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PALAEONTOLOGICAL ASSESSMENT (DESKTOP) REQUESTED IN TERMS OF SECTION 38 OF THE NATIONAL HERITAGE RESOURCES ACT NO 25/1999 FOR PROPOSED Prospecting Right on the Farm No.83, Situated in the Magisterial District of Barkly West, Northern Cape Region.

Prepared by

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and

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Sunday, 30 June 2019

DECLARATION OF INDEPENDENCE

Pulafel 4D Consulting Pty Ltd is an independent consultancy: It is hereby declare that it does not have ay interest, be it business, financial, personal or other vested interest in the undertaking of the proposed activity, other than fair remuneration for work performed, in terms the National Heritage Resources Act (No 25 of 1999).

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Full Name: Joseph Chikumbirike

Title / Position: Palaeontologist

Qualifications: PhD in Palaeosciences, University of the Witwatersrand

EXECUTIVE SUMMARY

Table 1: Executive summary details

Item	Description
Proposed development and location	Prospecting Right for diamonds on the Farm No.83, situated in the Magisterial District of Barkly West, Northern Cape Region
Purpose of the study	To carry out a Palaeotological Impact Assessment to determine the presence/absence of fossils and the impact of the proposed project on paleontological resources within the proposed diamond prospecting area.
1:50 000 Topographic Map	2824AB
Coordinates	28° 2'11.16"S, 24°18'11.84"E
Municipalities	Barkly West Magisterial District
Predominant land use of surrounding area	Agriculture (animal husbandry) and mining
Developer	Kimberley Impex Group Pty Ltd
Contact Person	Thato Tau
Contact Details	Cell: 084 929 6029 Email:ttau@telkomsa.net
Heritage Consultant	Pulafel 4D Consulting Pty Ltd
Date of Report	Draft report 27 06 2019
Heritage Contact	

Pulafel 4D Consulting Pty Ltd was commissioned by Kimberley Impex Group Pty Ltd to undertake Palaeontological Impact Assessment (PIA) for Prospecting Right on the Farm No.83, situated in the Magisterial District of Barkly West, Northern Cape Region. In accordance with the terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Department of Mineral Resources of South Africa

request that an HIA report to be produced before prospecting can begin. In compliance with South African heritage legislation, Pulafel 4D Consulting Pty Ltd conducted a desktop assessment of the literature on previous PIA and other relevant information in the project are (Farm No. 83). It is evidently clear from the literature survey that the proposed prospecting project area that the Campbell Rand Group (Vgu) of the Ghaap Group is rich in stromatolite assemblages (stratoform, domical, columnar), and important early microfossil biotas. These are considered to be of **MODERATE** to **HIGH** palaeontological sensitivity. The Vryburg Formation of the Ghaap Group also contain stromatolites in carbonates and are of **MODERATE** palaeotological sensitivity. The surface calcretes **(Qc**) are associated with diatoms, molluscs, stromatolites etc., however, these calcretes are of **LOW** palaeontological sensitivity. Based on the results of the desktop survey, it is therefore concluded that the proposed project area has **moderate** fossil remains. Accordingly, the impact of the proposed development on the heritage resources located during the assessment of the literature is **Moderate sensitivity** (Almond 2009). Therefore, there is no heritage reason to stop the proposed development by Kimberley Impex Group Pty Ltd but great care should be exercised when drilling underground because of the possibility of encountering limestone caves as to the north lies the Taung World Heritage Site, whose cave system produced hominin fossils of great importance. Should this happen, proper reporting procedures should be followed. It is therefore recommended that newly exposed stromatolites should be sampled and recorded during development. According to Groenewald (2014), recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region, and therefore the recommendations made here are significant. Should substantial fossil remains such as mammalian bones or teeth be exposed during construction, SAHRA should be notified by the ECO so that appropriate mitigation can be undertaken.

