Palaeontological Impact Assessment for the proposed changes at the Forzando North Coal Mine, Bethal Magisterial District, Mpumalanga Province

Site Visit Report (Phase 2)

For

Cabanga Environmental

07 June 2023

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Expertise of Specialist

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

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Cabanga Environmental, Randpark Ridge, 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 Palaeontological Impact Assessment was requested for the Forzando North Coal mine Basic Assessment and Mining Right Amendment application process. The mine is located approximately halfway between Hendrina and Bethal, along the R38 road, 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 potentially very highly sensitive rocks of the Vryheid Formation (Ecca Group, Karoo Supergroup) which is the target for the coal mine. The site visit and walk through by palaeontologists on 07 June 2023 confirmed that there are NO FOSSIL PLANTS of the *Glossopteris* flora present on the surface.

Nonetheless, 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, drilling or mining 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.

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/ PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	High	Low	Paleontological Impact Assessment	Section 7.2. SAHRA Requirements

Table of Contents

1. Background

Forzando North is an operational coal mine, located within the Bethal Magisterial District of Mpumalanga.

The Holder of the Mining Right, Forzando Coal Mines (Pty) Ltd intends has applied to expand the Forzando North Mining Right Area to incorporate contiguous areas currently held under the following Prospecting Rights: 17030PR, 15106PR, and 14478PR on the farms Bankpan 225 IS and Killowen 465 IS.

Through an intensive drilling exercise on the Prospecting Right Areas, economically viable blocks of coal have been defined. It is proposed to mine these newly defined blocks of coal via underground methods, accessing them from the existing underground workings.

Coal will be brought to surface at the Forzando North incline. Existing infrastructure and services at Forzando North will be utilised for the Project and thus infrastructure requirements are expected to be minimal and limited to: -

- two new ventilation shafts;
- an additional processing plant – to be located adjacent to the existing Forzando North plant; and
- associated infrastructure:
    - access / haul roads;
    - electricity supply and distribution;
    - slurry and water reticulation pipelines.

Cabanga Environmental has been appointed as the Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment Process for the Project.

A Palaeontological Impact Assessment was requested for the Forzando Coal: Bankpan and Killowen 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

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
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

