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NOTE ON A VERY TINY SPECIMEN OF THRINAXODON LIORHINUS

By A. S. Brink

Abstract

This paper describes a specimen of *Thrinaxodon liorhinus*, evidently a mature female, with a very tiny specimen closely associated with it in the same nodule. Attention is largely given to tooth replacement. The conclusion arrived at is that *Thrinaxodon* has not yet reached that stage in evolution where light is thrown on the development of the typical mammalian arrangement of dental succession.

In May 1954 I visited the National Museum in Bloemfontein and discussed the question of tooth replacement with Dr. A. W. Crompton. We considered existing descriptions and agreed that there is no evidence whatsoever of a typically mammalian dental succession in higher Cynodonts like *Thrinaxodon*,, *Cynognathus* and some less advanced Gomphodonts. *Diademodon*, however, with its somewhat more advanced dentition, appears to have achieved to some extent the mammalian single dental succession, although it is admitted that this arrangement could not have been acquired suddenly, so that for a considerable period conditions should show a gradual development in this direction, and exceptions are to be expected for a considerable time afterwards. It is not certain at all that canines were replaced only once in *Diademodon*, but it is certain that replacement was arrested when the animal reached maturity.

It is obvious that no satisfactory agreement can be reached on this issue unless the palaeontologist is able to produce as complete a growth series as possible of each of a good variety of genera. From earlier to higher Cynodonts it would be interesting to study the following aspects in such growth series:

(1) The difference in size of the teeth between the extremely young and the very old individuals of a species, this having a bearing on the number of replacements.
(2) The difference in the number of postcanine teeth of the young and the old.
(3) The number of replacements that take place till the animal is fully mature and whether replacement is then arrested or continues indefinitely.
(4) Whether the number of replacements is inclined to become less in the posterior postcanine teeth, relative to the anterior ones.
(5) At what stage in evolution did the number of postcanine teeth start increasing with permanent teeth, i.e. teeth for which replacement was not provided?
(6) How can it be proved beyond doubt that in a fossil specimen a tooth was replaced only once?

Realising that without suitable growth series little can be achieved, I decided to spend a day (with Mr. J. W. Kitching) in search of a number of *Thrinaxodon* specimens at Harrismith, hoping to find a series of different ages. We failed to collect a good series but our endeavour was rewarded by the discovery of a specimen which I consider as most significant: an adult female skull of *Thrinaxodon liorhinus* with a very tiny skull of the same species included in the same nodule.

