

**Palaeontological Impact Assessment for the proposed
Shaphat Cash crop Farming project on Farm Nieuw
Engeland 60 LT, Vhembe District,
Limpopo Province**

Desktop Study (Phase 1)

For

Plantago lanceolata

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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 Plantago lanceolata, 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 by SAHRA (Case ID: 16863) for the proposed cash crop farming project on a portion of the Farm Nieuw Engeland 60 LT, the Shaphut project. The area is in the Vhembe District of the Limpopo 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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the intrusive gabbro, syenite and carbonatites of the Schiel Complex. These rocks are volcanic and ancient and therefore would not preserve any fossils. The soils are very young and of granitic origin. The underlying rocks and topography are not conducive to the formation of pans, dunes or springs so there is no chance of fossils being preserved or entrapped in the project footprint. As far as the palaeontology is concerned, the project should be authorised.

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1. Background

The Shaphat cash-crop farming project has been proposed for a portion of farm Nieuw Engeland 60 LT, Ha- Vhangani Village. The proposed area covers roughly 2.9 hectares of vacant land which is located roughly 3,5 km southeast of the Vhangani Village stands and roughly 4 km east of the main tarred road from Elim to Giyani (Figures 1, 2).

The area is located west of a non-perennial stream where river sand deposits is currently mined by local community for house construction activities. The surrounding area is dominated by well fenced ploughing fields, some dominated by recuperating indigenous vegetation, whilst others have evidence of recent ploughing activities in a form of tractor rills. Several newly demarcated residential sites have been noted towards the western section of the proposed development, the proposed study area falls within the Collins Chabane local Municipality of the Vhembe district, Limpopo Province South Africa.

As part of the application process and good corporate citizenship an archaeological impact assessment study was conducted (Millenium Heritage Group, 2021), but a palaeontological impact assessment was not done.

A Palaeontological Impact Assessment was requested for the Shaphat cash-crop project. To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: 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;	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	N/A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/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
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