LIST OF ABBREVIATIONS

AIA - Archaeological Impact Assessment

DARD - Department of Agriculture and Rural Development

DEA - Department of Environmental Affairs (National)

DEADP - Department of Environmental Affairs and Development Planning

DENC - Department of Environment and Nature Conservation (Northern Cape)

DMR - Department of Mineral Resources (National)

HIA - Heritage Impact Assessment

MPRDA - Mineral and Petroleum Resources Development Act, no 28 of 2002

NEMA - National Environmental Management Act, no 107 of 1998

NHRA - National Heritage Resources Act, no 25 of 1999

PIA - Palaeontological Impact Assessment

SAHRA - South African Heritage Resources Agency

SAHRIS - South African Heritage Resources Information System

LIST OF FIGURES

INTRODUCTION

The present desktop palaeontological impact assessment (PIA) has been conducted on behalf of the Kimberley Impex Group Pty Ltd. The proposed prospecting right on the Farm No.83, Situated in the Magisterial District of Barkly West, Northern Cape Region. The desktop PIA was conducted in order to fulfil the requirements for a Heritage Impact Assessment (HIA) as stipulated by Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999).

According to the NHRA Act No. 25 of 1999, palaeontological resources are fossilised remains or traces of animals or plants which lived in the geological times other than fossil fuels or fossiliferous rock intended for industrial use. Therefore, palaeontology is the scientific study of life forms that existed in the earth's distant past through the examination of fossils of plants and animals organisms. The following are examples of fossil types: body fossils, tracks (ichnites), burrows, cast-off parts, coprolites, palynomorphs and chemical residues. The study of palaeontology is very important for reasons such as provision of evidence for the theory evolutionary (life-historical), establishment of long-term physical changes of paleogeography and paleoclimatology that affected the history of life, how ecosystems have responded to these changes and have changed the planetary environment in turn, and how these mutual responses have affected today's patterns of biodiversity.

The Taung child is an example of a fossil discovered in the North Western province of South Africa, at the Buxton quarry, Taung, in 1924. This discovery has helped in understanding of the paths taken by evolution (specifically the theory of descent with modification). Palaeontological studies contribute to the understanding of the development of ecosystems and understanding of how the modern human beings emerged. This site also yielded other primate fossils like baboons.

Location and Physical Setting

The study is located on Farm No.83 which is situated in the Magisterial District of Barkly West, Northern Cape Region. The following coordinates provide the geographic location of the study area: 28° 2'11.16"S, 24°18'11.84"E; 28° 2'15.99"S, 24°18'11.24"E; 28° 2'18.04"S, 24°18'11.02"E; 28° 2'20.41"S, 24°18'19.48"E; 28° 2'20.67"S, 24°18'25.94"E

28° 2'14.54"S, 24°18'20.71"E; 28° 2'16.22"S, 24°19'14.86"E; 28° 2'12.37"S, 24°19'14.03"E; 28° 0'51.14"S, 24°20'13.77"E; 28° 2'11.58"S, 24°18'3.48"E and 28° 2'30.45"S, 24°15'55.63"E. The map below is a portion of a 1:50000 which shows the location of the study area. Figure 2 below shows the project location area.

Figure 1: Location of the project area

LEGAL FRAMEWORK *Relevant heritage legislation*

Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens as some of the various categories of heritage resources that are recognised as part of the National Estate of South Africa (NHRA, 1999, p14 and section 32.1a).

This is to say palaeontological (Fossil) heritage in South Africa is protected, with important exceptions, by the National Heritage Resources Act of 1999 (NHRA, Act 25 of 1999). Therefore a palaeontological impact assessment (PIA) was commissioned as part of a comprehensive Environmental Impact Assessment (EIA) for the proposed prospecting right on the Farm No.83. A desktop study was conducted in order to produce this PIA report for inclusion in an EIA as well as an Environmental Management Plan for the proposed prospecting project.

