DOUBLE TEETH IN THE SPERM WHALE (PHYSETER MACROCEPHALUS L.)

by

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Recently a fairly large number of teeth of the sperm whale were acquired for the collections of the Rijksmuseum van Natuurlijke Historie. These teeth were picked out from an extensive material of sperm whale teeth collected in the Antarctic region and preserved by the whalers for their commercial value. Together with Dr. A. B. van Deinse at Rotterdam the author spent two days in selecting from the available material those specimens which showed peculiarities of some kind so that they might prove interesting for further examination. I want to thank Dr. Van Deinse here for his kind help in saving so many peculiar specimens for scientific purposes.

Double teeth of the sperm whale are not unknown, but as far as I am aware only two instances have been described, and of one of these it is still doubtful whether it is a double tooth or not.

The doubtfully double tooth is the one described by Pouchet and Beauregard (1889, pl. 6 fig. 5) and commented upon by Neuville (1928, 1932). This tooth is in the collection of the Nantucket Museum, where it was examined by Pouchet. The description and the figures in the cited papers are after a plaster cast of this tooth in the Paris Museum. The tooth has two roots which rather strongly diverge. According to Neuville (1932) no traces of grooves are found on the topmost part of the tooth. Probably therefore Pouchet's explanation is correct, assuming that the two roots have arisen on account of fusion of the lateral walls of the fang in the central part of the tooth. After this fusion each half of the fang then has grown out independently from the other half. This explanation in my opinion is preferable to the one given by Neuville (1932), who is inclined to regard this tooth as the result of fusion of two teeth, which have become separated again in their lower parts.

An undoubtedly double tooth of a sperm whale was described and figured

by the same authors (Pouchet and Beauregard, 1889, pl. 6 fig. 4; Neuville, 1928, figs. 37 and 38; Neuville, 1932, pls. III and IV). In this compound the two teeth have coalesced in their topmost region, where they are united

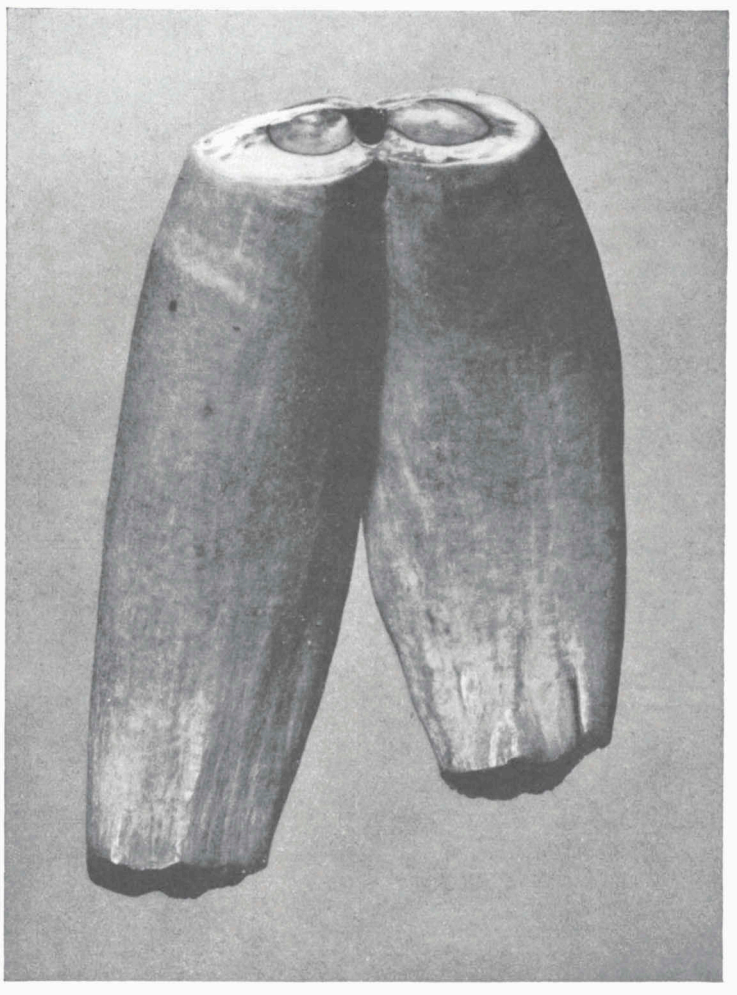

Fig. 1. Double tooth of *Physeter macrocephalus*. Lingual surface, natural size.

