

**A LITTLE KNOWN ODONTASPID SHARK FROM THE ANTWERP SANDS MEMBER  
(MIOCENE, HEMMOORIAN) AND SOME STRATIGRAPHICAL REMARKS ON THE  
SHARK-TEETH OF THE BERCHEM FORMATION (MIOCENE, HEMMOORIAN)  
AT ANTWERP (BELGIUM)**

by

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The Berchem Formation (Miocene, Hemmoorian) was studied in a temporary outcrop at Berchem (province of Antwerp, Belgium). Three shark associations were collected in the various deposits of this section, offering basic information for correlations with other Miocene deposits. Teeth of a quite common, but little known odontaspid shark were collected and are described in detail in this paper.

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## INTRODUCTION

During the months June and July of the year 1977 the Kiel Sands Member and especially the Antwerp Sands Member of the Miocene Berchem Formation were exposed in a construction-pit at Berchem, (province of Antwerp, Belgium).

The available section was measured in detail and a large number of shark-teeth could be collected in the various layers. This material contains many teeth of a little known odontaspid shark, which are described in this paper in detail. Furthermore it was the first time that the shark species

*Hemipristis serra* Agassiz, 1843 was collected *in situ* in the Belgian Tertiary deposits. Three shark associations could be distinguished by comparison of the material from the various beds.

#### ACKNOWLEDGEMENTS

The author wishes to express his gratitude to Messrs M. van den Bosch and A.W. Janssen (both Rijksmuseum van Geologie en Mineralogie, Leiden, The Netherlands) for information on shark literature and for critically reading and improvement of the manuscript respectively.

#### LOCATION AND DESCRIPTION OF THE SECTION (Fig. 1)

The exposure was a temporary construction-pit for an office-building of the 'Antwerpse Hypotheekkas'. The size of the excavation was approximately 100 x 100 m. It was situated close to the St. Willebrordus church at Berchem, and surrounded by the Binnensingel, the Grote Steenweg and the Solvijnstraat. Coordinates X = 153.800 and Y = 210.800, map-sheet 15/3-4 of the Topographical Map of Belgium (1 : 25,000). According to this map the height of the surface is approximately 10 m + O.P.

On the 26th of July 1977 the following section was measured in this pit:

depth in m	layer nr	description of sediment
0.00 - 2.00	13	greyish-brown to yellowish-brown, rather fine sand with scattered brick fragments.
2.00 - 2.90	12	yellowish-white to yellowish-brown, rather fine sand with fine, horizontal sedimentary structures.
2.90 - 3.00	11	light brown to reddish-brown, rather fine sand with very coarse gravel.
3.00 - 3.80	10	light brown to dark yellow, rather fine sand with abundant shells, some shark-teeth, bone fragments and concretions.
3.80 - 3.95	9	greyish-green, rather fine to rather coarse sand, much glauconite, abundant specimens of <i>Glycymeris</i> in life position.
3.95 - 4.10	8	as above, greyish-brown, with some brown patches, some scattered shells in life position, some gravel of variable diameter.
4.10 - 4.25	7	as above, greenish-grey to yellowish-grey, abundant specimens of <i>Glycymeris</i> in life position.
4.25 - 4.35	6	as above, greenish-grey to grey, some scattered shells in life position.
4.35 - 4.50	5	as above, greyish-green to yellowish green, abundant specimens of <i>Glycymeris</i> , at the base also <i>Panopea</i> in life position.
4.50 - 5.20	4	brownish-grey, rather fine to rather coarse sand, very silty, near the top brown and grey laminated, some reddish-brown patches, very much glauconite, some isolated shells ( <i>Glossus</i> , <i>Panopea</i> ) in life position.
5.20 - 5.45	3	greenish-brown, rather fine to rather coarse sand, much glauconite, very many irregular <i>in situ</i> concretions, abundant large specimens of <i>Glycymeris</i> in life position, some shark-teeth and bones.

5.45 - 5.80	2	dark grey to blackish, rather fine to rather coarse sand, very much glauconite, very silty; a thin and wavy bed with shells of <i>Pycnodonte</i> ; some scattered internal moulds of shells, some spines of regular sea-urchins, sometimes in small concentrations, some shark-teeth and bones; many small greyish-green sandstones at the base.
5.80 - 9.70 m	1	greyish-black, rather coarse to coarse sand, with many white quartz grains, extremely much glauconite; many burrows; some spines of regular sea-urchins.

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Stratigraphical interpretation of the above section:

0.00 - 2.00 m	layer 13	Holocene (mixed deposits)
2.00 - 3.00 m	layers 11-12	Pleistocene (various deposits)
3.00 - 3.80 m	layer 10	? Pleistocene (crag)
3.80 - 5.80 m	layers 2-9	Miocene, Hemmoorian (Antwerp Sands Member, Berchem Formation)
5.80 - 9.70 m	layer 1	Miocene, Hemmoorian (Kiel Sands Member, Berchem Formation).

*Discussion* — The Kiel Sands contain very few remains of Elasmobranchs. In the exposed upper part of these sands, however, the number of bony fish remains (skeleton parts) increases markedly from bottom to top. Also some vertebrae of dolphins and other Odontoceti were collected, all of them without obvious traces of transport. The sediment shows many burrows, especially in the higher part, which may be compared with layer 11 of the Slijkhoek-section (Gaemers & de Ceuster, 1977). The lower part of the Kiel Sands contains less burrows, but they are wider in diameter. This lower part may be correlated with layer 10 of the Slijkhoek section.

Especially in its higher part this deposit contains many spines of regular sea-urchins. The contact with layer 2 is not very distinct, as a result of some reworking of the uppermost level of layer 1, resulting in a more or less gradual transition between these two layers. At one place, however, a sharp boundary was present, obviously because of a local difference in erosion.

