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A Rhinoceros tooth from basal strata of the Port Durnford Formation, Zululand, South Africa: The relocation of Anderson's mammalian fossil site

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SYNOPSIS

A fossil rhinoceros tooth from coastal outcrops of the Pleistocene Port Durnford Formation near Richards Bay is the first record of a mammalian fossil from these strata since the original discovery of vertebrate remains by W. Anderson in 1903.

The location of Anderson's mammalian fossil site was never precisely fixed but it is considered to be the same as the Gabhagabha site, 6 km north-east of Richards Bay, from which a rhinoceros tooth was recently recovered. Additional mammalian remains have since been found. The fossiliferous strata are only briefly and periodically exposed and at such times the basal strata of the Port Durnford Formation are well exposed near the fossil site. They overlie an aeolianite unconformably, a situation not previously recorded. Foraminifera from the aeolianite suggest that the vertebrate fauna is no older than lower Pleistocene, while the fauna itself suggests a middle Pleistocene date.

The stratigraphic sequence recorded by Anderson is apparently a *composite* one based on exposures along about 50 km of coastline northwards from Port Durnford.

INTRODUCTION

The literature on fossil vertebrate faunas of the Natal/Zululand area is particularly limited. Anderson (1907) commented on sediments from this area bearing mammalian remains in association with fossiliferous marine shales passing upward into sands carrying beds of sandy lignite. He described the outcrops containing the mammalian remains as occurring close to low-water mark and usually covered deep in sand. This mammalian fauna was described in detail by Scott in the same publication. Unfortunately, locality data presented by Anderson are vague. He states that the lignite beds outcrop at intervals on the coast from Port Durnford northward, but details of the mammalian fossil locality are lacking. From the material sent to him by Anderson, Scott described and tentatively named new species of supposedly extinct forms of hippopotamus, buffalo, elephant and rhinoceros.

Subsequently, the identification of Scott's 'new' species has been critically reviewed by several authors. The revised identifications are as follows:

Rhinoceros (*Opsiceros simplicidens*): The type specimen belongs to a white rhinoceros (*Ceratotherium simum*) while the paratypes belong to the black rhinoceros (*Diceros bicornis*) (see Cooke 1950).

Hippopotamus (*H. Ponderosus*): Actually the living species *H. amphibus* is represented (Cooke 1963).

Buffalo (*Bubalus andersoni*): According to Cooke (1963) this really is an extinct species, but Hopwood & Hollyfield (1954) suggest it may be the living species, *Syncerus caffer*. The correct generic name is certainly *Syncerus* (not *Bubalus*, which refers to the Asiatic water buffalo) and it would probably be in order to list it as *Syncerus andersoni*.

Elephant (*Elephas* (*Loxodonta*) *zulu*): Now identified as *Loxodonta atlantica zulu* (see Maglio 1973).

Anderson attributed a Tertiary age to the mammalian fossils and to the strata enclosing them, on the basis of marine mollusca identified by Etheridge. However, with regard to the mammalian fossils, Scott regarded them as probably early Pleistocene. Many years later, on the basis of comparison with species recovered from the 'Younger' Vaal River gravels, the Port Durnford mammalian species and associated sediments were reassigned a late Middle Pleistocene age (Du Toit 1954: 440).

In addition to Du Toit (1954), both Cooke (1963) and Maglio (1973) place Anderson's fauna in the Middle Pleistocene.

Several investigators have made reference to these beds, e.g. McCarthy (1967) and Maud (1968), generally referring informally to the outcrops near Port Durnford lighthouse as the Port Durnford Beds and extensions of these outcrops along the coast north of Richards Bay as the Kwa-Mbonambi Beds. However, the most detailed study has been that of Hobday & Orme (1974) who formally designated these deposits a lithostratigraphic unit recognised as the Port Durnford Formation. They interpreted the sedimentary assemblage of this Formation as a barrier-lagoon complex deposited during a marine transgression which culminated in a sea-level approximately 8 m above the present, an event most probably related to the Sangamon (Eem) Interglacial Stage.