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

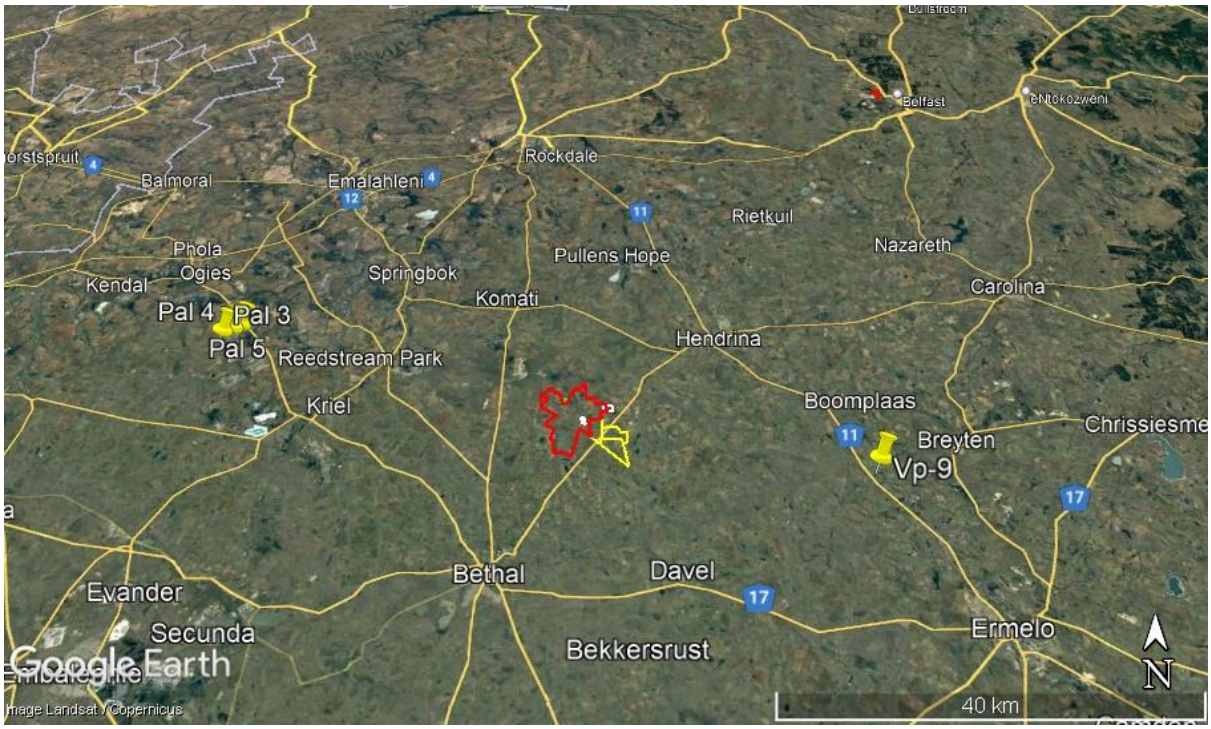

Figure 1: Google Earth map of the existing Mining Right Area (red outline) and proposed expansion (yellow outline).

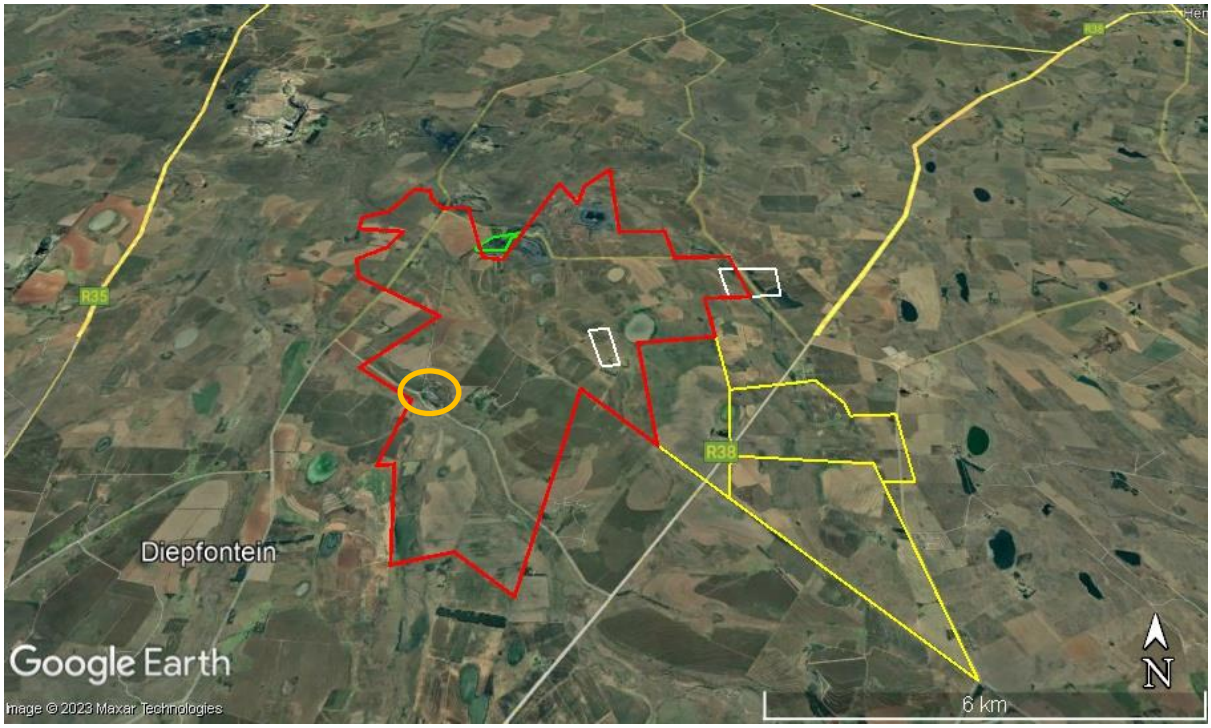

Figure 2: Annotated Google Earth map for the Forzando North Project. Surface activities will be in the proposed extended stockpile (green polygon), ventilation shaft (two white polygons). The red outline is the existing Mining Right Area and the yellow outline is the proposed expanded Mining Right Area. Orange area is the Forzando South infrastructure area.

