

**Palaeontological Impact Assessment for the proposed
Prospecting Activities, Verdoorst Kolk,
Northern Cape Province**

Desktop Study

For

Cabanga Environmental

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Expertise of Specialist

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Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf

Experience: 30 years research; 20 year PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Cabanga Environmental (South Africa). The views expressed in this report are entirely those of the author and Cabanga Environmental and no other interest was displayed during the decision making process for the project.

Specialist: Prof Marion Bamford.....

Signature:



Executive Summary

A desktop Palaeontological Impact Assessment for the prospecting rights for the on Verdoorst Kolk No. 342 Kenhardt Rd, Portions 1,2 and R/E, in the Hantam Local Municipality, Namakwa District of the Northern Cape Province south of Brandvlei, Northern Cape Province, by Witkop Fluorspar Mine (Pty) Ltd, has been completed. The rocks in the area are mudstones of the Prince Albert Formation from the settling of marine or deltaic suspension muds. Sterile Jurassic dykes are close by. However, since there is an extremely small chance of finding fossils a chance find protocol and monitoring programme are included. It is the opinion of the palaeontologist that the project may proceed as far as the palaeontology is concerned.

Palaeontological Impact Assessment for the proposed Prospecting Activities, Verdoorst Kolk, Northern Cape Province

1. Background

Witkop Fluorspar Mine (Pty) Ltd is applying for a Prospecting Right on the property Verdoorst Kolk No. 342 Kenhardt Rd, Portions 1,2 and R/E, in the Hantam Local Municipality, Namakwa District of the Northern Cape Province. The application relates to the search for the industrial mineral, Gypsum.

Prospecting for Gypsum will be by means of a TLB mounted auger drill. Drilling will be to a maximum depth of 5m. The associated activities include:

- Clearance of vegetation in areas where drilling is proposed
- Relocation of species of conservation concern in areas to be disturbed (assumed at this stage).
- Establishment of a site camp, laydown area and storage site. Including fuel storage and portable chemical toilets.
- No formal roads will be constructed; farm tracks will be used as far as possible.
- Rehabilitation of the boreholes and disturbed areas

The total Prospecting Right Area totals 8,223.3736Ha.

Phase I (of four phases) constitutes the application process associated with obtaining the applicable Mineral Rights, Permits and Authorisations, as well as Environmental Screening to identify no-go areas.

The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
An indication of the scope of, and the purpose for which, the report was prepared	Section 1, page 3
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to fossils

A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2, page 4
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 2
An identification of any areas to be avoided, including buffers	n/a
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6, page 9
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
Any mitigation measures for inclusion in the EMPr	n/a
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, page 9
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	n/a
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	n/a
A description of any consultation process that was undertaken during the course of carrying out the study	Section 3 page 6
A summary and copies if any comments that were received during any consultation process	n/a
Any other information requested by the competent authority.	n/a

