

Expansion of agricultural activities on Portion 5 of the Farm Nooitgedacht No. 118, Sunland, near Addo, Sundays River Valley Municipality, Eastern Cape

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1. SUMMARY

It is proposed to expand the existing citrus cultivation on Portion 5 of the Farm Nooitgedacht No. 118 near Addo, Sundays River Valley Municipality, Eastern Cape, by establishing approximately 38.4 hectares for additional citrus orchards and associated agricultural infrastructure.

The study area near Sunland, some 8 km WNW of Addo in the Sundays River Valley, Eastern Cape, is largely underlain by Early Cretaceous marine sediments of the Sundays River Formation (Uitenhage Group). This mudrock-dominated succession with subordinate sandstones has yielded rich fossil assemblages of marine invertebrates (notably molluscs, such as ammonites and bivalves), plant remains (e.g. driftwood) as well as very rare vertebrate remains (e.g. dinosaurs) from the Algoa Basin of the Eastern Cape. Several fossil localities have been recorded along the Sundays River Valley to the west of Addo by McLachlan and Anderson (1976) and earlier authors. However, in the areas along the northern and eastern boundaries of Farm Nooigedacht 118 that are earmarked for development the Sundays River Formation is largely mantled by Late Tertiary river gravels of the Kudus Kloof Formation that may be up to several meters thick and are at most very sparsely fossiliferous. Significant impacts on fossil heritage are therefore not anticipated here.

It is concluded that no further palaeontological heritage studies or specialist mitigation are required for this agricultural project, *pending* the discovery or exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood, fossil plant-rich horizons, buried laminated shales) during the construction phase. The ECO responsible for these developments should be alerted to the possibility of important fossil remains being found either on the surface or exposed by fresh excavations during construction.

Should fossil remains be discovered during construction, these should be safeguarded (preferably *in situ*) and the ECO should alert the Eastern Cape Provincial Heritage Resources Authority (ECPHRA. Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; Email: smokhanya@ecphra.org.zaso) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000; Tel: 021 462 4502; Email: cscheermeyer@sahra.org.za). Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

2. INTRODUCTION & BRIEF

Mnr Hermanus Potgieter is proposing to expand the existing citrus cultivation on Portion 5 of the Farm Nooitgedacht No. 118 near the town of Sunlands, Sundays River Valley Municipality, Eastern Cape, by establishing approximately 38.4 hectares for additional citrus orchards and associated agricultural infrastructure. The farm is currently utilised for a variety of activities, including commercial buffalo farming, citrus production, tourism activities (Kududu Guest Farm) and cattle grazing. The farm is located on the southern side of the Sundays River, some 8 km WNW of Addo and east of the provincial MR470 gravel road that extends from the R75 Uitenhage / Graaff-Reinet Road to the Sunland road (R336).

The proposed development will entail the following activities on the site:

- Clearing of vegetation from portions of the site proposed for agriculture (38.4 ha);
- Levelling and landscaping the site to provide runoff control;
- Establishment of internal roads to provide access to orchards;
- Possible expansion of an existing storage dam for irrigation water;
- Installation of a drip irrigation system;
- Establishment of citrus trees;
- Establishment of wind breaks.

The final design and layout of the development will be informed by technical and environmental specialist input during the Basic Assessment process.

The company Public Process Consultants (Contact details: Marisa Jacoby, Public Process Consultants, 120 Diaz Road, Adcockvale, Port Elizabeth. Phone: 041 374 8426. Fax: 041 373 2002. Cell: 083 233 5612. E-mail: marisa@publicprocess.co.za) has been appointed by the developer as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment for this agricultural project.

The study area is underlain by potentially fossiliferous sediments of the Sundays River Formation (Uitenhage Group) of Early Cretaceous age. In accordance with the National Heritage Resources Act, 1999, a palaeontological heritage assessment is required as part of a Heritage Impact Assessment for this project since important fossil material (e.g. dinosaur remains) has previously been recorded from the Kirkwood – Addo area within this formation. In view of the very limited exposure of Cretaceous bedrocks within the study area, a basic desktop assessment of the fossil heritage resources in the study region was commissioned by Public Process Consultants.



