

RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES:

Proposed dolerite quarry near Indwe, Indwe Magisterial District, Eastern Cape

John E. Almond PhD (Cantab.)
Natura Viva cc,
PO Box 12410 Mill Street,
Cape Town 8010, RSA
naturaviva@universe.co.za

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1. OUTLINE OF DEVELOPMENT

The company Elitheni Coal (Pty) Ltd is proposing to develop a small 1,5 hectare dolerite quarry at a site about 9 km southwest of Indwe, Indwe Magisterial District, Eastern Cape Province (Fig. 1). The quarry will be exploited for road material and is situated at c. 1430 m amsl on the plateau of a flat-topped *koppie* within 0.4 km of Elitheni Coal's opencast coal mine at Indwe (31° 31' 47" S, 27° 16' 23" E; see Fig. 2).

A permit for the quarry development is required from the Department of Mineral Resources (DMR) according to the Minerals and Petroleum Resources Development Act, Act No 28 of 2002. A letter of exemption from further palaeontological studies has been requested for this development by Mr Rudi Gerber of Algoa Consulting Mining Engineers (Office 9, Moffett On Main Centre, c/o William Moffat & Main Road, Walmer, Port Elizabeth; tel: 082 653 2568, 041 367 5501).

2. GEOLOGICAL BACKGROUND

The geology of the study area is shown on 1 : 250 000 sheet 3126 Queenstown (Council for Geoscience, Pretoria; Johnson 1984) (Fig. 3). The region is underlain by several units of Mesozoic continental sediments belonging to the upper part of the Karoo Supergroup, *i.e.* the **Stormberg Group** (Johnson *et al.* 2006). These include:

- Late Triassic fluvial sediments and coals of the **Molteno Formation (TRm)** which underlie the study area and are the host rocks for the Ethelini coal mine;
- Late Triassic to Early Jurassic "red beds" of the **Elliot Formation (TRe)** that crops out to the ESE of the study area.

The Stormberg sediments are extensively intruded by tough-weathering dolerite sills and dykes of the Early Jurassic **Karoo Dolerite Suite (Jd)** in Fig. 3; 183 Ma) that preceded the break-up of the Gondwana supercontinent. These intrusions are briefly described by Johnson (1984) and form prominent-weathering topographic ridges and plateaux (See also Duncan & March 2006). The dolerites are responsible for thermal metamorphism (baking) of the adjacent Karoo bedrocks; for example, fine-grained mudrocks are metamorphosed to form black, flinty "lydianite" or hornfels that was extensively exploited by Stone Age hunter-gatherers in the Great Karoo as a raw material for stone tools. Colluvial debris (scree) from the dolerite outcrops mantles the adjacent Mesozoic sediments to some degree.

The proposed new quarry is to be excavated into a dissected, flat-lying dolerite sill that crops out at surface as rusty-brown weathering, massive but well-jointed igneous rock.

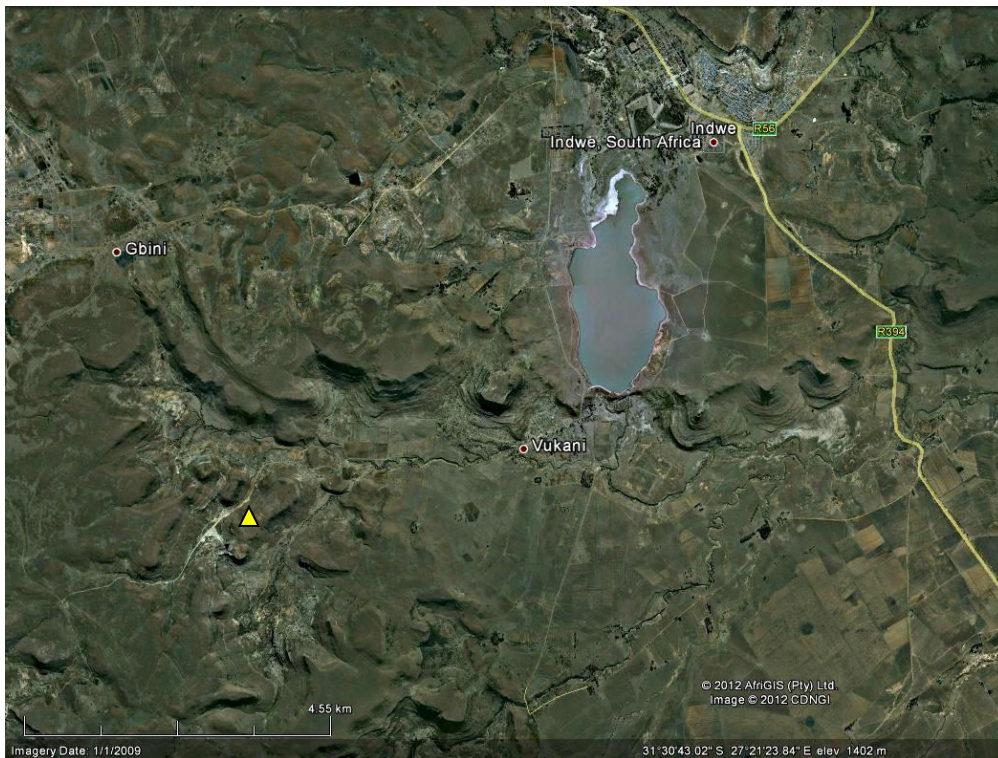


Fig. 1. Google earth© satellite image of the area southwest of Indwe, Eastern Cape, showing the location of the proposed new dolerite quarry (yellow triangle).

