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NEW FIND OF *DIARTHROGNATHUS* (THERAPSIDA: CYNODONTIA) AFTER SEVENTY YEARS.

by

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ABSTRACT

Diarthrognathus is arguably South Africa's most famous therapsid fossil. Since its discovery seventy years ago no new material had come to light until now. This paper records the recovery, from the Elliot Formation of South Africa, of a partial left lower dentary with most of its dentition preserved.

KEY WORDS: Therapsida, Ictidosauria, Tritheledontidae.

INTRODUCTION

Mammals are descended from a group of fossil mammal-like reptiles known as cynodonts which are well represented in the rocks of the Karoo. Perhaps the most famous cynodont is *Diarthrognathus broomi* (Crompton 1958), one of a group of cynodonts known as ictidosaurs or tritheledontids. The name means "two joint jaw": reptiles and mammals have entirely different jaw suspensions, so it has long been realised that at some stage a mammalian ancestor must have existed in which both types of joint were present. *Diarthrognathus* was considered by Crompton to represent that stage, but such is not the case (Gow 1981). The honours belong instead to the very earliest mammals, such as *Morganucodon*.

The type of *Diarthrognathus*, a partial skull and fairly complete skeleton, and a second specimen, a partial skull and some postcranial elements, came from a sandstone quarry in the Clarens Formation near Ladybrand in 1924. Until now no new material of *Diarthrognathus* has come to light, in spite of much intensive collecting. In fact some have doubted the validity of *Diarthrognathus* (Hopson & Kitching 1972, Kitching & Raath 1984), believing it to be a junior synonym of the closely related, and more common form *Pachygenelus monus* (Watson 1913), usually found as rather small juvenile skulls and lower jaws. Gow (1980) described the dentitions of both taxa, showing that they are similar but clearly different.

Fossils are generally scarce in the rocks of the Stormberg (Elliot and Clarens Formations; formerly Redbeds and Cave Sandstone respectively), but as they represent crucial stages in the evolution of both mammals and dinosaurs the incentive to keep looking is great. An exception to the scarcity rule is a lithological horizon within the Elliot Formation, aparently confined to the outcrop in the northeastern Orange Free State, which represents a time of greatly diminished sedimentation (R Smith, pers. com.), dubbed the *Tritylodon* acme zone (Kitching and Raath 1984). This band is relatively fossil rich, though the fossils are not as well preserved as more isolated finds from other parts of the sequence where burial was more rapid – they tend to be broken, crushed and disarticulated and often coated with a thick layer of haematite. This band does however contain representatives of all the elements of the fauna of the Upper Elliot Formation, and so merits careful attention.

The fragment of *Diarthrognathus* jaw described below was collected by J W Kitching from the *Tritylodon* acme zone on the farm Maquatleng in the Clocolan district. Its identity only became apparent during preparation.

DESCRIPTION

It is convenient to compare the *Diarthrognathus* jaw (part of a left ramus) with a similar jaw fragment of *Pachygenelus* (part of a right ramus which is shown reversed in Figure 1 for comparison). Both are dentary fragments with the postdentary bones missing. Both were coated in haematite and have been prepared using the thioglycolic acid technique (Howie 1974).The leading edge of the coronoid process rises more steeply in *Diarthrognathus*, otherwise the two jaws are very similar. The position of the coronoid is clearly evident on the *Pachygenelus* dentary, with an adductor muscle scar behind it. These features are not displayed by the *Diarthrognathus* jaw, possibly due to poorer preservation, as Crompton (1958) illustrates the coronoid quite clearly.

The *Diarthrognathus* jaw contains evidence of nine postcanine teeth, of which the fourth and last four are complete, and the first is a partially errupted replacing tooth. The fifth tooth shows partial root resorption and its partially erupted successor is visible beneath it. Crypts for replacing teeth are present along the groove for the dental lamina (these are obscured by matrix in the *Pachygenelus* specimen).Though considerably smaller, these teeth are identical to the teeth of the type