by cement. Neuville could show that the mass of dentine of each tooth remains separate from that of the other tooth; the transverse section shows that in each tooth it has a more or less circular shape. On the slightly abraded top of the compound too the dentine of each tooth is clearly visible as two distinctly separated masses.

The specimens of double teeth in the Leiden Museum in many respects correspond with Neuville's specimen; as each of them shows certain particulars different from the other, each of the compounds may be

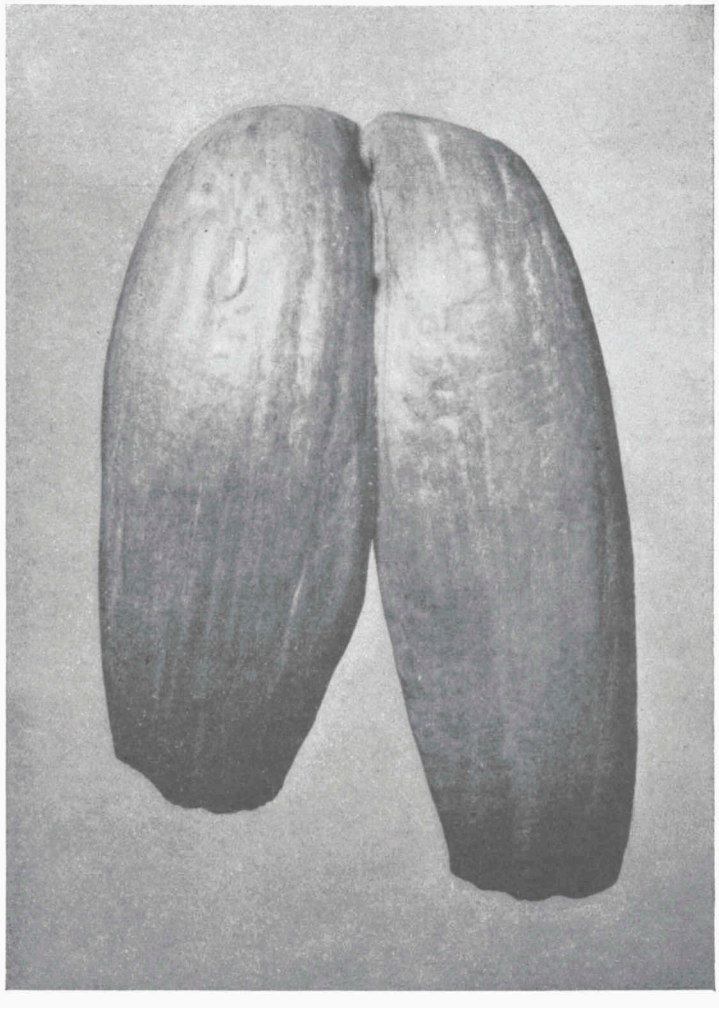

Fig. 2. Specimen of fig. 1. Labial surface, natural size.

described here. In these descriptions I have indicated the concave side of each compound as the lingual surface, the convex side as the labial surface. In my opinion this is a matter of fact, for when the teeth of the sperm whale are curved they are slightly bent inward. The only exception to this rule

may be found in the teeth of the upper jaw, which, rudimentary as they often are, may be curved in every possible plane.

