project falls in the Steve Tshwete Local Municipality and the Nkangala District Municipality.

juwi South Africa (Pty) Ltd (hereafter referred to as juwi) is proposing to develop a hybrid renewable energy cluster, located on various land parcels in the western part of Mpumalanga, in the Emakhazeni Local Municipality. All of the projects fall within the Emalahleni Renewable Energy Development Zone (REDZ) but outside of the strategic transmission corridor.

The Roos PV facility is envisioned to be the solar PV component of a hybrid wind and solar facility. The intention is to develop (through one BA process) a cluster of five 20MW solar PV facilities and associated infrastructure on the property, depending on site sensitivities. The joint PV cluster will be located on the portions of the properties not used for wind energy development. So far these are in the west of the area. This will be confirmed prior to commencement of the EIA process – overall 270Ha of PV development area (indicated in white shading below) should be authorised. The associated infrastructure would include a BESS, site camp, substation and OHL, and O&M building. The 132kV OHL route will be confirmed prior to the commencement of the BA.

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

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

	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
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
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	None
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;	Section 3
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	Section 8
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	EAP
p	A summary and copies of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

Figure 1: Google Earth map of the proposed Roos Solar PV Cluster on Farm Generaalsdraai 423 (white patches) showing the relevant landmarks.

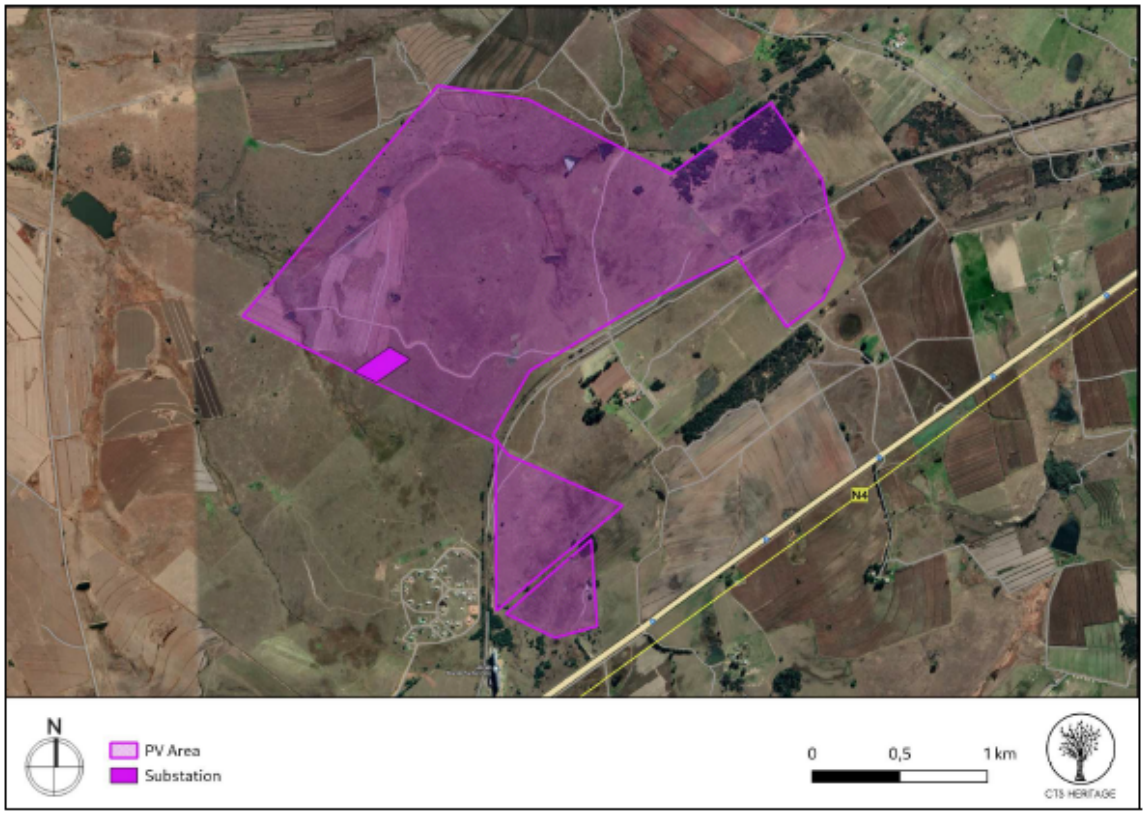

Figure 2: Annotated Google Earth map for the proposed Roos Solar PV Cluster site (purple outline) between west-southwest of Belfast near the N4 highway.

