

**Palaeontological Impact Assessment for the proposed  
clearing and planting (of macadamias) on 133ha,  
Bornmansdrift, close to Barberton,  
Mpumalanga Province**

**Desktop Study**

**For**

**BVP Farm/Henwood Environmental**

**20 August 2017**

**Prof Marion Bamford**

Palaeobotanist

P Bag 652, WITS 2050

Johannesburg, South Africa

[Marion.bamford@wits.ac.za](mailto:Marion.bamford@wits.ac.za)

## Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford

Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf

Experience: 30 years research; 20 years PIA studies

## Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Steven Henwood and BVP Farms, Barberton, 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

The desktop Palaeontological Impact Assessment for the area in and around Barberton for the proposed clearing and plant of Macadamia trees on the farm Bornmansdrift has been completed. The rocks in the area are ancient volcanic granites and gneisses of the Mpuluzi, Nelspruit and Kaapvaal plutons so do not contain any fossils because they are igneous in origin and too old for body fossils. Similarly the rocks of the Barberton Greenstone Belt are mostly igneous and very old but putative microfossils have been found in the Onverwacht and Fig Tree Groups. These rocks are too far away to be affected. There is a very small chance that trace fossils (ripple marks and microbial mats) could occur in the Bushveld Complex rocks but they too are too far away to be affected. It is concluded that the project may continue as far as the palaeontology is concerned and no further impact assessments are required.

# Palaeontological Impact Assessment for the proposed clearing and planting (of macadamias) on 133ha, Bornmansdrift, close to Barberton, Mpumalanga Province

## 1. Background

A desktop palaeontological impact assessment has been requested for the proposed clearing and planting (of macadamias) on 133ha, on the farm Bornmansdrift, to the north west of Barberton, Mpumalanga Province (Fig 1). Only the surface soils will be affected by this agricultural development and it is unlikely that solid rocks will be affected.

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.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

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	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
An indication of the scope of, and the purpose for which, the report was prepared	Section 1, page 3
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to fossils
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2, page 4
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 2
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 6, page 9
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
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 and	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	Section 3 page5
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

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records have been consulted.
2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.
3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department, or protected on site.
4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

## 3. Consultation Process

No consultations were carried out during the palaeontological desktop study.

## 4. Geology and Palaeontology

### Project location and geological setting

The site for the proposed agricultural development lies on the ancient rocks of the Kaap Valley Granite. To the east are the even older rocks of the Barberton Sequence (Fig 2 and Table 2).



Figure 1: Locality of proposed area to be cleared for the planting of Macadamia trees (red outline) and the extent of the farm Bornmansdrif (back outline). Barberton town is to the south east of the farm. Google Earth map supplied by Steven Henwood.

### Geology

The rocks in this region have been well studied as they are amongst the oldest rocks in the world. To the south, east and north are the oldest rocks, those of the Barberton Greenstone Belt and these belong to three Groups. The oldest rocks of the Barberton Greenstone Belt are the ultramafic to mafic rocks of the Onverwacht Group (approx. 3510 Ma [million years]; Brandl et al., 2006). Slightly younger are the greywackes, shales, cherts and dacitic volcanic rocks of the Fig Tree Group (3416-3298 Ma; Brandl et al., 2006). The youngest rocks of this Belt are the conglomerates, sandstones, siltstones and shales of the Moodies Group (Zm) and they range in age from about 3225-3084 Ma (Brandl et al., 2006). Intruding between the Fig Tree and Moodies Group sediments is the Kaap Valley Pluton. The proposed development is on this geological unit.

To the north is the extensive Nelspruit Granite Suite (Zne; Figure 2) which includes gneiss, porphyritic granite and two small plutons (Robb et al., 2006) and is approximately 3300 Ma.