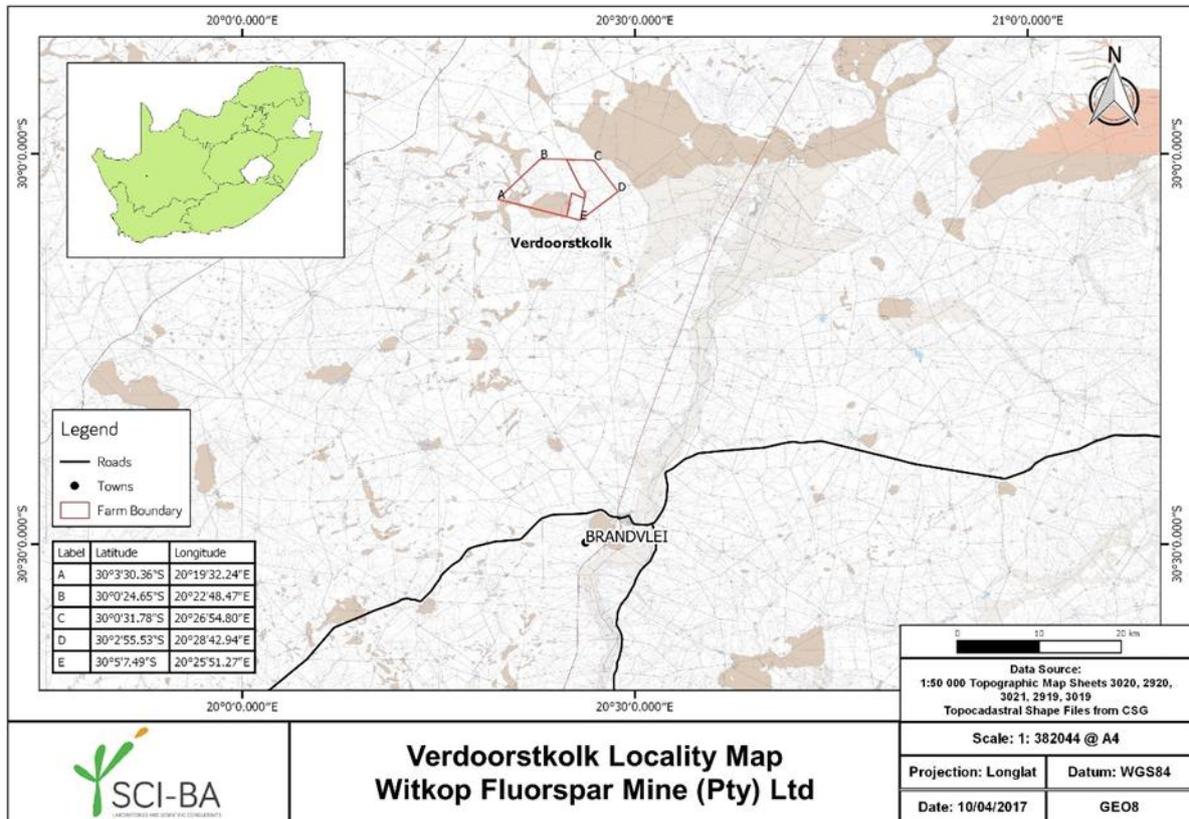


Figure 1. Locality map for Verdoorstkolk, Western Cape Province, South Africa.

2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records must be consulted.
2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.
3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.
4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