The lower part of the Antwerp Sands (layer 2) was the most interesting deposit, as it yielded most of the Elasmobranch remains mentioned here. In this layer a thin shell bed with specimens of *Neopycnodonte conchlear navicularis* (Brocchi, 1814) is locally present, sometimes running parallel with the base of layer 2, sometimes, however, lying more obliquely and reaching for layer 3, or even fused with it. Wherever this shell-bed is absent in a continuous form small shell concentrations are present from place to place. The shell bed nowhere reaches the base of layer 2. Abundant shark-teeth, small skeleton parts of bony fishes and a few vertebrae of dolphins, all without distinct traces of reworking, were collected in this deposit. Small sandstones are found concentrated at the base of layer 2.

Layer 3 is the lowermost shell-bed containing abundant large specimens of double-valved *Glycymeris* shells. Also some pectinids and many internal moulds of gastropods are present (e.g. Turritellidae). The *Glycymeris*-shells are strikingly large in size. From this layer a few shark-teeth, and bones of dolphins and baleen-whales were collected, frequently showing traces of transport. This layer contains abundant small and somewhat larger, irregular concretions. In the walls of the exposure it could be observed that this layer is somewhat undulating, although constant in thickness.

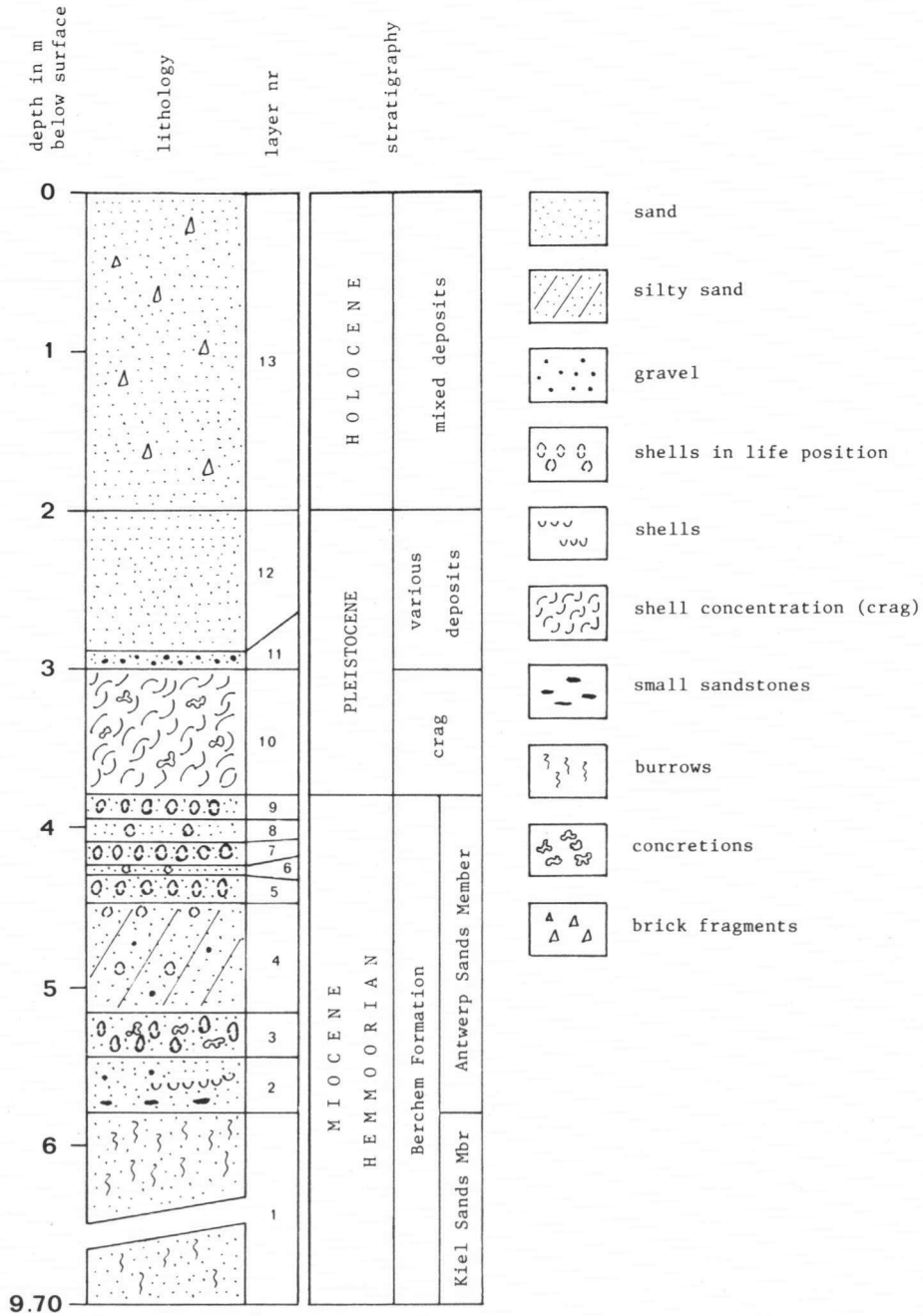


Fig. 1. Lithology and stratigraphical interpretation of the temporary excavation 'Antwerpse Hypotheekkas' at Berchem, Belgium, measured 26 July 1977 by the author.

Layer nr 4 contains only some scattered shells or moulds of shells, among which e.g. *Glossus lunulatus* (Nyst, 1835) in life position. Some specimens of *Panopea menardi* Deshayes, 1828 occur in this layer, but apparently they burrowed into this layer out of layer nr 5. In layer 4 a few small skeleton parts of bony fishes were collected.

