Palaeontological Impact Assessment for the proposed mining operation near Nababeep and Springbok, Northern Cape Province

Desktop Study

For

Southern African Tantalum Mining (Pty) Ltd

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 22 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Southern African Tantalum Mining (Pty) Ltd, 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

Since an application has been lodged for a Minin Right on a portion of portion 3 of the Farm Nababeep 134, near Nababeep, Northern Cape Province of the existing Wheal Flat mine, the palaeontological impact assessment part of the process is presented here.

The ore bodies of the Koperberg Suite contain copper sulphide minerals and are volcanic in origin and furthermore are too old and of the wrong type to preserve fossils. The overlying sand is alluvial and would not contain fossils either. As far as the palaeontological heritage is concerned the project can continue and no further assessment is required.

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1. Background

Wheal Flat Mine on the farm Nababeep in the Nababeep – Springbok area of the Northern Cape Province was opened 71 years ago to mine copper. It has a long history of activity, closures and changed ownership. There are at least two copper ore bodies on the farm, a northern and a southern one; one is a surface body and the other has been drilled to 300m (Lanham, 2004). The current application to re-open the mining operations are for a portions of Portion 3 of the Farm Nababeep 134, in District: Namaqualand. This report is the Palaeontological Impact Assessment for the application. The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

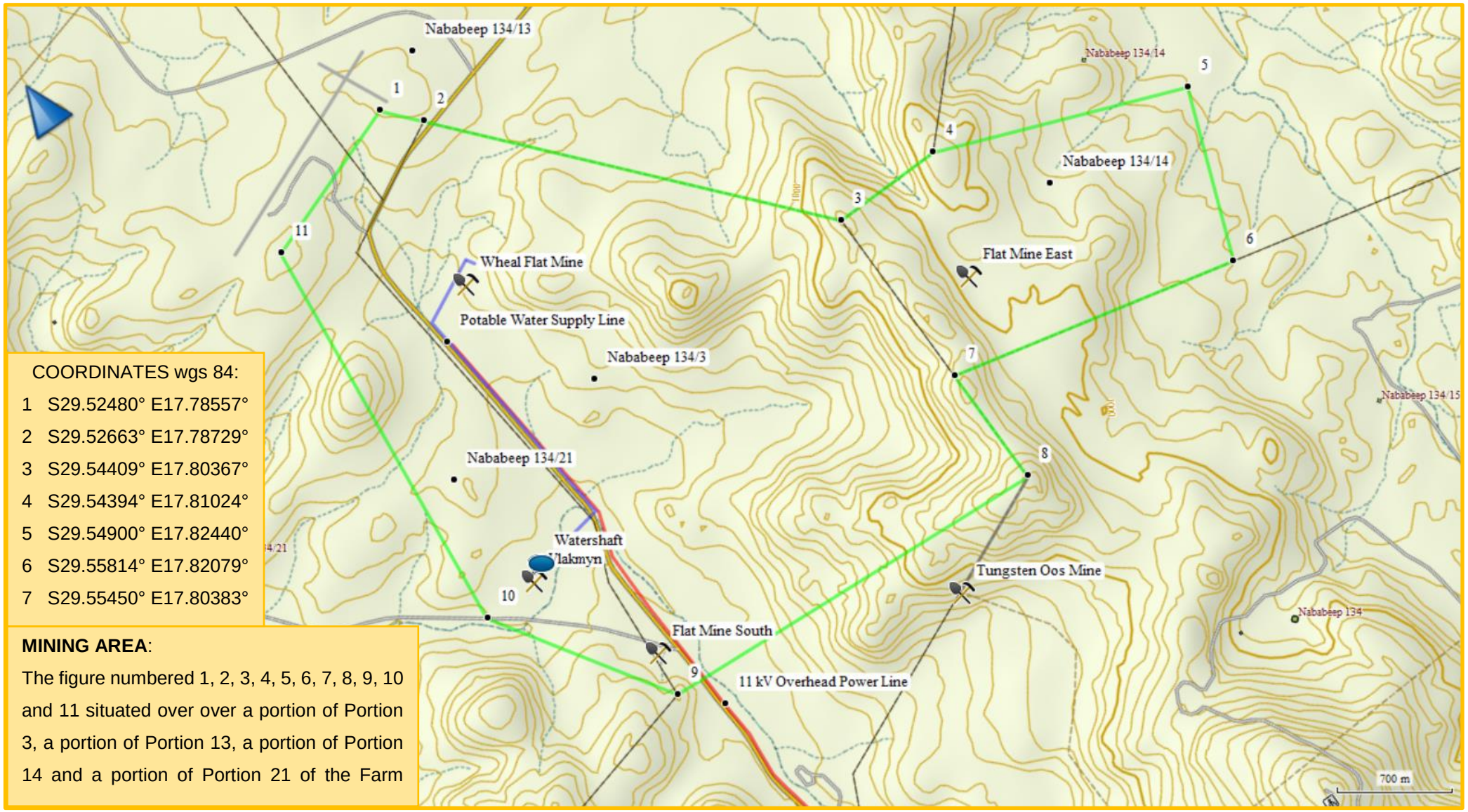
A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	**Relevant section in report**
Details of the specialist who prepared the report	Appendix A
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section ii
An identification of any areas to be avoided, including buffers	N/A
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
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
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
Any mitigation measures for inclusion in the EMPr	n/a
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	n/a

