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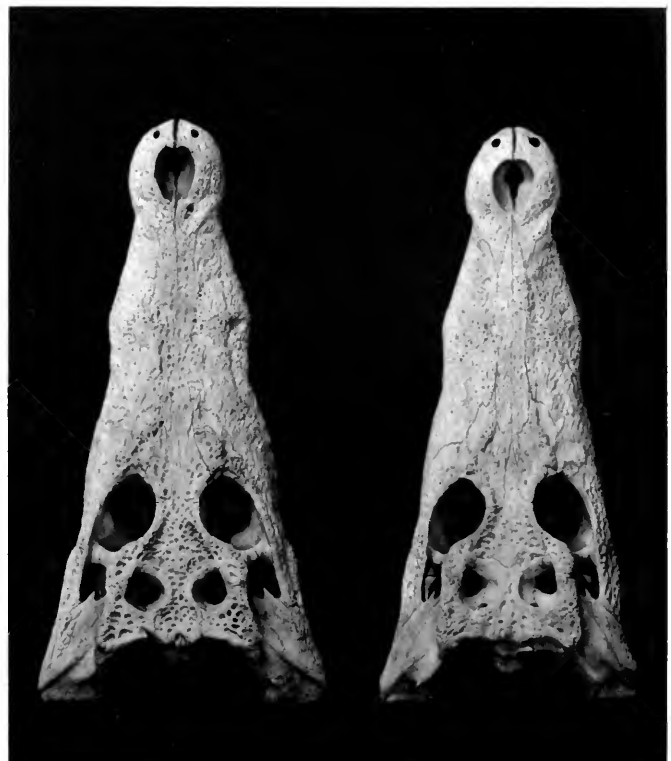
No. 14016 (167 mm.)



C. novae-guineae
No. 14048 (355 mm.)

C. porosus
No. 14031 (348 mm.)

JUVENILE AND ADULT SKULLS OF NEW GUINEAN CROCODILES

FIELD MUSEUM OF NATURAL HISTORY
FOUNDED BY MARSHALL FIELD, 1893

PUBLICATION 310

ZOOLOGICAL SERIES VOL. XVIII, No. 8

NOTES ON NEW GUINEAN CROCODILES

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REPORTS ON RESULTS OF
THE CRANE PACIFIC EXPEDITION

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CHICAGO, U. S. A.

JUNE 16, 1932

PRINTED IN THE UNITED STATES OF AMERICA
BY FIELD MUSEUM PRESS

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The announcement of a new species of crocodile as *Crocodilus novae-guineae*, in 1928, was based on two skulls in Field Museum which had been acquired as part of the Museum's extensive ethnological collections from New Guinea. The small amount of material, and certain misconceptions in the original description, together with a misinterpretation of the characters of skulls of juvenile crocodiles from Siam, caused Dr. Malcolm A. Smith to refer *novae-guineae* to the synonymy of *Crocodilus porosus* in the first of the volumes on Reptilia and Amphibia in the new edition of the Fauna of British India.

The specimens of New Guinean and Bornean crocodiles accumulated in Field Museum since 1928, chiefly from the collections of the Crane Pacific Expedition, now enable me to correct and amplify the original description. As leader of the scientific party of the Crane Pacific Expedition, with my attention specifically directed to the study of New Guinean crocodiles by my previous paper, I made special effort to secure specimens and skulls of crocodiles in the course of our voyage up the Sepik River. It is disappointing to record that, at the time of our visit, high water so dispersed the crocodile population that we secured only four specimens in the flesh, two of which were shot by Mr. Sidney N. Shurcliff as they lay sunning on the muddy river banks, while two small specimens were obtained from native collectors. Our disappointment in this direction was greatly compensated for by the acquisition of twenty-six skulls from native villages in trade for knives and plane blades.

The skulls of crocodiles are preserved by the Papuans as ceremonial and often merely as curious objects in their dwelling houses and men's club-houses. Many such skulls are undecorated; some are painted or covered with clay; and others are provided with palm-fiber tassels or have the lower jaw attached to the upper by means of woven rattan. One skull, F.M.N.H. No. 142712–2 (Department of Anthropology), is part of the decoration of a carved ceremonial shield. Nine large skulls preserved in men's club-houses along the Sepik River were not obtainable; measurements of these are included in my notes.