Fig. 1. Location of the study site on Portion 5 of Farm 118 Nooitgedacht situated c. 8 km WNW of Addo, Sundays River Valley Municipality, Eastern Cape (Image abstracted from Background Information Document prepared by Public Process Consultants, Port Elizabeth, November 2013).

1.1. Legislative context of this palaeontological study

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

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

- (1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- (2) All archaeological objects, palaeontological material and meteorites are the property of the State.
- (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.

Minimum standards for the palaeontological component of heritage impact assessment reports have been developed by SAHRA (2013).

3. APPROACH TO THE PALAEOONTOLOGICAL HERITAGE ASSESSMENT

The information used in this desktop study was based on the following:

1. A project outline (BID) and maps provided by Public Process Consultants;
2. A review of the relevant scientific literature, including published geological maps, satellite images, and previous fossil heritage assessments in the region (e.g. Almond 2010);
3. The author's database on the formations concerned and their palaeontological heritage.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development. The potential impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (e.g. sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the

construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority, *i.e.* SAHRA for the Northern Cape (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

3.1. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;
4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (*e.g.* of commercial mining companies) - that is not readily available for desktop studies;
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

- (a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- (b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the Farm 118 Nooitgedacht agricultural project the major limitation for fossil heritage assessment is the low level of Mesozoic bedrock exposure due to cover by largely unfossiliferous superficial sediments. For this reason, a field-based assessment was not considered warranted.

