

RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES:

PROPOSED GATEWAY FUEL STATION & CONVENIENCE CENTRE ON ERF 767 IN JAN KEMPDORP, PHOKWANE MUNICIPALITY, NORTHERN CAPE

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EXECUTIVE SUMMARY

The predominantly volcanic basement rocks of the early Precambrian Ventersdorp Supergroup underlying the proposed Gateway Fuel Station project area on Erf 767 Jan Kempdorp, Northern Cape, at depth are probably entirely unfossiliferous; no lacustrine stromatolites (fossil microbial mounds) have been reported from this area so far. The overlying Kalahari Group sediments (aeolian sands) mantling the Precambrian bedrocks are generally of low palaeontological sensitivity. It is concluded that further development of the already disturbed urban site is unlikely to have significant impacts on local palaeontological heritage resources.

It is therefore recommended that, pending the discovery of significant new fossils remains during construction of the proposed fuel station and convenience centre, exemption from further specialist palaeontological studies and mitigation be granted for this project.

Should any substantial fossil remains (e.g. well-preserved stromatolites, mammalian bones and teeth) be encountered during excavation, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, i.e. The South African Heritage Resources Authority, as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. A tabulated Fossil Chance Finds Procedure is appended to this report.

1. OUTLINE OF THE PROPOSED DEVELOPMENT

The company HHH General Trading (Pty) Ltd is proposing to re-open an existing, non-operational, fuel station, converting it into a modern fuel station with related infrastructure on Erf 767, situated along National Route 18 in Jan Kempdorp, Phokwane Municipality, Northern Cape (Figure 2). The following project description has been provided by Onyxia Environmental Management:

Erf 767 is currently zoned as Business Zone 1 and was previously used as a fuel station. The site has become derelict; however, the existing infrastructure is in such a condition that it can be

refurbished for future use. As such, the applicant is proposing the following as part of the development:

- It is proposed to decommission the existing underground tanks for refurbishment and re-use as above-ground diesel tanks with a combined capacity of 30 m³.
- Additional new underground tanks will be installed for storage of petrol, with a combined capacity of 30 m³.
- Refurbish the existing infrastructure (buildings, roof structures for the carport, driveways, etc.) for future use. The refurbishment will include upgrades and expansions to the existing buildings.
- Accommodate modern and newly-planned infrastructure and services at the refurbished site, including the provision of a convenience centre. It is proposed to develop the convenience centre with an area which can serve as an outlet for produce from local suppliers (e.g. pecan nuts and maize meal).
- Provide parking space for trucks and small vehicles.
- Upgrade the access from and to the N18 to allow for large vehicle access and safe deceleration and acceleration lanes.
- Indigenous landscaping and storm water design.

Since the fuel station site overlies potentially fossiliferous bedrocks, a desktop palaeontological heritage assessment of the project area has been requested by the South African Heritage Resources Agency (Their Case 13333; Interim Comment Letter of Jan. 17, 2019) in accordance with the National Heritage Resources Act (No. 25 of 1999).

The present palaeontological heritage comment (PIA) for the Jan Kempdorp fuel station has been commissioned by Ms Anèl Dannhauser of Onyxia Environmental Management, Fish Hoek (Address: Postnet Suite 26, Private Bag X2, Fish Hoek, 7974. Cell: 084 955 7080; Fax: 086 471 4954. Email: anel@onyxia.co.za). The PIA will contribute to the Heritage Impact Assessment for the project that is being compiled by Professor David Morris of Sol Plaatjie University, Kimberley, as part of the Basic Assessment process for this development.

2. GEOLOGICAL BACKGROUND

The Gateway Fuel Station project area is situated in flat terrain at 1150-1160 mamsl on the western side of N18 Warrenton to Vryburg tar road, on the southern outskirts of Jan Kempdorp town. The site is already disturbed by urban development. Satellite images show that the broader region is largely transformed for agriculture. A couple of small, shallow pans lie less than a kilometre to the west and there are no obvious drainage lines close to the site; the Harts River bed lies some 4 km to the east. The broader region outside town is mantled in orange-hued sandy soils with Savannah vegetation.

The geology of the Jan Kempdorp area is shown on 1: 250 000 geology sheet 2724 Christiana and briefly described in the accompanying sheet explanation by Schutte (1994) (Fig. 1). The study area is underlain by ancient Precambrian bedrocks of the Ventersdorp Supergroup that are mantled here with aeolian (wind-blown) sands of the Kalahari Group.