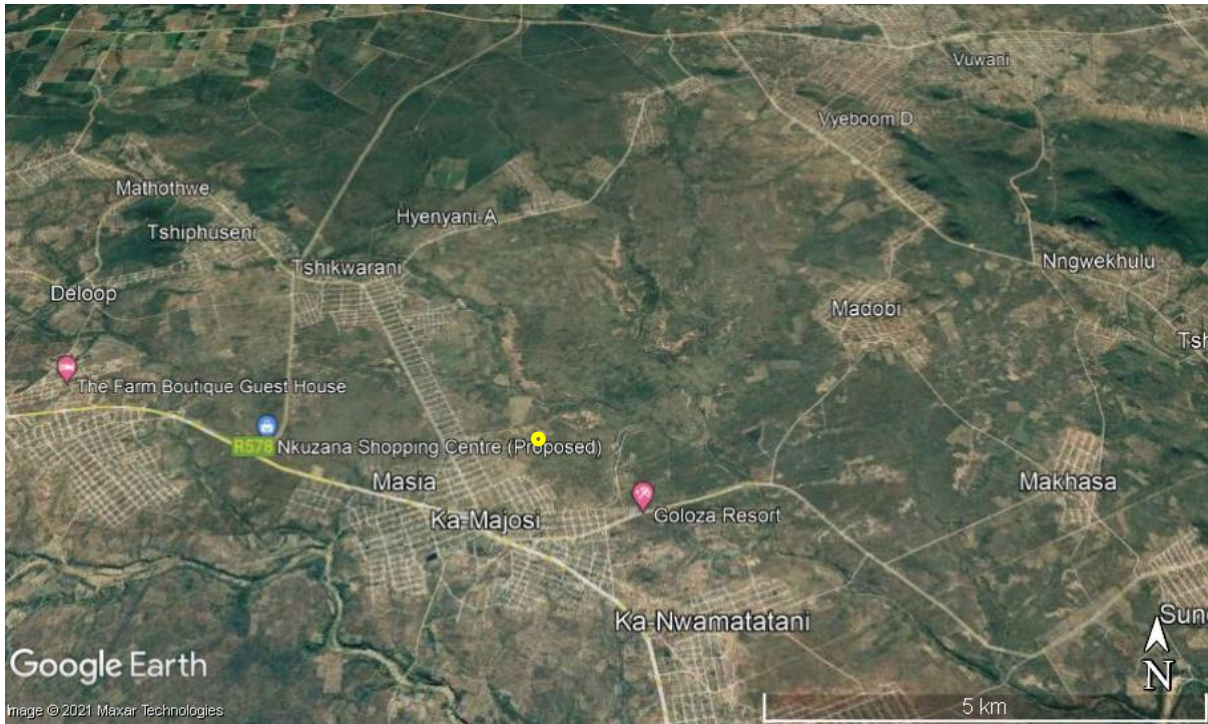


Figure 1: Google Earth map of the proposed development of the Shaphat cash-crop farming project relative to other landmarks (yellow dot).



Figure 2: Google Earth map showing the outline of the Shaphat project on Farm Nieuw Engeland 60 LT indicated with the yellow polygon.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources 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 site lies in the northeaster Kaapvaal Craton that is characterised by the widespread Goudplaats-Hout River Gneiss Suite of Kaapvaal Craton which is 3600 – 3200 million years old (Figure 3). These are some of the oldest rocks on earth. This suite comprises a wide spectrum of granitoid gneisses of various types and compositions (Robb et al., 2006). The gneissic bodies range from leucocratic to dark dark-grey, from fine-grained to pegmatoidal (large crystals) and from homogeneous to strongly layered (*ibid*).

The much younger Schiel complex has formed by the intrusion of syenite, syenite-gabbro, pyroxenite, granite and carbonatite through the Goudplaats Gneiss. This is one of a series of intrusions through the Kaapvaal Craton while it was undergoing tensional stresses. These intrusions also metamorphosed the granites through which they intruded (Vervoerd and du Toit, 2006).