The first compound (figs. 1—3) consists of two united teeth the crown ends of which are strongly abraded. The upper part of each of these teeth reminds strongly of that in the tooth of the "Round-Headed Cachalot" figured by Pennant (1776, pl. VII), but the fangs of the teeth are much wider than that in Pennant's specimen. Undoubtedly these united teeth came from the hindmost part of the lower jaw of a sperm whale. The teeth have a height of 110 and 95 mm, their greatest antero-posterior diameter is 33

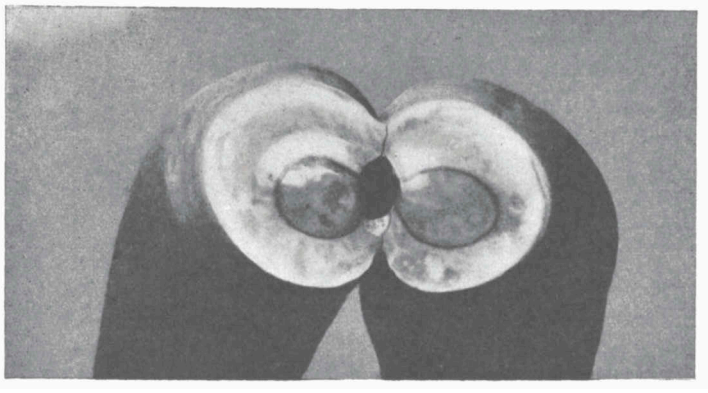

Fig. 3. Specimen of fig. 1. Crown end, seen from above, natural size.

and 35 mm, their greatest labio-lingual diameter is 34 and 31 mm. In each tooth the fang has a wide and deep pulp-cavity (in the larger this depth is 18 mm, in the smaller 15 mm); the fang is gradually narrowing towards its base. The crown end of the teeth presents a more or less flat surface; here the two separate masses of dentine are visible each surrounded by its layer of cement which in the median region of the compound has fused with that of the other tooth. In the centre of the crown end of the compound there is a deep narrow hole (depth 28 mm), just between the two masses of dentine (fig. 3). Undoubtedly this hole is the result of a kind of disease of the teeth, which may have started as soon as the teeth came into contact. The two teeth are united by a common mass of cement for a length of 55 mm; on the lingual surface as well as on the labial surface of the compound a deep ridge is found between the two teeth (figs. 1, 2).

The second compound (fig. 4) is of a quite different character. Here the two teeth are united for the whole of their extent. This double tooth has a height of 91 mm, the greatest antero-posterior diameter is 36 mm and the greatest labio-lingual diameter 20 mm. The compound is of slender shape,

broadest in the lower half, whilst the upper half is gradually tapering to the top. The crown end is slightly worn, so that the two separate masses of dentine become visible. The two teeth are broadly united, so that on both

