Mammal-like Reptiles

The living reptiles of South Africa can be divided into three groups, vis. (1) the tortoises and turtles, (2) the crocodiles, and (3) the lizards and snakes. It is less well known that a fourth group of reptiles, the so-called mammal-like reptiles, also once roamed the South African plains. These animals are now found as fossils in the Karoo layers (see map below).

The uppermost two layers of the Karoo are known as the Beaufort Group and the Stormberg Group respectively. The Beaufort covers the period 250 to 215 million years ago, while the Stormberg dates from 215 to 190 million years ago.

During the whole of the Karoo period the major part of South Africa was a very vast and very flat plain. More or less along the present eastern coast there was a long mountain range, while a shallow sea was to be found in the central part, approximately in the present position of the Orange Free State. The rivers flowed mainly from the high eastern mountain range into the shallow sea in the centre.

At the beginning of the Beaufort period it must have been fairly wet and marshy conditions prevailed. This was followed by alternating periods of low and high rainfall, but the general tendency over the whole Beaufort period was towards a dry climate. However, as the country was very flat, even occasional torrential rains caused the shallow rivers to overflow their banks and this inundated the plains. Animals were trapped in the mud, died and sank into it, and through the years their skeletal remains were fossilized.

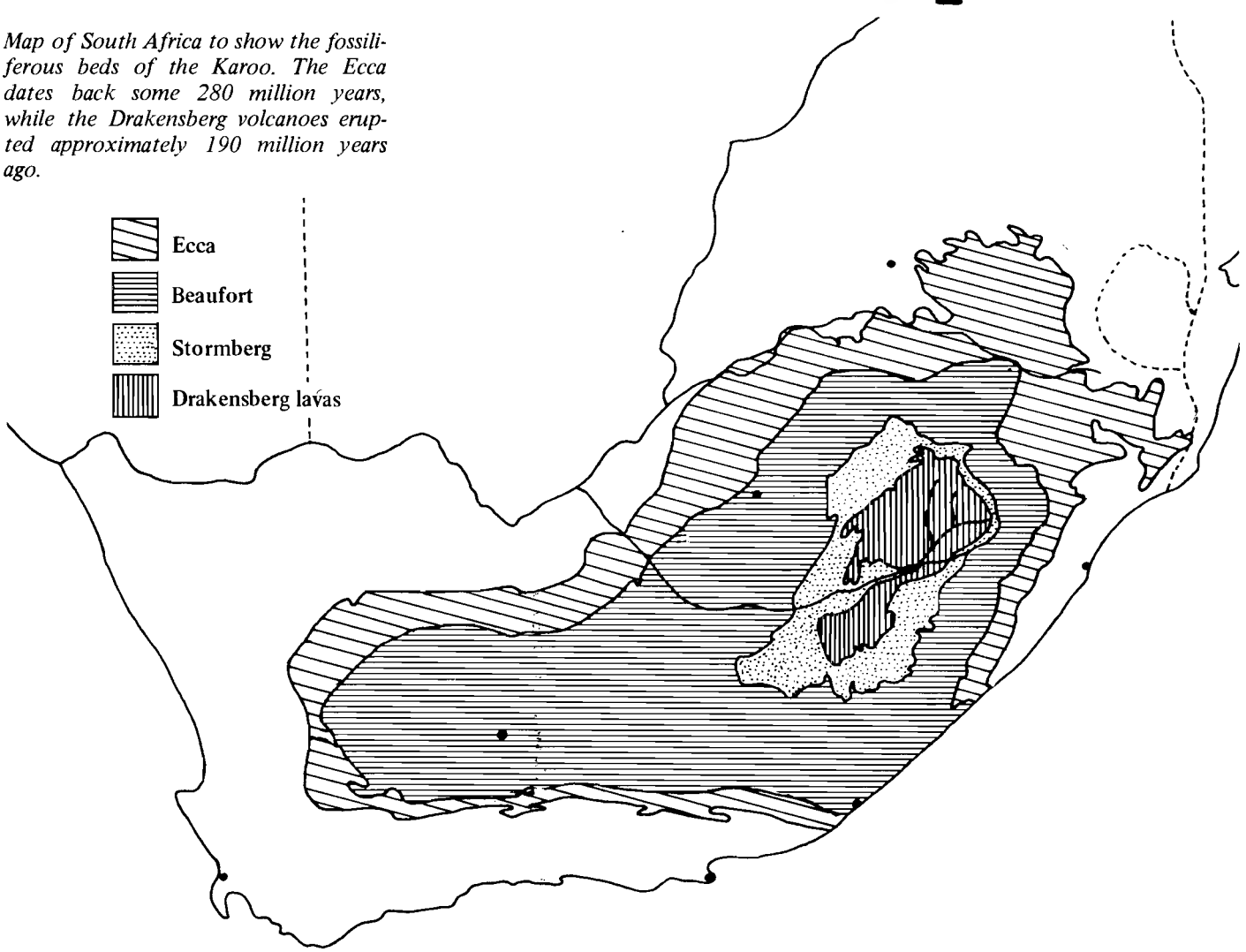
In the Beaufort formations the remains of a variety of reptile fossils are found. Early relatives of the modern turtles and tortoises, like *Procolophon*, were common. These reptiles form one main branch of the reptiles and are characterized by having no temporal openings behind the orbits. The earliest representatives of the lizards and the crocodiles (e.g. *Euparkeria)* are also found in the Beaufort; these reptiles all have two temporal openings behind each orbit. The mammal-like reptiles, like the living mammals, have only one temporal opening on each side. This is the basic similarity between the mammal-like reptiles and the mammals.