In addition to this New Guinean material, the expedition obtained fifteen crocodile skulls from the neighborhood of Sandakan, British North Borneo, owing to the kind interest of Mr. D. D. Wood, Director of Forestry at the time of our visit. These skulls range in length from 105 mm. to 379 mm. Other material in Field Museum from the Oriental region includes a large skull from India, two skulls and one skin from the Philippines, and a skull fragment from the Solomon Islands. Correspondence with Dr. Malcolm A. Smith, at the British Museum, secured the loan of the two skulls from Siam, mentioned by him in referring *novae-guineae* to the synonymy of *porosus* (1931, p. 44). An additional skull from New Guinea (B.M. No. 86.5.20.1) and one from the Solomon Islands were also borrowed from this source.

From all sources, more than sixty skulls have been examined. These fall perfectly into two distinct series, one corresponding to *Crocodilus porosus*, with expanded palato-pterygoid passage, which includes the Solomon Island, Philippine, Bornean, Siamese, and Indian specimens, with twenty from New Guinea; while the other, with sixteen skulls of assorted sizes, all from New Guinea, represents *C. novae-guineae* with its slender, unexpanded palatines. Thus I am prepared, from cursory examination of this enlarged material, to reaffirm the existence of two species of crocodile in New Guinea. The principal differences are in the following characters:

	C. porosus	*C. novae-guineae*
Nasal passage	palato-pterygoid inflation	no inflation
Palatines	widened posteriorly	not widened posteriorly
Internal nares	posterior	inferior
Quadratojugals	constricted, narrow	parallel-sided, broad
Preorbital ridge	longitudinal, sharp	more transverse, blunt
Occipital scutes	absent	present
Cranial table	subrectangular to trapezoidal	trapezoidal

Detailed measurements of all the skulls available show clearly that the proportions of the skull regarded as characteristic of *novae-guineae* in the original description do not hold. If all measurements be reduced to a proportion with reference to the length from tip of snout to occipital, the greatest width of the skull varies from .44 to .58 in *novae-guineae* and from .41 to .63 in *porosus;* the width at the tenth tooth varies from .21 to .29 in *novae-guineae* and from .24 to .34 in *porosus*. The form of the cranial table is subrectangular in juvenile *porosus*, clearly trapezoidal in young *novae-guineae;* but this character also fails in larger specimens. There are distinctive differences in the proportionate measurements of almost every skull

element, but these are masked by individual variation and by changes with growth.

External characters.—The two juvenile, alcoholic specimens, F.M.N.H. No. 13965 from Bien, below Marienberg, and No. 14080 from Marienberg, are referred to *novae-guineae* after examination of the palatines (by raising a flap of the palate) and on account of

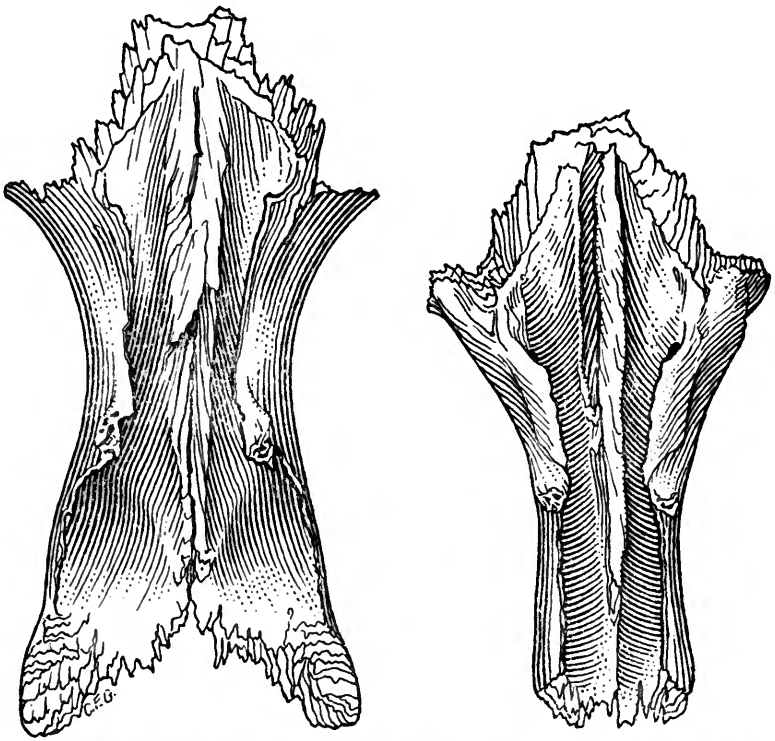

FIG. 28. Dissociated palatine bones of New Guinean crocodiles, viewed from above. Inflation of internal nasal passage shown in left figure (No. 14032, *C. porosus*); lack of inflation in right figure (No. 14039, *C. novae-guineae*).

the trapezoidal cranial table. These specimens both have the four well-developed occipital scutes, which are described as usually absent in *C. porosus*, normally present in all other species of crocodiles. The nuchals are 4–2 in both. The dorsal shield is composed of ten longitudinal rows of scutes and seventeen transverse rows in No. 13965, and of eight longitudinal and seventeen transverse rows in No. 14080. Both specimens have eighteen caudal verticils double-crested and about twenty single-crested.