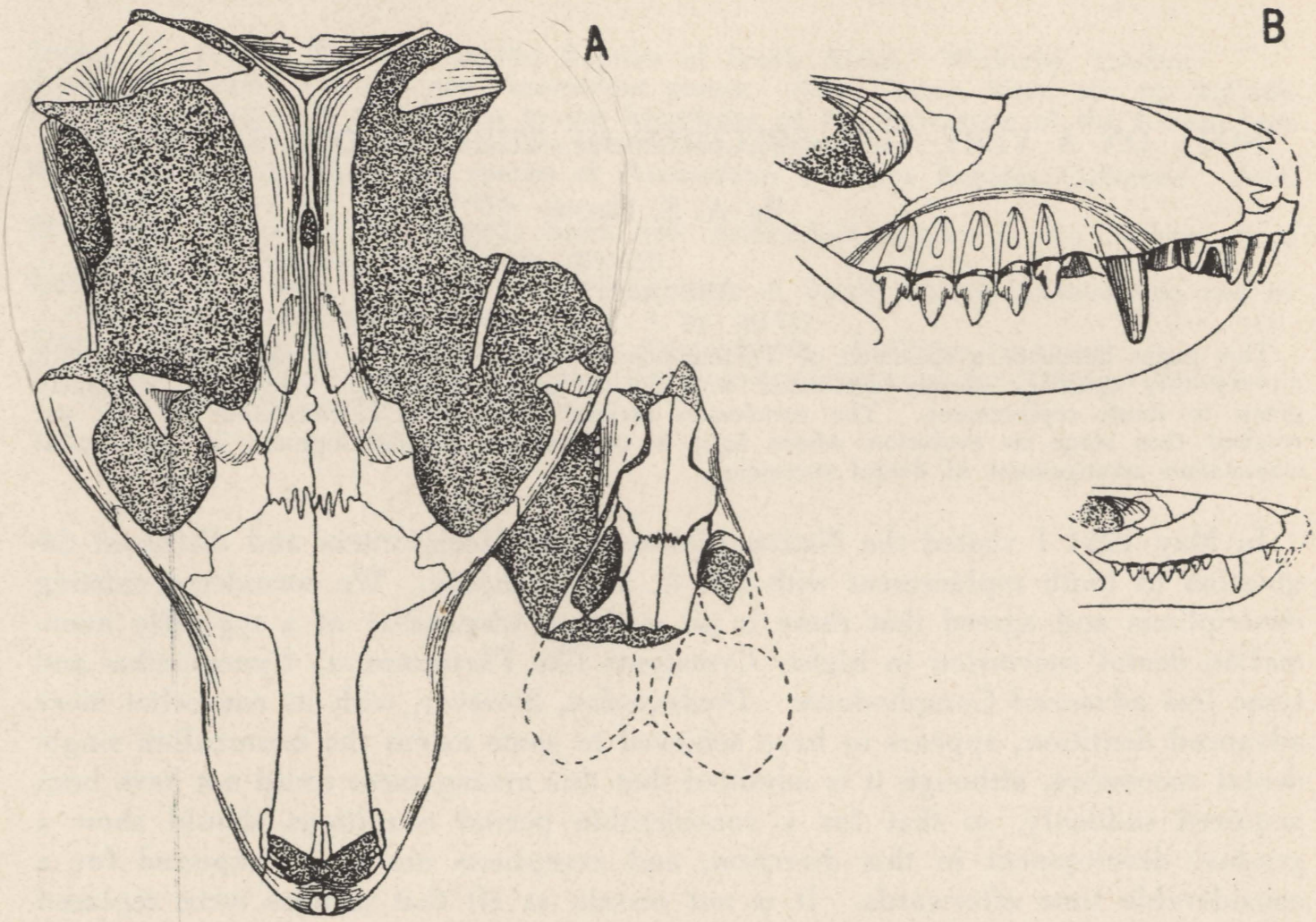

Fig. 26.—A, Dorsal view of the adult and young *Thrinaxodon liorhinus*, as preserved, and B, Side view of both specimens showing the dentition. Natural size.

Although there is a remarkable difference in the sutural pattern between the two skulls, there can be no doubt that the one is an adult and the other a very tiny specimen of the same species. The following differences are rather significant (see figure 26A):

(1) The size of the frontals. There is little increase in the size of the frontals from the newly born, or hatched, to the adult. The frontals are so large in the tiny specimen that they almost contribute to the dorsal margins of the orbits, and they articulate with the nasals farther anteriorly, relatively to the orbits, than in the adult.

(2) The prefrontals are small in the tiny specimen and do not reach far back. They merely meet the postorbitals, while in the adult they extend below the postorbitals backward to the margins of the temporal fossae. Both postorbitals are lost in the adult.

(3) The postorbital bar is still incomplete in the small individual.

(4) The parietal crest appears to be relatively much broader than in the adult.

In spite of these differences the small specimen is without any doubt a tiny *Thrinaxodon liorhinus*. It is certainly very young, judging from the sutures. It would not be an extraordinary occurrence to discover two skulls of different genera so closely associated in the same nodule, had they both been adult, but to find the practically newly "born" individual so closely associated with the adult of another, but closely related, species is almost impossible, rather than unlikely.

However, the dentition of the tiny specimen is that of a small *Trinaxodon liorhinus*. The palates are also strikingly similar, the tiny specimen showing a secondary palate exactly like that of the adult. There is, however, one significant difference. The posterior border of the secondary palate in the tiny specimen is at the level of the 5th postcanine teeth, whereas in the adult it is at the level of the 3rd postcanine teeth.

I am not only positive that these two specimens belong to the same species, but I am inclined to believe that the elder is actually the mother of the young specimen, an aspect which in itself is most significant. As shown in the collection of *Thrinaxodon* specimens in the National Museum, Bloemfontein (Brink, 1954, Res. Nat. Mus., i, p. 115), it is possible to distinguish between males and females on the basis of difference in size. The collection includes a slab containing nearly all the remains of four individuals. One specimen is larger and more robust than the other three. The balance of the specimens in the collection agree in size with either the large specimen or the three smaller specimens. There were no intermediate sizes and the dentitions showed that they were all adults, as far as actual visible replacement of teeth are concerned. Admittedly sockets were not opened to ascertain the presence of tooth buds.