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 north-eastern part of the Karoo basin where the lower Karoo Supergroup strata are exposed (Figure 3). Along the rivers and streams much younger reworked sands and alluvium overly the older strata.

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.

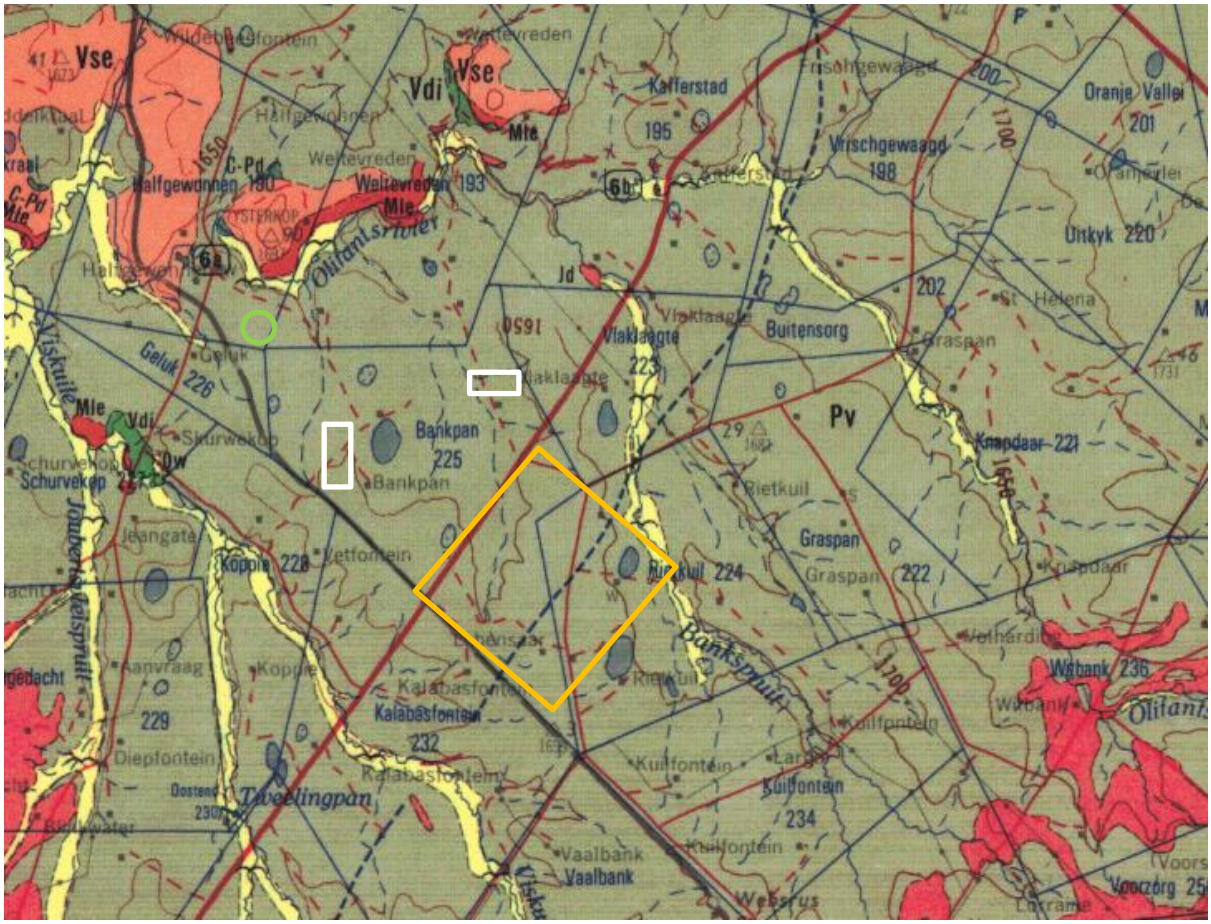

Figure 3: Geological map of the area around Forzando North coal mine. Green oval is the proposed stockpile expansion and the white rectangles are the proposed sites for the ventilation shafts. Orange area encompasses the proposed expansion. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (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
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, mudstone, sandstone, coal seams	Early Permian Ca 290-270 Ma
Mle	Lebowa Granite Suite	Porphyritic granite, biotite granite	Palaeoproterozoic Ca 2040 Ma
Vse	Schrikkloof Fm, Rooiberg Group, Transvaal SG	Porphyritic rhyolite with interbedded mudstone and sandstone	Palaeoproterozoic Ca 2089-2056 Ma

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for the surface infrastructure for the underground mining is in the Vryheid Formation.

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).

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 a different 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).

The Jurassic dolerite does not preserve fossils because it is an intrusive volcanic rock. The very young Quaternary sands along the stream are also very unlikely to preserve fossils as they have been moved by the river floods and fossils would have been destroyed, if present in the first place.

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed new mining right for Forzando North Project shown within the yellow oval. Green oval is for the stockpile and the white rectangles for the proposed ventilation shafts. Expansion area is in the southeastern part. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

iii. Site visit observations

Figure 5 shows the site stops, labelled P-1 to P-9, with the observations in Table 3 and relevant site visit photos.

