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XI. *A further Contribution to the Knowledge of the existing Ziphioid Whales. Genus* Mesoplodon. *By* WILLIAM HENRY FLOWER, *F.R.S.*, *V.P.Z.S.*

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[PLATES LXXI.–LXXIII.]

DURING the six years that have elapsed since I communicated to the Society a memoir on the recent Ziphioid Whales (Trans. Zool. Soc. vol. viii. p. 203) very considerable additions have been made to our knowledge of the group. Instead of being so rare as was then supposed, since the attention of naturalists resident in our colonies has been directed to the importance of losing no opportunity of securing such specimens as accidents of wind and waves may cast upon their shores, it has been proved that in the seas of the southern hemisphere these Whales exist in considerable numbers both as species and as individuals, and that one species at least is gregarious, having been met with in two instances in "schools" of considerable numbers.

On the other hand, no remarkable deviations from the forms already known have been met with; and all additional information as to their osteology has fully confirmed the value of the division of the Ziphioid Whales into four distinct types or genera, at that time indicated. With perhaps one exception (to be noticed further on), which presents some signs of transition, all the known individuals lately discovered can be arranged without any hesitation either as *Hyperoodon*, *Berardius*, *Ziphius*, or *Mesoplodon*, as defined in the previous memoir.

It is in our knowledge of the animals of the last-named genus that the greatest advances have been made of late; and it is to these that the present communication will chiefly relate.

After examining all the available specimens and published descriptions, I have arrived at the conclusion that evidence exists at present of six distinct specific modifications of this form, of which four inhabit the southern temperate seas. To these I shall have to add two more, although in neither case on evidence so satisfactory as might be desired. The synonymy and habitats of the hitherto known species are as follows:—

1. M. BIDENS (Sowerby).

Physeter bidens, Sowerby, Brit. Miscellany, p. 1 (1804).

Delphinus (*Heterodon*) *sowerbiensis,* Blainville, Nouv. Dict. d'Hist. Nat. 2nd ed. tome ix. p. 177 (1817).

D. sowerbyi, Desmarest, Mammalogie, p. 521 (1822).

Delphinorhynchus micropterus, Cuvier, Règne Animal, t. i. p. 288 (1829); Dumortier, Mém. Acad. Roy. Bruxelles, t. xii. (1839).

Mesoplodon sowerbiensis, Van Beneden, Mém. Acad. Belgique, coll. in 8vo, t. xvi. (1863).
M. sowerbensis, Gervais and Van Beneden, Ostéographie des Cétacés, p. 392 (1877).
Micropteron bidens, Malm, "Hvaldjur i Sveriges Museer år 1869," K. Svenska Vetenskaps-Akad. Handl. 1871.

Hab. Coast of Elginshire (*Sowerby*); Havre (*Blainville*); Ostend (*Dumortier*); Salenelles, Calvados (*E. Deslongchamps*); Brandon Bay, Ireland (*Andrews*); Norway (*Malm*).

2. M. EUROPÆUS (Gervais).

Dioplodon europæus, Gervais, Zool. et Pal. françaises, 1re édit. t. ii. Explic. No. 40 (1850).
D. gervaisii, E. Deslongchamps, Bull. de la Société Linnéenne de Normandie, tome x. (1866).

A single specimen found floating in the sea at the entrance of the British Channel about 1840. The skull is now in the Museum at Caen. It should be mentioned that some doubts have been thrown upon the supposed distinctive characters between this and the last species.

3. M. DENSIROSTRIS (Blainville).

Delphinus densirostris, Blainville, Nouv. Dict. d'Histoire Nat. 2nd edit. tome ix. p. 178 (1817).
Mesodiodon densirostris, Duvernoy, Annales des Sciences Naturelles, sér. 3, t. xv. p. 59 (1851).
Ziphius sechellensis, Gray, Zool. E. & T. p. 28 (1846); Krefft, P. Z. S. 1870, p. 426.
Dioplodon densirostris, Gervais, Zool. et Pal. françaises, 1re édit. t. ii. Explic. No. 40 (1850); Ann. des Sciences Nat. sér. 3, t. xiv. p. 16 (1850).

Hab. Seychelles Islands (*Duvernoy*); South Africa (*Mus. R. Coll. Surgeons*); Lord Howe's Island (*Krefft*).

4. M. LAYARDI (Gray).

Ziphius layardi, Gray, P. Z. S. 1865, p. 358; Owen, Crag Cetacea, p. 12, pl. i. (1870).
Ziphius (*Dolichodon*) *layardi,* Gray, Cat. Seals and Whales Brit. Mus. p. 353 (1866).
Dolichodon layardii, Hector, Trans. New-Zealand Inst. vol. v. p. 166, pl. iii. (1872).
Mesoplodon longirostris, Krefft, MS., *M. güntheri,* Krefft, MS., and *Callidon güntheri,* Gray, Ann. Mag. Nat. Hist. ser. 4, vii. p. 368 (1871).
Dolichodon traversii, Gray, Trans. New-Zealand Inst. vol. vi. p. 96 (1874).
Mesoplodon floweri, Haast, P. Z. S. 1876, p. 478.

Hab. Cape of Good Hope (*Layard*); Near Sydney (*Krefft*); New Zealand (*Haast*); Chatham Islands (*Hector*).

Two skulls, an adult and a young specimen, of this well-established species were brought home by the naturalists of the 'Challenger,' and will be described in detail by Professor Turner in his Report on the Marine Mammalia collected during the expedition.

5. M. HECTORI (Gray).

Berardius arnuxii, Hector, Trans. New-Zeal. Inst. vol. ii. p. 27 (1870).
Smaller Ziphioid Whale, Knox & Hector, T. New-Zeal. Inst. vol. iii. p. 125, pls. xiii., xiv. & xv. (1871).

Berardius hectori, Gray, Annals & Mag. N. H. ser. 4, vol. viii. p. 117 (1871).
Mesoplodon knoxi, Hector, Trans. New-Zeal. Inst. vol. v. p. 167 (1873).

Hab. Titai Bay, New Zealand. Very young; length 9′ 3″, 1866 (*Knox* and *Hector*).

6. M. GRAYI, Haast, Proc. Zool. Soc. 1876, p. 7.

Oulodon grayi, Haast, P. Z. S. 1876, p. 457[1].

Hab. New Zealand.

These six species do not differ greatly in size, and present a close family or, rather, generic resemblance; but still there are certain cranial and dental characters by which the skulls can readily be distinguished.

The most easily recognized of these are:—

a. In some species there is a deep lateral longitudinal groove at the base of the rostrum, commencing posteriorly in a blind pit below the tubercle of the maxilla situated in front of the anteorbital notch, and bounded above and below by sharply defined prominent ridges, both formed by the maxilla. This groove characterizes *M. grayi* and *M. densirostris.* No trace of this groove, but a prominent ridge instead, which gives a wide base to the rostrum, as seen from above or below, exists in *M. bidens*, *M. europæus*, and *M. hectori.* The groove is slightly developed in *M. layardi*, which in this respect presents an intermediate condition.

b. The relative position of the foramina for the exit of the facial branches of the second division of the fifth nerve appears to afford constant distinctive characters between certain of the species. The principal foramina are in two pairs:—1, the larger or more external, situated in the maxilla, and often double, corresponding to the infraorbital foramen in man (Plate LXXI. *mf*); and, 2, the smaller and nearer the middle line, situated in the præmaxilla (*pf*). The latter are rather in front of, or on the same level with, the maxillary foramina in *M. bidens*, *M. europæus*, *M. hectori*, and *M. layardi*, and placed decidedly on a posterior level in *M. densirostris* and *M. grayi.*

c. The constant presence of a row of small teeth in the upper jaw is said to distinguish *M. grayi* from the other species, though, as will be discussed presently, this can scarcely be considered of generic importance.

d. The position of the large tooth in the lower jaw, whether close to the apex of the

[1] In the notice of this paper in the Proceedings of the Zoological Society, 1877, p. 684, for "7. *M. haasti*, n. sp. . . . . . . present memoir," read:—

7. *M. haasti*, n. sp.

Hab. New Zealand.

Known only by a portion of a cranium in the Museum of the Royal College of Surgeons.

8. *M. australis*, n. sp. = *M. hectori* (Gray). Hector, Trans. New-Zealand Inst. vol. vi. p. 86, and vol. vii. p. 362.

Hab. New Zealand.

A complete skeleton, now in the British Museum, described in the present memoir.

mandible, as in *M. hectori*, or near the hinder part of the symphysis, as in all the others, forms another good distinctive character.

e. Finally, the character and form of this tooth presents some important variations. In *M. layardi*, its apex is everted, and seated upon a flat strap-like base, which grows upwards, backwards, and finally inwards, closing over the upper jaw and meeting its fellow of the opposite side. In *M. densirostris* the apex is directed vertically, placed on a very massive base, which is implanted in a greatly expanded alveolar margin of the jaw, not found in any of the other species. In *M. grayi* the tooth is triangular and compressed, and the apex is vertical at all ages. In *M. hectori* the apex of the tooth in the young animal is directed forwards. In *M. bidens* the apex of the tooth is at first directed backwards, but during growth becomes rotated forwards. In the only specimen of *M. europæus* known (an adult) the apex of the tooth is directed somewhat forwards.