What did these mammal-like reptiles look like and how did they live?

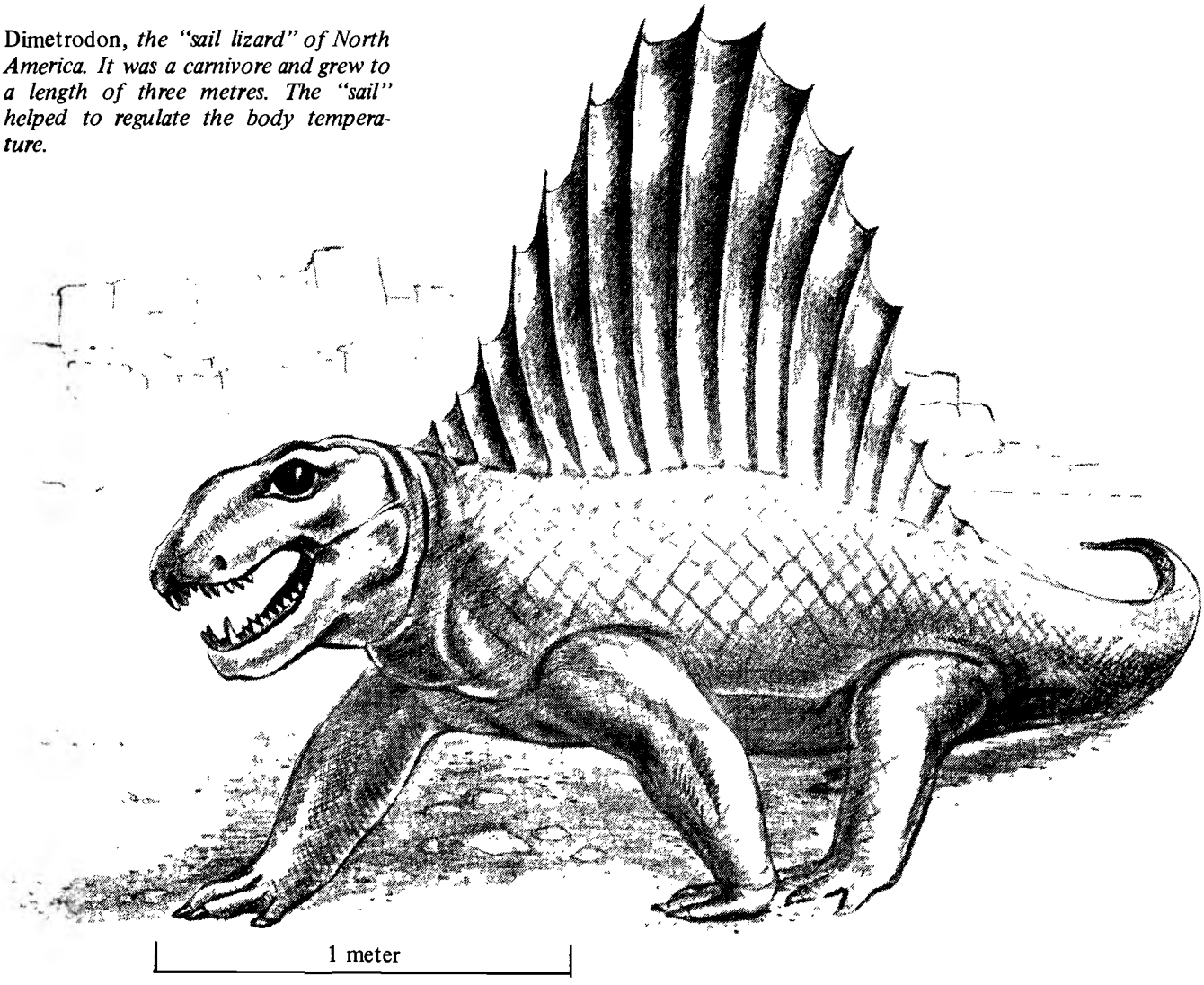
The oldest representatives of the group are found in North America and a prime example is the "sail lizard" *(Dimetrodon* - see illustration on next page). A large number of specimens of different sizes have been found to date and it has been established that the size of the sail was determined by the volume of the animal, not by its length. This again indicates that the sail was used to radiate and/or absorb heat - it was a simple way to regulate the body temperature.