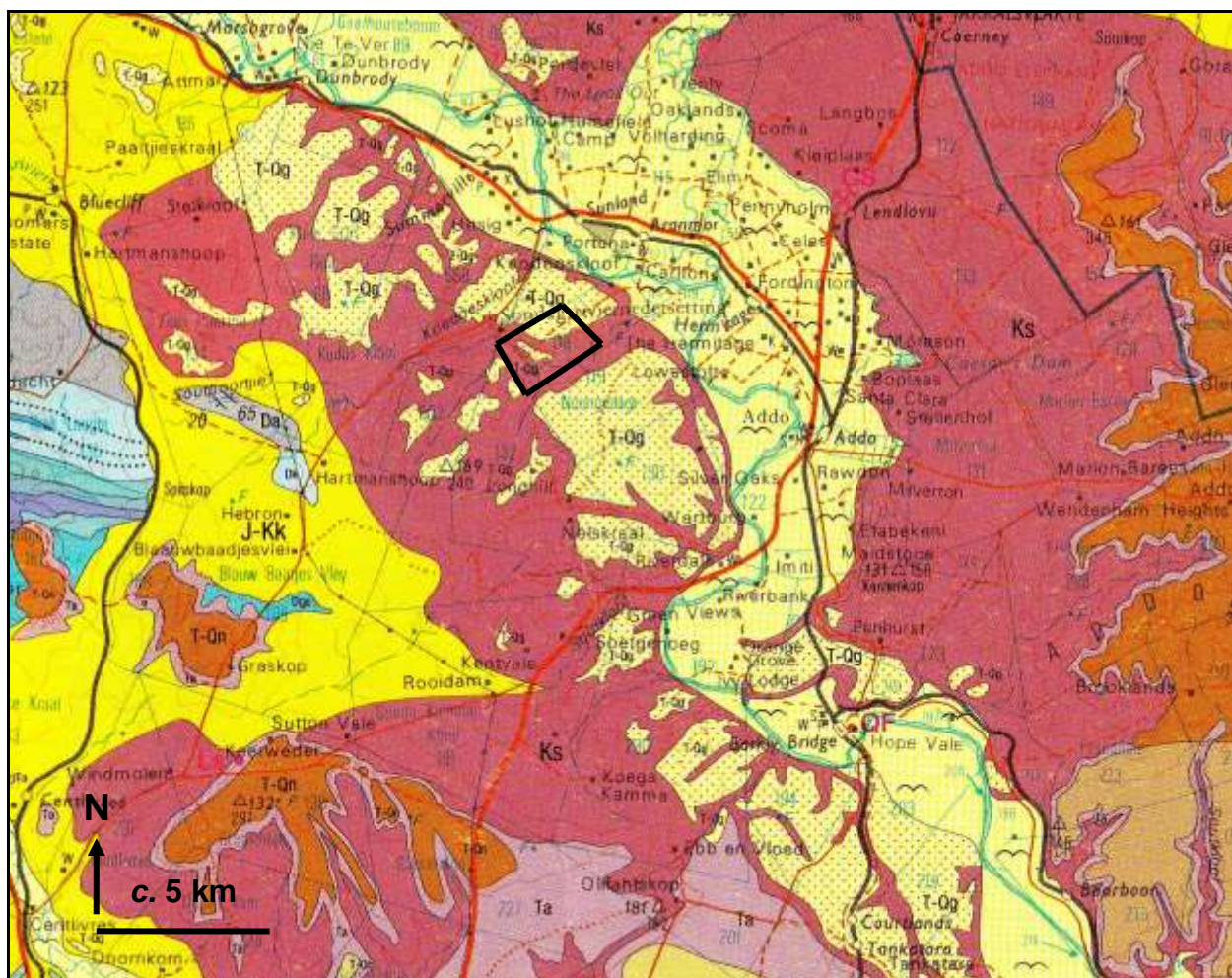


Fig. 2. Extract from 1: 250 000 geological map 3324 Port Elizabeth (Council for Geoscience, Pretoria). The study area on Portion 5 of Farm 118 Nooitgedacht, some 8 km WNW of Addo, Eastern Cape (black polygon), lies on the southern side of the Sundays River. It is underlain at depth by Early Cretaceous sediments of the Sundays River Formation (Ks, pink) that are mostly mantled here by Late Tertiary pediment gravels of the Kudus Kloof Formation (pale yellow with red stipple).

