TERTIARY FRESH-WATER FISHES AND CROCODILIAN REMAINS FROM GLADSTONE AND DUARINGA, QUEENSLAND.

By E. Sherbon Hills, University of Melbourne.

Plate IX.

The occurrence of fish remains at Duaringa in freshwater Tertiary deposits was reported by Dunstan in 1900. The remains were stated to consist of an " abundance of fragments, including spines, vertebrae, and scales, and a well-preserved specimen of a headless fish, which must have been about 4 inches long when perfect. In addition, there is the impression of the head of another fish and an imperfect impression of a crustacean." The presence, in the Tertiary oil-shales at The Narrows, Gladstone, of " ostracods and plant remains similar to those at Oxley," has been mentioned by Jones (1926).

A general similarity in the lithology and fossil content of many of the isolated deposits of freshwater Tertiaries in Eastern Queensland has been noted by Ball (1915), Dunstan (1900) and Jones (1926), and apparently there has been a tendency to regard the various local deposits as being approximately contemporaneous (*see* especially Jones, 1926). Bryan and Whitehouse (1926) have, however, issued a timely note of warning against this view. The flora and fauna of the Palaeogene (? Oligocene) Redbank Plains Series bear a strong general resemblance to forms now living in parts of Queensland. Many of the plant genera are represented in the existing flora ; the insects are related to living forms ; the fishes include *Epiceratodus*, an Osteoglossid and *Percalates*, and there are also Crocodilians, and a fresh-water tortoise apparently identical with the living *Chelodina insculpta*. Since so many of these forms are represented by allied species or closely related genera in the existing flora and fauna, it is clear that the general assemblages of fossils in all fresh-water Tertiary formations of appropriate facies in Queensland will bear marked family resemblances, and that it will be only on a basis of careful and detailed palaeontological studies that it will be possible to determine their relative age. It will, moreover, always be extremely difficult to effect a correlation with the standard European Tertiary succession on palaeontological grounds alone.

The material described herein comprises only a few fragmentary remains from Duaringa, the collection (referred to above) that was examined by Dunstan being no longer available. In addition, there is a larger number of specimens, obtained from bores at The Narrows, near Gladstone. Naturally, these specimens are also fragmentary, but they are excellently preserved in shale and oil-shale, and have fortunately yielded material sufficiently definite to establish with certainty the general characters of the assemblage. The collections were forwarded to me by Mr. L. C. Ball, Chief Government Geologist of Queensland, to whom I am indebted for the opportunity to examine and describe an interesting suite of fossils. Material for comparison was kindly made available to me by Mr. Heber Longman, Director of the Queensland Museum, and by Mr. G. Mack, of the National Museum, Melbourne. For the photographs (Plate IX), I am indebted to Mr. J. S. Mann.

*Faunal List.**

Locality 1 : The Narrows, Gladstone.

Bore 1, *Munduran*—

Depth 206 ft. *Lutjanus* sp.—pre-operculum [F1967].

Depth 212 ft. *Percalates* sp.—scales [F1968].

Depth 298 ft. *Scleropages* aff. *leichardti*—operculum and branchiostegal rays [F1969].

Bore 3, *Munduran*—

Depth 220 ft. Small Percoid fish, *incertae sedis*—various broken bones, spines, and scales [F1970].

Depth 239 ft. (i) *Epiceratodus* sp.—scale [F1971].

(ii) Crocodilian remains—dermal scutes; proximal phalangeal of fifth digit of right pes. [F1972 *a* to *e*].

Depth 256 ft. Percoid fish, *incertae sedis*—ceratohyal and epihyal bones [F1973].

Locality 2 Parish of Wallbury.

Small Percoid fish, *incertae sedis*—1st and 2nd anal spines, ceratohyal, palatine teeth, vertebrae, scales, and other fragmentary bones [F1974].

Systematic Descriptions.

Class PISCES; Sub-class Dipneusti; Order Sirenoidei; Family Ceratodontidae; Genus *Epiceratodus* Teller 1891.

NEOCERATODUS Castelnau, 1876 *nom. nud.*

EPICERATODUS sp. (Plate IX, Fig. 1).

The scale referred to *Epiceratodus* is preserved as an incomplete impression of the inner surface. It exhibits distinctive reticulate markings, which are casts of grooves on the original scale. The areas between the grooves exhibit a finely granular ornament. The size and markings of the specimen are sufficient to indicate its generic affinities with certainty. On scales of the living species, the granular ornamentation is finer than on the fossil, which I take to indicate a specific distinction, but naturally specific determination is not possible. Detached scales of *E. forsteri* show a marked tendency to curve after separation from the body, the inner surface becoming concave. The fossil scale exhibits a similar curvature.