These characters may be thus placed in a synoptical form:—

Lateral basirostral groove.	Præmaxillary foramen to maxillary.	Position of mandibular tooth.	Other dental characters.	
Absent.	Level.	Close to apex of mandible.	....	*M. hectori.*
Absent.	Level.	At middle of mandibular symphysis.	....	*M. europæus.*
Absent.	Level.	Near hinder edge of mandibular symphysis.	Apex of tooth at first directed backwards, and during growth rotated forwards.	*M. bidens.*
Slight.	Level.	Ditto.	Apex of tooth everted and mounted on a flattened base, which increases in length with age, and finally curves round the maxilla.	*M. layardi.*
Deep.	Behind.	Ditto.	Apex of tooth vertical. Alveolar portion of jaw expanded.	*M. densirostris.*
Deep.	Behind.	Ditto.	Apex of tooth vertical. A row of small teeth in upper jaw.	*M. grayi.*

Besides the above, there are many minor differences, more appreciable by a comparison of the specimens than by description, some of which will be pointed out in the sequel.

The special materials upon which the present communication is based are:—

1. The skull of a young specimen of *M. hectori*, the type and at present only known example of that species. It was taken in Titai Bay, Cook's Strait, January 1866; and the skull is figured by Dr. Hector in the Trans. New-Zeal. Inst. vol. iii. 1870, pls. xiv.

& xv. The length of the animal is stated by Dr. Knox to have been 9 feet 3 inches. The skull is now in the British Museum.

2. The skeleton of a perfectly adult animal, attributed by Dr. Hector to the same species, prepared from a specimen cast ashore in Lyall Bay, and described by Dr. Hector in Trans. New-Zeal. Inst. vol. vii. p. 262, 1875. This is also in the British Museum [1].

3. The skeleton of an adolescent male *M. grayi*, stranded, with others, on the coast near Saltwater Creek, about thirty miles north of Banks's Peninsula, New Zealand.

4. The rostrum, mandible, and mandibular teeth of an old male animal, stranded in December 1875 on the east coast of the North Island, attributed by Dr. v. Haast to the same species.

The last two were presented to the Museum of the Royal College of Surgeons by Dr. Julius v. Haast, F.R.S., of Christchurch, New Zealand.

Of the specific distinction or identity of the 2nd, 3rd, and 4th I am not perfectly satisfied, as the materials at hand are unfortunately not sufficiently complete for the purpose of arriving at a definite conclusion.

No. 3, though a perfect skeleton, is still immature. No. 2, though adult, is incomplete as regards the very important evidence furnished by the dentition. No. 4 is only a fragment, and, although identified by Dr. v. Haast with his species *M. grayi*, presents strongly marked differential characters which seem beyond the range of individual variation. Under the circumstances, it is somewhat difficult to know what course to pursue with reference to the names by which these specimens are to be respectively distinguished; but on the whole it will lead to less confusion if I designate them, provisionally at least, by specific appellations, bearing in mind that it is quite possible that further information and more abundant materials may cause a modification of this view. I shall therefore, in the present memoir, speak of the British-Museum skeleton from Lyall Bay as *M. australis*, and the fragmentary skull from the east coast of the North Island as *M. haasti*.

Skull.—The skull of animals of the genus *Mesoplodon* is very easily distinguished from those of the other Ziphioids by the characters previously given (T. Z. S. vol. viii. p. 208)[2]. The ossification of the mesethmoid cartilage, and its coalescence with the surrounding bones to form a solid rostrum, appear to be greatly dependent upon the influence of age. It has not hitherto been found wanting in any thoroughly adult example of any species of *Mesoplodon* or of *Ziphius*; on the other hand, it appears never to occur either in *Hyperoodon* or *Berardius*.

[1] I am indebted to Dr. Günther's kindness for facilities in examining and comparing these specimens, which were sent to the British Museum by Dr. Hector, F.R.S., of Wellington, New Zealand.

[2] Almost simultaneously with my memoir appeared an excellent description of the skull of *M. sowerbyi*, compared with that of *Ziphius cavirostris*, by Professor Turner (Transactions of the Royal Society of Edinburgh, vol. xxvi.).

The tympanic bone of *Mesoplodon* is quite different from that of *Ziphius*[1], the groove between the lobes at the posterior end being very well marked as in the true Dolphins, whereas in *Ziphius* it is obsolete. In *Hyperoodon* also it is scarcely apparent, while in *Berardius* it is nearly as well marked as in *Mesoplodon*. Thus, by the form of this very characteristic bone, *Ziphius* allies itself to *Hyperoodon*, and *Mesoplodon* to *Berardius*, and the two former approach nearest to *Physeter*, and the latter to the less-modified Dolphins.

The relationship between *Berardius* and *Mesoplodon* is undoubtedly close. One of the specimens (*M. hectori*) now under consideration has been placed sometimes in one genus and sometimes in the other; and it does certainly present some transitional characters; but as it is only known by the skull of a very young individual, it is scarcely safe to decide its position, except provisionally, especially as it is not yet known in which direction the alterations which must take place during the progress towards maturity tend.

The animal stranded at Lyall Bay, which I have called *M. australis*, is perfectly adult, as shown not only by the union of the sutures at the base of the cranium, but also by the condition of the other bones of the skeleton, the terminal epiphyses of the bodies, even of the thoracic vertebræ, being completely consolidated. The mesorostral or mesethmoid cartilage is densely ossified throughout its whole length. There is still much to be learned with regard to the mode of ossification of this cartilage. All the specimens which I have had an opportunity of examining are either so young that ossification has not commenced, and the trough of the vomer in the rostrum proper is completely empty in the dried skull, or so old that the consolidation of the cartilage and its union with the surrounding bone has been completed. But it must be observed that, although the cartilage appears to be nothing more than a continuation forwards of the ordinary mesethmoid lamina or septum of the nose, the ossification is not a simple extension forwards of that which occurs in all Cetacea (in all Mammalia, in fact) in the hinder or internarial portion of the septum, but appears to be an independent production, peculiar to the genera *Mesoplodon*, *Ziphius*, and certain allied extinct forms. It is separated by an interval (which appears to diminish with age, but of which traces can always be seen on the upper surface of the rostrum near its base) from the true mesethmoid ossification. It differs from the latter in being intensely hard and compact, whereas the mesethmoid is, especially at its anterior part, somewhat spongy in texture. It differs also in showing strong indications of being formed by a pair of lateral ossifications, united in the middle line, as the upper surface in many parts and the anterior apex show a marked median groove. I think it will be well therefore to adopt Professor Turner's name of "mesorostral" bone for this solid bar forming the centre of the rostrum, restricting "mesethmoid" to the part lying between the nares and a short distance in front of them, which is ossified in the

[1] Figured by Prof. Turner, *loc. cit.* plate xxx.

young animal and in all other species of Cetacea. The median ossicle in the snout of the Pig offers a similar case of an independent ossification in the anterior extremity of the mesethmoid cartilage.

The skull, as seen from above (Plate LXXI. fig. 1), presents several characters by which it can be readily distinguished from *M. bidens* and the closely allied *M. europæus*. The principal of these is the sudden narrowing of its outline at the commencement of the rostrum, due to the presence of the deep lateral groove mentioned above. In the British species the rostrum is wider at the base, and passes more insensibly into the cranium. The next point is the relative position of the præmaxillary (*pf*) and the maxillary (*mf*) infraorbital foramina—the former being behind the latter in the southern, and on the same level in the northern species. The third is the form of the præmaxillæ, which are more expanded and flattened out (especially the right) immediately in front of the narial apertures in *M. australis*. In the conformation of the upper ends of the præmaxillæ and of the nasal bones the differences are but slight.

M. layardi, as mentioned above, agrees with the northern species in the disposition of the infraorbital foramina, and the absence of any marked lateral basirostral groove; and by these as well as by its very characteristic dental characters it is distinguished from the one now under consideration. *M. densirostris* is much more closely allied to our new species, having (judging by the figure in Van Beneden and Gervais's Ostéographie, pl. xxv.) a very similar outline as seen from above. It differs, however, independently of the mandibular and dental characters, in the far more massive rostrum, which, although no longer, has exactly double the vertical height at the middle, as seen in the profile view of the skull.

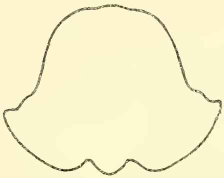
A marked difference is also seen on the lower surface of the skull. In *M. densirostris* the palate-bones completely surround the anterior pointed ends of the pterygoids, widely separating the latter from the maxillaries; while in *M. australis* the palatines on the inferior surface of the skull lie altogether on the outer side of the pterygoids, and do not even extend so far forwards as the pointed extremities of those bones, which thus by their free end and inner side come into direct contact with the maxillaries.

It remains only to compare this skull with the other New-Zealand forms—the typical *M. grayi* of Haast, the rostrum which I propose to call *M. haasti*, and *M. hectori*.

With the former it has very near affinities—so much so, that from an examination of the cranium alone I should scarcely think of placing them in different species.