Despite the repeated efforts of these and other investigators over a number of years, the location of Anderson's mammalian fossil site has remained unknown. Probably because Port Durnford was the only locality actually mentioned by Anderson, it is possible that most investigators expected the mammalian fossil site to have been somewhere in this vicinity.

Various explanations have been offered to explain the failure to find further mammalian fossils, one being that active wave erosion and collapse of the cliff sections has caused cliff retreat over the years and Anderson's mammalian fossil site either has been obliterated or now lies some short distance seaward of the present shoreline.

Other features which have puzzled us over the years are the marked inland dip of the strata as well as the remarkably detailed and complete character of the cliff section depicted by Anderson (1907: Pl. VII). No such section has ever been observed by any of the investigators and it is our opinion that Anderson's section is a *composite* one representative of outcrops from many places along the coast. Furthermore, although Anderson's Third Report was written and published during 1907, it embraced field-

work actually carried out during the years 1903, 1904 and 1905. In the introduction to his report, Anderson (1907: 7) lists dates and localities of his field trips and movements during these years and there is only a single reference to work on the Zululand coast during 1903, namely 'From June 3rd to August 7th . . . on the littoral north of the Umhlatuzi River' (Richards Bay). Thus it seems highly probable that Anderson's mammalian fossil site is located *northward* along the coast from Richards Bay. In many details the Gabhagabha locality described below, from which the fossil rhinoceros tooth and subsequently other mammalian fossils have been recovered recently, is identical with the lower portion of Anderson's section.

The relocation of Anderson's mammalian fossil site is of considerable historical and palaeontological interest since the fossils represent the only substantial Pleistocene mammalian fauna on the east coast and Anderson's discovery was the first record of Pleistocene mammalian fauna described from southern Africa. The original fossils described by Scott were returned to South Africa from Princeton University several years ago and are now in the collections of the South African Museum (Q. B. Hendey, pers. comm.).

LOCALITY DATA

During a cursory visit in July 1974 to Gabhagabha (28°44½'S; 32°10½'E) on the coast north of Richards Bay (Fig. 1), a fossil rhinoceros tooth was found (Figs 2 and 3). At the time a local resident informed the first author that he had never seen the shoreline outcrops so free of sand cover. The tooth, in association with abundant fossil wood fragments, was found at low-tide level in a dark, sandy outcrop on a gentle beach slope almost covered by sand, Above this outcrop is a prominent bluff which forms the first major exposure of the Port Durnford Formation approximately 6 km north of Richards Bay (Figs 4 and 5). The tooth fragment attracted attention because of its unusual character. It was later identified as a rhinoceros tooth by the second author.

At the time, conditions did not permit photographing the material *in situ*. In order to corroborate this discovery, the first author returned to the site in July 1976 when beach and tide conditions duplicated those on the first visit. Although the site was exposed almost exactly as on the first occasion, no further mammalian remains were observed. However, a return visit the following day at ebb tide found the site uncovered to a depth of nearly a metre (Fig. 4). Numerous bone fragments were exposed on the flanks of a shallow gully, including a tooth of the extinct pig, *Mesochoerus*. Some of these fossils were photographed *in situ* and excavated. The bone-bearing exposures were free of sand for about two hours. At the turn of the tide the sand cover was restored and this probably explains the inability of numerous investigators to locate this site. It is possible that since the construction of the pier at Richards Bay beach drift of sand northwards will be considerably diminished and these and other low-lying outcrops along the coast will be better and more frequently exposed. The additional fossil material was later sent to Dr Q. B. Hendey of the South African Museum, Cape Town, for identification.

Description of this material and a detailed account of the geological features of the Port Durnford Formation at this locality will be presented in a later paper. However, it is of significance to note that these fossils are in a state of preservation

similar to that of the fossils found by Anderson. This provides some evidence that the two assemblages are from the same occurrence since the nature of the preservation of fossils is often distinctive (Q. B. Hendey, pers. comm.).

