PALAEONTOLOGICAL IMPACT ASSESSMENT (PIA)

Blomskraal 216, Lejweleputswa District Municipality, Free State Province

(Virginia 1, Virginia 2, Virginia 3 Solar Parks, and Power Line Corridor)

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EXECUTIVE SUMMARY

Outline of the development project:

Bruce Rubidge and Marc Van den Brandt were appointed by Johan Botha on behalf of AGES Limpopo (Pty) Ltd to undertake the palaeontological impact assessment process for the farm Blomskraal 216 and a Power Line Corridor adjacent to the farm, near of the town of Virginia, in the Free State Province. The planned development includes the three solar parks (termed Virginia 1, Virginia 2, and Virginia 3 Solar Parks), each of approximately 300 MW capacity. This palaeontological impact assessment (PIA) is one of the specialist studies, used to determine the best areas for the development footprints. We have produced two PIA's for this project: 1) this PIA report for the farm Blomskraal, 216, and separately, 2) the Power Line Corridor PIA.

Outline of the geology and palaeontology of the study area:

The study area is situated in the Main Karoo Basin of the Free State province. The farm is underlain by Late Permian rocky deposits of the Adelaide Subgroup of the Lower Beaufort Group of the Karoo Supergroup. These Karoo rocks are overlain by Quaternary alluvial deposits (soil) which are covered by vegetation, grasses and bushes over most of the farm, irrigated cropland in the northwest and northeast, and two small *koppies* or hills capped by Jurassic dolerite, west and east. Biostratigraphically, the farm Blomskraal, 216, lies within the upper *Daptocephalus* Assemblage Zone (*Lystrosaurus maccaigi-Moschorhinus* Subzone) (Viglietti et al, 2016, Viglietti, 2020). Good outcrops of fossil bearing rocks in this part of the basin, near Virginia, are sparse, and fossils are rare.

Summary of finding:

A Phase 1 Palaeontological Impact Assessment was conducted, including a Desktop Study and an onsite inspection for fossils by Marc Van den Brandt over three days (7, 8 and 10 April 2021). The on-site study found that on the farm Blomskraal, 216, the mapped Permian bedrock is almost entirely covered in thick Quaternary alluvial deposits which in turn is covered by grass and bush. The north-south running Maselspruit River cuts into the Permian bedrock and exposes patches of potentially fossiliferous mudstone/siltstone and sandstone, but no Permian fossils were found, apart from erratic fossil wood fragments in the Quaternary alluvial deposits. The edges of the Maselspruit expose Quaternary alluvium deposits (sandy soil to more consolidated gravel) which had isolated fossilised mammal bones, teeth and shells of the bivalve *Unio*. There is an exposed sandstone ridge in the east and the small western and eastern hills are capped with dolerite.

Recommendations:

We recommend that the proposed development be constrained to the flat, naturally vegetated grassy and bushy areas that cover the majority of the farm (currently serving as cattle and game farming land), and the irrigated cropland in the northwest and northeast sections of the farm, currently bearing maize fields.

Due to palaeontological sensitivity, we do not recommend development on the north-south Maselspruit River, the three east-west erosional gullies or tributary streams west of the

Maselspruit, and the south-east running erosional gully or tributary stream east of the Maselspruit.

Stakeholders responsible for decisions or next actions:

In the event that fossils are discovered in the course of the proposed development, the Environmental Control Officer must follow the steps outlined in the Chance Find Protocol (Appendix A) whereby a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented. The Chance Find Protocol must be incorporated into the Environmental Management Programme (EMP) for the proposed development.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION AND PROJECT BACKGROUND

Bruce Rubidge and Marc Van den Brandt were appointed by Johan Botha on behalf of AGES Limpopo (Pty) Ltd on 24 March 2021, to produce two Phase 1 Palaeontological Impact Assessment reports (PIA's) to assess the potential palaeontological impact of parts of the proposed Virginia 1, Virginia 2, Virginia 3 Solar Parks and Power Line Corridor project.

Virginia 1 Solar Park by Ursa Energy (Pty) Ltd , Virginia 2 Solar Park by Fornax Energy (Pty) Ltd , and Virginia 3 Solar Park by Volans Energy (Pty) Ltd propose the establishment of new renewable energy generation facilities, in the form of Photovoltaic (PV) Power Plants), with a maximum generation capacity of up to 300 MW each, and associated connection infrastructure and structures on the farm Blomskraal, 216; Ventersburg road (4246 ha), Remainder of Palmiet Fontein, 229, Winburg road (1761 ha), Delaporte, 887, Winburg road (598 ha), and Portion 3 of Quaggafontein, 3, Winburg road (467 ha), totalling 7064.6714 ha in extent, located within the Matjhabeng and Masilonyana Municipalities, Lejweleputswa District Municipality, Free State Province (Figure 1). In addition, a 16.2 km long Power Line Corridor is proposed to connect the on-site substation to the Eskom Theseus Main Transmission Substation (MTS). The final size and location of the development area (footprint) required for the proposed project will be determined following the outcomes of the Public Participation Process and the recommendations and conclusions of the Specialist Studies conducted during the Environmental Impact Assessment (EIA) process. The Environmental Impact Assessment process permits the identification and assessment of potential environmental impacts resulting from the proposed project.

This PIA relates to the proposed development on the farm Blomskraal, 216, only.

The proposed development of the Photovoltaic (PV) Power Plants and connection infrastructure consists of the installation of equipment, such as photovoltaic modules, mounting systems for the PV arrays, internal cabling, medium voltage stations, workshops and warehouses, on-site high-voltage substation(s) with high-voltage power transformers, Battery Energy Storage Systems (BESS), electrical system, internal roads, fencing of the site, water access point, water supply pipelines, water treatment facilities, and a sewage system. Additionally, during the construction phase, the site may be provided with additional water access points, water supply pipelines, water treatment facilities, prefabricated buildings, and workshops and warehouses, to be removed at the end of construction.

Ursa Energy (Pty) Ltd , Fornax Energy (Pty) Ltd , and Volans Energy (Pty) Ltd will undertake the required Environmental Impact Assessment process and appointed AGES Limpopo (Pty) Ltd as Environmental Assessment Practitioner (EAP) in order to identify and assess potential environmental impacts, and propose appropriate mitigation and management measures as part of an Environmental Management Programme (EMP).

Specialist Studies, including this Palaeontological Impact Assessment, are required to identify all potential significant environmental impacts and issues, including impacts on heritage resources. This Palaeontological Impact Assessment forms one of the Specialist Studies required for this proposed development as part of the:

- Heritage Impact Assessment (HIAs) called for in terms of Section 38 of the National Heritage Resources Act (Act No. 25 of 1999); and the

- Environmental Impact Assessment (EIA) or Environmental Management Programme (EMP) process required.

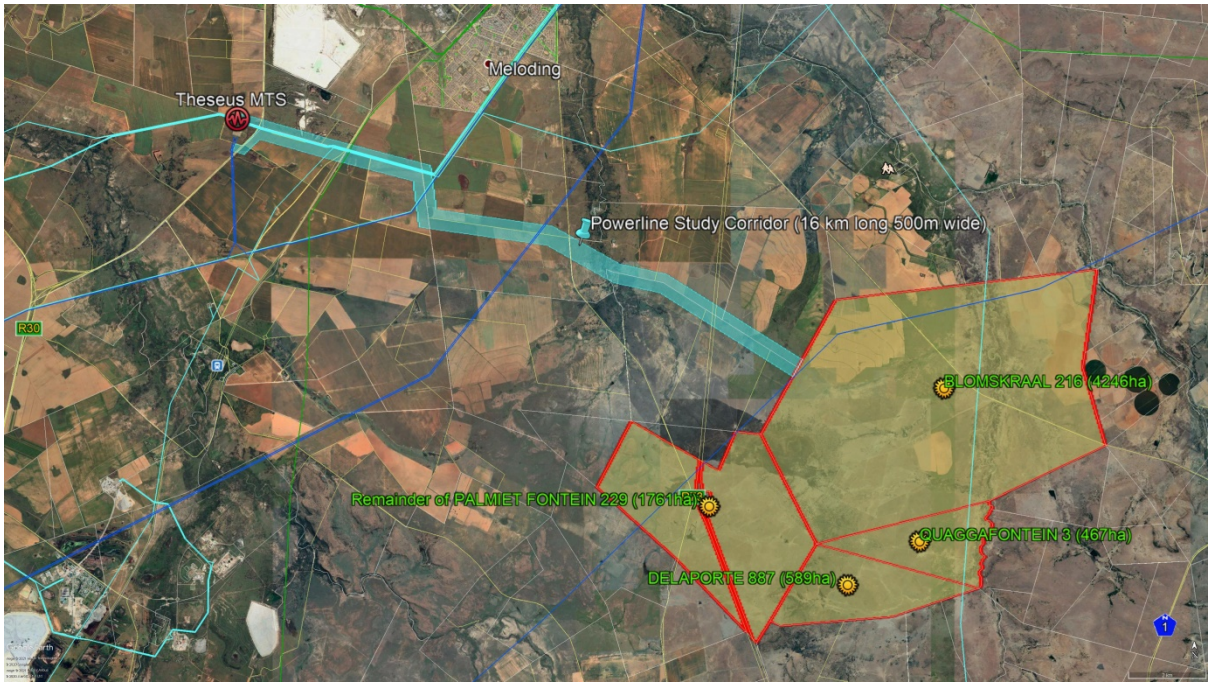


Figure 1: Google Earth projection of the proposed study area comprising the farm Blomskraal, 216 (4246 ha, outlined in red, yellow shaded). The other farms shown and the blue shaded Power Line Corridor are part of the larger project, and are not included in this Palaeontological Impact Assessment Report.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act (Act No. 25 of 1999), according to which, palaeontological resources may not excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The purpose of this Palaeontological Impact Assessment is to 1) identify potential palaeontological resources on the site of the proposed development, 2) assess the potential impact the development may have to palaeontological heritage resources, and to 3) make recommendations for protection or mitigation of impact. This PIA will therefore inform the Environmental Management Programme (EMP) for this project.

Terms of Reference:

- This PIA relates to the proposed development on the farm Blomskraal, 216, only;
- Determine and assess the potential impacts of the proposed development on palaeontological heritage resources in the proposed areas of impact;
- Determine any "no go" areas for the proposed development in terms of potential or real damage or impacts to the palaeontological heritage resources;
- Recommend mitigation measures to minimize impacts associated with the proposed development.

2. LEGISLATIVE REQUIREMENTS

This Palaeontological Impact Assessment (PIA) for the proposed development on the farm Blomskraal, 216, is part of the Heritage Impact Assessments (HIAs) required for the proposed development, and is guided by the South African National Heritage Resources Act (Act No. 25 of 1999).

National Heritage is protected by the South African National Heritage Resources Act (Act No. 25 of 1999). Developers are required to submit development plans to SAHRA for approval. These plans must include documentation detailing the expected impact that the development will have on national heritage, including palaeontological heritage.

Categories of heritage resources recognised as part of the National Estate (Chapter 1, Section 3.2 & 3.3, National Estate) of the National Heritage Resources Act include, among others:

(3.2) Without limiting the generality of subsection (1), the national estate may include:

- *(e)* geological sites of scientific or cultural importance;
- *(f)* archaeological and palaeontological sites;
- *(i)* movable objects, including
    - *(i)* objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;

(3.3) Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of:

- *(c)* its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

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

35. (1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(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.

3. DESCRIPTION OF THE PROPERTY OR AFFECTED ENVIRONMENT

The study area of this Palaeontological Impact Assessment relates to the farm Blomskraal, 216; Ventersburg road (4246 ha), located within the Matjhabeng Municipality, Lejweleputswa District Municipality, Free State Province. Blomskraal is located approximately 15 km South-East of Virginia and 20 km South-West of Ventersburg, between the N1 Highway in the East and the R73 in the West. The farm boundaries form a five-sided polygon (Fig. 2) and a tarred road passes through the farm from northwest to south east, towards the N1 highway

Maps used in this report include:

- 1: 50 000 Topographic map (2826 BB), showing the Western part of the farm Blomskraal 216 (red outline) (Fig. 3);
- 1: 50 000 Topographic map (2827 AA), showing the Eastern part of the farm Blomskraal 216 (red outline) (Fig. 4);
- 1:250 000 Geological map (2826 Winburg – D.J.L Visser and C.C Nolte 1987) showing the position of the study locality (red outline) (Fig. 5).

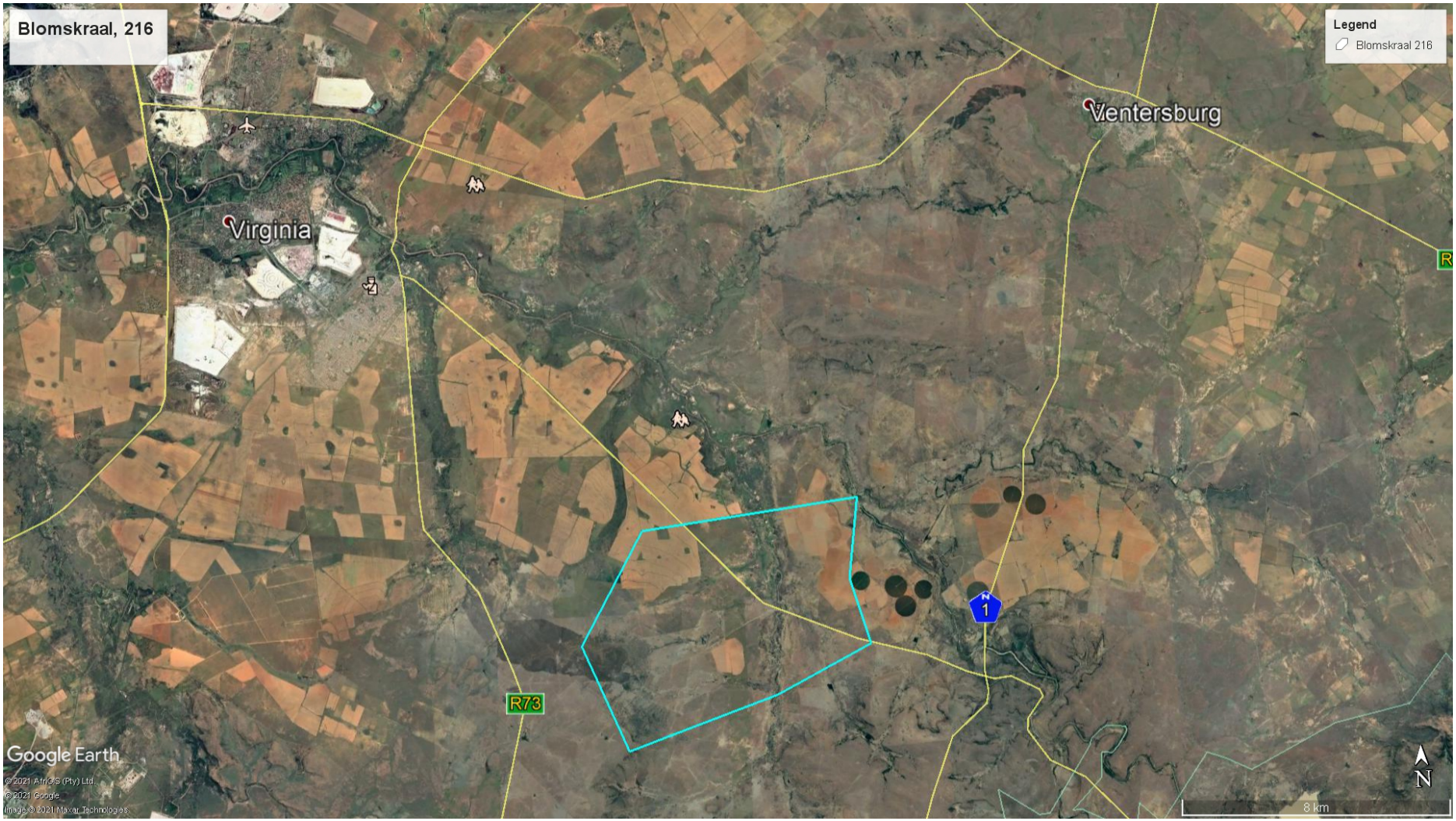


Figure 2: Google Earth projection of the location and boundary (blue outline) of the farm Blomskraal, 216, South-East of Virginia and South-West of Ventersburg, between the N1 highway and the R73.

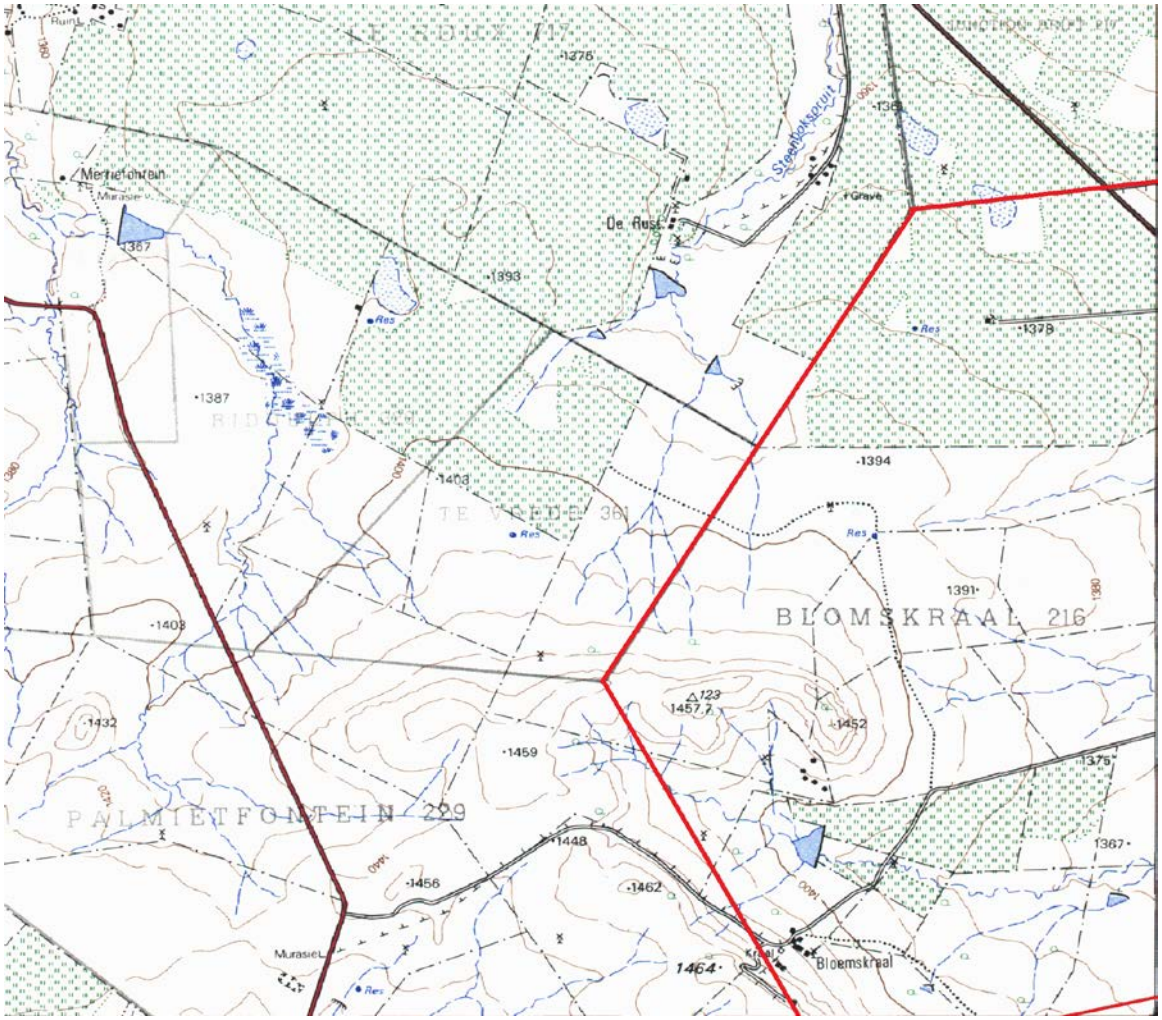


Figure 3: 1: 50 000 Topographic map (2826 BB), showing the Western third of the farm Blomskraal, 216 (red outline).

Most of the farm is flat, and covered by grazing for livestock. A hill is present in the south-western corner of the farm, and forms the highest point of the farm (1457.7m, Fig. 3). In the Eastern half of the farm, the meandering Maselspruit River runs north-south through the farm. West of the Maselspruit River, three west-east running erosional gullies extend from the foothill of the south-western hill into the Maselspruit, and East of the Maselspruit, there is a south-easterly running erosional gully. There is another smaller hill, East of the Maselspruit River.

The farm house (Blomskraal) and other farm buildings are located in the extreme south-western corner of the farm. A tarred road passes diagonally through the farm, northwest to southeast, which terminates at the N1 highway only a few kilometres beyond the farm's eastern boundary.

