Palaeontological Impact Assessment for the proposed Reg 42 Mine Plan, Wansley, East London, Eastern Cape Province

Site Visit (Phase 2) Report

For

HCAC

10 October 2020

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 23 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Heritage Contracts and Archaeological Consulting, 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: 

Executive Summary

A palaeontological Impact Assessment was requested for the proposed Mining Rights on a portion of Portion 1 of Farm No 652, Wansley, in the Magisterial District of East London, Eastern Cape Province. To comply with 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 Palaeontological Impact Assessment (PIA) was completed on 29th September 2020 and is presented here.

The proposed site lies mainly on the non-fossiliferous Jurassic dolerite dyke but the margins are on potentially fossiliferous Adelaide Subgroup (Beaufort Group, Karoo Supergroup). No fossils were found during the survey. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological site visit is required unless fossil bones are found once drilling and excavations have commenced.

Table of Contents

1. Background

In accordance with Regulation 42 of the Mining Title's Regulation Act (Act 16 of 1967), Wansley Siyakhula (Pty) Ltd is applying for an amendment to the Mining Rights area of a portion of Portion 1 of Farm No. 652, Wansley, East London Magisterial District (Figures 1 and 2). The amendment is in terms of Section 102 of the Mineral and Petroleum Resources Development Act, (Act 22 of 2002). The total extent of the area is 32.1311 hectares.

A Palaeontological Impact Assessment was requested for the Mining Rights Application. To comply with 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 or phase 2 Palaeontological Impact Assessment (PIA) was completed for the proposed project on 29th September 2020 and is presented herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (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
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix
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	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	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
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	N/A
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 Reg 42 Mine Plan on Portion 1 of Farm 652 at Wansley, northeast of East London with the section shown by the pin.