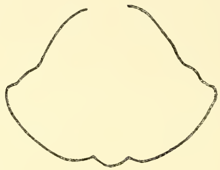
It is needless to dwell upon differential characters which may be merely individual; but I may indicate the following as perhaps of more importance. *a*. Size: *M. australis* would appear to be smaller than *M. grayi*. The two complete skulls are practically of the same size; but that of the former is adult and that of the latter young, and the tympanic bone of the latter is slightly larger than that of the former. Dr. Haast gives 17′ 6″ as the length of an adult female of *M. grayi*, whereas the adult *M. australis* (sex not stated) is given by Dr. Hector as 15′ 6″; this difference, however, can scarcely be considered beyond the limits of individual variation. *b.* The form of the tympanic bone differs slightly, the inner side of the posterior edge (as seen from below) being more bevelled and the inner posterior lobe less prominent in *M. australis*. *c.* The lateral groove at the base of the rostrum is very much deeper in *M. australis*, running upwards into the maxillary bone, and forming a blind pit at its upper termination, of the depth of nearly one inch, whereas in *M. grayi* this pit is quite shallow. It is possible, however, that this may be a question of age.

Fig. 1.



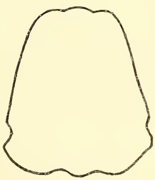
Mesoplodon australis (adult).

Fig. 2.



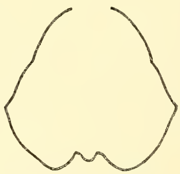
Mesoplodon grayi (young).

Fig. 3.



Mesoplodon haasti (adult).

Fig. 4.



Mesoplodon hectori (young).

Outlines of section of middle of rostrum. Natural size.

While the section of the rostrum of both the above (figs. 1 & 2) agree very closely in general outline and size, that of the supposed *M. haasti* (fig. 3) differs very greatly, being altogether more compressed and wanting the lateral wing-like ridges near the lower border; its length is also considerably greater, being $22\frac{1}{2}''$, while that of the adult *M. australis* is only 18″. Making every allowance for individual variation, it scarcely seems possible that a rostrum such as that shown in fig. 2 could change in the course of growth to that in fig. 3. If so, most of the determinations of the fossil species based solely upon the form of the rostrum are quite valueless.

It should be mentioned that in this fragmentary rostrum the lateral groove and pit at its base are deeper even than in *M. australis*, and that it departs, therefore, in this character, still further from (the young) *M. grayi*.

The cranium of *M. hectori*, from Titai Bay, New Zealand, now in the British Museum, presents a conformation quite distinct from that of either of the specimens last under consideration. As is shown in the synoptical table at p. 418, it more nearly resembles the northern species in the relation of the maxillary foramina, the absence of the basirostral groove, and, it may be added, the correlated greater breadth of the base of the rostrum. The skull is evidently that of a very young animal: the teeth are still concealed beneath the gum; the symphysis of the lower jaw is not united; the meso-rostral cartilage is entirely unossified; the basisphenoidal suture is open (as seen from the interior of the cranium; for on the outer surface it is covered by the vomer); and the bones generally are very spongy and greasy. On the other hand, the elements of the occipital bone have all coalesced with each other and with the basisphenoid. The principal difference between this cranium and that of *M. bidens* and, in fact, of all others of the genus, is that the upper extremities of the præmaxillæ are less developed laterally and less everted, and therefore approximate more to the form of *Berardius*; but unfortunately a large piece of one of these bones is broken off from the right side, or that which is usually most strongly marked, and it is impossible to say how much of the absence of characteristic eversion may be due to the immaturity of the specimen. There is also a greater elevation of the longitudinal ridge on the upper surface of the maxilla, immediately to the inner side of the anteorbital notch, than in any other *Mesoplodon*. This ridge, it should be remarked, forms a strongly pronounced elevation in *Berardius*, and is developed in *Hyperoodon* into the immense bony mass which forms such a characteristic feature of the skull of that genus. The nasals, however, are completely sunk between the ends of the præmaxillæ, whereas in *Berardius* they form prominent masses rising to the vertex.

The palate-bones only appear on the palatal surface as narrow strips on the outside of the pterygoids, not reaching as far forwards as they do. The vomer is visible in the middle third of the inferior surface of the rostrum.

The mastoids and squamosals are quite free; and the former are largely developed, forming the principal part of the great post-tympanic processes of the skull.

The tympanic is very slightly larger than that of *M. australis*, and therefore equal to that of *M. grayi*, and presents a very close resemblance to both, but is nearer in the form of the lobes at the posterior part to the former. I have not had an opportunity of comparing it with the tympanic of *M. bidens*. As the tympanic bone of *Berardius* is constructed on exactly the same type as that of *Mesoplodon*, this bone gives no assistance in determining the supposed relationship of *M. hectori* to *Berardius*.

The principal dimensions of these crania are as follows:—

	M. australis, adult.		*M. grayi*, young.		*M. hectori*, young.	
	inches.	millim.	inches.	millim.	inches.	millim.
Extreme length of cranium	30·3	770	30·3 [1]	770 [1]	22·3	567
Length of rostrum (from the apex of the præmaxilla to the middle of a line drawn between the anteorbital notches [2])	19·9	505	20·2	510	12·6	320
From middle of hinder edge of palate (formed by the pterygoids) to apex of rostrum	23·8	605	24·5	622	17·4	442
Greatest height of cranium from vertex to pterygoids	11·0	278	10·4	264	9·5	241
Breadth of cranium across middle of superior margin of orbits	11·2	283	10·5	268	9·2	235
Breadth of cranium between zygomatic processes of squamosals	11·7	298	11·1	282	10·2	259
Breadth between anteorbital notches	7·4	187	7·2	183	5·3	135
Breadth of middle of rostrum	1·7	44	1·6	40	1·5	37
Breadth of occipital condyles	3·9	99	3·7	95	3·6	92
Præmaxillæ, greatest width behind anterior nares	5·4	138	5·1	138	4·6	117
Præmaxillæ, least width opposite anterior nares	4·4	111	4·0	103	4·2	107
Præmaxillæ, greatest width in front of anterior nares	4·6	117	4·4	111	4·5	114
Width of anterior nares	2·0	52	2·1	53	2·0	51
Length of tympanic bone	1·9	49	2·0	51	2·1	54
Greatest breadth of tympanic bone	1·3	32	1·4	35		
Mandible, length of ramus			26·0	660	19·1	484
Mandible, length of symphysis			8·4	214	5·9	150
Mandible, greatest vertical height of ramus			4·1	105	3·3	83

The lower jaw appears to present no differentiating characters whereby the different species of *Mesoplodon* can be distinguished, except as regards the implantation of the teeth, which will be considered presently.

The thyro- and basihyals are present in the younger skeleton but not in the older one. They are not united. In general form they resemble those of *Berardius* and the ordinary Dolphins, presenting none of the peculiar enlargement and flattening characteristic of *Physeter* and *Kogia* and seen to a slight extent in *Hyperoodon*. The stylo-hyals are preserved in both skeletons, and, allowing for difference of age, are similar. They do not present the simple cylindrical characters of the same bones of all the true Dolphins, and even of *Physeter* and *Berardius*, but are (especially those of the older specimen) remarkably flattened and widened towards the lower end, and thus approximate to the form which has hitherto been thought peculiar to *Hyperoodon*. In *M. australis* these bones have a length of $5''\cdot 6 = 142$ millims., and a greatest

[1] As the apex of the rostrum is still covered with the dried gum, this is not absolutely exact.

[2] I have thus defined the commencement of the rostrum for the sake of uniformity with previous measurements; but, owing to the breadth of the maxilla in front of the anteorbital notches, the rostrum in *Mesoplodon* appears to commence more than an inch in advance of the spot indicated.

breadth of $1''\cdot 3 = 34$ millims; in *M. grayi*, a length of $5''\cdot 3 = 135$ millims. and a breadth of $1''\cdot 0 = 26$ millims.

Dental characters.—All the Ziphioid Whales have previously been characterized as having " no functional teeth in the upper jaw. Teeth of mandible quite rudimentary and concealed in the gum, with the exception of one or occasionally two pairs, which may be largely developed, and project like tusks from the mouth, especially in the male sex "[1].

A series of small rudimentary and concealed teeth has been shown to exist in the lower jaw, behind the large functional teeth, in *Mesoplodon bidens*, by Gervais, in the upper jaw of *Ziphius cavirostris* by Gervais, and in both the upper and lower jaw of a member of the same genus, if not species, by Burmeister; and they may have been present, but overlooked, in many other specimens, as such teeth, not being fixed in the bony alveoli but only attached loosely in the gums, would invariably be lost by maceration. The discovery by Dr. von Haast of the constant presence, in many individuals of different ages and sexes, of a row of small teeth of determinate number and definite form, with their crowns projecting beyond the gum of the upper jaw, in a species of *Mesoplodon*, is therefore of great interest. We have here the permanent retention of a condition intermediate between that of the irregular, completely concealed, probably only temporary, and quite functionless teeth mentioned above and the normal state of dentition of the true Dolphins; and it is especially interesting that this should have been met with in a member of the genus otherwise least modified from the Dolphins. I must, however, take leave to differ from Dr. Haast in thinking that it is a difference of generic importance, especially as it is associated with no other structural peculiarity, as far as is at present known[2].

