

RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES:

Proposed diamond mining on the farm Palmietfontein 208JP near Pilanesberg, Moses Kotane Local Municipality, Bojanala District, Northwest Province

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EXECUTIVE SUMMARY

The proposed diamond prospecting and mining area on Farm Palmietfontein 208 JP near Pilanesberg, Northwest Province is underlain by Precambrian and Cretaceous igneous rocks of the Pilanesberg Alkaline Igneous Complex, Bushveld Complex and Kimberley Province that are completely unfossiliferous. The overlying Late Caenozoic superficial sediments (stream alluvium, surface gravels, soils *etc*) are of very low palaeontological sensitivity. It is concluded that the proposed prospecting and mining developments are of very low impact significance in terms of palaeontological heritage resources. It is noted that the Pilanesberg Alkaline Complex is a world-class geological site of considerable scientific and geoheritage significance.

It is recommended that, pending the discovery of significant new fossils remains before or during mining, exemption from further specialist palaeontological studies and mitigation be granted for the proposed diamond prospecting and mining on Farm Palmietfontein 208 JP.

Should significant new fossils - such as vertebrate bones and teeth - be exposed during borrow pit excavation, the responsible Environmental Control Officer should alert SAHRA (*i.e.* The South African Heritage Resources Authority. Contact details: Dr Ragna Redelstorff, SAHRA, P.O. Box 4637, Cape Town 8000. Tel: 021 202 8651. Email: rredelstorff@sahra.org.za or Ms Natasha Higgitt. Tel: 021 462 4502. Email: nhiggitt@sahra.org.za) as soon as possible so that appropriate action can be taken in good time by a professional palaeontologist. Palaeontological mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as of associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy). The ECO should be guided by the generic Fossil Finds Procedure developed by Heritage Western Cape that is appended with this report.

1. OUTLINE OF THE PROPOSED DEVELOPMENT

The company Fidulex (Pty) Ltd is applying for diamond prospecting and mining rights on the farm Palmietfontein 208 JP (3260.8416 ha) that is situated on the south-western margins of the Pilanesberg massif, approximately 50 km NNW of Rustenburg and 16 km NW of Sun City in the Bojanala District Municipality (Moses Kotane Local Municipality), North-West Province (Fig. 1).

Diamond mining here will involve clearance of vegetation, excavation as well as removal and stockpiling of topsoil cover. The main infrastructural components of the development include:

- (i) Processing Plant (with screening, scrubber and sorter);
- (ii) Clean storm water dam and drains channelling water to the dam, as well as a return water dam;
- (iii) Septic tank and associated infrastructure for containment/storage and transportation of sewage waste from the ablution facilities;
- (iv) Maintenance workshop;
- (v) Salvage yard for temporal storage and screening of waste miscellaneous material; and
- (vi) Perimeter fencing.

A Palaeontological Impact Assessment (PIA) conducted by a qualified palaeontologist has been requested for proposed development by SAHRA (Case ID: 11479, Interim Comment of 1 September 2017).

The present palaeontological heritage comment has been commissioned as part of a comprehensive heritage impact assessment for the mining project co-ordinated by Dr Edward Matenga of Archaeological & Heritage Services Africa (AHSA) (Pty) Ltd, Johannesburg (Contact details: Archaeological & Heritage Services Africa, 8843 Odessa Crescent, Cosmo City Ext 7, Northriding 2188, Johannesburg. Cell: 073 981 0637 / 084 073 7774, Email: e.matenga598@gmail.com).