The present larger specimen falls within the range of dimensions of the smaller or female group, slightly larger than the largest female in the collection at Bloemfontein. For adult females the length of the skull ranges from 70 mm. to 80 mm. and for males from 90 mm. to 100 mm. The length of the skull of the present specimen is 82 mm. and the individual is fully mature; all the sockets of the upper right teeth were opened and no sign of a tooth bud was found. It is therefore quite likely a female and could possibly be the mother of the tiny specimen.

It is not a common practice for a reptile to hatch its young and then nurse them. Nursing is a common practice with birds, but in mammals, together with giving birth, it is a basic characteristic. It is rather likely that in the advanced Cynodonts certain advances could have been made in the direction of giving birth and nursing, perhaps even with the aid of "milk glands". It is, therefore, significant to find possible evidence in support of nursing in a much earlier Cynodont.

The dentition is of great importance. Most striking is the fact that the tiny specimen has already seven postcanine teeth, exactly like those of the adult. The adults shows evidence of a tiny vestigial tooth posteriorly in the postcanine series on the right. The total number could therefore be taken as six, but on the left side there are only five. Six postcanine teeth are more common for adults of the species *Thrinaxodon liorhinus*, so that there is evidence of a tendency towards a reduction of the number of postcanine teeth, strongly supported by the seven in the tiny specimen. The development of a single dental succession must have been preceded by a tendency to incerase the number of postcanine teeth with advancing age, after the number of replacements had already become limited and the individual had to start life with a smaller number of larger teeth. *Thrinaxodon liorhinus* is, therefore, too early a form, or too far separated from the main line of evolution towards mammals, to be used conveniently in ascertaining the origin of the single mammal-like dental succession. There is such a considerable difference in the sizes of the teeth between the two individuals (see figure 26b) that it is

difficult to imagine less than three or four successions throughout the series during a particular animal's life.

The five postcanine teeth of the adult occupy a length of 18 mm. on each side. The seven postcanine teeth of the tiny specimen occupy 9 mm. With the canine inclusive these measurements are 25 mm. and 11.5 mm. for the old and the young specimens respectively. From the posterior margin of the canine to the tip of the snout is a distance of 17.5 mm. in the adult as compared with 8 mm. in the tiny specimen. Parrington (1936, *Phil. Trans. Roy. Soc.*, ccxxvi, p. 125) observed that in a series of *Thrinaxodon* specimens the increase in the distance occupied by the precanine and postcanine teeth is rather slight, but the smallest specimen in his series is considerably larger than the present tiny specimen. Parrington's observations, although extremely significant, are therefore based on perhaps the latter third or quarter of a complete growth series. If Parrington's observations revealed such significant results in the latter stages, it would be interesting to know what occured in the line of tooth replacement prior to the stage from where he started.

Parrington (op. cit.) could establish only one replacement of each tooth in the postcanine series (replacement occurring alternately in the series) in the material at his disposal. Crompton (by kind information), working on additional material which Parrington placed at his disposal, revealed additional replacements in higher Cynodonts (not yet published), supporting the present evidence that *Thrinaxodon* could have had perhaps at least four replacements in a complete growth series.

The number of replacements, the considerable difference in size between the teeth of the young and old, and the reduction in the number of postcanine teeth, rather than an increase, are facts which place *Thrinaxodon* rather well away from the initial attempts at establishing a typically mammalian single dental succession. *Diademodon*, on the other hand, had apparently already reached or passed the initial stage in the attempt at establishing a single dental succession, for the following reasons:

(1) *Diademodon* certainly started life with a smaller number of teeth than found in the adult and, although Crompton (by kind information) could demonstrate, in a *Diademodon* specimen, evidence of replacement even in the eleventh postcanine tooth, there is certainly no evidence of replacement in the twelfth and subsequent teeth.

(2) The first four postcanine teeth in the largest *Diademodon* skull are very small and it is difficult to imagine that they were much smaller in a newly "born" individual, not to such an extent that one would be induced to consider more than one replacement. Subsequent teeth in the postcanine series also increase gradually in size backward, a feature which could be interpreted as unnecessary had there been consistent replacement.

(3) It appears that replacement of the first four postcanine teeth occurred only when the animal reached a certain size, or age, but it is quite certain that replacement was arrested, because in many specimens the sockets of some of the so-called "premolars" had become closed prior to death.

The two specimens, numbered 273 and 274 for the adult and tiny specimen respectively, were discovered by J. W. Kitching in a donga immediately east of Harrismith.