

**Development on Portion 132 of the
Farm Honingklip 178IQ, Erf 30,
Letamo Estate, Mogale Local
Municipality, Gauteng**

**PALAEONTOLOGICAL IMPACT ASSESSMENT
REPORT**

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1. Executive Summary

The underlying geology in the study area is mostly covered with grass and shallow soil and few outcrops are visible. The underlying rocks will be exposed during development.

The study site is underlain by highly deformed and metamorphosed mafic and ultramafic igneous rocks of the Muldersdrift Complex of the Archaean Basement. It is considered by some that this geological unit may contain microfossils based on the chronostratigraphic correlation with similar Swazian-aged rocks in the Barberton area. No microfossils have been reported from the Archaean Basement rocks in Gauteng however and it is highly unlikely that any would be found here.

2. Introduction

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area that may be impacted by the proposed development.

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in inter alia the origin of dinosaurs, mammals and humans. Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and played a crucial role in the discovery of Gondwanaland and the formulation of the theory of plate tectonics. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa has the longest record of palaeontological endeavour in Africa. South Africa was even one of the first countries in the world in which museums displayed fossils and palaeontologists studied earth history. South African palaeontological institutions and their vast fossil collections are world-renowned and befittingly the South African Heritage Act is one of the most sophisticated and best considered in the world.

Fossils and palaeontological sites are protected by law in South Africa. Construction and mining in fossiliferous areas may be mitigated in exceptional cases but there is a protocol to be followed.

This is a Palaeontological Impact Assessment which was prepared in line with Regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involved a site visit where the palaeontologist evaluated the nature of the geology and potential palaeontology of the study site and an overview of the literature on the palaeontology and associated geology of the area.

3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(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 with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.
- **Subsection 35(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 procedures 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.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports. The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them. The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A **Palaeontological Desktop Study** – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial

photos, etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A **Phase 1 Palaeontological Impact Assessment** is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is **unknown**. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A **Phase 2 Palaeontological Mitigation** involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

4. Details of study area and the type of assessment:

The study area (yellow rectangle in Figure 1) is situated in the area bordering the Cradle of Humankind World Heritage Site (COHWHS) north of Krugersdorp in Gauteng.