DESCRIPTION OF FOSSIL TOOTH

Systematics

Order Perissodactyla

Family Rhinocerotidae

Genus and species uncertain

Fossil material consists of only the anterior half of an upper left molar (Figs 2 and 3). The tooth is either the 4th premolar or 1st molar. The protoloph is strongly curved posteriorly. Structure of the medivallum indicates that the missing metaloph was also curved though not as strongly as the protoloph. Cingulum well developed and the overall dimensions of the tooth indicate a large animal. The high-crowned tooth is suggestive of *Ceratotherium*.

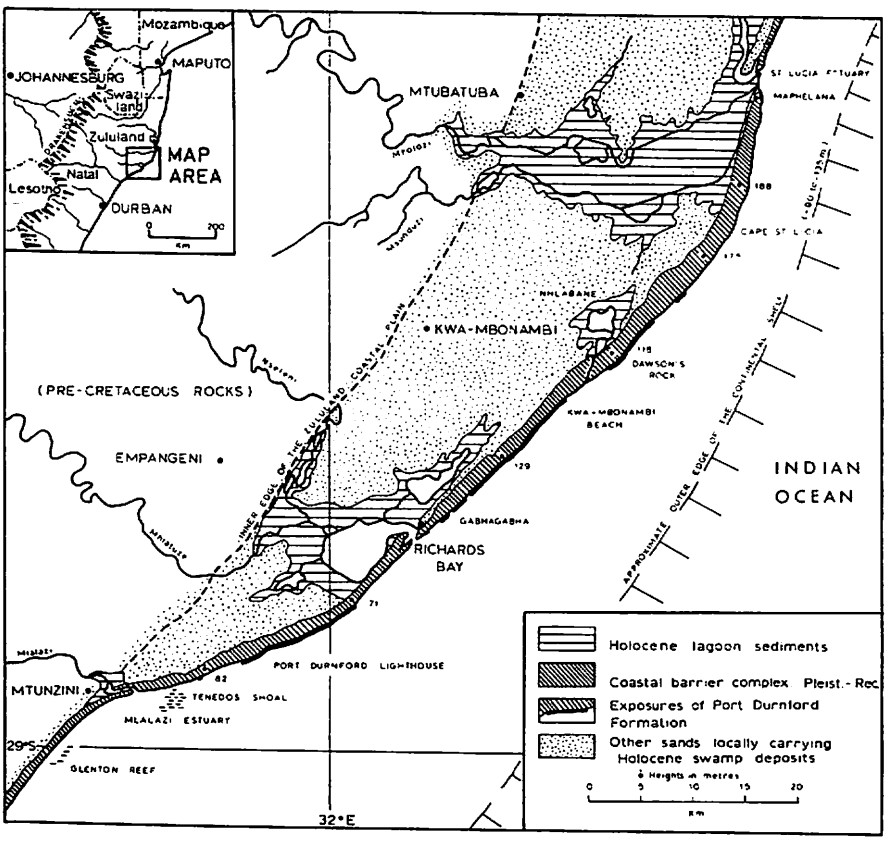


Fig. 1. Locality plan of the coastal plain of southern Zululand showing Gabhagabha and distribution of outcrops of Port Durnford Formation and associated features. Based on Hobday & Orme (1974: Fig. 1).