These teeth, from seventeen to nineteen in number on each side, are entirely unconnected with the bone; and when the dense fibrous gum is removed there is no trace of a socket or groove for them. They have been preserved in the specimen under description, the soft coverings of the rostrum having been allowed to dry upon it. They are nineteen in number on each side, and occupy a space of four inches in the middle of the rostrum, the anterior teeth being seven and a half inches from the apex. The first is very minute; but they gradually increase in size to about the sixth, then remain nearly equal, but diminish again, though not to the same extent, in the posterior part of the series. They are slender, conical, compressed from before backwards, and incurved at the apex, with sharp-pointed enamelled crowns, resembling, in fact, those of the genus *Delphinus* in miniature. The apices of many are broken or blunted; whether from use or after

[1] Trans. Zool. Soc. vol. viii. p. 204.

[2] Professor Gervais seems to be of the same opinion, as he says, " Mais c'est particulièrement auprès du *Mesoplodon sowerbense* qu'il doit prendre place, et dans la rangée de dents qu'il présente dans une partie de la longueur de sa mâchoire supérieure, on ne trouverait aucune bonne raison pour le séparer génériquement de ce dernier, encore moins du *Dolichodon*" (Ostéographie des Cétacés, livr. xv. p. 518).

death can scarcely be determined now; but Dr. v. Haast mentions that in his recent specimens some of the teeth were "evidently worn down from use." The crowns of the largest of these teeth are 4 millims. in length, projecting that distance above the gum in its present dried state, though when recent they must have been covered to a larger extent. Some teeth of an older individual (figured in P. Z. S. 1876, p. 10) are somewhat larger. Their whole length, including crown and root, is 12 millims. or half an inch, and their greatest thickness (in the part concealed by the gum) $2\frac{1}{2}$ millims. There is no evidence of the presence of any such teeth in *M. australis* or *M. hectori*; and whether they were present or not in *M. haasti* I am not able to say, as the bones were cleaned before they came into my possession.

The genus *Mesoplodon* is characterized by possessing a single pair of compressed mandibular teeth, which are usually situated at about one third of the distance from the apex of the mandible to the condyles, or opposite the hinder edge of the symphysis. This is, in fact, their situation in all known species, except *M. europæus* and *M. hectori*; and it is doubtful whether the first should be considered an exception; for though the teeth are situated further forward than in the others, relatively to the whole ramus of the mandible, they have the same relation to the hinder border of the symphysis, which appears (judging only by the published figure) to be shorter than in the other species. The teeth of the different species appear to agree in their essential structure [1], having a small and pointed enamel-covered crown, composed of true dentine, which, instead of surmounting a root of the ordinary character, is raised upon a solid mass of osteodentine, the continuous growth of which greatly alters the form and general appearance of the organ as age advances, as seen most strikingly in the case of *M. layardi*.

The changes that take place during growth in the mandibular teeth of *M. grayi* are well exemplified in the different specimens described by Dr. v. Haast. In the young male skeleton the apex of the tooth projects but a quarter of an inch above the level of the alveolar margin, and is quite unworn. During life it was probably altogether concealed beneath the gum, though the animal had attained three fourths of its full dimensions. The apex is directed upwards and outwards. It lies in a special expansion of the dental groove, which groove, it should be mentioned, continues to exist, even in the aged animal, in a marked degree, along the whole upper border of the dentary portion of the ramus. Although quite loose, it could not be removed to examine its base until a portion of the bone had been cut away; yet in the old tooth, which completely filled the socket, owing to the alteration of the form of the latter this difficulty did not exist.

When removed the tooth has a triangular form; the apex, which is pointed and somwhat everted, is covered with a thin layer of enamel, which extends to a greater distance (*i e.* 13 millims.) in front and behind than at the sides (7 millims.) The

[1] See E. Ray Lankester, Trans. Microsc. Soc., new series, vol. xv. 1867, p. 55, and Trans. Zool. Soc. vol. viii. p. 223.

height of the tooth at the middle is 1″·7, or 43 millims. The base is extended antero-posteriorly to a length of 2″·1 or 53 millims., and has a rough, spongy, unfinished and laminated edge, without any distinct pulp-cavity. The greatest lateral thickness of the tooth is 6 millims. or 0″·25.

The old specimen (*M. haasti* of this communication) has a tooth very closely resembling that of the adult *M. grayi*, judging of the latter from Dr. Haast's description and from photographs which he has sent me, and well illustrates the changes which have taken place in passing to maturity. These are:—rounding of the apex, with almost complete destruction of the enamel, except a small patch on the hinder part of the tooth; great wear of the whole anterior edge or shoulder of the tooth; and a great increase of the supporting mass or bone, the growth of which is evidently completed, as the lower edge is now firm and rounded, and has developed upon it a number of short root-like processes. The height of the tooth is 3″·3 = 84 millims., its greatest antero-posterior breadth 3″·9=99 millims., its greatest lateral width 11 millims. or nearly half an inch[1].

This tooth is therefore of altogether a different form from that of the adult *M. bidens* and *europæus*, in neither of which does the base enlarge in the antero-posterior direction, but forms an oblong figure with parallel sides, the axis of which does not coincide with the axis of the apex. Neither has it any resemblance to that of *M. layardi*, the highly characteristic form of which has already been pointed out. In *M. densirostris*, though the exposed portion of the tooth is triangular and has its apex placed nearly vertically, as in *M. grayi* and *M. haasti*, the root when complete assumes an oval form, contracting towards the base, and its vertical direction greatly exceeds the antero-posterior. Most unfortunately, in the otherwise nearly perfect adult skeleton of *M. australis*, these most important and characteristic organs are wanting. They were carried off, as Dr. Hector informs us, by some mischievous boys, by whom the jaw-bone was broken into many pieces in extracting them; and thus no satisfactory idea even of the form of the alveolus can be obtained. As, however, the whole of the symphysis, with the anterior margin of the left alveolus, is preserved, it can be demonstrated that the situation of the tooth in relation to the mandible was quite the same as in *M. grayi* and *M. haasti*, though (in accordance with the general smaller size of the individual) the distance between the apex of the mandible and the tooth is somewhat less than in the latter.

It is very probable that the fragment of a jaw of a very young *Mesoplodon*, found on the beach at Kaikoura, and described and figured by Dr. Hector, may belong to this

[1] It has long been suspected that the sexes of *Mesoplodon* differ greatly in the development of the teeth; but, owing to the want of materials, this has not been definitely proved. Of *M. grayi*, however, Dr. Haast informs us that in a full-grown female "the mandibular tooth could scarcely be felt when passing the finger over the gums; and its existence could scarcely have been ascertained in that way had I not known its position" (P. Z. S. 1876, p. 458).

species [1]. The tooth is in a very early stage of development, being merely a hollow cap of dentine, with a smooth and enamelled tip, and entirely embedded within the alveolus. The formation of the base of osteo-dentine appears not to have commenced. It is compressed and triangular, smaller than the young specimen of *M. grayi* described above, and of different form, being narrower at the base, compared with the height; but, as in that specimen, the apex was placed quite vertically. From so very young a tooth it is not safe to draw conclusions as to the ultimate form the organ would assume.

With regard to *M. hectori* the same difficulty exists. The only specimen known is so young as to have the teeth entirely embedded in the alveoli; but, as before mentioned, their situation at the anterior extremity of the mandible distinguishes this from all other species. The apex, which is the anterior part of the tooth as it lies in its socket, is exactly 1 inch from the anterior margin of the symphysis. The tooth is very much compressed, being no where more than 5 millims. in breadth. The base is composed of two laminæ, nearly in contact, with an open fissure between them. The point is sharp, capped with enamel to the extent of 8 millims. The height of the tooth is 1″·2 or 31 millims., the antero-posterior diameter of base 1″·1 or 28 millims.

Vertebral Column.—The length of the vertebral column of the adult *M. australis*, all the bones being placed in apposition, is 130 inches. Allowing the same increase for the intervertebral substance which was found in a common Porpoise, viz. as 115 is to 100 [2], we should obtain a length of 150 inches; the length of the skull (30 inches) added to this gives a total length of 180 inches, or 15 feet, for the whole skeleton, which corresponds very closely with Dr. Hector's measurement of 15 feet 6 inches for the animal when recent [3].

In the younger skeleton of the typical *M. grayi* the vertebræ measure 123 inches; and by the same process the whole skeleton would be 14 feet 3 inches, rather more than the length given by Dr. Haast, viz. 13 feet 8 inches; but of course the allowance made above for the intervertebral substance is only approximative. Dr. Haast gives the length of an adult female of the same species as 17 feet 6 inches [4].

The skeleton of *M. australis* has the following vertebral formula:—C. 7, D. 9, L. 11, C. 20 = 47; that of *M. grayi* has C. 7, D. 10, L. 11, C. 20 = 48. In both cases there is probably one minute terminal vertebra wanting.

These numbers closely correspond to those of the few other complete skeletons of *Mesoplodon* known, viz.:—that of *M. bidens* at Brussels, which has (according to Van Beneden) C. 7, D. 10, L. 10, C. 19 = 46; that of the same species at Gothenburg, which has C. 7, D. 10, L. 9, C. 20 = 46 (Malm); and that of *M. layardi*, at the Canter-

[1] Notice of a variation in the dentition of *Mesoplodon hectori*, Gray, Trans. N.Z. I. vol. vi. p. 86, pl. xv. A, 1874.