A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
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
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

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*).



COORDINATES wgs 84:

1 S29.52480° E17.78557°
2 S29.52663° E17.78729°
3 S29.54409° E17.80367°
4 S29.54394° E17.81024°
5 S29.54900° E17.82440°
6 S29.55814° E17.82079°
7 S29.55450° E17.80383°

MINING AREA:

The figure numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 situated over over a portion of Portion 3, a portion of Portion 13, a portion of Portion 14 and a portion of Portion 21 of the Farm

Figure 1: Detailed map outlining the proposed mining areas to the west of the town of Okiep on the farm Nababeep 134, Northern Cape Province.

3. Geology and Palaeontology

i. Project location and geological context

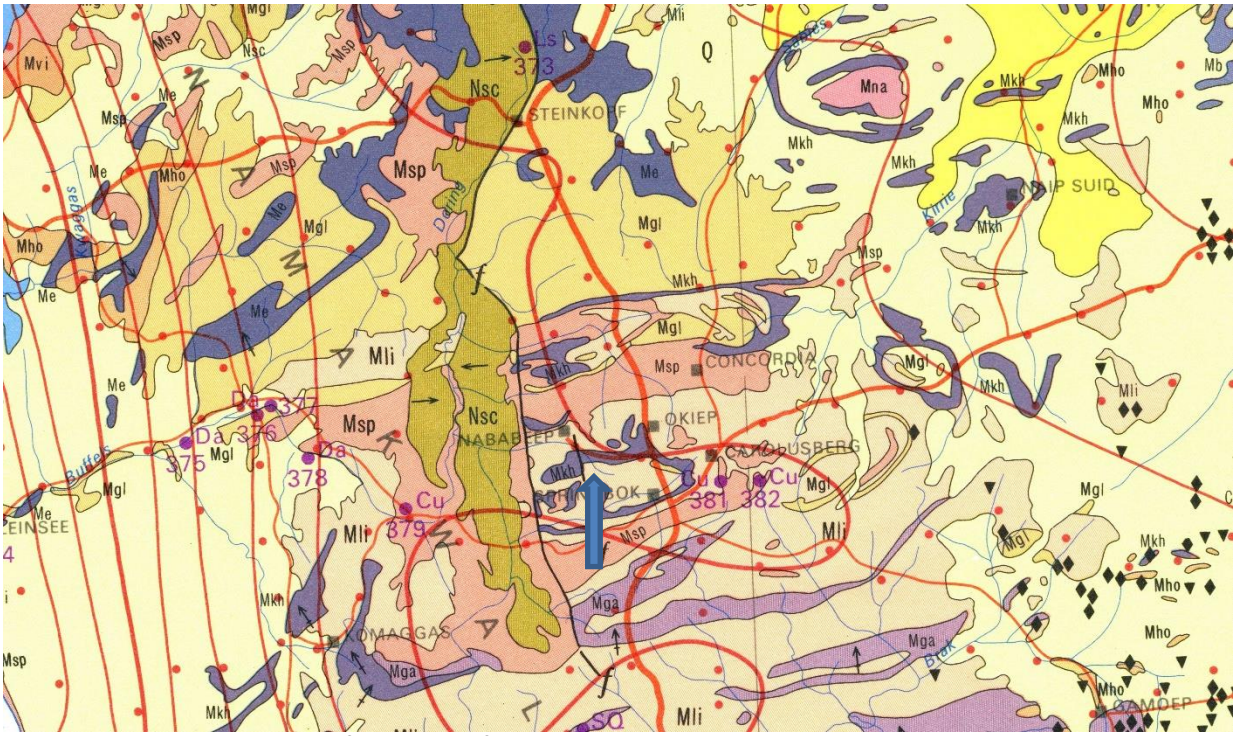


Figure 2: Geological map of the area of Namaqualand. The mine development is shown by the arrow, at Nababeep. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Cornell et al., 2006; Erikssen et al., 2006. Johnson et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary sand; Gordonia Fm	Sands, alluvium, calcrete	Last 2.5 Ma
Mho	Hoogoor Suite	Pink gneiss	
Nsc	Schwarzrand subgroup, Nama Group	Limestone shale	Ca 1200 – 1000 Ma
Msp	Spektakel suite	Aplogranite, porphyritic granite	1060 Ma
Mli	Little Namaqualand Suite	Augen gneiss	1200 Ma
Mho	Hooghoor Suite	Pink gneiss	
Mgi	Gladkop suite	Grey, fine-grained gneiss	1800 Ma
Mvi	Vioolsdrift Suite	Granodiorite, adamellite	
Me	Aardvark and Een Riet subgroup, Okiep Group Now Koperberg Suite	Schist, gneiss, quartzite	
Mkh	Khurisberg subgroup,	Quartzite, schist	