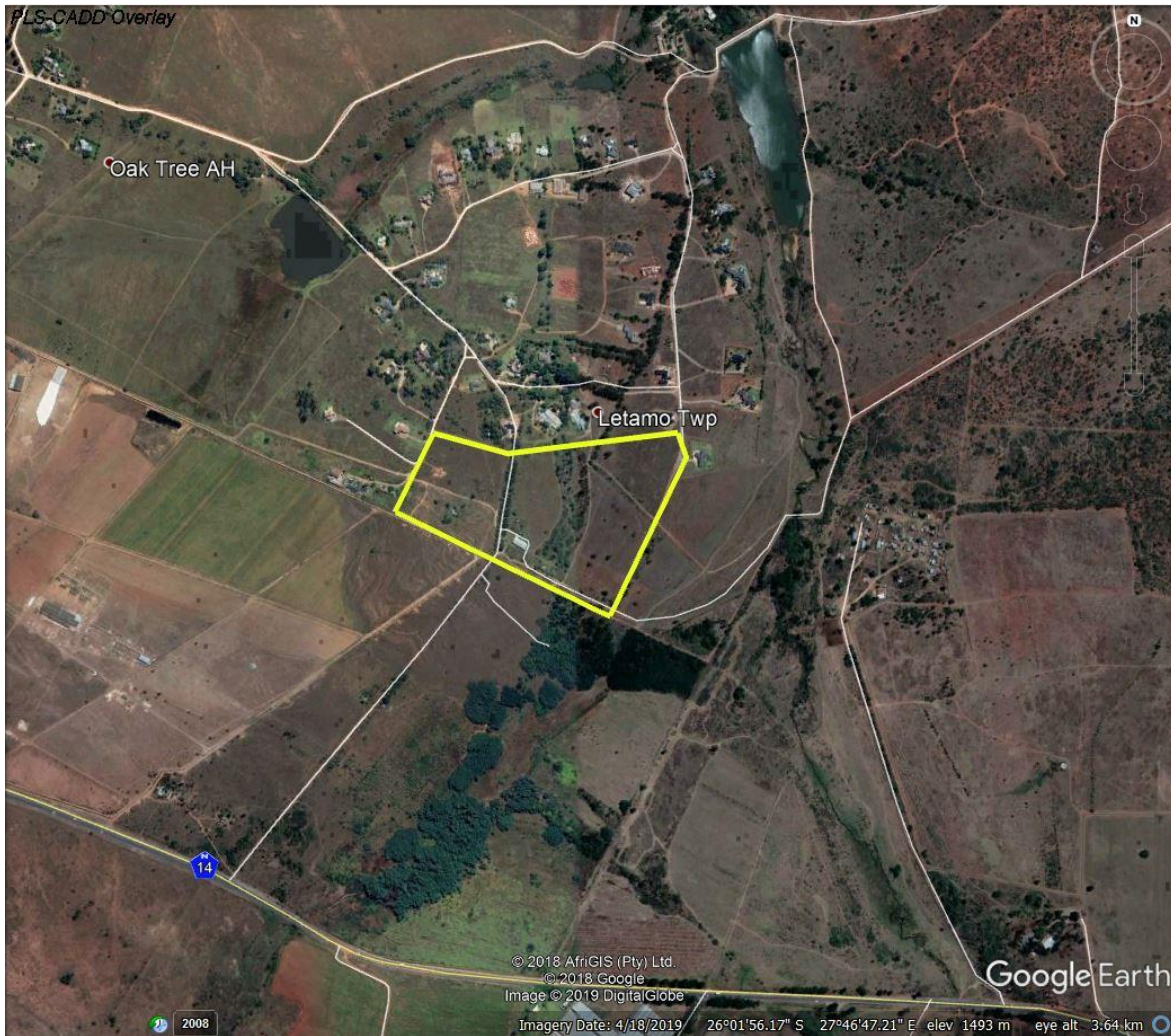


Figure 1: Google Earth photo indicating the study area (yellow rectangle)

The study site was visited and the relevant literature and geology map for the study area, in which the development is proposed to take place, have been studied for a Palaeontological Impact Assessment.