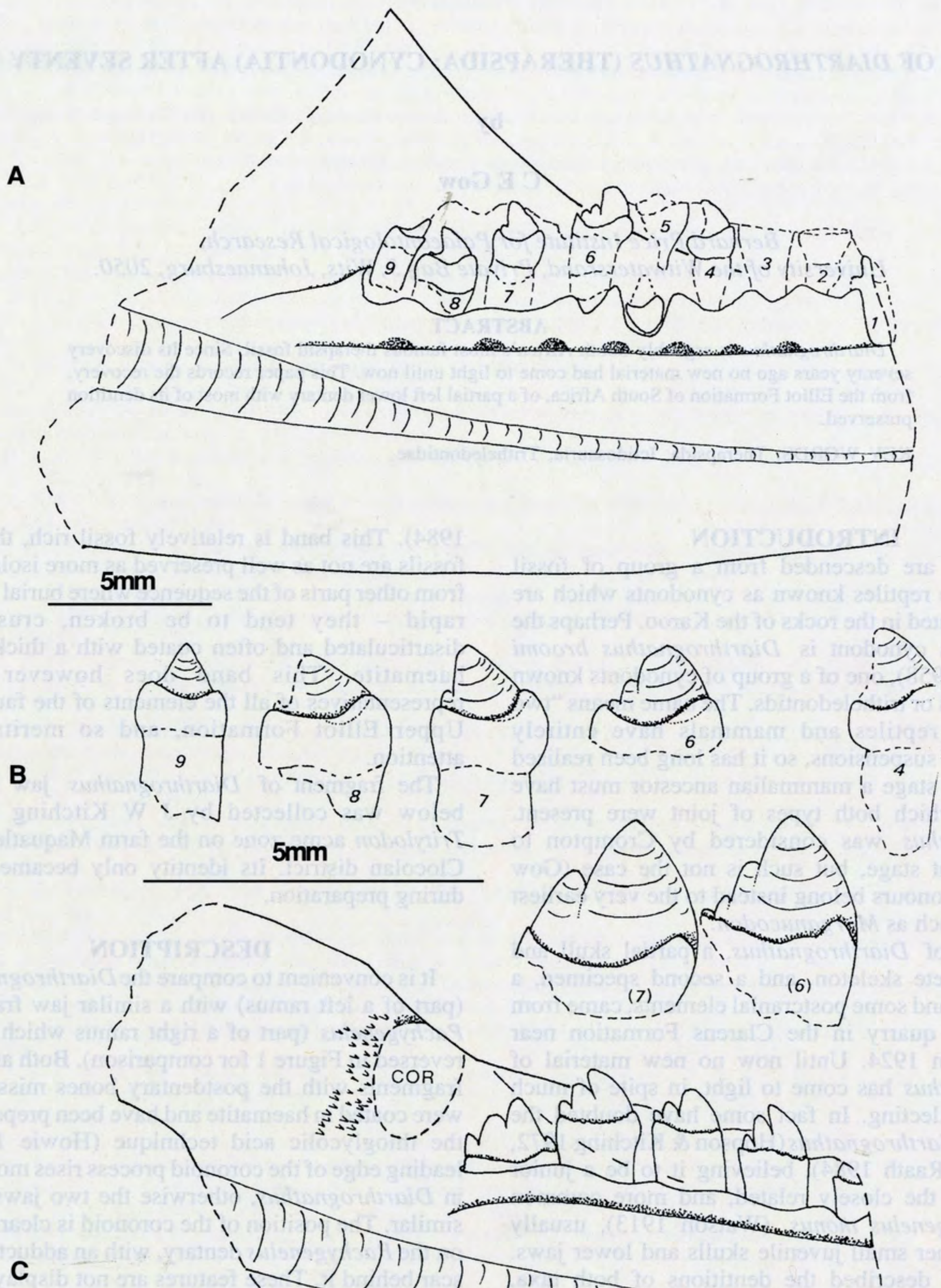

Figure 1. A. *Diarthrognathus* BP/1/4882. Left lower jaw fragment. Matrix between teeth indicated by dashed line. Profile of dentary behind teeth indicated by thick dashes.

B. Enlargement of teeth numbered to correspond with A. Teeth with numbers in brackets belong to the type material of *D. broomi*.

C. *Pachygenelus monus* BP/1/4741. Matrix still present between teeth, outline of dentary indicated by dashed line. COR = position of coronoid, behind this is an adductor muscle insertion scar. Smaller scale applies to both jaws, larger scale to all teeth.