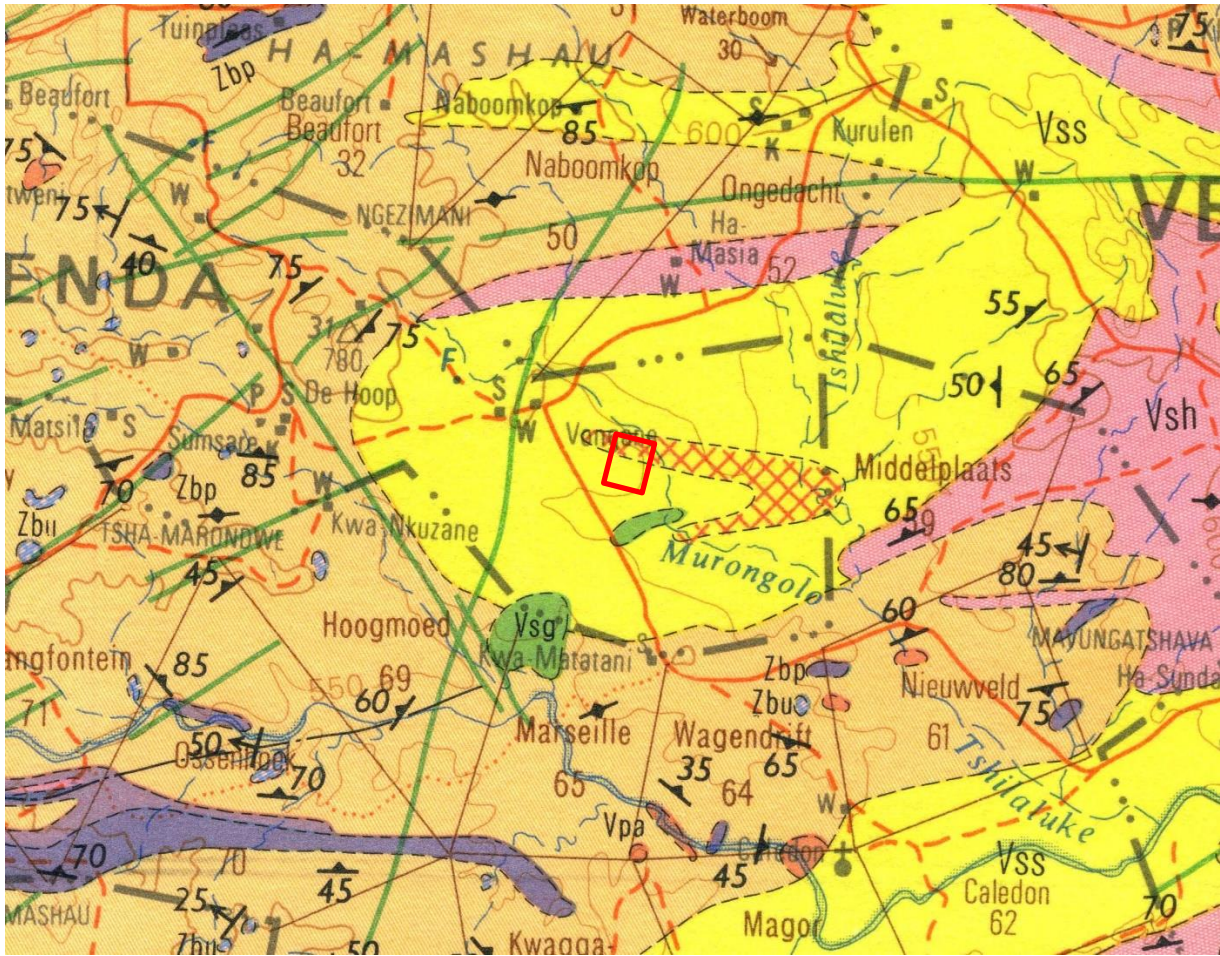


Figure 3: Geological map of the area around the Shaphut cash-crop site on Farm Nieuw Engeland 60 LT. The location of the proposed project is indicated within the red rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2330 Tzaneen.

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

Symbol	Group/Formation	Lithology	Approximate Age
Vsh	Schiel Complex	Syenite, carbonatite	2100 – 1200 Ma
Vsg	Schiel Complex	Syeno-gabbro	2100 – 1200 Ma
Vss	Schiel Complex	Syenite gabbro	2100 – 1200 Ma
Zg	Gouplaats Gneiss-Hout River complex	Gneiss, granite	3600 – 3200 Ma

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the volcanic and metamorphosed rocks of the Schiel complex. Such rocks do not preserve any fossils, only sedimentary rocks can preserve fossils. The rocks are

overlain by soils and they do not preserve fossils either because they are weathering product of older rocks, together with the addition of organic matter. There are no Kalahari sands in this region and so no pans or dunes that could have entrapped fossils.