There are two large areas of irrigated crop land in the northwest and northeast of the farm, and the two smaller mapped areas of irrigated crop land in the south-central and south-west parts of the farm that have returned to natural vegetation (Figs 3,4).

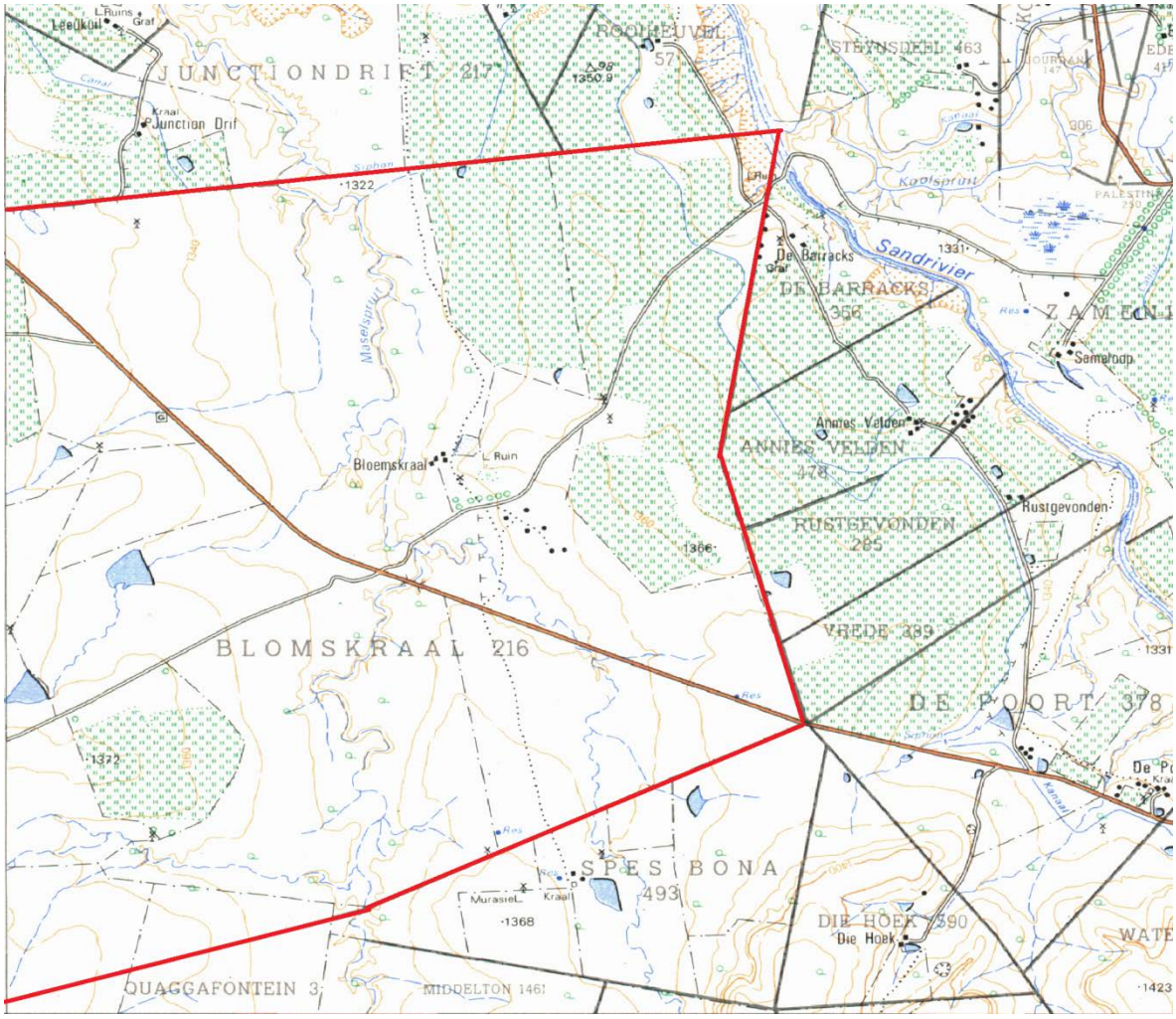


Figure 4: 1: 50 000 Topographic map (2827 AA), showing the Eastern two-thirds of the farm Blomskraal, 216 (red outline).

4. GEOLOGICAL SETTING

4a. Description of the rock units

The study area for the proposed project is situated in the Main Karoo Basin of the Free State province (Fig. 5) and the geology around Virginia comprises Late Permian deposits of the Adelaide Subgroup of the Lower Beaufort Group, Quaternary alluvial deposits, and Jurassic aged dolerite (Groenewald, 2021; Mavuso, 2014).

The terrain on Blomskraal itself comprises alluvial (soil) over the majority of the farm (+-80%). A western hill, a small eastern hill, the Maselspruit River and its associated erosional gullies or streams, account for the remaining +-20% of the farm by surface area. Rocky outcrop is rare. There are two small isolated outcrops of sandstone. The two hills are capped by dolerite and in the Maselspruit River and the associated erosional gullies there are isolated patches of mudstone, siltstone and sandstone outcrops.

Permian deposits (Fig. 5: Pa-Green):

Based on the 1:250 000 Geological map, 2826 Winburg, (Fig. 5) the farm Blomskraal, 216, is underlain by Late Permian sedimentary rocks of the Adelaide Subgroup of the Lower Beaufort Group of the Karoo Supergroup (Fig. 5: Pa - Green). These rocks were deposited by meandering river systems across the floodplains of the ancient Karoo Basin (Rubidge, 1995).

Apart from two small isolated outcrops of a sandstone ridge in the East of the farm, the only exposures of the Beaufort Group occur along the Maselspruit River and in the four smaller feeder erosional gullies (Fig. 5: light yellow shading) where isolated patches of Permian bedrock is exposed in the river bed.

Quaternary alluvial deposits (Fig. 5: Qs-Yellow):

Based on the 1:250 000 Geological map, 2826 Winburg, in the northwest and northeast sections of the farm, the Late Permian rocks are overlain by thick Quaternary alluvial deposits (soils) (Fig. 5: Qs-Yellow).

Dolerite (Fig. 5: Jd-Pink):

According to the Geological map, 2826 Winburg, (Fig. 5: Jd-Pink) two small regions of intrusive Jurassic Dolerite are present: a thin, long ridge that caps the western hill and a region in the east of the farm (covering a smaller hill). Our on-site field inspection confirmed both outcrops of dolerite on these two hills.

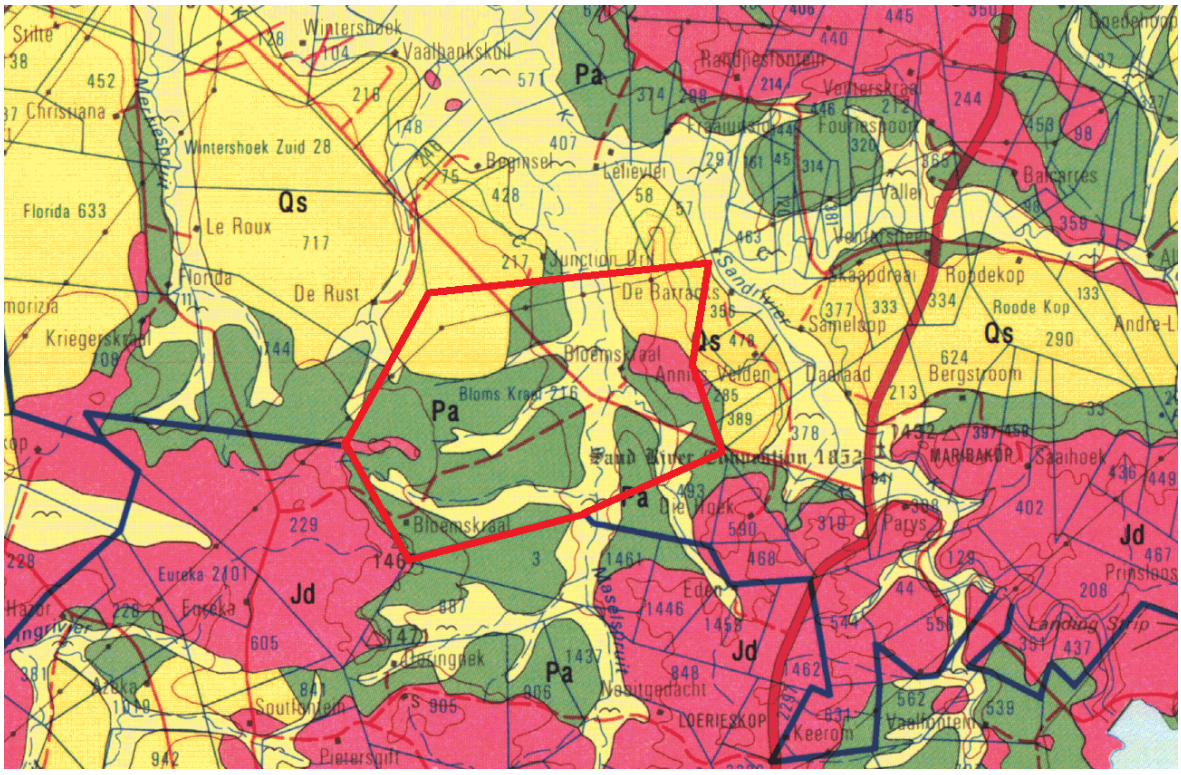


Figure 5: 1:250 000 Geological map (2826 Winburg– D.J.L Visser and C.C Nolte 1987) showing the position of the study locality (red outline). Pa, Permian (Adelaide Subgroup); Qs, Quaternary; Jd, Jurassic dolerite.

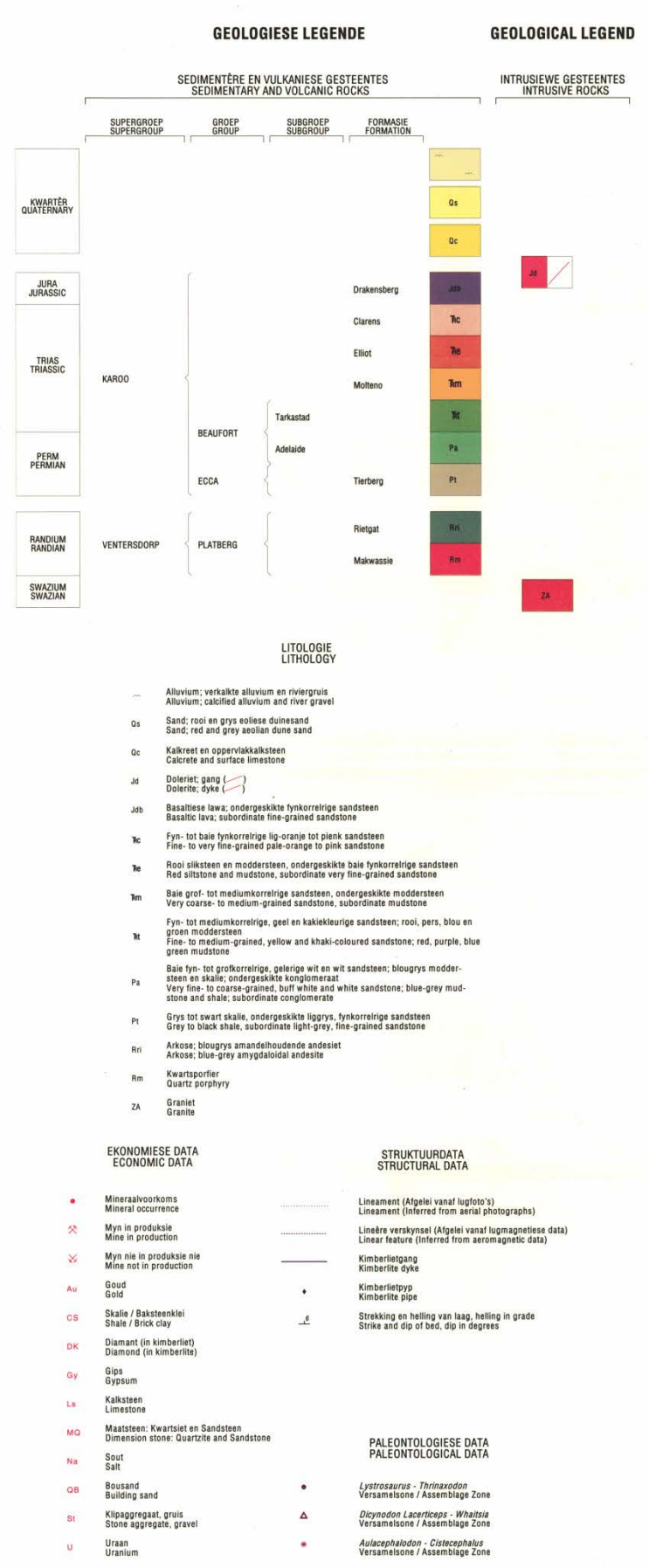


Figure 6: Key to the 1:250 000 Geological map (2826 Winburg– D.J.L Visser and C.C Nolte 1987).

5. PALAEONTOLOGICAL HERITAGE OF THE AREA

5a. Literature review

Because of its wealth of fossils the rocks of the Karoo Supergroup have been subdivided into biozones (eg. Kitching, 1977; Rubidge, 1995; Smith et al., 2020). The *Daptocephalus* Assemblage Zone (the biozone covering the study area) is Changhsingian (Late Tatarian - 253 to 251 Ma) in age (Rubidge, 2005). Recently, Viglietti (2020) proposed a two-fold subdivision of the *Daptocephalus* Assemblage Zone into lower (*Dicynodon-Theriognathus*) and upper (*Lystrosaurus maccaigi-Moschorhinus*) subzones. Good outcrops of Karoo rocks in the part of the basin, near Virginia, are sparse and are covered by thick Quaternary alluvium. Recent research by Groenewald (2021) in the Beaufort Group did not reveal any vertebrate fossils near Virginia, but did find some plant impressions of *Glossopteris* on sandstone on the farm Weltevreden (Groenewald, 2021: 118) and fossil wood (*Agathoxylon africanum,* and/or *Agathoxylon karooensis*) and an unidentified Gymnosperm.

De Ruiter et al., (2010) published a study based on three years of excavations at an early Pliocene locality referred to as Matjhabeng (formerly named the Virginia Railway Cut Site). With an estimated age of 4.0–3.5 Ma, the site is located on farm Virginia 448 (Geological map 2826BB; 28°06’39’S, 26°54’56’E), not far from the study area of this Palaeontological Impact Assessment Report, and contains an early Pliocene faunal assemblage recovered from a horizontally stratified, riverine deposit. The site represents a temporal and geographic intermediate between the better known sites of Makapansgat to the north and Langebaanweg to the south. It also represents one of only a few river-deposited Pliocene localities in the central interior of southern Africa. These researchers recovered a diverse fossil fauna that included fish, amphibians, reptiles, birds and mammals. Mammals range in size from rodents to mammoths, including an array of proboscideans, perissodactyls and artiodactyls, alongside rare carnivores. In total, they recognized 29 taxa. Some of the taxa from Matjhabeng are shared with Langebaanweg, and others with Makapansgat, confirming the intermediate status of this locality. These researchers distinguish between gravel components that represent a high-energy river discharge while silty-sandy units represent abandoned-channel equivalents formed when the paleo-river periodically changed its course.

5b. Karoo Vertebrate Fossil Database

The Karoo Vertebrate Fossil Database documents nearly 30 000 fossil specimens collected in the Karoo over the past 150 years, curated in major South African museums and universities. A search of the database (hosted by the Evolutionary Studies Institute at the University of the Witwatersrand, Johannesburg) reveals that the area around Virginia is depauperate as far is Karoo fossils are concerned (Table 1, Fig. 7). There are no recorded Karoo fossils from the farm Blomskraal, 216, nor any from the immediate surrounding neighbouring farms. Two *Lystrosaurus* specimens were collected from the farm Wessels Punt (GHG111, GHG112), east of Winburg, two more from the farm Halfweg (GHG94, GHG97), between Winburg and Senekal, and a *Lystrosaurus* and a *Dicynodon* from Kruisvlei (GHG72, GHG74).

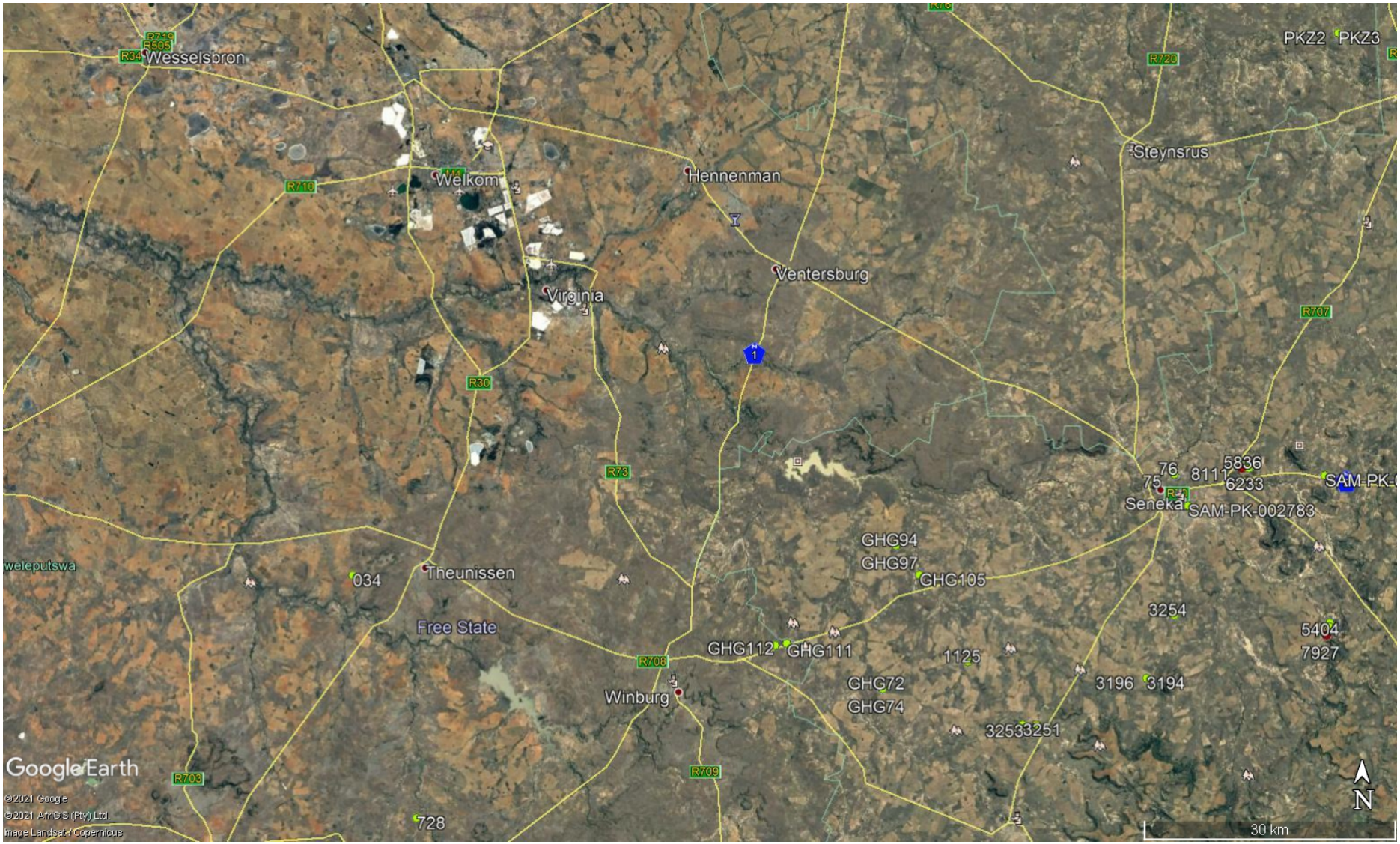


Figure 7: Fossil occurrences in the area around Virginia, Free State Province (courtesy Dr Michael Day, Karoo Vertebrate Fossil Database).

Table 1. Vertebrate Fossil records extracted from the Karoo Fossil Database for the districts of Virginia, Ventersburg, Winburg and Theunissen (courtesy Dr Michael Day).