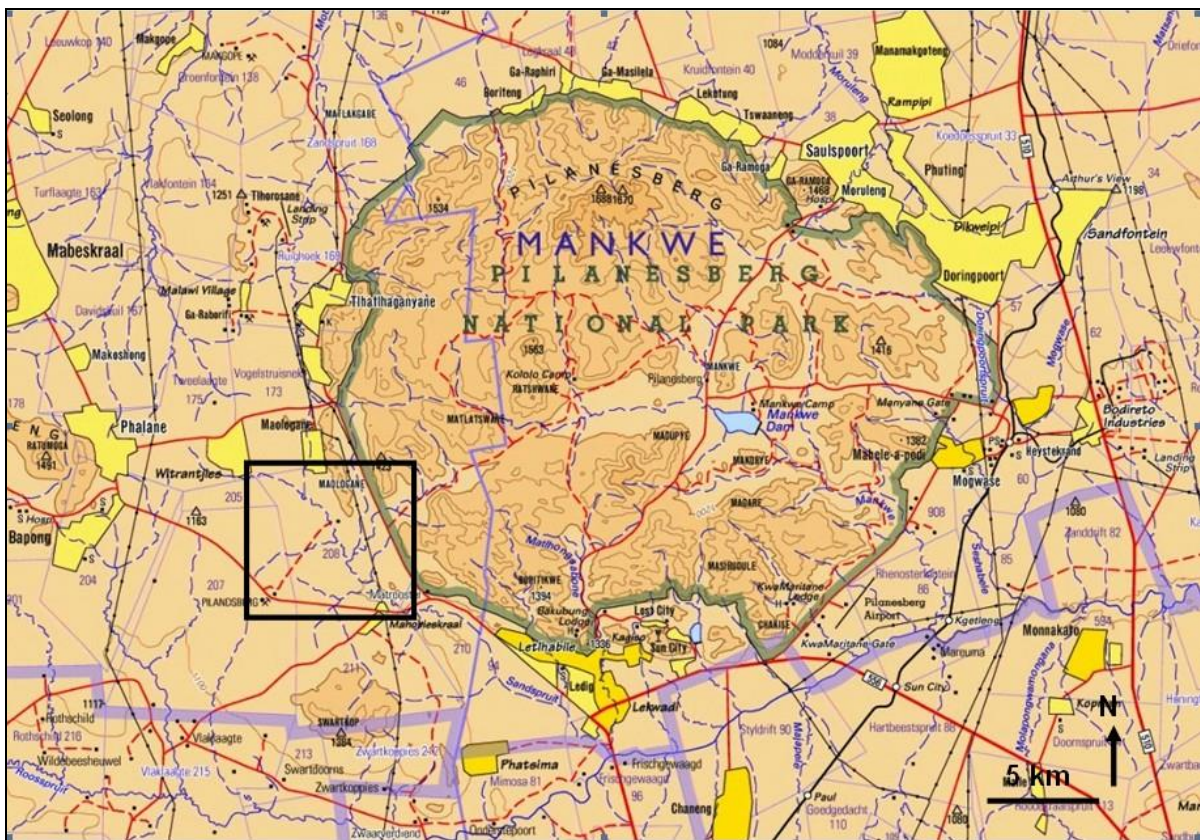


Figure 1. Extract from 1: 250 000 topographical map 2526 Rustenburg (courtesy of the The Chief Directorate: National Geo-spatial Information, Mowbray) showing the approximate location of the study area on Farm Palmietfontein 208 JP on the south-western margin of the Pilanesberg National Park, Northwest Province (black rectangle).