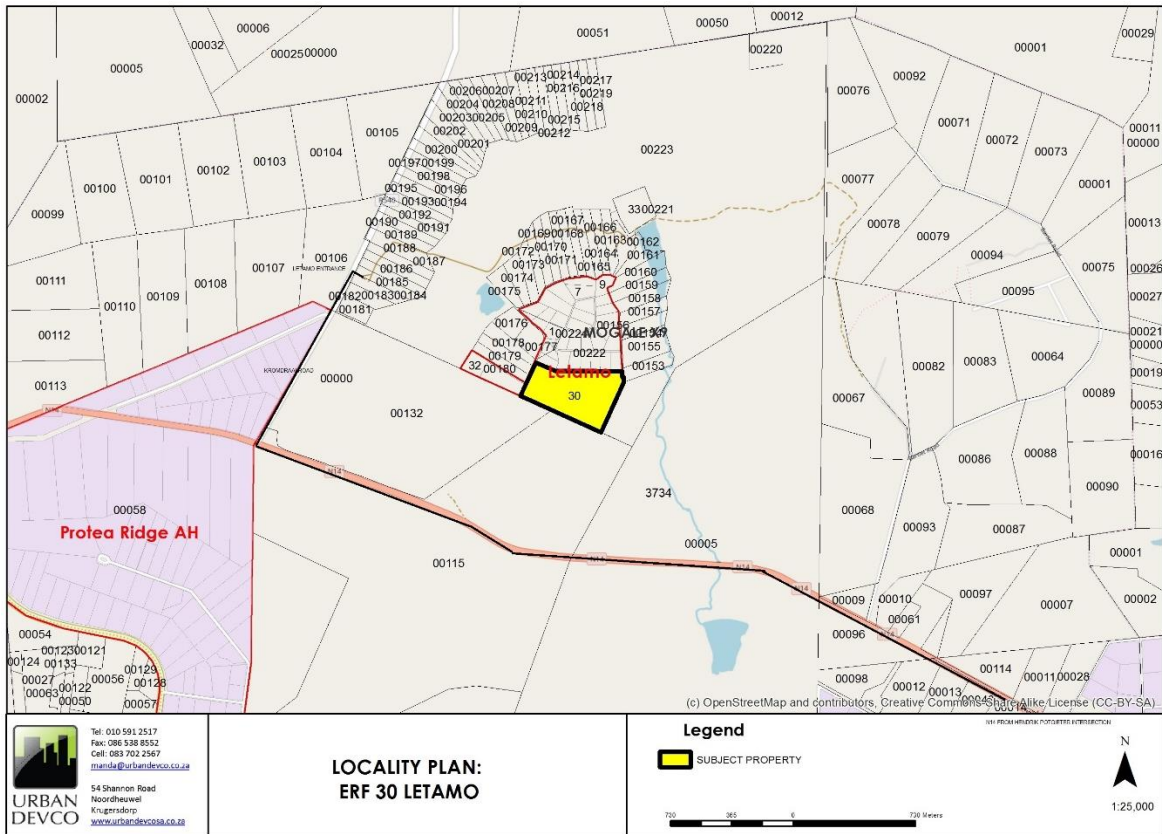


Figure 2: Site plan of proposed development

The study site is situated in the existing Letamo Estate (see Fig. 2). The estate is known for its low housing density, natural grassland, wetland and wildlife. A previous palaeontological assessment was done in 2001 for the Letamo Estate.

5. Geological setting of the study area



The study area is indicated by the black polygon

Figure 3: Geology of the study site and surroundings. Adapted from the 2626 WEST RAND 1:250 000 Geology Map (Geological Survey, 1986)

GEOLOGICAL LEGEND

	Lithology	Stratigraphy		Age
Vdi	Diabase			
Vmd	Stromatolitic carbonates (limestone, dolomite), minor chert, mudrock and carbonaceous shale.	Malmani Subgroup of the Chuniespoort Group	Transvaal Supergroup	Vaalian
Vbr	Quartz arenites, conglomerates and subordinate mudrocks	Black Reef Formation		
Rh	Ferruginous shale, quartzite	Hospital Hill of the West Rand Group	Witwatersrand Supergroup	Randian
Ro	Quartzite, shale	Orange Grove of the West Rand Group		
Zm	Mafic and ultramafic rocks	Muldersdrif Complex		Swazian

Mafic and ultramafic igneous rocks of the Muldersdrif Complex of the Johannesburg Dome underlie the study site (Ahaeusser, 1978) (see Fig. 3). The Muldersdrif ultramafic layered intrusion consists of dunite, harzburgite and pyroxenite, all of which had been metamorphosed into serpentinite and various amphibolite, chlorite and talc schists (Anhausser, 2009). The age of this intrusion could not be determined directly because of the lack of material suitable for dating

but may be older than the 3.20-3.34 Ga intrusive tonalitic and trondhjemitic gneisses recoded elsewhere on the Johannesburg Dome (Anhausser, 2009).

The sedimentary layers that constitute the Witwatersrand Supergroup were deposited on top of the Archaean Basement when deltas, fed by large river systems, fed into an inland sea in the Witwatersrand Basin approximately 2.8 Ga (McCarthy and Rubidge, 2005).

The 8000 m thick Witwatersrand Supergroup is subdivided into two main divisions, the lower unit called the West Rand Group and an upper unit known as the Central Rand Group. The West Rand Group is in turn subdivided into three units: the Hospital Hill Subgroup, Government Reef Subgroup and Jeppestown Subgroup. The Central Rand Group is subdivided into the Johannesburg Subgroup and the Turffontein Subgroup. Each of these strata derived its name from the area where it was first described, but is not limited to that area. The Johannesburg Subgroup of the Central Rand Group contained the richest deposit of gold and was mined extensively throughout the Witwatersrand Basin (McCarthy and Rubidge, 2005, Viljoen and Reimold, 2002).

The Transvaal Supergroup overlies the Ventersdorp Supergroup discordantly. The basal layer of this sequence, called the Black Reef, consists of sedimentary rock which contains limited deposits of gold. The area occupied by the Witwatersrand Basin sediment was eroded heavily by an extensive northwards-flowing river system more than 2.2 Ga (Viljoen and Reimold, 2002).