Superorder *Teleostei*; Order Isospondyli; Family Osteoglossidae; Genus *Scleropages* Gunther 1864.

SCLEROPAGES AFF. LEICHARDTI Gunther.

Plate IX Fig. 2.

The operculum is the distinctive bone on which the determination of *Scleropages* is based. The operculum of *Phareodus*, the extinct Osteoglossid that occurs in the Tertiary deposits at Redbank Plains and Cooper's Plains, is ornamented with strong tuberculate ridges radiating from the articular facet, and its shape approximates to a segment of a circle. The operculum here described bears an indistinct radial ornament almost exactly comparable with that in *Scleropages*, and in its general

*Types in Geological Survey of Queensland Government.

dimensions it is indistinguishable from the operculum in that genus. It differs from *Phareodus* not only in ornamentation but also in its greater width as compared with its depth, and the resemblance to the living *Scleropages leichardti* is so marked that an affinity is definitely indicated with that species.

Order *Percomorphi ;* Family *Moronidae ;* Genus *Percalates* Ramsay and Ogilby 1887.

PERCALATES sp.

Bore 1, *Munduran, 212 ft.* (Pl. IX, Fig. 4). The two scales in this specimen are beautifully preserved in translucent chalcedony (?) so that even the individual species of the ctenoid area can be as clearly distinguished as in a scale from a living fish. As has been shown by Cockerell (1913), the scales of teleost genera are of diagnostic significance, but, unfortunately, little has been published on the minute details of the scales of Australian fishes. I have, however, examined the scales of a number of fresh-water and of some marine Percoid fishes, in order to afford some slight basis for the study of the scales in the present collection, and find no difficulty in establishing a very close similarity between the scales at 212 ft. in Bore No. 1, Munduran, with those of *Percalates* and in distinguishing them from the scales of all other genera I have examined. The resemblance is greater to *P. antiquus* than to *P. colonorum*, as shown by the smaller number of radii characteristic of the former species. The study of fish scales can, as presaged by Cockerell, be of the greatest value in determinative palaeontology, but the task of making an adequate survey by existing and fossil species is a formidable one, and must await more settled times.

Family *Lutjanidae ;* Genus *Lutjanus* Bloch 1790.

LUTJANUS sp.

The determination of *Lutjanus* is based entirely on the pre-opercular bone (Pl. IX, Fig. 3). The distinctive and characteristic features of the specimen are that the posterior edge is finely denticulate, the angulation and the horizontal margin possessing stronger denticles, all of which are retrorse : immediately dorsal to the angulation, there is a slight notch in the hinder margin of the bone, due to a posteriorly directed extension of the angle, which projects somewhat backwards from the line of the vertical limb. The shortness of the horizontal limb as compared with the vertical is also notable. These features are all characteristic of species of *Lutjanus*, and the posterior notch above the angulation is a characteristic of the genus. Although only a single bone is available in the fossil, I have no hesitation, after examining a large series of Percoid skulls, in referring the specimen to *Lutjanus*, a close comparison being possible with the living *L. erythropterus* Bloch, which, however, is smaller in the specimens available to me. Although normally marine, some species of *Lutjanus* enter fresh water, and the occurrence of the genus in The Narrows oil-shales is therefore not indicative of a marine origin for that portion of the succession in which the fossil occurs.

Indeterminate Percoid Fish.

Parish of Wallbury (Pl. IX, Fig. 5). The only remains available from the Duaringa District are a disintegrated skeleton of a small percoid fish, of which the most distinctive parts are the scales. These are preserved in finest detail, but only as impressions. They show some resemblance to the scales of *Percalates*, but certain points of difference are to be noted, such as the presence of coarser and more extensive

granulations on the inner surface near the growth centre, a well-marked ctenoid area, and a tendency towards a sub-rectangular outline with rounded corners, as in *Therapon*. The available data are, however, insufficient to warrant generic determination.

Class Reptilia ; Order Crocodilia.

The crocodilian remains consist of a broken proximal phalangeal of the fifth digit of the right pes, and four imperfect bony dermal scutes (Pl. IX, Figs. 6-9). The phalangeal bone is not so stout as the corresponding element in *Crocodilus porosus*, the estuarine crocodile of Northern Australia. Three fragmentary dermal scutes, and one small, nearly complete scute are associated with the phalangeal bone in a few inches of the bore-core, and there is no doubt that all the remains were derived from the one individual. None of the scutes shows a crest or angulation such as is present on the dorsal scutes of all living crocodilian species (Smith Woodward, 1886), and they must therefore either be ventral scutes or dorsal scutes of an extinct form, some of which did possess unkeeled dorsal scutes (Smith Woodward—Zittel, 1932). Among living crocodilians, ventral scutes are present in *Caiman* and *Jacare* only, according to Huxley (1860). It is therefore clear that the remains are those of a form that is now extinct in Australia, but, in the absence of the skull, generic determination is not possible.

