

AN ALMOST COMPLETE SKULL ROOF AND
PALATE OF THE DIPNOAN *DIPNORHYNCHUS*
SUSSMILCHI (ETHERIDGE)

by K. S. W. CAMPBELL

ABSTRACT. A preliminary account is given of the cranial structure of *Dipnorhynchus sussmilchi* (Etheridge) based on a newly found topotype from the Middle Devonian of Taemas, New South Wales.

UP till now the Devonian Dipnoan genus *Dipnorhynchus* Jaekel has been known from two specimens only, one *D. lehmanni* Westoll (Lehmann and Westoll 1952; Lehmann 1956) from the Lower Devonian Hunsrückschiefer of Germany, and the other *D. sussmilchi* (Etheridge 1906; Hills 1933, 1941) from the Middle Devonian of Taemas, New South Wales. The genus is of particular interest since it is the oldest known member of the Order Dipnoi, and the structure of its skull table displays many primitive features which have been of value in comparative studies of the Dipnoi and the Rhipistidia, as well as in studies of dipnoan evolution (Westoll 1949).

A new specimen of *D. sussmilchi* has been discovered in the 'Spirifer yassensis Limestone' at the locality known as Shearsby's Wallpaper, Taemas, Burrinjuck Dam, close to the locality at which the original specimen was obtained. The skull roof is almost complete, and is only slightly distorted. The only parts missing are the bones 4+X and the postero-lateral tips of the bones H (for terminology see Westoll 1949). The bones of the snout, which are covered by a layer of cosmine obliterating the sutures in the other two specimens, can be seen with great clarity. There are no cheek bones. Most of the palate is present, and a large part of the quadrate ramus appears to be embedded in the matrix on one side.

Little has yet been done to prepare the specimen, but from a preliminary study the following conclusions can be drawn:

1. The relative length of the otic region is even greater than had been anticipated in the reconstructions of Hills (1941, fig. 6). This is a primitive feature in which *D. sussmilchi* is now known to be very similar to *D. lehmanni*.

2. This relative increase in length is due to the larger size of bones 'H' and 'I'. 'H' especially is larger, and in this it differs from the same bone in *D. lehmanni*.

3. There is no bone 'A' as was inferred by both Hills (1941) and Westoll (1949), but the bones 'I' join medially as Westoll was able to show (by means of X-ray photographs) in the case of *D. lehmanni*. However, a more or less symmetrical gap in the medial portion of the back of the skull may have been the site of a loosely articulated bone 'A'.

4. Although the bones 'B₂' are medially fused in the type specimen (Hills 1941, p. 51), they are divided by a clear suture in this individual.

5. Bones 'J₁', 'J₂', 'J₃', 'K', 'L₁', 'L₂', 'M', 'N', and 'Q' are all present as separate entities as in the type specimen, and show no sign of fusions. There is only one minor difference—the enlargement of 'L₂' on the right side.

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6. There is one lateral line bone anterior to 'Q', and three or four lying medially to this one. All these bones are irregularly shaped and as yet have not been named. Another set of unnamed bones—three on the left side and four on the right—lie in front of bone 2. This latter bone is itself split into two elements on the right side.

7. Between the lateral line bones and anterior to B₂ there are twenty-nine separate irregularly shaped bones which are only roughly symmetrically arranged. This is by far the greatest number known in any member of the Dipnoi. On their exposed surfaces the bones show the same characters as the others and there is no reason to believe that they are histologically different in any way (cf. Westoll 1949, p. 141).

8. The anterior tip of the snout is very thick and is cosmine covered. It shows the characteristic depressions for the external nares.

9. From the arrangement of the sensory pores both sub- and supra-orbital lateral line canals are inferred to be present and show a pattern similar to that of the type. However, in many places it is not possible to identify the position of the canals with precision, and this must await further preparation of the specimen. The anterior part of the supra-orbital canal is somewhat more flexed than that of the type (compare text-fig. 1a with Hills 1941, figs. 5–6). The sub-orbital canal appears on the snout in the position indicated on Westoll's diagram (1949, fig. 5A). It can be traced as a line of very coarse pores running around the under edge of the snout across the top of the external naris and gradually dying out toward the mid-line.