COLL PREFIX	COLL NUM	COLLECTION	TAXON 1	TAXON 2	ORIGINAL GENUS	CURRENT GENUS	PROVINCE	DISTRICT
GHG	111	Council_for_Geoscience	Synapsida	Dicynodontia	*Lystrosaurus*	*Lystrosaurus*	FState	Winburg
GHG	112	Council_for_Geoscience	Synapsida	Dicynodontia	*Lystrosaurus*	*Lystrosaurus*	FState	Winburg
GHG	105	Council_for_Geoscience	Synapsida	Dicynodontia	*Dicynodon_lacerticeps*		FState	Senekal
GHG	72	Council_for_Geoscience		Archosauromorpha	*Proterosuchus*		FState	Marquard
GHG	74	Council_for_Geoscience	Synapsida	Dicynodontia	*Dicynodon*	*Unidentified*	FState	Marquard
GHG	94	Council_for_Geoscience	Synapsida	Dicynodontia	*Lystrosaurus*	*Lystrosaurus*	FState	Senekal
GHG	97	Council_for_Geoscience	Synapsida	Dicynodontia	*Lystrosaurus*	*Lystrosaurus*	FState	Senekal
NMQR	1125	National_Museum	Synapsida	Dicynodontia	*Lystrosaurus*	*Lystrosaurus*	FState	Marquard
COLL PREFIX	**COLL NUM**	**CADASTRAL FARM NAME**	**FARM NO.**	**MAP SHEET**	**LATITUDE**	**LONGITUDE**	**GROUP**	**ASSEMBLAGE ZONE**
GHG	111	Wessels_Punt	2315	2827AC	-28,4814	27,1475	Beaufort	*Lystrosaurus*
GHG	112	Wessels_Punt	2315	2827AC	-28,4814	27,1475	Beaufort	*Lystrosaurus*
GHG	105	?	971	2827AD	-28,4083	27,3078	Beaufort	*not_yet_verified*
GHG	72	Kruisvlei	279	2827CB	-28,5292	27,2636	Beaufort	*Lystrosaurus*
GHG	74	Kruisvlei	279	2827CB	-28,5292	27,2636	Beaufort	*Lystrosaurus*
GHG	94	Halfweg	356	2827AD	-28,3772	27,2794	Beaufort	*Lystrosaurus*
GHG	97	Halfweg	356	2827AD	-28,3772	27,2794	Beaufort	*Lystrosaurus*
NMQR	1125	Wildebeestlaagte	228	2827CB	-28,5000	27,3667	Beaufort	*Lystrosaurus*

6. APPROACH TO THIS PALAEONTOLOGICAL HERITAGE STUDY

As the Beaufort Group of the Karoo Supergroup is palaeontologically sensitive following the sensitivity map of SAHRA, a site visit and a Phase 1 Palaeontological Impact Assessment was necessitated.

6a. Phase 1 Palaeontological Impact Assessment methodology

This Phase 1 Palaeontological Impact Assessment includes a Palaeontological Desktop Study (a background study that uses geological maps, scientific literature, institutional fossil collections, satellite images, etc.) and a field survey of the proposed development, and includes:

a) details of the property to be developed (Section 3);
b) location of the rock units that are found (Section 4);
c) descriptions of the characteristics of each rock unit (Section 4) and known palaeontological resources (Section 5);
d) assessment of the sensitivity and importance of geological units in terms of their palaeontological significance (Section 8);
e) assessment of the potential impact of the proposed development on the palaeontological resources (Section 8);
f) recommendations for conservation, if any (Section 9).

If from the Phase 1 Assessment it is evident that fossil heritage of scientific or cultural significance is threatened by the proposed development, palaeontologists may recommend a Phase 2. A Phase 2 Palaeontological Mitigation/Rescue involves planning the protection of significant sites, and may include excavations or collection (with a permit) of fossil material at sites that may be lost to development.

A Phase 3 Palaeontological Site Conservation and Management Plan may be required in rare cases where the site is so important that development will not be allowed.

Field Survey methodology, Limitation, Assumptions, Date and Season:

An initial assessment of the geology of the farm using satellite images (Google Earth) showed potential Permian bedrock exposures on the western hill, the smaller eastern hill, in patches along the north-south running Maselspruit River and in patches along the four erosional gullies or streams of the Maselspruit. These regions of exposed rocks with potential fossil occurrences were inspected on-site by Marc Van den Brandt, an experienced Karoo palaeontologist, who visited the farm of Blomskraal, 216, to conduct an on-site field inspection for rock units and palaeontological heritage, over three days, 7, 8 and 10 April 2021. The on-site inspection was limited to the search for geological and palaeontological heritage and artefacts only (rock layers and outcrops, fossils and trace fossils) and excluded archaeological and biological artefacts. This was in the season of Autumn 2021. Different annual seasons do not affect rock exposures or palaeontological field work and so has no relevance or implications and is not applicable to palaeontological field work or this report. The on-site inspection findings are shown in Tables 2.1-2.6, and Figures 8A and 8B.

A Garmin eTrex 10 GPS was used to record GPS coordinates of sites in the Degrees, Decimal Minutes format. A 13 Megapixel (4160x3120) camera was used for photography, with a 15

cm/6 inch scale bar. Basic palaeontological field equipment, such as field notebook, brush, hammers and chisels were used.

6b. Information sources

The information presented in this Palaeontological Heritage Study (format and content) is based on the following sources:

1. SG 2.2 SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports (16 May 2007);
2. SG 2.2 SAHRA APMHOB Guidelines: Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports (October 2012);
3. South African National Heritage Resources Act (Act No. 25 of 1999);
4. Virginia 1,Virginia 2 and Virginia 3 Solar Park: Background Information Document - February 2021 supplied by Johan Botha;
5. Satellite Image (Google Earth) Virginina1,2 and3 Solar Park and Power Line Corridor Project Locality Map supplied by Johan Botha (Fig. 1);
6. Satellite Image (Google Earth) Locality Map of the farm Blomskraal (Fig. 2);
7. Topographic maps 2826 BB and 2827 AA supplied by Johan Botha (Figs. 3, 4);
8. Geological map (1:250 000: 2826 Winburg) (Fig. 5);
9. Relevant published Scientific literature (See Reference List);
10. A three day on-site palaeontological field inspection conducted by Dr Marc Van den Brandt over 7, 8 and10 April 2021;
11. Consultation with Dr David Groenewald, a Palaeontological and Geological expert of the field study area of the Free State Province;
12. Consultation with Dr Michael Day, to extract fossil occurrences in the Virginia area from the Karoo Vertebrate Fossils Database;
13. Appendix A: Chance Find Protocol.
14. Comments from the Department on the Virginia Solar Parks project, for specialist assessments, supplied by Johan Botha on 01 October 2021.
15. Appendix 6 of the EIA regulations, Government Gazette no 38282, 4 December 2014, pages 71-72, supplied by Johan Botha on 01 October 2021.

7. DESCRIPTION OF SITES VISITED AND FOSSIL OCCURANCES

Although the entire study area was searched for fossils sites, the greatest potential for fossil discoveries on the farm Blomskraal, 216 are shown in Figures 8A and 8B, and Tables 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6.

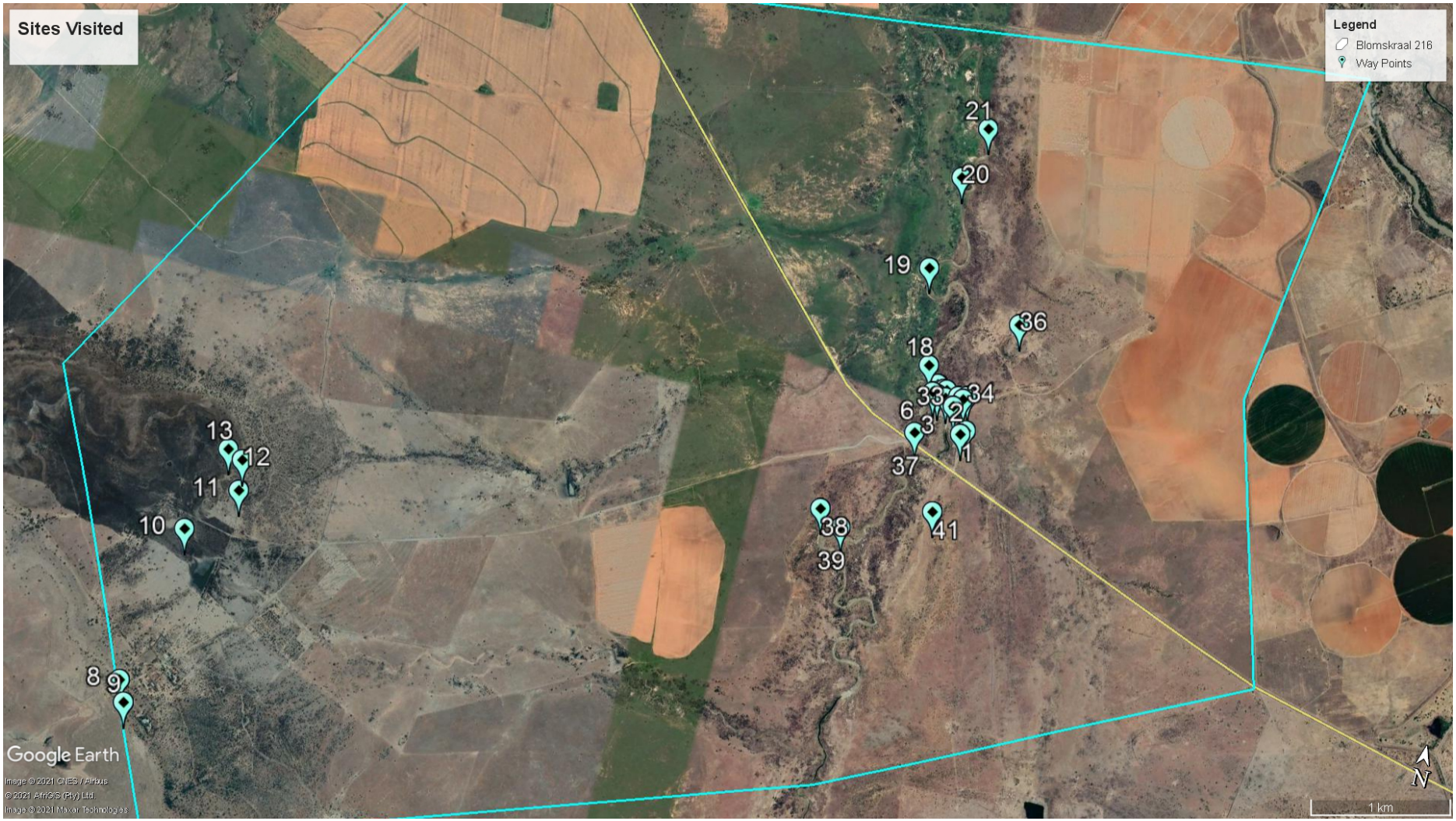
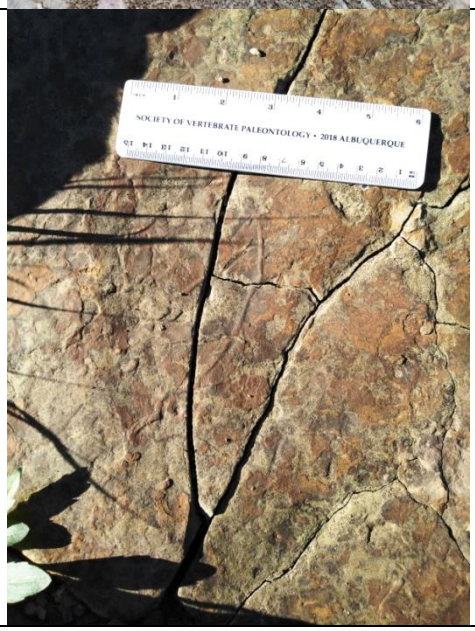


Figure 8A: Sites with the most potential for fossil discoveries on the farm Blomskraal, 216.

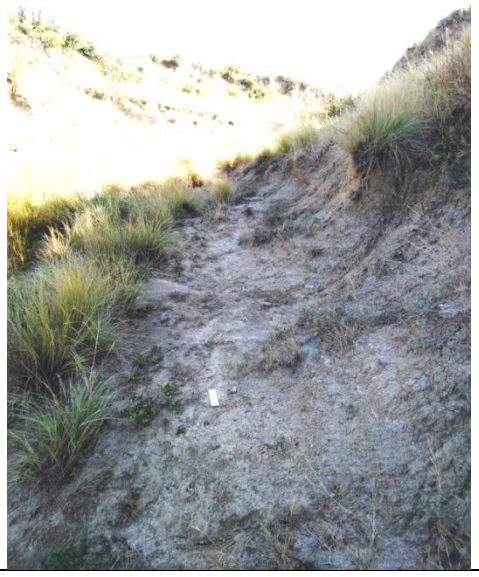
Figure 8B: Sites with the most potential for fossil discoveries on the farm Blomskraal, 216, close up of central region.

Table 2.1. Sites visited (Way Points 4, 5, 6, 14, 15, 16, 17, 18, 19, 20, 21, 37, 38, 39) along the north-south Maselspruit River on the farm Blomskraal, 216. Scale bar equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
4	S 28 13.128 E 27 01.617	Maselspruit River bed	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with ripple marks, no fossils found.	
4	S 28 13.128 E 27 01.617	Maselspruit River bed	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with invertebrate trace fossils.	

5	S 28 13.114 E 27 01.585	Maselspruit River edge	Alluvium, 5m high, potentially-fossiliferous, no fossils found.	
6	S 28 13.148 E 27 01.571	Maselspruit River bed	Water eroded and smoothed sandstone boulders with mineral veins, no fossils found.	
14	S 28 13.158 E 27 01.631	Maselspruit River bed	Sandstone blocks with spongy/rugose black texture, on top of lime green mudstone outcrop, both potentially-fossiliferous sedimentary rocks, no fossils found.	

15	S 28 13.128 E 27 01.629	Maselspruit River bed	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, no fossils found.	
16	S 28 13.114 E 27 01.589	Maselspruit River edge	Alluvium, 3m high, Quaternary fossil, bovid tooth (wide view).	
16	S 28 13.114 E 27 01.589	Maselspruit River edge	Alluvium, 3m high, Quaternary fossil, bovid tooth (close up).	

17	S 28 13.153 E 27 01.592	Maselspruit River edge	Alluvium, 1m high, Quaternary fossil, bivalve shell (*Unio*) (wide view).	
17	S 28 13.153 E 27 01.592	Maselspruit River edge	Alluvium, 1m high, Quaternary fossil, bivalve shell (*Unio*) (close up).	
18	S 28 13.051 E 27 01.528	Maselspruit River bed	Alluvium, 5m high, Quaternary fossil bovid/equid metacarpal/ metatarsal (wide view).	

18	S 28 13.051 E 27 01.528	Maselspruit River bed	Alluvium, 5m high, Quaternary fossil bovid/equid metacarpal/ metatarsal (close up).	
19	S 28 12.687 E 27 01.431	Maselspruit River edge	Alluvium, 8m high, potentially-fossiliferous, no fossils found.	
19	S 28 12.687 E 27 01.431	Maselspruit River edge	Consolidated gravel alluvium (Quaternary), with two *in situ* red/brown Permian silicified fossil wood fragments.	

20	S 28 12.320 E 27 01.477	Maselspruit River bed	Consolidated gravel alluvium (Quaternary) with two *ex situ* silicified Permian fossil wood fragments (wide view).	
20	S 28 12.320 E 27 01.477	Maselspruit River bed	Consolidated gravel alluvium (Quaternary) with two *ex situ* silicified Permian fossil wood fragments (close up).	
21	S 28 12.114 E 27 01.541	Maselspruit River bed	Soil with Quaternary fossil cervical vertebra of a bovid (wide view).	

21	S 28 12.114 E 27 01.541	Maselspruit River bed	Soil with Quaternary fossil cervical vertebra of a bovid (close up).	
37	S 28 13.315 E 27 01.535	Maselspruit River edge	Alluvium 6m high, potentially-fossiliferous, no fossils found.	
38	S 28 13.683 E 27 01.213	Maselspruit River edge	Alluvium 8m high, potentially-fossiliferous, no fossils found.	

39	S 28 13.735 E 27 01.317	Maselspruit River edge	Consolidated gravel alluvium (Quaternary), 5m high, containing fragmentary large mammal fossil tooth, mammal bones, Permian silicified fossil wood fragments, and fossil bivalve (wide view).	
39	S 28 13.735 E 27 01.317	Maselspruit River edge	Consolidated gravel alluvium (Quaternary), containing a fragmentary large bovid fossil tooth (close up).	
39	S 28 13.735 E 27 01.317	Maselspruit River edge	Consolidated gravel alluvium (Quaternary), containing Permian silicified fossil wood fragments (close up).	

39	S 28 13.735 E 27 01.317	Maselspruit River edge	Consolidated gravel alluvium (Quaternary), containing a fossil bivalve (close up).	

Table 2.2. Sites visited (Way Points 3, 33, 34) along the south-east-tributary of the Maselspruit River on the farm Blomskraal, 216. Scale bar equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
3	S 28 13.183 E 27 01.672	Maselspruit south eastern tributary	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, no fossils found.	

3	S 28 13.183 E 27 01.672	Maselspruit south eastern tributary	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with two calcareous nodules and with potentially-fossiliferous consolidated alluvial soil on top, no fossils found.	
3	S 28 13.183 E 27 01.672	Maselspruit south eastern tributary	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with two yellow calcareous nodules, no fossils found.	
33	S 28 13.148 E 27 01.707	Maselspruit south eastern tributary	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with potentially-fossiliferous consolidated alluvial soil on top, no fossils found.	

34	S 28 13.134 E 27 01.722	Maselspruit eastern stream	Exposed lime green mudstone outcrop, potentially-fossiliferous sedimentary rocks, with calcareous nodules, capped by brown sandstone.	

Table 2.3. Sites visited (Way Points 11, 12, 13) along the western hill on the farm Blomskraal, 216. Scale bar white ruler equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
11	S 28 14.129 E 26 58.746	Non irrigated land, (velt) covered in grass and bushes, southern foothill of western hill.	No outcrop, no fossils.	

12	S 28 14.012 E 26 58.734	Top of western hill.	Dolerite with very sandy/grainy weathering, no fossil potential.	
13	S 28 13.984 E 26 58.665	Top of western hill.	Dolerite, no fossil potential.	
13	S 28 13.984 E 26 58.665	Top of western hill or ridge.	Dolerite, no fossil potential.	

Table 2.4. Site visited (Way Point 36) at the small eastern hill on the farm Blomskraal, 216. Scale bar equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
36	S 28 12.820 E 27 01.869	Flanks of eastern hill	Scattered dolerite boulders, no fossils p	

Table 2.5. Sites visited (Way Points 1, 2, 41) along the eastern sandstone ridge outcrop on the farm Blomskraal, 216. Scale bar equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
1	S 28 13.281 E 27 01.730	Exposed weathered sandstone blocks from a sandstone ridge in the velt	Sandstone outcrop, potentially-fossiliferous sedimentary rocks, no fossils found.	

2	S 28 13.263 E 27 01.750	Borrow pit excavated (scrape marks) into weathered Beaufort Group overbank mudrocks, below the sandstone layer.	Exposed lime green mudstone outcrop below sandstone layer, potentially-fossiliferous sedimentary rocks, no fossils found.	
41	S 28 13.595 E 27 01.690	Exposed weathered sandstone blocks from a sandstone ridge in the velt	Sandstone outcrop, potentially-fossiliferous sedimentary rocks, no fossils found.	

Table 2.6. Grassland and dolerite sites visited (Way Points 7, 8, 9, 10) on the farm Blomskraal, 216. Scale bar equals 15 cm/6 inches.

Way Point	GPS Coordinates	Description	Geology & Palaeontological Significance	Photograph
7	S 28 13.142 E 27 01.685	Non irrigated land, (velt) covered in grass and bushes.	No outcrop, no fossils.	
8	S 28 14.927 E 26 58.447	Non irrigated land, (velt) covered in grass and bushes.	Dolerite outcrop in foreground, no fossil potential.	

9	S 28 15.006 E 26 58.487	Non irrigated land, (velt) covered in grass and bushes, near hill beacon.	Dolerite outcrop, no fossil potential.	
10	S 28 14.320 E 26 58.553	Non irrigated land, (velt) covered in grass and bushes.	No outcrop, no fossils.	

8. PALAEONTOLOGICAL SENSITIVITY (HERITAGE VALUE)

The potential palaeontological resources in the study area, are grouped into LOW, MEDIUM or HIGH sensitivity (significance/impact), are shown in Table 3, according to their potential scientific value.

Table 3. P**alaeontological Sensitivity (significance/impact) of geological units in the study area.**

Geological Unit	Rock Type & Age	Fossil Heritage (Virginia area)	Vertebrate Biozone	Palaeontological Sensitivity
Balfour Formation	Sandstone/ Mudstone - Late Permian	*Glossopteris* plant impressions, fragmentary fossil wood (*Agathoxylon africanum*,, *Agathoxylon karooensis*), unidentified Gymnosperm (Groenewald 2021)	*Daptocephalus* Assemblage Zone	HIGH
Quaternary alluvial deposits	Soil - early Pliocene	Bovid bones and teeth, bivalve (*Unio)* shells.	N/A	LOW
Dolerite	Dolerite - Jurassic	None	N/A	N/A

Although the Palaeontological sensitivity of the Late Permian mudstone/sandstone deposits is HIGH, Quaternary alluvial deposits (soil), with LOW sensitivity, covers most of the farm and most of the Permian bedrock. Sensitive Permian Karoo bedrock is only exposed in places in the Maselspruit River and in even fewer places in the four erosional gullies or streams of the river, and in two regions of an exposed sandstone ridge. If development is avoided in these Palaeontologically sensitive areas of Permian outcrop, the Palaeontological impact of the proposed development is LOW.