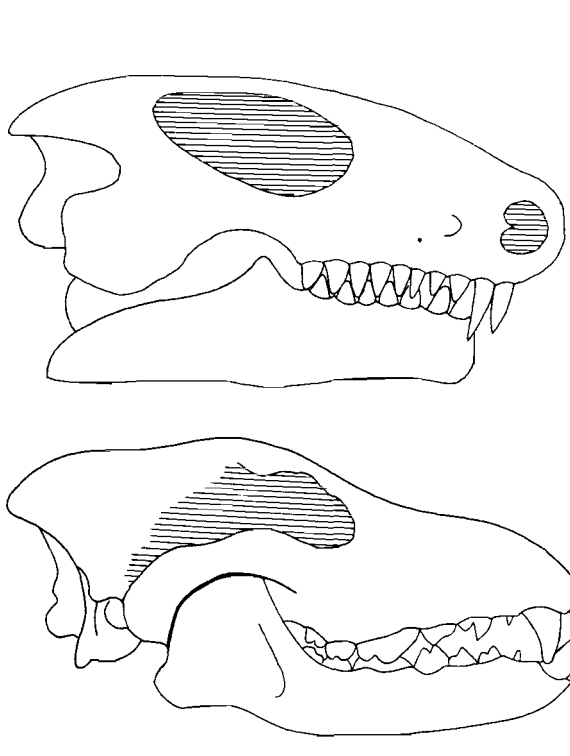
The South African mammal-like reptiles, like *Lycaenops, Lystrosaurus, Thrinaxodon* and *Cynognathus,* do not have a sail, but many have a "third eye"

