NOTES ON A FOSSIL WHALE FROM WYNYARD, TASMANIA.

Plates xxi., xxii.

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(Communicated by Mr. R. N. Atkinson.)

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The specimens here referred to were discovered by Mr. R. N. Atkinson in the tertiary fossil-bearing strata of the Table Cape series, imbedded at the present tide line. This horizon is practically basic, and is therefore here assumed to be miocene. The history of the several recoveries of fossil cetacean remains in Australia, New Zealand, and Tasmania, has of late years been made the subject of an extensive paper by Dr. T. S. Hall, of the Melbourne University. (1) Quite recently, also, Mr. F. Chapman, of the National Museum, Melbourne, has noted the occurrence of *Scaldicetus* in the Beaumaris cliffs. (2) In these several records Tasmania is accredited with a single fossil tooth, discovered by Prof. Baldwin Spencer, and referable under Dr. Hall's revised taxonomy to *Parasqualodon Wilkinsoni*—being therefore generically and specifically homotaxial with Victorian specimens first recorded by Prof. McCoy in 1864. (3) As far as is known to me, this is the first recorded instance of fossil whale bones belonging to the appendicular skeleton being noted in Australia or Tasmania, and therefore the find is of more than local interest. Against this obvious gain there must be set the manifest disadvantage, that all the tertiary fossil whales have been described from teeth and skulls, while the appendicular skeleton remains quite unknown.

In the present Table Cape cetacean the teeth and skull being unknown makes direct comparison with the recorded tertiary whales of Victoria impossible. In a general way also this applies to other tertiary fossil whales, including those recorded from Europe, North and South America.

As illustrating this point, I may just say that out of 343

(1) On the systematic position of the species of *Squalodon* and *Zeuglodon*, described from Australia and New Zealand. *Proc. Roy. Soc. Vict.* 23 (N.S.) 1911, p. 257.

(2) On the occurrence of *Scaldicetes* in Victoria. Records Geological Survey of Victoria, vol. 3, part 2.

(3) *Geological Mag.* v. 4 (1864) p 145 pl. 8, f. 1.

distinct finds of fossil cetacean remains recorded in the catalogue of the British Museum (4) the several parts of the skeletons thus preserved are as follows:—Vertebræ, 141; tympanics, 62; perotics, 8; skulls, 47; jaws, 9; teeth, 55; humeri, 6; radii, 4; ulnæ, 4; ribs, 6; scapula, 1.

It will thus be obvious that the discovery of the arm bones of the Table Cape whale, without any fragments of the skull for collateral evidence, renders the problem unusually complicated, even when a large comparative collection is available for study, and doubly so in the absence of such. Lastly, in this connection it must be said that the cetacean that left its remains in the Table Cape rocks was an immature animal, and as the skeletal variations due to immaturity, sex, and individuality are enormous—even among existing whales—the problem is still further complicated.

In some whales the epiphyses of the vertebræ, and even the limbs, never completely ankylose, while in other genera they ankylose to extinction. The bones available, in the case of the present fossil, consist of parts of one arm, some vertebræ and ribs, with various vertebral epiphyses, all of which, in point of size, approximately agree with a fully grown dolphin of the genus *Tursiops*. But, as will be shown presently, these bones could not have been derived from any dolphin of the genera *Delphinus*, *Tursiops*, or *Globiocephalus*.

Taking the arm bones first, as being of the greatest importance, I propose to compare their epiphyses with those of a common dolphin *(D. delphis)* dissected by me in August, 1903. This was an immature male, of a total length of 6 feet 5 inches, as against 8 feet 1 inch for an adult of the same species, also similarly dissected.

Mature Dolphin.	*Immature Dolphin.*
Humerus--all epiphyses ankylosed to extinction.	Humerus--all epiphyses ankylosed.
Radius and Ulna—all epiphyses ankylosed to extinction.	Radius and Ulna—proximal epiphyses ankylosed to extinction, distal epiphyses still open.
Metacarpals — epiphyses all ankylosed.	Metacarpals proximal, epiphyses still open.
All vertebral epiphyses ankylosed to extinction.	Vertebral epiphyses still open.
Sternum—all segments ankylosed, thus presenting a single solid piece of bone.	Sternum—in three pieces, viz., manubrium, gladiolus, and ziphioid.

(4) With the exception of the *ziphioids*, this total does not include the smaller toothed whales, whose congeners still exist in our seas.

1913.

Tongue Bones—so called—basihyal — a single solid bone.	Tongue Bones—so called—basihyal—in three pieces —viz., 1 true basihyal, and 2 thyro-hyals—all distinct moieties.

