

PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY

Proposed gypsum quarry on Portion 1 of East of Gous Kraal No. 257, Cacadu District, Eastern Cape

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April 2009

1. SUMMARY

The proposed new gypsum quarry north of Mount Stuart (Steytlerville area, Eastern Cape) will entail shallow excavations into potentially fossil-bearing mudrocks of the Early Permian (278 Ma) Whitehill Formation. The most important fossils likely to be found here include aquatic mesosaurid reptiles, primitive bony fishes and crustaceans. However, the overall impact of the development on palaeontological resources is likely to be minor since unweathered bedrock is unlikely to be exploited and the planned quarrying activities are both small-scale and short-term. Further specialist palaeontological mitigation is therefore not recommended. Should fossil remains be encountered during excavation, however, the material should be safeguarded and SAHRA or a local museum be contacted for advice by the responsible ECO.

2. INTRODUCTION & BRIEF

S.A. Lime (Eastern Cape) (Pty) Ltd are proposing to quarry gypsum for agricultural lime on Portion 1 of the farm East of Gous Kraal No. 257, situated c. 25km northwest of Steytlerville in the Eastern Cape (Ikwezi Magisterial Area, Cacadu District). The new quarry will be located on the west side of the R338 and some 3 km north of the hamlet of Mount Stuart (Fig. 1). It will be in operation for about five months and will only involve an area of 150m X 100m. An existing quarry that has been operated by PPC since 1965 is situated on the opposite side of the R338 road.

The quarry area is underlain by potentially fossiliferous sediments of the Whitehill Formation (Ecca Group). A desktop palaeontological impact assessment for the project is therefore required by SAHRA in accordance with the requirements of the National Heritage Resources Act, 1999. This study was accordingly commissioned on behalf of the client by Mr Rudi Gerber of Algoa Consulting Mining Engineers.

3. GEOLOGICAL BACKGROUND

As shown by the 1: 250 000 scale geological map 3324 Port Elizabeth and satellite images, the study area lies close to the axis of a WNW-ESE syncline in marine sediments of the lower Ecca Group (Fig.1). The S.A. Lime quarry will be excavated into superficial weathered bedrock belonging to the **Whitehill Formation**. This is a thin (c. 20-30 m) succession of finely-laminated, carbon-rich pyritic mudrocks of Early Permian (Artinskian) age that forms part of the lower Ecca Group (Karoo Supergroup). In addition to mudrocks, thin cherts, volcanic tuffs (ash bands) and large dolomitic concretions also occur (Toerien & Hill 1989, Johnson & Le Roux 1994). These Whitehill sediments were laid down about 278 Ma (million years ago) in an extensive shallow, brackish to freshwater basin – the Ecca Sea – that stretched across southwestern Gondwana, from southern Africa into South America (McLachlan & Anderson 1971, Oelofsen 1981, 1987, Visser 1992, 1994, Cole & Basson 1991, Johnson *et al.* 2006). Iron sulphides (pyrite or fools' gold) originally precipitated within the oxygen-poor muds on the floor of the Ecca Sea weather under near-surface conditions to form the whitish mineral gypsum which is of economic value both in agriculture and the cement industry.

In the study area fresh Whitehill bedrock (black in colour due to its high carbon content) is covered by a thin cover of soil and pale, deeply-weathered mudrocks. The latter contain the gypsum deposits that are to be exploited commercially.