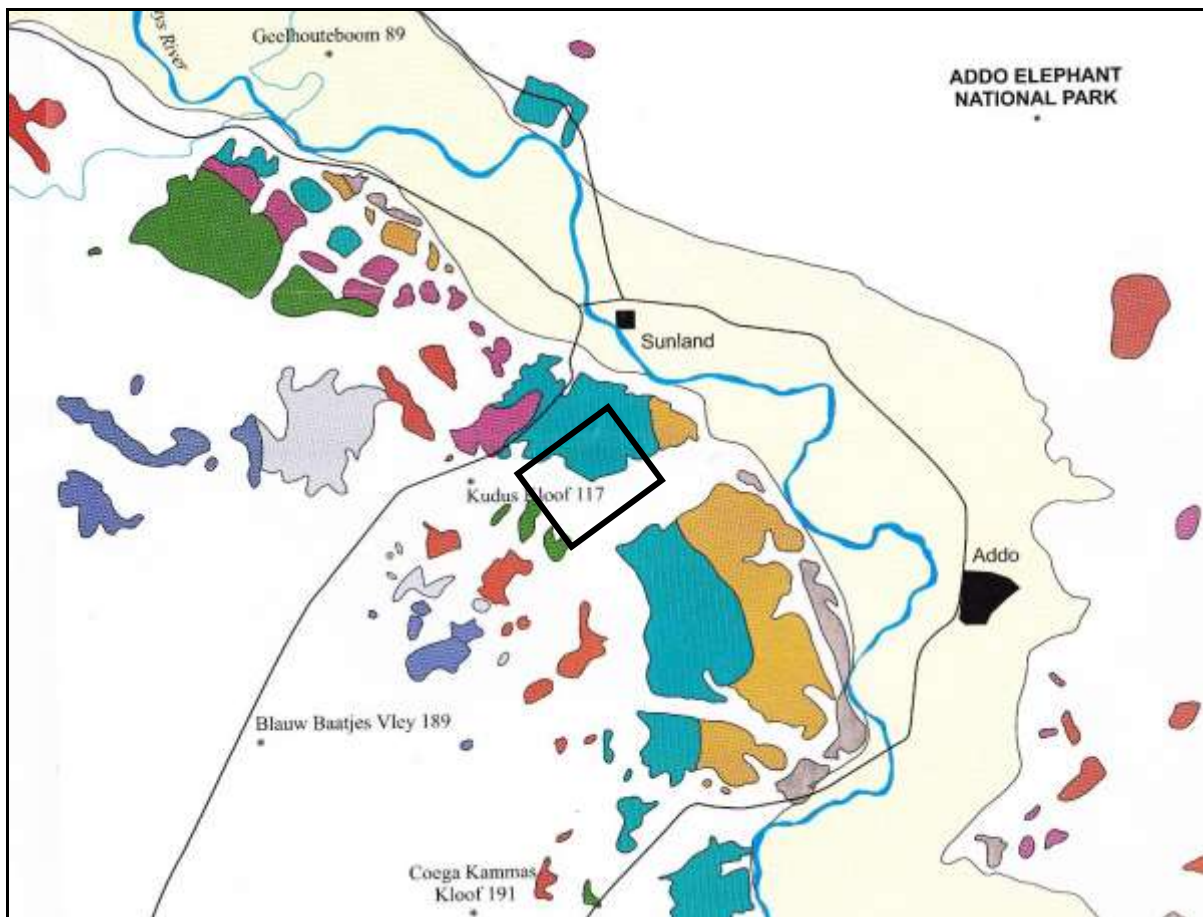


Fig. 3. Extract from map of High Level Terrace Gravels of the Sundays River published by Hattingh (2001, Appendix 2) showing the presence of Terrace 7 gravels of inferred Late Pliocene age within the Farm 118 Nooitgedacht study area (black rectangle). The older terrace gravels are now grouped within the Kudus Kloof Formation (Hattingh 1994).

4. GEOLOGICAL BACKGROUND

The Farm 118 Nooitgedacht study area is situated on terraced ground at elevations of around 70 to 130 m amsl and some two kilometres south of the Sundays River, now mostly transformed for agriculture (Fig. 1). The geology of the Addo area is shown on 1: 250 000 geological map 3324 Port Elizabeth (Council for Geoscience, Pretoria; Toerien & Hill 1989) (Fig. 2). The area lies towards the northern edge of the extensive Algoa Basin that is infilled with a 3.5 km thick succession of alluvial fan, fluvial and estuarine to marine shelf sediments of Late Jurassic to Early Cretaceous age (c. 150-125 Ma) that are referred to the **Uitenhage Group** (McLachlan & Anderson 1976, Shone 2006).

The study area is underlain by marine sediments of the **Sundays River Formation** (Ks, pink in Fig. 2) that are overlain by fluvial sediments of the Kirkwood Formation to the south east. The Uitenhage Group rocks overlie older (Devonian) Bokkeveld Group sediments in this region. Judging from satellite images, the recessive-weathering Sundays River beds are poorly exposed in the study area.

The Sundays River Formation is of Early Cretaceous (Valanginian-Hauterivian) age, *i.e.* around 136 Ma (million years old). It comprises a thick (up to 2 km) succession of thin-bedded grey sandstones, siltstones and finer-grained mudrocks that are often highly fossiliferous (Shone 2006). Depositional settings range from estuarine through littoral (shoreline) to marine outer shelf (McMillan 2003). These beds are differentiated from the older Kirkwood Formation of the Uitenhage group by (a) the absence of reddish-hued mudrocks, (b) the presence of prominent-weathering calcareous sandstones, and (c) the frequent occurrence of fossil marine shells. These last are commonly, but not invariably, associated with the thin, calcareous sandstone beds, many of which are tempestites (*i.e.* storm deposits). Key geological accounts of the Sundays River Formation include those by Du Toit (1954), Rigassi & Dixon (1972), Winter (1973), McLachlan & McMillan (1976), Tankard *et al.* (1982), Dingle *et al.*, (1983), McMillan (2003) and Shone (1976, 2006). For the study area the geological sheet explanations by Haughton (1928), Engelbrecht *et al.* (1962), Toerien and Hill (1989) and Le Roux (2000) are most relevant.

In the higher-lying portions of the Nooitgedacht 118 study area, especially towards the north, the Cretaceous bedrocks are mantled with Late Tertiary (Neogene) fluvial gravels ("High Level Gravels") covering a river-cut pediment surface at an elevation of c. 130 m amsl. This surface forms one of a series of terrace deposits of Miocene to Holocene age bordering the Sundays River that have been grouped into the **Kudus Kloof Formation** by Hattingh (1994, 2001). The type area for this formation is situated just to the west of the present study area on Farm 604, 4 km southwest of Sunland. According to the detailed map of Hattingh (2001, Appendix 2; Fig. 3 herein), the gravels on Nooitgedacht belong to Terrace 7 of inferred Late Pliocene age (through correlation with fossil-dated equivalent wave-cut terraces along the coast. Such older terrace deposits of the Kudus Kloof Formation are mainly composed of clast-supported, horizontally- and cross-bedded gravels interbedded by thinner packages of coarse sand. They are often well-consolidated due to secondary calcification (Hattingh 1994, 2001, Partridge *et al.* 2006). A detailed description of, and profile through, a 4.5 m-thick succession of Terrace 7 gravels overlying Sundays River mudrocks at Kudus Kloof, 5 km west of Sunland, is given by Hattingh (2001, his Fig. 4.3b).