Sections 34, 35, 36 and 38 of the National Heritage Resources Act (No 25 of 1999) provide the legal basis in which Heritage Impact Assessments are conducted. This PIA study was therefore guided by these statutory references. A PIA is a tool applied in Cultural Resource Management (CRM) to inform intervention strategies and decision-making for the protection of palaeontological heritage resources on the Farm No. 83. According to Section 38 of the NHRA, the nature and scale of development which triggers a PIA as a component of an HIA:

38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50 m in length;

(c) any development or other activity which will change the character of a site—exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by

SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m2 in extent; or

(e) any other category of development provided for in the regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In addition Section 34 provides provisional protection of buildings and structures more than 60 years old:

(1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. On the other hand Section 35 (4) of the NHRA prohibits the destruction of archaeological, palaeontological and meteorite sites:

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.

Section 36 of the NHRA gives priority for the protection of Graves and Burial Grounds of victims of conflict and graves and burial grounds more than 60 years old. Within this frame cautious approaches are considered including managed exhumations and re-interment to pave way for development:

(1) Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit.

(2) SAHRA must identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with the grave referred to in subsection (1), and must maintain such memorials.

(3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and reinternment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

Section 36(6) implies that all kinds of graves found during the course of development must be reported and investigated:

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in co-operation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and

(b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit. A pre-development Heritage Impact Assessment is predicated on Subsection 6 which requires a developer to halt operations if graves are discovered, even as Section 36 does not specify what course of action to take in respect of graves other than those of victims of conflict or less than 60 years old found in an area earmarked for development.

METHODOLOGY AND THEORETICAL APPROACHES

A review of reports of previous HIAs and PIAs conducted in the general locality, books, and project planning documents was conducted. In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations etc.) represented within the study area were determined from geological maps and previous. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region in consultation with professional colleagues as well as examination of institutional fossil collections may play a role here or later. 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 Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; e.g. Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature of the development itself, most notably the extent of fresh bedrock excavation envisaged. The present desktop study also includes the an assessment of the likelihood of fossil material in the proposed area of development, identification of aspects of the planned development that will have direct impact on paleontological deposits and materials, recommendations for management of fossil heritage within the development area, recommendations for mitigation of fossil heritage for the EMP (planning, construction and operation phases). When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field survey by a professional palaeontologist is usually warranted to identify fossil hotspots as a basis for further specialist mitigation.

Assumptions made for this PIA desktop study

The assumption that fossil heritage is fairly uniformly distributed throughout the outcrop area of a given formation is made. Experience has however shown that this assumption does not always hold because of different factors. Some of the factors are that the original depositional setting across a formation that may extend over hundreds of kilometres may vary significantly with palaeoecological implications (e.g. from a shallow to deeper water environment). The occurrence of fossils is often patchy thus weakening the assumption.

Depending on their levels, tectonic deformation (folding, cleavage development etc.), as well as the intensity and nature of metamorphism and weathering experienced by a given formation may change markedly the distribution of these fossils across its outcrop area. Therefore these factors may seriously compromise the preservation of fossil remains present within the original sedimentary rock so that the effective palaeontological sensitivity of a rock unit that is normally highly fossiliferous may be effectively very low in some areas.

GEOLOGY AND THE PALAEONTOLOGICAL PROFILE OF THE AREA

A picture of the palaeontological profile of this part of the Northern Cape can be obtained from the work of Almond (2011, 2012 and 2014). Almond et al. (2009) indicate that large areas of the Northern Cape Province have barely been examined for fossils, if at all. The known sites are widely scattered across the landscape, and the most valuable material there may already have been collected and that most fossils are hidden below ground. It is therefore argued that there is always a chance of striking fossil-bearing rocks and when that happens during the construction phase, they must be reported to the relevant heritage authority. Figure 1 shows the geological time scale which provides a sense of the time period and ages of the palaeontological heritage in South Africa.

