

**Palaeontological Impact Assessment for the proposed extension of the 5 ha kaolin mine on portion 1 of the farm Rondawel 638, Namaqualand District, Northern Cape Province**

**Desktop Study**

**For**

**Rondawel Kaolien (Pty) Ltd**

**09 September 2018**

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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 Rondawel Kaolien (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**

A palaeontological Impact Assessment was requested for the extension of the 5-ha kaolin mine on portion 1 of the farm Rondawel 638, Namaqualand District, Northern Cape Province by Imvusa Kaolien (Pty) Ltd. 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 desktop Palaeontological Impact Assessment (PIA) was completed for the proposed extension of the mining area.

The proposed site lies on the sands of the Quaternary group with underlying kaolin of unknown origin. In the vicinity are ancient volcanic rocks, mostly granites of some form, that do not contain fossils. Nearby are mudstones and shales of the Knersvlakte Subgroup, Vanrhynsdorp Group, of Early Cambrian age and these could potentially preserve trace fossils of invertebrate burrows, stromatolites and shells, although they have not been reported from this site. Nonetheless a Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required and permission to extend the kaolin mine be granted.

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# 1. Background

An Archaeological impact assessment has already been done for this project (by Halkett, D., Gribble, J. and Robinson, J., November 2017, prepared on behalf of Imvusa Kaolien (Pty) Ltd). Details of the locality, site and proposed activities are in that report. In summary the landowner proposes to extend the mining operation to the east of the existing mine.

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

<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:</b>	<b>Relevant section in report</b>
Details of the specialist who prepared the report	Appendix B
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
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 <b>Error! Reference source not found.</b>
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	Section 8
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



Figure 1: Google Earth map of the proposed extension of the mine (blue outline in the red circle) site for the mining of kaolin by Rondawel Kaolien (Pty) Ltd. Map supplied by Klaas van Zyl.

## 2. Methods and Terms of Reference

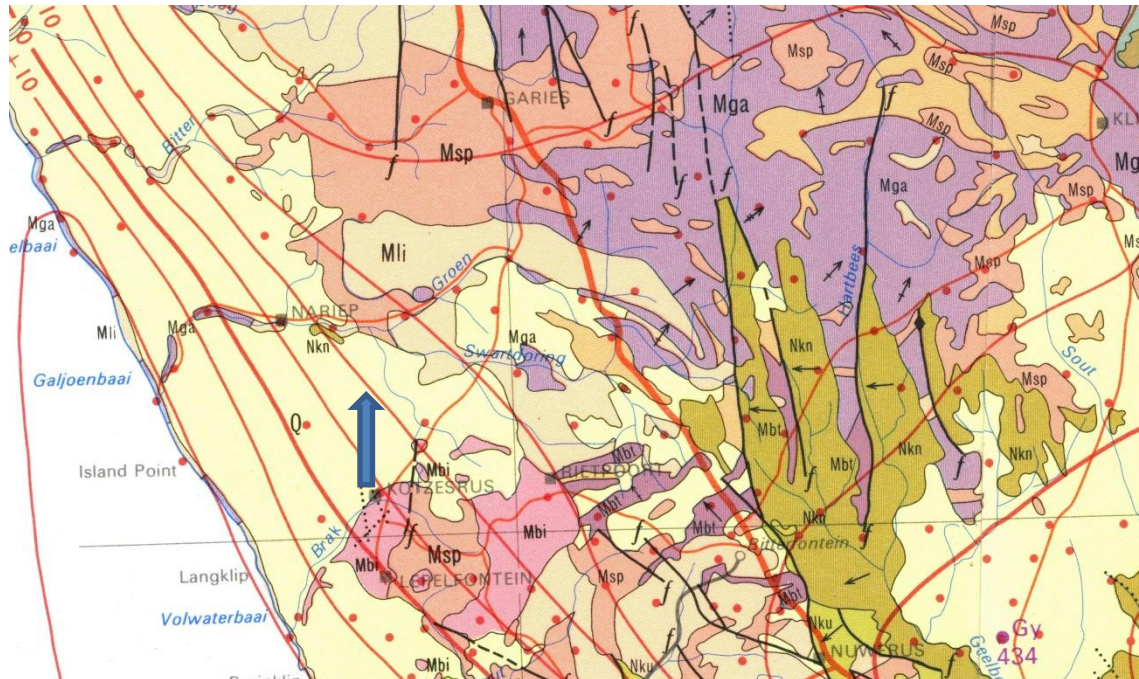
The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

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 1: Geological map of the area around the kaolin mine on Farm Rondawel 638, just south of Groen River in the Namaqualnd District. The location of the proposed project is indicated with the arrow. 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. Gresse et al., 2006; Plumstead, 1969). SG = Supergroup; Fm = Formation.**

