Palaeontological desktop study of the farms De Paarl 246, Goedgedacht 255, Bedford 254 and Syferbult 257 situated near Dwaalboom, North West Province.

Report prepared by Palaeo Field Services, PO Box 38806 Langenhovenpark 9330.

15 October 2018

Summary

The desktop investigation indicates that the proposed study area is underlain by potentially fossil-bearing sedimentary strata (stromatolitic carbonate interbeds) of the Early Proterozoic Timeball Hill Formation (Pretoria Group, Transvaal Supergroup) that are capped by superficial deposits of low to very low palaeontological sensitivity. It will be difficult to determine the potentially adverse effect of excavations into potentially fossil-bearing bedrock sediments underlying the area other than to emphasize that such impacts on fossil heritage are generally irreversible. Conversely, the recovery of new fossils as a result of industrial excavation activities can also be considered a positive impact, but only if the process is accompanied by appropriate scientific recording and retrieval methods. As far as palaeontological heritage is concerned, it is advised that a professional palaeontologist is called in once after the trenching process is completed and fresh bedrock is exposed in order to record potential stromatolitic occurrences if planned trenching is going to exceed widths and depths of >1m into unweathered/fresh bedrock where the latter starts below the superficial soil overburden. The palaeontologist must apply for a valid collection / removal permit from SAHRA if fossil material has to be removed afterwards.

Introduction

The report is a preliminary assessment of potential palaeontological impact with regard to application for prospecting rights for drilling and trenching on the farms De Paarl 246, Goedgedacht 255 and Bedford 254 and Syferbult 257, situated about 35 km due west of Northam (R510) and 18 km due south of Dwaalboom, North West Province (**Fig. 1**).

Site Coordinates:

A) 24°52'38.18"S 26°44'21.61"E

B) 24°52'19.32"S 26°55'48.00"E

C) 24°54'54.83"S 26°55'44.66"E

D) 24°54'52.33"S 26°43'0.95"E

Methodology

The assessment was carried out in accordance with National Heritage Resources Act 25 of 1999 with the aim to assess the potential impact on palaeontological heritage resources that may result from the proposed development. The palaeontological significance of the affected areas were evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

Assumptions and Limitations

The assessment provided within this report is based upon a desktop study without the benefit of a site visit. As such, the presentation of geological units present within the study area is derived from the 1:1 000 000 scale map of South Africa and the 1:250 000 scale geological map 2426 Thabazimbi, which may vary in their accuracy. It is also assumed, for the sake of prudence, that fossil remains are always uniformly distributed in fossil-bearing rock units, although in reality their distribution may vary significantly.

Background

The roughly northern half proposed of the study area is represented by Transvaal Supergroup dolomites and limestones, subordinate chert, minor carbonaceous shale and quartzites of the late Archaean Malmani Subgroup of the Chuniespoort Group (*Vm*, Button 1973) (**Fig. 3**). The carbonate rocks of the Malmani Subgroup (subgroup located at the base of the Transvaal Supergroup) consist of stromatolite- and microfossil-bearing dolomite, dolomitic limestone and chert members that were formed by the precipitation of carbonate rocks when colonies of shallow marine to intertidal stromatolites and organic walled microfossils thrived in shallow, tropical marine environments at the beginning of the Proterozoic Eon, sometime between 2.6 Ga and 2.4 Ga to form the earliest extensive carbonate reefs. Stromatolites are layered mounds, columns, and sheet-like sedimentary rocks and can be up to several tens of metres across (Truswell and Erikson 1972; Klein *et a*l. 1987). They were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe that lives today in a wide range of environments ranging from shallow marine conditions to lakes,

rivers, and even soils. Cyanobacteria peaked during the time of the Transvaal Supergroup dolomite deposition when vast quantities of O^2 were produced, resulting in the precipitation of massive iron and manganese deposits. Abundant domes of fossil stromatolites may be observed within the Malmani Subgroup dolomites.