Mga	Garies subgroup	Biotite gneiss	
Mbt	Bitterfontein Fm, Bushmanland Group	Gneiss, quartzite, schist	Ca 1140 Ma

The Namaqua-Natal Province is an extensive (1400km long and 400km wide) arcuate orogenic belt that extends beneath the Phanerozoic Karoo Supergroup. It outcrops in the Namaqualand area and in Natal. In the Namaqualand region it has been divided into five domains and Springbok-Okiep is in the Bushmanland Terrane (Cornell et al., 2006).

The Koperberg Suite forms numerous mafic intrusions in the Okiep Copper District (Gibson et al., 1996) and these host copper sulphide minerals. The mineralisation has been attributed to a combination of fractionation in mantle-derived magmas and contamination by crustal melts. This was followed by high temperature oxidation during the Namaquan metamorphic peak and a lower temperature overprint possibly associated with a pan African event (Cornell et al., 2006).

Overlying part of these ancient rocks are deposits of the Kalahari Group that are considerably younger and are composed of aeolian sands, alluvium and calcrete. A thin film of haematite on the rounded sand grains gives them a reddish colour (Partridge et al., 2006). In some parts the sands form dunes that have been stabilised by vegetation.

ii. Palaeontological context

The intrusive rocks are plutonic or volcanic in origin and post-date the surrounding metamorphic rocks of the Bushmanland Group. The broad age range of 1200 – 1000 Ma is too old for body fossils and the rock type, metamorphic or igneous, would not preserve fossils. Sedimentary rocks are required for preservation of fossils. Because of the age and rock type there would be no chance of finding fossils in this material that will be mined.