The **Ventersdorp Supergroup** represents a major episode of Archaean igneous extrusion (LIP = Large Igneous Province) that is associated with fracturing of the Kaapvaal Craton some 2.7 Ga (billion years) ago (Van der Westhuizen *et al.* 2006). The basal lava pile termed the Klipriviersberg

Group - mainly basaltic lavas welling up in fissure eruptions, totalling up to two kilometres thick and 100 000 km² in extent - accumulated over a comparatively short period of some six million years (McCarthy & Rubidge 2005). The overlying **Platberg Group** comprises a range of felsic to mafic volcanic rocks, including lavas and pyroclastics, as well as subordinate carbonate and siliclastic sediments. The present study area probably overlies the **Rietgat Formation** (Rr, green with V-symbols in Fig. 1) within the upper part of the Platberg Group. According to Schutte (1994) the Rietgat Formation in the Taung – Jan Kempdorp region comprises various volcanic rock types such as lavas, tuffs, tuffites and cherts that overlie quartz porphyries of the Makwassie Formation.

Aeolian (wind-blown) sands overlying the Precambrian bedrocks near Jan Kempdorp (Qw, pale yellow in Fig. 1) can be provisionally assigned to the **Gordonia Formation** of the Kalahari Group. These sands are of Quaternary to Recent age (Thomas 1981, Dingle *et al.* 1983, Thomas & Shaw 1991, Schutte 1994, Haddon 2000 and Partridge *et al.* 2006).

3. PALAEOLOGICAL HERITAGE

The fossil heritage associated with each of the major rock units represented in the Jan Kempdorp fuel station study area is briefly outlined here.

The volcanic rock units that dominate the Archaean **Ventersdorp Supergroup** succession are unfossiliferous. However, domical stromatolites (microbial mounds, sometimes building reef-like structures) are recorded from shallow water lacustrine calcarenites within the volcano-sedimentary succession of the **Rietgat Formation** at the top of the Platberg Group (Schopf 2006, Van der Westhuizen *et al.* 2006). The overlying predominantly siliclastic Bothaville Formation contains conical stromatolites (Schopf 2006). Carbonate sediments are not reported in association with the Allanridge Formation lavas at the top of the Ventersdorp Supergroup, however. Since lacustrine sediments are not reported from the Rietgat Formation in the Jan Kempdorp region, it is considered highly unlikely that fossil stromatolites are present here and the palaeontological sensitivity of the bedrocks in the study area is accordingly assessed as LOW.

The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks (including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be LOW.

4. CONCLUSIONS & RECOMMENDATIONS

The predominantly volcanic basement rocks of early Precambrian age underlying the Jan Kempdorp fuel station study area at depth are probably entirely unfossiliferous; no lacustrine stromatolites have been reported from bedrocks in this area so far. The overlying Kalahari Group sediments (aeolian sands) mantling the older bedrocks are generally of low palaeontological sensitivity. It is concluded that development of the already disturbed urban site is unlikely to have significant impacts on local palaeontological heritage resources.

It is therefore recommended that, pending the discovery of significant new fossils remains during construction of the proposed fuel station and convenience centre on Erf 767 in Jan Kempdorp, Phokwane Municipality, Northern Cape Province, exemption from further specialist palaeontological studies and mitigation be granted for this project.

Should any substantial fossil remains (e.g. well-preserved stromatolites, mammalian bones and teeth) be encountered during excavation, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, *i.e.* The South African Heritage Resources Authority, as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. A tabulated Fossil Chance Finds Procedure is appended to this report.

5. KEY REFERENCES

ALMOND, J.E. 2008a. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.

HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.

MCCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

SCHUTTE, I.C. 1994. Die geologie van die gebied Christiana. Explanation to 1: 250 000 geology Sheet 2724 Christiana, 58 pp. Council for Geoscience, Pretoria.

SCHOPF, J.W. 2006. Fossil evidence of Archaean life. *Philosophical Transactions of the Royal Society of London B* 361, 869-885.

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press.

VAN DER WESTHUIZEN, W.A., DE BRUIYN, H. & MEINTJES, P.G. 2006. The Ventersdorp Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa*, pp. 187-208. Geological Society of South Africa, Marshalltown.

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, Northwest, Mpumalanga, Kwazulu-Natal and the Free State Provinces under the aegis of his Cape Town-based company *Natura Viva cc*. He has previously served as a 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.