Table 3: Forzando North site visit stops, observations and relevant photographs.

GPS	Observations	Figures
P-1 26° 15' 11.1" S 29° 35' 08.51" E	North of East shaft site (no permission to go onto the farm). Along the main road it is possible to see that the topography is gently rolling with sandy soils under cultivation or lying fallow. No rocky outcrops are visible.	6A-D
P-2 26° 17' 07.42" S 29° 35' 38.63" E	Proposed expansion area, earmarked for underground mining. Northern part of Farm Bankpan belonging to Mr Pelser. Rolling topography, dams and ploughed fields. No rocky outcrops of shales or any potentially fossiliferous rocks.	7A-B

GPS	Observations	Figures
P-3 26° 17’ 44.74” S 29° 35’ 05.53” E	Proposed expansion area, earmarked for underground mining. Western part of Farm Bankpan. Same observations as above.	7C-D
P-4 26° 17’ 59.45” S 29° 34’ 37.83” E	Proposed expansion area, earmarked for underground mining. Southern part of Farm Killowen belonging to Mr Pelser. Mostly under cultivation with mielies being harvested while we were there. Sandy soils and no rocks. A pile of rocks that had been removed, comprising laterite only was seen during the site visit.	8A-B
P-5 26° 17’ 17.83” S 29° 33’ 37.51” E	Southern part of Forzando property looking north to the proposed West shaft area. Pan in the distance. Land has sandy soil and is under cultivation. No rocky outcrops and no fossils seen.	9A-D
P-6 26° 18’ 28.89” S 29° 32’ 44.97” E	Southern part of mining right area heading towards the Forzando South Mine. Cultivated fields.	10A-B
P-7 26° 17’ 27.29” S 29° 32’ 00.59” E	Looking towards Forzando South Mine. Cultivated and dumps in the far distance. No rocky outcrops and no fossils noted.	10C-D
P-8 26° 18’ 35.52” S 29° 35’ 12.51” E	Proposed expansion area, earmarked for underground mining. North-western part of Farm Bankpan Ptn 8 with cultivated fields.	11A-D
P-9 26° 19’ 33.71” S 29° 36’ 03.06” E	Proposed expansion area, earmarked for underground mining. South-eastern part of Farm Bankpan Ptn 8 with cultivated fields and dams. No rocky outcrops and no fossils.	12A-D