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 25 Ma to present
Nkn	Knersvlakte Subgroup, Vanrhynsdorp Group	Shale, siltstone, sandstone, limestone	Namibian to Early Cambrian 550-530 Ma
Msp	Spektakel Suite	Aplogranite, porphyritic granite	Ca 1050 Ma
Mli	Little Namaqualand Suite	Augen gneiss	Ca 1200 Ma
Mga	Garies subgroup, Okiep Group	Biotite gneiss	Ca 1600 Ma
Mbi	Biesiesfontein Granite, Gladkop Suite	leucogranite	2050-1700 Ma

The mine lies in the Bushmanland Terrane of the Namaqua-Natal Province and the Little Namaqualand Suite is one group of many intrusive rocks. It consists of sheet-like bodies of mesocratic quartz-microcline-biotite augen gneiss with variable amounts of plagioclase, garnet and magnetite with the composition of the rocks being granite to adamellite (Cornell et al., 2006). The Spektakel Suite is another group of intrusive rocks and has three distinctive units that are various forms of granites.

Also, within the Bushmanland Terrane are a number of smaller thrust-bound terranes including the Okiep terrane, previously called the Okiep Group and including the Garies subgroup. They are part of the Kheisian Basement and these rocks are structurally complex, highly metamorphosed and there are intrusions of intrusions.

The Knersvlakte Subgroup, comprising six formations, is the middle subgroup of the Vanrhynsdorp Group. This group was formed in a shrinking foreland peripheral basin. Turbidites from a northwest source form the base of the Knersvlakte subgroup, followed by shoreline deposits as the basin shrank.

## ii. Palaeontological context

The granites and gneisses of the older rocks do not contain fossils as they are igneous and have been metamorphosed so will not be considered any further.

The shoreline sediments of the Knersvlakte Subgroup could potentially preserve fossils as these have been recorded from outcrops to the south east near the towns of Vanrhynsdorp and Bitterfontein, and to the north near Violsdrift (Almond unpublished in Gresse et al., 2006). Fossils of this age and formations are mostly trace fossils of *Phycodes*, *Neonereites*, *Planolites* (all burrows), stromatolites and shelly fossils (see Fig 4). There is only a small isolated exposure of the Knersvlakte Subgroup along the Groen Rivier (Fig 3) and the predominant rock type is the sands of the Quaternary Kalahari group. The palaeontological sensitivity of the area under consideration is presented in Figure 3 with highly sensitive areas along the river and this would apply to the trace fossils.