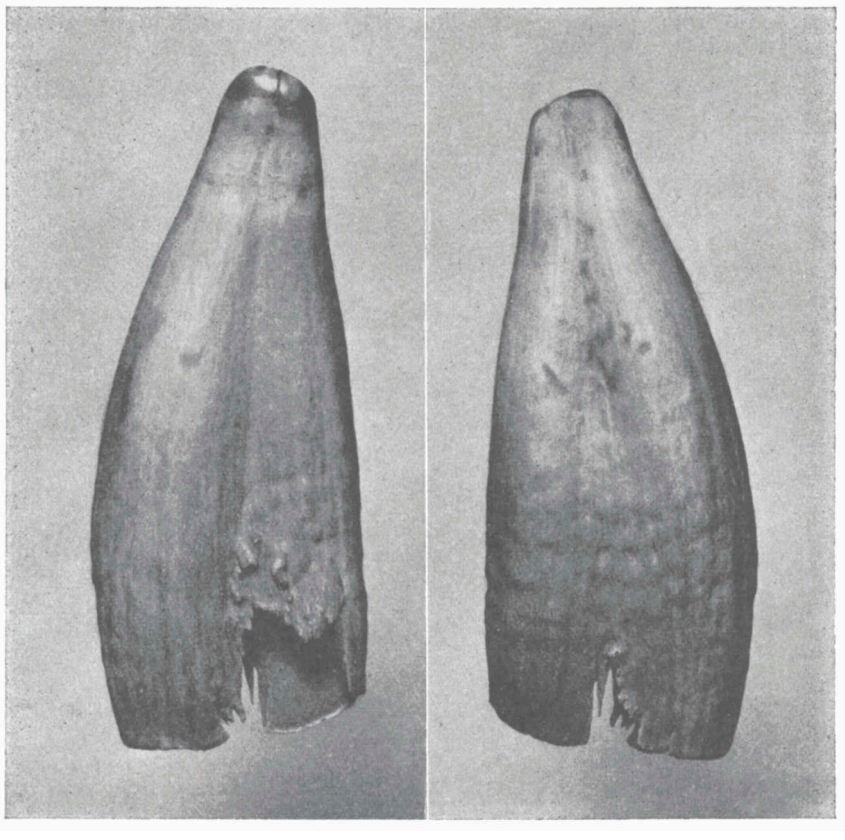

Fig. 4. Double tooth of *Physeter macrocephalus*. Lingual surface (left) and labial surface (right), natural size.

the labial and the lingual surfaces only a shallow ridge indicates the double origin of the compound. In the fang there is a common large pulp-cavity of a flattened conical shape (depth 31 mm), so that at this side of the compound it appears as a single laterally compressed tooth. The fang itself shows some irregularities, its border is defect in two spots and the formation of cement has taken place here rather irregularly.

The third compound (figs. 5—7) is incomplete. It has been removed from the jaw apparently by an axe, so that the lower part of the fang is lacking. As in the former specimen the two teeth are largely united so that

only feeble grooves are visible at the lingual and the labial surfaces. The compound is of a flattened conical shape, its topmost part is slightly curved. Owing to the shape of the double tooth it probably was taken from the right half of a lower jaw. The specimen has a height of 90 mm, a maximum antero-posterior diameter of 57 mm and a maximum labio-lingual diameter

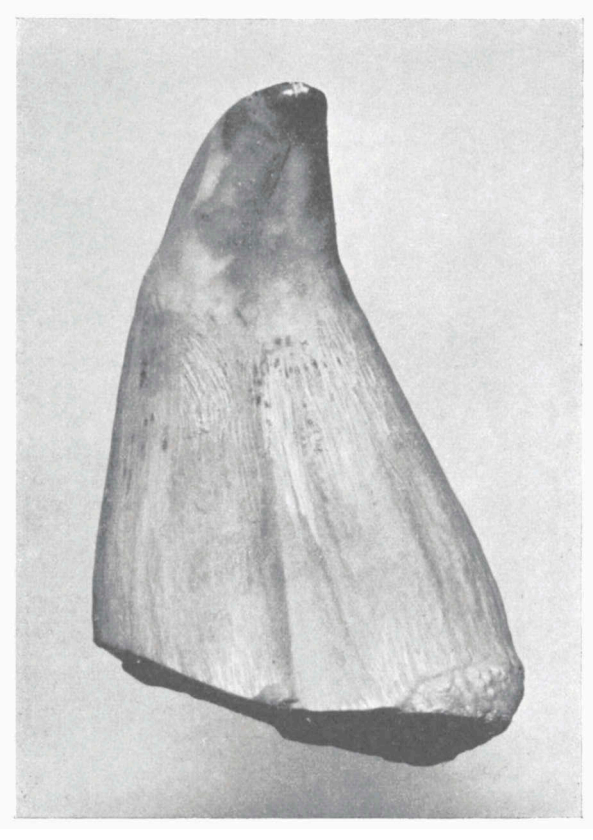

Fig. 5. Double tooth of *Physeter macrocephalus*. Lingual surface, natural size.

of 27 mm. In the topmost part of this double tooth the two masses of dentine are distinctly separate, the crown end of the compound is very little abraded and the masses of dentine here have a more or less circular outline. They are just visible in the upper part of fig. 6. Figs 7 a and b, showing the top of the specimen, give a good view of the two masses of dentine in their surrounding layers of cement. On one surface (probably the anterior surface) the specimen shows two rather long nicely polished facets, owing

to abrasion of the cement against a tooth of the upper jaw. One of these facets is visible in the upper part of fig. 5, at the left side. Much more distinctly the facets are to be seen in fig. 7 c.