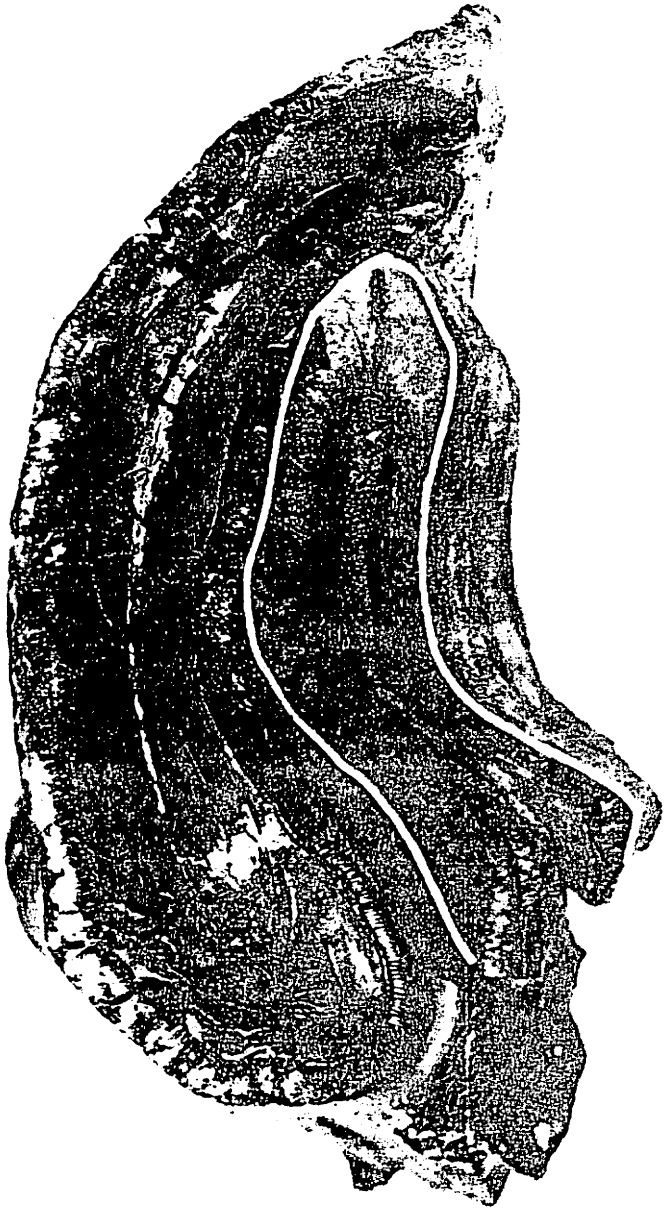


Fig. 2. Occlusal view of fossil rhinoceros tooth fragment from basal strata of the Port Durnford Formation at Gabhagabha, 6 km north of Richards Bay, Zululand. Mineral matter filling space (medivallum) and showing form of part of missing posterior portion (metaloph) of the tooth is outlined in white. The tooth width (parastyle to base of protoloph) is 50 mm.

Fig. 3. Anterior view of fossil rhinoceros tooth fragment from Port Durnford Formation at Gabhagabha, Zululand. The tooth height (crest of parastyle to base of crown) is 60 mm.

Measurements

Width (parastyle to base of protoloph)—50 mm.
Height (crest of parastyle to base of crown)—60 mm.

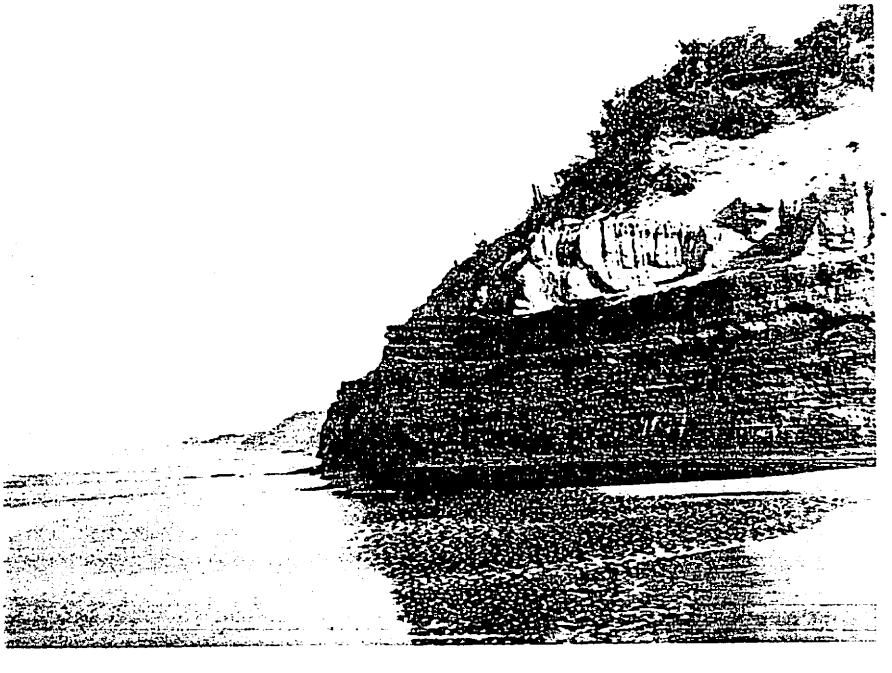
STRATIGRAPHY

The Older Pleistocene Aeolianite and the Basal Strata of the Port Durnford Formation