9. RECOMMENDATIONS FOR MONITORING AND MITIGATION

This Phase 1 Palaeontological Impact Assessment confirms that the study area is located in a region of the Karoo which is underlain by sedimentary rocks of Late Permian age and overlain by Quaternary alluvial deposits. Outcroppings of the palaeontological sensitive rocks of the Beaufort Group did not reveal any fossils, and the Quaternary alluvial deposits revealed only sporadic fragmentary fossils. As very few fossils were found during our investigation in this area we recommend that from a palaeontological perspective the proposed development should proceed.

As the proposed development has the potential to expose fossils, we recommend the following mitigation clauses, that the proposed development be constrained to:

- the flat, non-irrigated grassland, that covers the majority of the farm, currently serving as cattle and game farming land (Fig. 9: Pa-Green);

- the irrigated cropland in the northwest and northeast sections of the farm, currently growing maize/corn (Fig. 9: Qs-Yellow).

No Go Areas:

Due to palaeontological sensitivity, we do not recommend development on:

- the north-south Maselspruit River (Fig. 9: light yellow shading);
- the three east-west erosional gullies or tributary streams, west of the Maselspruit River (Fig. 9: light yellow shading);
- the south-east running erosional gully or tributary stream, east of the Maselspruit River (Fig. 9: light yellow shading).

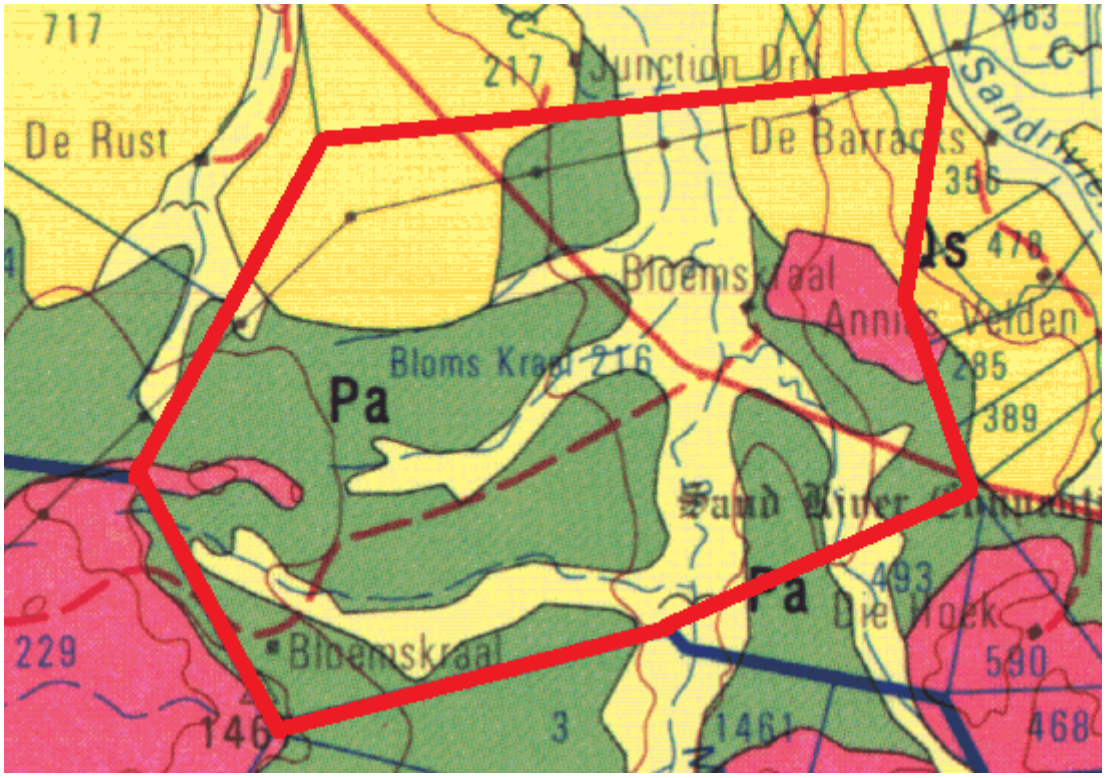


Figure 9: Magnified view of the 1:250 000 Geological map (2826 Winburg– D.J.L Visser and C.C Nolte 1987) showing the position of the study locality (red outline) and the No Go areas as light yellow shading, along the river courses. Pa, Permian (Adelaide Subgroup); Qs, Quaternary; Jd, Jurassic dolerite.

During construction, the proposed development of the Photovoltaic (PV) Power Plants and connection infrastructure will result in extensive excavations on site, possibly through the Quaternary sediment cover into the underlying bedrock, which may expose potential fossil heritage on site. Blomskraal, 216, and the immediate surrounding area have yielded few Permian fossils, so any fossil finds may be significant and have the potential to add to our scientific knowledge. If fossils are exposed in the process of development a qualified palaeontologist must be contacted (See Appendix A: Chance Find protocol).

The recommended mitigation procedures are detailed in Appendix A: Chance Find Protocol, which details the procedures required if fossils are exposed by excavations, and must be incorporated into the Environmental Management Programme (EMP) for the proposed development.

10. CONCLUSION

The proposed development on of the farm Blomskraal, 216, is underlain by Late Permian sedimentary and potentially fossil bearing rocks. These rocks are only exposed in patches along the Maselspruit River, the four erosional guiles or tributary streams, and the eastern sandstone ridge. Most of the study area is overlain with Quaternary alluvial deposits which are covered by grass and bush vegetation or by irrigated cropland.

It is unlikely that fossils will be exposed as a result of the proposed development. If Karoo rocks are exposed by development this will create an opportunity to find fossils in an area which has delivered very few Late Permian Karoo fossils.

It is thus recommended that, from a palaeontological perspective, the proposed solar park development should proceed but should be constrained to the flat, grass and bushy vegetation covered areas currently used for cattle and game farming, as well as the irrigated cropland. Development should not take place near the north-south running Maselspruit River, or its four erosional guiles or tributary streams.

Should fossils be uncovered in superficial Quaternary deposits or in the underlying Karoo sedimentary rocks during the course of development activities, the developer must immediately contact a qualified palaeontologist to assess the exposure for fossils so that the necessary rescue operations are implemented (Appendix A: Chance Find Protocol).

11. ACKNOWLEDGEMENTS

We thank Johan Botha of AGES Limpopo (Pty) for providing the relevant background information and Ted van Wyk for farm access to Blomskraal during our on-site inspection. Dr Mike Day, Natural History Museum, London, provided information of fossils recorded near Virginia, from the Karoo Vertebrae Fossil Database and Dr David Groenewald for information relating to fossils from the Virginia area.

12. QUALIFICATIONS AND EXPERIENCE OF THE AUTHORS

Professor Bruce Rubidge is Director of the DST/NRF Centre of Excellence for Palaeosciences until the end of 2021 and is currently a Distinguished Professor at the Evolutionary Studies Institute at the University of the Witwatersrand. Following completion of his B.Sc., B.Sc. (Hons) cum laude at Stellenbosch University he was appointed to a curatorial position in the Karoo Palaeontology Department at the National Museum in Bloemfontein in 1980, becoming Head of the Department in 1982. He was appointed Director of the Bernard Price Institute (BPI) and Head of the Palaeontology Department at the University of the Witwatersrand in 1990. In 2013 he was appointed Director of the newly established DST/NRF Centre of Excellence for Palaeosciences at Wits. Rubidge has broad research interests but most of his work focusses on the remarkable fossil record of the Karoo and their significance in understanding the origin of mammals. He has published more than 180 research publications in internationally accredited journals and 36 MSc and PhD students

achieved their degrees under his supervision. He has extensive experience in Palaeontological Impact Assessments.

Doctor Marc Van den Brandt is an Honorary Research Fellow in the Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg. Marc has a BCom and BCom (Hons) with distinction in Information Systems from Rhodes University (1998-2002). Following a successful career as a Business Analyst, Marc obtained his B.Sc (Hons) with distinction, MSc with distinction and PhD in Vertebrate Palaeontology from the University of the Witwatersrand (2013 – 2020) and has participated in 22 palaeontological and archeologically field trips in South Africa, mostly to Permian localities in the Beaufort Group of the Karoo Supergroup. Marc has a published seven papers in internationally accredited journals, focusing on the anatomy and biostratigraphy of Permian Karoo vertebrates. Marc has served as a reviewer on three internationally published palaeontological papers.

13. DECLARATION OF INDEPENDANCE

I, Bruce S. Rubidge 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.

Prof Bruce S. Rubidge
PhD, FGSSA, FRSSA, Pr Sci Nat

I, Marc J. Van den Brandt, 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 Marc J. Van den Brandt
PhD (Palaeontology)

14. REFERENCE LIST

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APPENDIX A: CHANCE FIND PROTOCOL

<table>
<tr><td colspan="3">Chance Fossil Finds Procedure: Virginia 1, Virginia 2, and Virginia 3 Solar Parks, and Power Line Corridor, near Virginia, Free State Province.</td></tr>
<tr><td>Province & Region:</td><td colspan="2">Free State Province, Lejweleputswa District Municipality</td></tr>
<tr><td>Responsible Heritage Authority</td><td colspan="2">South African Heritage Resources Agency (SAHRA)
111 Harrington Street PO Box 4637 Cape Town 8001
Contact: Dr Ragna Redelstorff. Tel: 021 202 8651/076 2523 627. Email: rredelstorff@sahra.org.za</td></tr>
<tr><td>Rock Unit(S)</td><td colspan="2">Adelaide Subgroup (Lower Beaufort Group), and Quaternary alluvium</td></tr>
<tr><td>Potential Fossils</td><td colspan="2">Vertebrate bones & teeth, vertebrate and other burrows, plant compressions, petrified wood</td></tr>
<tr><td rowspan="5">Environmental Control Officer (ECO) Protocol or the foreman or site agent in the absence of the ECO</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
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) and depth below surface;
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering).</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
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.</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully 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</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably qualified palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority.</td></tr>
<tr><td>Specialist Palaeontologist</td><td colspan="2">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 the Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and the Heritage Resources Authority minimum standards.</td></tr>
</table>

MARC VAN DEN BRANDT

CURRICULUM VITAE

October 2021

Personal Details

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Residence	Oviston, Venterstad, 9798, Eastern Cape, South Africa

Personal Profile: Business Analyst to Palaeontologist

I initially studied for a BCom and then a BCom Honours degree at Rhodes University in 2001 and 2002 respectively. After obtaining my BCom Honours in Information Systems (with distinction) in 2002 from Rhodes University, I worked as a Business Analyst with an IT consulting firm, the IQ Business Group, from 2003 to 2008, and with Absa Bank from 2010 to 2013. I became interested in palaeontology and fossils due to my volunteer activities at the University of the Witwatersrand in 2012, where I helped to sort and classify fossils on the weekends in the Cradle of Humankind area as well as at the university fossil stores. I developed a deep interest and love for palaeontology, evolution, fossils and the culture of the Palaeontology department (Now the ESI, formerly the BPI) at the University of the Witwatersrand. I discovered that it was possible to register for a BSc Honours at the University of the Witwatersrand in Palaeontology, using my undergraduate BCom and Honours BCom Commerce degrees from Rhodes, even though these degrees were not directly related to Palaeontology or Earth Sciences.

I was a full time student at the University of the Witwatersrand in 2013 and completed my BSc Honours in Palaeontology at the Evolutionary Studies Institute (ESI). Despite my previous undergraduate studies being in commerce and having no scientific background, I worked diligently and consistently throughout the year and enjoyed every day of these studies, ahieving the BSc Honours degree in Palaeontology with distinction.

In 2014 I worked as a Consultant in order to raise funds for and to support myself during my Masters and PhD Palaeontological studies. I registered for MSc in Palaeontology in 2015 at the University of the Witwatersrand and chose to work on the anatomy of the pareiasaurs from the middle Permian of the Karoo in South Africa, due to the current poor understanding of these animals. My MSc degree (2015-2016, achieved with distinction) resulted in the first comprehensive cranial description of one pareiasaur species, *Embrithosaurus*, published as a monographic work in an important international journal, the Zoological Journal of the Linnean Society.

My PhD degree (2017-2019) produced the first comprehensive cranial description of the pareiasaur *Nochelesaurus alexanderi*, postcranial descriptions for *Bradysaurus baini*, *Embrithosaurus schwarzi* and *Nochelesaurus alexanderi* and updated phylogenetic, taxonomic, diagnostic and stratigraphic ranges for all these taxa. I also used this opportunity to visit some of the most important palaeontological collections in which there are remains of pareiasaurians, both locally as internationally, and study the specimen's targeted in my PhD by first-hand experience.

I am currently (2020-2021) publishing my PhD thesis chapters as three –four separate papers in palaeontological journals, and contributing towards publishing at two further pareiasaur centred papers with colleagues in 2021.

Employment History

03/2021 – Present	Honorary Research Fellow, Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg.
03/2020 – 06/2020	Internship, University of the Witwatersrand, Johannesburg (Palaeontology) (4
05/2014 – 10/2014	Business Analyst Contractor at Freethinking Business Consultants, Johannesburg
09/2010 – 01/2013	Business Analyst at Absa Bank Ltd, Johannesburg (2.5yrs)
01/2009 – 08/2010	Independent Systems/Business Analyst Consulting, Cape Town & Pretoria (1.5yrs)
01/2003 – 12/2008	Business Analyst and Process Analyst Consultant at The IQ Business Group, Johannesburg (6yrs)

Education

01/2017 – 3/2020	Doctor of Philosophy Degree, University of the Witwatersrand
01/2015 - 12/2016	Master of Science Degree, University of the Witwatersrand
01/2013 - 12/2013	Bachelor of Science Honours Degree, University of the Witwatersrand • Palaeontology (Distinction)
01/2002 - 12/2002	Bachelor of Commerce Honours Degree, Rhodes University • Information Systems (Distinction)
01/1998 - 12/2001	Bachelor of Commerce Degree, Rhodes University • Information Systems and Business Management
12/1997	Senior Certificate (Grade 12), Fairmont High School, Durbanville, Western Cape • Overall B Aggregate: Distinctions in Business Economics Higher Grade and

Research Outputs: Conference presentations (Palaeontology)

Society of Vertebrate Palaeontology (SVP), 75th Annual Conference, 17-21 October 2018, Albuquerque, USA	Understanding middle Permian pareiasaur diversity: the crania morphology of *Nochelesaurus alexanderi* and *Embrithosaurus schwarzi*

Centre of Excellence in Palaeosceinces (CoE-Pal) 5 year anniversary lecture series, 29-31 August 2018, Gauteng	Understanding middle Permian pareiasaur diversity: the crania morphology of *Nochelesaurus alexanderi* and *Embrithosaurus schwarzi*
Palaeontological Society of Southern Africa (PSSA), 20th Biennial Conference, Bloemfontein, South Africa, 4-7 July 2018	Understanding middle Permian pareiasaur diversity: the crania morphology of *Nochelesaurus alexanderi* and *Embrithosaurus schwarzi*
Palaeontological Society of Southern Africa (PSSA), 19th Biennial Conference, Stellenbosch, South Africa, 5-9 July 2016	Cranial morphology of *Embrithosaurus schwarzi* (Parareptilia, Pareiasauria) and a taxonomic and stratigraphic reassessment of the South African middle Permian pareiasaurs.

Publications

1

Title of Article	**Physiological implications of the abnormal absence of the parietal foramen in a Late Permian cynodont (Therapsida)**
Title of Journal	The Science of Nature, Naturwissenschaften
Volume	December 2015, 102:69
Authors	Benoit,J., Abdala,F., Van den Brandt,M.J., Manger,P.R., and Rubidge,B.S.
Status	**Published**
Year	2015
Web Address	*http://link.springer.com/article/10.1007%2Fs00114-015-1321-4*
Contribution	Most of the data for this paper was provided by myself in the form of Computer Tomography (CT) data of 5 fossil skulls of *Cynosaurus*, originally scanned by myself in 2013 for my BSc Honours degree in Palaeontology. I also contributed two edited photographs.

2

Title of Article	**Cranial morphology and phylogenetic analysis of *Cynosaurus suppostus* (Therapsida, Cynodontia) from the Upper Permian of the Karoo Basin, South Africa**
Title of Journal	Palaeontologia Africana
Volume	52, 2017-2018
Authors	Van den Brandt,M.J., and Abdala,F.
Status	**Published**
Year	2018
Web Address	*https://hdl.handle.net/10539/24254*

Contribution	I am the lead author on the article on this lengthy paper which comprises a detailed cranial description, including an updated phylogenetic analysis, and contains 10 scientific figures. The paper is based on my BSc Honours Degree research project in Palaeontology at the University of the Witwatersrand, completed in 2013. I conducted all the direct cranial research and produced all scientific figures as lead author. My Honours degree Research project Supervisor, Fernando Abdala, is the co-author.

3

Title of Article	**Oxygen isotopes and ecological inferences of Permian (Guadalupian) tetrapods from the main Karoo Basin of South Africa**
Title of Journal	Palaeogeography, Palaeoclimatology, Palaeoecology,
Volume	538
Authors	Rey, K., Day, M.O., Amiot, R., Fourel, F., Luyt, J., Van den Brandt, M.J., Lécuyer, C., and Rubidge, B.S.
Status	**Published**
Year	2019
Web Address	https://doi.org/10.1016/j.palaeo.2019.109485
Contribution	I Identified the pareiasaur fossil specimens used in this research. I wrote sections of the manuscript, and provided reviews and edits.

4

Title of Article	**Cranial morphology and phylogenetic relationships of the Middle Permian pareiasaur *Embrithosaurus schwarzi* from the Karoo Basin of South Africa**
Title of Journal	Zoological Journal of the Linnean Society
Volume	188(1), 202-241
Authors	Van den Brandt, M.J., Abdala, F., and Rubidge, B.S.
Status	**Published**
Year	2020
Web Address	https://doi.org/10.1093/zoolinnean/zlz064
Contribution	I was the lead author of this lengthy paper which comprises a detailed cranial description, including an updated phylogenetic analysis, and contains 19 scientific figures. The paper is based on my MSc thesis in Palaeontology at the University of the Witwatersrand, completed in 2016 and includes research conducted during my PhD degree as well. I conducted all the direct cranial research and produced all scientific figures as lead author.

5

Title of Article	**Cranial morphology of the middle Permian pareiasaur *Nochelesaurus alexanderi* from the Karoo Basin of South Africa**
Title of Journal	Earth and Environmental Science Transactions of the Royal Society of Edinburgh
Volume	N/A
Authors	Van den Brandt, M.J., Rubidge, B.S, Benoit, J. and Abdala, F.
Status	**Published**
Year	2021
Web Address	https://doi.org/10.1017/S1755691021000049
Contribution	This paper is the published form of chapter three of my PhD thesis, the cranial description of the pareiasaur *Nochelesaurus alexanderi* and is the first comprehensive modern cranial description for this species.

6

Title of Article	**Postcranial morphology of the South African middle Permian pareiasaurs from the Karoo Basin of South Africa**
Title of Journal	Palaeontologia Africana
Volume	55
Authors	Van den Brandt, M.J., Rubidge, B.S, Benoit, J. and Abdala, F.
Status	**Published**
Year	2021
Web Address	http://wiredspace.wits.ac.za/handle/10539/31290
Contribution	This lengthy paper is a conversion of chapters four, five and six of my PhD thesis, and discussion, and is an extremely comprehensive work, delivering the first modern detailed comparative postcranial descriptions and diagnoses of all three valid South African middle Permian pareiasaurs, including 74 figures.

7

Title of Article	**Volumetric body mass estimate and in-vivo reconstruction of the Russian pareisaurs *Scutosaurus karpinskii***
Title of Journal	Frontiers in Ecology and Evolution
Volume	17 June 2021

Authors	Marco Romano, Fabio Manucci, Bruce S Rubidge and Marc Johan Van den Brandt
Status	**Published**
Year	2021
Web Address	https://doi.org/10.3389/fevo.2021.692035
Contribution	Marco Romano is the lead author of this paper that provides a body size estimate for the Russian pareiasaur *Scutosaurus*. I wrote approximately 50% of this paper, comprising the Introduction, the taxonomic history of the Russian pareiasaurs including *Scutosaurus*, and the parts of the Discussion and Conclusion that focused on posture and body size.

