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Cruickshank, A. R. I.

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THE MODE OF LIFE OF GORGONOPSIANS

by

A. R. I. Cruickshank

The gorgonopsians as typically developed were undoubtedly the dominant land carnivores of the Upper Permian and have been compared with the sabre-tooth cats of the Tertiary (Parrington, 1955, p. 7 and Kemp, 1969b, p. 321). However, the similarities between the two groups are almost entirely confined to their dentitions and the general proportions of their lower jaws, both possessing greatly enlarged canine teeth and relatively weak coronoid processes on the lower jaw. In addition, both groups show adaptations to allow the lower jaw to make a wide gape, thus allowing the upper and lower canines to clear each other when the jaw is opened and, at the same time, keeping the jaw articulations from dislocating during this movement.

The popular image of a Tertiary sabre-tooth is of a powerful animal leaping on to the back of a medium-sized ungulate and stabbing the canines into the back of the neck, or some other similar vital spot (e.g. Augusta and Burian, 1960, plate 58). By analogy a similar method of attack is assumed for the typical gorgonopsians (e.g. Crompton, 1968, fig. 12).However, Bohlin (1940; 1947) has discussed the method of feeding of one of the more typical Tertiary sabre-tooths (*Smilodon*) and has concluded that the forms with the exaggeratedly elongated canines would make very poor active predators, tending to break their canines in a leap on to their prey, and in any case being unsighted while leaping with their mouths open and their canine teeth poised for killing. Bohlin suggests alternatively that these forms with the long canines were in fact better suited to a scavenging way of life and were able to use their long canines on the relatively thick-skinned larger pachyderms of the time. The canines seem adapted to pierce the skin of the belly and so enable the cat to cut up and eat the softer portions of the carcase. However, it is obvious that if they were scavengers their teeth were not adapted to crush bone as do the hyaenas.

An extension of this idea springs from the recent redescriptions by the van Lawick-Goodalls (1971) of hyaenas hunting actively and killing prey by a concerted pack effort, involving the disabling of the running prey by an attack on the hamstring muscles, or the belly. Thus, the sabre-tooth cats, with much the same physical build of a hyaena, could have disabled their prey by similar methods. It is assumed that as the hyaenas prey on small and medium-sized ungulates, the sabre-tooths could possibly have attacked the heavier pachyderms in a similar way.

Bohlin (pers. comm.) has observed the mode of feeding of the large Komodo Dragon (*Varanus komodoensis*) which may have some relevance to this line of thought. He described how a tethered goat was attacked in the wild by one of these big lizards and dispatched remarkably quickly.

The first move was a slashing attack with the teeth on the soft under belly of the prey, followed by the prey being gripped and shaken energetically and thus eviscerated. While the goat was expiring the viscera were eaten, followed by the carcase starting at the head. The whole process took only a few minutes and left little but a damp patch on the ground.

Thus, if gorgonopsians had a mode of life in between that of a hyaena and that proposed for the Tertiary sabre-tooth cats by Bohlin, the enlarged canines would be suitable to pierce the skin of their prey and thus a similar mode of dispatch of the prey used by the Komodo Dragon could be postulated for the gorgonopsian.

However, while all the foregoing have been based on an assumption that it is the typical large gorgonopsians that were involved, it must be remembered that the Gorgonopsia are divided into two families viz. the Gorgonopsidae and the smaller Ictidorhinidae (Sigogneau, 1970a and b). Kemp (1969b, pp. 54–63) has described in detail the olfactory structures to be expected in the former group and it is obvious from his arguments and the relatively small size of the orbit in these animals that they were primarily "olfactory hunters". On the other hand the Ictidorhinidae have relatively much larger orbits, are generally smaller animals and seem to be more scarce in the fossil record. Keyser (1970, p. 688) pictures the Upper Permian Karroo environment ". . . as a dry playa or pan-like flat, almost devoid of vegetation, traversed by water courses along which both vegetation and animal life was concentrated". This vegetation he thinks (op. cit., p. 687) was mainly equisetalian. Furthermore, Kemp (1969a, p. 231) notes ". . . it seems certain that they (the gorgonopsians) must have had a high degree of mobility of their heads, including the ability to rotate their skulls about a longitudinal axis . . . to use their jaws laterally". That oblique blows of the

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head and thus the canines could be delivered is indicated by the relatively large insertion areas for the dorsal and lateral neck muscles, as compared with those for head depressors (Sigogneau, 1970a, figures many gorgonopsian occiputs illustrating this feature).

The pose of the body would from this assumption be different from that which Colbert (1949) or Romer (1966, p. 179) suggest, with the ". . . hind limbs (tending) to be underneath the body, making support easier". A sprawled or semi-sprawled typically reptilian gait would necessitate strong lateral movements of the head, particularly if the canines were to be used to disembowel the prey.

Finally, a gorgonopsian (in exactly the same way as a sabre-tooth cat) launching itself at its prey would more than likely break its canines the first time it did so (Bohlin, 1940, fig. 1 and 2; 1947, fig. 1). That they could not have acted so is reflected in their success in the upper Permian.

The interpretation put on all the foregoing speculation is that the larger Gorgonopsidae lived on the larger bulky and probably sluggish anomodonts (Keyser, 1970, p. 688), hunting their quarry by scent through the vegetation along the river banks, attacking their soft under belly with their powerful canines and thus disembowelling them before ripping the flesh off the carcase with their powerful incisors and bolting it wholesale.

The smaller, more keen-sighted Ictidorhinidae possibly lived in the open areas and hunted the small, active lizard-like animals *Millerosarus* and *Milleropsis* that Gow (1962, p. 261) has redescribed.

The larger Gorgonopsidae seem to have been replaced to a certain extent by the whaitsiid Therocephalia in the uppermost Permian *Daptocephalus* zone (Kitching, 1970) where this zone fossil is seen to replace the earlier large anomodonts such as *Aulacephalodon* and *Rachiocephalus* (Keyser, 1970, p. 688). Thus, the concept of these large Therocephalia being purely scavengers as hitherto thought by many also deserves reconsideration.

A final thought concerns the dentition of the Gorgonopsidae and Whaitsiidae. The former have a highly reduced post-canine dentition, and the latter have none and this has caused some discussion in various places in the past. However, if it is realised that one important difference between a reptile and a mammal is the ability of the latter to alternate the shearing pressure from one cheek to the other while feeding and that in carnivores this is an important mechanism particularly in bone-crushing, then a plausible solution to this enigma becomes possible.

The Gorgonopsidae had a highly developed jaw hinge which would seem to preclude any possibility of such an alternation of shearing pressure (Parrington, 1955). Likewise, Kemp (1969b) has described in detail the mechanism used by these animals to mesh the upper and lower incisors, apparently to aid them in pulling flesh off their prey. However, if the flesh was bolted, no mastication would be necessary and finally it must be remembered that the bones of the synapsids had not developed marrow at that time and so no necessity would exist for a mechanism to extract their marrow. This last factor also would therefore be important in the whaitsiid Therocephalia, and might also explain why they had no post-canine teeth at all.

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