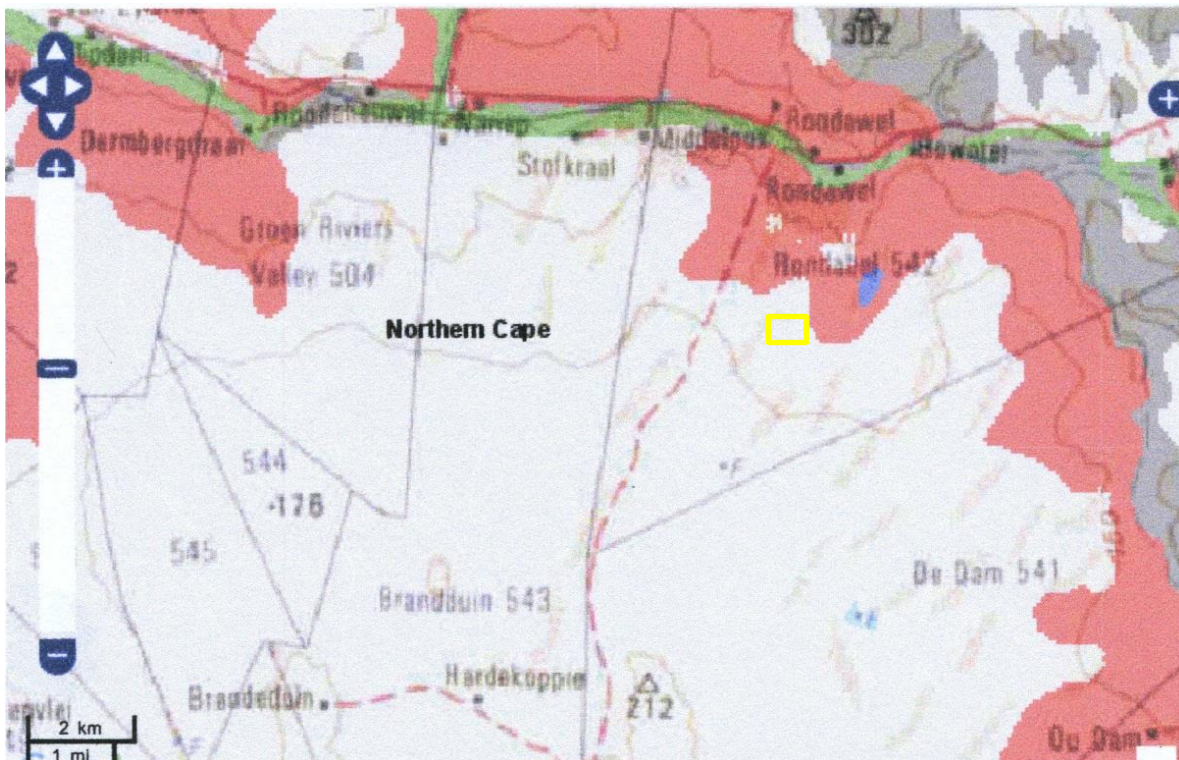


Figure 3: SAHRIS palaeosensitivity maps for the site for the kaolin mine shown within the yellow rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.



From the SAHRIS map above the area is indicated as insignificant (grey) but is surrounded by highly sensitive areas (red) so a desktop study is presented here. From the archaeological heritage report (Halkett et al., 2017, fig 5) there are young deposits overlying the area to be developed and comprise disturbed sands, aeolianite and silcrete. These are not primary rocks and would not contain fossils in context.

## 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**

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

**Table 3b: Impact Assessment**

<b>PART B: ASSESSMENT</b>		
<b>SEVERITY/NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	Loose sands do not preserve fossils; Shales and siltstones of the Knersklakte Subgroup could preserve trace fossils but the mine is targeting kaolin. The impact would be very unlikely.
	<b>L+</b>	-
	<b>M+</b>	-
	<b>H+</b>	-
<b>DURATION</b>	<b>L</b>	-
	<b>M</b>	-
	<b>H</b>	Where manifest, the impact will be permanent.
<b>SPATIAL SCALE</b>	<b>L</b>	Since only the possible fossils within the area would be trace plants from the Vanrhynsdorp Group, the spatial scale will be localised within the site boundary.
	<b>M</b>	-
	<b>H</b>	-
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	It is extremely unlikely that any fossils would be found in the loose sand that forms the overburden or in the kaolin but trace fossils could be nearby so a chance find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities are unlikely to impact upon the fossil heritage as there would be no fossils in the Quaternary sands, or below in the kaolin. Most rocks in the region are much too old to contain fossils. Potentially fossiliferous rocks of the Knersvlakte Subgroup, Vanrhynsdorp Group (Early Cambrian), occur in the vicinity and might contain trace fossils of invertebrate burrows, stromatolites and shells as they have been reported from other outcrops, but not here. Since there is a very small chance that fossils from the nearby Knersvlakte Subgroup may be disturbed a 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 granites, gneisses, dolomites, sandstones, shales and sands are typical for the country, the ancient igneous rocks and younger sands do not contain fossils, however the Early Cambrian shoreline facies might contain trace fossils because they have been recorded from other sites, but not from the mine area.

## 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 loose sands of the Quaternary. There is small chance that fossils may occur in the mudstones and shales of the Knersvlakte Subgroup, Vanrhynsdorp Group so a Chance Find Protocol should be added to the EMP: 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

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.

Halkett, D., Gribble, J., Johnson, J., Nov 2017. Archaeological Impact Assessment for the proposed the extension of the 5-ha kaolin mine on portion 1 of the farm Rondawel 638, Namaqualand District, Northern Cape Province. Report produced for Umvusa Kaolein (Pty) Ltd. 16pp.

Gresse, P.G., von Veh, M.W., Frimmel, H.E., 2006. Namibian (Neoproterozoic) to Early Cambrian Successions. 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 395-420.

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.