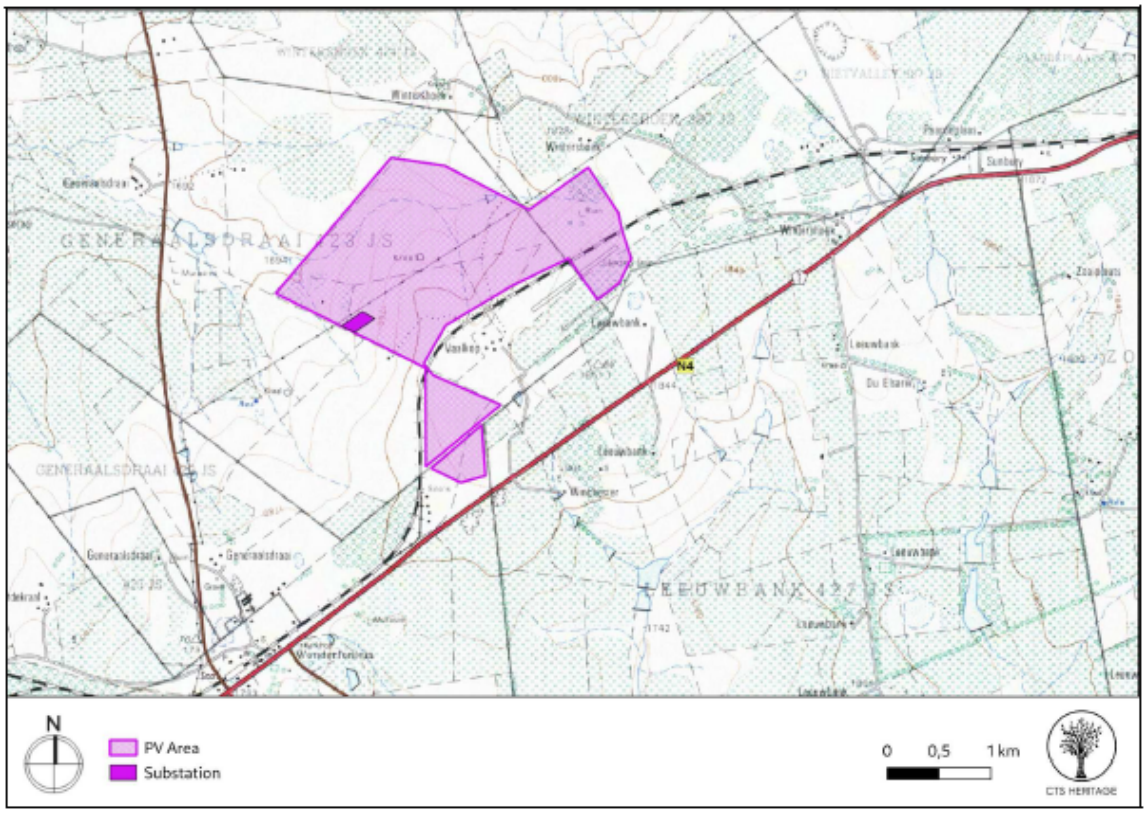

Figure 3: Topographic map with the Roos Solar PV Clustersite outlined in purple (from CTS Scoping Report).

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

The site lies in the southern part of the Transvaal Basin where the Rustenburg Layered Suite of the Bushveld Igneous Complex is partially exposed. It is unconformably overlain in northeastern part of the Karoo basin by the lower Karoo Supergroup strata (Figure 4). Along the rivers and streams much younger reworked sands and alluvium overly the older strata.