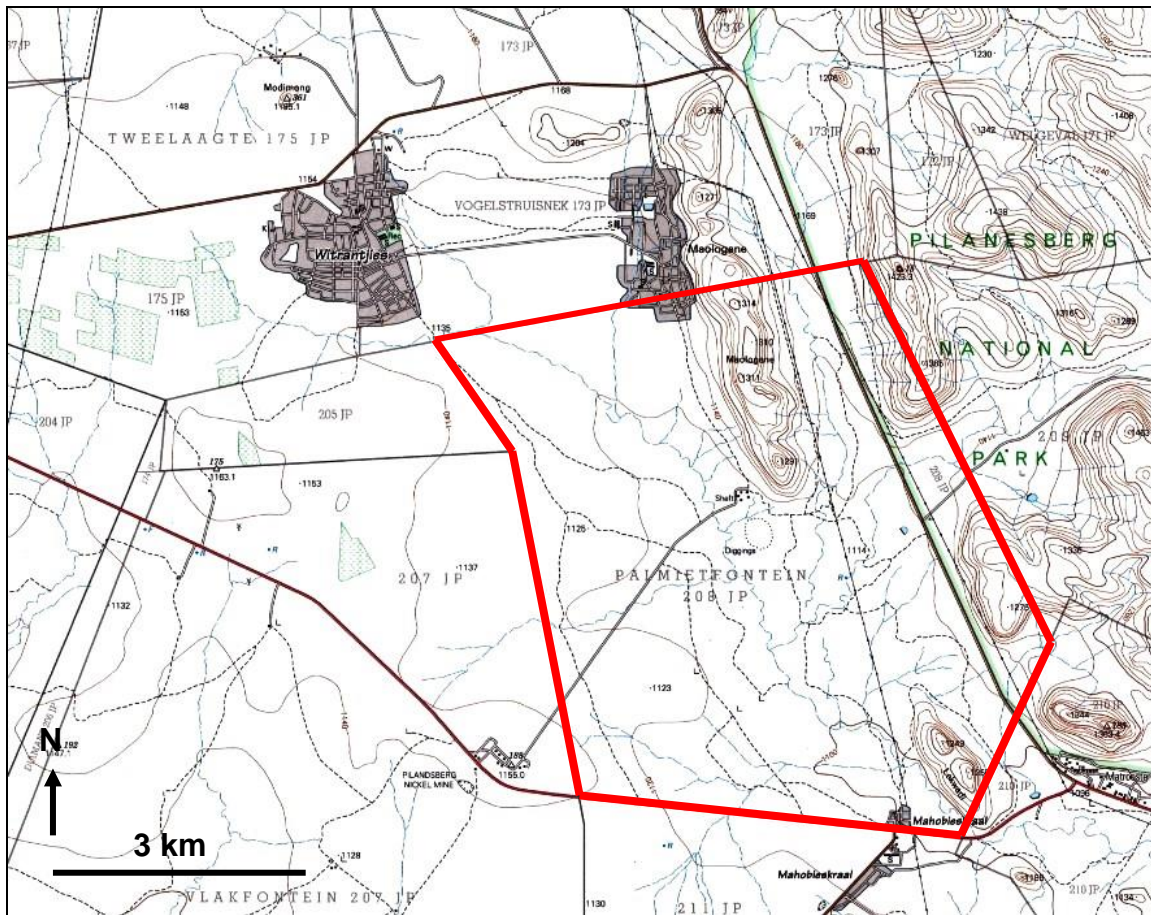


Figure 2. Extract from 1: 50 000 topographical sheet 2526 BD Mabaalstad (courtesy of the The Chief Directorate: National Geo-spatial Information, Mowbray) showing the study area on farm Palmietfontein 208 JP to the south of the communities of Witrantjie and Maologene (red polygon).

1.1. Legislative Framework

The present palaeontological heritage assessment report contributes to the Basic Assessment for the proposed development and falls under the South African Heritage Resources Act (Act No. 25 of 1999). It will also inform the Environmental Management Programme (EMPr) for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites; and
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

- (1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.

- (2) All archaeological objects, palaeontological material and meteorites are the property of the State.
- (3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- (4) No person may, without a permit issued by the responsible heritage resources authority—
 - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
 - (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- (5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
 - (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
 - (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
 - (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
 - (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by the South African Heritage Resources Agency, SAHRA (2013).

1.2. Study approach and methodology

The footprint of the proposed prospecting and mining development is small, while the inferred palaeontological sensitivity of the study area based on geological maps and the SAHRIS palaeosensitivity map is LOW. A desktop-level palaeontological impact assessment is therefore appropriate here.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc.*) represented within the study area are determined from geological maps and

satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (provisional tabulations of palaeontological sensitivity of all formations in the Eastern Cape have already been compiled by the author); see also the palaeosensitivity maps provided on the SAHRIS website). The likely impacts of the proposed development on local fossil heritage are then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field-based assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation or monitoring required before or during the construction phase of the development.

1.3. Limitations of this study

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies.
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

- a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc.*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the present study areas near the Pilanesberg, Northwest province, confidence levels for this palaeontological impact assessment are moderately high, based on the local geology, despite the lack of previous field-based palaeontological assessments in the region.

2. GEOLOGICAL BACKGROUND

Farm Palmietfontein 208 JP is situated on the south-western margin of the circular Pilanesberg massif (Fig. 1) This area comprises fairly flat-lying, semi-arid, sandy to rocky terrain at around 1100 m amsl and is drained by a network of shallow, ephemeral streams that are tributaries of the SE-flowing Sandrivier drainage network (Figs. 2 & 3). Narrow rocky ridges up to 1300 m amsl are present in the northern and south-eastern parts of the area.