5. PALAEOLOGICAL HERITAGE

5.1. Fossils in the Sundays River Formation

In palaeontological terms the Sundays River Formation (Uitenhage Group) contains one of the most prolific and scientifically important marine biotas of Mesozoic age in southern Africa (See brief review by Almond 2010, from which the following section is largely abstracted). Fossils have been recorded from the Sundays River beds in the Algoa Basin since the early nineteenth century (1837). Cooper (1981) provides a good review of the earlier literature. Important collections were made, for example, by the famous Eastern Cape geologists W.G. Atherstone and A.G. Bain (see Sharpe 1856) and there has been a long history of palaeontological publications dealing with the Sundays River fauna since then. Among the key papers are those by Sharpe (1856), Kitchin (1908), Spath (1930), Du Toit (1954), Engelbrecht *et al.* (1962), Haughton (1969), McLachlan & McMillan (1976, 1979), Klinger & Kennedy (1979), Cooper (1981, 1991), Dingle *et al.* (1983), McMillan (2003) and Shone (1986, 2006). An accessible, well-illustrated account of Sundays River fossils has recently been given by MacRae (1999). The ammonites and microfossils are of particular biostratigraphic (rock dating) importance, while the foraminiferans (a group of protozoans) are useful for palaeoenvironmental analysis (See extensive discussion in McMillan 2003).

The main invertebrate macrofossils recorded from the Sundays River Formation are a rich variety of molluscs. These include several cephalopod subgroups - mainly ammonites, *plus* much rarer nautiloids and belemnites. The cephalopod fauna has been revised recently by Cooper (1981, 1983) and is dominated by a series (14 spp.) of strongly ribbed, coiled ammonites of the Genus *Olcostephanus* (Fig. 4), also well known from Early Cretaceous marine faunas elsewhere in the world. Interestingly, clear examples of well-developed sexual dimorphism (male and female shells of different size and form) are shown in this genus. Much rarer partially coiled ammonites (*Distoloceras*) and straight-shelled, obliquely ribbed forms (*Bochianites*) also occur.

The Sundays River molluscs include a number of mainly small-bodied gastropods (*c.* 6 genera, including limpets), and over forty genera of bivalves (mussels, clams *etc.*). In terms of abundance as well as biodiversity the bivalve molluscs are also the dominant group. The commonest form is the thick-shelled "Devil's toenail" oyster *Aetostreon* (previously known as *Exogyra* or *Gryphaea*) which is often preserved in dense *coquinas* (shell beds) at the base of storm sandstones (Fig. 5). Some of the other bivalves, such as the strongly-ribbed or knobbed trigoniids (eleven species in seven genera, recently revised by Cooper 1979, 1991) and the elongate-shelled *Gervillella* - all shallow infaunal forms - are also quite substantial (20-30 cm long or more) with robust shells. Encrusting oysters cemented onto shells, rocks or hardgrounds are common. Dense storm-transported accumulations of scaphopod molluscs (tusk shells) were discovered during a recent field study by Almond (2011). Most of these South African fossils are badly in need of taxonomic and palaeobiological revision along the lines of recent work on similar-aged South America molluscs by Lazo (2007 and earlier papers).