The upper part of the Antwerp Sands contains three clearly recognizable *Glycymeris*-beds (layers nr 5, 7 and 9), separated by sandy deposits containing only some scattered shells. They contain mainly medium-sized, usually double-valved specimens of *Glycymeris*. Among them some rare shark-teeth, some vertebrae of larger bony fishes and rather many otoliths were collected. At the base of layer 5 many shells of *Panopea menardi* are present in life position. This layer nr 5 was decalcified in the southwestern corner of the exposure, as a result of erosion of the overlying deposits. Here only ghost structures of the fossils are left.

On top of the partly eroded upper *Glycymeris* bed of the Antwerp Sands a very compact shell-bed (layer 10) is present, in which a few reworked shark-teeth and whale-bones were collected. At the base many isolated valves of *Glycymeris* are present. The contact with the Antwerp Sands is erosive and very irregular. In this deposit some very characteristic, sphaerical, very hard phosphoritic concretions are found, containing moulds and casts of molluscs, shark-teeth and smaller skeleton parts of bony fishes and mammals.

There has been quite some discussion on the age of this deposit. Boekschoten (1974) discussed a similar shell-bed at Tielrode (named 'Tielrode Sands' by him) and considered it to be of Pliocene (Scaldisian) age. Janssen & van der Mark (1968) regarded this deposit as Quaternary and named it 'Scheldt-deposit' ('Schelde afzetting'). Recent research of the present author (de Ceuster, in prep.) in this deposit at Borgerhout yielded Pleistocene mammals like mammoth and rhinoceros.

The layers 11 and 12, equally of Pleistocene age, show some resemblance with deposits in the area of Rumst-Reet-Terhagen, South of Antwerp (de Ceuster, 1976). There too a well-marked basal gravel was found to be present.

## SAMPLING PROCEDURES

To obtain a fair impression of the Elasmobranch faunas present in the various deposits it would have been necessary to sample large quantities of sediment from each layer. Unfortunately circumstances were not favourable in this exposure. So, for instance, sampling of the compact shell-beds appeared to be very difficult, just for the simple reason that such deposits cannot be penetrated with a spade. Furthermore water was absent and so it was not possible to wash large quantities of sediment through fine sieves. Most of the time I used a sieve with a 5 mm mesh for dry sieving. In this way large quantities of material were collected from several levels. It is obvious, that this collecting method makes quantitative comparisons between smaller and larger species impossible. The numbers of elasmobranchs present in the finer residues (0.65 mesh) was really surprising.

## SYSTEMATICAL PART

Teeth of twenty shark species were collected in the layers 1 to 6 of this exposure. A list of the species and the numbers of teeth are summarized in Table 1.

As mentioned above quite a number of teeth of an unknown odontaspid shark were collected. Initially I was convinced to have found a new species, but than Mr M. van den Bosch (Leiden) drew my attention to a form described by Probst (1879), which indeed seems to agree with the Berchem material. This author described shark-teeth from the 'Molasse' in Baltringen, among which several

Table 1. Elasmobranchii from layers 1 to 6, collected in the temporary exposure 'Antwerpse Hypotheekkas' at Berchem, Belgium, 1977. De Ceuster collection.

Layer 1 = Kiel Sands Member, layer 2-6 = Antwerp Sands Member

\* = gillrakers

layer nr	1	2	3	4	5	6
<i>Notorhynchus primigenius</i> (Agassiz, 1843) (Pl. 4, Figs. 2, 3)	-	47	3	-	-	-
<i>Squalus</i> sp.	1	2	-	-	-	2
<i>Squatina subserata</i> (von Münster, 1846)	9	15	8	-	-	2
<i>Synodontaspis acutissima</i> (Agassiz, 1843) (Pl. 1, Figs. 1-7)	1	9	2	-	-	-
<i>Synodontaspis reticulata</i> (Probst, 1879) (Pl. 2, Figs 1-8, Pl. 3, Figs 1-6)	1	28	2	-	-	-
<i>Synodontaspis vorax</i> (le Hon, 1871)	-	19	6	-	-	1
<i>Carcharoides caticus</i> (Philippi, 1846)	-	3	1	-	-	-
<i>Isurus desori</i> (Agassiz, 1843)	-	24	3	-	-	-
<i>Isurus hastalis</i> (Agassiz, 1843)	-	10	6	-	-	3
<i>Isurus retroflexus</i> (Agassiz, 1843)	-	-	8	-	-	1
<i>Carcharocles megalodon</i> (Agassiz, 1843)	-	-	1	-	-	-
<i>Parotodus benedeni</i> le Hon, 1871	-	-	1	-	-	-
<i>Cetorhinus</i> cf <i>maximus</i> (Gunner, 1765)	1*	5*	1*	-	-	2*
<i>Scyliorhinus distans</i> (Probst, 1879)	-	1	3	-	-	2
<i>Galeorhinus</i> sp.	-	3	-	-	-	-
<i>Paragaleus</i> sp. (Pl. 4, Fig. 4)	-	-	1	-	-	-
<i>Hemipristis serra</i> Agassiz, 1843 (Pl. 4, Fig. 1)	-	1	-	-	-	-
<i>Carcharhinus priscus</i> (Agassiz, 1843)	1	18	4	-	-	1
<i>Galeocерdo aduncus</i> Agassiz, 1843	1	11	3	-	-	1
<i>Sphyrna</i> sp.	-	-	2	-	-	-
<i>Aetobatis arcuatus</i> Agassiz, 1843	-	3	-	-	-	-
<i>Raja</i> sp. + <i>Dasyatis</i> sp.	15	23	17	1	-	11

new species. One of these is *Lamna (Odontaspis) reticulata*, a name fallen into oblivion. The illustrations of Probst are not very convincing, but the description in his text gives more information. As this species seems to be quite common during the Hemmoorian of Belgium and The Netherlands a description of the material is given here, for which also material collected in 1987 from a temporary exposure at Borgerhout was used.

The classification of the Elasmobranchii used in this paper is adopted from Cappetta (1987). As most species are well-known only a description of *Synodontaspis reticulata* and some notes on *Hemipristis serra* will be given.