The Chuniespoort Group of the Transvaal Supergroup overlies the Black Reef Formation. The Chuniespoort Group consists of chemical and biochemical sediments including stromatolitic carbonates and banded ironstone. This unit which is approximately 1200-2000m thick in Gauteng and Northwest Province was set down during the transgression of the Transvaal Supergroup epeiric sea approximately 2.67 – 2.46 Ga (Eriksson *et al.*, 2001). The carbonates which were set down 2.643 - 2.520 Ga (Obbes, 2000) are subdivided into several formations most of which were dolomitised and partially silicified (Eriksson and Reczko, 1995) (Fig.4). The Transvaal Supergroup rocks include quartzite, mudstone, shale, siltstone, conglomerate, limestone, diamictite, tuff and andesite suggesting a range of depositional sources ranging from alluvial fans, floodplains, deltas to coastal and deep basinal environments (Eriksson *et al.*, 2009).

6. Site visit



Figure 4: 26°01'55.32"S 27°46'39.65"E looking North



Figure 5: Rocky outcrop at 26°01'55.32"S 27°46'39.65"E

7. Palaeontological potential of the study area



Figure 5: Palaeosensitivity map of the study site (white polygon) and surroundings (SAHRA, 2019)

Colour	Palaeontological Significance	Action
RED	VERY HIGH	Field assessment and protocol for finds are required.
GREEN	MODERATE	Desktop study is required.
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required.

The Plio-Pleistocene palaeontological sites in South Africa are situated within the Malmani Subgroup dolomites in the northern part of South Africa. The abundance of the dolomitic caves in this region is the main reason for the concentration of heritage resources in the COHWHS. Although hundreds of fossil sites have been discovered in the Cradle of Humankind and surroundings, 13 were selected for their exceptional fossil content and preservation for inscription into the COHWHS by UNESCO. These are: Bolt's Farm, Sterkfontein, Swartkrans, Coopers, Kromdraai, Minnaars, Drimolen, Wonder Cave, Motsetse, Gondolin, Haasgat, Gladysvale and the one closest to the proposed development: Plovers Lake. These sites yielded hundreds of thousands of fossils, including hominin fossils. Subsequently, after the proclamation of the COHWHS, more hominin-bearing fossil sites were discovered including Rising Star Cave and Malapa. The fossiliferous Malmani rocks are situated approximately 2 km west northwest of the study site.

Although no fossils have been reported from the igneous Archaean Basement rocks in Gauteng, some consider that there may be a possibility that microbial fossils and microbial trace fossils could be preserved within cherts and volcanic

glasses similar to those in similar-aged Barberton Greenstone Belt rocks (Groenewald & Groenewald, 2014). For this reason the rocks of the study area are considered to be of Low Palaeontological Sensitivity (see Fig. 5) and a Chance Find Procedure has to be included in the report (pp. 15-16).

References:

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McCarthy, T. & Rubidge, B. (2005). Earth and Life. Kumba Resources. Struik, Pretoria.

Obbes, A.M. (2000) The structure, stratigraphy and sedimentology of the Black Reef-Malmani-Rooihogte succession of the Transvaal Supergroup southwest of Pretoria. Bulletin 127, Council for Geoscience, South Africa.

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8. Conclusion and recommendations:

The study area (Portion 132 of the Farm Honingklip 178IQ) is covered in shallow soil and tall grass with few rocky outcrops. The shallowness of the soil is vividly evident from the neighbouring area to the south of Letamo where the developer has removed the bedrock and has graded the property down to the bedrock for development. I could not find any SAHRA heritage report for this development however.

The study site is underlain by the igneous mafic and ultramafic rocks of the Archaean Basement. It is highly improbable that any fossils would be found in these rocks.

In the highly unlikely event that a significant fossil find is made in chert or volcanic glass in the highly distorted and metamorphosed igneous rocks or the soil cover of the study site, the ECO should take the following steps:

PROCEDURE FOR CHANCE PALAEOLOGICAL FINDS

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during the life of the project:

1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

- a. The material is of no value so development can proceed, or:

b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:

c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.

7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

9. Declaration of Independence:

I, Jacobus Francois Durand declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, 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.



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