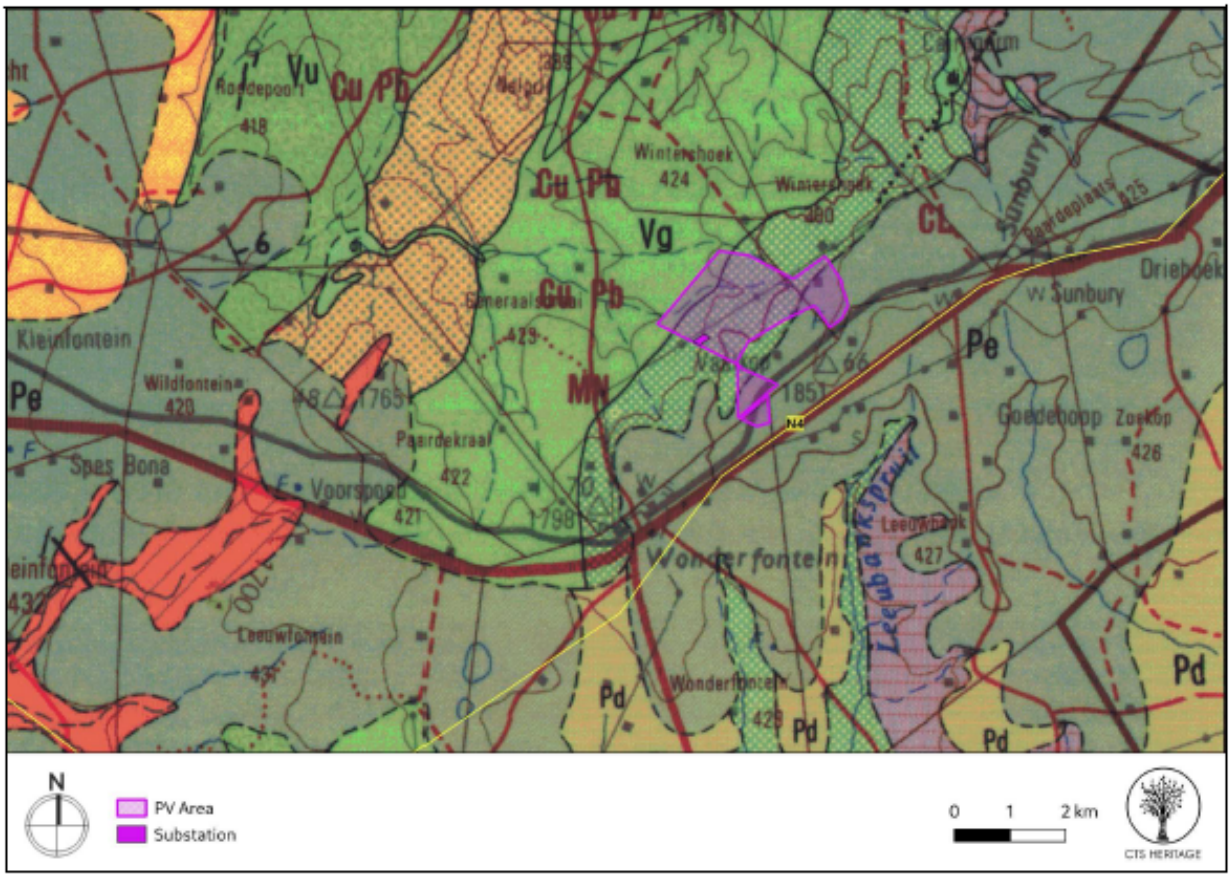

Figure 4: Geological map of the area around Farm Generaalsdraai 423 for the Roos Solar PV Cluster. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2528 Pretoria.

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

Symbol	Group/Formation	Lithology	Approximate Age
Qc	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, Ca 183 Ma
Pe/Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, mudstone, sandstone, coal seams	Early Permian Ca 290-270 Ma
Pd	Dwyka Group, Karoo SG	Diamictites, tillitesm mudstones	Late Carboniferous to Early Permian Ca 320-300 Ma
Vc	Critical Zone, Rustenburg Layered Suite, Bushveld Igneous Complex	Pyroxenite, leucogranite, norite, anorthosite	Palaeoproterozoic Ca 2080 Ma

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; Isbell et al., 2012). 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 Mpumalanga, the Free State 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.