PISCES

Chondrichthyes

Ordo Lamniformes

Familia Odontaspidae Müller & Henle, 1839

Genus *Synodontaspis* White, 1931

**Synodontaspis reticulata** (Probst, 1879)

Pl. 2, Figs 1-8, Pl. 3, Figs 1-6.

- 1879 *Lamna* (*Odontaspis*) *reticulata* Probst, p. 145, pl. 2, fig. 26-32.  
 1926 *Odontaspis acutissima*, mut. *vorax* le Hon — Leriche, p. 394, pl. 28, figs 37, 47 [non le Hon; non figs 31-36, 38-46, 48-49 = *S. vorax* (le Hon)].  
 1937 *Odontaspis* (*Synodontaspis*) *acutissima* (Ag.) — van de Geyn, p. 274, pl. 2, fig. 40-48, pl. 3, figs 1-4 (non Agassiz).  
 1970 *Odontaspis* sp — Cappetta, p. 34, pl. 26, fig. 20.  
 1975 *Odontaspis molassica* Joleaud, 1912 — van den Bosch, pl. 21, figs 6-9 (non Joleaud).  
 1976 *Odontaspis* spec. nov. — de Ceuster, p. 125, pl. 1, figs 5-6.

*Material* — Berchem, temporary exposure 'Antwerpse Hypotheekkas', layer 1: 1 right upper anterior tooth; layer 2: 4 right upper lateral teeth, 1 right upper anterior tooth, 2 left upper symphyseal teeth, 1 left upper anterior tooth, 6 left upper lateral teeth, 5 right lower lateral teeth, 1 right lower anterior tooth, 2 right lower symphyseal teeth, 1 left lower symphyseal tooth, 2 left lower anterior teeth, 3 left lower lateral teeth; layer 3: 1 right lower lateral tooth, 1 left lower lateral tooth. Total: 31 teeth.

Borgerhout, temporary exposure along E3 'Kleine Ring' motorway, same deposit as layer 2 of the Berchem section: 6 right upper lateral teeth, 6 right upper anterior teeth, 1 right upper symphyseal tooth, 1 left upper symphyseal tooth, 7 left upper anterior teeth, 11 left upper lateral teeth, 7 right lower lateral teeth, 4 right lower anterior teeth, 8 left lower anterior teeth, 1 left lower lateral tooth. Total: 52 teeth.

*Diagnosis* — Small teeth with slender crown and strongly widened basal part. In the major part of the available material the crown bears very faint vertical striations at its lingual face and at the base of the labial face. Two pairs of sharply pointed lateral cusplets are present next to the crown.

*Description* — Upper jaw: small teeth (height to 19 mm), with slender crown, basal part strongly widened. The crown is directed towards the commissure, slightly so in the anterior teeth, strongly so in the lateral ones. The lingual face of the crown is slightly convex, the labial face is more strongly convex. Some teeth have very faint vertical striations at their lingual face and occasionally a very fine, short striation is also present on the labial part. Some teeth lack striations on both faces of the crown. In the anterior teeth the cutting edges of the crown never reach the base, contrary to the lateral teeth, in which the cutting edges reach the foot of the crown. Two pairs of sharply pointed lateral cusplets are connected with the base of the crown. The inner pair is well-developed, whereas the outer pair always is strongly reduced in size. The basal part of the crown is slightly convex at the labial face, some teeth bear a short vertical plication. The two branches of the root are clearly separated and strongly divergent, especially in lateral teeth. The external face of the root is concave, often with vertical striations. The internal face is convex, bearing a fine vertical medial groove.

Lower jaw: small teeth (height to 19 mm), with slender crown and a strongly widened basal part. The crown is directed slightly towards the commissure. The labial face of the crown is flat to slightly convex, the lingual face is strongly convex. In some teeth the lingual face of the crown bears a faint vertical striation. In anterior teeth, also in some lateral teeth, the cutting edges do not reach the foot of the crown. One or two pairs of sharply pointed lateral cusplets, joined with the base of the crown, are present. The basal labial part of the crown is slightly concave and demonstrates a short vertical plication in some teeth. The root is high, with clearly separated branches. The external face of the root is concave; the internal face is convex, with a fine vertical median groove. The crown has a sigmoid shape in labio-lingual view.

*Discussion* — Up to now teeth fitting the above description were in Belgium considered to belong to the species *Synodontaspis acutissima* (Agassiz, 1843). In the material available from Berchem and Borgerhout two species could be separated. Both were found together in the same layer and not reworked. Teeth of *Synodontaspis acutissima* differ from *S. reticulata* by their larger dimensions, their wider crown and by the fact that the lingual face of the crown bears very distinct striations. Furthermore only one pair of lateral cusplets is present in *acutissima* (compare Pl. 1, Figs 1-7).

Teeth of *Synodontaspis molassica* (Probst, 1879) are larger than those of *reticulata* and have a more convex crown. Only short lateral cusplets are present in *molassica*, and a vertical striation is absent, both on the labial and on the lingual face. A wide variety in shape of the teeth of *S. acutissima* was already mentioned by van de Geyn (1937), van den Bosch (1969) and Cappetta (1970). Undoubtedly part of their material belongs to *S. reticulata*.

Up to now the species *Synodontaspis reticulata* is only known with certainty from Miocene (Hemmoorian and Reinbekian) deposits. Material of Reinbekian age has not yet been published, but is present in the RGM collections from Dingden (F.R.G.).

The teeth identified by van de Geyn (1937) as *O. acutissima* are housed in the RGM collections at Leiden, where I could study them thanks to the kind cooperation of Mr M. van den Bosch. This material undoubtedly belongs to *S. reticulata*. It originates from the ROvD well Oploo (The Netherlands, province of Noord Brabant), but the samples bear no depth indication. As in this well both Hemmoorian and Late Miocene deposits are represented it cannot be excluded that (part of) the material originates from younger Miocene strata.