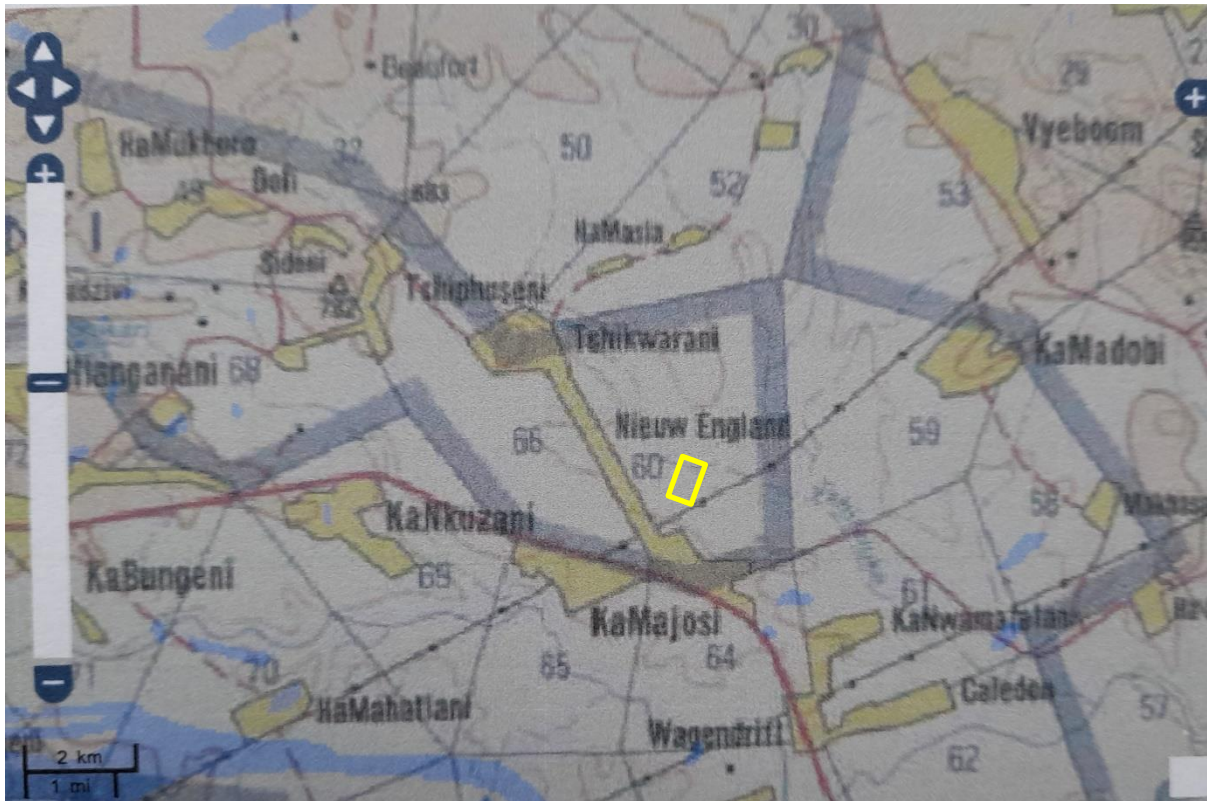


Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Shaphat Cashcrop farming project on Farm Nieuw Engeland 60 LT shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as having insignificant to zero sensitivity (grey) so there is no chance of fossils occurring on the site. The area is not conducive to the formation of pans, springs or dunes since these form on low gradient plains and usually on shales (Goudie and Wells, 1995).

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 and metamorphosed rocks do not preserve any fossils; so far there are no records 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 there is no chance of fossils being preserved in the volcanic and metamorphosed rocks, 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 soils or sand that will be cultivated.

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 of the incorrect type to preserve any fossils. Furthermore, the material to be cultivated is

young soils or sands and this does not preserve fossils. There is NO Chance that fossils will be disturbed. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the gneiss, syenite, gabbro and carbonatite for the country and do NOT contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the volcanic rocks or on the soils formed from the weathering of the granites and gneisses. The rocks are too old, and the topography and surface sediments are not conducive to the formation of such features as pans that would entrap fossils. Since there is no chance of fossils occurring in the area it is recommended that, as far as the palaeontological heritage is concerned, the project may be authorised.

7. References

Goudie, A.S., Wells, G.L., 1995. The nature, distribution and formation of pans in arid zones. *Earth Science Reviews* 38, 1–69.

Millennium Heritage Group (Pty) Ltd, Sept 2021. Phase 1 Archaeological impact Assessment relating to the proposed Shaphat Property Cash crop farming on Farm Nieuw Engeland 60 LT, Ha-Vhangani village within the Collins Chabane Local Municipality of the Vhembe District, Limpopo Province, south Africa, for Plantago lanceolate (Pty) Ltd.

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.

Robb, L.J., Brandl, G., Anhaeusser, C.R., Poujol, M., 2006. Archaean Granitoid Intrusions. 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 57-94.

Verwoerd, W.J., du Toit, M.C., 2006. The Phalaborwa and Schiel complexes. 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 291-299.

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
- 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
- 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.