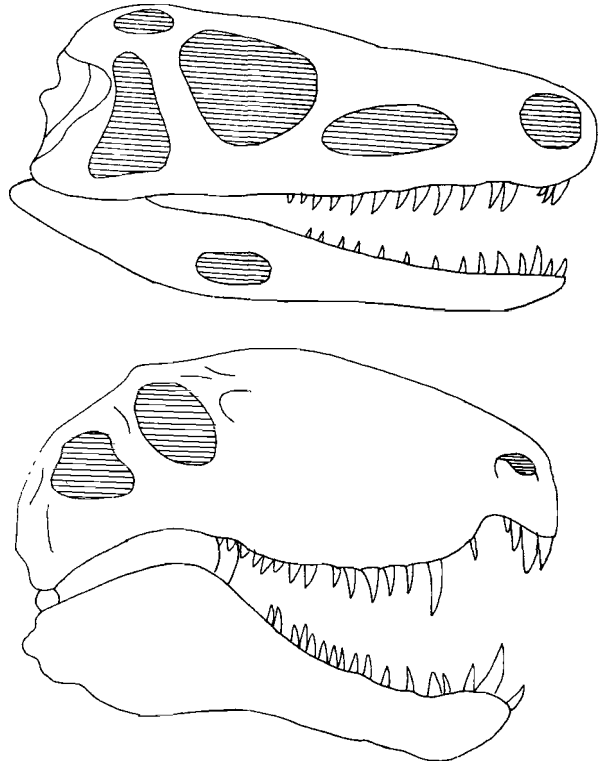
Map of South Africa to show the fossiliferous beds of the Karoo. The Ecca dates back some 280 million years, while the Drakensberg volcanoes erupted approximately 190 million years ago.



Dimetrodon, *the "sail lizard" of North America. It was a carnivore and grew to a length of three metres. The "sail" helped to regulate the body temperature.*