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 5 and lies on the norite and leucogranites of the Rustenburg Layered Suite and on the Vryheid Formation (Ecca Group, Karoo Supergroup). The Bushveld Igneous Complex rocks are intrusive volcanic rocks that have been metamorphosed. They do not preserve any fossils.

The Vryheid Formation lies on the uneven topography of pre-Karoo or Dwyka Group rocks in the northern and northwestern margins, but lies directly on the Pietermaritzburg Formation in the central and eastern part. The lithofacies show a number of upward-coarsening cycles, some very thick, and they are essentially deltaic in origin. There are also delta-front deposits, evidence of delta switching, and fluvial deposits with associated meandering rivers, braided streams, back swamps or interfluves and abandoned channels (Cadle et al., 1993; Cairncross, 1990; 2001; Johnson et al., 2006). Coal seams originated where peat swamps developed on broad abandoned alluvial plains, and less commonly in the backswamps or interfluves. Most of the economically important coal seams occur in the fluvial successions (ibid). In the east

(Mpumalanga and northern KwaZulu Natal), the Vryheid formation can be subdivided into a lower fluvial-dominated deltaic interval, a middle fluvial interval, and an upper fluvial-dominated deltaic interval again (Taverner-Smith et al., 1988).

Figure 5: SAHRIS palaeosensitivity map for the site for the proposed development area shown within the lilac polygon. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The Vryheid Formation preserves the distinctive Gondwanan flora, the *Glossopteris* flora. As the climate warmed up and the huge continent drifted polewards the land was rapidly colonised by luxuriant vegetation, in some parts. Peats formed in waterlogged environments and over time were buried, preserved and altered by heat and pressure to eventually form the coal seams typical of this formation and abundant in Mpumalanga and KwaZulu Natal coalfields. Coals themselves do not preserve the original plant structures, but plant impressions or compressions can be preserved in the lenses between the coals or in fine grained sediments. The flora is composed of the dominant *Glossopteris* plants (leaves, seeds, reproductive structures, roots and wood). Other plants are lycopods, sphenophytes, ferns, cordaitaleans and other early gymnosperms. Vertebrates are not found with the fossil plants because they require adifferent set of conditions for preservations. Plants require rapid burial in a reducing and anoxic environment, while bones can be preserved in oxidizing environments (Cowan, 1995).

iii. Site visit observations

The proposed project area is situated west-southwest of Belfast adjacent to the N4 highway. The land has been cultivated and/or grazed for decades and so is highly disturbed from clearing of the land of rocks for cultivation and ploughing. There are no rocky outcrops within the cultivated land. With a gently rolling topography covered with either secondary grassland or exposed soils after ploughing, the visibility was generally good. Streams were not surveyed for fossils because they are seldom permitted to be developed, but more importantly, water and water-logged areas are not good for the preservation of fossils.

The palaeontologists walked the route (Figure 6), looked for rocky outcrops and took photographs. NO FOSSILS of any kind were seen on the ground surface and are unlikely to be found in the overlying soils.