At Gabhagabha the bone-bearing stratum rests with an irregular contact on a friable calcarenite. The exposure there is very poor and could be seen only below water level in a pool seaward of the shallow gully exposed during the short period when the bone-bearing outcrops were free of sand cover. A similar calcarenite is well exposed some 500 m further north along the coast where the base of the Port Durnford Formation is about 1 m above mean sea-level. The contact is flat in some

Fig. 4. View looking northeast across abnormally exposed bone-bearing stratum. Rhinoceros tooth and other fossils were recovered from shallow gully at foot of cliff, left centre. Prominent ledge at cliff base in far distance is Gabhagabha aeolianite formation. (See Fig. 6.)

Fig. 5. View looking southeast, Port Durnford Formation at Gabhagabha mammalian fossil locality. Dark laminated clays 5 m thick overlain by crossbedded yellow sand. Comminuted shell layer near base forms prominent wave-cut notch.



places and highly irregular in others. The contact can be observed over a total distance of about 100 m. No mammalian fossils were detected here in the basal strata which comprise a layer averaging about 1 m thick of sandy black clay containing abundant shell fragments and scattered pieces of fossil wood. Where the contact is irregular, rubble and small slabs of the underlying calcarenite occur along the contact. The layer with comminuted shells is massive, probably as a result of strong bioturbation. It is markedly less resistant to wave erosion than the associated strata and commonly forms a wave-cut notch or ledge in cliff sections (Fig. 5). This layer sometimes carries larger shell fragments and occasional clusters of the large oyster *Ostrea* and in some places rests with an almost planar contact on the calcarenite as in Fig. 6.

The calcarenite is well sorted and medium- to fine-grained with high-angle large-scale cross-bedding typical of aeolian deposition. Two sets of cross-beds could be observed, one inclined to the south-west, the other inclined in a northerly direction.

The calcarenites bear a Pleistocene shallow water foraminiferal fauna with the following species: *Elphidium crispum*, *Elphidium macellum*, *Ammonia beccarii*, *Rotalia* sp., *Triloculina* spp., *Quinqueloculina* spp., *Spiroloculina* sp., *Amphistegina* sp., *Eponides* sp., *Globigerina bulloides*, *Globigerinoides ruber*, *Globorotalia truncatulinoides*, *Textularia* sp.

Other microfossils present in this unit include several species of ostracods, bryozoa, micromolluscs and echinoderm fragments. Planktonic foraminifera are very rare, but the species *Globorotalia truncatulinoides* suggests that the fauna is no older than lower Pleistocene. Flakes of iridescent aragonite material from mollusc shells and the

