The Systematic Status of the Crocodile *Osteoblepharon osborni*

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THE validity of the crocodilian genus *Osteoblepharon*, described by Schmidt (1919), has been questioned by Chabanaud (1920) and Kälin (1933) on the basis of comparisons with skulls of the related genus *Osteolaemus*. These authors regard *Osteoblepharon osborni* Schmidt (type locality Niapu, Upper Congo) as a synonym of *Osteolaemus tetraspis* Cope (type locality "Ogobai River, West Africa"=Ogowe River). A new adult specimen from Beni in the Upper Congo, and five of varying ages from West Africa, afford an opportunity to examine the characters thought to distinguish the two genera and to form an opinion as to the status of the two species. The following is a list of specimens examined in the course of this study.[1]

No.	Locality	Snout-quadrate length
CNHM 17601	Atakpame, Togo	56 mm.
CNHM 44410	Oda, Gold Coast	61 mm.
CNHM 44442	Oda, Gold Coast	90 mm.
AMNH 7766	Lagos, Nigeria	140 mm.
AMNH 24740	West Africa	170 mm.
AMNH 29889	Bungulu (near Beni), Belgian Congo	190 mm.
AMNH 10083*	Niapu, Belgian Congo	190 mm.

* A paratype of *Osteoblepharon osborni*.

In describing *Osteoblepharon*, Schmidt distinguished it from *Osteolaemus* on the basis of the following characters:

1. No nasal septum
2. Palatines narrow, sides sub-parallel
3. Snout not raised anteriorly
4. Pterygoids produced forward into the palatal fenestrae
5. Frontal entering the supratemporal fossae
6. Maxillo-premaxillary suture transverse

In addition Schmidt stated that in the type specimen of *Osteoblepharon osborni* (AMNH 10082) the pterygoids were fused with no trace of a suture.

Kälin attacks the importance of the nasal septum as a diagnostic character by citing the fact that the degree of ossification is subject to much individual variation in *Alligator* and may also be so in *Osteolaemus*. Chabanaud, in describing a specimen from Diani, French Guinea, observed that the septum was incomplete, the nasals projecting forward to approximately the center of the opening, the premaxillaries backward to almost the center. There is some variation in this respect in the West African specimens available to me. In the smallest of these (CNHM 17601, 44410, and 44442), the

1 I wish to express my appreciation to Mr. Karl P. Schmidt for his advice and helpful criticism. I also wish to thank Mr. Charles M. Bogert, of the American Museum of Natural History, for the loan of material and Mr. Arthur Loveridge, of the Museum of Comparative Zoology, for information on one of the paratypes of *osborni*. The skulls of five of the above-listed specimens were prepared by Mrs. Dorothy Foss, of the Chicago Natural History Museum.

septa are only one-half complete; but cartilage bridging the gap between the nasals and premaxillaries was observed during the preparation of these skulls. In AMNH 7766 and AMNH 24740 the septum is approximately four-fifths complete. It appears likely that the degree of ossification in the septum is dependent on age in the West African material. However, in all the Upper Congo skulls, all of which (including the type, snout to quadrate 169 mm.) are as long or longer than the largest West African skull, the bony septum is less than one-fourth complete. The conclusion is that the West African specimens continue a process of ossification that is halted at an early period in the ontogeny of individuals from the Upper Congo. A similar phenomenon appears in connection with the growth changes in the palatines.

The palatines of *Tetraspis*, as shown by Schmidt's figure, are constricted in the center and dilated posteriorly, contrasting with the uniformly narrow, parallel-sided bones of *osborni*. Both Mook (1921) and Kälin attributed constricted palatines to *tetraspis*. Kälin, though placing *osborni* in the synonomy of *tetraspis*, does not mention the form of the palatines in Schmidt's figured type. The palatines of the West African juveniles (i.e., *tetraspis*) are narrow and do not flare posteriorly. However, the palatines of the larger West African individuals show an increasingly greater development of their posterior part with an increase in size. This development involves not only widening but also deepening, so that a large bulb is formed in the posterior part of the palatines. The Congo skulls, both of which are larger than those from West Africa, have the palatines uniformly narrow throughout their length, as figured by Schmidt. There is no palatal bulb in the Congo specimens. Thus, in the palatines also, there is a sharp distinction between the West African (*tetraspis*) and Upper Congo (*osborni*) specimens, a distinction dependent upon a difference in the growth pattern.

The significance of the profile of the snout was questioned by Kälin because he believed the profile to be subject to change with age. The skulls before me bear out Kälin's belief; however, contrary to his expectation, the turning up of the end of the snout in the West African skulls is more pronounced in the older than in the younger ones. The Upper Congo skulls differ from the larger West African ones in not having the tip of the snout turned up. In this character also the distinction between *tetraspis* and *osborni* is maintained.

In the *tetraspis* skull figured by Schmidt, the palato-pterygoid suture is at the level of the posterior end of the palatal fenestrae. By contrast the figure of *osborni* shows the pterygoids produced forward so that the entire suture is anterior to the end of the fenestrae. Chabanaud's specimen has the lateral edges of the suture at the level of the end of the fenestrae whereas the median portion of the suture is anterior to that point. Examination of my material indicates a considerable amount of individual variability in this character. If the part of the pterygoids projecting into the fenestrae is divided by the length of the fenestrae and the ratio then plotted (Fig. 1) against the snout-quadrate dimension, there seems to be a relation between the ratio and size in the West African specimens. The Upper Congo specimens apparently do not fit into the same pattern. Although the data are not conclusive, the differences in growth pattern apparently follow those found in the preceding characters.