The double tooth of fig. 5 has been divided into four parts to study the manner of contact of the two teeth in different levels [1]). In the topmost

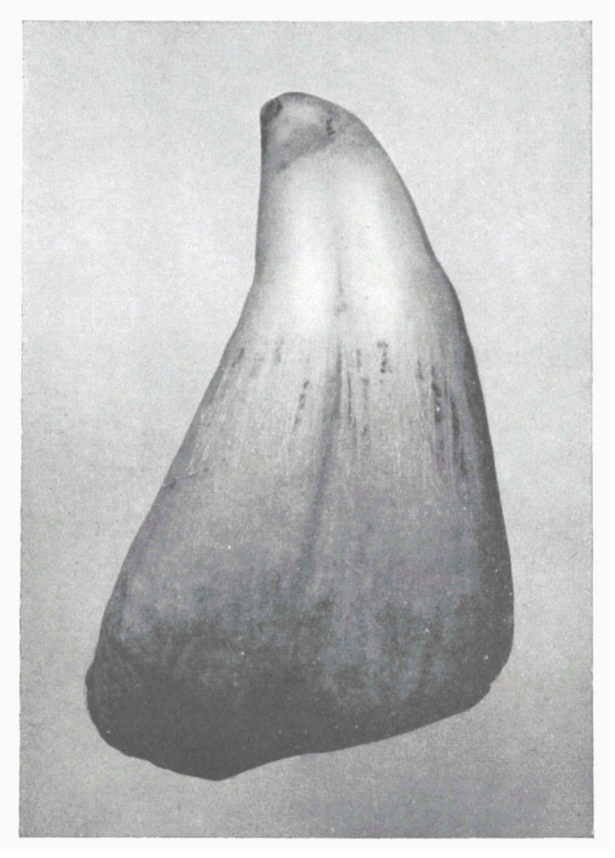

Fig. 6. Specimen of fig. 5. Labial surface, natural size.

part of the compound the two masses of dentine are distinctly separated by a thin layer of cement (fig. 7 a, b). Already at a distance of 15 mm from the top the two masses of dentine are in close contact along a broad line in the middle (fig. 7 c; the crack in the compound probably has developed after the tooth was extracted). The central canal in each of the

1) The cutting of the tooth and the polishing of the surfaces was done in the Rijksmuseum van Geologie en Mineralogie at Leiden by the kind permission of the director, Professor Dr. B. G. Escher.

two masses of dentine is clearly visible as a dark spot; moreover there are a few dark spots caused by inclusions of osteodentine. At a lower level, about 28 mm from the top (fig. 7 d), the two masses of dentine have largely united, the median line of separation has vanished, but two sharp notches at the lateral surfaces indicate the sizes of the two parts of dentine. The central canals of each of the two masses of dentine are united by a narrow fissure in antero-posterior direction. At each side of this fissure there is a globular mass of osteodentine (showing as black spots in the figure). In the lower part of the double tooth the mass of dentine is more or less oval, slightly narrowed in the middle (fig. 7 e). The fissure uniting the two central canals has become somewhat wider here. The black spots in the figure below this fissure again are particles of osteodentine.

In the section represented in fig. 7 c the mantle of cement presents some sharp angles at the left side of the figure. Here the tooth has been into contact with a tooth of the upper jaw, so that distinct facets have been formed here. Polished surfaces of this kind are by no means rare in the sperm whale, numerous instances have been recorded by Neuville (1932), and a few have been described by the author in a previous paper (Boschma, 1938).

The fourth specimen to be dealt with here is a single tooth which without any doubt in the living animal was united to another tooth. This other tooth, however, has not been found. The tooth (fig. 8) has a height of 55 mm, an anterio-posterior diameter of 20 mm and a labio-lingual diameter of 17 mm. It is, therefore, of small size, but it had already stopped growth, for the pulp-cavity is entirely filled with osteodentine. As the tooth is more or less straight its position in the jaw cannot be ascertained. The crown end of the tooth is strongly abraded, so that a broad circle of dentine is visible within the mantle of cement. On the topmost part of this tooth there is a slightly elevated mass of cement with a rather flat, though rough, surface. This mass of cement undoubtedly has been into contact with another tooth of approximately the same size. The compound of which the specimen has formed one half must have been of about the same shape as the double tooth of figs. 1—3, though being much smaller. The elevated mass of cement indicates that the fangs of the two teeth which formed the compound were strongly diverging.