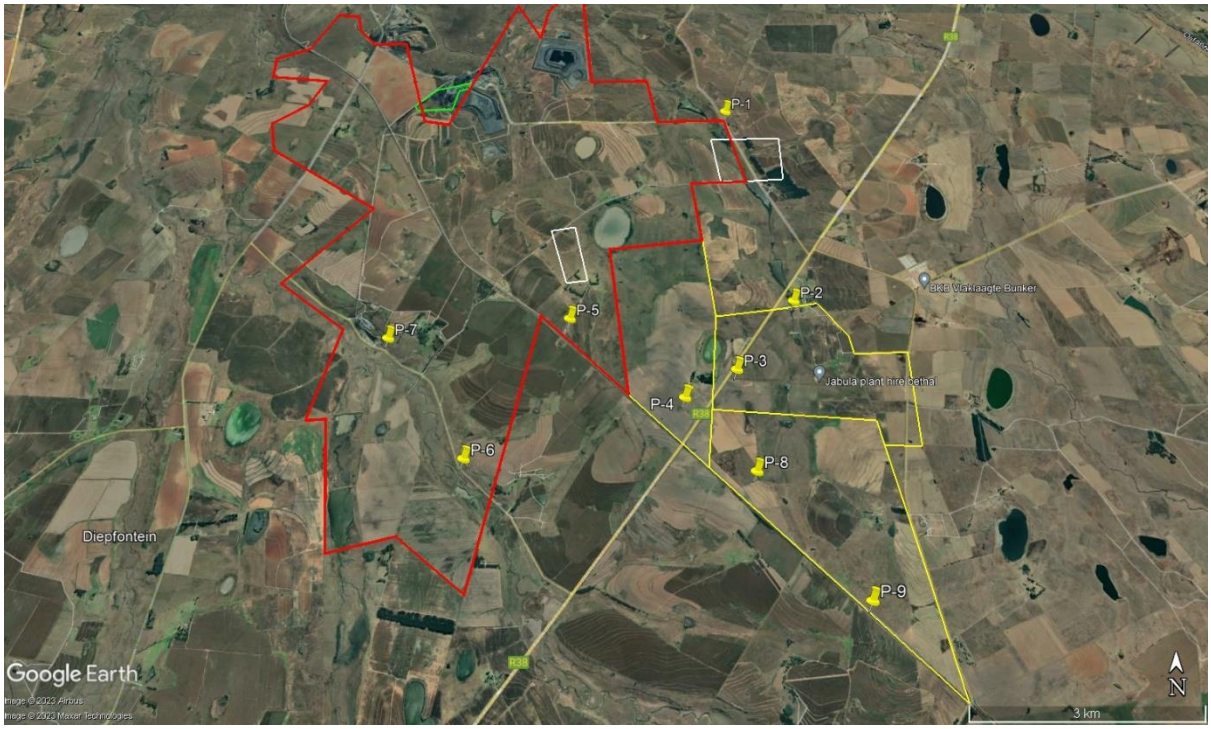

Figure 5: Google Earth map for the site stops and observations (refer to Table 3).

Most of the land has been cultivated and is either recently cleared or was in the process of harvesting the mielies. Along the watercourses only thick grasslands were observed. There were no rocky outcrops such as shales where one could expect to find fossil plants of the *Glossopteris* flora. The only rocks seen were fragments of sandstone in one area, possibly brought in for the road, and two piles of laterite that had been cleared from a dam and dumped in a pile. No shales were seen at all. In summary, there were no fossils seen in the entire area surveyed.

Figure 6: Site photographs for Forzando North project. See Table 3 for details.

Figure 7: Site photographs for Forzando North project. See Table 3 for details.

Figure 8: Site photographs for Forzando North project. See Table 3 for details.

Figure 9: Site photographs for Forzando North project. See Table 3 for details.

Figure 10: Site photographs for Forzando North project. See Table 3 for details.

Figure 11: Site photographs for Forzando North project. See Table 3 for details.

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 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	**-**
	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 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 good chance that fossils from the Vryheid Formation will be disturbed if open cast or underground mining takes place, 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 very 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 fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on 06 June 2023 by palaeontologists confirmed that there are no fossils on the surface. Outcrops of shales were absent but it is not known what lies below the surface. The sands and soils of the Quaternary period that cover the entire area 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 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 in 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 environmental officer, or other responsible person once construction and drilling have commenced for the surface infrastructure for the expansion project, then they should be rescued and SAHRA notified so that a palaeontologist can be called to assess and collect a representative sample.