[2] See Trans. Zool. Soc. vol. vi. p. 311.

[3] Trans. New-Zeal. Inst. vol. vii. p. 262.

[4] Proc. Zool. Soc. 1876, p. 457.

bury Museum, New Zealand, which has C. 7, D. 10, L. 10, C. 19 = 46 (Haast, P. Z. S. 1876, p. 481).

The cervical vertebræ of the two skeletons are very much alike; indeed, considering the difference of age and the great tendency to individual variation, it may be doubted whether any differences that may justly be called specific can be detected between them. In both the atlas and axis are completely united by the whole of the body and arch, except for the spaces in the latter which constitute the foramina for the exit of the second cervical nerves; in both all the other vertebræ are perfectly free[1]. This is the minimum of vertebral union known in any Ziphioid, and is the same which occurs in the specimens of *M. bidens* at Brussels and at Gothenburg. In *M. layardi* the atlas and the second and third cervical vertebræ are united into one large triangular bone, the rest are all free[2]. In the skeleton of *Berardius arnouxi*, in the Museum of the College of Surgeons, the third is united by its body to the completely conjoined first and second. In the fine skeleton of *Ziphius cavirostris* from Villa Franca, in the Museum at Jena, the first, second, and third vertebræ are completely united by their bodies, and the fourth is joined to them by the spine. In another specimen from Corsica, described by Fischer, the six anterior vertebræ are united. In the Gothenburg *Ziphius* the first four are joined. In *Hyperoodon* the bodies of all seven are firmly united together, and the spines of all except the seventh join to form a single elevated conical mass.

The arch of the atlas bears in both specimens a complete foramen for the passage of the cervical or suboccipital nerve, not a groove only, as in *Berardius*. In other respects these bones bear a great resemblance to those of that genus, more than they do to *Ziphius* and, *à fortiori*, to *Hyperoodon*.

In *M. grayi* the upper and lower transverse processes of the axis are united on the left side, leaving only a small circular foramen between them at the base; but on the right side in this specimen, and on both in *M. australis*, the processes are quite distinct, and separated by a wide notch. In all the other vertebræ, as far as the sixth, the upper and lower processes are present and not united. They are developed in a nearly corresponding degree in the two specimens, except that in the sixth vertebra the upper process is very rudimentary in *M. australis*, and the left lower process is developed to nearly double the length of the right. This is evidently an individual peculiarity.

These processes differ very considerably from the corresponding parts of *Berardius*, as they are directed downwards, outwards, and in the main backwards, instead of forwards as in *Berardius*, in which it is the anterior portion of the process, and not the principal or posterior part, which is chiefly developed[3].

The arches and spines of the cervical vertebræ are better developed generally than in

[1] Dr. Haast tells me in a letter (Dec. 12, 1876) that in the skeleton of an adult female of *M. grayi* the third cervical vertebra is united to those before it.

[2] Haast, P. Z. S. 1876, p. 482.

[3] See Trans. Zool. Soc. vol. viii. p. 225.

Berardius. They are all completely united above, except the fifth of the young *M. grayi*. In the sixth, in both specimens, the spine is so well developed as to equal in height the spinal canal over which it is placed. In the seventh, in *M. australis*, it is considerably higher than in *M. grayi*, and also much stouter at the base. It is a question, however, how much the difference between the two may be due to age. The seventh in both has a large articular surface on the posterior edge of the side of the body for articulation with the head of the first rib. At the lower end of this surface is a small tubercle representing the inferior transverse process of the preceding vertebra.

Dimensions of the Cervical Vertebræ.

	M. australis.		*M. grayi.*	
	inches.	millim.	inches.	millim.
Antero-posterior length of the bodies of the seven vertebræ in contact (inferior surface)	5·1	130	4·9	124
Length of body of united first and second	1·9	48	1·7	43
Length of body of seventh	·9	23	·6	15
Height from top of spine to lower edge of body of atlas	5·1	130	4·6	117
" " " third vertebra	4·1	104	3·5	89
" " " sixth vertebra	5·5	140	5·0	127
" " " seventh vertebra	7·1	180	5·6	142
Breadth between outer borders of articular surfaces of atlas	3·7	94	3·9	99
Breadth between ends of transverse processes of atlas	5·6	142	5·5	140

It will be seen from the above that the only measurement in which *M. grayi* exceeds *M. australis* is the width of the surfaces for articulation with the occipital condyles. This, taken in conjunction with the immaturity of the specimen, is a tolerably sure indication that it would, if adult, attain a larger size than the latter.

The thoracic vertebræ of both skeletons present all the characteristic features of the group, the most remarkable of which is the sudden transition of the articulation of the ribs from the upper to the lower processes, by which the Physeteridæ are distinguished from the Delphinidæ. The principal difference between the two is that in *M. australis* there are but nine with nine pairs of ribs (as in *Hyperoodon*), whereas in *M. grayi* there are ten, as in all the other recorded examples of *Mesoplodon* [1].

In the erect high spines of the thoracic vertebræ *Mesoplodon* resembles both *Ziphius* and *Hyperoodon*, and differs in a marked manner from *Berardius* [2].

[1] It should be mentioned that, according to Hector's original description (Trans. N.Z. Inst. vol. vii. p. 262), the skeleton of *M. australis* had ten pairs of ribs; but the number now present with it is that which I have stated above, and the vertebra which I have reckoned as the first lumbar bears no trace of an articulation for a rib at the end of the transverse processes. Moreover a close comparison shows that the rib which is wanting would not correspond to the last of *M. grayi* or the other ten-ribbed species, but rather to one from the middle of the series; and yet there is no indication of the accidental loss of both vertebra and pair of ribs, which must have been the case if Dr. Hector's enumeration was correct.

[2] See Trans. Zool. Soc. vol. viii. p. 226.

Articular surfaces of the arch, or zygapophyses, are developed in all the anterior vertebræ as far as to between the sixth and seventh in *M. australis*, and as far as the tenth (though in a very rudimentary condition) in *M. grayi*. Metapophyses first appear as distinct tubercles in both on the anterior edge of the transverse process of the third vertebra, and gradually increase in size in passing backwards. Articular surfaces for the heads of the ribs on the hinder edge of the body occur from the first to the seventh inclusive in both, for the tubercles of the ribs on the transverse processes from the first to the seventh in *M. grayi*, and to the seventh on the left side only in *M. australis*. The last two (or the ninth and tenth in *M. grayi*, and the eighth and ninth in *M. australis*) have the rib attached to the end of the transverse process springing from the side of the body of the vertebra. The eighth rib in *M. grayi* is attached to the articular surfaces on the contiguous sides of the body of the seventh and eighth vertebræ, on a line with the last, and not to any transverse process; so in this specimen seven ribs are attached in the ordinary way by upper and lower attachments to body and transverse process, and three to the lower attachment only. In *M. australis* six were attached by the former method, two by the latter, and the intermediate one by the former method on the left, and the latter on the right side; so that the seventh vertebra and pair of ribs appear clearly to represent both seventh and eighth of the other specimen combined in one, and so to account for the smaller number altogether.

The lumbar vertebræ are all very much alike in both skeletons. Their bodies, as in all the Ziphioids, are long compared with those of the true Dolphins, their length considerably exceeding their transverse diameter. They are strongly carinate below. The transverse processes are short, their length not exceeding the width of the body; their bases arise from rather more than the anterior half of the sides of the body; they are all directed forwards, and rounded at the free extremity. The spines are very long, and nearly vertical, much compressed laterally, but broad from before backwards (exceeding half the length of the body), expanding and truncated at their upper extremity. They all have broad, flattened, lamelliform metapophyses, projecting forwards from the anterior edge of the lamina, at nearly the same level throughout the series.

The caudal vertebræ in the two skeletons bear the closest resemblance in all essential features. The one which I have reckoned as the first of this series differs from the lumbar vertebræ in having the keel rudimentary and divided posteriorly, where it presents slight indications of the presence of chevron bones, probably in a rudimentary condition, as they were not preserved in either skeleton. In the second and succeeding vertebræ the median line of the inferior surface is channelled, and has a pair of lateral longitudinal ridges terminating in front and behind in the articular surfaces for the chevron bones. In both skeletons there are eleven of the series of compressed or chevron-bone-bearing caudal vertebræ; the twelfth is the transitional vertebra; and there are thirteen of the depressed form, which lie within the laterally expanded portion of the tail. As before mentioned, the appearance and size of the last vertebra present leads to the belief that in both cases an additional minute terminal vertebra has been lost.

The arches and spines gradually diminish from the first, the last being on the eleventh in both skeletons; and in both the last trace of a transverse process is seen on the ninth. As in *Berardius*, the transverse processes are not perforated, but grooved posteriorly. In the eighth of *M. grayi* a vertical arterial canal passes through the base of the rudimentary transverse process, which in the corresponding vertebra of *M. australis* is grooved only; in the ninth and all succeeding vertebræ of both skeletons the canals pierce the sides of the bodies.