Familia Hemigaleidae Hasse, 1879

Genus *Hemipristis* Agassiz, 1843

### **Hemipristis serra** Agassiz, 1843

Pl. 4, Fig. 1.

1843 *Hemipristis serra* Agassiz, p. 237, pl. 27, figs 18-30.

1843 *Hemipristis paucidens* Agassiz, p. 238, pl. 27, figs 31-33.

1846 *Hemipristis serra* Agassiz — von Münster, p. 21.

Plate 1. *Synodontaspis acutissima* (Agassiz, 1843)

Fig. 1. Second right upper anterior tooth.

Fig. 2. Left upper lateral tooth.

Fig. 3. Right upper lateral tooth, lingual view.

Fig. 4. Right lower lateral tooth, lingual view.

Fig. 5. Right lower lateral tooth, lingual view.

Fig. 6. First left lower anterior tooth.

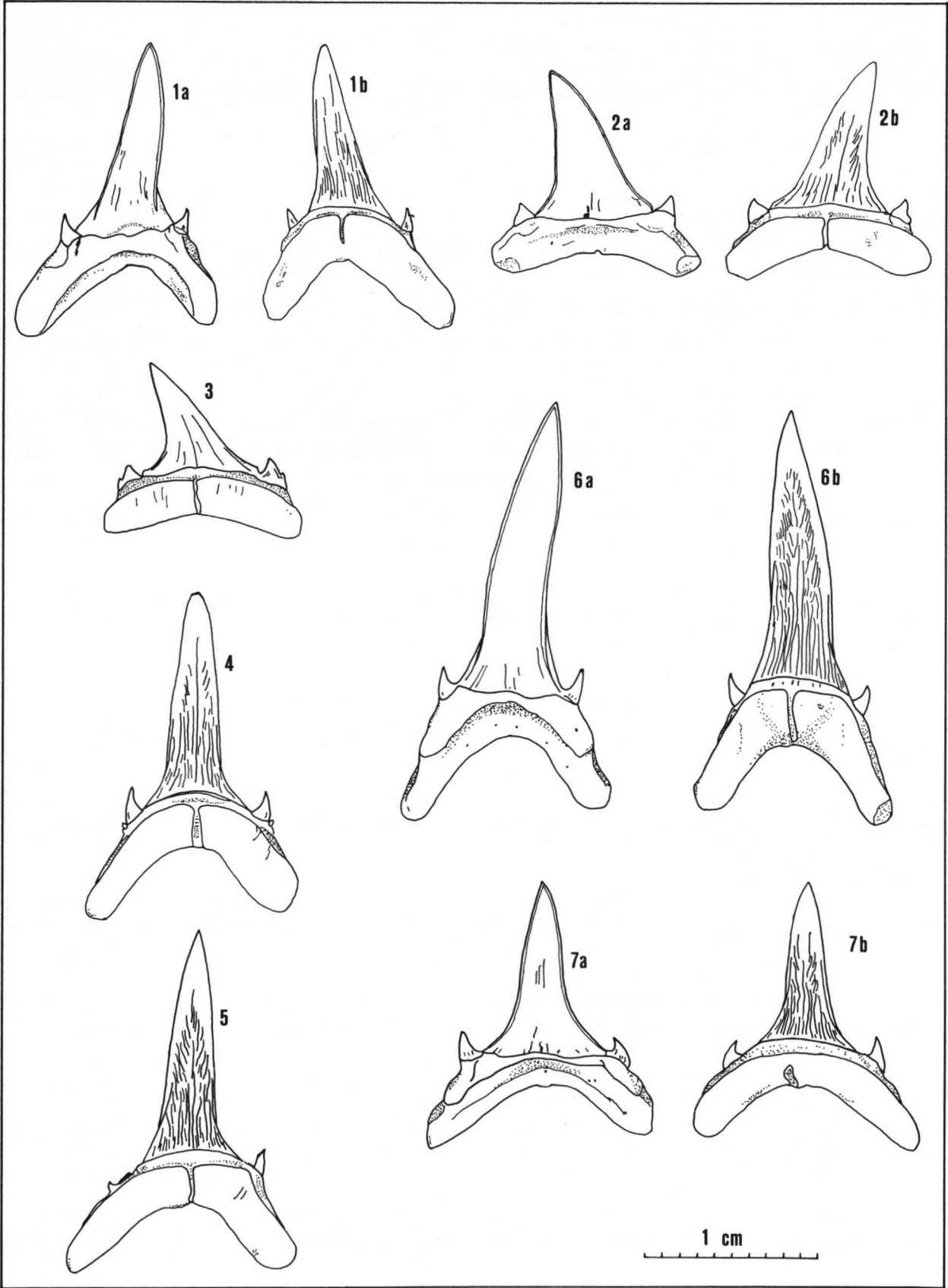
Fig. 7. Left lower lateral tooth.

a: labial views; b: lingual views.

Figs 1, 2, 4 and 6 from Berchem (temporary excavation 'Antwerpse Hypotheekkas'), Figs 3, 5 and 7 from Borgerhout (temporary excavation 'E3-Kleine Ring').



Plate 1



- 1846 *Hemipristis paucidens* Agassiz — von Münster, p. 21.  
1937 *Hemipristis serra* Ag. — van de Geyn, p. 324, pl. 12, figs 53-54; pl. 13, figs 1-6.  
1969 *Hemipristis serra* Agassiz 1843 — Menesini, p. 32, pl. 6, figs 1-9.  
1970 *Hemipristis serra* Agassiz, 1843 — Cappetta, p. 48, pl. 11, figs 1-18.  
1974 *Hemipristis serra* Agassiz, 1843 — Menesini, p. 150, pl. 8, figs 7-19.  
1976 *Hemipristis serra* Agassiz, 1843 — de Ceuster, p. 138, pl. 6, fig. 8.