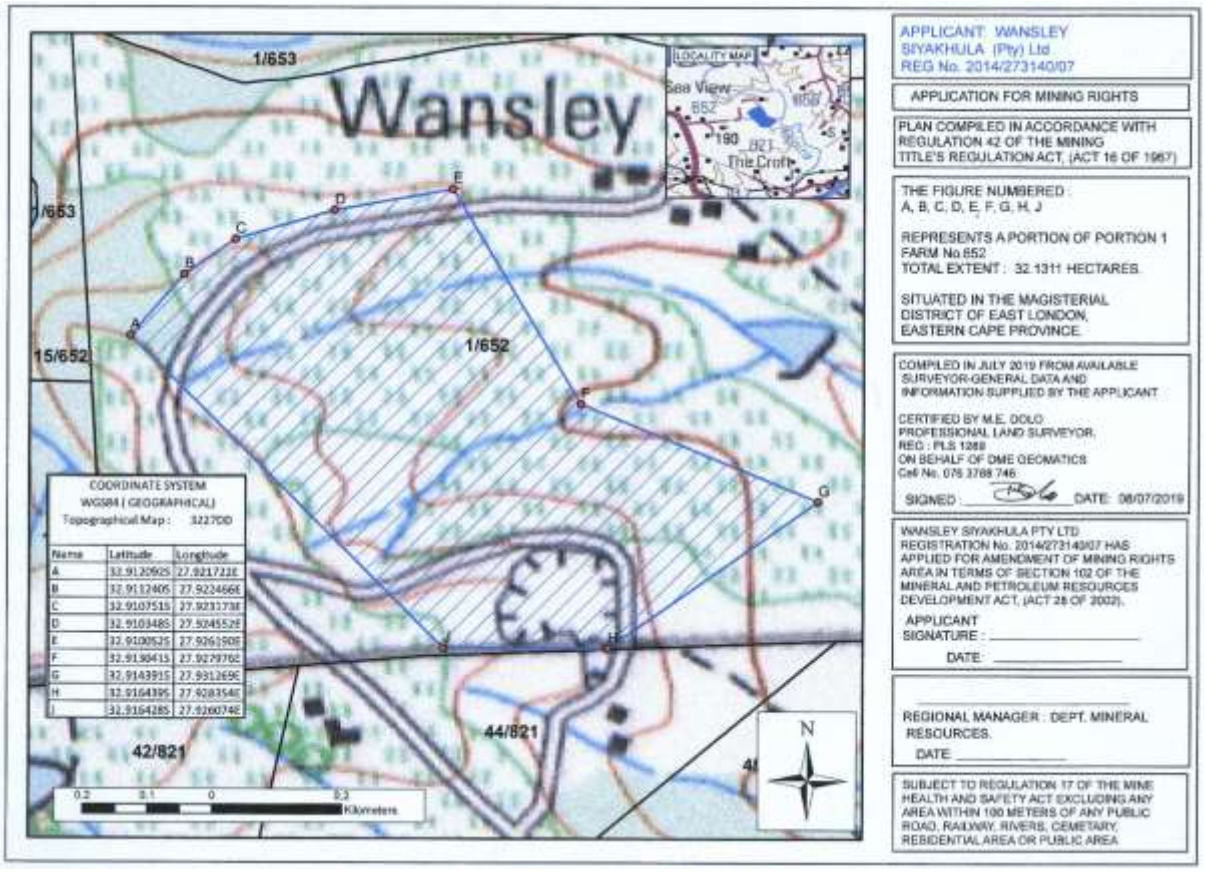

Figure 2: Topographic site map for the Reg 42 Mine Plan on a portion of Portion 1, Farm No 652 at Wansley.

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 reported herein, and collect or rescue fossils if required);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*as indicated in section 4 below)*; and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a just a representative sample collected and housed in a recognised repository.

3. Geology and Palaeontology

i. Project location and geological context

Figure 3: Geological map of the area around the proposed mine at Wansley, northeast of East London. The location of the proposed project is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 3226 King Williams Town.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006; Rubidge et al., 1995). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 25 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pub	Balfour Fm, Adelaide Subgroup, Beaufort Group, Karoo SG	Grey mudstone, siltstone, shale, sandstone,	Late Permian

Symbol	Group/Formation	Lithology	Approximate Age
Pum	Middleton Fm, Adelaide Subgroup, Beaufort Group, Karoo SG	Grey and red mudstone, sandstone	Late Permian

The site is in the eastern margin of the main Karoo Basin where Beaufort Group rocks predominate, in particular the two formations in the Adelaide Subgroup, the lower Middleton Formation and overlying Balfour Formation. They are composed of mudstones, shales and sandstones so unless index fossils are present it is not possible to distinguish between the two formations. The palaeoenvironment was a low energy meandering and lacustrine system changing to braided rivers and meandering streams (Catuneanu et al., 1998).

During the Drakensberg basalt outpourings of the Jurassic period there were numerous dykes and sills that intruded through the Karoo sediments. These dolerite dykes are very common in this part of the basin (Figure 3).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for the Wansley mine is in the dolerite with only the margins occurring in the Middleton Formation. Dolerite is of volcanic origin and does not preserve fossils, and they dykes tend to destroy fossils in their immediate vicinity.

Fossil vertebrates of the Beaufort Group have been well studied and used to divide the lithologic strata into Assemblage Zones.

The area proposed for development is underlain by geological sediments of the Adelaide Subgroup of the Beaufort Group (of very high palaeontological sensitivity) and Jurassic Dolerite, which has zero paleontological sensitivity. According to the currently accepted biostratigraphy, the whole of the Adelaide Subgroup has been divided into eight Assemblage Zones based on the dominant or temporally exclusive vertebrate fossils (Rubidge et al., 1995; Rubidge, 2005). The zones are shown in Figure 3 below. If vertebrate fossils were common in this region and had been well mapped then the specific Assemblage Zone would have been indicated in the literature. Common names for the fossils that could occur here are fish, amphibians, reptiles, therapsids, terrestrial and freshwater tetrapods, as well as freshwater bivalves, trace fossils including tetrapod trackways and burrows. Where the vertebrates do not occur it is possible to find sparse to rich assemblages of vascular plants of the late Glossopteris Flora, including some petrified logs), and insects are also prevalent at some sites.