According to Schmidt, *osborni* can be distinguished from *tetraspis* by the transverse nature of the premaxillo-maxillary suture of the former. The suture in *tetraspis* has been described as V-shaped. In the series of skulls from West Africa there is a gradation in the suture from transverse to V-shape as the skulls increase in size. The two Upper Congo skulls agree with the type of *osborni* in having the suture transverse. Here again the distinction between the two groups of skulls is in the growth pattern.

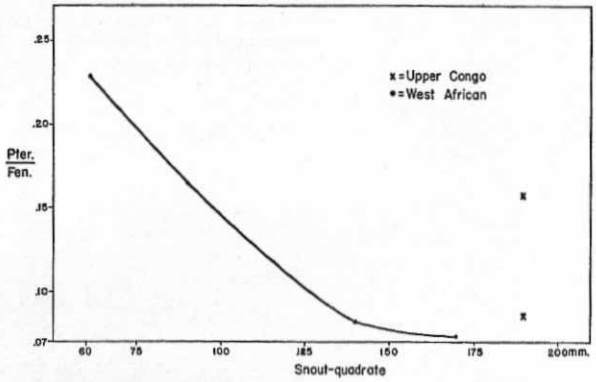

Fig. 1. The relation between the ratio pterygoid/fenestrae and snout-quadrate length. For fuller explanation of ratio see text.

Several other diagnostic characters employed in the original description of *osborni* do not hold up under examination. For example, only the type of *osborni* has the frontal entering the supratemporal fossae. In none of my specimens does the frontal participate in the fossae. The absence of a suture between the pterygoids of the type of *osborni* was thought to be of importance in defining the species. However, in all of the skulls I have seen, there is a suture separating the two pterygoids. Mr. Arthur Loveridge has informed me that this suture is also present in a second paratype of *osborni*. Obviously these two characters are of no importance taxonomically.

In the course of this investigation, several new differences have been observed. Returning to the palatal fenestrae, in the Upper Congo specimens the lateral borders are smooth curves without interruption. However, in the larger specimens from West Africa, the anterior part of the ectopterygoids sends a projecting flange into the fenestrae. This distinction appears in Schmidt's figures, although he does not mention it in his diagnosis. The fenestrae of the smallest West African skull are essentially identical to those of the Upper Congo skulls. The flange becomes increasingly apparent as the West African skulls increase in size. This is another distinguishing character in

which the adult West African specimens show "deviation" from the Upper Congo group in the sense that the term is used by De Beer (1940).

One more diagnostic character is offered by the scutellation. Considering only the supracaudal scales anterior to the point at which the tail crest becomes single, the counts for the type and two paratypes (one of which is included in my material) of *osborni* are given by Schmidt as 14, 12 and 13. Without exception every West African specimen I have seen has 11 such supracaudals. The Upper Congo specimen (AMNH 29889) not included in Schmidt's counts has 13. Thus a separation of the two groups can be made on the basis of this character. The supracaudals posterior to the point mentioned above vary from 17 to 19 without geographic association. Schmidt indicated that one of the paratypes had but 12 "posterior" supracaudals; this individual, which is included in my series, has the tip of the tail damaged, accounting for the low number of scales. In other respects the scutellation of the two geographic groups is similar.

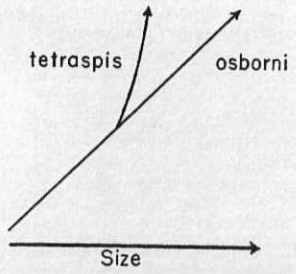

Fig. 2. The relations of skull growth patterns of *Osteolaemus tetraspis* and *O. osborni*.

The geographic distribution remains to be discussed. If the localities of my material, Chabanaud's specimen, and the type localities of *tetraspis* and *osborni* are considered, relative to the tropical rain forest, an important distinction becomes evident. The specimens referred to as "West African" occur in the coastal streams of the rain forest and may even be found in the savanna country, whereas the Upper Congo form is apparently limited to the uppermost tributaries of the Congo in the rain forest. It may also be significant that there is no overlap in the distribution of the two forms.

Validity of the Species *osborni*

I can only conclude from the significant and constant differences between the West African and the Upper Congo series of crocodiles that *tetraspis* and *osborni* are fully distinguishable as species. While they are to a degree geographically representative, it seems preferable to maintain them as distinct species until their distribution is better known. Considering the skull characters, *osborni* is apparently the more generalized and primitive form from

which *tetraspis* has "deviated." The relations of the skulls of the two could be pictured as in Figure 2. The skull characters of young *tetraspis* are essentially those of adult (and presumably also young) *osborni*. The palatal bulb of large *tetraspis* is a specialized structure(see discussion in Schmidt, 1932, of a similar development in *Crocodylus porosus*). This is one reason for designating *osborni* as the more generalized. Recalling the zoogeographic principle that the tropical rain forest may serve as a refuge for primitive forms, the distribution of the two forms in Africa also somewhat vaguely supports the interpretation of *osborni* as primitive.

Generic Untenability of *Osteoblepharon*

With respect to the tenability of generic distinction between the two forms the case is quite different. The distinction between the two species is of the nature of a deviation during growth of a series of characters. When one considers the classification of the remaining genera of Crocodilia, this difference is not great enough to warrant placing them in different genera. In conclusion, then, these two species are regarded as clearly belonging to a single genus in which they stand as *Osteolaemus tetraspis* Cope and *Osteolaemus osborni* (Schmidt). This conclusion, so far as taxonomic arrangement is concerned, has been independently reached by Mertens (1943) and Werner (1933).

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