

**Palaeontological Impact Assessment for the Section
24G application for Branscombe (Pty) Ltd,
Portion 1071 (a portion of Portion 158, Farm
Zwavelpoort 373 JR, Tshwane,
Gauteng Province**

Desktop Study (Phase 1)

For

Beyond Heritage

04 September 2021

Prof Marion Bamford

Palaeobotanist

P Bag 652, WITS 2050

Johannesburg, South Africa

Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Beyond Heritage, Modimolle, 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 that reads "MKBamford". The signature is written in a cursive style and is positioned above a horizontal line.

Executive Summary

A Palaeontological Impact Assessment was requested for the S24G Rectification Application for the unauthorised activities located on Portion 1071 (a portion of Portion 158) of the Farm Zwavelpoort 373 JR, City of Tshwane Metropolitan Municipality, Gauteng Province, South Africa, S24G/03/20-21/0534.

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 existing development.

The site lies on the non-fossiliferous volcanic rocks of the Hekpoort Formation (Pretoria Group, Transvaal Supergroup) even though it is indicated as moderately fossiliferous on the SAHRIS Palaeosensitivity map. Since it is extremely unlikely that fossils could have been present in the project footprint, it is recommended that the Section 24G application be granted, as far as the palaeontology is concerned.

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1. Background

Branscombe Pty Ltd (Branscombe) voluntarily applied for a Section 24G application for the unlawful commencement of construction of recreational facilities and associated infrastructure, including parking bays, recreational accommodation for guests, staff accommodation, as well as a workshop and private facilities for the applicant’s personal use on Portion 1071 (a portion of Portion 158) of the Farm Zwavelpoort 373 JR, City of Tshwane Metropolitan Municipality.

Branscombe purchased the property, Portion 1071 (a portion of Portion 158) of the Farm Zwavelpoort 373 JR (refer to Figure 1), in 2017 and proceeded with the town planning application and construction of the facilities unaware that the process triggered activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and associated regulations. During the town planning application process Branscombe became aware that the construction of the facilities will require environmental authorisation, all construction activities were ceased. The Gauteng Department of Agriculture and Rural Development (GDARD) was contacted in 2020 and the applicant, realising the contravention, commenced with the Section 24G Application Process (S24G).

A Palaeontological Impact Assessment was requested for the above 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 existing development and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
ai	Details of the specialist who prepared the report	Appendix A
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
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;	Fig 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	None
l	Any conditions for inclusion in the environmental authorisation	None
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	None
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,
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A



Figure 1: Google Earth map of the existing development on Portion 1071 (a portion of Portion 158) of Farm Zwavelpoort 373 JR, Tshwane Metropolitan Municipality. The site shown by the red outline. Map supplied by Beyond Heritage.



Figure 2: Part of the existing infrastructure for Branscombe on Farm Zwavelpoort.

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 (*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

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

Making up the lower Pretoria Group are the Timeball Hill Formation and the Boshhoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the Dwaalheuwel conglomerates, siltstone and sandstone (not present here). A hiatus separates the Strubenkop Formation slates and shales from the overlying quartzites of the Daspoort Formation. Upper Pretoria Group formations are the Silverton, Magaliesberg, Vermont, Lakenvalei, Nederhorst, Steenkampsberg and Houtenbek Formations.

A geological map of the area is provided in Figure 3 and the list of abbreviations in Table 2.



Figure 3: Geological map of the area around the Farm Zwavelpoort 373 JR. The location of the existing project is indicated within the yellow triangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2528 Pretoria.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006; 2012; Zeh et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Vdi	Diabase	Intrusive volcanic sills and dykes	Post Transvaal SG
Vsi	Silverton Fm, Pretoria Group, Transvaal SG	Shale, carbonaceous in places, hornfels, chert	Ca 2202 Ma
Vdq	Daspoort Fm, Pretoria Group, Transvaal SG	Quartzite	<2240 Ma
Vst	Strubenkop Fm, Pretoria Group, Transvaal SG	Shale, in places ferruginous	Ca 2242 Ma
Vdw	Dwaalheuvel Fm, Pretoria Group, Transvaal SG	Quartzite, chert, jaspilite	Ca 2224 Ma

Symbol	Group/Formation	Lithology	Approximate Age
Vha	Hekpoort Fm, Pretoria Group, Transvaal SG	Volcanic rocks	Ca 2224 Ma
Vt	Timeball Hill Fm Pretoria Group, Transvaal SG	Shale, siltstone, conglomerate in places; dotted = Quartzite	< 2420 Ma

The site lies in the central part of the Transvaal Basin that is filled with the sediments and volcanic rocks of the Transvaal Supergroup, on the Kaapvaal Craton.