8

Title of Article	**Taxonomy, phylogeny and stratigraphy of the South African middle Permian pareiasaurs from the Karoo Basin of South Africa**
Title of Journal	Journal of Systematic Palaeontology
Volume	
Authors	Van den Brandt, M.J., Abdala, F., Benoit, J., Day, M. O., and Rubidge, B. S.
Status	**In Press (Accepted, February 2021)**
Year	2021
Web Address	
Contribution	This paper is a conversion of chapters seven, eight, nine and ten of my PhD degree. This is a comprehensive work, delivering the results and conclusions of my PhD, including an updated taxonomy, phylogeny and stratigraphy of all valid South African middle Permian pareiasaurs.

Palaeontological Museum and Institutional visits to collect data for Degree research: Honours (2013), Masters (2015-2016) and PhD (2017-2019)

	SOUTH ARICAN INSTITUTIONS
SAM, Iziko South African Museum, Cape Town, South Africa	• 17 June – 26 July 2019. Studied 110 pareiasaurs for re-identification purposes, and relocated the material from the Basement to the new 3rd floor collections facilities of the museum. • 20-24 May 2019: Studied the 6 historic pareiasaur holotypes for taxonomic reasons. • 21 Dec 2018. The mounted *Bradysaurus baini* studied. • 14 May - 14 June 2018 (Describe all postcrania of SAM-PK-6238 *Nochelesaurus*) • 10 Jan 2018 (Access preservation of SAM-PK-6238 *Nochelesauurs* postcrania) • 1-30 July 2017 (Describe SAM-PK-6238 *Nochelesauurs* crania) • 17 Feb 2017 (SAM-PK-8034 and SAM-PK-6239 postcrania loaned to the

	University of the Witwatersrand) • 17 Jan 2017 (Access preservation of 6 historic pareiasaur holotypes) • 13 May - 9 June 2016. (Re-identify 100 pareiasaur cranial specimens) • 14 April 2015 (SAM-PK-8034 crania loaned to the University of the Witwatersrand) • 10-20 Feb 2015 (Pareiasaur collection studied) • 13 December 2012 (SAM-PK-4333 and SAM-PK-K10694, *Cynosaurus*)
CGP, Council for Geosciences, Pretoria, South Africa	• 12-13 Aug 2019. Studied 20 pareiasaurs for re-identification purposes. • 19 Jan 2018 (JA109 photographs taken and line drawings made) • 1 Dec 2017 (CBT112 postcrania loaned to the University of the Witwatersrand) • 7 Aug 2017 (JA109 added to *Nochelesaurus* cranial description) • 12 Jun 2017 (CBT112 accessed for preparation needed) • 17 Oct 2016 (CBT112 crania, R338, loaned to the University of the Witwatersrand) • 20-21 Jun 2016 (Re- Re-identify 30 pareiasaur cranial specimens) • 28 July 2015 (CBT112 *Embrithosaurus* studied) • 23 Jan 2015 (Pareiasaur collection studied)
VW, Victoria West Regional Museum, Victoria West, South Africa.	• 23 Feb 2015 (Studied *Bradysaurus seeleyi* specimen)
TM, Ditsong National Museum of Natural History (formerly Transvaal Museum), Pretoria, South Africa	• 29 Jan 2015 (Pareiasaur collection studied)
Albany Museum, Grahamstown, South AFrica	• 19-23 Nov 2018: Holotype specimen of *Pareiasaurus acutirostris* studied, and the cast of the holotype of *Bradysaurus baini*.
Rubidge Collection, Wellwood, Graaff-Reinet, Eastern Cape, South Africa	• 5-7 Sep 2021: Museum catalogue (spreadsheet) checked and updated for all 852 specimens, over 3 days, with Prof Bruce Rubidge.
	INTERNATIONAL INSTITUTIONS
AMNH, American Museum of Natural History, New York, United States of America	• 22-26 October 2018 (Study historic pareiasaur holotypes AMNH FARB 5567, AMNH FARB 2232, and other specimens)
FMNH, Field Museum of Natural History, Chicago, United States of America	• 03-08 Feb 2019. 22 partial pareiasaurs studied, including two mounted, very complete specimens.
NHMUK, Natural History	• 21 Jan – 01 Feb 2019. Holotypes of *Bradysaurus baini* NHMUK R1971and

Museum of London, United Kingdom	*Bradysaurus seeleyi* studied NHMUK 49426 and approximately 5 other specimens. • 4-20 April 2016 (Study historic pareiasaur holotypes NHMUK R1971, NHMUK 49426, and other specimens R7782, R1970)
UMZC, University Museum of Zoology, Cambridge, United Kingdom	• 21 April 2016 (Study *Deltavjatia rossicus*; UMZC T1321)
PIN, Paleontological Institute of the Russian Academy of Sciences, Moscow	• 25 Oct – 4 Nov 2016 (Study Russian pareiasaur holotypes, including several cranial and postcranial specimens of *Scutosaurus*, *Deltavjatia* and *Obirkovia*)

Outreach: Public Communication: Palaeontological Exhibitions

Rand Easter Show, Johannesburg, South Africa	• 23-28 April 2019: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 60 hours of talking to the public. • 1-8 Apr 2018: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 80 hours of talking to the public. • 14-23 Apr 2017: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 100 hours of talking to the public. • 25Mar-3 Apr 2016: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 90 hours of talking to the public. • 4-12 April 2015: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 80 hours of talking to the public.
University of the Witwatersrand "Yebo Gogo" Johannesburg, South Africa	• 7-12 May 2019: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 30 hours of talking to the public. • 12-13 May 2018: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 16 hours of talking to the public. • 10-14 May 2017: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 40 hours of talking to the public.
National Science Week/Sci Bono, Newtowm, Johannesburg, South Africa	• 2 & 9 Aug 2018: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Sci-Bono Science center, Johannesburg. 16 hours of talking to school groups and the public. • 4-5 Aug 2017: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Nelson Mandela University, Port Elizabeth. 14 hours of talking to the public. • 10-11 Aug 2016: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Sci-Bono Science center, Johannesburg. 15 hours of talking to the public. • 7-8 Aug 2015: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Sci-Bono Science center, Johannesburg. 15 hours of talking to the public. • 1-2 Aug 2013: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Sci-Bono Science center, Johannesburg. 15 hours of talking to the public.
Comic Convention (Comic Con) Africa, Midrand, Johannesburg, South AFrica	• 22-23 Sep 2019: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition, Gallagher Estate. 18 hours of talking to the public.

RAGE Computer Gaming expo, Northgate, Johannesburg, South Africa	• 27-29 Sep 2019: University of the Witwatersrand Palaeontology and Palaeoanthropology exhibition. 27 hours of talking to the public.

Public Communication: Scicom Posts (Facebook)

2010-2021	• I have been enthusiastically posting and sharing Paleontological related articles on Facebook since 2010 and have posted several hundred articles. I repost, share and contribute to the official Facebook social pages of the University of the Witwatersrand, the Evolutionary Studies Institute, the Centre of Excellence in Palaeosciences, The Palaeontological Society of Southern Africa, and several more.

Field Work experience (Palaeontology/Palaeoanthropology/Archaeology)

2021	• 19-26 Aug: Served as a volunteer fossil finder and mentor to 15 Wits University Palaeontological Honours students during "Project THRINAX 2021" at the Oviston Nature Reserve, and the farms Vanwyksfontein and Waschbank, near Gariep Dam. • 7-10 Apr: Palaeontological Impact Assessment field visit. Farm Blomskraal, near Virginia, Free State Province of South Africa. Late Permian in age. • 15-20 Mar: Farms in the Prince Albert and Sutherland districts. Karoo Supergroup, middle Permian, excavations and identification of pareiasaur and Karoo fossils previously found by Dr John Almond during Palaeontological Impact Assessment field work.
2020	• 01-21 Dec: Farm Mars Hill in the Dortrecht district. Opening of a Middle Stone Age Rock Shelter site, Archaeological field work under the direction of Dr Paloma de la Penya. • 23 Feb - 9 Mar: Farms in the Prince Albert district, principally Abrahamskraal. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge. • 02-12 Oct: Farm Skylderkrans in the Dortrecht district. Open air Middle Stone Age Archaeological field work under the direction of Dr Paloma de la Penya.
2019	• 16 Nov - 1 Dec: Served at one of three Tutors/Supervisors to 15 Palaeontological Honours students "Project THRINAX", a field trip organized by Julien Benoit to teach palaeontological field work and skills. • 24 Feb – 10 Mar: Several farms in the Laingsberg district, and Jasfontein, Victoria West district. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge.
2018	• 23-24 Mar: Border cave, Kwazulu-Natal province, Lyn Wadley archaeological research group, data collection assistant to Dr Ashely Kruger (Drone photography/video). • 29 Feb – 9 Mar: Laingsberg. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge.
2017	• 27 Feb – 14 Mar: Merweville Deesveesfontien. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge. • 15-22 May: Sutherland. Karoo Supergroup, middle Permian, Albany museum Grahamstown palaeobotanical collecting field trip. Hosted by Dr. Rose Prevec.
2016	• 28 Feb – 13 Mar: Laingsberg. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge. • 18-27 Sep: Sutherland. Karoo Supergroup, middle Permian, Albany museum Grahamstown palaeobotanical collecting field trip. Hosted by Dr. Rose Prevec. New Permian insect species found.

2015	• 6-8 Feb: Jaggersfontein. Karoo Supergroup, Late Permian, fossil collecting field trip for PhD research of Pia Viglietti. • 22 Feb – 6 Mar: Renostervalley Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge. • 10-19 Nov: Karoo, Beaufort group, late Permian, Iziko South African museum colleting field trip. Hosted by Roger Smith.
2014	• 26 Feb – 13 Mar: Muggefontein. Karoo Supergroup, middle Permian, ESI annual collecting field trip. Hosted by Prof Bruce Rubidge. • 8-23 Sep: Karoo Supergroup, late Permian, fossil collecting field trip for PhD research of Pia Viglietti.
2013	• 12-15 May: University of the Witwatersrand Honours Degree Field trip of the entire Karoo Supergroup sequence. Hosted by Prof Bruce Rubidge. • 1-4 Sep: University of the Witwatersrand Honours Degree Field trip of the Stormberg sequence (Dinosaur deposits) Hosted by Prof Jonah Choinere. • 9-23 Nov: Science Tent, primary fossil cataloguer for the discovery of a new hominid species *Homo Naledi*, Rising Star Cave, Cradle of Humankind, Gauteng. Catalogued 1200 new hominid fossils. Hosted by Prof Lee Burger.

Professional Palaeontological Society Memberships

2018	Society of Vertebrate Palaeontology (SVP)
2014-2020	Palaeontological Society of Southern Africa (PSSA)

Lecturing, Demonstrating, Tutoring and other University departmental duties

Lectures	• 3 Apr 2018: University of the Witwatersrand Honours Palaeontology class: Introduction to Pareiasaurs, 15 hours preparation, 1 hour presentation.
Fossil cataloging	• 1-4 Nov 2016: Ian Machlachlan Permian catalogue capturing. 20 hours.
Tutoring	• 17 Sep 2018. University of the Witwatersrand Geology 2nd year, tutoring and demonstrating. 3 hours. • 15 Sep -30 Oct 2017. University of the Witwatersrand Palaeontology 3 tutoring and demonstrating. 40 hours. • 12 Sep -25 Oct 2016. University of the Witwatersrand Palaeontology 3 tutoring and demonstrating. 40 hours. • 1-15 May 2016: University of the Witwatersrand Geology 1 tutoring and demonstrating. 10 hours. • 1-20 May 2015: University of the Witwatersrand Geology 1 tutoring and demonstrating. 10 hours.

Palaeotological Impact Assessments (PIA's)

1	March/April 2021: Co-author along with Prof Bruce Rubidge on two Palaeontological Impact Assessment Reports: 1) Blomskraal 216, Lejweleputswa District Municipality, Free State Province (Virginia 1, Virginia 2, Virginia 3 Solar Parks, and Power Line Corridor); and 2) Power Line Corridor, Lejweleputswa District Municipality, Free State Province (Virginia 1, Virginia 2, Virginia 3 Solar Parks, and Power Line Corridor).

Articles Reviewed

1	Marchetti L, Voigt S, Mujal E, Lucas S. G, Francischini H, Fortuny J, and Santucci V. L (2020). Extending the footprint record of Pareiasauromorpha to the Cisuralian: earlier appearance and wider palaeobiogeography of the group. *Papers in Palaeontology*, https://doi.org/10.1002/spp2.1342
2	Piñeiro, G., Ferigolo, J., Mones, A., & Núñez Demarco, P. (2021). Mesosaur taxonomy reappraisal: are Stereosternum and Brazilosaurus valid taxa?. *Revista Brasileira De Paleontologia*, 24(3), 205-235. https://doi.org/10.4072/rbp.2021.3.04
3	Cisneros J. C, Dentzien-Dias P, and Francischini H. (2021) The Brazilian pareiasaur revisited. *Frontiers in Ecology and Evolution*, (in press).

References

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Professor Fernando Abdala	Unidad Ejecutora Lillo, CONICET-Fundación Miguel Lillo, Miguel Lillo 251, Tucumán, Argentina. E-mail: nestor.abdala@wits.ac.za.
Doctor Julien Benoit	Senior Researcher, Evolutionary Studies Institute (ESI), University of the Witwatersrand, Johannesburg. Office: +27 11 717 6687. Mobile +27 79 789 6503. Fax +27 11 717 6694. E-mail: julien.benoit@wits.ac.za.
Professor Roger Smith	Evolutionary Studies Institute, University of the Witwatersrand and Karoo Palaeontology, Iziko South African Museum, PO Box 61 Cape Town, 8000 South Africa. +27(0) 82 723 2804. E-mail: roger.smith4@wits.ac.za, rsmith@iziko.org.za.

Bruce Sidney Rubidge Curriculum Vitae

PERSONAL DETAILS

Name:	Rubidge, Bruce Sidney
Date of birth:	1 June 1956
Marital status:	Married to Alida Marina (née Liebetrau) on 17 November 1984
Children:	Sidney Richard (30 October 1988)
	Mark Lourens (20 September 1990)
Present position:	Director: DSI-NRF Centre of Excellence in Palaeosciences,
	University of the Witwatersrand, Johannesburg, Private Bag 3, P.O. Wits. 2050
Previous position:	Director: DSI-NRF Centre of Excellence in Palaeosciences & Interim Director: Evolutionary Studies Institute, University of the Witwatersrand, Private Bag 3, P.O. Wits. 2050.

PROFILE

Apart from my first work-year in 1980, my entire research career has been in positions of research leadership. From 1981 to 1990, I was Head of the Karoo Palaeontology Department at the National Museum in Bloemfontein. From 1990 to 2017 was the Director of the Bernard Price Institute for Palaeontological Research (BPI) at the University of the Witwatersrand, Johannesburg (Wits) renamed the Evolutionary Studies Institute (ESI). Under my Directorship, the research staff component of the Institute has doubled, the number of postgraduate students has more than doubled, and the research programme of the Institute has greatly expanded. I was closely associated with developing and fundraising for the Institute for Human Evolution (IHE) at Wits, driving the amalgamation of the Wits palaeontological collections under a single collections curator. I was instrumental in the planning the expansion and renovation of the building for the Palaeosciences Centre, which serves as the research and curatorial hub of the established ESI) (an amalgamation of the BPI and IHE). I am currently Director of the DSI-NRF Centre of Excellence in Palaeosciences, and have an A2 rating from the NRF. Being passionate about highlighting the remarkably diverse palaeoheritage of South Africa to the public, I was involved in the development of the UNESCO Cradle of Humankind World Heritage Site. I have developed and expanded the Kitching Fossil Exploration Centre as a sustainable business in the Karoo town of Nieu Bethesda. On an annual basis, I teach at least two palaeontology courses to undergraduate students, three courses to honours students and am involved in the supervision of MSc and PhD graduates.

Although I have administered and sponsored research on the Cenozoic fossil hominid sites in the Cradle of Humankind and have supervised postgraduate geology and palaeontology students researching the Devonian rocks of the Cape Supergroup, most of my research has been on projects relating to the palaeontology, sedimentology, stratigraphy and basin analysis of the Permian-Jurassic Karoo Supergroup. In the process, I have attempted to stimulate international research

collaboration on the Karoo and its fossils, and as a result, have ongoing collaborations with palaeoscientists involved in research on Karoo-aged rocks on all continents of the world. The Karoo fauna is of global interest as southern Africa occupied a central place in Gondwana, and the fossils found in the time-extensive Karoo Supergroup have a global distribution. Recently collaborators and I have published the first radiometric dates for the Permian biozones of the Beaufort Group, a development which will have important consequences for dating tetrapod-bearing Permian deposits from around the world, the timing for basin modelling, as well as determining the rate of evolutionary development in Permian tetrapods.

My current research speciality is to understand biodiversity changes in the lowermost Beaufort Group (Abrahamskraal Formation). This Formation comprises the most complete fossil-bearing Middle Permian terrestrial succession and is one of the only places in the world able to provide evidence for the effect of the end Guadalupian mass extinction (recently noted in the marine realm) on land. For three decades my collaborators and I have undertaken stratigraphic fossil collecting and documentation of the 3000 m thick Abrahamskraal Formation at various localities around the Karoo basin; in the process, we have described more than ten new basal tetrapod species, discovered a new and older faunal biozone, as well as undertaking taxonomic and phylogenetic research on the tetrapod faunas. Because of the complicated structural geology of the southern Karoo and the relative paucity of fossils in these lower horizons, research progress was at first slow as it was challenging to build up large and representative numbers of specimens. Now, however, trends are beginning to emerge around the basin and shortly we will be publishing the first accurate stratigraphic ranges of Middle Permian tetrapod taxa, presenting diversity trends, and proposing a new basin development model for the Abrahamskraal Formation. These findings will have international importance as they will be the first accurate representations for understanding Middle Permian biodiversity changes in the terrestrial realm.

VOCATIONAL QUALIFICATIONS

1988	PhD (Geology/Palaeontology), University of Port Elizabeth
1983	MSc (Palaeontology) cum laude, University of Stellenbosch
1979	BSc Honours (Palaeontology) cum laude, University of Stellenbosch
1975–1978	BSc (Zoology and Geology), University of Stellenbosch

PROFESSIONAL EXPERIENCE

2013-2020	Director: DSI-NRF Centre of Excellence in Palaeosciences,
2013-2017	Interim Director: Evolutionary Studies Institute, & DSI-NRF Centre of Excellence in Palaeosciences
2001–2013	Director of Bernard Price Institute for Palaeontological Research, University of the Witwatersrand, Johannesburg
2001–2002	Deputy Dean (Research), Faculty of Science, University of the Witwatersrand, Johannesburg

May 1990– 2000	Director of Bernard Price Institute for Palaeontological Research & Head of Palaeontology Department, University of the Witwatersrand, Johannesburg
1992–1993	Consultant on Beaufort Biostratigraphy for the Atomic Energy Corporation Uranium Exploration Programme
August 1988	Consultant on Palaeontology for ERL in the Environmental Division of the Lesotho Highlands Development Authority
Jan 1981–Apr 1990	Head of Department of Karoo Palaeontology, National Museum, Bloemfontein
Apr 1980–Dec 1980	Associate curator of Karoo Palaeontology, National Museum, Bloemfontein

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- Sedimentology Division of the Geological Society of SA: *Executive Committee, 1991–1997; Chair, 1997*
- Institute for the Study of Man in Africa: *Executive Committee, 1991–1997*
- Palaeontological Society of Southern Africa: *Vice President, 1990–1992; President, 1992–1994; Immediate Past President, 1994–1996; President, 2004–2006; Immediate Past President, 2006–2008*
- Geological Society of Southern Africa: *Fellow; Committee of Orange Free State Branch of Geological Society of Southern Africa, 1984–1990; Conservation Committee, 1996–2002*
- Royal Society of South Africa, *Fellow*
- Zoological Society of Southern Africa, *Fellow*
- Herpetological Association of Southern Africa, *Member*
- Southern African Museums Association, *Member 1992–2001*
- Archaeological Society of Southern Africa, *Member (Patron, 1992–2021)*

RESEARCH AFFILIATIONS

- Council, National Museum, Bloemfontein, *1999–2012; Chairperson, 2005–2012*
- National Heritage Council, *2006–2012*
- STS Working Group on non-marine Triassic correlations, *1996–2000*
- Consultative Committee of the Geology Section of Museum Africa, *1991–2005*
- Biostratigraphic Task Group of the South African Commission for Stratigraphy, *1986–; Chairperson since 1990*
- South African Committee for Stratigraphy, *1999–*
- Honorary Curator of the South African National Monuments Council, *1989–1994*
- South African Heritage Resources Agency, Permit Committee, 2001–2008
- National Monuments Council of South Africa, PACTS Committee, 1998–2000
- Grantee of the National Research Foundation (NRF), *A rating*
- Have served and continue to serve on NRF evaluation committees, and reviewed research proposals, for the past two decades
- Scientific advisor to Palaeontological Scientific Trust (PAST), *2004-2010*

TENURE ON UNIVERSITY OR UNIVERSITY-RELATED COMMITTEES

- School for Geosciences, *Executive 2001–2013*
- Fossil Hominid Collection Access Committee, *2002–*
- Institute of Human Evolution (IHE) Board, *2007–2012*
- Science Faculty Research Committee, *2009–2013*
- Senate, *1996–*
- Origins Centre Board, *2005–2017*
- Origins Centre Manco, 2005-*2017*
- Kitching Fossil Exploration Centre, Board Chairperson, *2005–*
- Vice Chancellor's Research Award Committee
- URC equipment committee
- University screening committee for NRF rating applications

EXHIBITIONS

1980–1983	Designed and coordinated production of large display on the origins and development of life, National Museum, Bloemfontein
1990–1994	Designed and coordinated a new palaeontology exhibit, BPI Palaeontology, University of the Witwatersrand, Johannesburg
1996–	Designed and coordinated display on the development of life in the Bleloch Museum, Geology Department, University of the Witwatersrand, Johannesburg
1997–1999	Exhibit of life-sized animatronic reconstructions of prehistoric creatures
2003–	With Dr I. McKay, designed and coordinated a new palaeontology exhibit, BPI Palaeontology, University of the Witwatersrand, Johannesburg
2005–	With Dr I. McKay and Dr W. de Klerk, designed set up and coordinated the business plan, guide development and displays at the Kitching Fossil Exploration Centre, Nieu Bethesda
2009–	Palaeontological consultant for the Golden Gate fossil exhibition centre

CONFERENCE PARTICIPATION

November 2021. Argentinean congress of paleontology.