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/ PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	High	Low	Paleontological Impact Assessment	Section 7.2. SAHRA Requirements

7. References

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8. Chance Find Protocol

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

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations/mining commence.
2. When excavations begin the rocks and 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 12). 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 an AMAFA or SAHRA permit must be obtained. Annual reports must be submitted to AMAFA 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 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.

Appendix A – Examples of fossils from the Vryheid Formation

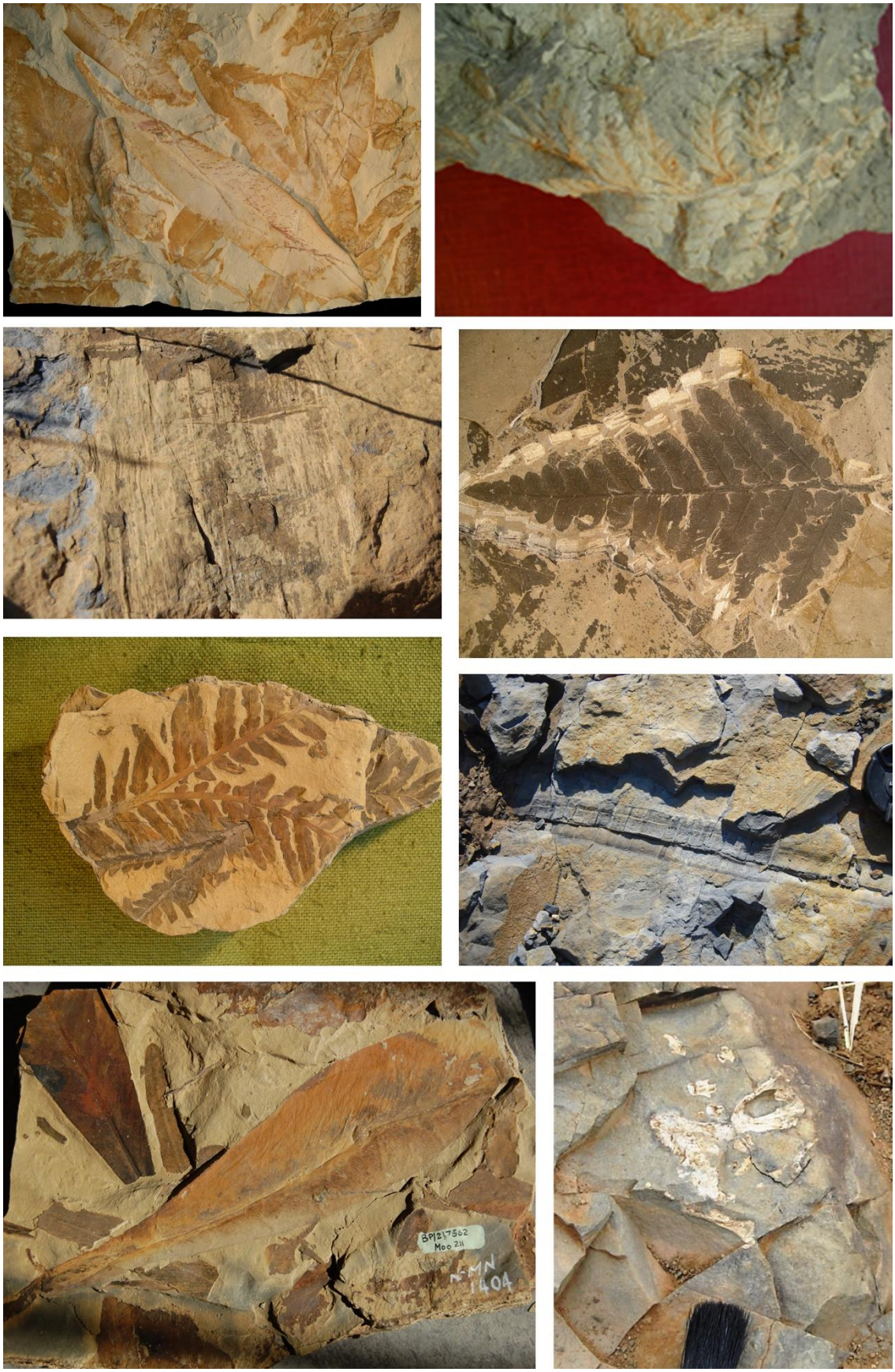

Figure 12: Photographs of fossil plants from the Vryheid formation that would be expected to occur.