Quaternary alluvial sands do not preserve fossils because of their friable and transported nature. Almond and Pether (2009) do not record fossils from this region. The SAHRIS palaeosensitivity map indicates that this region is blue and grey meaning a low sensitivity to no sensitivity or chance of finding fossils (Figure 3). There might be fossils in the palaeochanels or pans but these features are not evident in the maps.

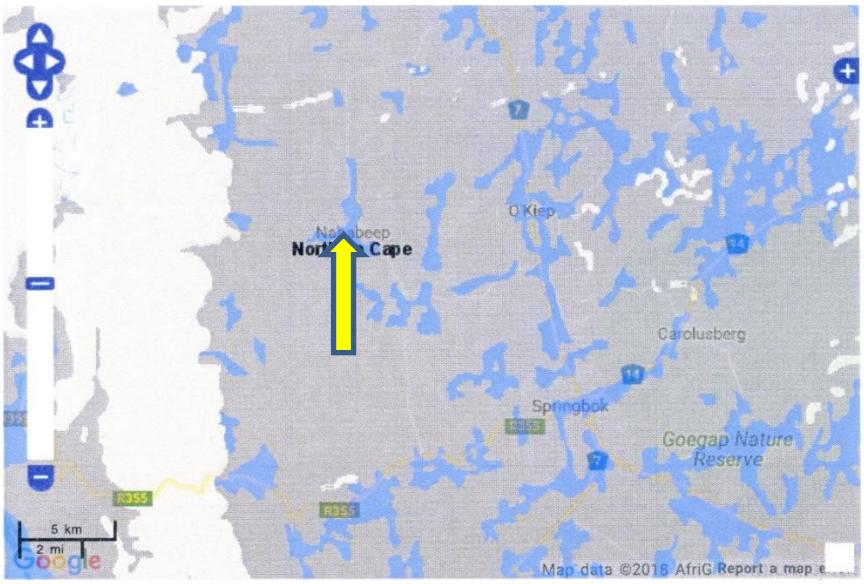


Figure 3: SAHRIS palaeosensitivity map of the region around Nababeep. The site is in the grey area (arrow). Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

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	There is no chance of any fossils being found here
	L+	-
	M+	
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	The spatial scale is extremely small.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	
	L	There is no chance of finding fossils in the surrounding rocks or in the sand.

Based on the nature of the project, the alluvial sands only will be removed and the ground would be penetrated for the underground mining operations. Since there is no chance of finding fossils in either the hard rock or loose surface sands there would be no impact on the

fossil heritage. There is no chance of finding fossils so a phase 2 or site visit is NOT recommended. Taking account of the defined criteria, the potential impact to fossil heritage resources is zero.

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 gneisses, schists, granites, amphibolites and sands are typical for the country and do not contain any microfossils, fossil plant, insect, invertebrate and vertebrate material.

6. Recommendation

Based on the ancient volcanic rocks and the lack of any previously recorded fossils from the area, it is extremely unlikely any fossils would be identified in the proposed site. No further palaeontological assessment is required. As far as the palaeontology is concerned the project may continue.

7. References

Almond, J., Pether, J. 2009. Palaeontological Heritage of the Northern Cape. SAHRA Palaeotechnical Report. 143 pp.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. 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 325-379.

Gibson, R.L., Robb, L.J., Kisters, A.F.M., Cawthorn, R.G., 1996. Regional setting and geological evolution of the Okiep Copper district, Namaqualand, South Africa. South African Journal of Geology 99, 107-120.

Lanham, A., 2004. Okiep – it's not over yet! Mining Weekly. 12 March 2004 (online version).

Partridge, T.C., Botha, G.A., Haddon, I.G., 2006. Cenozoic deposits of the interior. 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 585-604.

Appendix A – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2018

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	5	2
Masters	6	3
PhD	9	3
Postdoctoral fellows	5	3

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 -
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

xi) Research Output

Publications by M K Bamford up to January 2018 peer-reviewed journals or scholarly books: over 110 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 22; Google scholar h index = 24;
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)