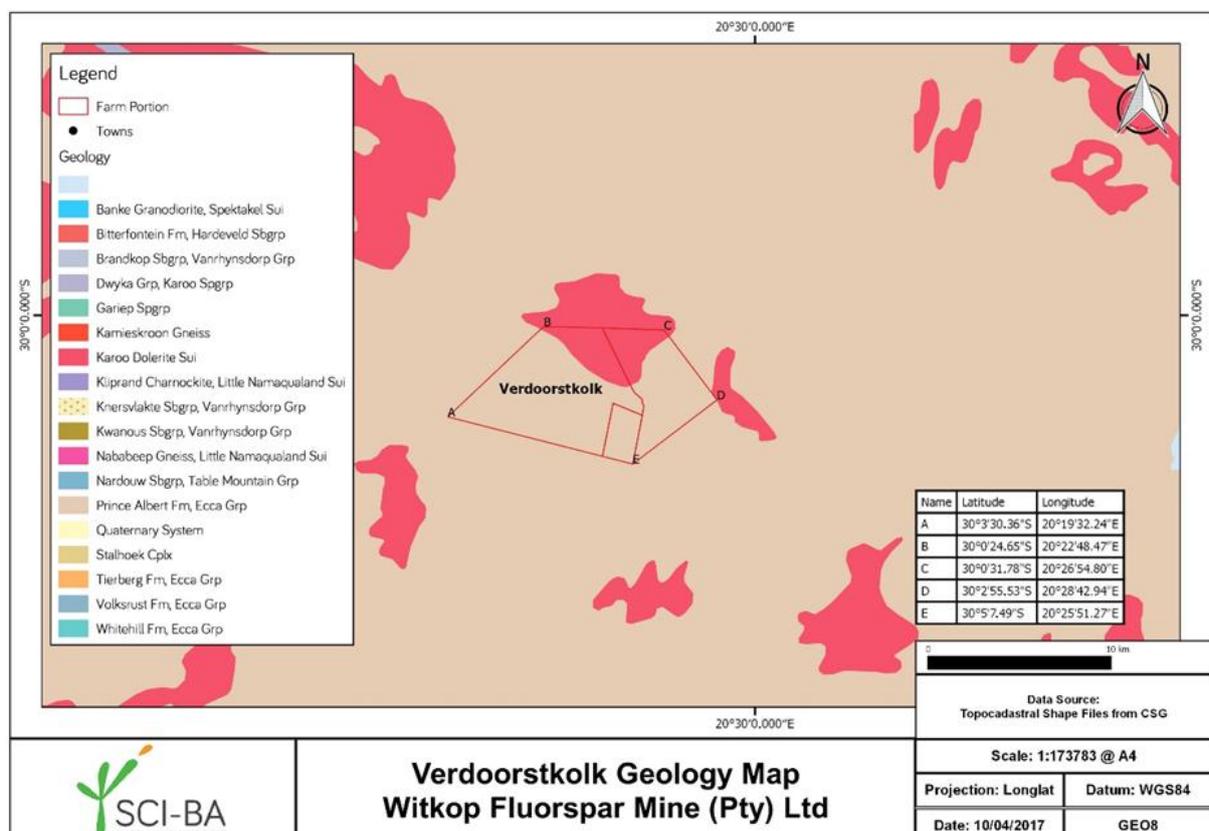


Figure 2: Simplified geology map of the area around Verdoorstkolk.

3. Consultation Process

No consultations were carried out during the desktop study. Apart from reviewing interested and/or affected party (IAP) comments received by the EAP during the Basic Assessment process, no other consultation took place as part of the paleontological study.

4. Geology and Palaeontology

Project location and geological setting

The proposed gypsum mine is on the Farm Verdoorst Kolk about 40km north of Brandvlei. The property is partially covered by Jurassic dolerite dykes (Fig 2) to the north and the prospecting area is on the southern portion on the sandstones and shales of the Prince Albert Formation (Figs 2, 3). Dwyka sandstone, mudstones and shales outcrop far to the north and west. Small exposures of carbonaceous shales of the Whitehill Formation are to the south of the site. Quaternary sands, alluvium and calcretes occur to the north and east.