A careful examination of these data will prove that the epiphyses in the smaller toothed whales ankylose up according to the same general rules as those that govern the growth of land vertebrates generally, including man himself. Therefore a dolphin with its humeral epiphyses closed, and only the distal epiphyses of the radius and ulna open, is very close to the standard of full growth. This conclusion is also reached by another method of computation, namely, by taking the actual lengths of the two dolphins under review, a proceeding which yields a four-fifths growth for the immature creature. Reverting now to the fossil whale:—In the arm of this animal all the epiphyses, both proximal and distal, are open, and therefore if it belongs to a genus in which ankylosis takes place at maturity the animal may be fairly assumed to be less than four-fifths fully grown and perhaps only half grown.

From my personal knowledge of the smaller whales, added to such comparative tests as are available to me, I should say the animal at the time of its death did not exceed 12 feet in length. If this is correct, we are dealing with an animal whose length at maturity did not exceed thirty feet and was possibly less. Just here it may be convenient to say that one arm of a whale may show more epiphysial development than the other, so that if two workers were to study these arms without knowing their history, one might grant the whale a slightly more advanced age than the other would—all of which, of course, suggests the need for great caution.

The humerus of this fossil whale is devoid of its proximal epiphysis, but in the dolphin family this does not add to the total length since the head is at right angles to the shaft. If we assume that the same rule applies to the fossil, we get the following comparative measurements of the arm bones of three animals:—

Fossil Whale.	*Tursiops* (fully grown 12 foot male).	*D. Delphis* (fully grown 8 feet 1 inch).
Humerus (including distal epiphysis) = 125 mm.	Humerus (adult) = 95 mm.	Humerus (adult) = 70 mm.
Radius (distal epiphysis missing—10 mm. allowed) = 100 mm.	Radius (adult) = 110 mm.	Radius (adult) = 90 mm.
Ulna (distal epiphysis mutilated—10 mm. allowed) = 130 mm.	Ulna (adult) = 85 mm.	Ulna (adult) = 80 mm.

Expressed in another form we get:—

Name of Whale.	Largest Arm Bone.	Second Largest Bone.	Smallest Arm Bone.
Dolphin	Radius	Ulna	Humerus
Tursiops	Radius	Humerus	Ulna
Globiocephalus	Radius	Ulna	Humerus
Table Cape Fossil Whale	Ulna	Humerus	Radius

This information assists us in our search, since the humerus is the longest bone in the arms of cachalots and platanists, but shorter in whalebone whales, *Ziphius*, *Hyperoodon*, *Grampus*, and all dolphins. We can eliminate the cachalot and the platanistid. Again, we can, with the osteological data available, immediately cut out *Delphinus*, *Tursiops*, and *Globiocephalus*, since the shafts of both bones of the lower arm in the fossil are of equal diameter, and not as much flattened as in the dolphin group, where also the radius exceeds the ulna in width. Geologically, it may be added, that the largest members of the dolphin group, viz., *Orca* and *Pseudorca*, are unknown earlier than the newer pliocene, and since our fossil is (with all caution exercised in the act of presumption) older than that, our field is practically rid of the modern dolphin group altogether. We have next to consider the whalebone whales, and the ancient, though still lingering, group of ziphioid cetaceans, which, according to Prof. Flower, are "the survivors of an archaic family that once played a far more important part than now among the cetacean inhabitants of the ocean." These latter were apparently fairly numerous in the miocene oceans of Australia, and their remains were recorded by Prof. McCoy from Geelong.

In the right whale (*Balæna mysticetus*) the radius and ulna vastly exceed the humerus in length, in fact in about the ratio of eight to five. The rorqual is somewhat similar in this respect, although the ratios may not be quite so high. Influenced by these facts, I am tempted to discount the possibility of the fossil whale having any affinities with the whalebone whales, for even in the young of these animals the brachial and anti-brachial measurements would manifest the ratios of maturity. If, therefore, we are not dealing with an absolutely new whale altogether, its affinities by the above chain of reasoning should be with the ziphioid cetacean group, and it now remains for us to see what osteological evidence supports this conclusion.

The first thing that strikes an observer is the disproportion between the size of the arm and the ribs, for while the arm suggests a whale larger than *Tursiops*, the ribs are intermediate between that animal and the common dolphin of eight feet in length.

This agrees very well with the osteology of the ziphioids, in which whales the ribs are slender and less numerous than obtains in the dolphin group. Also, the sternal ribs are unossified in the ziphioids, and as far as the evidence yielded by the remains of the fossil animal goes, the sternals are absent. Naturally this latter point must not be pushed too far in dealing with fragmentary remains.

The shapes of the ribs in the fossil make many interesting departures from the dolphin type, their sections conforming to a more oval outline.

The epiphyses of the centra approach more nearly to *Tursiops* than they do to *Delphinus*, having the same amount of flattening as they contribute moieties to the naural canal.

From such fragments of the neural spines as have survived, I should judge them to have been more slender, and taller than those found in the dolphins, which also agrees with the osteology of an immature ziphioid, as far as it is known. I have been unable to collect any trustworthy data respecting the articulation of these fossil ribs, with their respective diapophyses and centra. One specimen looked promising, but as it has obviously sagged in the matrix I reluctantly abandoned the quest.