*Material* — Berchem, temporary exposure 'Antwerpse Hypotheek-kas', layer 2: 1 right upper lateral tooth.

*Remarks* — It is the first time in NW Europe that a tooth of this species could be isolated from an autochthonous, non-reworked shark-association of Middle Miocene age. Up to now some ten teeth of *Hemipristis serra* were known from Belgium, all found in various Early Pliocene lag deposits. Usually the teeth were found among similarly reworked Miocene associations of shark teeth.

In the well-known basal gravel of the Scharberg at Elsloo (The Netherlands) only eight teeth of this species were found among not less than almost 10,000 collected teeth. The Elsloo association resembles closely the fauna of layer 2 in the Antwerp area, as described in this paper. The scarceness of *Hemipristis serra* in NW Europe and its very common occurrence in southern Europe leads to the assumption that during the Miocene only occasionally individuals of this species penetrated from the warm waters in the South into the colder waters of our area.

## STRATIGRAPHICAL NOTES AND CORRELATION WITH OTHER MIOCENE DEPOSITS

The shark material discussed in this paper and specified in Table 1 can be subdivided in three associations, characterized by the presence or absence of species (especially the species *Isurus retroflexus*), and by differences in the ratios of the numbers of specimens in some related species. In particular the changes in the ratios of *Isurus desori* and *I. hastalis*, and of *Synodontaspis acutissima* and *S. reticulata* seem to be useful for biostratigraphic interpretations.

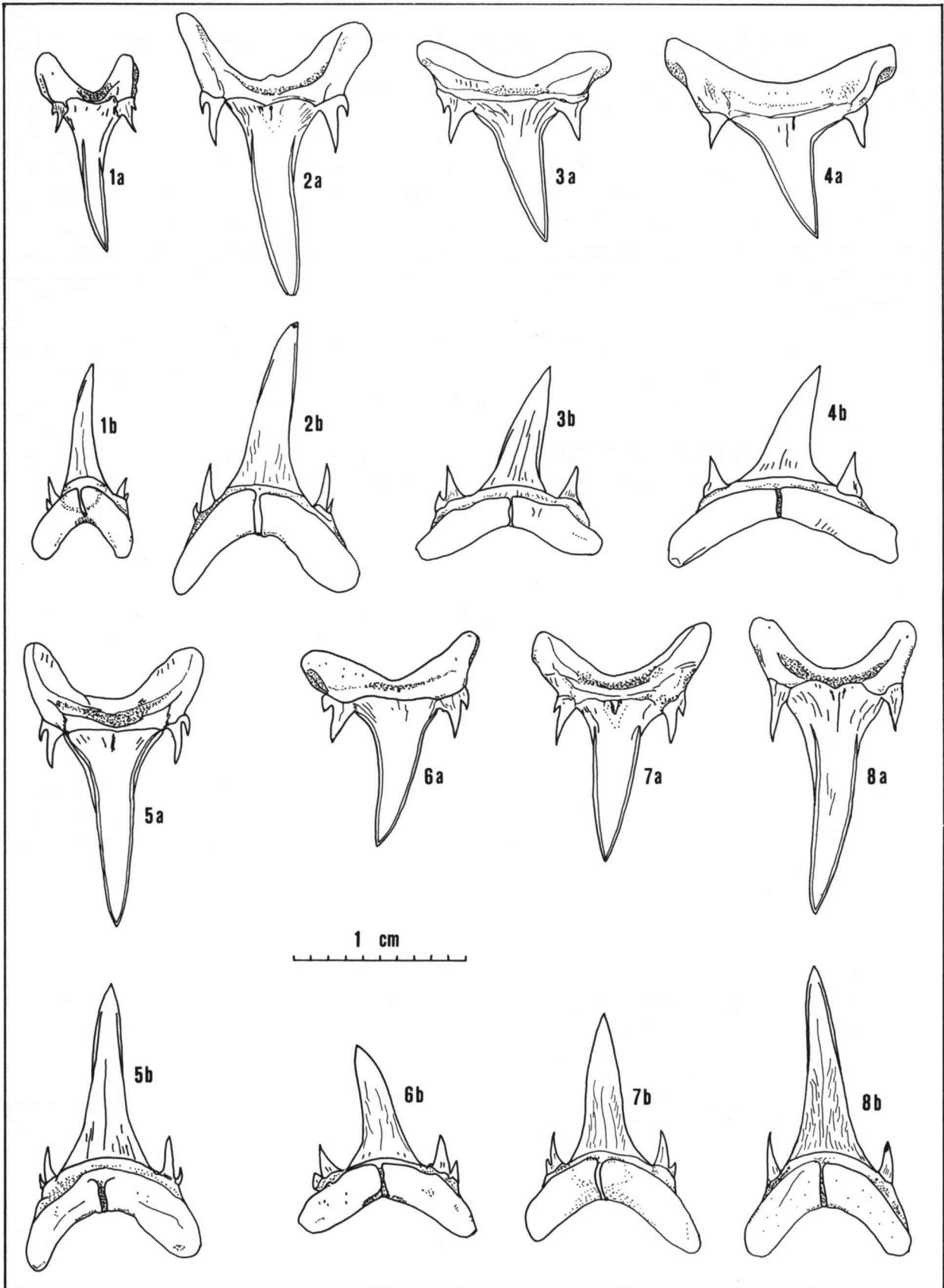
### Plate 2. *Synodontaspis reticulata* (Probst, 1879)

- Fig. 1. Left upper symphyseal tooth.  
Fig. 2. First left upper anterior tooth.  
Figs 3-4. Left upper lateral teeth.  
Fig. 5. First left upper anterior tooth.  
Fig. 6. Right upper lateral tooth.  
Fig. 7. Second right upper anterior tooth.  
Fig. 8. First right upper anterior tooth

a: labial views; b: lingual views.