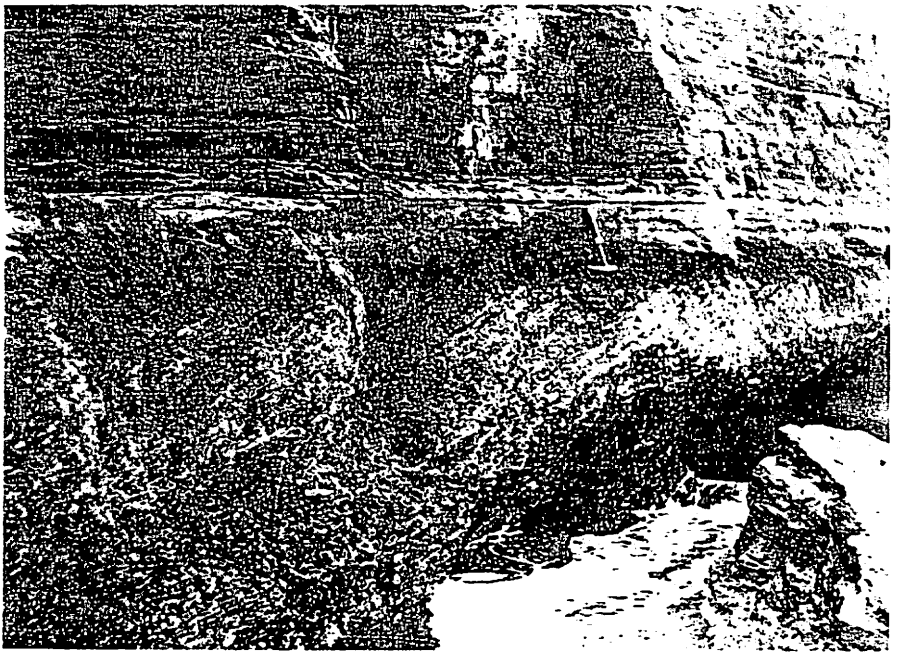


Fig. 6. Gabhagabha aeolianite formation overlain unconformably by laminated clay of Port Durnford Formation.

pigmentation of many of the mollusc shells supports the very young geologic age of these sediments.

This aeolianite, which is informally termed the Gabhagabha aeolianite formation, suggests correlation with a similar aeolianite exposed in litoral outcrops at Dawsons Rocks, about 17 km north-eastward along the coast, as well as with a calcarenite encountered during dredging operations in the extreme north-eastern part of Richards Bay. The calcarenites at both the latter localities bear similar Pleistocene foraminiferal assemblages.

Discussion of Anderson's Section (Plate VII of Third Report, 1907)

As mentioned earlier, Anderson's cliff-section (Pl. VII reproduced here as Fig. 7) is considered to be a composite one representative of the general stratigraphic relation-