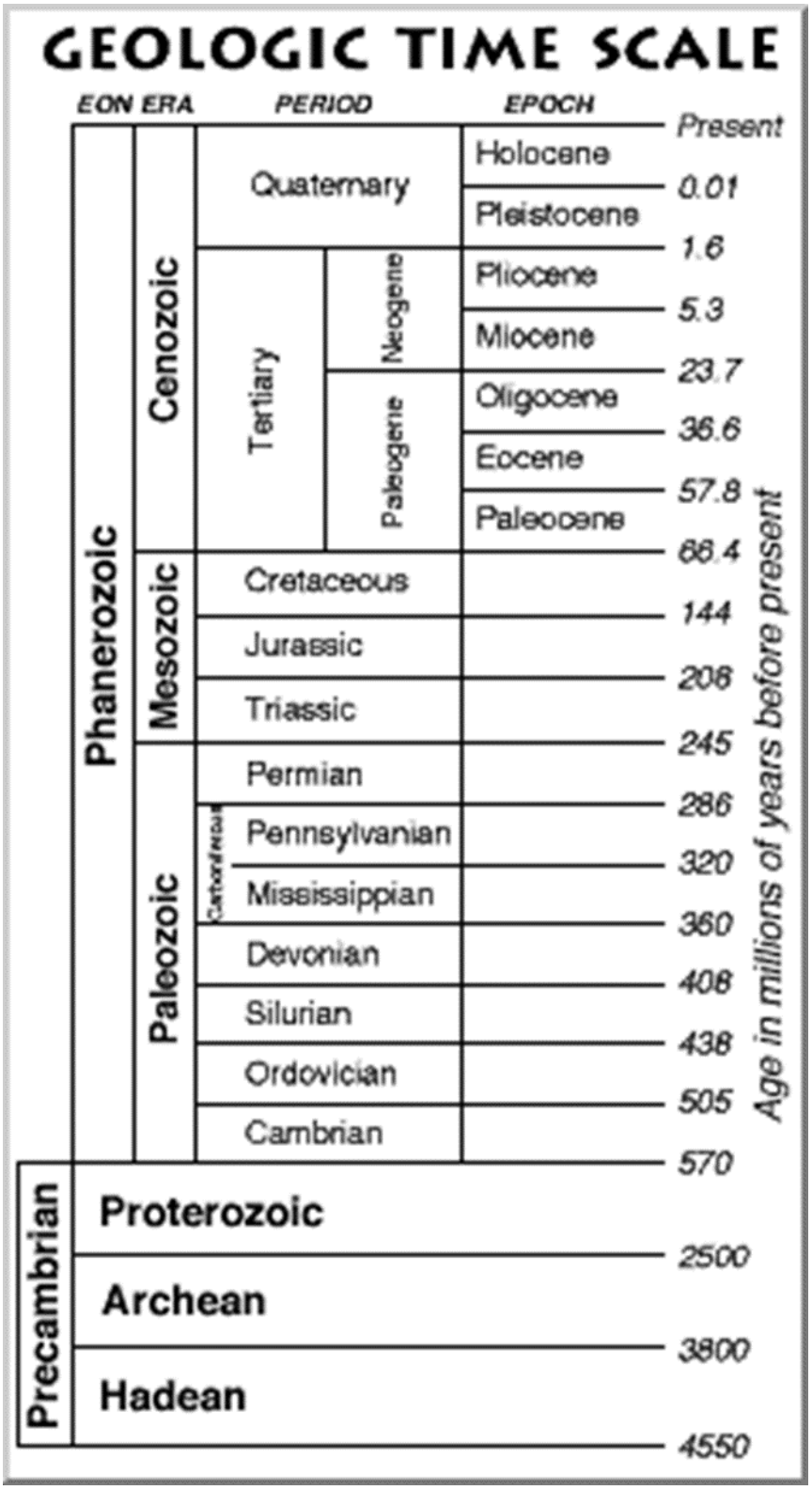

Fig 2: Table of Geological Time Scale

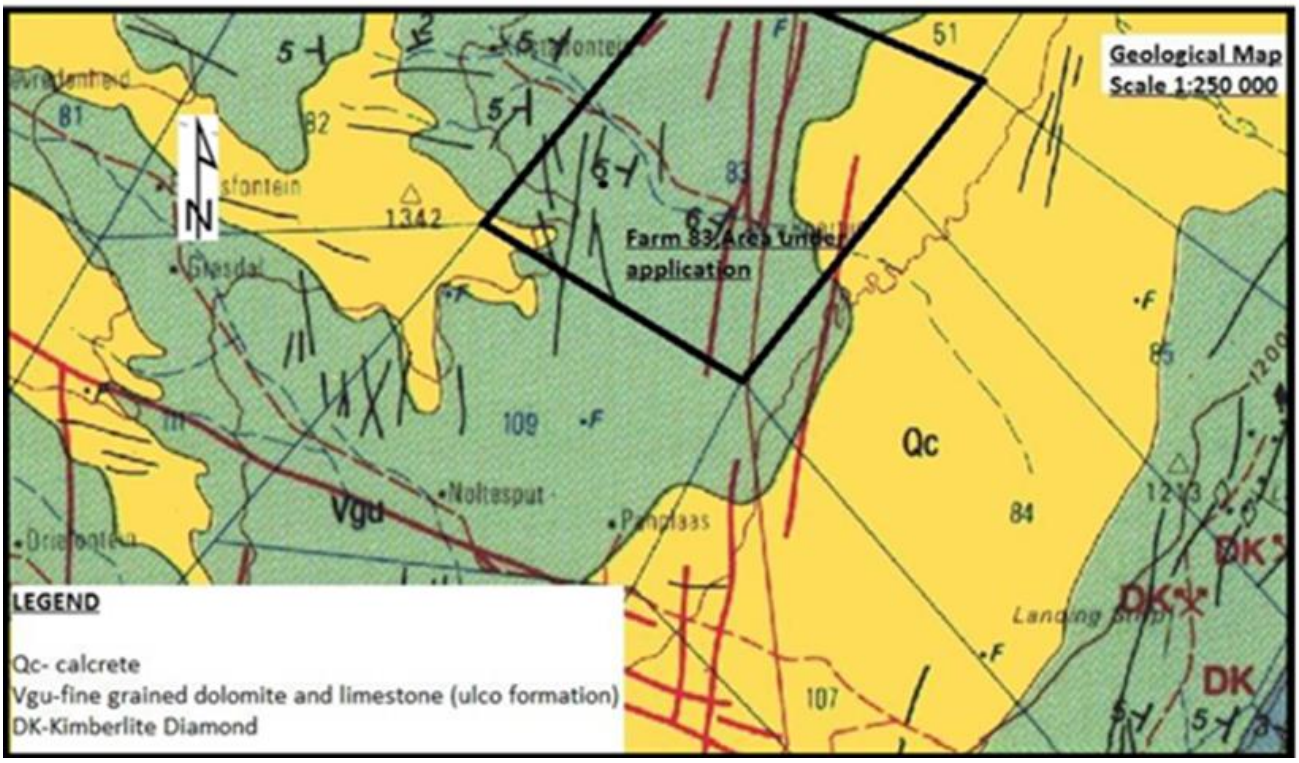

Figure 3: 1:250 000 geological map of the project area (Qc- calcrete; Vgu- fine grained dolomite and limestone (ulco formation); DK- Kimberlite diamond).

The study area is situated in an area largely underlain by new horizontal sedimentary rocks of the Ghaap Plateau Subgroup. Some areas are covered by calcrete as shown in the 1:250 000 geological map above. The Ghaap (Vryburg Formation, Campbell Rand Subgroup) are found fossiliferous marine shelf carbonates. The Ulco sites are overlain by Late Caenozoic calcretes or pedogenic limestones (Almond 2013). The calcrete or surface limestone cover large areas of the Ghaap Group carbonates (Almond 2013:18) such as the Ulco which is less than 30km from the project area. . It also occurs to the east of Postmasburg. The calcrete deposits are described by Truter et al. (1988), Visser (1958) and Bosch (1993). According to Almond (2013), the calcrete my reach a thickness of 20m, however, they are often thinner or less than that. Almond (ibid) further states that the Pliocene- Pleistocene calcretes in the broader Kalahari region include sandy limestones and calcretised conglomerates. These have been assigned to the Mokalanean Formation of the Kalahari Group.