The geology of the Pilanesberg region is shown on 1: 250 000 sheet 2526 Rustenburg (Fig. 4) (Walraven 1981). The higher ground in the east belongs to the outer edge of Pilanesberg alkaline igneous complex that forms a major part of the 1450-1200 Ma (million-years old) Pilanesberg Alkaline Province which was intruded through the Kaapvaal Craton in Precambrian (Proterozoic) times (Verwoerd 2006). This circular feature is of considerable geo-heritage significance as one of the largest (*c.* 28 km wide) and best-studied alkaline igneous provinces in the world (Lurie & Viljoen 2016). The volcanic components of the complex have been preserved by cauldron collapse as well as protective cover by Karoo Supergroup sediments (since eroded off). The Pilanesberg complex was emplaced within much older country rocks of the equally famous Rustenburg Layered Suite, a vast layered intrusion of mafic magma that was injected into the Kaapvaal Craton crust around 2060 Ma, *i.e.* in Early Proterozoic or Vaalian times (Cawthorn *et al.* 2006). The Bushveld Complex has been described as “One of the great geological wonders of the world” – the largest layered igneous complex in the world with the richest reserves of platinum group metals known anywhere. The bedrocks in the lower-lying, western and central portions of the study area belong to the Rustenburg Layered Suite succession and have been mined there for a wide range of metals (red symbols in Fig. 4). Potentially diamond-bearing kimberlite pipes and dykes (black diamond symbols, lines marked “k” on geological map) in the Pilanesberg area belong to the Cretaceous Kimberley Province of Late Cretaceous age (99-70 Ma) (Skinner & Truswell 2006). The bedrocks in the study area are extensively mantled by a range of Late Caenozoic superficial sediments that are mapped as undifferentiated surface deposits (Q, yellow in Fig. 4). These include stream alluvium, scree and downwasted rock rubble, surface gravels, sands and soils (field photos in Matenga 2017). The distinctive black soils (“turf”) occurring to the west of the Pilanesberg, and

clearly seen in satellite images (Fig. 3), are transported soils unrelated to the underlying bedrocks. Apparently, they are weathering products of dolomitic rocks of the Malmani Subgroup (Transvaal Group) cropping out to the north (Walraven 1981).



Figure 3. Google earth© satellite image of the southwestern margin of the Pilanesberg showing the terrain in the study area (compare with Fig. 2). Note the black “turf” soils occurring to the west of the Pilanesberg. Scale bar = 5 km.

3. PALAEOLOGICAL HERITAGE

Precambrian igneous bedrocks of the Rustenburg Layered Suite (Bushveld Complex) and the Pilanesberg alkaline igneous complex underlying the study area are completely unfossiliferous. The same applies to the Late Cretaceous kimberlite intrusions. The Late Caenozoic superficial deposits might contain very sparse fossil or subfossil remains, such as vertebrate bones, teeth and horn cores or plant material such as subfossil wood, but in general they are of very low palaeontological sensitivity. To the author’s knowledge, there are no fossil records from the study area.