Now the question arises: how did the pairs of teeth develop into the compounds as they are now? As far as concerns the specimen of figs. 1—3 it is evident that the two teeth originally developed at a sufficiently large distance, as the centres of the fangs are separated from each other for about 5 cm. Here at least one of the teeth grew out in an abnormal, oblique

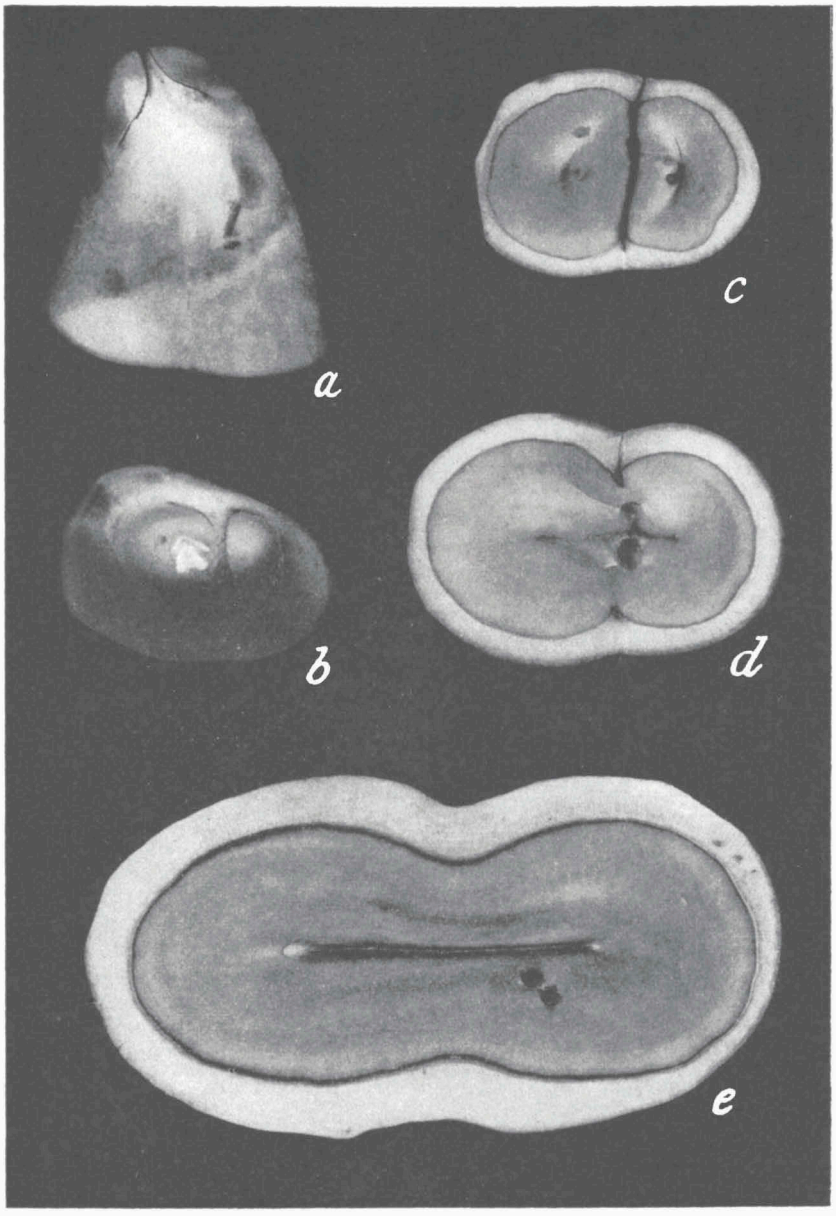

Fig. 7. Specimen of fig. 5. a, crown end, labial surface; b, crown end, seen from above; c, section at a distance of about 15 mm from the top; d, section at a distance of about 28 mm from the top; e, section at a distance of about 60 mm from the top. All figures × 2.

direction so that by further growth the tops of the two teeth came into contact and gradually united. Evidence for this view is given by the occurrence of the deep hole between the two teeth, for it is known that pressure of one tooth against another may cause the beginning of disease (cf. Colyer, 1936). What influence caused the growth of one of the teeth in an abnormal direction is unknown. It can scarcely have been the contact with a tooth from the upper jaw, as no trace of a facet can be found on the compound.