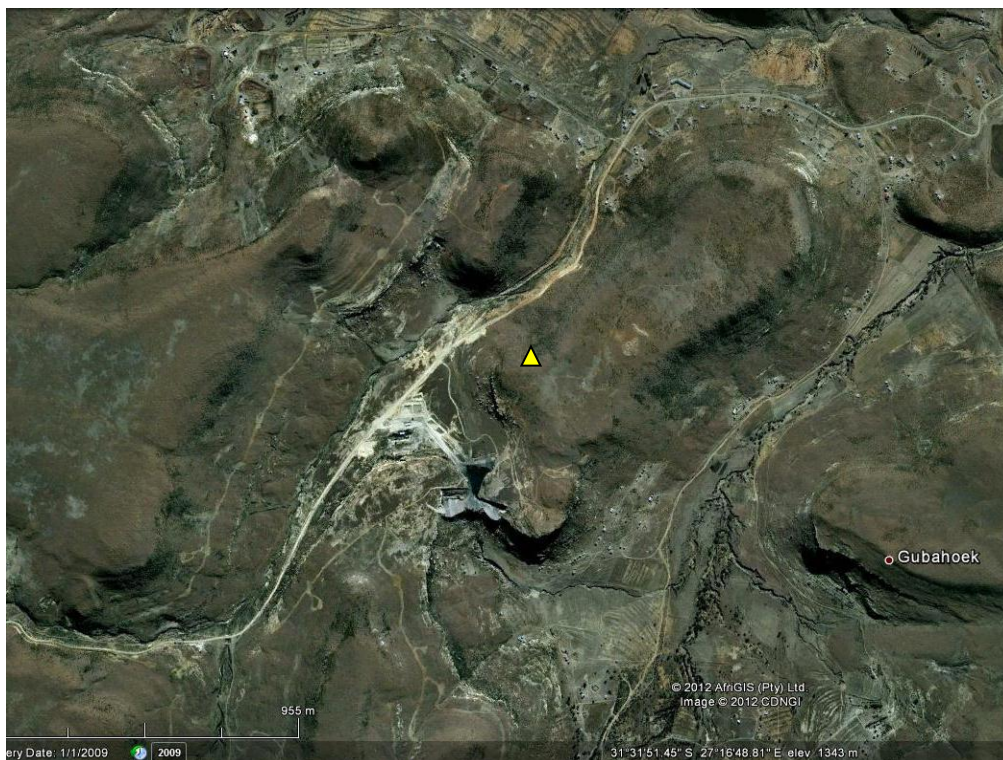


Fig. 2. Detail of Google earth© satellite image of the Elitheni open cast coal mine area southwest of Indwe to show the location of the proposed dolerite quarry on the plateau of a dolerite-capped *koppie* (yellow triangle). The coal mine lies c. 400m to the southwest.