10. The occipital commissure of the lateral line system is not clearly marked, but the presence of several large pores near the postero-median corners of the bones 'I' suggests that it probably passes out of these bones in this region. This supports the view that a movable bone 'A' was originally present in this region, but further preparation is needed.

11. It is difficult to distinguish between fine cracks and pit lines in some areas, but the pit lines shown in text-fig. 1 are definite.

12. The bone of the palate is an enormously thick structure and its edges are knobbed where they were embedded in cartilage. All the bones are fused, and while the vomers can be distinguished from each other and from the pterygoids by emarginations and deep grooves, it is not possible to separate the pterygoids and the parasphenoids. The vomers are short and do not reach to the snout. At the posterior end of the palate the bone thins out rapidly and rises abruptly. There is clearly no parasphenoidal stalk. In general form the palate is very similar to that of *D. lehmanni*, though in that species Westoll (1952, fig. 4B) claimed to be able (with difficulty) to delineate a narrow parasphenoid.

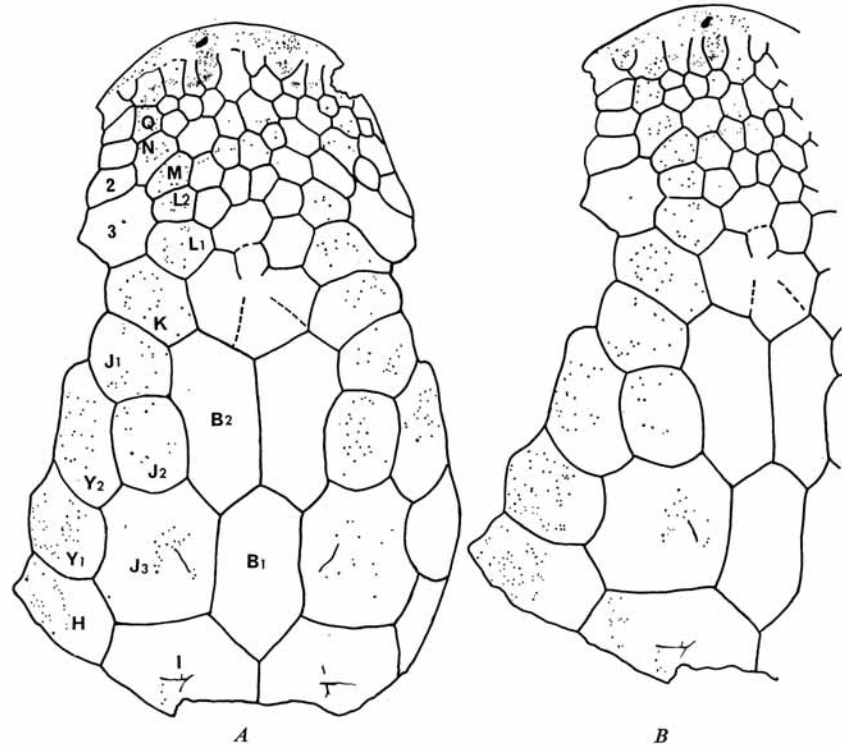
13. There is no ceratodont dentition. The teeth form three large, slightly elongate bulbous masses. The central one is the most anterior and is itself subdivided into three segments by the remnants of the sutures between the vomers and the pterygoids, and between the two pterygoids themselves. Where the sutures join there is a deep pit. The two lateral teeth are at the antero-lateral margins of the pterygoids and are formed entirely from these bones. Teeth of this shape and the massive palatal bones suggest that

EXPLANATION OF PLATE 91

Figs. 1–3. *Dipnorhynchus sussmilchi* (Etheridge), dorsal, ventral, and lateral views of the skull. The dorsal view was photographed with the long axis horizontal, and the ventral view with the palate horizontal. All approx. $\times 1$.

the animal was a shell feeder. The plate figured by Hills (1933, pl. 12, fig. 4) is not a tooth plate of *Dipnorhynchus*.

14. The associated fauna is very rich and consists mainly of brachiopods, orthoconic cephalopods, high spired gastropods, bivalves, and trilobites. These undoubtedly indicate a marine environment. As has been suggested by Hills (1958) the fine state of



TEXT-FIG. 1A-B. Dorsal and dorso-lateral views of the skull prepared by inking in the sutures and the sensory pores on enlarged photographs, and then bleaching them.

preservation of the fish fauna in the Murrumbidgee limestones in general indicates that they probably have not been transported far after death. The interpretation of the structure of the teeth and palate given above supports the view that it was a marine organism.