More minor invertebrates - including stenohaline as well as euryhaline taxa - from the Sundays River Formation are solitary and branching colonial corals, tube-dwelling serpulid polychaetes, bryozoans, echinoderms (usually fragmentary crinoids or sea lilies, ophiuroids or brittle stars, sea cucumbers, regular echinoids) and shrimp-like crustaceans. However, more intensive collecting from these beds is likely to reveal further invertebrate taxa. This is suggested by the recent discovery of two new crustaceans (including several specimens of strongly tuberculate crabs) within Sundays River concretions (Dr Billy de Klerk, pers. comm., 2010), the scaphopods or tusk shells mentioned earlier, and recent new records of beetle remains south of Addo (Mostovski & Muller 2010). Sundays River trace fossils are poorly studied, but are locally abundant. They range from dense banks of cylindrical intrasediment burrows to a range of borings into wood, shells and hardgrounds (*i.e.* cemented substrata on the sea floor including, for example, exhumed early diagenetic concretions). A spectrum of microfossils from this stratigraphic unit include foraminiferans, ostracods, dinoflagellates and land-derived pollens and spores (Dingle *et al.*, 1983,

McMillan 2003). Among the rarer microfossil groups recorded are radiolarians, shrimps, and fragments of echinoderms (ossicles of crinoids, ophiuroids, holothurians and echinoids).



Fig. 4. Well-preserved specimen of the ammonite *Olcostephanus* from the Sundays River Formation (Albany Museum, Grahamstown). This is a macroconch (female) and c. 25cm across (Image from Almond 2010).



Fig. 5. Well-preserved specimen (“Devil’s toenail”) of the common free-living oyster *Aetostreon* from the Sundays River Formation, main brick pit at Coega (Image from Almond 2010).

The Sundays River beds contain sparse, often unidentifiable plant fossils such as fragments of driftwood (sometimes insect- or perhaps mollusc-bored), leaf and twig debris, amber (fossil resin), lignite, charcoal and the reproductive structures of charophyte algae (stoneworts).

Fossil vertebrates from the Sundays River Formation are very rare indeed. The best-known example is the partial skeleton of a 3 m-long plesiosaur (an extinct group of large marine reptiles), *Leptocleidus capensis* (Fig. 6). This comes from the famous, but poorly-localized, site of Picnic Bush on the Swartkops River near Port Elizabeth (Andrews 1910; see MacRae 1999 for good illustrations). Isolated dinosaur bones and teeth have also been mentioned (e.g. a dinosaur vertebra from Barclay Bridge south of Addo; Engelbrecht *et al.* 1962), though several earlier records probably stem from the older Kirkwood Formation. Gess (undated report) recently reported small vertebrate remains associated with marine molluscs and drift-wood from a site in the Sundays River Valley.

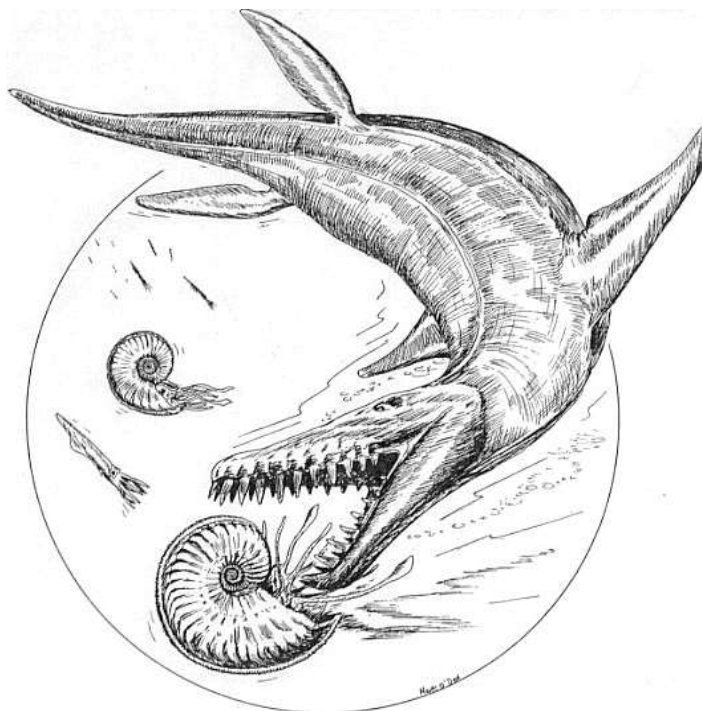


Fig. 6. Artist's reconstruction of a Cretaceous plesiosaur hunting ammonites.