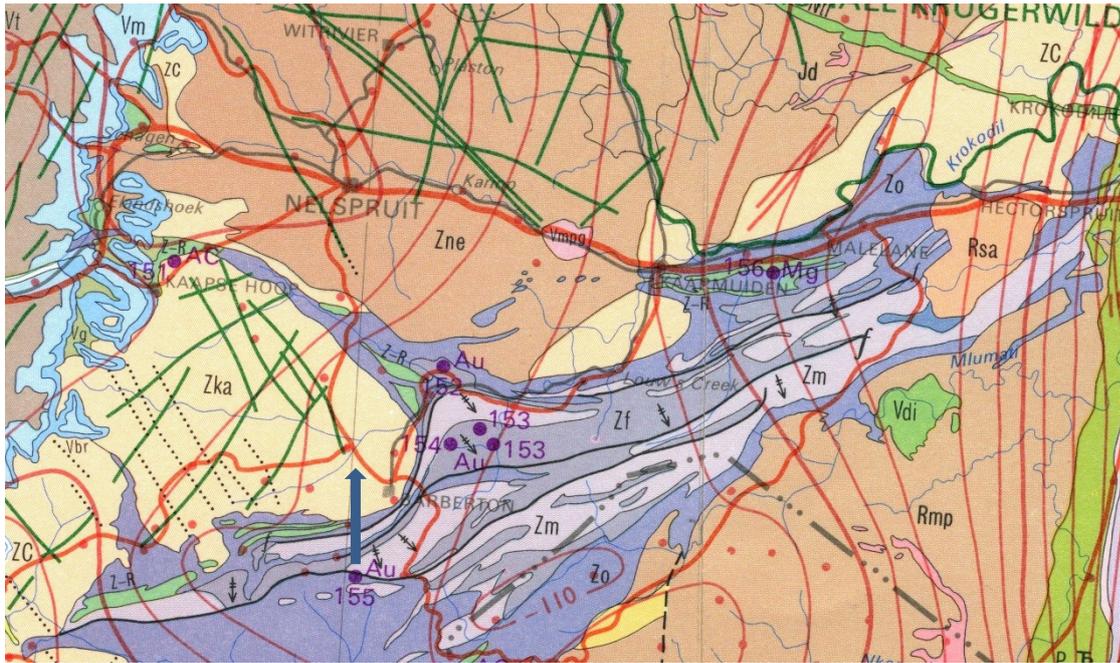


Figure 2: Geological map of the area around Barberton with the site of the farm Bornmansdrift indicated by the blue arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Brandl et al., 2006; Duncan and Marsh, 2006; Robb et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Z-R	Unnamed ultrabasic rocks	Ultrabasic volcanic rocks	
Rmp	Mpuluzi Batholith (Mpuluzi Suite)	granites	Ca 3303 Ma
Zne	Nelspruit Batholith (Nelspruit Suite)	Gneiss, porphyritic granite	Ca 3303 Ma
Zh	Hebron pluton	granodiorite	Ca 3105 Ma
ZB	Unnamed potassic granite and granodiorite	granites	
ZC	Unnamed trondhjemitic and tonalitic gneiss	gneiss	
Zm	Moodies Group, Barberton Greenstone Belt, Barberton Supergroup	Conglomerate, sandstone, siltstone, shale	Ca 3225-3084 Ma
Zka	Kaap Valley Pluton	Tonalitic hornblende granite	3227 Ma
Zf	Fig Tree Group, Barberton Greenstone Belt, Barberton Supergroup	Greywacke, shale, chert and dacitic volcanic rocks	Ca 3461-3227 Ma
Zo	Onverwacht Group, Barberton Greenstone Belt, Barberton Supergroup	Ultramafic to mafic volcanic rocks	Archaean 3450 Ma

## Palaeontology

(Refer to Figure 3 for SAHRIS palaeosensitivity map)

Batholiths and plutons do not preserve any fossils as they are igneous in origin. These particular ones, the Kaap Valley Pluton, Mpuluzi and Nelspruit batholiths are also too old to preserve fossils even if any life forms were around as they are over 3300 Ma. At this time there were only single-celled algae or bacteria present (Knoll, 1984).