Paper: Abdala, N.F., Benoit, J., Jasinoski, S.C., Gaetano, L.C., Day, M.O., Rubidge, B.S. The earliest record of cynodont therapsids from the late Permian of the Karoo Basin, South Africa.

September 2021. 9th Bone Diagenesis Confeerence.

Paper: Rey,K., Amiot, R., Fourel, F., Luyt, J., Fluteau, F., Lécuyer, C., Rubidge, B.S. $\delta^{18}O_p$ geographical variability within the South African Karoo Basin during Permo-Triassic based on tetrapod apatite.

August 2021. IMGRAD Conference, NECSA. 4-5August.

Paper. Duhamel, A., Benoit, J., Rubidge, B.S., Liu, J. Filling Olson's Gap? A re-appraisal of *Raranimus dashankouensis* (Synapsida, Therapsida) using CTscanning technologies

Paper: Norton, L.A., Abdala, N.F., Rubidge, B.S., Botha, J., Benoit, J. ^5 Years of using X-rays to study tooth replacement in Therapsida.

June 2021. 35th IAS Meeting of Sedimentology, Prague, Czech Republic. 21-25 June.

Poster: Marriot, S.B., Bordy, E.M., Day, M.O., Paiva, F., Rubidge, B.S*. Karoo palaeosols at the end Capitanian extinction event suggest increasing landscape stability.*

October 2020. 80th SVP Meeting, 12-16 October.

Paper: Duhamel, A., Benoit, J., Rubidge, B.S., Day, M.O. Recognising juveniles: an ontogenetic study of the enigmatic Biarmosuchia (Synapsida, Therapsida) using CT scanning.

December 2019. French – South African Science and Innovation days. 2-3 December 2019.

- *Invited Speaker*: Rubidge, B.S. French South African regional partnership in palaeosciences..

September 2019. 65th South African Orthopaedic Congress, Durban. 2-6 September.

- *Invited Keynote Speaker*: Rubidge, B.S. The road to humanity came through diversity – fossils clarify the future.

October 2019. 79th Annual meeting of the Society of Vertebrate Paleontology, Brisbane, Australia, 9-12 October.

- *Paper:* Benoit, J, Ruf, I., Miyamae, J., Fernandez, V., Rodrigues, P.B., Rubidge, B.S. The infraorbital foramen in cynodonts and mammals: origin of whiskers and homology.
- *Paper:* Day, M.O., Ramezani, J., Frazer, R., Rubidge, B.S. U-PB (CA-TIMS) Age constraints on the Middle Permian land vertebrate evolution from the main Karoo Basin, South Africa.
- *Paper:* Duhamel, A.E., Benoit, J., Rubidge, B.S. Liu, J., Filling Olson's Gap? A re-appraisal of *Raranimus dashankouensis* (Synapsida, Therapsida) Using CT scanning technologies and Bayesian analysis.
- *Paper:* Groenewald, D., Day,M.O., Penn-Clarke, C.R., Rubidge, B.S. Biostratigraphy of the lowermost Beaufort Group in the main Karoo Basin, South Africa: implications for mid- to late-Permian faunal provincialism and Karoo basin development.

October 2018. 78th Annual meeting of the Society of Vertebrate Paleontology, Albuqueque, USA. 17-20 October.

- *Paper:* Cisneros, J.C., Day, M.O., Rubidge, B.S. Small tetrapod and fish trace fossils from the Middle Permian of the South African Karoo.
- *Paper:* Van Den Brandt, M.J., Rubidge, B.S., Benoit, J, Abdala, F. Understanding Middle Permian
- *Paper:* Pareiasaur diversity: the cranial morphology of *Nochelesaurus alexanderi* and *Embrithosaurus schwarzi.*

July 2018. 5th International Paleontological Congress, Paris, France. 9-13 July.

- *Paper:* Day, M.O., Rubidge B.S. The mid-late Permian transition and the Capitanian mass extinction among tetrapods.

- *Paper:* Rey, K., Day, M.O., Amiot, R., Rubidge, B.S. Stable isotope record implicates aridification in late Guadalupian mass extinction.

July 2018. 20th PSSA Conference, University of the Free State, Bloemfontein.

- *Paper:* Benoit, J., Ruf, I., Fernandez, V., Rubidge, B.S., Is the infraorbital foramen homologous in non-mammaliaform cynodonts and mammals? Implications for the evolution of whiskers.
- *Paper:* Day, M.O., Rubidge, B.S., Biesiespoort revisited: a case study on the relationship between tetrapod assemblage zones and Beaufort lithostratigraphy south of Victoria West.
- *Paper:* Duhamel, A., Benoit, J., Day, M.O., Fernandez, V., Rubidge, B.S., Juvenile biarmosuchians from the Karoo Beaufort Group shed new light on basal therapsid ontogeny.
- *Paper:* Groenewald, D., Rubidge, B.S., Day, M.O., Litho- and biostratigraphy of the Lower Beaufort Group in the northeastern part of the Main Karoo Basin – Preliminary results.
- *Paper:* Harris, C., Gess, R.W., Rubidge, B.S., Penn-Clarke, C.R., Coombs Hill: a new Devonian fossil-bearing locality in the Witpoort Formation, Eastern Cape, South Africa.
- *Paper:* Jirah, S., Rubidge, B.S., Taxonomic revision of the Titanosuchidae (Therapsida, Dinocephalia) of the Karoo Basin, South Africa: a key to understanding middle Permian tetrapod diversity.
- *Paper:* Rey, K., Day, M.O., Amiot, R., Goedert, J., Lécuyer, C., Sealy, J., Rubidge, B.S., Stable isotope record implicates aridification without warming during the late Capitanian mass extinction.
- *Paper:* Rubidge, B.S., Day, M.O., Angielczyk, K., Ramezani, J., Bowring, S., Jirah, S., Middle Permian dicynodont stratigraphic ranges coupled with ID-TIMS dates from the Karoo Basin have implications for broad-scale stratigraphic correlation.
- *Paper:* van den Brandt, M.J., Rubidge, B.S., Benoit, J., Abdala, F., Understanding middle Permian pareiasaur diversity: the cranial morphology of *Nochelesaurus alexanderi* and *Embrithosaurus schwarzi.*

July 2018. Geocongress 2018, University of Johannesburg, Johannesburg. 18-20 July.

- *Paper:* Groenewald D.P., Rubidge, B.S. & Day M.O. Litho- and Biostratigraphy of the lower Beaufort Groupin the northeastern part of the main Karoo Basin – Preliminary Results.
- *Paper:* Hancox, J. & Rubidge, B.S. Mid-Late Triassic Beaufort-Stormberg Contact – Implications for TriassicKaroo basin development.
- *Paper:* Rubidge B. S., Day M. O., Angielczyk K. Ramezani, J., Bowring, S. & Jirah S. Ranges of Mid Permian Dicynodonts coupled with U-Pb ID-TIMS dates have implications for Karoo stratigraphic correlation and basin development.
- *Paper:* Viglietti, P., Smith, R.M.H. & Rubidge, B.S. Changing palaeoenvironments and tetrapod populations in the *Daptocephalus* Assemblage Zone (Karoo Basin, South Africa) indicate early onset of the Permo-Triassic mass extinction.

December 2017. 61st Annual Meeting of the Palaeontological Association, London, UK. 17–19 December.

- *Paper:* Day, M.O., Abdala, F., Golubev, V.K., Sennikov, A.G., Rubidge, B.S. 2017. New insights on the correlation of Permo-Triassic terrestrial faunas of South Africa with those of European Russia.

October 2017. International Conference for Continental Ichnology. Worcester, 1-4 October

- *Invited Keynote Speaker*: Rubidge, B.S. SA's Palaeontological Past.
- *Paper:* Groenewald D.P., Rubidge, B.S. & Day M.O. Tetrapod trackways and the Permian Ecca-Beaufort contact in the Estcourt District, Kwazulu Natal Province, South Africa.

September 2017. SEEZA destination network launch, Pretoria, 29 September.

- *Paper:* Rubidge B.S. 2016. Opportunities for palaeotourism in South Africa.

August 2017. 77th Annual meeting of the Society of Vertebrate Paleontology, Calgary, Canada.23-26 August.

- *Paper:* Angielczyk K. D., Benoit J., Rubidge, B. S., Sidor C. A., Steyer, S. & Tolan S. A new cistecephalid dicynodont from the Upper Madumabisa Mudstone Formation (Upper Permian), Luangwa basin, Zambia: endocranial anatomy and biogeographic implications.
- *Paper:* Benoit J., Fernandez, V. Manager P. R., Rubidge B. S. Evidence for endothermy in basal Therapsida revealed by synchrotron scanning.
- *Paper:* Groenewald, D.P., Rubidge B. S., Day M. O. Evidence for faunal provincialism in the Permian Beaufort Group (Karoo Supergroup) of South Africa.
- *Paper:* Rubidge B. S., Day M. O., Angielczyk K. & Jirah S. Middle Permian dicynodont (Therapsida, Anomodontia) stratigraphic ranges in the main Karoo basin – implications for continental biostratigraphy.

December 2016. 60th annual meeting of the Palaeontological Association, Université Claude Bernard Lyon 1, Lyon, France. 14–17 December.

- *Poster*: Duhamel A., Benoit J., Day M. & Rubidge B.S. 2016. A new juvenile burnetiamorph (Therapsida: Biarmosuchia) skull from the Beaufort Group, South Africa and its role in a revision of *Lemurosaurus pricei*, Broom, 1949.

October 2016. XIV International Palynological Congress and X International Organisation of Palaeobotany Conference, Salvador, Brazil, 23–28 October 2016.

- *Paper:* Barbolini, N., Bamford, M.K. & Rubidge, B.S., 2016. The significance of radio-isotopic ages in calibrating Gondwanan Permian palynozones.

August 2016: 35th International Geological Congress, Cape Town.

- *Paper:* Day, M.O. Rubidge, B.S. The *Pristerognathus* AZ and the aftermath of the Capitanian extinction event in the main Karoo Basin.
- *Paper:* Benoit, J., Manger, P.R., Rubidge, B.S. Paleoneurology of Therapsida (Synapsida) and the Evolution of soft tissue traits in the mammalian ancestry.
- *Paper:* Rubidge, B.S. Day, M.O. Guven, S., Govender, R., Tapinocephalid dinocephalians, the first large terrestrial tetrapods – Potential for refined Middle Permian Biostratigraphy?
- *Paper:* Groenewald, D.P, Rubidge, B.S., Day, M.O. *Preliminary findings: An in-depth litho- and biostratigraphic analysis of the Lower Beaufort Group, Karoo Supergroup, between Jagersfontein and the Orange river in the central Free State Province, South Africa, and implications for the depositional history of a distal bulge.*
- *Paper:* Hancox, P.J., Rubidge, B.S., The Beaufort-Stormberg contact in the main Karoo Basin – the most important unconformity surface for understanding the basin's development.
- *Paper:* McKay, I., Rubidge, B.S. Developing sustainable palaeotourism in South Africa. The Kitching Fossil Exploration Centre in the Eastern Cape as a case study.

- *Paper:* Penn-Clarke, C.R., Rubidge, B.S., Jinnah, Z.A.Palaeoenvironmental shifts and sequence analysis of the Early-Middle Devonian Bokkeveld Group in the Clanwilliam Sub-basin of South Africa.
- *Paper:* Abdala, F., Day, M.O., Golubev, V.K., Sennikov, A.G., Rubidge, B.S. Tetrapod biocorrelation of Pangea: the Permo-Triassic terrestrial vertebrate faunas of South Africa and Russia.

Jul 2016: 19th Biennial Conference of the Palaeontological Society of Southern Africa, Stellenbosch.

Papers.

- *Paper:* Benson, R., Day, M.O., Rubidge, B.S., Butler, R., Carrano, M., Alroy, J. Tetrapod diversification and sampling in the Karoo Basin, and the world.
- *Paper:* Barbolini, N, Bamford, M.K., Rubidge B.S**.** Glacial barriers to floral migration in the Permo-Carboniferous of Gondwana.
- *Paper:* Day, M.O., Rubidge, B.S., Abdala, F. A new burnetiamorph therapsid from the *Pristerognathus* AZ of South Africa and a proposed solution to their stratigraphic incongruence.
- *Paper:* Duhamel, A., Rubidge, B.S, Benoit, J., Day, M. New Burnetiid specimens add to the understanding of Biarmosuchian taxonomy and ontogeny.
- *Paper:* Groenewald, D.P., Rubidge, B.S., Day, M.O., Preliminary finding: Litho-and biostratigraphic analysis of the Lower Beaufort Group, Karoo Supergroup, in the central Free State Province, South Africa, and implications for the depositional history of a distal bulge.
- *Paper:* Jirah, S., Rubidge, B.S., Abdala, N.F. Middle Permian diversity of large herbivores: taxonomic revision of the Titanosuchidae (Therapsida, Dinocephalia) of the Karoo Basin, South Africa.
- *Paper:* Norton, L.A., Abdala, F., Rubidge, B.S., Botha-Brink, J. Comparison of tooth replacement patterns of the Permo-Triassic epicynodonts *Cynosaurus* and *Galesaurus.*
- *Paper:* Penn-Clarke, C.R., Rubidge, B.S**.**, Jinnah, Z.A. The rise and fall of the Malvinokaffric Realm in South Africa: insights from palaeenvironmental, biostratigraphic and sequence stratigraphic data.
- *Paper:* Rammutla, R.T., Rubidge, B.S**.**, Day, M. Lithology and Palaeontology of the Ecca-Beaufort contact in the northern Karoo Basin.
- *Paper:* Rubidge, B.S, Day, M.O. The Middle Abrahamskraal Formation and the mystery of the *Eodicynodon-Tapinocephalus* Assemblage Zone transition.
- *Paper:* Van den Brandt, M.J., Rubidge, B.S., Abdala, N.F. Cranial morphology of *Embrithosaurus schwarzi* (Parareptilia, Pareiasauria), and a taxonomic and stratigraphic reassessment of the
  South Africa Middle Permian pareiasaurs.

- *Paper:* Viglietti, P.A., Rubidge, B.S., Smith, R.M.H. A new litho- and biostratigraphic framework for the latest Permian (Balfour and Teekloof formations) Karoo Basin of South Africa: Implications for basin development.
- *Paper:* Rey, K.A, Amiot, R, Fourel, F, Fluteau, F., Jalil, N-E., Liu, J., Rubidge, B.S., Smith, R.M.H., Steyer, J-S., Viglietti, P.A., Wang, X., Lécuyer, C. Oxygen isotopes suggest elevated thermometabolism within multiple Permo-Triassic therapsid clades.

Nov 2015: Participation in IMBIZO: Origin and Evolution of the Cape Mountains and Karoo Basin, Port Elizabeth, 23-24 Nov.

- *Paper:* Barbolini, N., Rubidge, B.S. &Bamford, M.K. Proximal and distal facies correlations in the Karoo retroarc foreland system using palynology.
- *Paper:* Day, M.O. & Rubidge, B.S. Middle Permian tetrapod biostratigraphy in the Main Karoo Basin and the Guadalupian-Lopingian faunal transition.
- *Paper:* Hancox, P.J. & Rubidge, B.S. The Beaufort-Stormberg contact in the main Karoo Basin – the most important unconformity surface for understanding the basin's development.
- *Paper:* Penn-Clarke, C., Rubidge, B.S. & Jinnah, Z. Storm-and-wave dominated depositional systems of the Early-Middle Devonian Bokkeveld Group in the Clanwilliam Sub-basin of South Africa
- *Paper:* Rubidge, B.S., Day, M.O., Viglietti, P.A., & Abdala, F., Recognising stratigraphic gaps in the Beaufort Group – consequences for basin modelling.
- *Paper:* Viglietti, P.A., Rubidge, B.S.& Smith, R.M.H. The *Daptocephalus* Assemblage Zone: A proposed biostratigraphy based upon new faunal ranges and refinement of lithostratigraphic members in the late Permian Beaufort Group, Karoo Basin.

Nov 2014: Participation in 74th SVP Conference, Berlin, Germany

- *Poster*: Angielczyk, K.D. & Rubidge, B.S. *The Middle Permian dicynodont (Therapsida, Anomodontia) Brachyprosopus broomi: Taxonomic status, phylogenetic position and biostratigraphic significance.*
- *Poster*: Kammerer, C.F & Rubidge, B.S. *The first gorgon: A new large-bodied gorgonopsian from the base of the Tapinocephalus Assemblage Zone of South Africa.*

Oct 2014. National Heritage Symposium, Richmond, Northern Cape Province, 17-18 Oct.

- *Invited Speaker*: Rubidge, B.S., *South Africa's remarkable fossil storyline opportunities for tourism and job creation?*

Sept 2014: International Palaeontological Congress (IPC), Mendoza, Argentina, 28 Sept-3 Oct.

- *Invited Speaker*: Rubidge, B.S., *Permian-Jurassic tetrapod biostratigraphy -- Applications for basin analysis and Pangean correlations.* (BiostratigraphyWorkshop).
- *Paper:* Day, M.O. & Rubidge, B.S. *Vertebrate extinctions near the Guadalupian-Lopingian boundary in South Africa.*
- *Paper:* Kruger, A., Rubidge, B.S. & Abdala, F. *Cranial ontogeny of the basal carnivorous dinocephalian Anteosaurus magnificus from the South African Karoo.*
- *Poster*: Fernandez, V., Abdala, F., Carlson, K., Gess, R., Rubidge, B. *Vertebrate burrowing activities at the Permo-Triassic transition in southern Africa.*
- *Poster*: Barbolini, N., Bamford, M.K. & Rubidge, B.S. *Floral provincialism hinders correlations of Permian palynological assemblages across Gondwana.*

Aug 2014: ICOM-SA Conference – Museum research in South Africa, relevance and future, Durban Natural Science Museum, 26-27 August.

- Invited Speaker: Rubidge, B.S., *Palaeontological research in South African museums: challenges and opportunities.*

Aug 2014: International Philosophy of Science Conference, New Thinking about Scientific Realism NTSR 2014, Cape Town, 5-7 August.

- *Invited Plenary Speaker*: Rubidge, B.S.. *The role of fossils in exploring the past to understand the present and future – How do palaeoscientists operate?*

Jul 2014: 18th Biennial Conference of the Palaeontological Society of Southern Africa, Johannesburg.