The area which lies on the Ghaap Group sediments is underlain by rocks of the Ventersdorp Supergroup. The Ghaap Group sediments contain dolomites, shales and quartzite that extend to approximately 500m below surface. These sediments are separated from underlying Ventersdorp lavas by a major geological unconformity. Dolomites may contain fossils, but they are usually poorly preserved because of diagenetic overprinting. The process of dolomitization results in most fossils of original

limestones to obliterate. However, the dolomites are characterised by fossils of algae formations that are known as stromatolites that contain high levels of calcium carbonate.

According to Eriksson et al. (2006:244), the Ghaap Group on the Griqualand West is divided into the following stratigraphic orders, namely the Schmidtsdrif, Campbell Rand, Asbestos Hills and Koegas subgroups. The Campbell comprises of different sedimentary facies in the Prieska and Ghaap Plateau sub basins.

The Asbestos Hills subgroup is uniform over the entire Griqualand West Basin. The Koegas is presented only in the southern part basin and along the southern western rim of the Maremane Dome. The Ghaap Subgroup spans over more than 200m in time period but it is younger than 2642 +/- 3 Ma (zircon age for Vryburg lavas below the Schmidtsdrift Subgroup (Eriksson et al 2006:244). The Danielskull Formation of the Asbestos Hills Subgroup provides the youngest radiometric age of the Ghaap Subgroup which is 2432 +/- 31 Ma (Baryon et al. 1994; Trendall et al. 1990).

The characteristic of the Schmidtsdrif are similar over the entire Griqualand West Basin. The Schmidtsdrif comprises of formations that are the lower Boomplaas Formation. According to Beukes (1979; 1983) it is up to 1000m thick, in surface outcrops, but comprising 185m of shale and carbonate rocks. Fossils found in the Schmidtsdrif are stomatolitic and oolitic carbonates (Almond 2013; Eriksson *et al*. 2006). In the Kathu shales and carbonates of deep lagoonal origin are found (Eriksson *et al*. 2006). The Clearwater Formation consists of shales, tuffites and BIF- like cherts that are transgressive deposits over Boomplaas platform and it is 50m thick in outcrops and in the Kathu borehole.

The Campbell Rand Subgroup in the Ghaap Plateau is estimated to be 1600m thick (Beukes 1980a, SACS 1980). The Kathu borehole indicates that the Campbell Rand Subgroup is 2500m thick with the uppermost part removed by the Palaezoic glaciation (Altermann and Siegfried 1997). The Monteville Formation is found at the base of the Campbell Rand Subgroup on the Ghaap Plateau and is 200m thick (Beukes 1980, 1987). The formation starts with stromatolitic domes, succeeded by microbial laminites (laminated stromatolitic carbonate rocks) with fenestrae and carbonate argrillites, shales and siltstone are intercalated and the date for this is 2555 +/- 19Ma. In the Kathu borehole the Monteville Formation is 540m thick. It comprises of stromatolitic carbonates and shales.

The Ravelio Formation is also part of the Campbell Rand Subgroup. It occupies the largest part of the Campbell Rand Formation and is 900m in thickness. It consists of dolomite with giant stromatolites domes intercalated with cycles of columnar stromatolites and fenestral facies.

The Gamohaan Formation comprises laminated microbial mat carbonates. The Tsineng Formation (30m of microbial lamination) terminates the Campbell Rand Subgroup in the Ghaap Plateau Sub basin.