Work on the specimen is proceeding and it is intended to produce a more complete account as soon as possible.

Note. Throughout this paper the bone nomenclature originated by Foster-Cooper (1937) and developed for *Dipnorhynchus* by Westoll (1949), has been used without modification for the sake of simplicity. It is *not* implied that this nomenclature is accepted in its entirety.

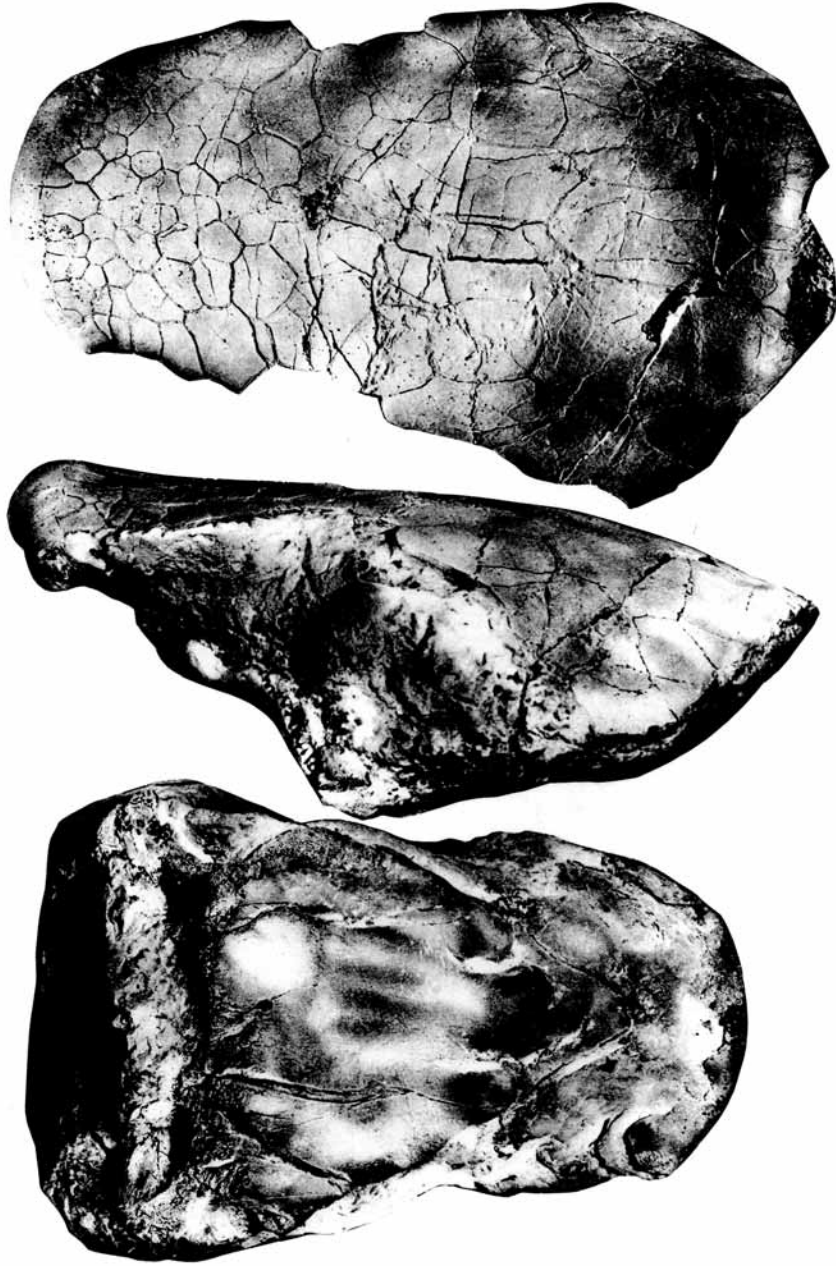
All except the posterior bones of the skull were found on the one piece of rock. During a search at a subsequent date these bones were found in place only a few feet from the original site by Mr. R. W. Day of this department. His assistance is gratefully acknowledged.

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