

**Palaeontological Impact Assessment for the proposed
Agripark on Portion 2 of Farm Goedgewaard 60 JR
Makapanstad, Morekele,
North West Province**

Site Visit/Phase 2 Study

For

PlantagoLanceolata(Pty) Ltd

25August 2019

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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 Plantago Lanceolata (Pty) Ltd, Pretoria, 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 development of an Agripark on Farm Goedgewaagd 60 JR, near the town of Makapanstad, Moretele area SAHRA Case ID:14597. A site visit was done Mr Rick Tolchard on 22nd August 2019 and is reported here.

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 (phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed application.

The proposed site lies on the shales, mudstones, sandstones and marls of the Irrigasie Formation, Springbok Flats Basin Group, Karoo Supergroup. No fossils and no shales were observed throughout the site, only sandy and loamy soils, scattered thorn bushes and small trees with a variable covering on grasses. Soils do not preserve fossils but there is a very small chance that shales and sandstones below the surface could preserve fossils of the *Dicroidium* flora or vertebrates of dicynodonts or early dinosaurs. None has been reported from the Irrigasie Formation. Once excavations for foundations and infrastructure commence there is a small chance that fossils could be disturbed so a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological site visits are required until fossils are found by the geologist or responsible person.

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1. Background

PlantagoLanceolata (Pty) Ltd has been appointed by the Department of Rural Development and Land Reform to conduct an Environmental Authorisation (EA) Application process for the proposed Makapanstad Agri-Hub on farm Goedgewaad 60 JR, near Makapanstad, North West Province. A Scoping Report in terms of the National Environmental Management Act, 107 of 1998 (NEMA) and the NEMA Environmental Impact Assessment (EIA) Regulations has been submitted.

The proposed infrastructure includes feedlot facility, abattoir, main processing and packaging building, office facilities and a retail facility over 40 ha. Civil services such as water, electricity and roads will also be constructed.

A Phase 2 (or site visit) Palaeontological Impact Assessment was requested for the proposed project SAHRIS Case ID:13597 (Figures 1, 2). This site lies in the Irrigassie Formation (Ecca Group) and is indicated as very highly sensitive on the SAHRIS Palaeosensitivity map (Figure 3).

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 was made on 22 August 2019 by Rick Tolchard, and the results are reported 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 specialists who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
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 Portion 2 of Farm Goedgewaard 60JR, just northwest of the town Makapanstad, for the proposed Agripark, with the section shown in blue.