Quaternary faunal systems and human origins

The study of human origins allows us to unravel the story of our past and in doing this to make predictions about our future. The major strength of the southern African fossil record is that it records the most time-extensive evidence on the planet of early hominin evolution and cultural development, as well as the effect our ancestors have had on biodiversity. Early hominins evolved in the context of the diverse fauna and shifting environments of the Quaternary. Rapid environmental changes appear to have played a major role in early hominin speciation, distribution and the development of modern human behaviour. That environmental change may have influenced population growth and dispersal, the timing of the emergence of innovative technology, and the implied advanced cognitive abilities it carries, shows no such correlation with evidence of environmental change. This suggests the influence of other factors that resulted in such a substantial cognitive and creative hominid expansion.

For example scientists of the Evolutionary Studies Institute (ESI) at the University of the Witwatersrand are involved in research in the Cradle of Humankind World Heritage Site and several Middle Stone Age sites (e.g. Blombos and Sibudu), which record the evolution of modern humans and their culture. These cave sites preserve evidence of human artistry and the biodiversity of the time in detail, and it is now possible to accurately date the stratigraphic successions with remarkable accuracy.

Palaeontology can be used as an “ambassador” for all areas of scientific endeavour, promoting heritage education and outreach and thus enthuse the younger generation in the wonders of scientific discovery.

The temporally and taxonomically diverse and internationally important fossil heritage of South Africa includes the oldest evidence of life, the earliest metazoan animals, the earliest land-living plants, a remarkable history of tetrapod diversification including the best record of the distant ancestry of mammals, dinosaurs and turtles, and a remarkable record of human origins as well as technological and cultural development.

The remarkable story of “Origins” has huge potential for palaeotourism and job creation possibilities in poorly resourced but scenically spectacular rural areas of the country. Already two World Heritage Sites have been established in South Africa, largely because of their palaeoscience heritage. This rich heritage of “African Origins” has the potential to develop a spirit of nationalism amongst a South African population that has been divided by an oppressive political history.

Paleontological or palaeosciences research can help to ask probing questions about the development of life, based largely on the uniquely rich and diverse South African fossil record. This record, because it is both geographically and time expansive, has to date received relatively little research attention.

South Africa has a uniquely rich fossil heritage which makes it possible to write a comprehensive text on the development of life on earth. Palaeoscience research in South Africa has the potential to contribute to understanding of biodiversity change over time.

PALAEONTOLOGICAL HERITAGE AND CONCLUSION

Based on the desktop study, it is clearly evident that the proposed prospecting project area the Campbell Rand Group (Vgu) of the Ghaap Group are rich in stromatolite assemblages (stratoform, domical, columnar), and important early microfossil biotas (Almond 2013). These are considered to be of **MODERATE** to **HIGH** palaeontological sensitivity. The Vryburg Formation of the Ghaap Group also contain stromatolites in carbonates and are of **MODERATE** palaeotological sensitivity. The surface calcretes **(Qc**) are associated with diatoms, molluscs, stromatolites etc., however, these calcretes are of **LOW** palaeontological sensitivity. Based on the results of the desktop survey, it is therefore concluded that the proposed project area has **moderate** fossil remains. It is ttherefore recommended that newly exposed stromatolites should be sampled and recorded during development. According to Groenewald (2014), recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region, and therefore the recommendations made here are significant. Should substantial fossil remains such as mammalian bones or teeth be exposed during construction, SAHRA should be notified by the ECO so that appropriate mitigation can be undertaken.

QUALIFICATIONS & EXPERIENCE OF THE AUTHORS

Dr Joseph Chikumbirike - Specialised in Paleobotany which is a branch of paleontology dealing with the recovery and identification of plant remains from geological contexts, and their place in the reconstruction of past environments and the history of life. Paleobotany includes the study of terrestrial plant fossils as well as the study of marine autotrophs, such as algae. A closely related field to paleobotany is palynology, the study of fossil and extant spores and pollen.

Mr Sifelani Jira – Specialised in Taxonic revision of Titanosuchid dinocephalians as a key to understanding Middle Permian biodiversity changes in the Karoo Basin of South Africa. He is also specialised in the stratigraphy and sedimentology of the Abrahamskraal Formation I the Merweville are in Western Cape Province, South Africa.

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