A

B

C

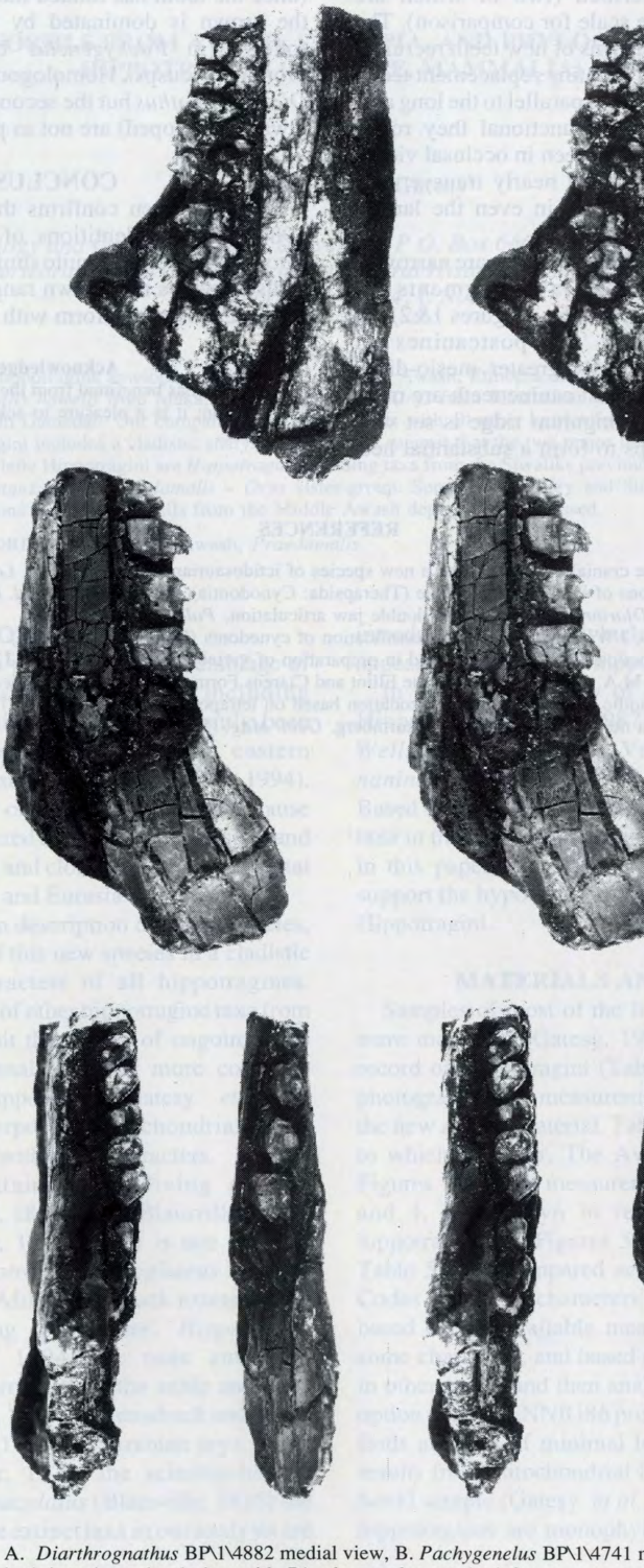

Figure 2 A. *Diarthrognathus* BP\1\4882 medial view, B. *Pachygenelus* BP\1\4741 medial view, C. both jaws in occlusal view with *Diarthrognathus* on the left.

material previously described (two of which are refigured here to the same scale for comparison). The specimen shows that the crowns of new teeth recruited at the back of the row, and erupting replacement teeth, are oriented with their long axes parallel to the long axis of the jaw. As they become functional they rotate (clockwise in the left ramus as seen in occlusal view), until the long axes are arranged nearly transversely. This rotation is far less marked in even the largest *Pachygenelus*.

The post canine teeth of *Pachygenelus* are narrow in bucco-lingual width. The jaw fragments of *Diarthrognathus* and *Pachygenelus* (Figures 1&2) are of comparable size, and the postcanines of *Pachygenelus* have a markedly greater mesio-distal diameter. *Diarthrognathus* post canine teeth are more nearly cylindrical and the cingulum ridge is set well back from the crown cusps to form a substantial heel (once the tooth has rotated into position). In both taxa the crown is dominated by the main cusp, this is followed in *Pachygenelus* by two lower but still prominent cusps. Homologous cusps are present in *Diarthrognathus* but the second and third (which is not always developed) are not as prominent.

CONCLUSION

This specimen confirms the earlier finding (Gow 1980) that the dentitions of *Diarthrognathus* and *Pachygenelus*, while quite similar, are clearly different. It also extends the known range of this taxon into the Upper Elliot, to conform with that of *Pachygenelus*.

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