Figs 1, 3 and 4 from Berchem (temporary excavation 'Antwerpse Hypotheekkas'), Figs 2, 5, 6, 7 and 8 from Borgerhout (temporary excavation 'E3-Kleine Ring').

Plate 2



The oldest association is found in the top of the Kiel Sand Member (5.80-8.00 m of the Berchem section, see Fig. 1). Remains of Elasmobranchs are very rare, only 7 species were collected, the most common one being *Squatina subserrata*. Remains of Teleostei are very common in this level.

The second association is found in the basal part of the Antwerp Sands Member (layer 2 of the Berchem section, compare Fig. 1, 5.45-5.80 m). The shark association comprises 15 species, represented by numerous teeth, among which especially the common occurrences of *Notorhynchus primigenius* and *Synodontaspis reticulata* are characteristic. Also very common are teeth of *Isurus desori*, *Synodontaspis vorax*, *Galeocерdo aduncus*, *Carcharhinus priscus* and *Squatina subserrata*. *Hemipristis serra* is very rare (one tooth only). The species *Isurus retroflexus* and *Carcharocles megalodon* are still absent. The species *Isurus desori* outnumbered *I. hastalis* in a ratio about 2.5 : 1. In a future paper attention will be paid to the smaller species of this association, based on material collected in the Borgerhout exposure.

The youngest association is situated in the higher part of the Antwerp Sands Member (layers 3 to 9 of the Berchem section, see Fig. 1, 3.80 - 5.45 m). In this association 17 species are present. The first appearance of *I. retroflexus* is in layer 3, in which layer also one tooth of *Carcharocles megalodon* was found. In layer 3 *I. desori* is outnumbered by *I. hastalis* in a ratio about 1 : 2. In layer 6 teeth of *desori* are no longer present. In this association *Notorhynchus primigenius* is becoming a rare species; the teeth of *Galeocерdo aduncus* are much larger than those from the lower associations.

The only known locality in Belgium yielding a similar shark fauna as the one in layer 2 is the Miocene deposit in Rumst (de Ceuster, 1976, p. 63; level 6.90-13.80 m). This deposit was up to now considered to represent a part of the Edegem Sands Member. As the Rumst deposit is resting directly on top of the Boom Clay (Oligocene, Rupelian) much reworked material is found at the base of the deposit, including black cetacean bones, crustaceans (decapods) and shark teeth as common components. Even one reworked specimen of *Hemipristis serra* was found (de Ceuster coll.). The autochthonous shark fauna of the Rumst deposit included the following common species: *Notorhynchus primigenius*, *Synodontaspis reticulata*, *Isurus desori*, *Galeocерdo aduncus*, *Carcharhinus priscus* and *Squatina subserrata*.

Recently collected mollusc material from the basal part of the Antwerp Sands Member at the Borgerhout exposure (de Ceuster, in prep.) shows much resemblance with the mollusc fauna of the Rumst deposit. Gaemers (1976, p. 17) dated the Rumst deposit by means of bony fish otoliths. In his opinion the Rumst fauna is younger than the Edegem Sands Member and slightly older than the Antwerp Sands Member.

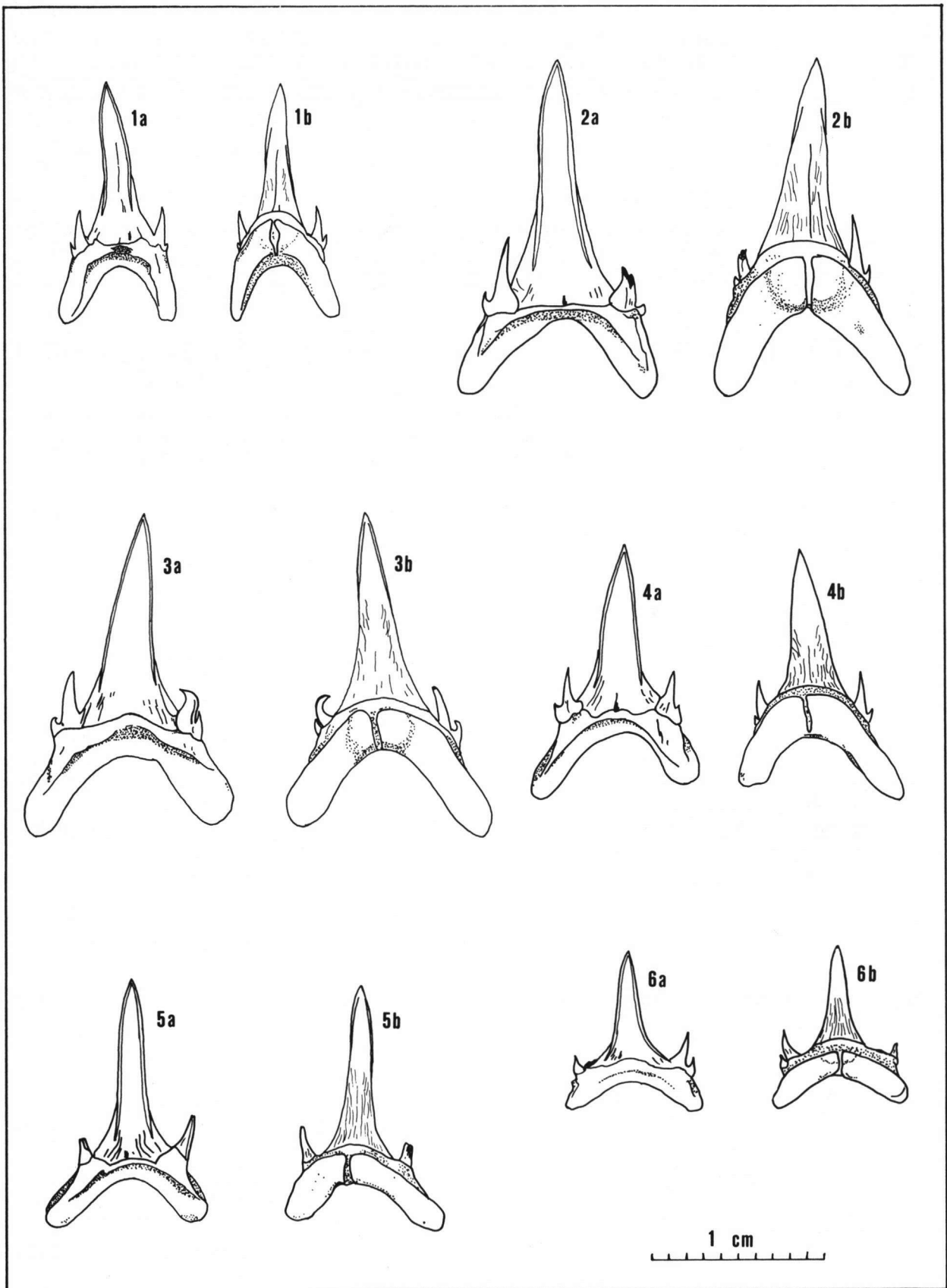
Plate 3. *Synodontaspis reticulata* (Probst, 1879)