The southern half of the study area is underlain by sedimentary rocks of the overlying, Eoproterozoic Timeball Hill Formation (Pretoria Group, Transvaal Supergroup) (**Fig. 3 & 4**). The Timeball Hill is ascribed to a fluvio-deltaic basin-fill sedimentation system and is composed of quartzite, lacustrine and fluvio-deltaic mudrocks, conglomerates and finely-laminated ferruginous shale with thin stromatolitic carbonate interbeds (Eriksson 1973; Erikson *et al.* 2006; Cateneu and Erikson 2002).

Impact Statement Recommendation

The desktop investigation indicates that the area pertaining to the proposed trenching and drilling activities is underlain by potentially fossil-bearing, Transvaal Supergroup sedimentary strata (stromatolitic carbonate interbeds) of the early Proterozoic Timeball Hill Formation (Pretoria Group), that are capped by superficial (Quaternary) deposits of low to very low palaeontological sensitivity, the latter being that the impact area is not situated within or near pan or well-developed alluvial deposits. Palaeontologically sensitive cave breccias are not anticipated in the study area, as opposed to the more cave-rich karst environment provided by the underlying Malmani dolomites, outcropping further to the north (**Fig. 5**). Stromatolites are also more commonly found within the underlying Malmani dolomites (examples, **Fig. 6**).

Given the overall presence of superficial overburden covering the landscape (**Fig. 7**), it will be difficult to determine the potentially adverse effect of trenching into the potentially fossil-bearing, ferruginous shales of the Timeball Formation, other than to emphasize that the chances of impacting on stromatolitic occurrences is moderate to high and that such impacts are generally irreversible. Conversely, the recovery and recording of new fossils as a result of industrial excavation activities can also be considered a positive impact, but only if the process is accompanied by appropriate scientific recording and retrieval methods.

As far as palaeontological heritage is concerned, it is advised that a professional palaeontologist is called in once after the trenching process is completed and fresh bedrock is exposed in order to record potential stromatolitic occurrences if planned trenching is going to exceed widths and depths of >1m into unweathered/fresh bedrock where the latter starts below

the superficial soil overburden. The palaeontologist must apply for a valid collection / removal permit from SAHRA if fossil material has to be removed afterwards.

References

Button, A.1973. The stratigraphic history of the Malmani dolomite in the eastern and north-eastern Transvaal. *Transactions of the Geological Society of South Africa* 76: 229 – 247.

Catuneanua O. And Eriksson P.G. 2002.Sequence stratigraphy of the Precambrian Rooihoogte–Timeball Hill rift succession, Transvaal Basin, South Africa. *Sedimentary Geology* 147:71–88.

Eriksson, K.A. 1973. The Timeball Hill Formation--A Fossil Delta. *Journal of Sedimentary Petrology* (4): 1046-1053.

Eriksson, P.G., Altermann, W. & Hartzer, F.J. 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa,* pp. 237-260. Geological Society of South Africa, Marshalltown.

Klein, C., Beukes, N.J. & Schopf, J.W. 1987. Filamentous microfossils in the early Proterozoic Transvaal Supergroup: their morphology, significance and paleoenvironmental setting. *Precambrian Research* 36: 81-94.

Truswell, J.F. and Erikson K.A. 1972. The morphology of stromatolites from the Transvaal dolomite north-west of Johannesburg, South Africa. *Transactions of the Geological Society of South Africa* 75: 99 – 110.

DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project.

15 / 10 / 2018

Figure 1. Locality of the study area in relation to postion of Northam and Dwaalboom.

Figure 2. Aerial view of the study area with proposed trenching an drilling positions marked on layout.