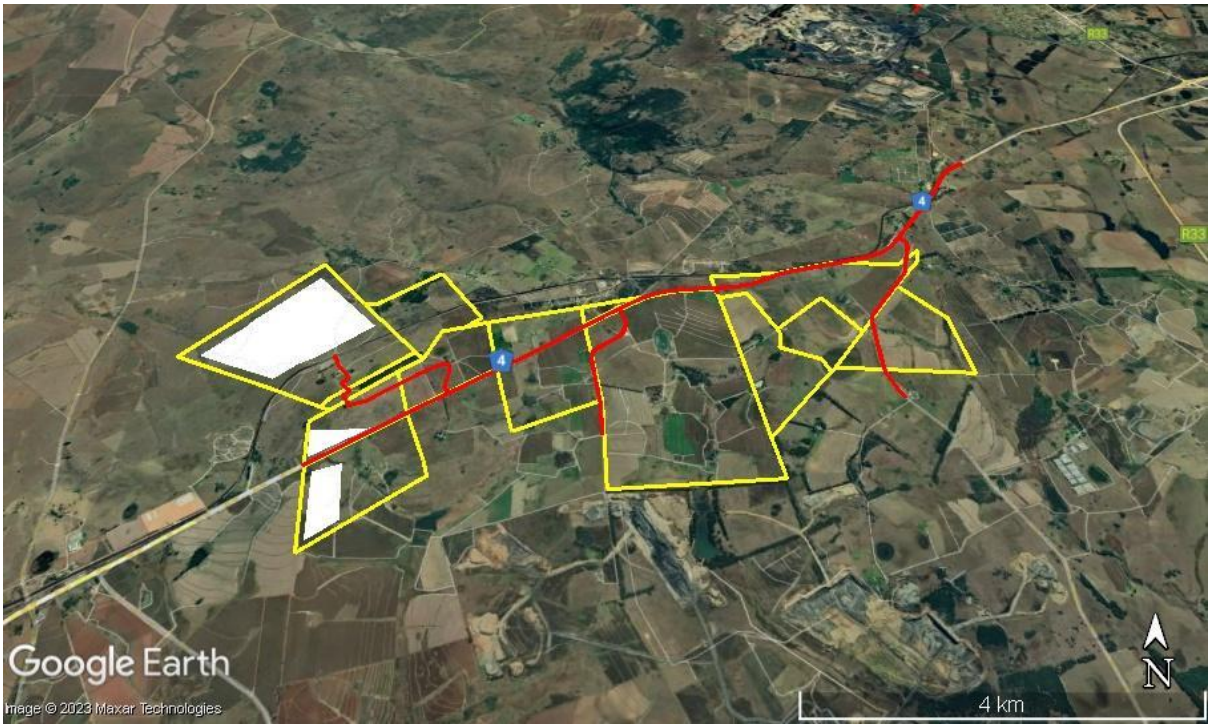

Figure 6: Orange line shows the route driven or walked by the palaeontologists within the area for the Roos Solar PV Cluster. The eastern and central paths off the N4 were to see the geology on the Vryheid Formation in the area. The northern path is on the project footprint.

Figure 7: Site photographs for the Roos Solar PV Cluster. A – B - general view of the area with grasslands on the eastern path off the N4 (not project footprint). C-D – another general view showing a flat land that is used for crops or fodder along the central path off the N4. Also not in the main solar project area.

Figure 8: Site photographs for the Roos Solar PV Cluster on Farm Generaalsdraai 423. A – B – General views looking northwards, starting from the N4 and heading north. C-D – general views showing flat fields that have been planted with grass for harvesting for fodder. No rocks, no rocky outcrops and no fossils found.

Figure 9: Site visit photographs for the Roos Solar PV project. A – gravel road showing the sandy soils on the road and adjacent to it. B – flat field that has a crop of maize growing on it. C-D – father along the road where more fields are used for fodder. No rocks, no rocky outcrops and no fossils.

Figure 10: Site visit photographs for the Roos Solar PV facility. A-C - North-western section on the non-fossiliferous rocks of the Rustenburg Layered Suite. D – only outcrop seen and this is laterite that has formed on a pebble band in more recent times. No rocky outcrops and no fossils seen.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 4:

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 do not preserve plant fossils; so far there are no records from the Vryheid Formation 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+	-
	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 fossil plants from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**

PART B: Assessment		
	L	It is extremely unlikely that any fossils would be found in the loose sand that will be developed for infrastructure but it is unknown what lies below the soils. Therefore, a Fossil Chance Find Protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that some of 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 significance in the project footprint. Furthermore, the surface material to be excavated is soil and this does not preserve fossils. Since there is a small chance that fossils from the Vryheid Formation might occur below ground and might be disturbed when excavations commence for foundations and infrastructure, a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low to moderate.

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 granites, dolomites, sandstones, shales and sands are typical for the country and only some do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on 14 March 2023 (summer) by palaeontologists confirmed that there are no fossils on the surface. There were no outcrops of shales that could potentially preserve fossils. There were no fossils on the surface. It is not known what lies below the surface but the soils appear to be a metre or more deep. The overlying soils and sands of the Quaternary period would not preserve fossils. Although the site appears to be on dolerite according to the map, there were no exposures of dolerite and the soils looked the same as those on the Vryheid Formation sites adjacent to this project.