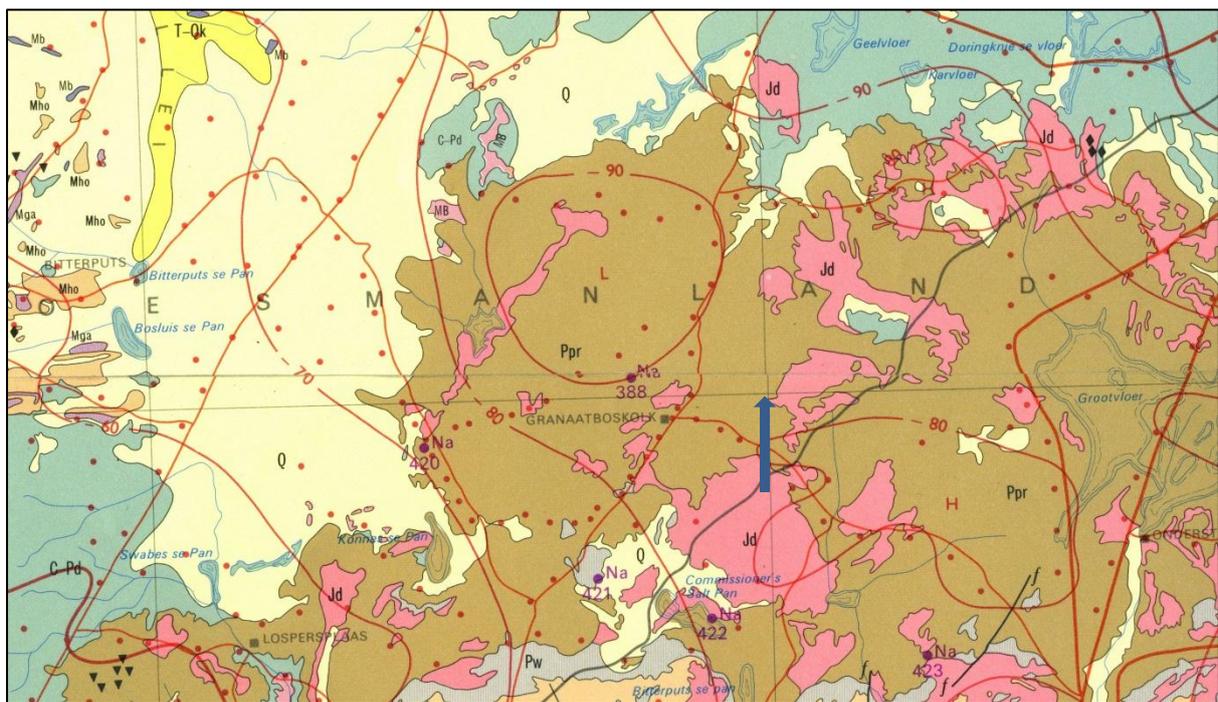


Figure 3: Geological map of the larger area around Verdoorstkolk. The approximate location of the proposed project is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Erikssen et al., 2006; Moen, 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Aeolian sands	Last 2.5 Ma
Jd	Jurassic dykes	dolerite	Ca 183 Ma
Pr	Prince Albert Fm, Ecça Group	Sandstones, shales	Early Permian 300 -
Pw	Whitehill Fm, Ecça Group	Carbonaceous shale	Early Permian
C-Pd	Dwyka Fm	Tillite, sandstone, mudstone, shale	Upper Carboniferous to Early Permian

Palaeontology

Diamictites and tillites of the Dwyka Formation represent the retreating glaciers of the Late Carboniferous and do not commonly preserve fossils but there have been reports of vascular plants, trace fossils, organic-walled, microfossils, rare marine invertebrates and fish from the Douglas area far to the east (McLachlan and Anderson, 1973). From the Whitehill Formation *Mesosaurus*, an early reptile, has only been reported from Namibia, north of Kimberley and near Calvinia (McLachlan and Anderson, 1973; Oelofsen and Araujo, 1987). Whitehill Formation plants are also very rare. The Kalahari Group sediments could preserve Cenozoic fossils but most of it is aeolian, however, there are some pans and springs that trap and preserve fossils, for example Kathu Pan. None has been reported from this area.

The proposed prospecting area is on mudrocks of the Prince Albert Formation which represents suspension settling of muds and turbidites in a marine or deltaic environment. Deltaic deposits with phosphatic and siliceous concentrations are probably the result of chemical or biological processes occurring in a reducing environment (Johnson et al. 2006). Fossils have not been reported from the Prince Albert Formation in this area, and they are extremely rare in this formation elsewhere. Such settings are not good for the preservation of fossils. Dolerite dykes are also present in the proposed area and they would have destroyed any fossils that might have present in their near vicinity.

According to the SAHRIS palaeosensitivity map (Fig. 4) there is very little chance of finding fossils in this area. A survey of the geological formations and literature confirms this.