- *Paper:* Barbolini, N., Bamford, M.K. & Rubidge, B., *Palynofloras of the Karoo vertebrate biozones and their contribution towards reconstructing Permo-Triassic extinction events.*
- *Paper:* Day, M.O., Rubidge, B.S., *The application of vertebrate assemblage zones to deciphering the evolution of the Karoo Basin in the Middle Permian.*
- *Paper:* Day, M.O., Rubidge, B.S, Abdala, F., *First thoughts on the aftermath of the end-Guadalupian extinction in tetrapods and the fate of the Pristerognathus* AZ.
- *Paper:* Du Plessis, A., Rubidge, B., Steyn, J., *CT scanning and 3D laser fossil preparation applied to a selection of South African fossils.*
- *Paper:* Fernandes, V., Gess, R.W., Rubidge, B.S., *Large helical burrow casts from the Later Permian of South Africa.*
- *Paper:* Kruger, A., Rubidge, B., Abdala, F., *Ontogeny and cranial morphology of the basal carnivorous dinocephalian, Anteosaurus magnificus from the Tapinocephalus Assemblage Zone of the South African Karoo.*
- *Paper:* Mavuso, S.S., Rubidge, B.S., *A bio- and lithos-stratigraphic study of the Ecca-Beaufort contact in the Northern Karoo Basin.*
- *Paper:* Penn-Clarke, C.R., Rubidge, B.S., Jinnah, Z.A., *New insights into the palaeo-environmental history of the Bokkeveld Group (Cape Supergroup) in the Clanwilliam sub-basin, South Africa.*
- *Paper:* Penn-Clarke, C.R., Rubidge, B.S., Jinnah, Z.A., *Two centuries of discovery: the palaeontological and geological heritage of the Bokkeveld Group (Cape Supergroup) of South Africa, a review.*
- *Paper:* Rubidge, B.S., Day, M.O., Viglietti, P.A., Abdala, F., *Pristerognathus Assemblage Zone fauna from the Central Free State Province – Support for reciprocal stratigraphy in Karoo Basin Development.*
- *Paper:* Viglietti, P.A., Rubidge, B.S., Smith R.M.H., *Stratigraphy and sedimentary environments of the Late Permian Dicynodon Assemblage Zone (Karoo Supergroup, South Africa) and implications for basin development.*

Nov 2013: Participation in 73rd SVP Conference, Los Angeles, USA

- *Paper:* Day, M., & Rubidge, B. *Middle Permian tetrapod biodiversity change and the Guadalupian*
  extinction: Insights from the Beaufort Group of South Africa.

- *Invited Symposium Paper*: Rubidge, B., Erwin, D., Ramezani, J., Bowring, S., Day, M. U/PB *Radiometric dates from the Karoo Supergroup (South Africa) enable correlation of Permian continental sedimentary successions and constrain mid-late Permian tetrapod biodiversity changes.*

Oct 2013: Participation in 77th National Conference of Southern African Museums Association, Kimberley.

- *Keynote Paper*: Rubidge, B.S. *Centre of Excellence in Palaeosciences – solution to a heritage problem?*

Oct 2013: Participation in Karoo Parliament, Phillipstown.

- *Invited Paper*: Rubidge, B.S. *Kitching Fossil Exploration Centre – sustainable palaeotourism business*

Sept 2013: Participation in 1st National Conference on "Imaging with Radiation" IMGRAD-1 (2013)

- *Invited Paper*: Carlson, K & Rubidge, B. *Microfocus X-ray Computed Tomography (CT) facility at Wits*
- *Paper:* Kruger, A., Rubidge, B. S. & Abdala, F. *Ontogeny and cranial morphology of the basal carnivorous dinocephalian, Anteosaurus magnificus from the Tapinocephalus Assemblage Zone of the South African Karoo*.

Sept 2013: Participation in Geoheritage Series Number 2, Oudtshoorn 8-9 September 2013.

- *Keynote Paper*: Rubidge, B. *The ancient Karoo – A geoheritage superlative recording landscape and ecosystem change over time*.

September 2012: 16th Conference of the Palaeontological Society of Southern Africa, University of Cape Town. *Palaeontologia africana* 47

- *Paper:* Abdala, F., Day, M. & Rubidge, B. Basal Therocephalia from the Middle Permian of South Africa: Taxonomy, geographic and temporal distribution.
- *Paper:* Carlson, K., Fernandez, V., Abdala, F., Rubidge, B., & Tafforeau, P. Was *Thrinaxodon liorhinus* a digger?
- *Paper:* Cisneros, J.C. & Rubidge, B. A New Pareiasaur Reptile from the Tapinocephalus Assemblage Zone, Middle Permian of the Karoo.
- *Paper:* Day, M., Rubidge, B. & Güven, S. Middle Permian Biodiversity in the Karoo: a Biostratigraphic Review of the Tapinocephalus Assemblage Zone.
- *Paper:* Fernandez, V., Abdala, F., Carlson, K., Cook, D., Rubidge, B., Yates, A. & Tafforeau, P. Synchrotron radiation sheds light on mammal forerunners entombed in their burrow.
- *Paper:* Güven, S., Rubidge, B. & Abdala, F. Taxonomy of tapinocephalid Dinocephalia from the South African Karoo Basin.
- *Paper:* Jirah, S. & Rubidge, B. Stratigraphy & Sedimentology of the Tapinocephalus Assemblage Zone (Abrahamskraal Formation) in the area around Merweville, South Africa.
- *Paper:* Nicoletti, N., Bamford, M. & Rubidge, B. A proposed a palynostratigraphic scheme for the Karoo Supergroup of South Africa.
- *Paper:* Norton, L., Rubidge, B. & Abdala, F. Variation of cranial morphology and size in the gorgonopsian Aelurognathus.
- *Paper:* Rubidge, B, Day, M. & Abdala, F. First biarmoscuchian therapsid from the Pristerognathus Assemblage Zone of the Karoo Basin, South Africa.
- *Poster*: Kruger, A., Rubidge, B.S., Abdala, F. A *redescription of a burnetiamorph (Therapsida – Biarmosuchia) from Karoo rocks of Malawi.*
- *Poster*: Penn-Clarke, C., Rubidge, B., Jinnah, Z. & Almond, J. Basin analysis, palaeontology and biostratigraphy of the Early to Middle Devonian Bokkeveld Group (Cape Supergroup), Western Cape.

- *Poster:* Güven, S., Day, M., Almond, J., Abdala, F. & Rubidge, B. First tapinocephalid dinocephalian from the Pristerognathus Assemblage Zone (Karoo Supergroup, South Africa), including new information on Criocephalosaurus (Therapsida: Dinocephalia).

November 2011: 71st SVP Conference, Las Vegas, USA.

- *Invited Symposium Speaker*: Rubidge, B.S., Day, M., Angielczyk, K. & Guven, S. Middle Permian biodiversity changes in the Guadalupian extinction on land; unravelling evidence from the Beaufort Group of South Africa.
- *Paper:* Marsicana, C., Abdala, F., Smith, R.M.H. & Rubidge, B.S. The early history of tetrapods in the southern hemisphere: spatial and temporal distribution of Palaeozoic basal tetrapods in western Gondwana.

April 2011: Conference marking the 60th anniversary of the death of Robert Broom, Royal Society, Rhodes University, Grahamstown.

- *Keynote Paper:* Rubidge, B.S., A legend in his time – Broom's mentorship in understanding mammal origins.

March 2011: 17th Scientific Meeting of the South African Association for Laboratory Animal Science, 2011 Congress, 9–11 March, Johannesburg.

- *Keynote Paper:* Rubidge, B.S. Our future depends on the Past: Southern Africa's remarkable fossil record and its relevance to us today.

October 2010: Wits University Biodiversity seminar day, Johannesburg.

- *Invited Paper:* Rubidge, B.S., Nicolas, M. & Day, M. Permian-Jurassic terrestrial vertebrate biodiversity changes and responses to extinction events.

September 2010: 6th International Geoscience Educators Conference, symposium 'Geoheritage and Education in South Africa', Geological Society of South Africa, Johannesburg.

- *Invited Paper:* Rubidge, B.S. The Karoo – Geological Significance of a Geological and Palaeontological Superlative.

August 2010: Fossil Fuel Foundation of Africa Conference on 'A review of the coal and anthracite industry in Kwazulu-Natal 2010', Champagne Sports Resort, Drakensberg, KwaZulu-Natal.

- *Plenary Paper:* Rubidge, B.S. Our future depends on the Past: Southern Africa's remarkable fossil record and its relevance to us today.

August 2010: 16th Conference of the Palaeontological Society of Southern Africa, Howick, KwaZulu-Natal.

- *Paper:* Day, M. & Rubidge, B.S. Middle Permian continental biodiversity changes as reflected in the Beaufort Group of South Africa: An initial review of the Tapinocephalus and Pristerognathus assemblage zones. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of

the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 22–23.

- *Paper:* Güven, S., Rubidge, B.S. & Abdala, F. Taxonomic reassessment of the dinocephalian family Tapinocephalidae. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 39–40.
- *Paper:* Hancox, J., Neveling, J. & Rubidge, B.S. Life in an Early Triassic lake: New developments from the Driefontein site, Burgersdorp Formation, (Cynognathus Assemblage Zone), South Africa. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 41–42.
- *Paper:* Jirah, S. & Rubidge, B.S. Sedimentological, palaeontological & stratigraphic analysis of the Abrahamskraal Formation (Beaufort Group) in an area south of Merweville, South Africa. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 46–47.
- *Paper:* McKay, I. & Rubidge, B.S. Kitching Fossil Exploration Centre (KFEC): an experiment in South African palaeotourism. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 60.
- *Paper:* Norton, L.A, Tafforeau, P., Rubidge, B.S. & de Klerk, W.J. Study of tapinocephalid dinocephalian dentition using synchrotron microtomography. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 68–69.
- *Paper:* Rubidge, B.S., Erwin, D.H., Ramezani, J., Bowring, S. & de Klerk, W.J. The first radiometric dates for the Beaufort Group, Karoo Supergroup of South Africa. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010, 82–83.
- *Paper:* Zipfel, B., Rubidge, B.S. & Kemp, C. Fantastic fossil facilities at the Wits Palaeocentre – upgrading of research and storage areas. In: Mostovski, M.B. & Ovechkina, M.N. Proceedings of the 16th Conference of the Palaeontological Society of Southern Africa (Howick, August 5–8, 2010) Pietermaritzburg, 2010,126–127.

January 2010: Biological Evolution, Chronometry and Chronostratigraphy, Indaba on the stratigraphy of South Africa to mark the retirement of Mike Johnson.

- *Invited Paper:* Rubidge, B.S. The Karoo – a mecca for Permian-Jurassic biodiversity.

November 2009: Interprovincial Conference on Creative Tourism in the Karoo: Implication for 2010 and beyond, Gariep.

- *Invited Paper:* Rubidge, B.S. The Karoo, a geological and palaeontological superlative: the economic potential of deep history.

September 2009: Southern African Heads of Independent Schools Conference (SAHISA), Swaziland.

- *Keynote Paper:* Rubidge, B.S. Our future depends on the past – southern Africa's remarkable fossil record and its relevance to us today.

September 2009: Society of Vertebrate Paleontology 69th Annual Meeting, Bristol, UK.

- *Paper:* Rubidge, B.S., Angielczyk, K., de Klerk, W. & Abdala, F. Gondwanan Middle Permian synapsid radiations.
- *Paper:* Liu, J., Rubidge, B.S. & Li, J. New basal synapsids from China – a key to understanding therapsid origins.
- *Paper:* Van den Heever, J., Abdala, F. & Rubidge, B.S. Southern African Bauridae (Theriodontia, Eutherapsida): implications for Early-Middle Triassic biostratigraphy.
- *Poster*: Norton, L., Tafforeau, P., Rubidge, B. & de Klerk, W. Use of synchrotron microtomography to examine tooth replacement patterns in a tapinocephalid dinocephalian.
- *Poster*: Atayman, S., Rubidge, B. & Abdala, F. Taxonomic revision of tapinocephalid dinocephalians – the key to understanding Middle Permian biodiversity.

June 2009: World Heritage and Geotourism Conference 2009, Council for Geoscience, Pretoria.

- *Invited Paper:* Rubidge, B.S. South Africa's remarkable fossil record.

March 2009: Karoo Development Conference and Trade Fair, Graaff-Reinet.

- *Keynote Paper:* Rubidge, B.S. The Karoo as a unique geological site: the economic potential of deep history.

February 2009: Science at Synchrotrons Symposium, DST, Pretoria.

- *Paper:* Norton, L., Tafforeau, P., Rubidge, B. & de Klerk, W. Investigation of the tooth replacement patterns of a tapinocephalid dinocephalian using synchrotron microtomography techniques.

October 2008: AAPG International Conference and Exhibition.

- *Keynote Paper:* Rubidge, B.S. The four-billion-year existence of life – Africa's role in understanding this remarkable story.

September 2008: 14th Conference of the Palaeontological Society of Southern Africa, Matjesfontein, Western Cape.

- *Paper:* Atayman, S., Rubidge, B. & Abdala, F. Taxonomic re-evaluation of tapinocephalid dinocephalians.
- *Paper:* Bordy, E.M., Sztano, O., Nador, A., Nagy, A., Bumby, A. & Rubidge, B.S. Vertebrate (Therapsida?) burrows in the Lower Katberg Formation (Beaufort Group) in the southwestern Main Karoo Basin (South Africa).
- *Poster*: Norton, L., Rubidge, B. & Abdala, F. Shape variability in the skull of Aeulognathus (Therapsida: Gorgonopsia).
- *Poster*: Nicolas, M., Kemp, C. & Rubidge, B.S. Beaufort Group GIS initiative: creating and maintaining an interactive fossil database for palaeontological research.
- *Poster*: Rubidge, B.S. & Angielczyk, K. Stratigraphic ranges of Tapinocephalus Assemblage Zone dicynodonts: implications for middle Permian continental biostratigraphy.

April 2008: Royal Society Centenary Conference, Cape Town.

- *Plenary Paper:* Rubidge, B.S. A continent's contribution to unravelling the story of life – reflections, breakthroughs and possibilities relating to the Southern African fossil record.

September 2007: Workshop: Problems in Western Gondwana Geology – South America-Africa Correlations: du Toit revisited.

- *Invited Paper:* Rubidge, B.S. Karoo tetrapod biostratigraphy: relevance to understanding Gondwanan development.

June 2007: Workshop of Geoparks, Geological and Mining Conservation and Tourism development in South Africa.

- *Invited Paper:* Rubidge, B.S., McKay, I. & de Klerk, W.J. Palaeotourism: gold mine or minefield?

September 2006: 14th Conference of the Palaeontological Society of Southern Africa, Albany Museum and Rhodes University, Grahamstown.

- *Paper:* Rubidge, B.S. & de Klerk, W.J. Only Albany dinocephalian reveals new toothy information.
- *Paper:* Jinnah, Z.A. & Rubidge, B.S. A double tusked dicynodont and its biostratigraphic significance.
- *Paper:* Mason, R.M., Rubidge, B.S. & Hancox, P.J. The Ecca-Beaufort contact in the Eastern Cape Province – a reappraisal of litho- and biostratigraphy.

October 2005: International Nonmarine Permian Symposium, Albuquerque, New Mexico, USA.

- *Keynote Paper:* Rubidge, B.S. Middle-Late Permian tetrapod fauna from the South African Karoo and its biogeographic significance.

July 2005: 5th International Conference of Animal Health Information Specialists, University of Pretoria, Onderstepoort, South Africa.

- *Invited Paper:* Rubidge, B.S. Catalogue to our past and clues for the future – what the fossil record tells us.

February 2005: Fossils X3; Pretoria, South Africa (3rd International Congress of Palaeoentomology with 2nd International Meeting on Palaeoarthropodology and 2nd World Congress on Amber and its inclusions).

- *Invited Paper:* Rubidge, B.S. Palaeontology in South Africa.

August 2004: 32nd International Geological Conference, Florence, Italy.

- *Paper:* Hancox, P.J., Damiani, R., Rubidge, B. & Neveling, J. The vertebrate fauna, palaeoecology and palaeoenvironment of the Early Triassic Burgersdorp Formation (Cynognathus Assemblage Zone) in the northern Free State, South Africa.
- *Paper:* Rubidge, B.S. & Hancox, P.J. Mid-Late Permian continental biostratigraphy of the South African Karoo – implications for global correlations and Karoo basin development.

July 2004: Geoscience Africa 2004, University of the Witwatersrand, Johannesburg.

- *Paper:* Bordy, E.M., Hancox, P.J. & Rubidge, B.S. The junction of the Molteno and Elliot Formations in the main Karoo Basin (South Africa): have these lithostratigraphic units ever co-existed?
- *Paper:* Hancox, P.J., Damiani, R.J., Neveling, J. & Rubidge, B.S. Palaeoenvironments of the Early Triassic Burgersdorp Formation (Cynognathus Assemblage Zone, Subzone A) in the northeastern Free State, South Africa.
- *Paper:* Jeannot, A.M., Damiani, R.J. & Rubidge, B.S. Cranial anatomy of Lydekkerina huxleyi (Stereospondyli: Lydekkerinidae) and its implications for lydekkerinid taxonomy.
- *Paper:* Rubidge, B.S. & Hancox, P.J. The Ecca-Beaufort contact in the Eastern Cape Province – new evidence documenting a typical Ecca-Beaufort style transition from sub-aqueous to sub-aerial deposition.
- *Paper:* Rubidge, B.S., Nicolas, M.V. & Netterberg, I. Fossils, databases and intellectual property – quo vadis?
- *Paper:* Rubidge, B.S., Sidor, C.A. & Modesto, S.P. A new biarmosuchian therapsid from the Tapinocephalus Assemblage Zone, Beaufort Group of South Africa.

May 2004: 3rd Southern African Library acquisitions Conference, CSIR, Pretoria.

- *Keynote Paper:* Rubidge, B.S. Adapt or be phased out – what the fossils tell us.

October 2003: Society of Vertebrate Paleontology 63rd Annual Meeting, St Paul, Minnesota, USA

- *Paper:* Angielczyk, K. & Rubidge, B.S. Dicynodont extinctions in the Permian: one, many or none.

September 2003: Environmental Network conference, Delta Park Environmental Centre, Johannesburg.

- *Keynote Paper:* Rubidge, B.S. South Africa's world-class fossil heritage – tourism winner or minefield?

September 2003: Goldschmidt Conference,

- *Paper:* de Kock, M., Beukes, N., Hancox, P.J. Kirschwink, J., Rubidge, B.S., Neveling, J.& Ward, P. Permian-Triassic magnetostratigraphy in the Karoo Basin of South Africa.

July 2003. Geoforum, Council for Geoscience, Pretoria.

- *Paper:* Rubidge, B.S. & Hancox, P.J. Sedimentological and palaeontological nature of the Ecca-Beaufort contact: implications for Permian evolution of the Karoo Basin.

- *Paper:* Bordy, E., Hancox, P.J. & Rubidge, B.S. New insights into the development of the Karoo Basin during deposition of the Elliot Formation in the Triassic- Early Jurassic.

October 2002: 12th Conference of the Palaeontological Society of Southern Africa, National Museum, Bloemfontein.

- *Paper:* Wright, C.A., Rubidge, B.S. & Hancox, P.J. The Ecca-Beaufort contact at Estcourt in Kwazulu Natal: implications for Karoo basin development.
- *Paper:* Rubidge, B.S. & Hancox, P.J. The Ecca-Beaufort contact: implications for the Permian development of the main Karoo Basin, South Africa.
- *Paper:* Smith, R.M.H. & Rubidge, B.S. Proburnetia (Therapsida: Biarmosuchia) from the Late Permian of South Africa: implications for trans-Pangean therapsid migration.
- *Paper:* Bristowe, A. & Rubidge, B.S. Postcranial skeleton of a basal anomodont therapsid from the Cistecephalus Assemblage Zone of the Karoo Basin.
- *Paper:* Govender, R., Rubidge, B.S. & Renaut, A.J. A comparative analysis of the postcranial skeleton of *Tapinocaninus pamelae*.
- *Paper:* Hancox, P.J., Neveling, J., Bender, P., Damiani, R.& Rubidge, B.S. The fauna of the lower part of the Cynognathus Assemblage Zone and its bearing on the biostratigraphic subdivision of the biozone.

August 2002: Sitting Ducks or Charging Bulls? The significance of South African Research (particularly Earth Sciences, Palaeontology, and Archaeology) and the impact it has on tourism and education. NRF, SA Museum, Cape Town.

- *Keynote Paper:* Rubidge, B.S. Karoo fossils – palaeotourism potential pitfalls and problems.

August 2002: 11th international Gondwana Conference, University of Canterbury, Christchurch, New Zealand.

- *Paper:* Rubidge, B.S. & Hancox, P.J. Reptile fossils, sequence analysis, and the nature of the Ecca-Beaufort contact: implications for the Permian development of the main Karoo Basin, South Africa.
- *Paper:* Catuneanu, O., Hancox, P.J., Cairncross, B. & Rubidge, B.S. Interplay of flexural tectonics and dynamic loading in foreland systems: accommodation and sedimentation in the Ecca seaway, Karoo Basin.
- *Paper:* Hancox, P.J., Catuneanu, O. & Rubidge, B.S. Triassic fill and tectonostratigraphic development of the main Karoo Basin (South Africa).

July 2002: 11 Quadrennial IAGOD Symposium and Geocongress 2002, Windhoek, Namibia.

- *Keynote Paper:* Rubidge, B.S. Reuniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust.

July 2002: 16th IAS Conference, Johannesburg.

- *Paper:* Rubidge, B.S. & Hancox, P.J. The marriage of sedimentology and palaeontology in basin development studies. The implications for the nature of the Ecca-Beaufort contact, and the development of the Karoo basin during the Permian.