6. Recommendation

The northern part of the project is on non-fossiliferous rocks of the Rustenburg Layered Suite but was surveyed. Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS of any significance such as those of recognisable *Glossopteris* floral elements, 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 very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the contractor, environmental officer, or other responsible person, once excavations and drilling have commenced for the foundations and infrastructure, then they should be rescued and SAHRA notified so that a palaeontologist can be called to assess and collect a representative sample.

7. References

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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 discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 11). 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/miners 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 and mining have finished then no further monitoring is required.

9. Appendix A – Examples of fossils from the Vryheid Formation

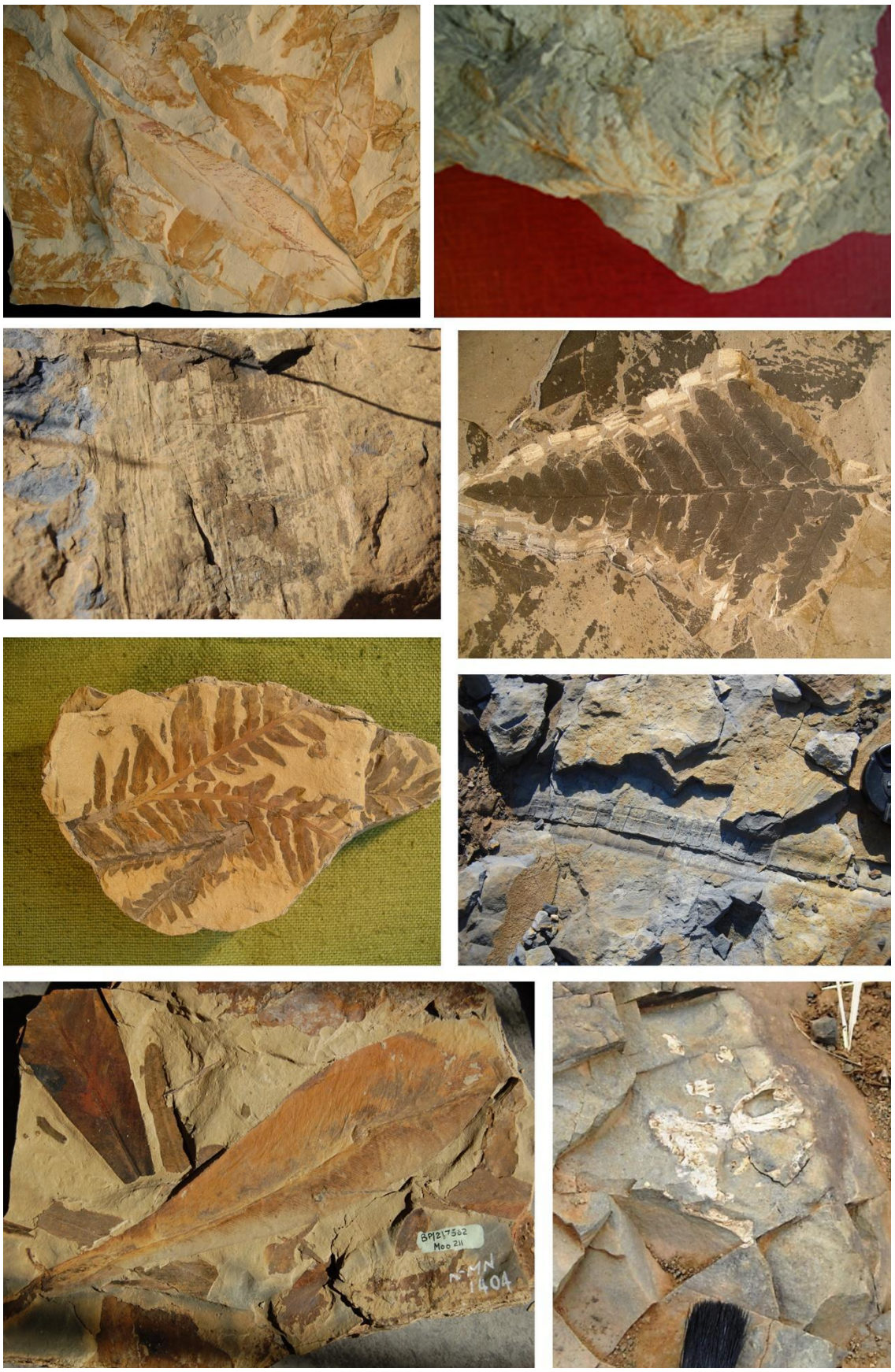

Figure 11: Photographs of fossil plants of the *Glossopteris* flora from the Vryheid Formation that would be expected to occur.