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

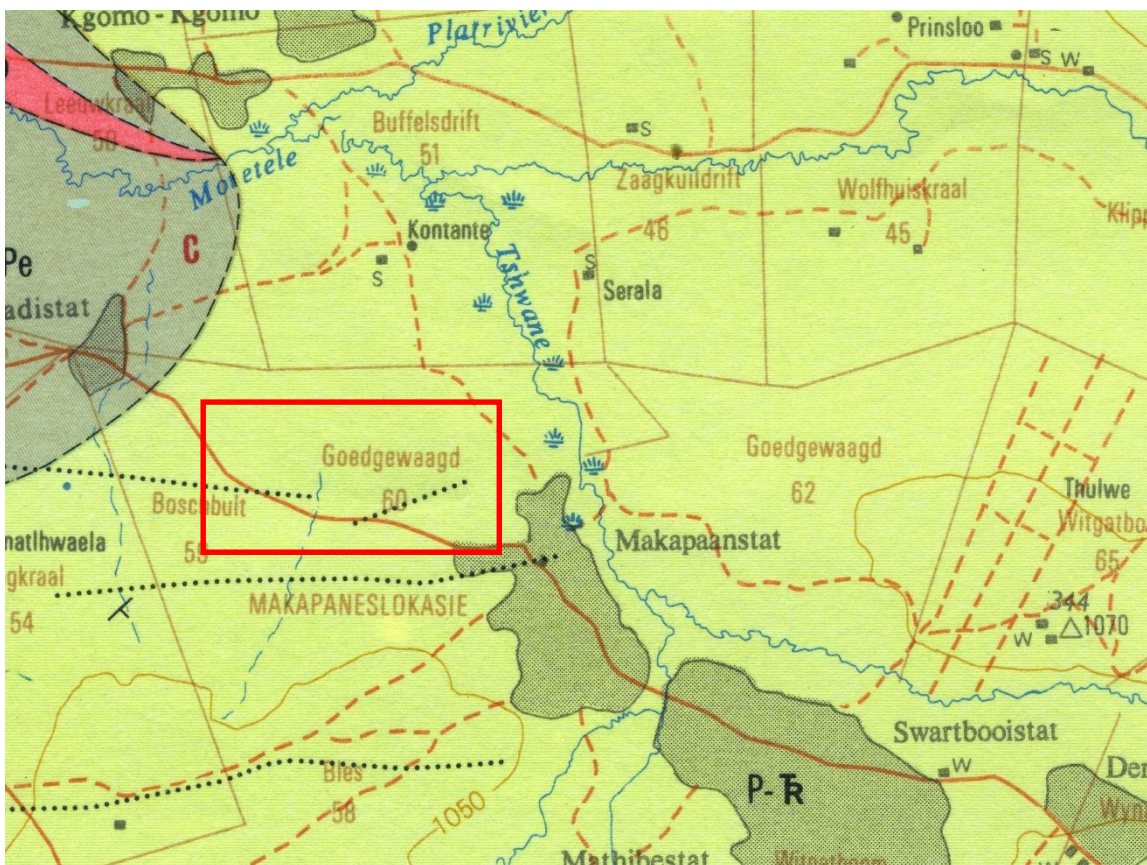


Figure 2: Geological map of the area around the farm Goedgewaagd 60 JR northwest of Makapanstad. The location of the proposed project is indicated within the red rectangle.

Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2528 Pretiria.

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

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
P-Tr	IrrigasieFm, Springbok Flats Basin, Karoo SG	Siltstones, sandstone, marls, mudstone, shale	Late Permian to Early Triassic, Stormberg Group
Pe	Ecca Group (undifferentiated)	Sandstones, shales	Early Permian, Ecca

The site, Farm Goedgewaargd 60 JR, lies in the Irrigasie Formation that is the Springbok Flats equivalent of the Molteno and Elliot Formations of the Main Karoo Basin. Jurassic dolerite dykes have cut through these sediments, mostly to the south and west of this area, and are associated with the Drakensberg basalt outpourings. To the west of the site is an outcrop of the undifferentiated Ecca Group.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The site for the Agriparkis in the IrrigasieFormation that is composed of siltstones with overlying sands and soil. Very little research has been done on this formation and only the sedimentology has been described (Johnson et al., 2006, p 487). It has the correct sedimentology and age for preserving fossils. It overlies a narrow coal seam but this belongs to the Hammanskraal Formation. Because of the lack of records a site visit was completed. In the Main Karoo Basin the Molteno formation is very rich in fossil plants of the *Dicroidium* flora, and the Elliot Formation has a patchy distribution of vertebrate fossils of dicynodonts and early dinosaurs, as well as but very rarely, silicified wood (Johnson et al., 2006; Plumstead, 1969).

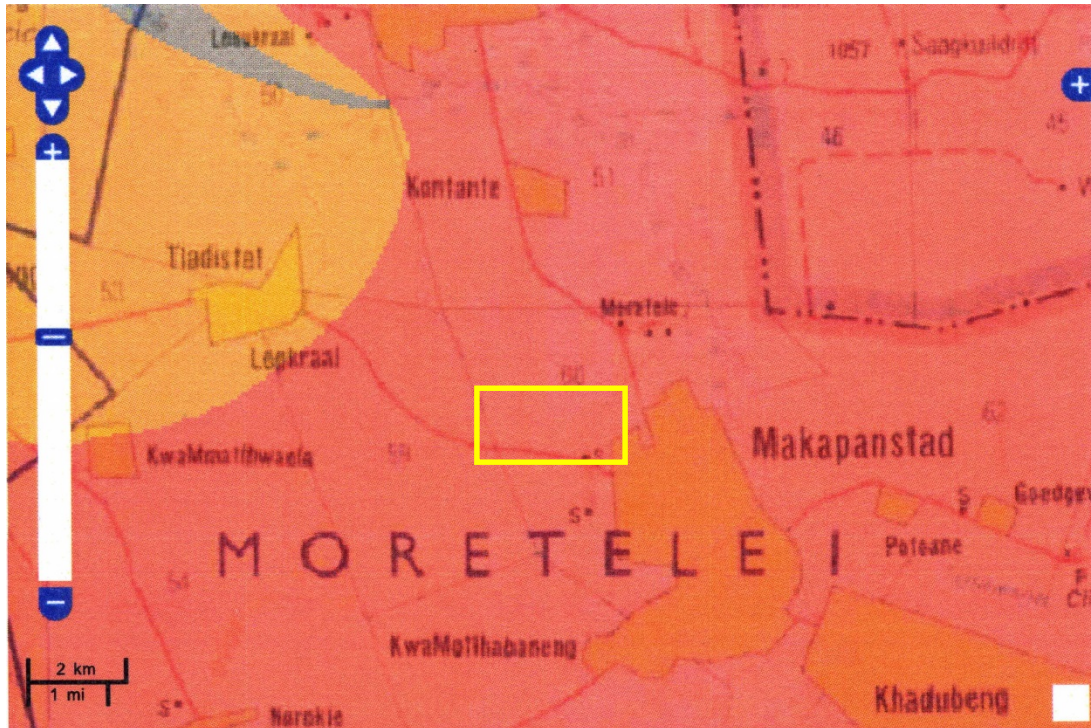


Figure 3: SAHRIS palaeosensitivity map for the site for the proposed Agripark on Farm Goedgewaagd shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as very highly sensitive (red) so a site visit was conducted and the observations are shown below (Table 3; Figures 4-5).