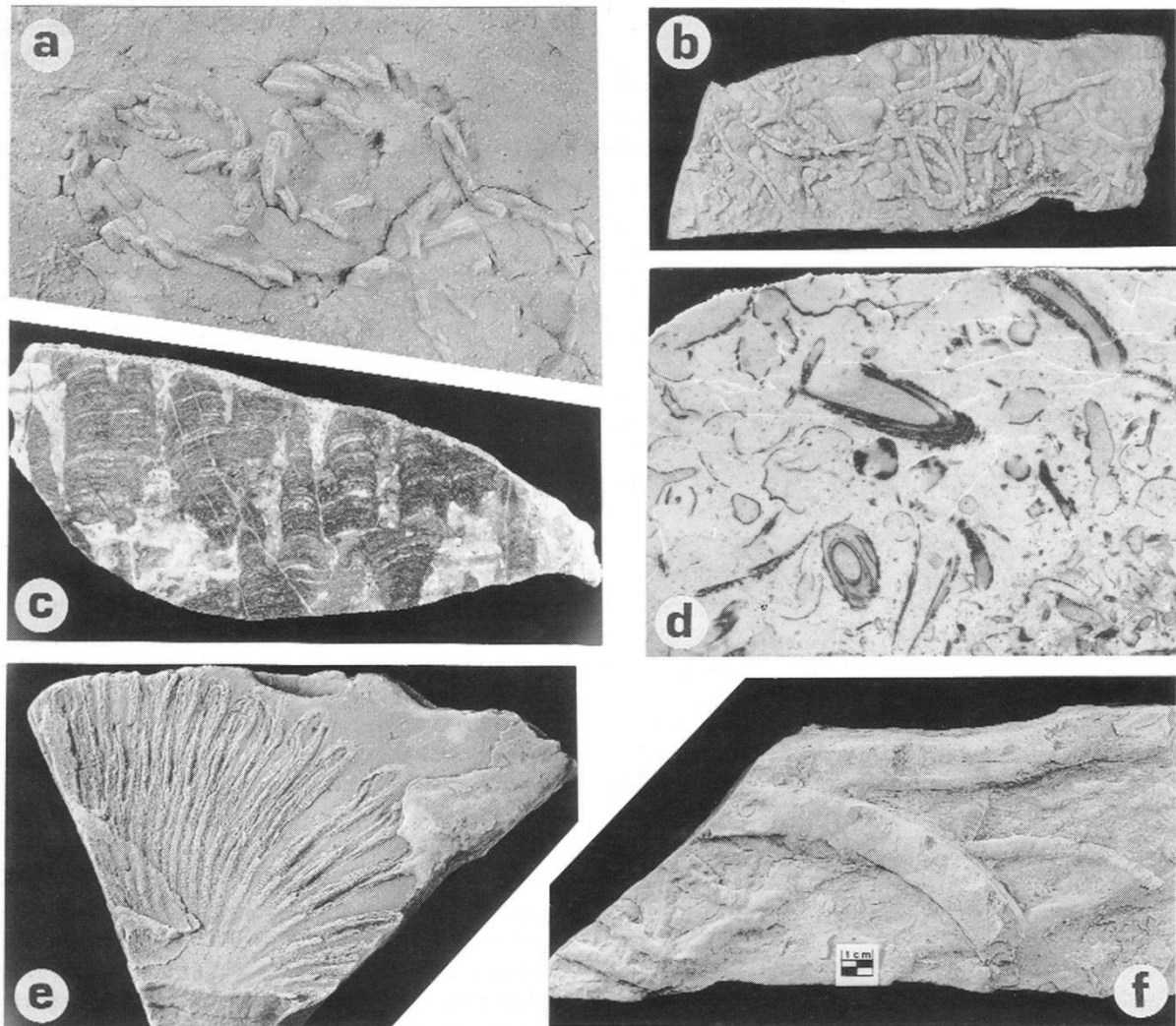
Robb, L.J., Brandl, G., Anhaeusser, C.R., Poujol, M., 2006. Archaean Granitoid Intrusions. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 57-94.

## 8. Chance Find Protocol

### **Monitoring Programme for Palaeontology – to commence once the mining begins.**

1. The following procedure is only required if fossils are seen 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 (invertebrate burrows, stromatolites or shells) should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 4). 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 shells or trace fossils 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. Annual reports by the palaeontologist must be sent to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

## Appendix A – examples of fossils



**Fig. 15** Trace fossils and stromatolites of the Nama and Vanrhynsdorp Groups.

(a) *Phycodes/Trichophycus pedum*, Kalk Gat Formation (Vanrhynsdorp Group), north of Vanrhynsdorp (x 0.5); (b) *Neonereites*, Kuibis Subgroup (Nama Group), near Nababeep (x 0.5); (c) Micro-columnar substructure of large domal stromatolite, Huns Member (Nama Group), near Violsdrif (x 0.8); (d) *Cloudina* and other unnamed shelly fossils, Mooifontein Member (Nama Group), near Violsdrif (x 1.5); (e) *Oldhamia*, Besonderheid Formation (Vanrhynsdorp Group), near Vanrhynsdorp (x 1.25); (f) *Planolites*, Gannabos Formation (Vanrhynsdorp Group), near Bitterfontein (x 0.5). (Photographs supplied by J.E. Almond.)

Figure 5 – examples of fossils that could be found in the Rondewal kaolin mining area. Figure from Gresse et al., 2006, page 414.

## Appendix B – Details of specialist

### Curriculum vitae (short) - Marion Bamford PhD June 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](mailto:marion.bamford@wits.ac.za) ; [marionbamford12@gmail.com](mailto: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	6	1
Masters	8	1
PhD	10	2
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: *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
- 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

### **xi) Research Output**

Publications by M K Bamford up to June 2018 peer-reviewed journals or scholarly books: over 120 articles published; 5 submitted/in press; 8 book chapters.

Scopus h index = 26; Google scholar h index = 28;

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)