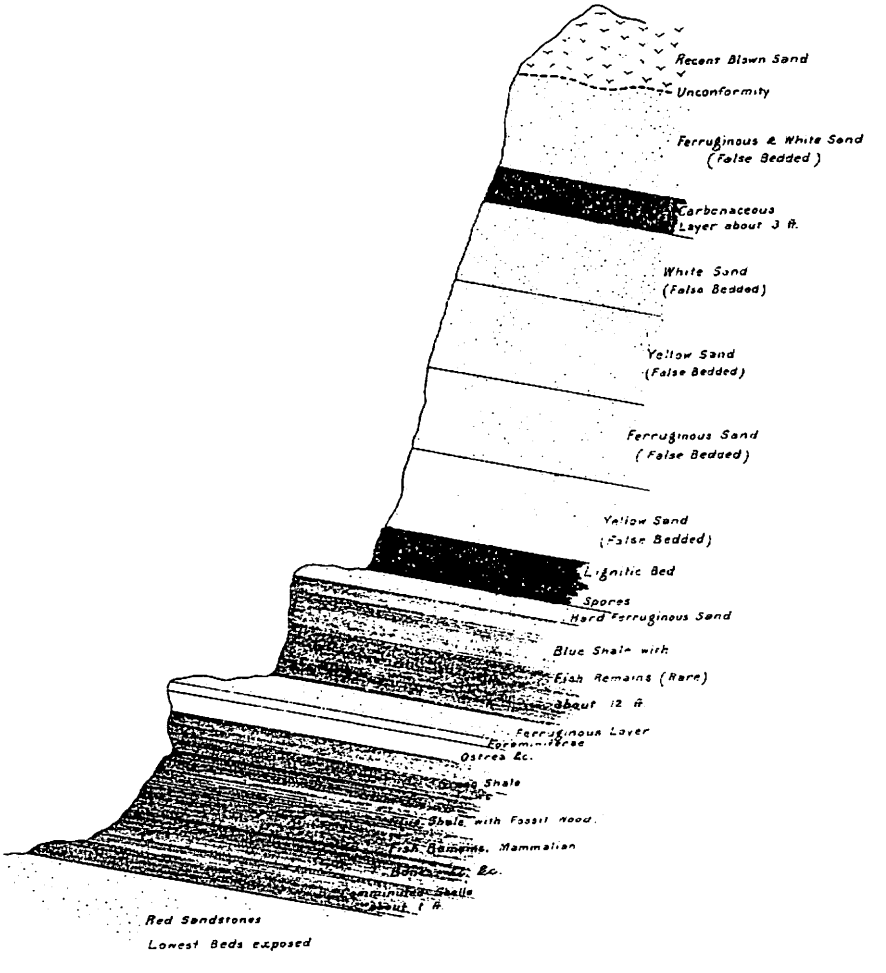


Fig. 7. Reproduction of Anderson's section, *Third and Final Report of Geological Survey of Natal and Zululand*, Plate VII, 1907.

ships observed by him along some 50 km of coastline northwards from Port Durnford. In cliff sections at Port Durnford there are two main lignite horizons; the upper one is discontinuous and of greatly varying thickness, while the lower one, about 2 m above high tide level at the base of the cliffs, is persistently about 1 m thick (see Hobday & Orme 1974: Fig. 2). In the Kwa-Mbonambi Beach area a persistent single lignite bed about 60 cm thick occurs just above high tide level. At both Kwa-Mbonambi Beach and Port Durnford the strata are undeformed and maintain consistent elevations over long distances. However, at Gabhagabha the Port Durnford Formation has no lignite layers. Instead the sediments overlying the basal strata described earlier are well-laminated clays about 5 m thick, often well jointed and exhibiting intraformational slump and slide structures and overlain by cross-bedded yellow and white sand (Fig. 5). In addition the whole sequence appears to have been disturbed to varying degrees and certain distinctive strata occur at varying elevations. The rather abrupt disappearance of the typical Port Durnford Formation cliffs to the north and south of the Gabhagabha occurrences appears to be due to the resistant laminated clay unit descending below sea-level. Particularly significant at Gabhagabha is the frequent inland (north-westerly) 5–10° dip of the strata, well seen in the cliffs adjacent the mammalian fossil locality, exactly as depicted in Anderson's section, a feature which does not apply to other localities.

The pronounced inland dip of the Port Durnford Formation at this locality, as well as substantiating the composite nature of Anderson's section, also strengthens the authors' conviction that the Gabhagabha locality is Anderson's original mammalian fossil site.

The thick development of 'shales' is a distinctive feature of Anderson's section, though they are perhaps more correctly described as compacted laminated clay. The section shows a thickness of some 7 or 8 m, but at Gabhagabha there is a maximum of about 5 m. The deformed nature of this dominant lithotype in the outcrops at Gabhagabha can easily lead to an overestimation of thickness, but a more probable explanation is that the lower clay strata are often missing from the succession. Anderson's *Ostrea* layer and the layer of comminuted shells merge at the northern end of the Gabhagabha outcrops and there rest directly on the underlying Gabhagabha aeolianite formation. Here the intervening clay strata are absent and a prominent ledge occurs, similar to that shown on Anderson's section. A major discrepancy between Anderson's section and the Gabhagabha outcrops is that according to the first author's observations the bone-bearing strata occur *below* the layer of comminuted shells (Fig. 8).

Two distinctive layers shown on Anderson's section are 'Hard ferruginous Sand' and 'Ferruginous layer'. These features do occur at Gabhagabha, usually at the junction between the permeable yellow sands and the underlying impermeable clay strata and are the result of secondary ferruginisation due to oxidation and evaporation of iron-rich groundwater seeping from inland.

A problematical aspect of Anderson's section is the reference to 'Red Sandstones—Lowest Beds exposed'. At Gabhagabha, the aeolianite formation is distinctly white or buff-coloured. At Dawson's Rocks 17 km northward, the possible extension of the sands comprising the upper part of the Port Durnford Formation do rest directly on a red clayey sand which is the weathered mantle and soil developed on an older

aeolianite. However, it is improbable that Anderson was referring to this occurrence. A more likely explanation is that at Port Durnford the lowermost unit is a blue-green compact mudstone (Hobday & Orme 1974). Large blocks of this material, dislodged and moved by wave action, often lie scattered across the littoral outcrops and beach. On exposure and oxidation a brilliant orange-red crust several centimetres thick