The total length of No. 13965 is 345 mm.; the tail from the anterior border of the anus measures 181 mm.; the fore limb from axilla to tip of claw is 50 mm. in length; and the hind limb measures 72 mm. The same measurements in the second specimen are 605; 312; 82; and 115.

The smaller specimen is brown above with about six transverse, dark cross-bands on the back and eleven on the tail; the larger is olive, with similar dark markings.

The palatine character.—The most conspicuous difference between the two series of skulls examined lies in the form of the palatine bones and the connecting portions of the pterygoid. In *porosus* there is a well-marked inflation of the nasal passage at the base of the palatines, which involves a widening of these bones and a thinning out of the palatine and pterygoid walls of the passage. No such bulb in the nasal passage is developed in *novae-guineae*. The dissociated palatine bones from skulls of subequal size of the two species, viewed from above, are shown in the figure on page 169. An unexpected character of the antero-lateral projections of the palatines of *novae-guineae*, which are relatively massive, is the presence in them of a pair of large diverticula opening into the longitudinal nasal passage. These are without distinct analogues in the palatines of *porosus*.

The palatine bulb is distinctly an age character, reaching its maximum development in large skulls. Comparison of juvenile with mature skulls of *porosus* might lead to the suspicion that the inflation is absent. Direct comparison of juvenile skulls of *novae-guineae* with specimens of similar size of *porosus*, however, shows that it is possible to distinguish a relative enlargement and thinning of the pterygoid-palatine tube even in the smallest specimens, and that the widening and forking of the base of the palatines is diagnostic.

In casting about for an explanation or a possible function for this inflation of the air passages of *porosus*, the best suggestion I am able to make is that it might be a resonance chamber; and with the frequent greater development of voice in males than in females of various animals, this suggests that the difference in this character between the two series of skulls examined is one of sex. This suggestion seems to be completely negatived, however, by the existence of the other distinctive characters which do not seem to have any direct association with the nasal bulb or with sex. Furthermore, the chance (1 to 32,768) that the series of fifteen Bornean specimens should all be males, is exceedingly remote; these specimens are

uniformly and characteristically *porosus*, and they were chosen at random to form a graded series in size. No sex dimorphism of this nature has been described in any other species of crocodile, and, if the skulls of females appear in about normal proportions in collections from New Guinea, they should be equally well-known from India, Siam, Borneo, and other parts of the range of this well-known species. The inflation of the nasal passage may, nevertheless, have some relation to voice; but the attractively simple explanation of *novae-guineae* as the female of *porosus* is untenable as an interpretation of the available data.

Other skull characters.—The peculiar character of the internal narial opening in the skull of *porosus*, which opens obliquely downward and backward, instead of downward (with reference to the plane of the pterygoid surfaces), as in other crocodiles, has been emphasized by Mook (1921, p. 187). Since *C. novae-guineae* agrees with the majority of the species of crocodiles in this character, it is unspecialized as compared with *porosus*.

The preorbital ridge, which is highly characteristic of *C. porosus*, is indicated in *novae-guineae* by a much shorter, more blunt, and more oblique ridge, not extending to the maxillaries. After a small series of skulls has been compared with reference to this feature, it may be used as a sight character for separating the skulls of the two species. The ridge overlies the naso-lacrymal duct, which is larger in *porosus* than in *novae-guineae*.

The quadratojugals are normally much narrowed anteriorly in *porosus*, wider and parallel-sided in *novae-guineae*. The single exception noted in this character is in a skull of *porosus* (i.e., with large palato-pterygoid bulb) from the Solomon Islands, loaned for study by the British Museum in this connection.

The difference in the form of the cranial table appears to be a constant character when skulls of approximately equal sizes are compared; the more trapezoidal form of this part of the skull in *novae-guineae* is well shown in the accompanying plates. The species may be recognized by the form of the preorbital ridge and the shape of the cranial table, which are as well visible in the flesh as in the cleaned skull; and by the presence of occipital scutes.

Distribution.—Dr. Albert B. Lewis, well-known authority on Melanesian ethnology, has called my attention to the remarks on crocodiles in New Guinea by Mr. C. A. W. Monckton, in Some Experiences of a New Guinea Resident Magistrate. He writes (p.