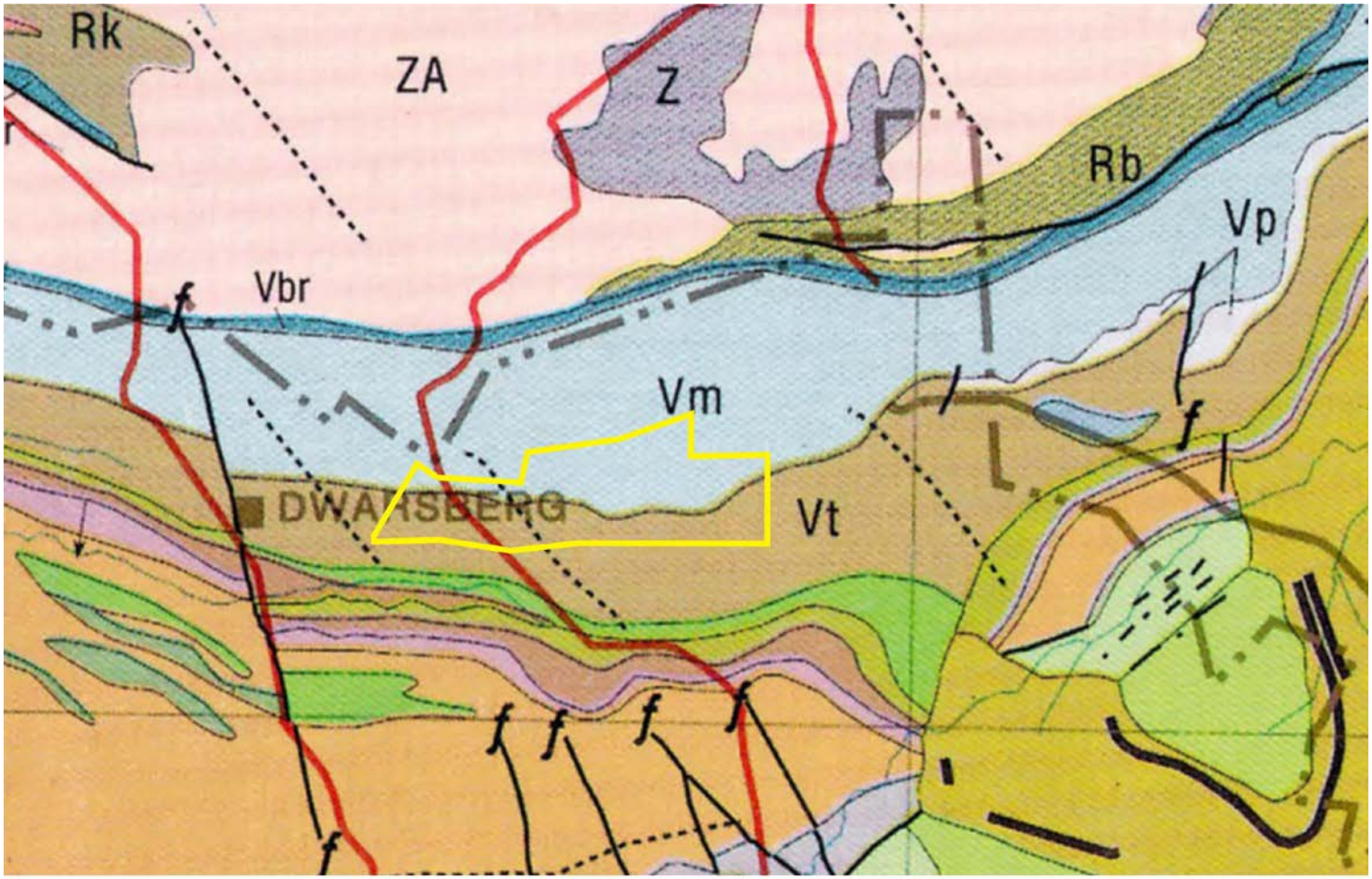

Figure 3. Study area (yellow polygon) marked on portion of 1: 1Ma scale geological map of South Africa. The roughly northern half proposed of the study area is represented by Transvaal Supergroup dolomites and limestones, subordinate chert, minor carbonaceous shale and quartzites of the late Archaean Malmani Subgroup (*Vm*), while the southern half of the study area is underlain by sedimentary rocks of the overlying, Eoproterozoic Timeball Hill Formation (*Vt,* Pretoria Group, Transvaal Supergroup)