Appendix B – Details of specialists

Marion Bamford (PhD)

Short CV for PIAs – July 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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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 170 articles published; 5 submitted/in press; 10 book chapters.
Scopus h-index = 31; Google Scholar h-index = 39; -i10-index = 116.
Conferences: numerous presentations at local and international conferences.

CV of Alisoun Valentine House

Jan 2023

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KEY SKILLS AND ATTRIBUTES

The stamina and ability to work effectively under pressure.
Highly developed social and interpersonal skills.
Good communication skills, both oral and written.
The ability to be creative and innovative and to find workable strategies to achieve stated aims.
Excellent organisational skills.
The ability to analyse situations, behaviour and thinking and respond with patience and understanding.
Research and scientific writing.

WORK HISTORY

Postdoc Fellow – Evolutionary Studies Institute
January 2019 – December 2020
January 2018 – December 2018
January 2017 – December 2020
January 2021 – December 2023 – Honorary Research Associate ESI
Analysis of archaeological charcoal from a Middle Stone Age and Early Iron Age sites
Host: Professor Marion Bamford

Sessional position – School of Animal, Plant and Environmental Sciences
March 2016 – November 2016
Academic support for postgraduate students

Short term internship – University of the Witwatersrand
August – November 2015

Assistant to Editor for 'Flora of the Witwatersrand' – University of the Witwatersrand

September 2008 – February 2010
Assisted with editing and preparing the Flora for publication

Tutor at the College of Science – University of the Witwatersrand
Academic years 2000 – 2003
Responsibilities included teaching general biology to first and second year students in the College of Science; as well as marking essays and assignments.

P.A. to Director/Manager of Cowling Davies (Small Advertising/Design Studio)
April 1992 – December 1992
Responsibilities included reception work; office administration; preparation of quotations; booking media advertisements and general assistance.

Herbarium Technician - University of the Witwatersrand
October 1991 – March 1992
Responsibilities included identification, pressing and mounting of plant specimens; capturing and maintaining data in the Herbarium computer system; maintaining the collection; filing; acting as librarian for the reference book collection and assisting students with research.

EDUCATION
Doctor of Philosophy (PhD) University of the Witwatersrand (2015)
Title: Systematic Applications of Pollen Grain Morphology and Development in the Acanthaceae
Supervisor: Professor Kevin Balkwill

Master of Science (MSc) University of the Witwatersrand (1991)
Title: A developmental study of Nephroselmis viridis (Inouye, Suda et Pienaar) Prasinophyceae
Supervisor: Professor Richard Pienaar
Degree awarded with Distinction.

Bachelor of Science with Honours (B.Sc. Hon.) University of the Witwatersrand (1987)
Awarded the Florence D. Hancock prize for a Dissertation in Phycology (1988)

Higher Diploma in Education (Postgraduate) for Secondary Education
University of the Witwatersrand (1985)
Teaching subjects: Biology and Science

Bachelor of Science (B.Sc.) University of Witwatersrand (1984)
Major: Botany
Sub-majors: Microbiology and Zoology

Matriculation Certificate Hyde Park High School (1979)
Subjects passed: English, Afrikaans, Biology, Mathematics, Geography, Home Economics

PUBLICATIONS

Young A.V. and Pienaar R.N. 1989. The ultrastructure of a new species of Nephroselmis (Prasinophyceae). Proceedings of the Electron Microscopy Society of Southern Africa. 19: 113–114.

House A. and Balkwill K. 2013. FIB-SEM: An Additional Technique for Investigating Internal Structure of Pollen Walls. Microscopy & Microanalysis 19: 1535–1541.

House A. and Balkwill K. 2014. FIB-SEM: A new technique for investigating pollen walls. Microscopy: advances in scientific research and education (A. Méndez-Vilas, Ed.) 1: 54–58. © FORMATEX.

