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## A remarkable feature in the dentine of teeth of Odontocetes

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### ABSTRACT

The neonatal line in teeth of *Phocoena phocoena* is studied. The length of the neonatal line measured from the upper end of the cementum to the point where the line ends against that layer, may offer an indication for sex determination in this species.

The layered structures of the cementum and dentine in teeth of Odontocetes are described, e.g. by Laws, 1953, 1960; Scheffer, 1959; Nishiwaki, Hibiya & Ohsumi, 1958; Ohsumi, Kasuya & Nishiwaki, 1963. They are used in age determination by counting the layers visible in transparent longitudinal sections of teeth. In these transparent sections translucent and opaque zones are visible. In transmitted light the translucent zones are clear or light while the opaque zones are dark. This reverses in reflected light. The first translucent zone or line, closest to the apex of the tooth, is called the neonatal line according to Nishiwaki, Hibiya & Ohsumi (1958) and Ohsumi, Kasuya & Nishiwaki (1963). This line is supposed to be formed during birth of the animal. The mass of dentine outside the neonatal line is covered by the enamel and it is supposed that this mass of dentine is formed during the prenatal period of the life of the animal. Apart from the neonatal line a great number of translucent lines are visible in the teeth of old animals. In *Phocoena phocoena* (Linnaeus, 1758), a particular phenomenon concerning the neonatal line becomes evident when the teeth of male and female individuals of all ages are compared.

The material used in the present examination consists of 8 males and 12 females. From these animals all or nearly all data concerning the collection, age, sex and the dissection are available. From another 9 individuals of *P. phocoena* examined, incomplete or no data at all were available. All teeth were taken from the middle of the lower jaw. The teeth of a small number of individuals of *Lagenorhynchus albirostris* Gray, 1846, *Tursiops truncatus* (Montagu, 1821) and of a *Sotalia guianensis* (van Beneden, 1864) are

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[157]

examined. The skeletons and skulls of all individuals examined are preserved in the collection of the Zoological Museum, Amsterdam.

From the teeth the following measurements were taken: length, smallest and largest diameter and weight. In these data no difference related to the sexes is found. The distance from the apex of the tooth to the neonatal line (fig. 1) can not be used because the apex of the tooth is subjected to wear, and no direct relation could be demonstrated between this wear and the age of the animals.