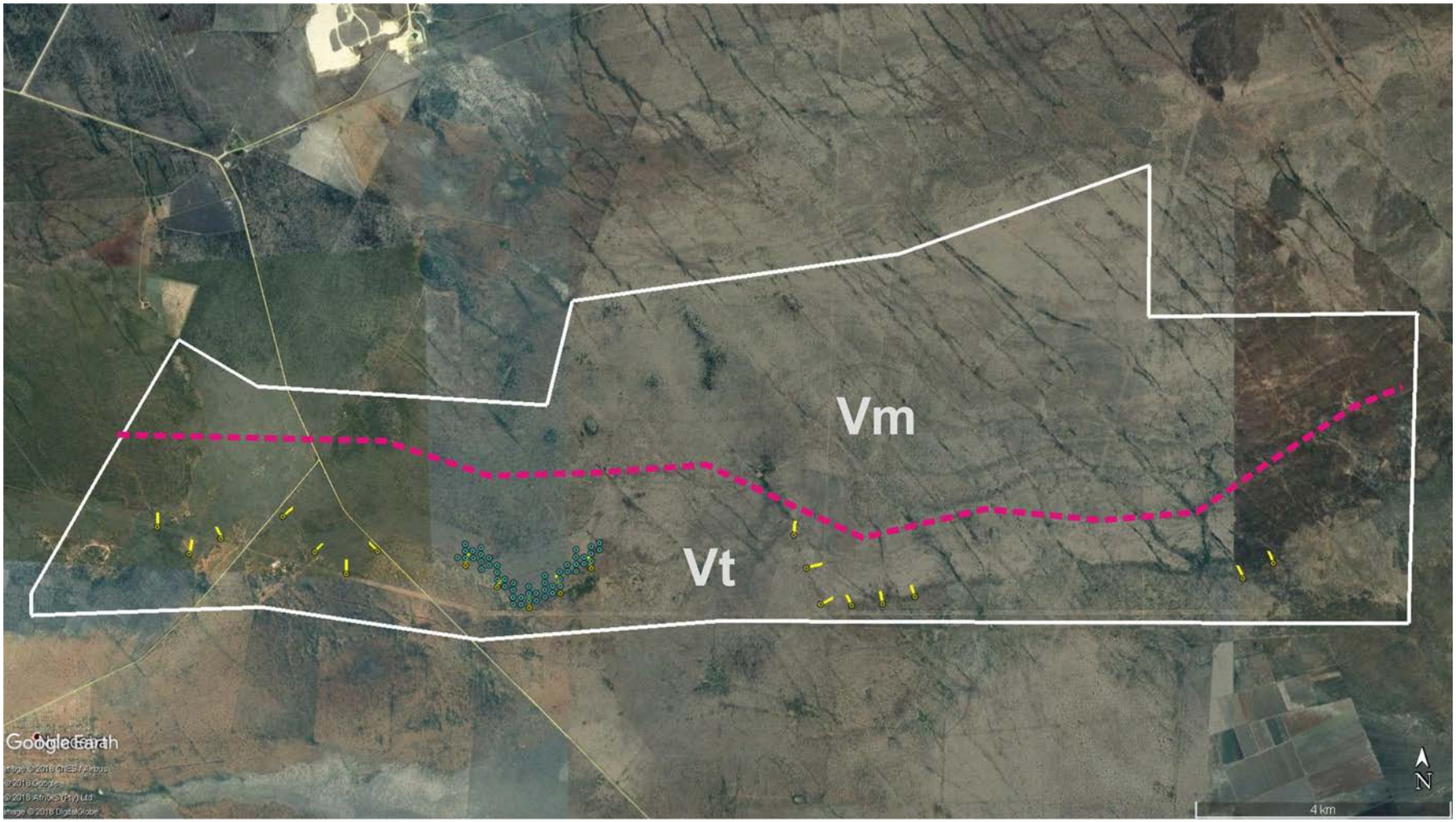

Figure 4. Approximate distribution of Malmani Subgroup dolomites (*Vm*) and Timeball Hill Formation quartzite and mudrocks (*Vt*) outcropping within the study area based on 1:250 000 scale geological map 2426 Thabazimbi.

Figure 5. Example of Pleistocene vertebrate fossils (metapodial & dentition) encased in breccia from cave located in karst environment (Buffalo Cave).

Figure 6. Examples of weathered stromatolite dome structures in Transvaal Supergroup dolomites: Malmani Subgroup (top & center, side view) and Ghaap Group (bottom, plan view).

Figure 7. Google Earth photo capture of the landscape at De Paarl 246.