iii. Observations from site visit

Table 3: Observations at each site with GPS coordinates and corresponding photograph taken at or near the point by Rick Tolchard, 22 August 2019.

Location	Observations	Figure
Point 1: S 25°13.607' E 28°05.785' 1604m	Flat topography, sandy soil cover and scattered thorn bushes. Some grass cover. No rock or shales exposed.	4
Point 2: S 25°13.735' E 28°05.588' 1040m	Flat topography, sandy soil cover and scattered thorn bushes. No rock or shales exposed.	
Point 3:	Flat topography, sandy soil cover and scattered thorn bushes to	

S 25°13.819' E 28°05.760' 1032m	small trees. No rock or shales exposed.	
Point 4: S25°13.468' E28°05.872' 1040m	Flat topography, sandy soil cover and scattered thorn bushes and scanty grass cover. No rock or shales exposed.	5
Point 5: S 25°13.443' E 28°05.450' 1037m	Flat topography, sandy soil cover and scattered thorn bushes, grass cover but very disturbed. No rock or shales exposed.	



Figure 4: Point 1 of site visit – Flat topography, sandy soil cover and scattered thorn bushes. No rock or shales exposed.



Figure 5: Point 4–Flat topography, sandy soil cover and scattered thorn bushes with scanty grass cover. No rock or shales exposed.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in 4:

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	Fossils of the <i>Dicroidium</i> flora are expected in the IrrigasieFm but none was observed in the widespread covering of modern soils. The impact would be very unlikely in the soils.No vertebrate fossils or rocks were seen
	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 plants from the <i>Dicroidium</i> flora in the shales, or vertebrate bones in the rocks (mudstones or shales), the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	H	-
	M	It is extremely unlikely that any fossils would be found in the soils but could be in the shales and mudstones if they occur. Therefore,a fossil chance find protocol should be added to the eventual EMPr.
	L	-

Based on the nature of the sandy and loamy soils overlying any potential shales or mudstone, there are no fossils visible in the surface because they do not occur in the soils. Fossil plant impressions might to occur in the shales and mudstones but none has been reported; no vertebrate fossils have been reported either. Only once excavations for foundations and infrastructure commence would there be a chance of finding fossils. Since there is a chance that fossils from the poorly studied (and possibly non-fossiliferous) Irrigasie Formation may be disturbed once excavations commence, a Fossil Chance Find Protocol has been added to this report (Section 8; Appendix A). Taking account of the defined criteria, the potential impact to fossil heritage resources is low to moderate.

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 might contain fossil plant, insect, invertebrate and vertebrate

material. The soils do not preserve fossils, however there may be fossil plant impressions or bones well below the surface and this will only be revealed, if present at all, once excavations commence.

6. Recommendation

Based on survey and observations during the site visit, it is clear that there are no fossils present in the soils. There is very small chance that fossils may occur in the shales and mudstones associated well below the surface. Their occurrence in the Irrigasie Formation (Springbok Flats, Basin Group) is unknown and not recorded. A Fossil Find Protocol should be added to the EMP: if fossils are found once excavations have 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: Prodrum of South African megaflores, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

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.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations begin.

1. The following procedure is only required if fossils are seen on the surface or below the surface when excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the geologist on site, environmental officer or designated person. Any fossiliferous material

- (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossil plants or bones must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for examples see Figure 5, 6). 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 the site inspections by the palaeontologist will not be necessary.
 8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – examples of possible fossils