Of chevron bones there are nine present in the skeleton of *M. australis*, and eight in that of *M. grayi*. These evidently correspond, the ninth being absent in the latter. The first (probably in reality the second) is small, and with the apex directed forwards. It consists of two laminæ, united in the middle line below, but not developing a keel. The next has a considerable keel. The third is the largest, and in the adult skeleton has a flattened rough surface at the apex. The fourth has a shorter but broader keel; and from this they gradually diminish to the end. The hæmal spines are longer proportionally than in *Berardius*, corresponding in this respect with the neural spines.

The *Sternum* of the adult *M. australis* (Plate LXXIII. fig. 5) consists of four distinct segments, connected only by cartilage, and, as is usual in the Ziphioids, not completely ossified in the middle line, so that a notch is left at the anterior and posterior end of each, forming a series of median foramina in the complete sternum. That between the third and fourth, however, is very small; that between the second and third is largest. At the anterior extremity two processes, projecting forwards, curve inwards, and nearly enclose another fenestra. The articular surfaces for the costal cartilages are well marked. The first is on the side of the first segment; the second between the first and second segment; the third between the second and third; the fourth between the third and fourth; the fifth on the side of the fourth segment. The terminal piece is unsymmetrical, being longer on the right than on the left side. The extreme length of the ossified sternum is 20 inches (508 millims.); the greatest breadth across the first segment is 5·8 inches (148 millims.).

In *M. grayi* the sternum (Plate LXXIII. fig. 2) presents all the characters of immaturity, the anterior and other processes being completely undeveloped. Otherwise it is of much the same form as the former; but the part corresponding to the fourth segment of that one is larger, and separated into two by a transverse suture, of which but slight indications are to be seen at the same place in the sternum of *M. australis*. Its length is 17 inches =432 millims., its greatest breadth 5″·7=145 millims.

The Ribs.—In the skeleton of *M. australis* there are nine, in that of *M. grayi* ten pairs of ribs[1]. In the former the first to the seventh inclusive have distinct articular surfaces on the head and the tubercle; the seventh on the left side is transitional; the remainder want the neck and head, articulating only by the tubercle to the extremity of the transverse process of the vertebra.

In *M. grayi* the first to seventh on both sides have distinct necks, and capitular and tubercular articular surfaces; the three others, wanting the head and neck, articulate only by the tubercle to the extremity of the transverse process. The general characters of the ribs are, of course, more marked in the older specimen; but otherwise they agree. The first is very broad and flat; and in all the angle and a space beyond presents a more or less strongly pronounced flattened surface on the outer side, with prominent posterior edge. This character, scarcely seen in the first, gradually becomes more marked to the last. None of the ribs materially increase in breadth at the lower extremity.

The sternal ribs in both skeletons, as in all Physeteridæ, are not ossified.

Pectoral Limb.—The scapula is perfectly delphinoid in form, more even than in *Berardius*, and therefore further removed from *Physeter* than any other Ziphioid, *Hyperoodon* being the nearest. The only differences between the two specimens are such as might arise from want of ossification of the suprascapular cartilage, and of the end of the coracoid process in the younger specimen. The humerus, and especially the ulna and radius, present the simple elongated narrow form characteristic of the Ziphioids, and by which they are easily distinguished from the Delphinidæ. Allowing for difference of age, there is nothing by which the two individuals can be specifically distinguished. The same can be said of the bones of the *manus*, as far as the available materials serve for comparison. In *M. grayi* both are quite complete; and in *M. australis* one hand is nearly so.

This segment of the limb closely resembles that of *Berardius*[2], except that the singular union of scaphoid and lunar, and of cuneiform and unciform bones, noticed in that animal, does not occur. The bones of the first row, the scaphoid, lunar, cuneiform, and pisiform, are all distinct. In the second row the trapezoid and magnum are united into a single bone, as in the skeleton of *M. bidens* in the Brussels Museum[3]. The first digit has a single slender phalanx; the second has six, the third the same number, the last being a minute nodule, scarcely larger than a pin's head; the fourth has three, and the second two phalanges. These are the complete number of the adult skeleton.

[1] Dr. Haast mentions in a letter (dated March 8th, 1876) that one specimen of *M. grayi* has ten, another eleven pairs of ribs.

[2] Trans. Zool. Soc. vol. viii. pl. 28. fig. 10.

[3] In the specimen at Gothenburg, Malm figures these bones as distinct, *loc. cit.* pl. v. fig. 52.

Dimensions of the Bones of the Pectoral Limb.

	M. australis.	*M. grayi.*
Scapula: height from middle of external margin of glenoid fossa to middle of superior border	in. millim. 8·2=208	in. millim. 7·3=185
Length from anterior to posterior superior angle	12·8=325	11·3=287
Length of pectoral limb from head of humerus to end of second digit	19·0=483	17·0=432
Humerus: length	5·3=135	5·2=132
Breadth at lower end	2·5= 64	
Radius: length	6·0=153	5·6=143
Ulna: length, including olecranon	6·5=166	5·9=150
Breadth of radius and ulna at lower end	3·1= 78	3·0= 75
Length of manus	9·0=229	7·0=178 [1]

Summary and Conclusion.

The evidence which has accumulated up to the present time is sufficient to show that there are at present existing in many parts of the ocean several distinct, though closely allied, species of Cetaceans, united by common characters, to which the generic name *Mesoplodon* may be applied. The reasons for the choice of this name in preference to many others which have been applied to members of the group have been fully stated in a previous communication [2].

The nearest known ally to these animals is unquestionably *Berardius*, although in some characters, especially the form of the spinous processes of the vertebræ, they rather resemble *Ziphius* and *Hyperoodon.*

With the three genera just named they form a natural group, allied on the one hand to *Physeter*, and on the other to the true Dolphins; but their affinities are, on the whole, nearest the former, which, indeed, may be regarded as a highly specialized form of the same type, *Hyperoodon* coming next to it, and *Mesoplodon* being the most generalized.

Gervais, who founded the name *Mesoplodon*, making *M. bidens* or *sowerbiensis* the type, did not include two species assigned to it above, viz. *M. densirostris* and *M. europæus*, but put them in another genus, *Dioplodon*, an arrangement to which he adheres in his recently published ‘Ostéographie des Cétacés.’ He has, however, never clearly defined the distinction between the two groups; and it is exceedingly difficult to discover any characters common to the two last-named species which is not also possessed by the former. This has been the opinion of most authors who have investigated the subject subsequently, as Duvernoy, Fischer, E. Deslongchamps (who, however, uses the name *Dioplodon* for the whole genus), and Van Beneden. A close examination of the cranial characters of the known species does, however, reveal

[1] As these measurements were taken after drying, the disproportionate shortness of the manus of the second specimen may in a great measure be accounted for by the shrinking of the cartilages, which occupy in it a far more considerable proportion than in the older animal.

[2] Trans. Zool. Soc. vol. viii. p. 208.

differences by which the group may be divided into two sections, not equivalent to those of Gervais, but to which, if thought advisable, his names might be applied, as his *Mesoplodon sowerbiensis* may be taken as the type of one, and his *Dioplodon densirostris* as the type of the other. To the first (*Mesoplodon* proper) belong *M. bidens*, *M. europæus* (if distinct), *M. layardi*, and *M. hectori*; to the second (to which the name *Dioplodon* may be given if it should appear that a generic term is necessary to distinguish it), *M. densirostris*, *M. australis*, *M. grayi*, and *M. haasti*. Certain cranial characters, and the position of the large mandibular tooth, distinguish *M. hectori*, and may possibly afford grounds for placing it in another section intermediate between *Mesoplodon* and *Berardius*; but with the present limited knowledge of its structure, derived only from the cranium of a very young individual, I think it preferable to retain it provisionally in the position to which it is assigned above. The structure of the vertebral column, when known, will throw light upon its relationship to *Berardius*. The objection that the name *Mesoplodon* is not applicable to this species is scarcely worth considering, as it is a case in which "the sooner a term becomes an arbitrary sign the better"[1].

The further subdivisions which have been proposed, as *Dolichodon* and *Callidon*, of Gray, and *Oulodon* of Haast, appear to me unnecessary, though, with regard to the latter, this may be a matter of opinion.

It has been assumed above that the different individuals assigned by various authors to the *M. bidens* or *sowerbiensis* are really one species; for I have not had an opportunity of making a critical comparison of them, though it would be desirable to do so as soon as a sufficient number of specimens are collected in our Museums to afford materials for thoroughly estimating all the variations to which they may be subject according to sex and age. Perhaps more light may then be thrown upon the relation to that species of the solitary example known of *M. europæus*, which is at present not a very satisfactorily established species.

Of the southern species, *M. layardi*, *M. densirostris*, and *M. grayi* are thoroughly well established; complete skeletons of each are in existence, and have been more or less perfectly described, though, unfortunately, no skeletons of either of the two former have yet reached Europe. *M. australis* is known by the skeleton, complete but for the important exception of the mandibular teeth; further evidence of its distinctness from *M. grayi* may perhaps be considered desirable. *M. haasti* is only known by a rostrum and mandible. *M. hectori* must be a totally distinct form, though at present very imperfectly known.