Coming now to the arm, which is the most perfect part of the whole find. The ratios between the upper and lower arm are agreeable with those found among ziphioids, as are also the straighter shafts and more even development of the bones of the lower arm. The departures from the dolphin group may be thus recapitulated :—

(1) Humerus more uniform in width throughout.

(2) Ulna not constricted in the region of the olecranon process.

(3) Olecranon, a wide fan-like crest and not a mere tubercle as in the dolphins.

From the published descriptions of the *Squalodons* it differs in having the arm bones more flattened, and thus making a nearer approach to the true whales; as also in having articular surfaces that apparently manifest no approach to the land carnivora.

Comparison with *Eurhinodelphis* is impossible since no description of the arm bones is available to me—if indeed these parts of the skeleton have been recovered. The extensive cetacean collection of the British Museum is not enriched with a single fragment of these creatures. In classification, Dr. Beddard allies *Eurhinodelphis* with the *Platanistidæ*, and if this taxonomy is sound it would cut out the Table Cape whale on the ratios of the upper and lower arm (vide supra).

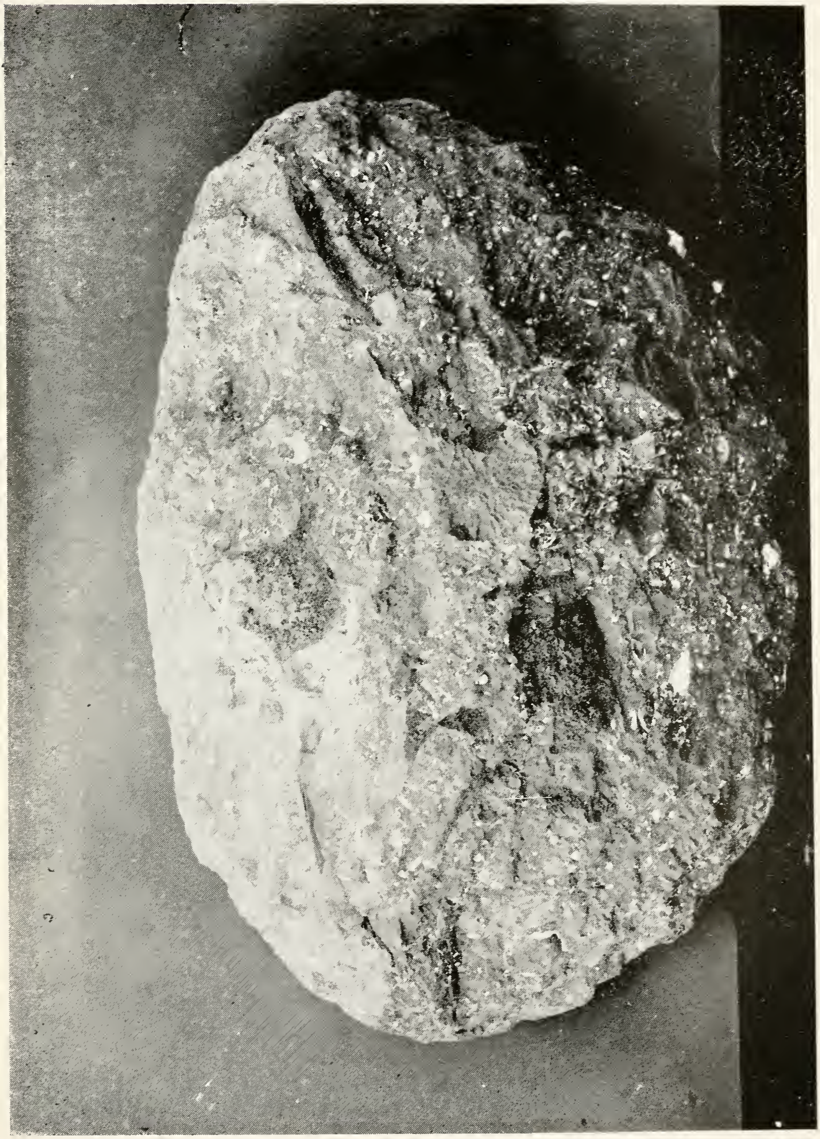
Lydekker, however, allies *Eurhinodelphis* more directly with the *Ziphiidæ.*

From such evidence as I have thus set forth I consider that the fossil whale approaches more closely to an immature ziphioid than anything else, and provisionally classify it as being such. In conclusion, I wish to thank Messrs. E. D. and R. N. Atkinson for granting me the honour of collecting these notes from their interesting specimen.

The Launceston Museum, 4th Sept., 1913.

FOSSIL WHALE FROM WYNYARD—UPPER AND LOWER ARM, SHOWING EPIPHYSES.

Size of Matrix, 12in. x 7in.



FOSSIL WHALE FROM WYNYARD REMAINS OF LUMBAR-SACRAL VERTEBRÆ.

Size of Matrix, 18in. x 15in.