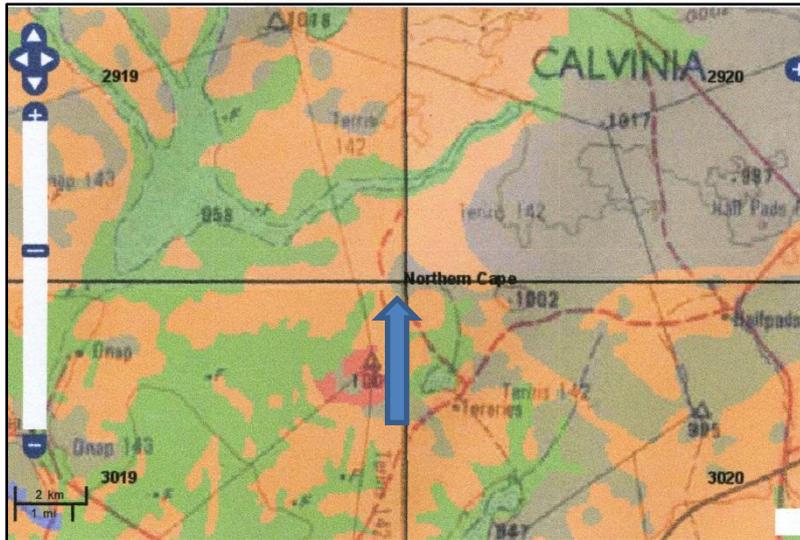


Figure 4: SAHRIS palaeosensitivity map with the location of the proposed prospecting area indicated by the blue arrow. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

5. Impact assessment

Using the criteria in the table below, the impact of the prospecting activities on the farm has been assessed.

TABLE 3: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY	H	Definite/ Continuous

(of exposure to impacts)	M	Possible/ frequent
	L	Unlikely/ seldom

The surface activities would not impact on the fossil heritage as the rocks are mudstones of the Prince Albert Formation and very rarely contain fossils. No fossils have been reported from this area. The IMPACT is nil (according to the scheme in Table 3).

Excavation for the roads and infrastructure would penetrate only a few metres below ground surface so there would be minor deterioration of the surface of sites and a minor impact on any potential fossils. Auger drilling would penetrate deep into the mudrock to the gypsum which is not fossiliferous. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: H.

Drilling will only take place within the prospecting right boundary so the SPATIAL SCALE will be localised within the site boundary: L.

There is a very small chance of finding trace or marine fossils but none has been reported for the area around Verdoorst Kolk. However, the PROBABILITY of affecting any fossils is unlikely or seldom: L

6. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the basement rocks, dolomites, sandstones, shales, quartzites, basalts and sands and diamictites are typical for the country and do not contain any body fossil material. The sediments the Prince Albert Formationn could contain tracefossils, however, they have yet to be recorded from the proposed site for prospecting.

7. Recommendation

It is unlikely that any fossils occur in the prospecting right area because mostly the rocks are of marine origin or deltaic with turbidites. As there is a small chance of finding fossils a chance find and monitoring protocol is recommended.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would only be required after excavations and drilling have commenced and if fossils are found by the geologist or environmental personnel. The procedure can be added to the EMPr.

8. Monitoring Programme for Palaeontology – to commence once the drilling activities begin.

The following procedure is only required if fossils are seen on the surface and when drilling commences:

1. When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fish, plants,) should be put aside in a suitably protected place. This way the construction activities will not be interrupted.
2. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures.
3. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
4. On a regular basis, to be agreed upon by the developer and the qualified palaeontologist sub-contracted for this project, the palaeontologist should visit the site to inspect the selected material and check the dumps where feasible. The frequency of inspections should be monthly. However, if the onsite designated person is diligent and extracts the fossil material then inspections can be less frequent.
5. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. An annual report must be submitted to SAHRA as required by the relevant permits.
6. If no good fossil material is recovered then the site inspections by the geologist or responsible person can cease.
7. If no fossils are found and the excavations have finished then no further monitoring is required.

9. References

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

McLachlan, I.R., Anderson, A., 1973. A review of the evidence for marine conditions in southern Africa during Dwyka times. *Palaeontologia africana* 15, 37-64.

Oelofsen, B.W., Araujo, D. 1987. *Mesosaurus tenuidens* and *Stereosternum tumidum* from the Permian of Gondwana of both southern Africa and South America. *South African Journal of Science* 83, 370-372.