The geographical distribution of the group has a very great interest in relation to that of many other Australian groups, both of vertebrates and invertebrates. Among the earliest known remains of Cetacea, in the Belgian and Suffolk Crags, *Mesoplodon* and closely allied forms are most abundant. Up to little more than ten years

[1] Owen, Trans. Geol. Soc. 1857, p. 55.

ago the few stray individuals of *M. bidens* occasionally stranded on the shores of North Europe were supposed to be their sole survivors. Since that time it has been proved that they are still numerous in species, and even in individuals (as many as twenty-five of *M. grayi* having been stranded on one occasion on the Chatham Islands, and four at another time on the New-Zealand coast, where it is sufficiently abundant and well known to have obtained the local name of Cowfish[1]) in the seas which surround the Australian continent, extending from the Cape of Good Hope on the one side to New Zealand on the other, though beyond these limits no specimens have yet been met with. It is the history of the Marsupial Mammals, of *Ceratodus*, of *Terebratula*, and of numerous other forms.

As the food of these Cetaceans consists, as far as is known, mainly of *Loligo* and other free-swimming Cephalopods, which frequent the open ocean, we need not be surprised if it should be found that their range in space is tolerably wide, although, with our present imperfect information, many of the species appear to be local.

The great advance that has been made in our knowledge of this interesting group in so short a period should encourage those to whom it is due not to relax their efforts to secure every specimen that may be brought within their reach.

Postscript.—Since this memoir was communicated to the Society I have received (Dec. 4th, 1877) the XVth part of the great 'Ostéographie des Cétacés, Vivants et Fossiles,' by Van Beneden and Gervais, in which the latter author describes and figures a complete skeleton of *Mesoplodon grayi*, also obtained by Dr. v. Haast, of the same age and sex as the specimen described above, and from the same locality. It appears to correspond in every detail with that described in the present memoir.

DESCRIPTION OF THE PLATES.

PLATE LXXI.

Fig. 1. Upper surface of cranium of adult *Mesoplodon australis*, from the specimen in British Museum.

Fig. 2. Upper surface of cranium of young *Mesoplodon grayi*, from the specimen in the Museum of the Royal College of Surgeons.

Fig. 3. Upper surface of rostrum of adult *Mesoplodon haasti*, from the specimen in the Museum of the Royal College of Surgeons.

[1] Haast, P. Z. S. 1876, pp. 7 and 457.

Fig. 4. Upper surface of cranium of young *Mesoplodon hectori*, from the specimen in the British Museum.

m.f, maxillary, *p.f*, præmaxillary division of the foramen for the exit of the infra-orbital branch of the second division of the fifth nerve.

All one fourth of the natural size.

PLATE LXXII.

Fig. 1. Side view of cranium of adult *Mesoplodon australis*, from the specimen in the British Museum.

Fig. 2. Side view of cranium and mandible of young *Mesoplodon grayi*, from the specimen in the Museum of the Royal College of Surgeons.

Fig. 3. Side view of the rostrum and mandible of adult *Mesoplodon haasti*, from specimen in the Museum of the Royal College of Surgeons.

Fig. 4. Side view of the cranium and mandible of young *Mesoplodon hectori*, from the specimen in the British Museum.

All one fourth of the natural size.

PLATE LXXIII.

Fig. 1. Side view of the articulated skeleton of the young *Mesoplodon grayi*, in the Museum of the Royal College of Surgeons.

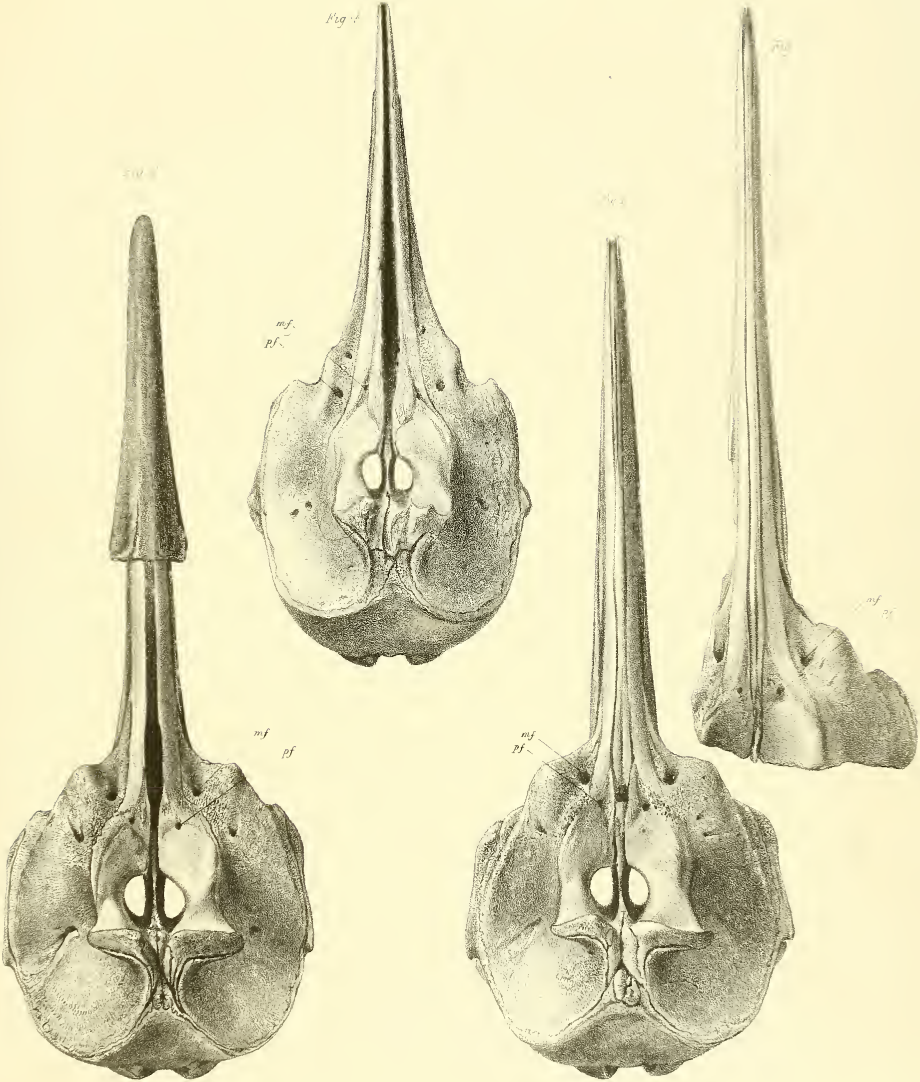
Fig. 2. Sternum of the same.

Fig. 3. Upper surface of the vertebral column of adult *Mesoplodon australis*, from the specimen in the British Museum.

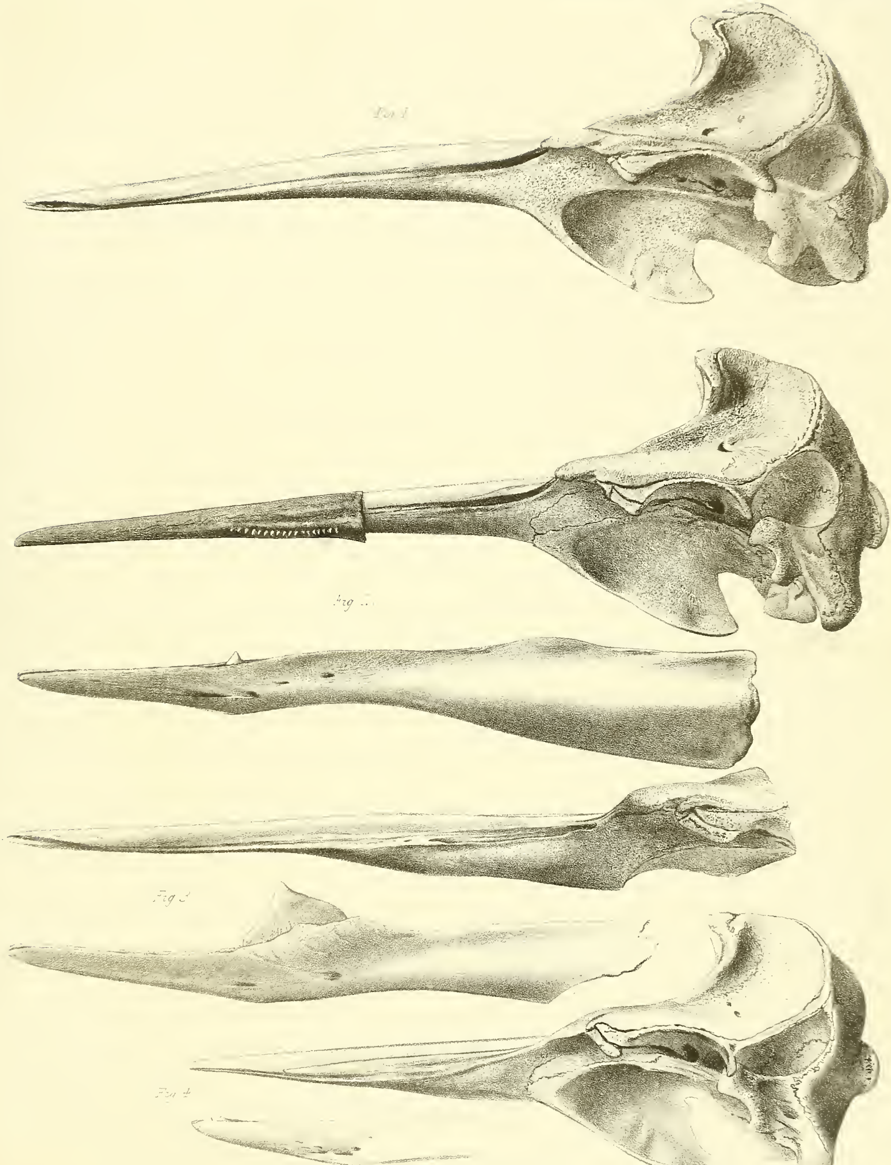
Fig. 4. Side view of the same.