GEOLOGICAL AGE.

1. *The Narrows, Gladstone.*—The fish-fauna from The Narrows is significantly different from that at Redbank Plains in the Ipswich district, to which a Palaeogene (? Oligocene) age was assigned (Hills, 1934). The extinct genera *Phareodus* and *Notogoneus* are absent, while in place of *Phareodus* the living genus *Scleropages* is found.

The absence of the dictinctly archaic elements of the Redbank Plains fauna clearly indicates a younger age for the strata at the Narrows, and this is supported by the affinity of the osteoglossid *Scleropages* with the living *S. leichardti* of Queensland rivers. The presence of *Lutjanus*, a common marine and fresh-water genus of Indo-Australian waters, also suggests a closer approach to the existing fauna, but *Lutjanus* has been recorded from the Lower Oligocene of Florida (Gregory, 1930) and therefore is of little real help. Nevertheless, the general character of the assemblage, with the genera *Epiceratodus*, *Scleropages*, *Percalates*, and *Lutjanus*, is modern, and implies a Neogene age.

The differences from the existing fauna reside in the occurrence of an extinct species of *Epiceratodus* ; a (probable) closer affinity of the *Percalates* species with the extinct *P. antiquus* rather than the existing *P. colonorum* ; and the presence of a Crocodilian now extinct in Australian waters, if not elsewhere. Pliocene fish-faunas are generally almost identical with those of the present day, and the presence of so many extinct species at The Narrows indicates a greater age than Pliocene, with some degree of certainty. I therefore take the view that the age of the strata is probably Miocene.

2. *Loc. 2, Parish of Wallbury.*—Of the fossils from this locality, it is possible to state only that they are Tertiary.

BIBLIOGRAPHY.

Ball, L.C., 1915. "Tertiary Oil Shales of The Narrows." *Geol. Surv. Qld.*, Pub. No. 249.

Bryan, W. H. and F. W. Whitehouse, 1926. "Later Palaeogeography of Queensland." *Proc. Roy. Soc. Qld.*, Vol. XXXVIII, pp. 103-114.

Cockerell, T. D. A., 1913. "Observations on Fish Scales." *U. S. Bur. Fisheries*, Bull. 32, pp. 117-174.

Dunstan, B., 1900. "Notes on Fossil Fish at Duaringa, Central Railway Line." *Geol. Surv. Qld.*, Annual Progress Rept., pp. 16-17.

Gregory, W. K., 1930. "A Fossil Teleost Fish of the Snapper Family (Lutianidae) from the Lower Oligocene of Florida." *Florida State Geol. Surv.*, Bull. No. 5, pp. 7-17.

Hills, E. S., 1934. "Tertiary Fresh Water Fishes from Southern Queensland." *Mem. Qld. Mus.*, Vol. X, pp. 157-174.

Huxley, T. H., 1860. "On the Dermal Armour of *Jacare* and *Caiman*, with Notes on the Specific and Generic Characters of Recent *Crocodilia*." *Proc. Linn. Soc. Lond.*, Vol. IV, pp. 1-28.

Jones, O. A., 1926. "The Tertiary Deposits of the Moreton District, South-Eastern Queensland." *Proc. Roy. Soc. Qld.*, Vol. XXXVIII, pp. 23-46.

Woodward, A. Smith, 1886. "The History of Fossil Crocodiles." *Proc. Geol. Assoc. Lond.*, Vol. IX, pp. 288-345.

————, ——, K. v. Zittel, 1932. "Text-Book of Palaeontology." Vol. II : Fishes to Birds ; London.

PLATE. IX

Fig. 1.—*Epiceratodus* sp. Cast of inner surface of scale.
[F1971] × $\frac{4}{3}$

Fig. 2.—*Scleropages* aff. *leichardti*. Operculum, inner aspect.
[F1969] × $\frac{4}{3}$

Fig. 3.—*Lutjanus* sp. Pre-operculum.
[F1967] × $\frac{4}{3}$

Fig. 4.—*Percalates* sp. Scale.
[F1968] × $\frac{2}{3}$

Fig. 5.—Percoid Fish. Scale : (*a*) cast of inner surface, (*b*) sketch of outer surface (diagrammatic).
[F1974] × 8

Fig. 6, 7, 8.—Crocodilian dermal scutes ; (*a*), (*b*), outer and inner aspects respectively.
[F1972, *a* to *c*] × $\frac{5}{3}$

Fig. 9.—Crocodilian, proximal Phalangeal, 5th digit of right pes. (*a*) Dorsal aspect ; (*b*) Lateral aspect.
[F1972, *e*] × $\frac{5}{3}$