- Fig. 1. Right lower symphyseal tooth.
- Fig. 2. First right lower anterior tooth.
- Fig. 3. Second left lower anterior tooth.
- Figs 4-5. Left lower lateral teeth.
- Fig. 6. Right lower lateral tooth.

a: labial views; b: lingual views.

Figs 1, 4, 5 and 6 from Berchem (temporary excavation 'Antwerpse Hypotheekkas'), Figs 2 and 3 from Borgerhout (temporary excavation 'E3-Kleine Ring').

Plate 3



Van den Bosch, Cadée & Janssen (1975), in their paper on the Tertiary deposits of the Winterswijk-Almelo region (eastern part of The Netherlands), listed the most important Elasmobranch species collected in the Oligo-, Mio- and Pliocene deposits of that area. Reworked teeth were found at the base of the Miste Bed (Aalten Member), with the species *Isurus desori* and *Synodontaspis reticulata* (identified as *Odontaspis acutissima* and *O. molassica*) as very common constituents, and some specimens of *Isurus retroflexus*. This latter species is found in a preservation somewhat different from that of the first mentioned two species (van den Bosch, Cadée & Janssen, 1975: 77). In my opinion the species *desori* and *reticulata* in the reworked fauna originate from the same shark association as the one present in layer nr 2 at Berchem. This is also documented by the fact that *Isurus desori* is absent in the autochthonous fauna of Winterswijk-Miste, in which on the contrary *I. hastalis* (common) and *I. retroflexus* are present. This faunal development agrees perfectly with the one observed at Berchem.

The reworked shark fauna from the well-known basal gravel of the Scharberg at Elsloo (province of Limburg, The Netherlands) was published by van de Geyn (1937) and revised by van den Bosch (1964). In this material teeth of *Notorhynchus primigenius*, *Isurus desori*, *I. hastalis*, *I. retroflexus* and many odontaspids are quite common. Also some teeth of *Hemipristis serra* were found. As all this material is found in a lag deposit, mixed with Oligocene and earlier Miocene elements it is rather difficult to make comparisons with the Belgian situation.

Several species occurring in the material described in this paper are also present in faunas published from Italy (Menesini, 1969, 1974) and southern France (Cappetta, 1970), e.g. *Notorhynchus primigenius*, *Isurus desori*, *I. hastalis*, *I. retroflexus* and *Hemipristis serra*. These faunas, however, are strongly influenced by a large number of southern neritic species and therefore direct comparisons are very difficult.

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Plate 4. Fig. 1. *Hemipristis serra* Agassiz, 1843  
Right upper lateral tooth.

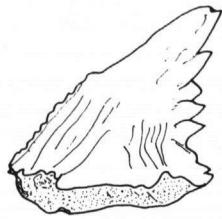
Figs 2-3. *Notorhynchus primigenius* (Agassiz, 1843)  
Lower symphyseal teeth, labial views.

Fig. 4. *Paragaleus* sp.

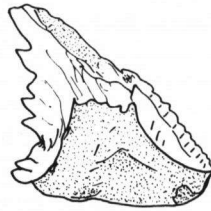
a: labial views; b: lingual views.

All specimens from Berchem (temporary excavation 'Antwerpse Hypotheekkas').

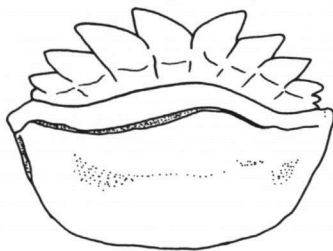
Plate 4



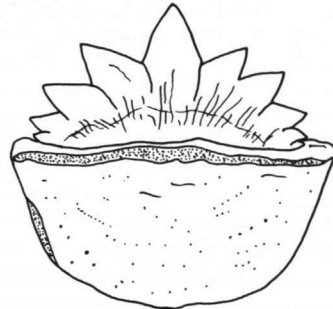
1a



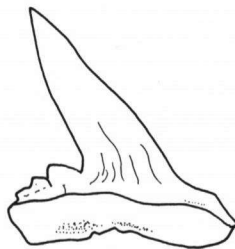
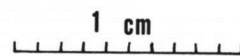
1b



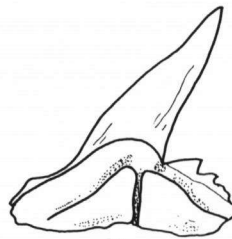
2



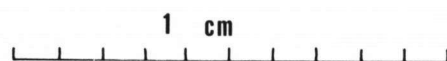
3



4a



4b



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