Early records of Cretaceous fossil remains from the Sundays River Formation of the Algoa Basin near Addo – including several reports of fossil molluscs (ammonites, bivalves, gastropods) as well as tubicolous serpulid worms - have been collated by McLachlan and Anderson (1976) (Fig. 7 herein). Despite the long history of palaeontological work on Sundays River fossils, there has been little systematic collection of fossils – especially macrofossils - from these beds in recent decades and most taxa remain poorly studied (e.g. most invertebrate groups, apart from the ammonites, trigoniid bivalves and foraminiferans). Much further research remains to be done here, however, and a lot of palaeontologically valuable material is undoubtedly being destroyed in the currently active brick pits in the Algoa Basin region.

In the areas along the northern and eastern boundaries of the Nooigedacht 118 study area that are earmarked for agricultural development the Sundays River Formation is largely mantled by Tertiary river gravels and significant impacts on fossil heritage are therefore not anticipated here.

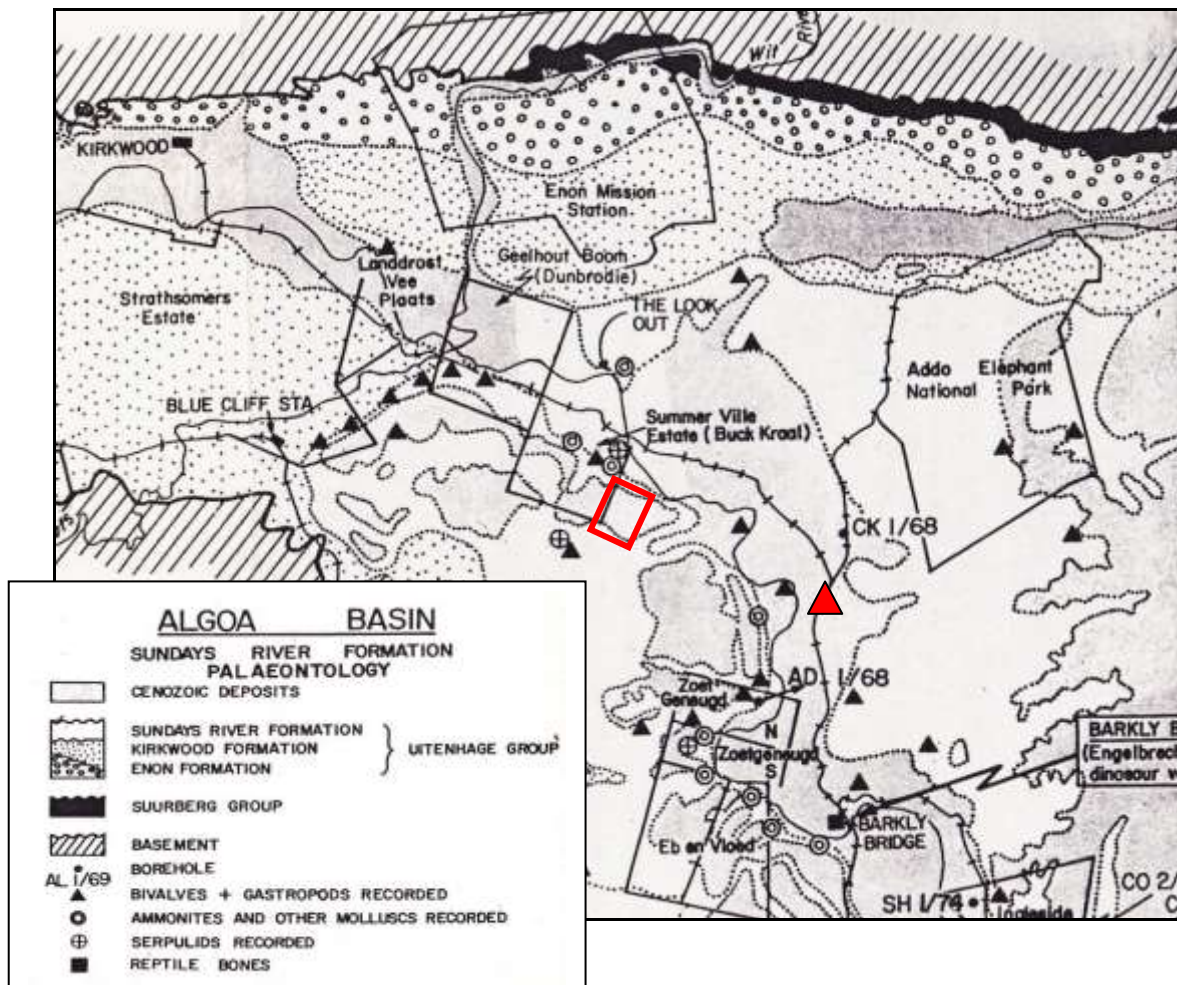


Fig. 7. Fossil localities in the Sundays River Formation of the Algoa Basin near Addo (town marked by red triangle), with the present study area approximately indicated by a red rectangle. Several groups of marine invertebrates (molluscs, including bivalves, gastropods and ammonites, as well as serpulid worm tubes) are reported from Sundays River Formation beds on the flanks of the Sundays River Valley in the area west of Addo, while various dinosaur and other vertebrate remains are recorded from Barclay Bridge to the south of Addo (Figure modified from McLachlan & Anderson 1976, their Fig. 8).

5.2. Fossils in Late Caenozoic High Level Gravels

Neogene to Recent colluvial, alluvial and lag gravel, sand and clay deposits may also contain fossil remains of various types. In coarser sediments like river conglomerates these tend to be robust, highly disarticulated and abraded (e.g. rolled bones, teeth of vertebrates) but well-preserved skeletal remains of plants (e.g. wood, roots) and invertebrate animals (e.g. freshwater molluscs and crustaceans) as well as various trace fossils may be found within fine-grained alluvium. Embedded human artefacts such as stone tools that can be assigned to a specific interval of the archaeological time scale (e.g. Middle Stone Age) can be of value for constraining the age of Pleistocene to Recent drift deposits like alluvial terraces. Ancient to modern “High Level Gravels” tend to be coarse and to have suffered extensive reworking (e.g. winnowing and erosional downwasting), so they are generally unlikely to contain useful fossils. No fossils are reported from the Kudus Kloof Formation by Hattingh (1994, 2001); these fluvial terraces are dated by reference to correlated fossiliferous marine terraces along the coast. Fine-grained carbonaceous muds associated with *vlei* areas may contain peats, palynomorphs (pollens, spores) and other microfossils as well as the bones and teeth of mammals and other fauna that died in the area.