Vertebrate fossils are fairly common in the Adelaide Subgroup in certain parts of the Karoo Basin and have been used to subdivide the strata into biozones (Rubidge et al., 1995; Day et al., 2015). The lower part of the Middleton Formation is in the Pristerognathus Assemblage Zone, the middle part is in the Tropidostoma Assemblage Zone and the upper part in the Cistecephalus, Daptocephalus and Lystrosaurus Assemblage Zones. The Balfour Formation

corresponds to the Dicynodon Assemblage and is overlain by the Lystrosaurus Assemblage Zone. In general the fauna is composed of anapsids (no temporal openings in the skull) and synapsids (single pair of lateral temporal skull openings; more like mammals). The common genera are *Pristerognathus, Diictodon, Tropidostoma, Cistecephalus, Aucalephalus* and *Oudenodon*.

Fossil plants also occur in the Adelaide Subgroup and they are from the *Glossopteris* flora and include leaf impressions of *Glossopteris*, early gymnosperms, lycopods, sphenophytes, ferns and silicified wood (Plumstead, 1969; Anderson and Anderson, 1985). These would be in the form of impressions on the fine-grained shales or mudstones. Impressions on coarser sandstones preserve very little diagnostic details.

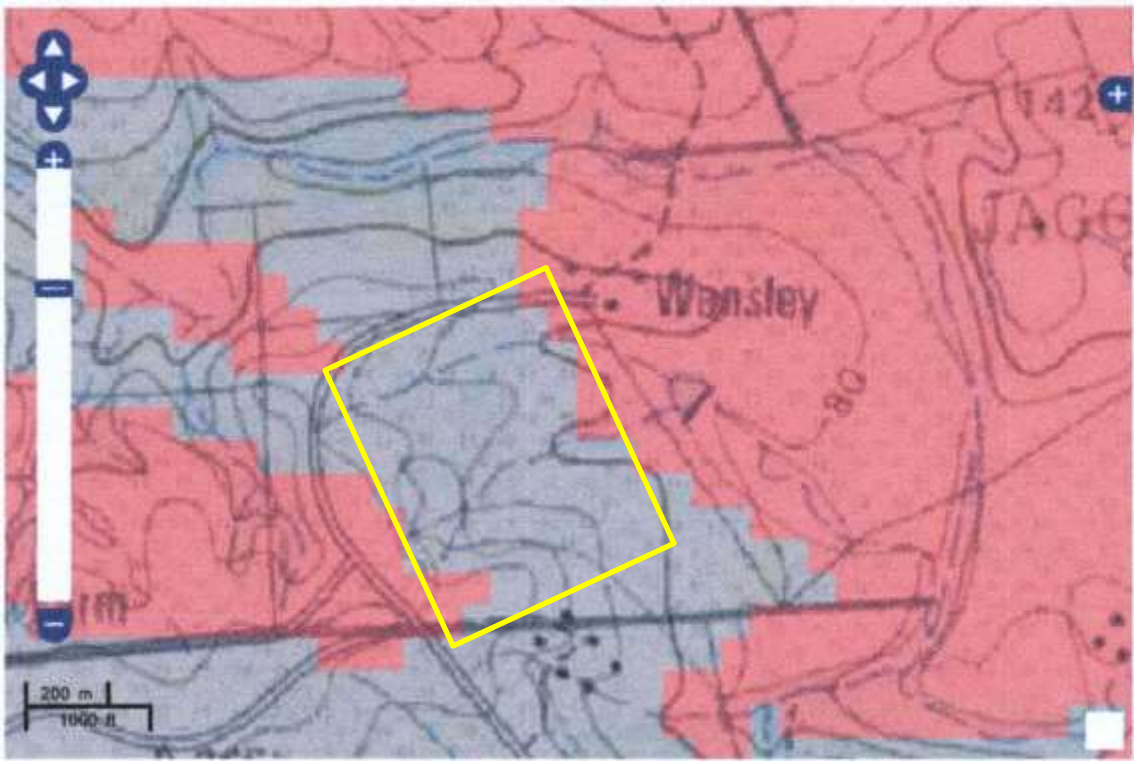

Figure 4: SAHRIS palaeosensitivity map for the site for the proposed Wansley mine application shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as very highly sensitive (red) on the margins so a site visit was undertaken.