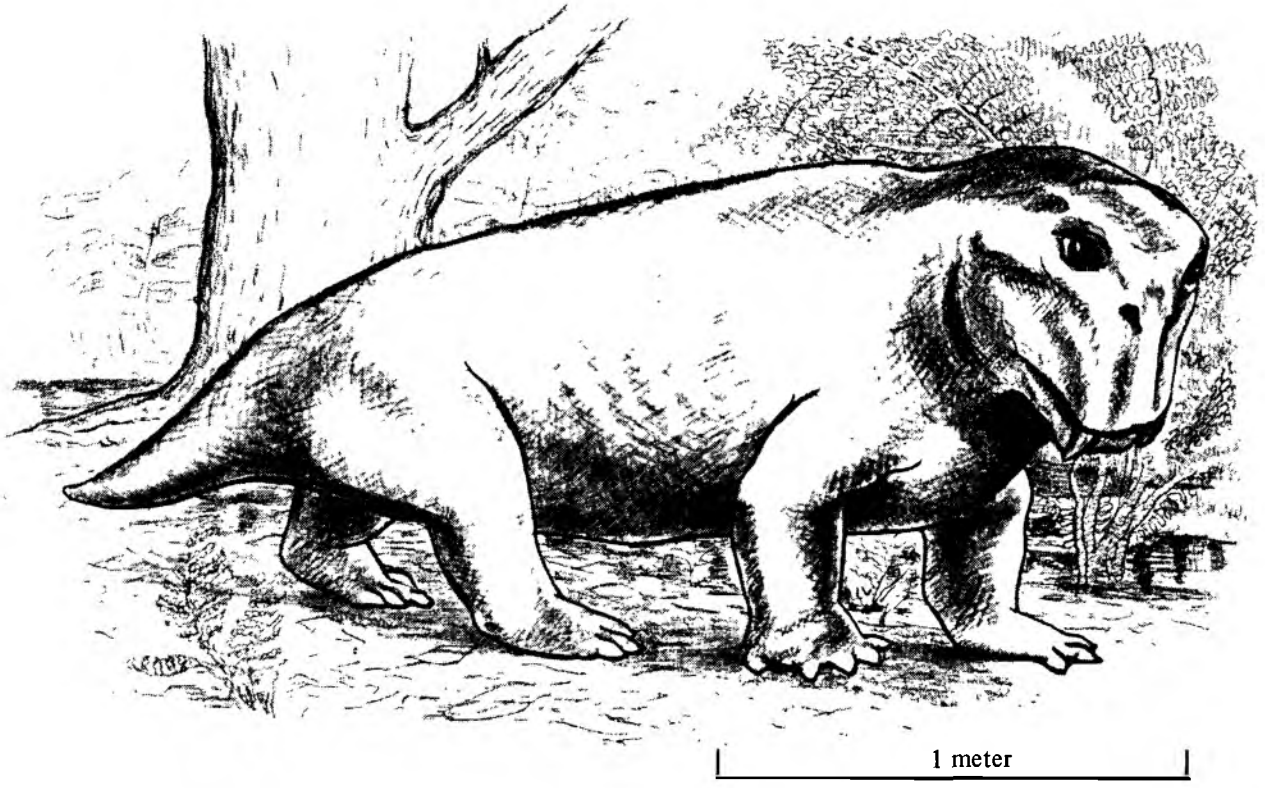






Top: *Side view of the skull of* Procolophon, *an early relative of the turtles. It had no temporal opening behind the orbit.*
Bottom: *Side view of the skull of a wolf* (Canis *sp) of 2 million years ago. Mammals have one temporal opening behind each orbit, but the postorbital bar (between orbit and temporal opening) often disappear.*

Top: *Side view of the skull of* Euparkeria, *which had two temporal openings behind each orbit. It is related to the modern crocodiles and the extinct dinosaurs.*
Bottom: *Side view of the skull of* Dimetrodon, *the "sail lizard", an early mammal-like reptile with a single temporal opening behind each orbit.*



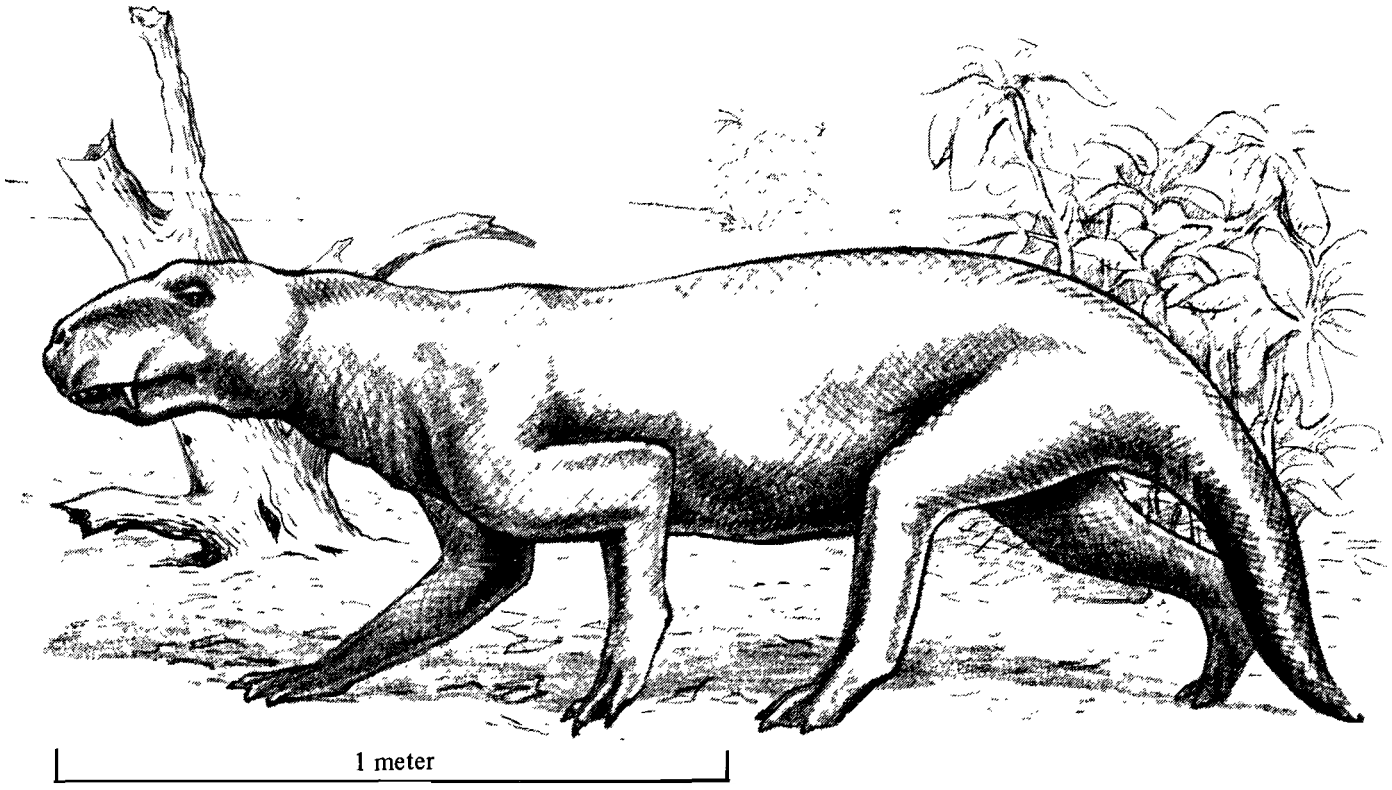
Above: Lystrosaurus, *an herbivorous mammal-like reptile one to two metres long. It inhabited the marshy areas.*