Fig. 5. Sternum of the same.

[It was intended that these figures should all be reduced to the same scale, viz. $\frac{1}{10}$; but by some error figs. 1 and 2 are reduced to about $\frac{1}{11}$, and figs. 3, 4, and 5 to between $\frac{1}{9}$ and $\frac{1}{10}$, giving the appearance of greater relative size to the latter skeleton than it really possesses.]



MESOPLODON 1, AUSTRALIS 2, GRAYI 3, HAASTI 4, HECTORI



MESOPLODON 1. AUSTRALIS 2. GRAYI 3. HAASTI 4. HECTORI

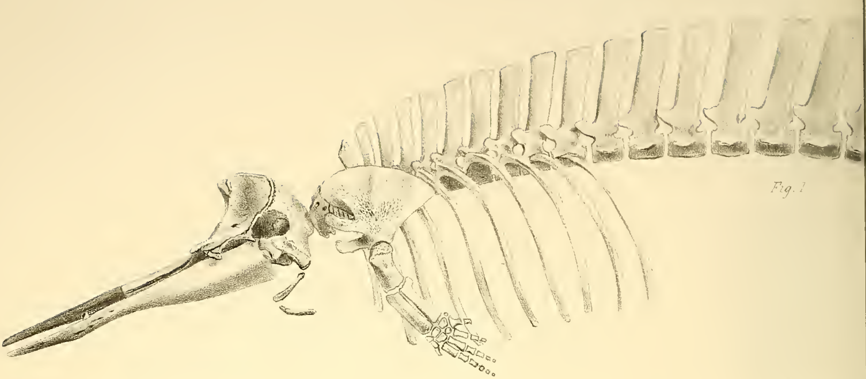


Fig. 1

Fig. 2

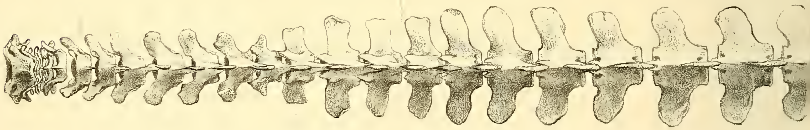
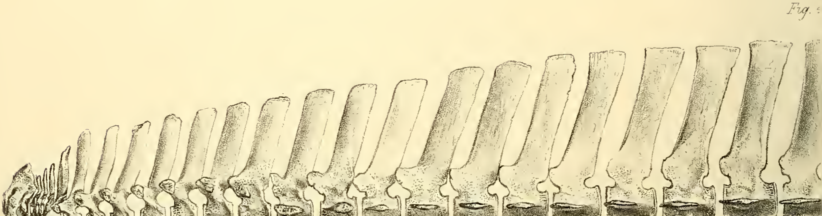


Fig.



J Smit lith.

MESOPLODON. 1,2 C

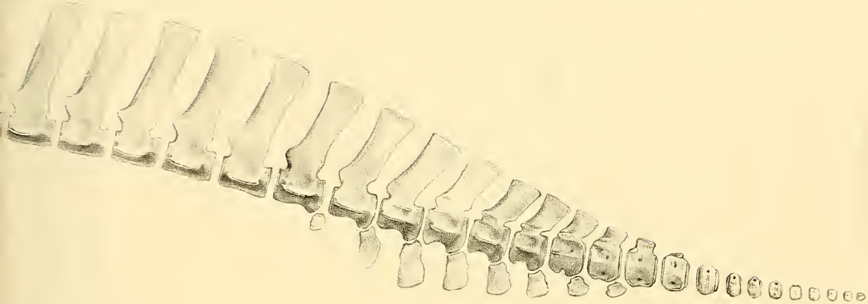
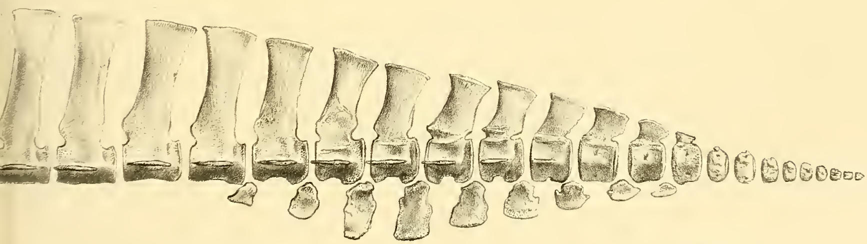


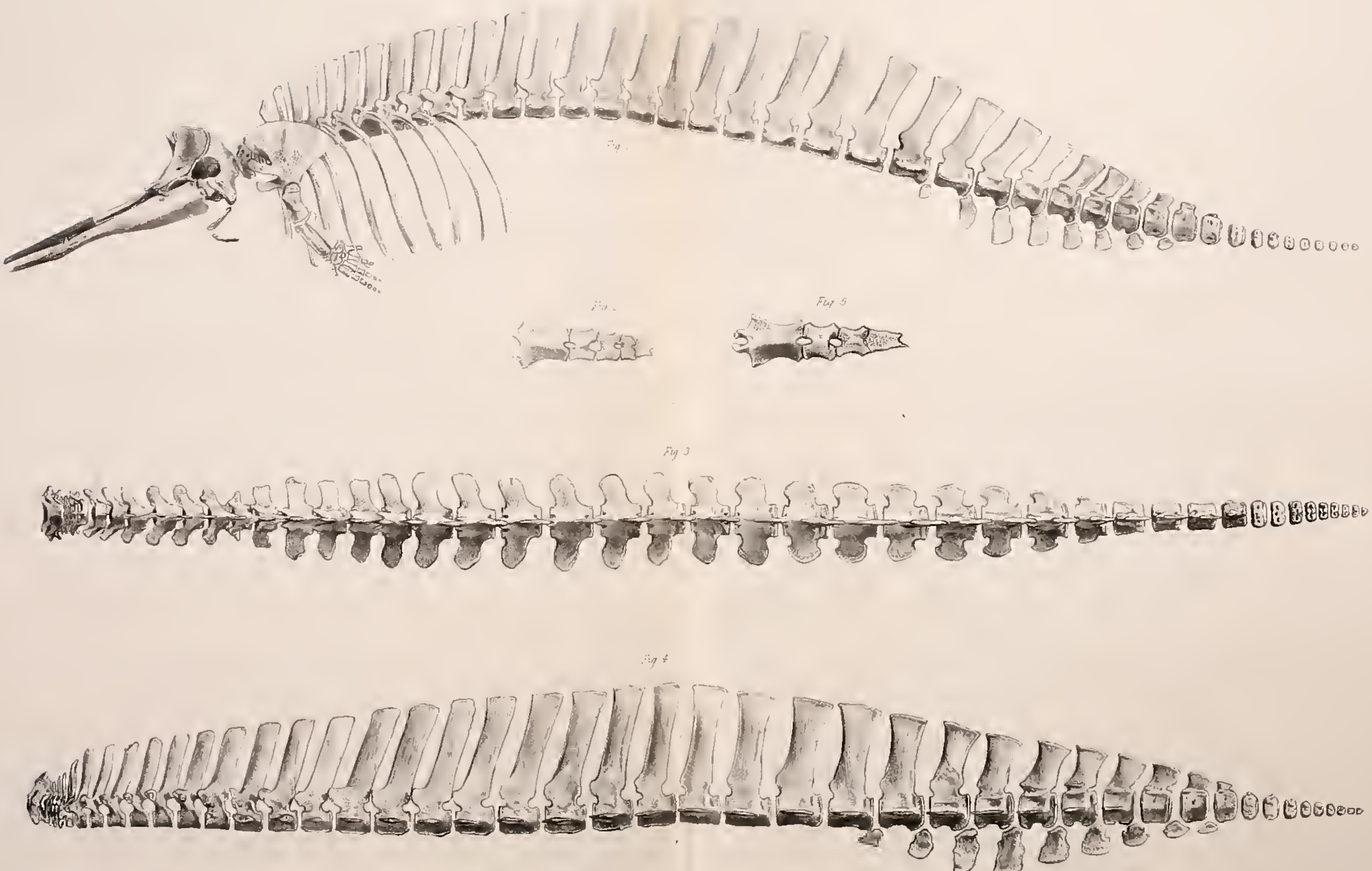
Fig. 5

3



Hanhart imp.

AYI [illegible] AUSTRALIS



J. Smit lith. Hanhart imp.

MESOPLODON 1. 2 GRAYI 3-5 AUSTRALIS