272): "In New Guinea there appear to be two different species of the brute, for in some rivers they are small and innocuous while in others they are large and of extreme ferocity." Mr. George Murray, Director of Agriculture of the Territory of New Guinea, recalled in conversation with me during the Crane Pacific Expedition's stay at Rabaul that his Papuan work boys, in the interior of Papua, had distinguished two species of crocodile, referring to one as harmless and to the other as a man-eater.

My original supposition that *porosus* would be found to be estuarine and *novae-guineae* a strictly fresh-water species in the Sepik River proves unfounded, for our large specimen of *porosus* was shot above Magendo, 65 miles from the river mouth, and a large skull was measured at Malu, nearly 250 miles from the sea. I still suspect that the habitats of the two species are more or less exclusive, *porosus* being the species of the large open rivers, *novae-guineae* of the marshes; but direct observations are required to solve this question.

The skull mentioned above as part of the decoration of a ceremonial shield (on exhibition in Field Museum) comes from Goari Bari, Kerewa District, on the Papuan Gulf. It is a typical *novae-guineae.* This, in connection with Monckton's and Murray's accounts, contributes to the supposition that *C. novae-guineae* has a wide range in New Guinea.

Much remains to be done to clear up the relations of the two New Guinean species of crocodiles, as to their distribution, habits, and external characters; but it seems clear that there *are* two species, and that one of these is unspecialized as compared with the other more widely ranging form.

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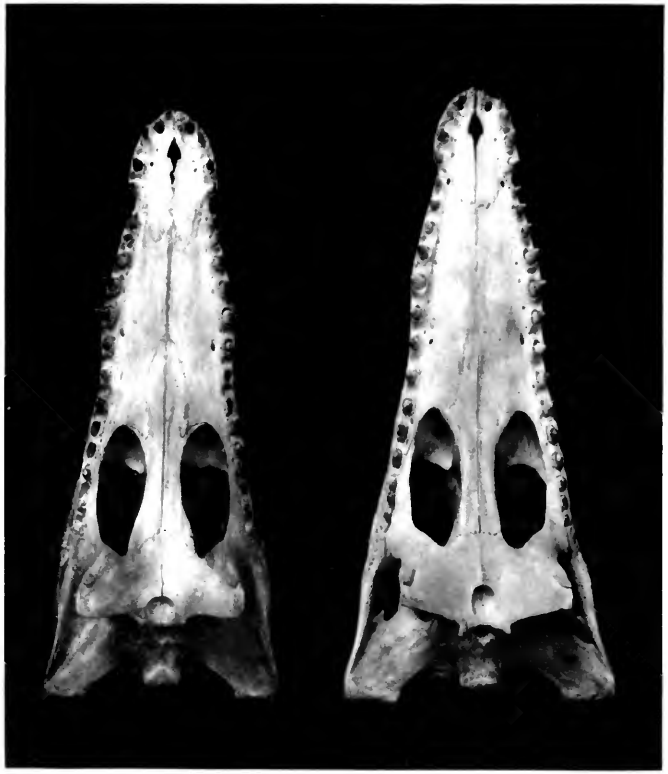

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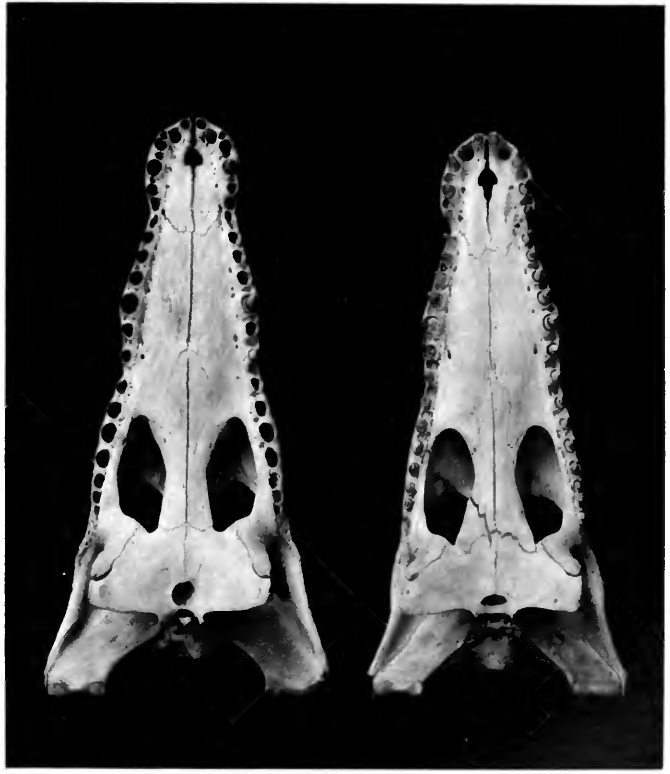

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