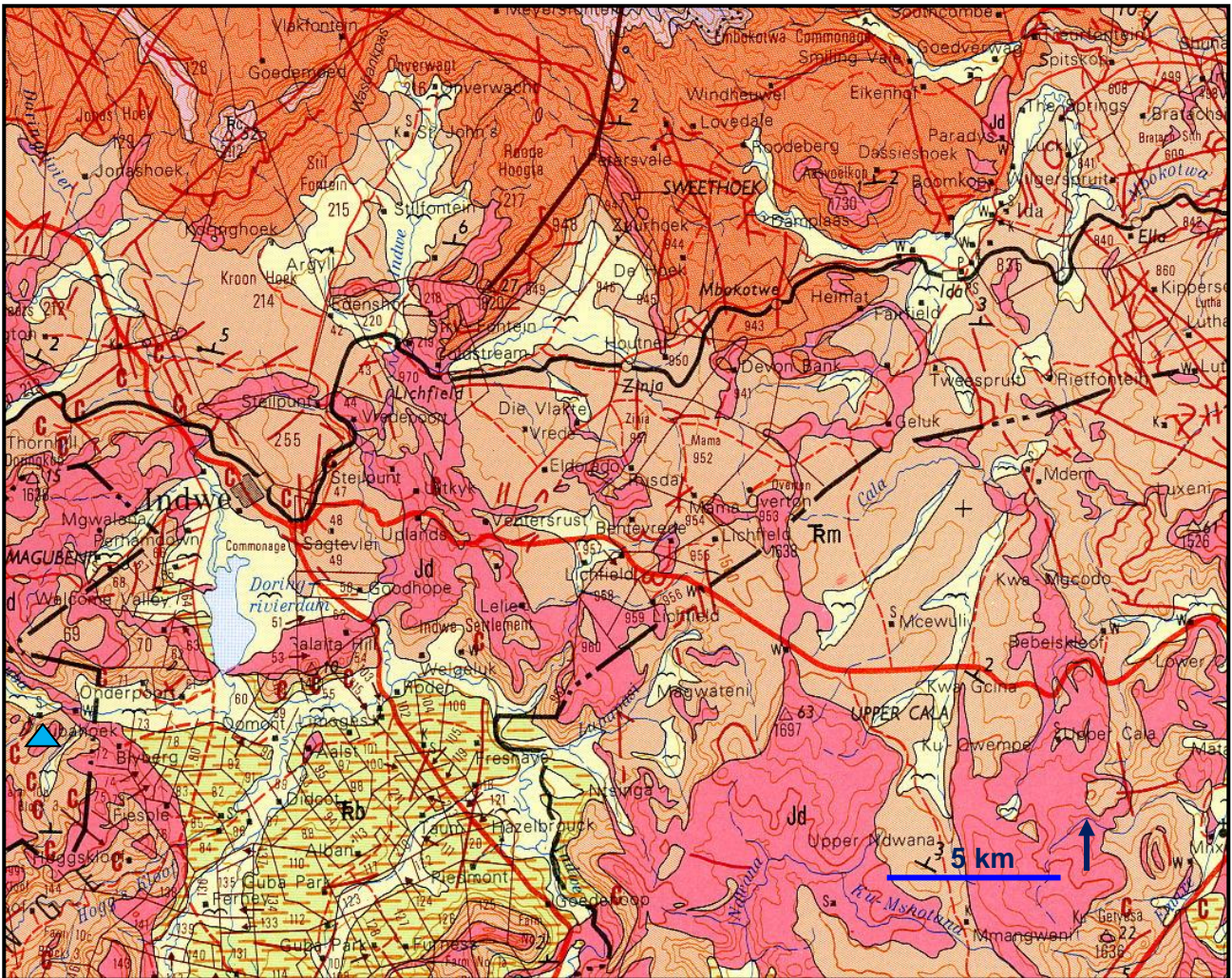


Fig. 2. Extract from 1 : 250 000 geological map 3126 Queenstown (Council for Geoscience, Pretoria) showing approximate location (blue triangle) of the study area on the top of a dolerite-capped koppie c. 9 km southwest of Indwe, Eastern Cape Province. Major rock units represented within the study area include:

TRm (flesh pink) = Late Triassic Molteno Formation

TRe (red) = Late Triassic to Early Jurassic Elliot Formation

Jd (bright pink) = Early Jurassic intrusions of the Karoo Dolerite Suite

Pale yellow areas = Late Cenozoic alluvium

The red C symbol refers to coal deposits within the Molteno Formation

3. PALAEOONTOLOGICAL HERITAGE

The Molteno Formation bedrocks in the study area are known for their rich plant fossil assemblages of Triassic age (Almond 2010, De Klerk 2007 and refs. therein) but these fossiliferous rocks will not be affected by the proposed dolerite quarry development.

The dolerite outcrops in the Eastern Cape study region are in themselves of no palaeontological significance since these are high temperature igneous rocks emplaced at depth within the Earth's crust (Almond *et al.* 2008). As a consequence of their proximity to large dolerite, the surrounding, potentially fossiliferous Stormberg Group sediments in this area have probably been thermally metamorphosed or "baked" (*ie.* recrystallised, impregnated with secondary minerals). Embedded

fossil material of phosphatic composition within the sedimentary country rocks, such as bones and teeth, is frequently altered by baking - bones in the East London area, for example, are typically black - and may be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser, p. 23 *in* Rubidge 1995). However, it should be noted that fossil vertebrate remains within the Molteno Formation are exceedingly scarce (e.g. very rare fish).

Superficial sediments (e.g. colluvium, alluvium, soils) mantling the Stormberg Group and Karoo dolerite bedrocks are generally only very sparsely fossiliferous.

4. CONCLUSIONS & RECOMMENDATIONS

In contrast to the nearby coal mining operation, the development of the proposed new dolerite quarry southwest of Indwe is of no significance in terms of local palaeontological heritage since these igneous rocks are entirely unfossiliferous, and any fossils preserved within the adjacent country rocks are likely to have been baked, perhaps destroyed, during intrusion of hot dolerite magmas. Furthermore, the footprint of the proposed development is small.

It is therefore recommended that exemption from further specialist palaeontological studies and mitigation be granted for this quarry development.

Should any substantial fossil remains (e.g. vertebrate bones and teeth, petrified wood, plant fossil assemblages) be encountered during excavation, however, these should be reported to SAHRA for possible mitigation by a professional palaeontologist.

5. REFERENCES

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6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva cc*. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape as well as Limpopo, Free State and Gauteng for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed 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 John E. Almond
Palaeontologist
Natura Viva cc