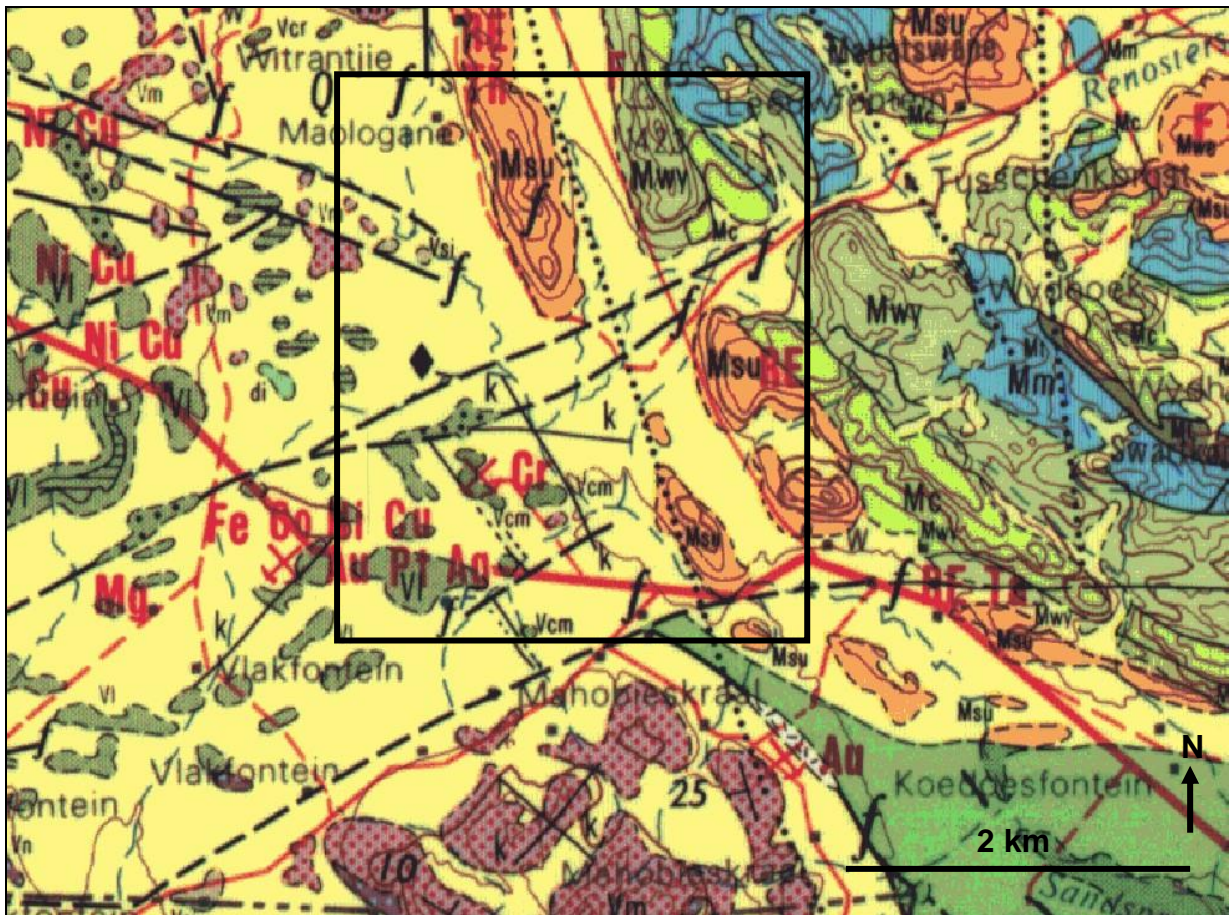


Figure 4. Extract from 1:250 000 geological map 2526 Rustenburg (Council for Geoscience, Pretoria) showing the approximate location of the mining rights study area on farm Palmietfontein 208 JP near Pilanesberg, Northwest Province (black rectangle). Orange areas (Msu) in the east form the margin of the Precambrian Pilanesberg alkaline igneous complex while grey areas (VI, Vcm) further west belong to the yet older Rustenburg Layered Suite (Bushveld Complex). Pale yellow areas (Q) comprise various Late Caenozoic superficial deposits, including alluvium and surface gravels.

4. CONCLUSIONS & RECOMMENDATIONS

The Precambrian and Cretaceous igneous bedrocks in the study area on Palmietfontein 208 JP near Pilanesberg are unfossiliferous while the overlying Late Caenozoic superficial sediments are of very low palaeontological sensitivity. It is concluded that the proposed prospecting and mining developments are of very low impact significance in terms of palaeontological heritage resources. It is noted that the Pilanesberg Alkaline Complex is a world-class geological site of considerable scientific and geoheritage significance.

It is recommended that, pending the discovery of significant new fossils remains before or during mining, exemption from further specialist palaeontological studies and mitigation be granted for the proposed diamond prospecting and mining on Farm Palmietfontein 208 JP.

Should significant new fossils - such as vertebrate bones and teeth - be exposed during borrow pit excavation, the responsible Environmental Control Officer should alert SAHRA (*i.e.* The South African Heritage Resources Authority). Contact details: Dr Ragna Redelstorff, SAHRA, P.O. Box 4637, Cape Town 8000. Tel: 021 202 8651. Email: rredelstorff@sahra.org.za or Ms Natasha

Higgitt. Tel: 021 462 4502. Email: nhiggitt@sahra.org.za) as soon as possible so that appropriate action can be taken in good time by a professional palaeontologist. Palaeontological mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as of associated geological data (e.g. stratigraphy, sedimentology, taphonomy). The ECO should be guided by the generic Fossil Finds Procedure developed by Heritage Western Cape that is appended with this report.

The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013). These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the mining development.

Please note that all South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils cannot be collected, damaged or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency (in this case SAHRA).

5. KEY REFERENCES

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6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Gauteng, KwaZulu-Natal, Mpumalanga, Limpopo, Northwest and Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has been a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and AHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



**Dr John E. Almond,
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