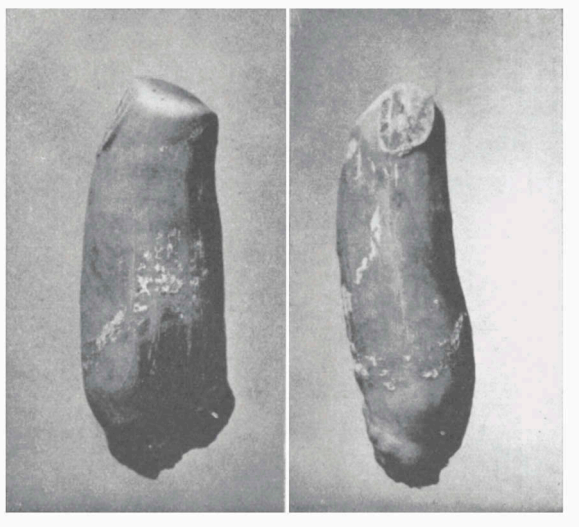

Fig. 8. *Physeter macrocephalus*. Tooth which formerly was united with another tooth. Lateral surface (left) and anterior or posterior surface (right), natural size.

The specimen of fig. 8 apparently is of the same kind as that of figs. 1—3: the fangs of the two teeth were so widely separated that both teeth originally must have developed in their normal places.

The double tooth of fig. 4 is of an altogether different kind. Here the two teeth which form the compound must have been in close contact from the beginning. During growth the contact of the two teeth even became more pronounced, as there is a single undivided pulp cavity of a flattened conical shape. We cannot assume here that the double tooth developed from two single teeth which originally occupied their normal places in the jaw, but the two teeth from which the compound took its origin must have arisen in a very restricted area. We have here then the abnormal case of two tooth-germs in one spot of the jaw each developing into a distinct tooth. Owing to their close proximity the two teeth have united in a very early stage of

growth. The two tooth-germs may have arisen independently or may have been the result of the division of one tooth-germ into two halves.

The specimen of figs. 5—7 in many respects is similar to that of fig. 4, as in the topmost part of the compound the two masses of dentine are still distinct, whilst towards the basal part these two masses of dentine gradually unite into one. Undoubtedly this compound too developed from two tooth-germs originating in almost the same spot.

In the sperm whale the teeth of the lower jaw are implanted at comparatively large distances from each other. Want of space therefore never can cause the contact of these teeth. Moreover the teeth of the upper jaw are so much smaller than those of the lower that by their action the latter could not be pushed forward or back far enough to bring about the contact necessary for coalescence. Moreover the teeth of the sperm whale are so firmly implanted in the jaw that contact of maxillary and mandibular teeth produces distinct facets often of a considerable depth.

Besides in the sperm whale double teeth are known to occur in a number of other Cetaceans. A beautiful example of this kind in the genus *Steno* has been described by Neuville (1928, fig. 35), this specimen reminds strongly of the compounds of figs. 4 and 5—6 of the present paper. In another paper by the same author (Neuville, 1932) besides double teeth in *Pontoporia* instances of abnormal position of the teeth are shown in *Inia* and in *Sotalia*. Especially one pair of teeth in *Sotalia* (Neuville, 1932, pl. VII fig. 29) reminds of the double tooth of *Physeter* of figs. 1—3 in the present paper, as far as concerns the direction of the long axes of the teeth. These teeth of *Sotalia* never could unite into one compound, as their tops are extending beyond the jaw. The double teeth of *Physeter* only could develop to their present state because the contact of the two teeth took place at a young stage when they had not yet erupted. At this stage the development of cement could proceed around the united tops of the teeth.

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