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The Genus *Strioterebrum* Sacco, 1891 in the Hemmoorian and Reinbekian (Middle Miocene) of the North Sea Basin

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In the Middle Miocene Hemmoorian and Reinbekian strata of the North Sea Basin five species belonging to the genus *Strioterebrum* Sacco, 1861 are found. Three of these species are new to science, and described as *Strioterebrum ariei* sp. nov., *Strioterebrum fabritzi* sp. nov., and *Strioterebrum ronaldi* sp. nov. There is a clear turnover within the *Strioterebrum* fauna in the lowermost Reinbekian as three species occurring in the North Sea Basin since the Vierlandian respectively earliest Hemmoorian times nearly simultaneously disappear to be replaced by two other species. Parallels to the development of the genus *Nassarius* Dumeril, 1806, are drawn. For this reason and the abundance of most of the species, the genus *Strioterebrum* is a useful tool in the Miocene North Sea Basin biostratigraphy.

KEY WORDS: Miocene, Hemmoorian, Reinbekian, North Sea Basin, Germany, Netherlands, Gastropods, *Strioterebrum*, new species, neotype designation, biostratigraphy.

Introduction

Species of the genus *Strioterebrum* Sacco, 1861 are a common faunal constituent of the Miocene of the North Sea Basin. Despite their abundance, the genus never received detailed taxonomic attention, and up to now only two species have been accepted. Janse & Janssen (1983) and Janssen (1984) were the first authors to recognize the presence of further species, but did not elaborate their ideas. The relationship of the material of these authors, from a single locality (Miste near Winterswijk, The Netherlands) and geological unit (Aalten Member, Miste Bed) with the new forms is unclear. *Strioterebrum* material investigated here is derived mainly from two drillings in the Lower Rhine Embayment covering a much larger stratigraphic interval in great detail. The material is excellently preserved and high numbers of specimens were available, and provides the base for a taxonomic review, which is the aim of this paper.

Material and methods

The material is derived from equivalents of the Hoerstgen-, Dingden- and Bislich beds from the Kevelaer, Wetten and Lüllingen boreholes (Nordrhein-Westfalen, Germany). Borehole Kevelaer is located at TK25, 4403 (Geldern), R: 16515.8, H. 15951.9, surface at 21.5 m above sea level. Borehole Wetten is located at TK25, 4403 (Geldern), R: 20800, H. 12660, surface at unknown altitude. Borehole Lüllingen is located at TK25, 4403 (Geldern), R: 17010, H. 11000, surface at 28.5 m above sea level. Upper Hemmoorian and lower Reinbekian (lower Middle Miocene: Gürs & Janssen, 2002) intervals are encountered in these boreholes. A detailed description of the localities is given in Wienrich (1997). From these boreholes, 64 samples of approximately 10 kg sediment were washed (minimum sieve mesh 0.1 mm). Specimens of *Strioterebrum* were separated and treated taxonomically. The *Strioterebrum* material was compared with material from Miste (Gelderland, The Netherlands: material in Naturalis collections, Leiden), as well as from Dingden (Nordrhein-Westfalen, Germany) from my own collection and from the collections F. von der Hocht (Kerpen, Germany) and Anton Janse (Brielle, The Netherlands). Furthermore material from Stemerdink-bridge, Nieuw Wassink (near Stemerdink bridge) and a borehole on the farm Stemerdink all near Winterswijk (collection Anton Janse) and samples from several boreholes in Schleswig-Holstein, northern Germany (Borchelhof, Heilshoop, Tornesch; coll. Karl Gürs, Kiel, Germany) were studied. All specimens are stored in the collection of the author (to be donated to the Forschungsinstitut Senckenberg, Frankfurt, Germany), unless stated otherwise.