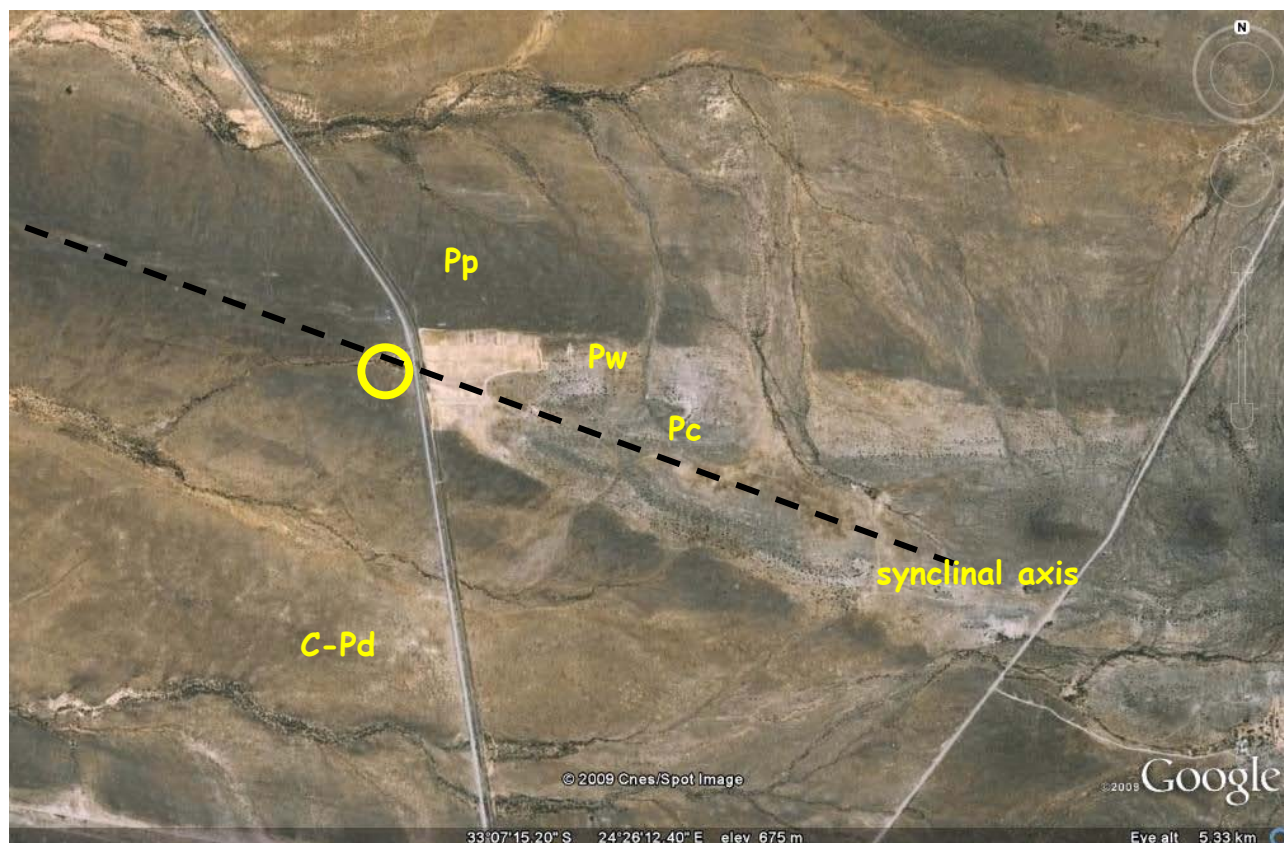


FIG.1. Google satellite image of the study area c. 3km north of Mount Stuart, Eastern Cape showing position of proposed new gypsum quarry on farm East of Gous Kraal 257 (yellow circle). Geological units indicated are Dwyka Group (C-Pd), Prince Albert Formation (Pp), Whitehill Formation (Pw, pale outcrop), Collingham Formation (Pc).

4. PALAEOLOGICAL HERITAGE

In palaeontological terms the Whitehill Formation is one of the richest and most interesting stratigraphic units within the Ecca Group. The overall palaeontological sensitivity of this formation has been rated elsewhere as very high (Almond & Pether 2008). In brief, the main groups of Early Permian fossils found within the Whitehill Formation include:

- aquatic **mesosaurid reptiles** (the earliest known sea-going reptiles)
- rare **cephalochordates** (ancient relatives of the living lancets)
- a variety of **palaeoniscoid fish** (primitive bony fish)
- highly abundant small **eocarid crustaceans** (bottom-living shrimp-like forms)
- **insects** (mainly preserved as isolated wings, but some intact specimens also found)
- a low diversity of **trace fossils** (eg king crab trackways, possible shark coprolites / faeces)
- **palynomorphs** (organic-walled spores and pollens)
- **petrified wood** (mainly of primitive gymnosperms, silicified or calcified)
- other sparse **vascular plant remains** (*Glossopteris* leaves, lycopods etc).

Important material of the fossil groups listed above has mainly been collected in the Western Cape Province during the twentieth century by a series of palaeontologists (See, for example, McLachlan & Anderson 1971, Oelofsen 1981, 1987, Almond 1996, 2008, Almond & Pether 2008, Evans 2005, and refs. therein). The fossil record of the Ecca Group as a whole in the Eastern Cape is still poorly recorded, mainly comprising isolated reports of vascular plant fragments, mostly unidentifiable, and various trace fossils which may be locally abundant (eg Haughton 1928, 1935, Johnson 1976, pp225-226). Note that in the earlier geological literature the Whitehill Formation or “Witband” was included within the Upper Dwyka Shales.

The biostratigraphic distribution of the most prominent fossil groups – mesosaurid reptiles, palaeoniscoid fishes and notocarid crustaceans – within the Whitehill Formation has been documented by several authors, including Oelofsen (1987), Visser (1992) and Evans (2005). A non-technical illustrated account of the fossil biota of the Ecca Sea is given in Appendix 1 (See also MacRae 1999).

5. CONCLUSIONS & RECOMMENDATIONS

The Whitehill Formation bedrock to be exploited in the proposed quarry is potentially fossiliferous. Any fossil remains found during excavation would be of scientific interest, especially given the sparse current knowledge of Ecca Group palaeontology in the Eastern Cape Province as a whole. Therefore any fossils encountered during fresh bedrock excavations made for this development should be safeguarded by the responsible ECO. SAHRA or a local museum (eg the Albany Museum, Grahamstown) should be contacted for advice at the earliest opportunity.

It is concluded, however, that pending further discoveries the proposed development will not have a significant impact on local fossil heritage resources given:

- the shallow nature of the excavations (focussing on weathered, gypsum-rich bedrock)

- the small area involved (100 x 150 m)
- the short time scale of the operation (c. 5 months)

No further palaeontological mitigation is therefore recommended for this project.

6. ACKNOWLEDGEMENTS

Mr Rudi Gerber of Algoa Consulting Mining Engineers is thanked for commissioning this study and for kindly providing the necessary background information.

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