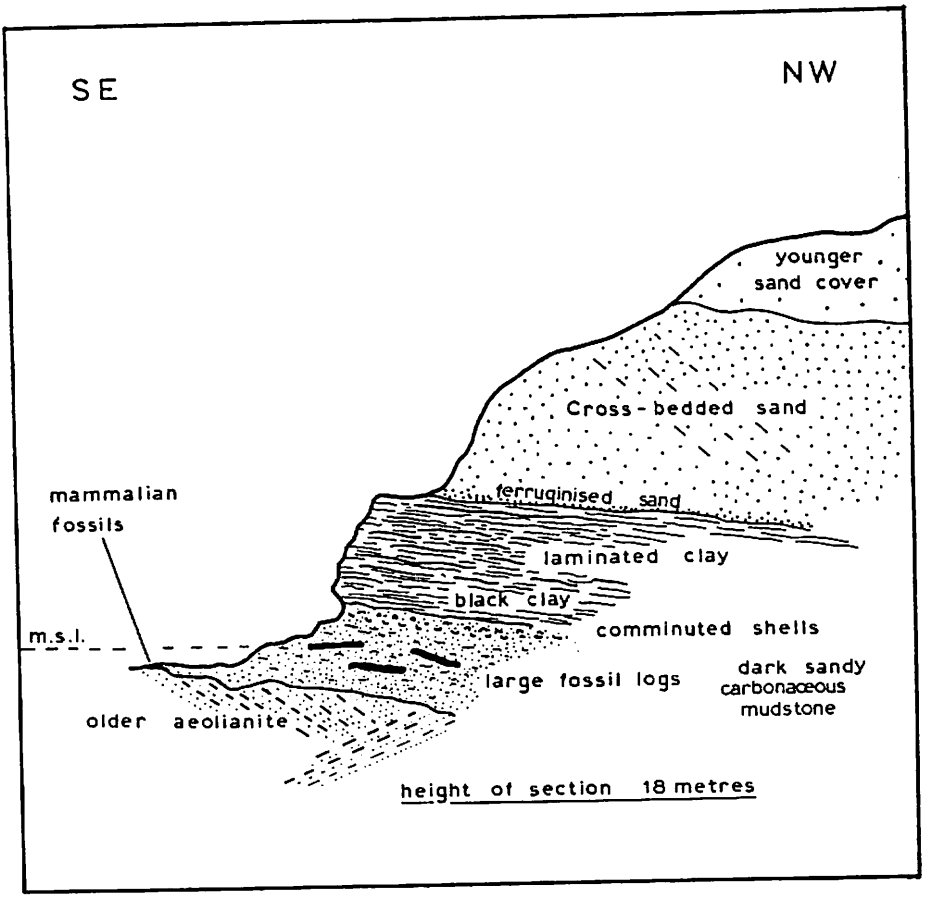


Fig. 8. Sketch showing main stratigraphical features of the Port Durnford Formation at Gabhagabha.

forms around these blocks. Although glauconite is a minor constituent of this mudstone and may in part be responsible for this coloration on exposed surfaces, it is more likely that siderite is the cementing material and oxidation thereof provides the orange-red crust. It seems probable that Anderson was referring to this occurrence in his section.

CONCLUSIONS

A fossil rhinoceros tooth and other mammalian bones recovered recently from coastal outcrops of the Pleistocene Port Durnford Formation at Gabhagabha 6 km north-east of Richards Bay are believed to be from the same site where Anderson made his original discovery of elephant, rhinoceros, hippopotamus and buffalo remains in 1903. This site, long sought by numerous investigators since Anderson, is exposed from under beach sand cover only at rare intervals and for periods of only a few hours.

Discrepancies between Anderson's section and the observed sequence at Gabhagabha can be explained when it is recognised that Anderson's section is a *composite* one, representative of intermittent outcrops extending along 50 km of coastline northwards from Port Durnford.

At Gabhagabha, the distinctive beds shown in the lower part of Anderson's section rest unconformably on an older Pleistocene aeolianite.

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