July 2002: 8th International Symposium on Mesozoic Terrestrial Ecosystems, Cape Town.

- *Paper:* Hancox, P.J., Rubidge, B.S., Renaut, A.J. & Modesto, S.P. Phylogenetic analysis of the Triassic dicynodonts (Synapsida: Therapsida).
- *Paper:* Hancox, P.J., Damiani, R.J., Neveling, J. & Rubidge, B.S. The vertebrate fauna, palaeoecology and palaeoenvironment of the Early Triassic Burgersdorp Formation (Cynognathus Assemblage Zone, Subzone A).

July 2001: Anatomy and Morphology Conference, Jena, Germany.

- *Paper:* Van den Heever, J.A. & Rubidge, B.S., 2001. Systematic revision of the Upper Permian dinocephalian Anteosaurus.

June 2001: NAPC Conference, Berkeley, California.

- *Paper:* Rubidge, B.S., Modesto, S.P. & Govender, R. Basal therapsid fauna from South Africa – implications for therapsid origins.
- *Paper:* Hancox, P.J., Rubidge, B.S. & Renaut A.J. 2001. Phylogeny of Triassic Dicynodonts: evolutionary and biochronological implications.

October 2000: Society of Vertebrate Paleontology 60th Annual Meeting, Mexico City, Mexico.

- *Paper:* Rubidge B.S. & Modesto, S.P. New basal therapsids from the Permian of South Africa: Implications for Karoo Basin development.
- *Paper:* Hancox P.J., Rubidge, B.S., Modesto, S. & Renaut, A. Systematics of the Triassic dicynodonts.
- *Paper:* Neveling J., Hancox, P.J., Damiani, R. & Rubidge, B.S. Early Triassic faunas from the Lystrosaurus and Cynognathus Assemblage Zones, South Africa.

September 2000: Palaeontological Society of Southern Africa,11th Conference, Pretoria.

- *Paper:* Rubidge, B.S., Modesto, S.P. & Welman, J. New basal therapsids from the Permian of South Africa: their importance for Karoo basin development.
- *Paper:* Rubidge, B.S. & Duncan, M. Palaeotourism: A means to sustain southern African Palaeontological Endeavour.
- *Paper:* Hancox, P.J., Rubidge, B.S., Damiani, R. & Neveling, J. 2000. The vertebrate fauna and palaeoenvironmental setting of the Early Triassic Burgersdorp Formation (Cynognathus Assemblage Zone Subzone A) in the northwestern Free State, South Africa.

1999 - 1982

July 1999: 18th Colloquium of African Geology, Graz, Austria.

Keynote Speaker; 1 poster: J. Neveling, J., Rubidge, B., Hancox, P.J. & Damiani, R.

July 1999: Annual Conference of the Zoological Society of Southern Africa, Pietersburg.

Two papers: Rubidge, B.S. & J. Hancox, J.; Hancox, J., Rubidge, B.S. & Modesto, S.

Sept 1998: 10th Conference of the Palaeontological Society of Southern Africa, Windhoek

Two papers: Modesto, S.P & Rubidge, B.; Holzfoerster, F., Stanisteet, I., Stollhofen, H., Rubidge, B. & Raath, M.

July 1998: 10th International Gondwana Conference, Cape Town

One paper: Rubidge, B.S & Modesto, S.P.

July 1997: CAVEPS Congress, Perth, Australia.

One paper: Rubidge, B.S

September 1996: 9th National Congress of the Palaeontological Society of Southern Africa, Stellenbosch

Two papers: Rubidge, B.S. & Hancox, P.J.; Rubidge, B.S.& Shishkin, M.A.

August 1996: International Geological Conference, Beijing, China

One paper: Shishkin, M.A., Rubidge, B.R. & Hancox, P.J.

March 1996: AAPG Annual Convention, Salt Lake City, Utah.

1 paper: Catuneanu, O., Rubidge, B.R. & Hancox, P.J.

March 1996: Recent Advances in South African Sedimentology. A symposium hosted by the Sedimentology Division of the Geological Society of South Africa, Pretoria.

One paper: Rubidge, B.S.

August 1995: 6th Mesozoic Terrestrial Ecosystems Conference, Beijing, China.

One paper: Shishkin, M., Rubidge, B.R. & Hancox, P.J.

April 1995: International Centennial Geocongress, Johannesburg

2 papers: Rubidge, B.S; Rubidge, B.S. & Hancox, P.J.

September 1994: 8th National Congress of the Palaeontological Society of Southern Africa, Albany Museum, Grahamstown.

One paper, and Presidential Address.

July 1994: Congress of the Zoological Society of South Africa, Pietermaritzburg.

March 1994: AEC conference on Karoo Uranium Exploration, Pelindaba.

One paper: Kitching, J.W & Rubidge, B.S.

September 1992: 7th National Congress of the Palaeontological Society of Southern Africa, University of the Witwatersrand, Johannesburg.

Two papers, and served on the organising committee.

July 1992: 24th Earth Science Congress of the Geological Society of South Africa (Geocongress 92), University of the Orange Free State, Bloemfontein.

One paper

September 1990: 6th National Congress of the Palaeontological Society of Southern Africa, Golden Gate, OFS.

One paper

July 1990: 23rd Earth Science Congress of the Geological Society of South Africa (Geocongress 90), University of Cape Town, Cape Town.

One paper

April 1989: 53rd Annual Conference of the Southern African Museums Association, Bloemfontein.

1 paper

September 1988: 5th National Congress of the Palaeontological Society of Southern Africa, Graaff-Reinet.

Three papers, and chair of the organising committee.

July 1988: 22nd Earth Science Congress of the Geological Society of South Africa (Geocongress 88), University of Natal, Durban.

One paper

October 1987: Geological Field School on Coastal Depositional Environments, Port Elizabeth (organised by Prof. I.C.Rust), Geology Department, University of Port Elizabeth.

One paper

April 1987: Special Conference, 'Problems relating to the Ecca-Beaufort contact of the Karoo Sequence in South Africa', Geological Survey of South Africa, Pretoria.

One paper

February 1987: Technical Conference of the South African Museums Association, National Museum, Bloemfontein.

One paper

October 1986: 4th National Congress of the Palaeontological Society of Southern Africa, South African Museum, Cape Town.

One paper

October 1984: Technical Conference of the South African Museums Association, Mc Gregor Museum, Kimberley.

One paper

July 1984: 3rd National Congress of the Palaeontological Society of Southern Africa, University of Stellenbosch, Stellenbosch. *2 papers.*

October 1983: Geological Field School on Fluvial and Coastal Depositional Environments, Plettenberg Bay (organised by Prof. I.C. Rust), Geology Department, University of Port Elizabeth.

July 1982: 2nd National Congress of the Palaeontological Society of Southern Africa, Geological Survey of South Africa, Pretoria.

One paper

NAMED GUEST LECTURES

1992	Sidney Rubidge Memorial Lecture, *Graaff-Reinet*
1993	Sidney Haughton Memorial Lecture, *Royal Society, Cape Town*
1995	Robert Broom Memorial Lecture, *Transvaal Museum, Pretoria*
1996	John Hewett Memorial Lecture, *Albany Museum, Grahamstown*
2002	Alex du Toit Memorial Lecture, *Geological Society of South Africa,*
2002	Schonland Memorial Lecture, Royal Society, Grahamstown
2005	Robert Broom Memorial Lecture, *Transvaal Museum, Pretoria* (with C.K. Brain)

EDITORSHIPS

2011–2013	Editorial Board of Journal of Vertebrate Palaeontology
2005–	Editorial Board of Researches of the National Museum
2001–	Editorial Board of Annals of the South African Museum
2002–	Associate editor of Palaeontologia africana
1990–2001	Editor of Palaeontologia africana (responsible for the production of volumes 27–37)
1998–2000	Guest Editorial Board of Journal of African Earth Sciences, for Gondwana 10. papers
1991–1999:	Editorial Board of South African Journal of Geology
1989–1995:	Editor of Biostratigraphy of the Rocks of the Beaufort Group, South Africa

SUPERVISION OF POSTGRADUATE STUDENTS

Masters

1. GROENEWALD, D. (Full time, first registration January 2016 submitted January 2017, achieved MSc with distinction and upgraded to PhD) *A litho- and biostratigraphic analysis of the Lower Beaufort Group, Karoo Supergroup, in the central Free State Province, South Africa.* Supervisors B.S. Rubidge & M. Day.

2. VAN DEN BRANDT, M. (Full time, first registration January 2015, graduated with distinction 2017). *Cranial morphology of Embrithosaurus schwarzi (Parareptilia, Pareiasauria), and a taxonomic*

and stratigraphic reassessment of the South African Middle Permian pareiasaurs. Supervisors B.S. Rubidge & F. Abdala.

3. WALTERS, S. (Full time, first registration January 2015, graduated 2017 with distinction) *Reanalysis of cryptic sedimentological relationships involving the Southern Karoo Ripon Formation and the south-western Karoo Vischkuil/Laingsburg Formations: Implications for basin and palaeoenvironmental reconstruction*. Stellenbosch University. Supervisors: R. Tucker and B. Rubidge.

4. KRUGER, A. (Full time, first registration January 2013, graduated Nov 2014). *Ontogeny and cranial morphology of the basal carnivorous dinocephalian, Anteosaurus magnificus from the Tapinocephalus Assemblage Zone of the South African Karoo.* Supervisors B.S. Rubidge & F. Abdala.

5. PENN-CLARKE, C. (Full time, first registration January 2012). *Basin Analysis, Palaeontology and Biostratigraphy of the Early to Middle Devonian aged Bokkeveld Group (Cape Supergroup), Western Cape, South Africa.* Supervisors: B Rubidge, Z Jinnah, J.N. Almond. (upgraded to PhD July 2013, having been awarded his MSc with distinction)

6. JIRAH, S. (Part-time, first registration June 2010, graduated Nov 2013). Stratigraphy and sedimentology of the Tapinocephalus Zone (Abrahamskraal Formation) in the area around Merweville. Supervisor: B.S. Rubidge.

7. NXUMALO, V. (Part-time, first registration January 2008, submitted December 2010, graduated 2011). Stratigraphic correlations and 3-dimensional modelling of the Kalahari-Karoo sub-basins in Southwest Botswana, Southeast Namibia and the Northern Cape Province of South Africa. Supervisors: B.S. Rubidge, G. Drennan and J. Neveling.

8. NORTON, L. (Full time, first registration 2008, submitted February 2012, graduated 2012). Relative growth and skull variability in Aelurognathus (Reptilia: Gorgonopsia). Supervisors: B.S. Rubidge and F. Abdala.

9. MASON, R. (Full time, first registration 2004, graduated 2007). A synthesis of the stratigraphy and biostratigraphy of the Ecca-Beaufort contact in the Eastern Cape Province, South Africa. Supervisors: B.S. Rubidge and P.J. Hancox.

10. PITCHER, A.M. (Full time, first registration 2002, graduated 2004). Morphology, variation and ontogeny in Lydekkerina huxleyi (Lydekker 1889) Amphibia, Temnospondyli. Supervisors: R. Damiani and B.S. Rubidge.

11. RUTHERFORD, A. (Part-time, first registration 2002, graduated 2009). Geology, stratigraphy and palaeoenvironment of the area around Thaba 'Nchu, Free State. Supervisors: B.S. Rubidge and P.J. Hancox.

12. GOVENDER, R. (Full time, first registration February 2000, graduated 2002). A Comparative description of the postcranial anatomy of the most basal tapinocephalid dinocephalian Tapinocaninus pamelae Rubidge (Amniota, Therapsida). Supervisors: B.S. Rubidge and A. Renaut.

13. MUNYIKWA, D. (Part-time, first registration 1998, graduated 2001). Dinocephalian mammal-like reptiles from Madumabisa Mudstone Formation (Permian) Hwange, Zimbabwe. Supervisors: B.S. Rubidge and M.A. Raath.

14. RENAUT, A. (Full time, first registration 1995, completed 1999 and upgraded to PhD). A re-evaluation of the cranial morphology and taxonomy of the Triassic dicynodont Kannemeyeria. Supervisors: B.S. Rubidge and P.J. Hancox.

15. ROSSOUW, L. (Part-time, first registration 1996, graduated cum laude 2001). The taxonomic status of Antidorcas australis as reflected by its postcranial osteomorphology. Supervisors: B.S. Rubidge and J.S. Brink.

16. NEVELING, J. (Full time, first registration 1996, completed 1998 and upgraded to PhD). A palaeontological, stratigraphic and palaeoenvironmental synthesis of the Triassic contact between the Lystrosaurus and Cynognathus Assemblage Zones of the Beaufort Group, South Africa. Supervisors: B.S. Rubidge and P.J. Hancox.

17. VAN ROOYEN, J.M. (Part-time, first registration 1988, graduated 1990). The osteology and functional anatomy of the postcranial skeleton of Gorgonops torvus. Owen (Gorgonopsia: Therapsida). Supervisors: S. Fourie and B.S. Rubidge.

Doctoral

1. GROENEWALD, D. (Full time, first registration June 2017, upgraded from MSc. A litho- and biostratigraphic analysis of the Lower Beaufort Group, Karoo Supergroup, in the central Free State Province, South Africa. Supervisors B.S. Rubidge & M. Day.

2. VAN DEN BRANDT, M. (Full time, first registration January 2017, graduated 2020). Cranial and postcranial anatomy of Middle Permian pareiasaurs. Supervisors B.S. Rubidge & J. Benoit.

3. JIRAH, S. (Part-time, first registration Sept 2014). Middle Permian diversity of large herbivores: Taxonomic revision of the Titanosuchidae (Therapsida, Dinocepahlia) of the Karoo Basin, South Africa. Supervisor: B.S. Rubidge & F. Abdala.

4. PENN-CLARKE, C. (Full time, first registration Jan 2012, upgraded from MSc, graduated 2017). Stratigraphy and sedimentology of the Bokkeveld Group, Cape Supergroup in the Koue Bokkeveld. Supervisors: B.S. Rubidge and Z. Jinah. (upgraded to PhD July 2013, having been awarded his MSc with distinction).

5. NORTON, L. (Full time, first registration 20013, graduated 2020). Tooth replacement patterns in Eutheriodontia from South Africa. Supervisors: F. Abdala, B.S. Rubidge, & J. Botha-Brink.

6. VIGLIETTI, P. (Full time, first registration Jan 2013; graduated 2016). Sedimentology, and Palaeontology of the Late Permian Barberskrans Member (Beaufort Group): Implications for Karoo Basin Evolution. Supervisors: B.S. Rubidge & R.M.H. Smith.

7. DAY, M. (Full time, first registration January 2010, graduated Nov 2013). Middle Permian continental biodiversity changes as reflected in the Beaufort Group of South Africa: A bio- and lithostratigraphic review of the Tapinocephalus and Pristerognathus assemblage zones. Supervisor: B.S. Rubidge.

8. BARBOLINI, N. (Full time, first registration January 2010, graduated July 2014). Gondwanan correlations of upper Karoo vertebrate biozones using palynology. Supervisors: M.K. Bamford and B.S. Rubidge.

9. GUVEN, S. (Full time, first registration 2008, graduated 2020). Taxonomic revision of the tapinocephalid dinocephalian subfamilies Moschopinae, Tapinocephalinae and Reibeeckosaurinae – the key to understanding Middle Permian tetrapod biodiversity. Supervisors: B.S. Rubidge and F. Abdala.

10. GESS, R. (Part-time, first registration 2005, submitted January 2011, graduated 2011). A taxonomic, biogeographic, biostratigraphic and palaeoecological synthesis of the Famennian Witpoort Formation of South Africa (Cape Supergroup, Witteberg Group). Supervisors: B.S. Rubidge and M. Coates.

11. CISNEROS, J-C. (Full time, first registration 2003, graduated 2007). Cranial anatomy of the South African genus Procolophon. Supervisors: B.S. Rubidge and R. Damiani.

12. NICOLAS, M. (Full time, first registration 2003, graduated 2007). Tetrapod biodiversity through the Permo-Triassic Beaufort Group (Karoo Supergroup) of South Africa. Supervisor: B.S. Rubidge.

13. LATIMER, E.M. (Full time, first registration 1994, upgraded to PhD 1995). A revision of Karoo amphibians of the family Rhinesuchidae, and an assessment of their biostratigraphic significance. Supervisor: B.S. Rubidge.

14. NEVELING, J. (Part-time, first registration 1995, upgraded to PhD 1998, graduated 2002). The biostratigraphy and palaeontology of the contact area between the Lystrosaurus and Cynognathus Assemblage Zones (Beaufort Group: Karoo Supergroup). Supervisors: B.S. Rubidge and P.J. Hancox.

15. FOURIE, H. (Part-time, first registration 1993, graduated 2001). A morphological, functional and systematic study of the postcrania of selected genera of Therocephalia (Amniota: Therapsida). Supervisors: B.S. Rubidge and G.M. King.

16. RENAUT, A. (Part-time, first registration 1999, graduated 2001). A re-evaluation of the cranial morphology and taxonomy of the Triassic dicynodont Kannemeyeria. Supervisors: B.S. Rubidge and P.J. Hancox.

17. BORDY, E. (Full time, first registration February 1998, graduated April 2001). Sedimentology of the Karoo Supergroup in the Tuli Basin (Limpopo River Area, South Africa). Supervisors: O. Catuneanu and B.S. Rubidge.

18. BENDER, P.A. (Part-time, first registration 1995, graduated 2000). Paleoniscid fish of the Lower Beaufort Group, South Africa. Supervisors: B.S. Rubidge and J. Long.

19. HANCOX, P.J. (Part-time, first registration 1994, graduated 1998). A stratigraphic, sedimentological and palaeoenvironmental appraisal of the Triassic Beaufort-Molteno contact in the vicinity of Sterkstroom, Eastern Cape Province. Supervisor: B.S. Rubidge.

POSTDOCTORAL AND VISITING FELLOWS

1992–1994	D.W. Dilkes
1994	M.A. Shishkin (Wilson Travel Fellowship)
1995	M.A. Shishkin (NRF Fellowship)
1998–2000	S.P. Modesto
1999–2004	R. Damiani
2002–2008	F. Abdala
2002–2004	E. Bordy
2003–2004	A. Yates
2005–2006	P.J. Hancox
2006–2008	R. Govender
2008–2009	R. Mutter
2011–2012	V. Fernandez
2012–2013	R. Gess
2013-2018	M. Day
2014-2017	J. Benoit

2016- 2020 K. Rey

2018-2019 M. Romano

PUBLICATIONS

Books and Book chapters

1. RUBIDGE B.S., DAY M.O., BARBOLINI N., HANCOX P.J., CHOINIERE J., BAMFORD M.K., VIGLIETTI P.A. MCPHEE B. & JIRAH S. 2016. Advances in nonmarine Karoo biostratigraphy: significance for understanding basin development. In: Linol, B. & de Wit, M.J. *Origin and Evolution of the Cape Mountains and Karoo Basin*. Springer, pp. 141-149.

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9. RUBIDGE, B.S. 2004. Lessons for the survival of the species. In: Bowes, B., Lundy, G. & Pennington, S. (Eds.) South Africa 2014: The Story of our Future. Interpak Books, Pietermaritzburg, pp. 345–346.

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20. RUBIDGE, B.S., & DAY, M.O. 2020. Biostratigraphy of the *Eodicynodon* Assemblage Zone. *South African Journal of Geology*, 123, 141-148. https://doi.org/10.25131/sajg.123.0010

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27. DAY, M.O., RUBIDGE, B.S. 2019. Biesiespoort revisited: A case study on the relationship of biostratigraphy to mapped lithostratigraphic units north of the Nuweveld. *Palaeontologia africana,* 53, 51-65. https://hdl.handle.net/10539/26240. ISSN 2410-4418.

28. FRASER-KING, S.W., BENOIT, J., DAY, M.O., & RUBIDGE, B.S. 2019. Cranial morphology and phylogenetic relationship of the enigmatic dinocephalian *Styracocephalus platyrhynchus* from the Karoo Supergroup, South Africa. *Palaeontologia africana,* 54, 14-29. https://hdl.handle.net/10539/28128

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30. PENN-CLARKE, C. R., RUBIDGE, B.S. & JINNAH, Z. A. 2019. Eifelian-Givetian (Middle Devonian) high-paleolatitude storm- and wave-dominated shallow-marine depositional systems from the Bidouw Subgroup (Bokkeveld Group) of South Africa. *Journal of Sedimentary Research* 88(9), 1040-1075.

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32. RUBIDGE, B.S., GOVENDER, R. & ROMANO, M. 2019. Postcranial analysis of the basal tapinocephalid dinocephalian *Tapinocaninus pamelae* (Synapsida: Therapsida) from the South African Karoo Supergroup. *Journal of Systematic Palaeontology*, DOI: 10.1080/14772019.2018.1559244

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