House A. and Balkwill K. 2016. Labyrinths, columns and cavities: new internal features of pollen grain walls in the Acanthaceae detected by FIB-SEM. Journal of Plant Research 129: 225–240.

House A. and Balkwill K. 2017. FIB-SEM enhances the potential taxonomic significance of internal pollen wall structure at the generic level. Flora-Morphology, Distribution, Functional Ecology of Plants 236–237C: 44–57.

House A. 2017. FIB-SEM: a new method for examining pollen grain walls and palaeontological specimens in 3D. Proceedings of the 21st diennial conference of the South African Society of Quaternary Research. Palaeontologia Africana, 52:21–22. ISSN 2410-4418.

House A. and Balkwill K. 2019. Development and expansion of the pollen wall in Barleria obtusa Nees (Acanthaceae). South African Journal of Botany 125: 188–195.

House, A., Bamford, M.K., 2019. Investigating the utilisation of woody plant species at an Early Iron Age site in KwaZulu-Natal, South Africa, by means of identifying archaeological charcoal. Archaeological and Anthropological Sciences 11, 6737-6750. https://doi.org/10.1007/s12520-019-00939-9

House, A., Bamford, M.K., Chikumbirike, J., 2022. Charcoal from Holocene deposits at Wonderwerk Cave, South Africa: A source of palaeoclimate information. Special issue on WW, in Quaternary International 614, 73-63. https://doi.org/10.1016/j.quaint.2020.10.039

Esteban, I., Bamford, M.K., Miller, C.S., Neumann, F.H., Schefuß, E., House, A., Pargeter, J., Cawthra, H., C., Fisher, E.C., in press. Palaeoenvironments of hunter-gatherers from MIS 3 to the Holocene 1 in coastal Pondoland (South Africa): a biochemical and palaeobotanical approach. Quaternary Research..

McCullum DA, House AV, Balkwill K (Eds).The Flora of the Witwatersrand. (Vol. 2). Dicotyledons – Piperaceae to Ebenaceae. NiSC. IN PRESS, (Publishing date-December 2019).

McCullum DA, House AV, Balkwill K (Eds).The Flora of the Witwatersrand. (Vol. 3). Dicotyledons – Oleaceae to Compositae. NiSC IN PRESS, (Publishing date-December 2019).

House A. and Bamford M.K. (accepted). Furnaces, hearths, rituals and construction: investigating the utilisation of woody plant species at an Early Iron Age site by means of identifying archaeological charcoal.

PALAEONTOLOGICAL IMPACT FIELD EXPERIENCE

- May 2018 – SARAO Williston and Carnarvon for Digby Wells
- August 2019 – Idlanga Coal MR, Rietvlei, Vryheid area – Digby Wells
- September 2019 – Schmidtsdrift PR for Thaya Environmental Specialist
- September 2019 – Estcourt Pvt Hospital for EnviroPro
- September 2019 – Vulindlela BWS for KSEMS
- November 2019 – Derseley outfall sewer for Digby Wells
- June-Nov 2020 – Frankfort-Windfield 88kV line for Eskom and 1World.
- October 2020 – Salene-McCarthy Manganese mine for Prescali
- November 2020 – Universal Coal Ubuntu Colliery for HCAC
- March 2021 – Doornhoek & Kaspersnek agriculture for Kudzala
- July 2021 – Smithfield-Rouxville-Zastron Eskom PL for TheroServ
- August 2021 – Dawn Park for iSquare
- September 2021 – Hennops River Farm 489 for Archaeological and Heritage Services Africa (Pty) Ltd
- November 2021 – Glossam Mine for Archaeological and Heritage Services (Pty)
- February 2022 – Wolf-Skilpad-Grassridge 132 kV OHPL for Zutari.
- September 2022 – Highveld SEFs Potchefstroom for CTS
- October 2022 – Chemwes SEFs Stilfontein for CTS
- November 2022 – FS Agricare water supply, Warden for AquaStrat Solutions
- February 2023 – Montrose-Middelvlei SEFs Venterspos for CTS
- March 2023 – Buffalo and Lyra SEFs for CTS