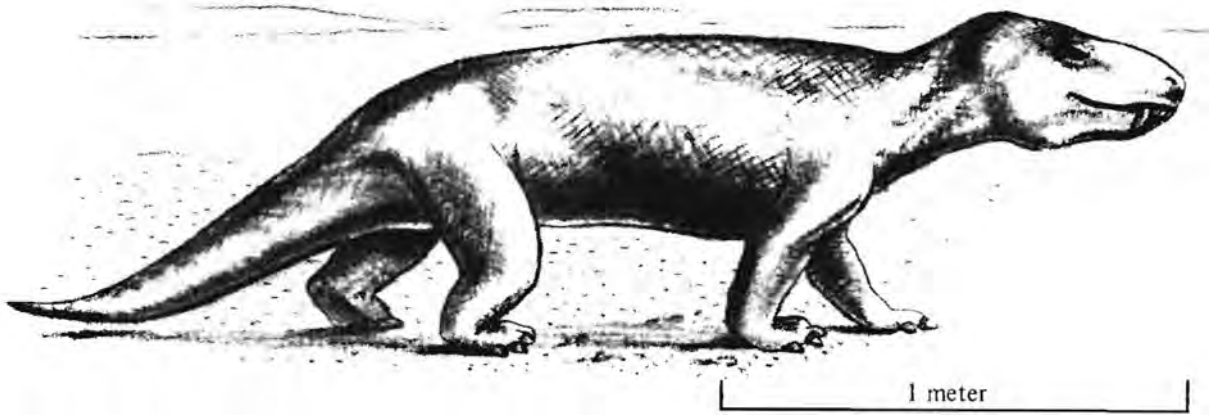
between the two temporal openings. This absorbed the sun's heat and kept the pineal organ and hypophysis directly below the "eye" warm and active. The microscopic structure of the bones is similar to that found in mammals, with an intricate system of blood vessels and this again is correlated with warm-bloodedness. Several specimens of *Thrinaxodon* have also been found curled up, which is a natural phenomenon in warm-blooded animals to conserve body heat.

The mammal-like reptiles are by far the dominant group among the Karoo reptiles. They can be divided into two main groups, viz. one where most (if not all) the teeth were lost and functionally replaced by a horny beak, and a second group where there is a progressive differentiation of the teeth.

Lystrosaurus (above) is representative of the first group. It retained the two tusks or canines in the upper jaw and these teeth probably served for defence only. *Lystrosaurus* is the most abundant of land-living vertebrates among the Karoo fossils and must have been a marsh-dweller, where it fed on soft marsh plants.