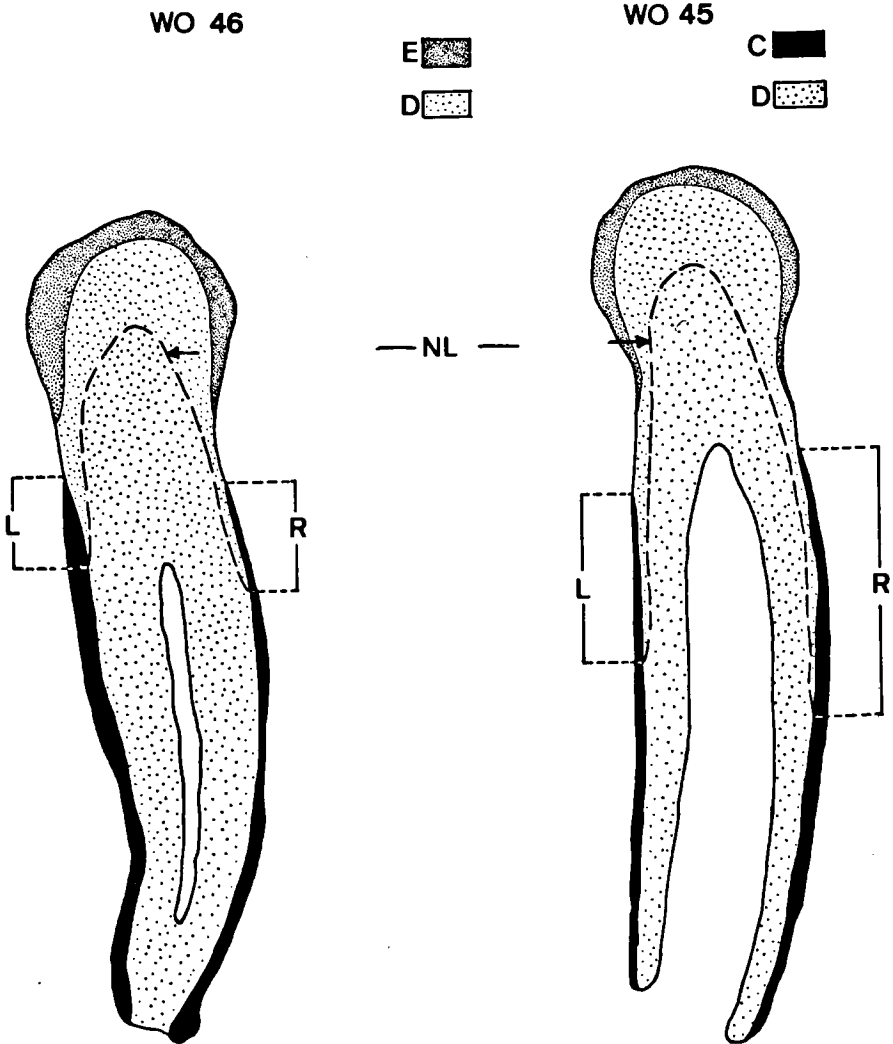


FIG. 1. Longitudinal ground sections of the teeth of *Phocoena phocoena*, animal W.O. 46, ♀ and W.O. 45, ♂, both of about the same age. E = enamel; n.l. = neonatal line; D = dentine; C = cementum; L = distance between upper end of cementum and lower end of neonatal line measured along the inner curve of the tooth; R = same distance measured along the outer curve of the tooth.

The distance between the neonatal line and the lower end of the root of the tooth (fig. 1) can not be used as it is not known how long growth of the root of the tooth proceeds after it has erupted from the gum. Besides, there is a considerable individual variation in the shape of the root of the teeth in *P. phocoena*. In some cases the roots are sharply bend as to form a hook. This points to differences in growth of the teeth in the various individuals, thus measurements taken of this part of the teeth are not directly comparable.

The measurements of the largest and smallest diameters of the teeth in males show the following results. The mean of the largest diameter is 2.68 mm (min. 2.40 mm, max. 2.95 mm). The mean of the smallest diameter is 2.10 mm (min. 1.00 mm, max. 2.55 mm). These means are based on 8 specimens. In females these figures are 2.50 mm (min. 2.10 mm, max. 2.95 mm) and 2.10 mm (min. 1.80 mm, max. 2.50 mm), respectively. These means are based on 12 specimens.

Though the number of animals is rather small, it is clear that there is no difference in the diameter of the teeth between both sexes. The length of the section of the neonatal line running into the root of the tooth, however, shows a striking difference in male and female specimens of *P. phocoena*. To show this difference the length of the cementum is measured from its upper end to the point in the root where the neonatal line ends against the cementum (fig. 1).

In the male animals of *P. phocoena* the mean length of this part is 0.328 mm (max. 0.407 mm, min. 0.264 mm) at the concave side of the teeth, and at the convex side of the teeth this length is 0.339 mm (max. 0.361 mm, min. 0.268 mm), see also table I. In females these sizes are respectively 0.141 mm (max. 0.207 mm, min. 0.114 mm) and 0.157 mm (max. 0.229 mm, min. 0.086 mm), see also table II.

From these figures it can be concluded that in males of *P. phocoena* the part of the neonatal line present in the root of the teeth is about twice as long as it is in the teeth of females of this species. In table III data are given from animals of which the sex is unknown, or of which the sex determined from the soft parts does not fit with the sex as indicated by the neonatal line (viz. Z.M.A. 2906 and Z.M.A. 2907). Animal no. Z.M.A. 2906 was recorded on its label to be a female but the data concerning the length of the neonatal line are typical for a male (cf. table I). Animal no. Z.M.A. 2907 was labeled as a male, but the length of the neonatal line is typically that of a female (cf. table II).

From all other animals in table III the sex was unknown. From the data of the length of the neonatal line, however, it can be seen that all animals were females except no. Z.M.A. 2626 which most probably was a male.

The difference between the lengths of the neonatal line in males and females is also found in the teeth of e.g. *Lagenorhynchus albirostris* (tables IV and V), *Tursiops truncatus*, and *Phoca vitulina*. As far as could be ascertained this difference is also present in the teeth of sheep.

This feature offers a good possibility for the determination of the sex in skeletal material, from which this is otherwise impossible.