The only record of fossils in this area is from the Onverwacht and Fig Tree Groups, shown in Fig 3 in blue. These fossils, coccoids, spheroids and rods, occur in the Theespruit and Hooggenoeg Formations but are microscopic and of doubtful biogenic origin (Altermann, 2001). Since these rocks are to the south east of the proposed site, there is no chance of them occurring in the volcanic pluton of the Kaap Valley.

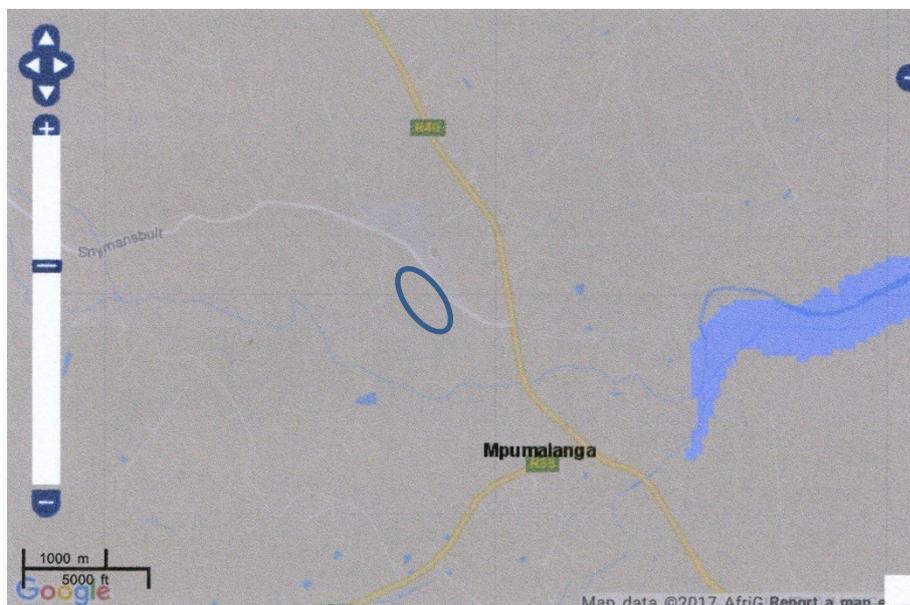


Figure 3: SAHRIS palaeosensitivity map. The proposed site for the clearing and planting of Macadamia trees on Bornmansdrift farm is within the oval outline. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

## **5. Impact assessment**

Using the criteria in the table below, the impact of the proposed clearing of vegetation and planting of trees on the farm Bornmansdrift has been assessed.

**TABLE 3: 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

The surface activities would not impact on the fossil heritage as the rocks are ancient and volcanic so there are no fossils present. The IMPACT is nil (according to the scheme in Table 3).

Clearing of the current vegetation and planting of the trees would penetrate only a few metres below ground surface at the most - of the soils - so there would be minor deterioration of the soils and no impact on any potential fossils which, if present, would be in hard rock. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: H.

No fossils are likely to be found in the granites but if any were then the SPATIAL SCALE will be localised within the site boundary: L.

There is no chance of finding microfossils in the soils as these have been reported from hard rocks of older and younger Formations, but not soils or unconsolidated sediments. Therefore, the PROBABILITY of affecting any fossils is unlikely or seldom: L

## **6. 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 basement rocks, granites, gneisses,

greywackes, cherts, basalts and other volcanic rocks are typical for the country and do not contain any fossil material. The rocks of the Onverwacht and Fig Tree Groups could contain microbial fossils, however, they have yet to be recorded from the proposed site for the agricultural development because this will be on the soils of volcanic origin.

## **7. Recommendation**

It is extremely unlikely that any fossils occur in the sites for the proposed dam wall because mostly the rocks are much too old and volcanic in origin.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would be unnecessary.

## **8. References**

Altermann, W., 2001. The oldest fossils of Africa – a brief reappraisal of reports from the Archean. *Journal of African Earth Sciences* 33, 427-436.

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