Below: Lycaenops, *a carnivorous mammal-like reptile about the size of a large dog. Its teeth were all conical.*





Lycaenops (previous page) is an early representative of the second main group. This carnivorous reptile was more or less the size of an Alsation dog and it had a whole series of conical teeth, those in the canine region being somewhat longer than the rest.

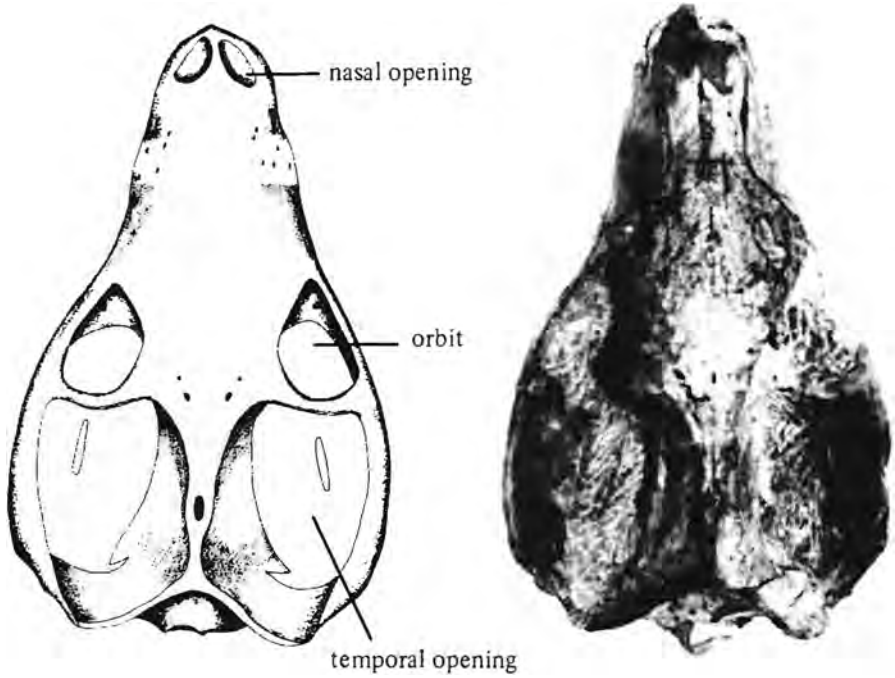
Trinaxodon and *Cynognathus* (above) are later members of the same group. Here we find well-developed incisors, canines and "molars". In *Cynognathus* the "molars" were developed as carnassial teeth, similar in structure to those found in modern jackals, dogs and wolves. The "molars" of *Thrinaxodon* had a broader surface with small cusps on the inside.

Correlated with the differentiation of the teeth is the development of the secondary palate. This separated the nasal cavity from the buccal cavity and ensured that the animal could chew its food. In animals without a secondary palate, the food is swallowed immediately, as it would otherwise prevent the passage of air during breathing.

We do not know whether the mammal-like reptiles suckled their young, and it is unlikely that we will ever have proof of this, as soft tissues are only fossilized under most exceptional conditions. Young specimens of *Thrinaxodon* have, however, been found with fully-grown specimens (presumably females), which points to the fact that these animals at least cared for their young. This is quite unlike the condition in turtles, lizards and crocodiles, where the young have to fend for themselves.

Above: Cynognathus, *an advanced carnivorous mammal-like reptile with carnassial-like teeth behind the canines. It was more or less the size of a leopard, but not as high off the ground.*

Text and line drawings by Jacques van Heerden, Karoo Palaeontologist of the Museum. Reconstruction drawings by Audrey van Eeden of the Museum's Art Department.



Drawings and photographs of the skull of the mammal-like reptile Thrinaxodon (specimen number R23 in the National Museum). Note the single temporal opening behind each orbit and the differentiation of the teeth.