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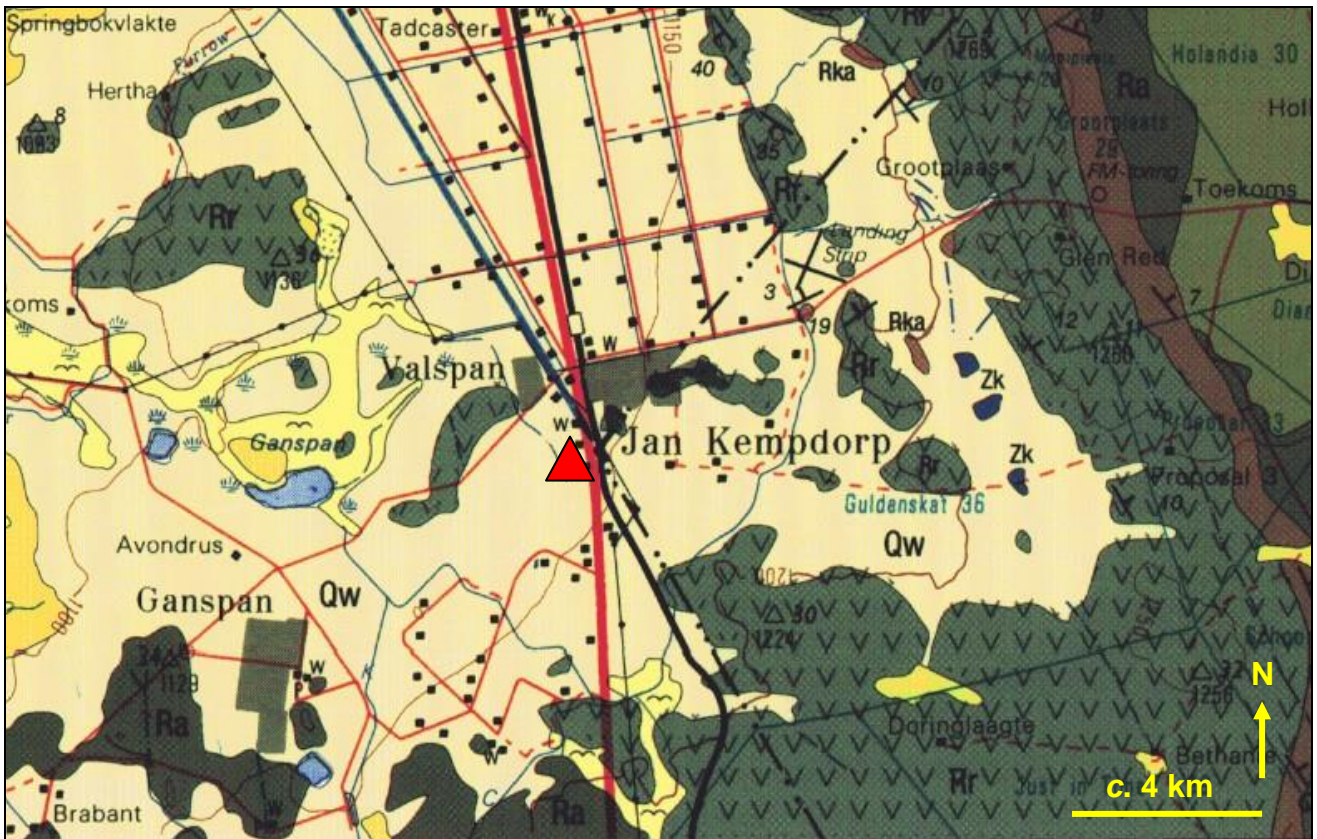


Figure 1: Extract from the 1: 250 000 geology sheet 2724 Christiana (Council for Geoscience, Pretoria) showing the location of the Gateway Fuel Station project site on the southern outskirts of Jan Kempdorpe, Northern Province (red triangle). The main geological units mapped in or beneath the study area are:

1. Precambrian (Archaean) volcanic rocks of the Rietgat Formation (Platberg Group, Ventersdorp Supergroup): Dark grey with V-symbols (Rr)
3. Late Caenozoic (Quaternary to Recent) superficial deposits: reddish aeolian sands of Gerdonia Formation (Kalahari Group): Pale pink (Qw)



Figure 2: Google earth© satellite image showing the location (yellow polygon, arrowed) of the proposed Gateway Fuel Station on the southern outskirts of Jan Kempdorp, Phokwane Municipality, Northern Cape. The project site is located on Erf 767, situated on the western side of National Route 18.

CHANCE FOSSIL FINDS PROCEDURE: Gateway Fuel Station on Erf 767, Jan Kempdorp	
Province & region:	PHOKWANE MUNICIPALITY, NORTHERN CAPE PROVINCE
Responsible Heritage Resources Authority	SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone : +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web : www.sahra.org.za
Rock unit(s)	Gordonia Formation (Kalahari Group) overlying Archaean Rietgat Formation bedrocks (Ventersdorp Supergroup)
Potential fossils	Calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (e.g. tortoise) bones, teeth within Gordonia sands. Possible lacustrine stromatolites (microbial mounds) within underlying Ventersdorp bedrocks.
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering)
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation • Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
	4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority	
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.