6. CONCLUSIONS & RECOMMENDATIONS

The study area on the Farm Nooitgedacht No. 118 near Sunlands, some 8 km WNW of Addo in the Sundays River Valley, Eastern Cape, is largely underlain by Early Cretaceous marine sediments of the Sundays River Formation (Uitenhage Group). This mudrock-dominated succession with subordinate sandstones has yielded rich fossil assemblages of marine invertebrates (notably molluscs, such as ammonites and bivalves), plant remains (e.g. driftwood) as well as very rare vertebrate remains (e.g. dinosaurs) from the Algoa Basin of the Eastern Cape. Several fossil localities have been recorded along the flanks of the Sundays River Valley to the west of Addo by McLachlan and Anderson (1976) and earlier authors. However, in the areas along the northern and eastern boundaries of Farm Nooigedacht 118 that are earmarked for development the Sundays River Formation is largely mantled by Late Tertiary river gravels of the Kudus Kloof Formation that may be up to several meters thick and are at most very sparsely fossiliferous. Significant impacts on fossil heritage are therefore not anticipated here.

It is concluded that no further palaeontological heritage studies or specialist mitigation are required for this agricultural project, *pending* the discovery or exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood, fossil plant-rich horizons, buried laminated shales) during the construction phase. The ECO responsible for these developments should be alerted to the possibility of important fossil remains being found either on the surface or exposed by fresh excavations during construction.

Should fossil remains be discovered during construction, these should be safeguarded (preferably *in situ*) and the ECO should alert the Eastern Cape Provincial Heritage Resources Authority (ECPHRA. Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; Email: smokhanya@ecphra.org.zaso) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

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7. ACKNOWLEDGEMENTS

Ms Marisa Jacoby of Public Process Consultants, Port Elizabeth, is thanked for commissioning this desktop study and for providing the necessary background information. I am grateful to Dr Billy de Klerk (Albany Museum, Grahamstown) for discussions on the Uitenhage Group palaeontology of the Algoa Basin.

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9. 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 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 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.



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