Iii Site visit observations

Table 4: Observation points and observations. All photographs in figures 5-10 taken by J van der Walt.

Observation pt.	Observations	Figure
486	General view of the existing quarry facing south east	5
493	General view across the un-mined area, from the central west margin looking to the north east. Note the sol cover and disturbed vegetation	6
507	Dolerite boulders in the south east. Where dolerite is present there are no fossils	7
496	Scree slope of shale and mudstone in the west central margin. No fossil bones or plant impressions	8
510	Eastern margin, central. Scree slope of Adelaide subgroup shales and mudstones. No fossils seen.	9
511	Eastern margin, central. Gully in the Adelaide Subgroup. Cutting goes through the shales but no fossils are visible.	10

Figure 5

Figure 6

Figure 7

Figure 8: Scree slope but no fossils.

Figure 9

Figure 10: Scree slope of Adelaide Subgroup shales and mudstones.

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.
	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local

Criteria for ranking the SPATIAL SCALE of impacts	**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	Dolerite does not preserve any fossils; so far there are no records from the Adelaide Subgroup 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 only the possible fossils within the area would be fossil bones of the Dicynodon AZ or 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 soils that cover the site or in the dolerite. Fossil bones or plant impressions might occur in the Adelaide Subgroup along the outer margins so a Fossil Chance Find Protocol should be added to the eventual EMPr.

Based on the nature of the project, the target material is the dolerite that is not fossiliferous. The margins of the mining area are in the shales and mudstones of the Adelaide Subgroup and this may impact upon the fossil heritage if preserved in the development footprint. No fossils were seen during the field survey although there are good exposures of the rocks. Since there is an extremely small chance that fossil bones or plant impressions from the nearby Adelaide Sungroup Formation may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and some might contain fossil plant, insect, invertebrate and vertebrate material. The covering sands and soils of the Quaternary period would not preserve fossils. The site visit revealed no fossils.

6. Recommendation

Based on the site visit and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the shales around the quarry site, and certainly not in the dolorites. Although no fossils were seen during the site visit, there is a very small chance that fossils may occur in the unexposed shales of the Adelaide Subgroup. Therefore, a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once mining has commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Catuneanu, O., Wopfner, H., Eriksson, P.G., Cairncross, B., Rubidge, B.S., Smith, R.M.H., Hancox, J.P., 2005. The Karoo basins of south-central Africa. Journal of African Earth Sciences 43, 211-253.

Day, M.O., Ramezani, J., Bowring, S.A., Sadler, P.M., Erwin, D.H., Abdala, F., Rubidge, B.S., 2015. When and how did the terrestrial mid-Permian mass extinction occur? Evidence from the tetrapod record of the Karoo Basin, South Africa. Proceedings of the Royal Society, London. 282, 1-8.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

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.

Rubidge, B.S. (Ed), 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). Biostratigraphy Series 1, South African Commission for Stratigraphy. Council for Geoscience, 46 pp.

Rubidge, B.S., 2005. 27th Du Toit Memorial Lecture: re-uniting lost continents — fossil reptiles from the ancient Karoo and their wanderlust. South African Journal of Geology 108: 135-172.

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 excavations/mining commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 11, 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 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 not 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 that might occur in the undisturbed rocks to be mined.

Figure 11: bone still in the rock.

Figure 12: A section of fossil plant impressions as seen in the rock (Vryheid Formation) and some bone (lower right).

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
June 2020

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	9	2
Masters	9	5
PhD	11	5
Postdoctoral fellows	10	4

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 –
Cretaceous Research: 2014 –
Journal of African Earth Sciences: 2020 –

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
- 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

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 27; Google scholar h index = 32;
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)