TABLE I. Tooth measurements of *Phocoena phocoena* males.

no.	date	sex	length in cm	weight in kg	distance in mm up- per end of cemen- tum to lower end of neonatal line	
					L	R
ZMA 8166 (≠WO 70)	VII-65	♂	106	18.5	0.407	0.361
ZMA 8651 (≠WO 72)	VII-65	♂	110	18.5	0.332	0.350
ZMA 9203 (≠WO 76)	IX-66	♂	124	24.0	0.314	0.339
ZMA 2643 (≠WO 45)	IV-59	♂	112	23.0	0.264	0.357
ZMA 10631 (≠WO 87)	IX-67	♂	132	36.2	0.304	0.268
ZMA 7623 (≠WO 67)	III-63	♂	147	48.0	0.364	0.436
ZMA 2119 (≠WO 39)	I-58	♂	129	35.0	0.329	0.286
ZMA 4193	V-61	♂	146	?	0.307	0.318

TABLE II. Tooth measurements of *Phocoena phocoena* females

no.	date	sex	length in cm	weight in kg	distance in mm up- per end of cemen- tum to lower end of neonatal line	
					L	R
ZMA 8716 (≠WO 74)	VII-65	♀	126	25.0	0.125	—
ZMA 2120 (≠WO 38)	I-58	♀	135	46.5	0.207	0.200
ZMA 6065 (≠WO 61)	IX-63	♀	116.5	18.5	0.114	0.179
ZMA 2582 (≠WO 46)	IV-59	♀	155	46.0	0.200	0.229
ZMA 2644 (≠WO 48)	I-60	♀	151	43.5	0.114	0.107
ZMA 8167 (≠WO 71)	V-65	♀	120	26.0	0.139	0.193
ZMA 8041 (≠WO 69)	V-65	♀	151	41.0	0.129	0.157
ZMA 2581 (≠WO 42)	VI-58	♀	155	50.5	0.157	0.171
ZMA 4794 (≠WO 57)	VI-61	♀	164	68.0	0.132	0.086
ZMA 2905	VIII-60	♀	186	?	0.192	0.143
ZMA 8474	VII-65	♀	127	?	0.129	—
ZMA 3050	X-60	♀	?	?	0.114	0.107

TABLE III. Tooth measurements of *Phocoena phocoena* without sufficient information.

no.	date	sex	length in cm	weight in kg	distance in mm up- per end of cemen- tum to lower end of neonatal line	
					L	R
ZMA 2906	VIII-60	♀	146	?	0.239	0.261
ZMA 2626	?	?	?	?	0.229	—
ZMA 2907	IX-60	♂	93	?	—	0.193
ZMA 2903	IX-60	?	124	?	0.136	0.157
ZMA 2627	?	?	?	?	0.150	0.129
ZMA 2902	IX-60	?	127	?	0.150	0.100
ZMA 8304	?	?	?	?	0.146	0.136
ZMA 8305	?	?	?	?	0.143	0.136
<i>P. phocoena</i> Sénégal	V-56	?	?	?	0.139	0.114

TABLE IV. Tooth measurements of *Lagenorhynchus albirostris* males.

no.	date	sex	length in cm	weight in kg	distance in mm upper end of cementum to lower end of neonatal line	
					L	R
ZMA 2810 (≠WO 47)	VII-59	♂	250	220	4.43	3.57
ZMA 11368 (≠WO 88)	I-68	♂	269	309	3.36	3.28
ZMA 10746 (≠WO 89)	I-68	♂	250	345	3.14	3.07

TABLE V. Tooth measurements of *Lagenorhynchus albirostris* females.

no.	date	sex	length in cm	weight in kg	distance in mm upper end of cementum to lower end of neonatal line	
					L	R
ZMA 2483 (≠WO 43)	XI-58	♀	266	219	0.13	0.54
ZMA 9478 (≠WO 77)	VIII-66	♀	223	249	1.14	1.50
ZMA 11384 (≠WO 90)	VI-68	♀	262	306	1.36	1.78

TABLE VI. Tooth measurements of:  
1 and 2) *Tursiops truncatus*, 3) *Delphinus delphis*, 4) *Sotalia guianensis*

no.	date	sex	length in cm	weight in kg	distance in mm upper end of cementum to lower end of neonatal line	
					L	R
ZMA 10504 (≠WO 86)	VIII-67	♀	326	286	0.93	1.07 <sup>1)</sup>
ZMA 8164 (≠WO 73)	VII-65	♀	345	400	0.86	1.00 <sup>2)</sup>
ZMA 10503 (≠WO 84)	IV-67	♀	222	120	1.21	0.50 <sup>3)</sup>
ZMA 10745 (≠WO 81)	V-64	♂	167	525	1.64	2.14 <sup>4)</sup>

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