ii. Palaeontological context

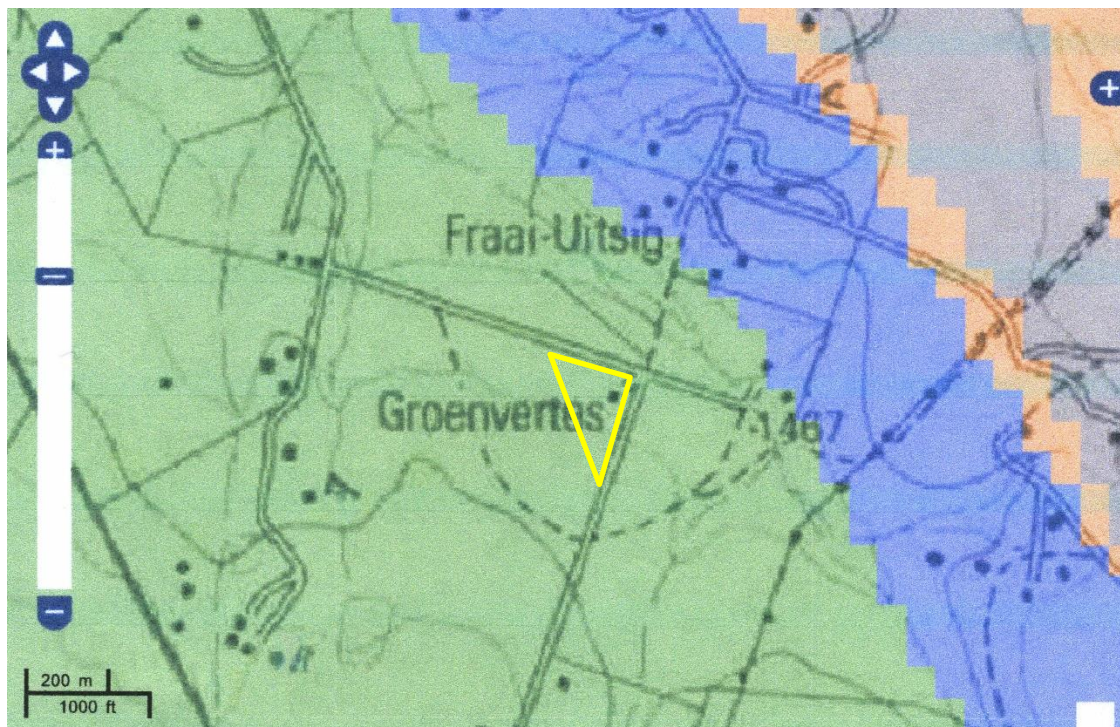


Figure 4: SAHRIS palaeosensitivity map for the site for the existing development on Portion 1071 of Farm Zwavelpoort 2727 JR shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above in Figure 4 the area is indicated as moderately sensitive (green) and this applies to the Hekpoort Formation (Figure 3). According to the geological literature these volcanic rocks, in particular they are basaltic-andesitic lavas (Eriksson et al., 2006). The Hekpoort Formation is indicated as moderately sensitive in the Gauteng Palaeotechnical Report (Groenewald et al., 2014) although there are no fossils recorded from this stratum. They warn that there is a possibility of finding dissolution cavities (caves) in the dolomites that might preserve Cenozoic fossils. This not make sense for volcanic rocks.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

TABLE 3A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	H	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	H	-
	M	-
	L	Volcanic rocks do not preserve any fossils; so far there are no records from the Hekpoort Fm formation of trace, plant or animal fossils at all 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 from other formations, not the Hekpoort Fm, 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 were excavated or in the volcanic rocks of the Hekpoort Fm.

Based on the nature of the project, surface activities would not have impacted on the palaeontological heritage because no fossils occur in the rocks in the project footprint, i.e. in the Hekpoort Formation.

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 not contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils. Although the SAHRIS palaeosensitivity map indicates the Hekpoort Formation as being moderately sensitive, there is no scientific evidence that this is the case.

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 volcanic rocks or surface soils of the Hekpoort Formation (Pretoria Group, Transvaal Supergroup). It is the opinion of this palaeontologist that the “moderately sensitive” assignment to this formation (Palaeotechnical Report for Gauteng, Groenewald et al., 2014) is overly cautious on this point. On this basis, it is recommended that there were no fossils on the site and that the Section 24G application be granted, as far as the palaeontology is concerned.

7. References

Beukes, N.J., 1987. Facies relations, depositional environments, and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbell Rand Subgroup, Transvaal Supergroup, southern Africa. *Sedimentary Geology* 54, 1-46.

Eriksson, P.G., Altermann, W., Hartzler, F.J., 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R., Lenhardt, N., 2012. A case study of microbial mats-related features in coastal epeiric sandstones from the Palaeoproterozoic Pretoria Group, Transvaal Supergroup, Kaapvaal craton, South Africa; the effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred palaeoenvironment. *Sedimentary Geology* 263, 67-75.

Groenewald, G., Groenewald, D., Groenewald, S., 2014. SAHRA Palaeotechnical Report. Palaeontological Heritage of Gauteng. 20 pages.

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.

Zeh, A., Wilson, A.H., Gerdes, A., 2020. Zircon U-Pb-Hf isotope systematics of Transvaal Supergroup – Constraints for the geodynamic evolution of the Kaapvaal Craton and its hinterland between 2.65 and 2.06 Ga. Precambrian Research 345, 105760.
<https://doi.org/10.1016/j.precamres.2020.105760>

Appendix A – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD July 2021

i) Personal details

Surname : **Bamford**
First names : **Marion Kathleen**
Present employment : Professor; Director of the Evolutionary Studies Institute.
Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone : +27 11 717 6690
Fax : +27 11 717 6694
Cell : 082 555 6937
E-mail : marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.

1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.

1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer

1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa

Royal Society of Southern Africa - Fellow: 2006 onwards

Academy of Sciences of South Africa - Member: Oct 2014 onwards

International Association of Wood Anatomists - First enrolled: January 1991

International Organization of Palaeobotany – 1993+

Botanical Society of South Africa

South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016

SASQUA (South African Society for Quaternary Research) – 1997+

PAGES - 2008 –onwards: South African representative

ROCEEH / WAVE – 2008+

INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	11	0
Masters	10	4
PhD	11	4
Postdoctoral fellows	10	5

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 2-8 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 –

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.

- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipootjie 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
- Lielifontein 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

xi) Research Output

Publications by M K Bamford up to July 2021 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 10 book chapters.

Scopus h-index = 29; Google scholar h-index = 35; i10-index = 92

Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)

NRF Rating: B-3 (2010-2015)

NRF Rating: B-3 (2005-2009)

NRF Rating: C-2 (1999-2004)