10. Appendix B – Details of specialists

Marion Bamford (PhD)

Short CV for PIAs – January 2023

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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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	14	1
PhD	11	6
Postdoctoral fellows	12	2

viii) **Undergraduate teaching**
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 12 - 20 students per year.

ix) **Editing and reviewing**
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Associate Editor: Cretaceous Research: 2018-2020
Associate Editor: Royal Society Open: 2021 -
Review of manuscripts for ISI-listed journals: 25 local and international journals

x) **Palaeontological Impact Assessments**

Selected from recent project only – list not complete:

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

- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe
- Glosam Mine 2021 for AHSA

XI) **Research Output**
Publications by M K Bamford up to January 2023 peer-reviewed journals or scholarly books: over 165 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 31; Google Scholar h-index = 39; -i10-index = 114.
Conferences: numerous presentations at local and international conferences.

Brandon Stuart CV
January 2023

After completing my BSc degree majoring in Zoology and Genetics in 2019, in 2020 I enrolled and completed a BSc Honours degree majoring in Zoology and specializing in Paleontology. My Honours research project was focused on describing the postcranial anatomy of the therocephalian *Moschorhinus kitchingi,* supervised by Dr. Jennifer Botha at the National Museum, Bloemfontein.

I have just completed my Masters degree at the University of the Free State for in Palaeobiology (awaiting examiners' reports). I carried out my research through the National Museum, Bloemfontein supervised by Dr. Jennifer Botha. My research is focused on studying the postcranial morphology of therocephalian therapsids from the Karoo Basin of South Africa. In February 2023, I will register for a doctoral degree at the University of the Witwatersrand, in the Evolutionary Studies Institute and will be supervised by Prof Botha and Prof Jonah Choiniere.

Qualifications
BSc – Majors: Genetics and Geology - University of the Free State – 2019
BSc Honours – Palaeontology – University of the Free State – 2020
MSc – Palaeontology – University of the Free State – registered 2021, submitted for examination.
PhD – Palaeontology – University of the Witwatersrand – Feb 2023 onwards.

PIA Fieldwork Experience
July 2021 – Sannaspos SEF, Free State, for CTS Heritage
October 2021 – Beatrix Mine-Theunissen Eskom Powerline for 1World
January 2022 – Fouriesburg residential development for Mang Geoenviron-mental
February 2022 – Balkfontein-Doornhoek 11 kV powerline for 1World
March 2022 – Transnet MPP Access routes, inland and coastal for ENVASS
June 2022 – Koria-Boesmanshoek 22 kV powerline for 1World
January 2023 – Virginia SEFs x 4 Phase 2 for AGES Limpopo (Pty) Ltd.

February 2023 – Amersfoort SEFs for CTS Heritage
February 2023 – Tournee SEFS for CTS Heritage
February 2023 – Ujekamanzi SEFs for CTS Heritage

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

Bailey M. Weiss CV
January 2023

I am currently enrolled as a PhD student at the University of the Witwatersrand, Evolutionary Studies Institute under the supervision of Prof Jonah Choiniere. The title of my thesis is "*The origin of crocodilians: functional anatomy, growth history, systematics, and phenotypic variation*." In 2021 I completed an MSc at the University of the Free State (UFS), on a research project entitled: *Bone microanatomy of Anomodontia (Synapsida: Therapsida) from the Karoo Basin of South Africa*. That 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 – 2021.
PhD – Palaeontology – University of the Witwatersrand – registered Jan 2022 - current

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 – Transnet MPP Coastal access routes – for ENVASS
October 2022 – Nndanganeni Colliery – for Eco-Elementum
November 2022 – Kendal Plots – for Amber Earth
November 2022 – Boschmanspoort 159JS for Eco-Elementum

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