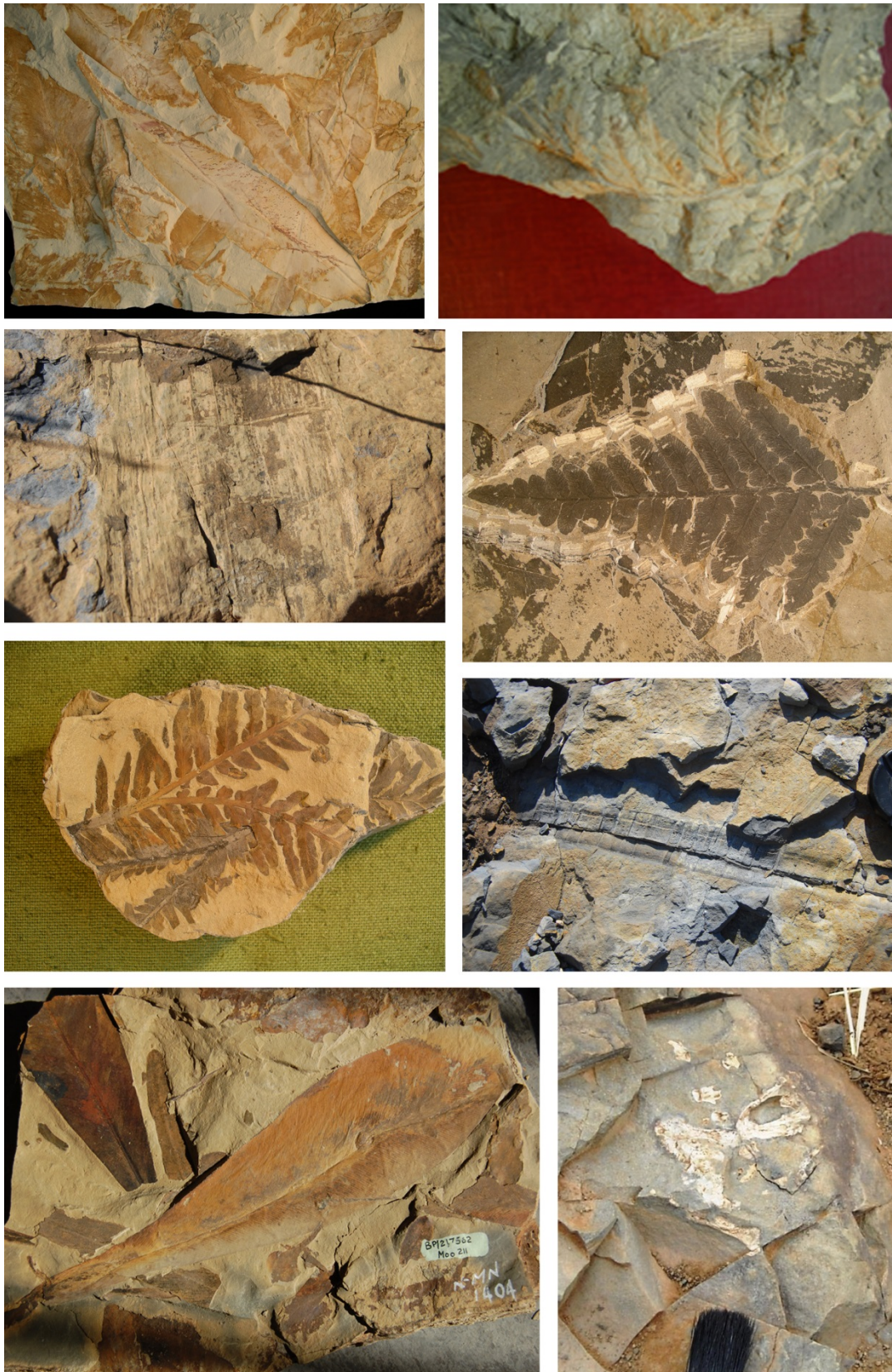


Figure 6: Selection of fossil plant impressions of the Dicroidium flora, including ferns, conifers and bone embedded in rock (bottom right).

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD June 2019

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 - Serviced'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	6	1
Masters	8	1
PhD	10	3
Postdoctoral fellows	9	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: Palaeontologiaafricana: 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
- 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

xi) Research Output

Publications by M K Bamford up to June 2019 peer-reviewed journals or scholarly books: over 130 articles published; 5 submitted/in press; 8 book chapters.

Scopus h index = 26; Google scholar h index = 30;

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)

Mr Frederick Tolchard

Brief Curriculum Vitae – June 2019

Academic training

BA Archaeology – University of the Witwatersrand, graduated 2015

BSc (Honours) Palaeontology – University of the Witwatersrand, 2017 with distinction

MSc Palaeontology – University of the Witwatersrand, 2018 – 2019.

Field Experience

Honours Fieldtrip – Karoo biostratigraphy – April 2017

Research fieldwork – Elliot Formation with Prof Choiniere – April 2018, November 2018; April 2019

PIA fieldwork projects

2018 May – Williston area – SARAQ project, Digby Wells

2018 September – Lichtenburg PVs – CTS Heritage

2018 November – Nomalanga farming – Digby Wells

2019 January – Thubelisha coal – Digby Wells

2019 March – Matla coal – Digby Wells

2019 March – Musina-Machado SEZ – Digby Wells

2019 June – Temo coal – Digby Wells