Abbreviations —

GWC Günther Wienrich Collection, Goch, Germany;

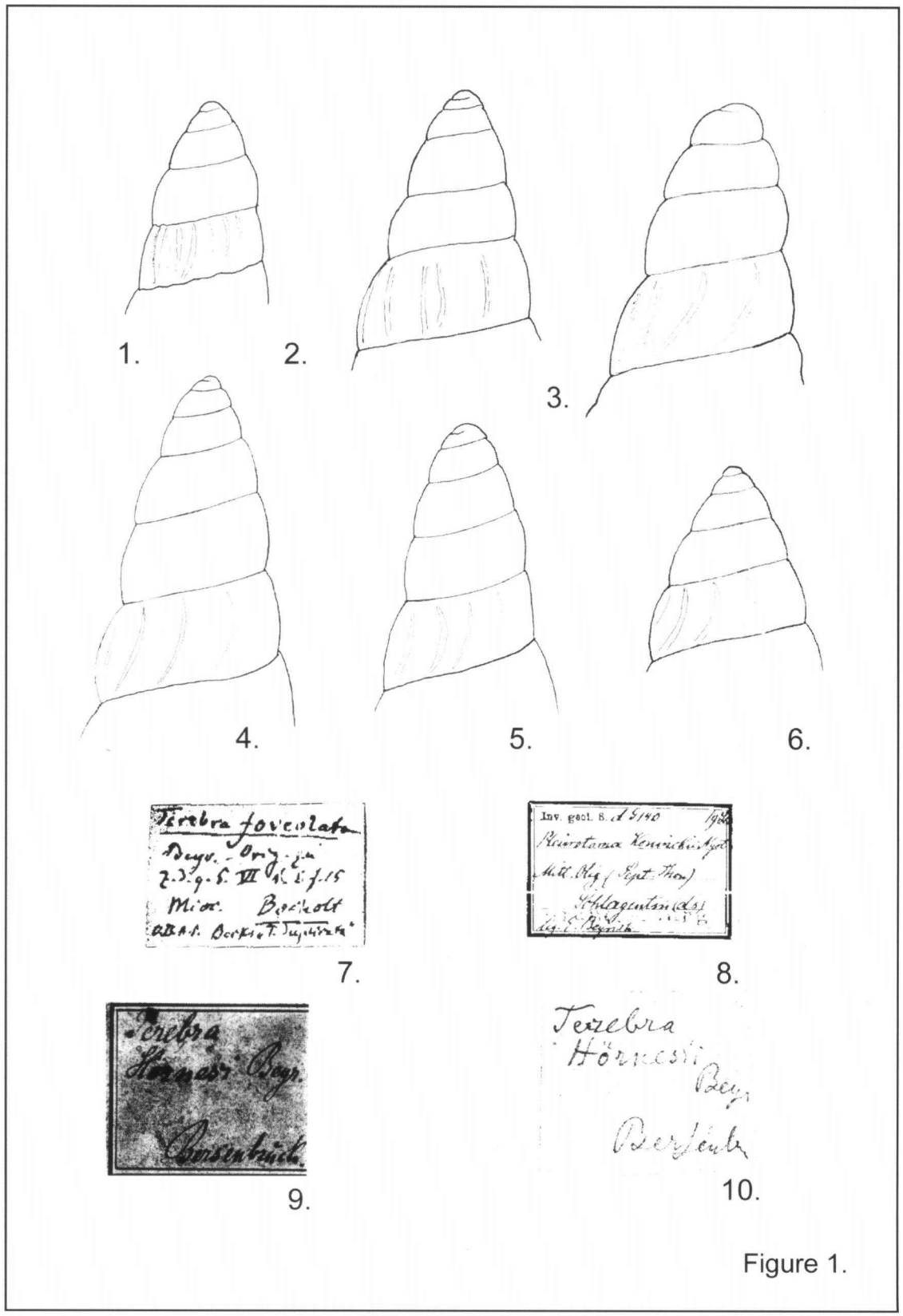

Figure 1.

Figure 1.

Figure 1. 1, *Strioterebrum (Strioterebrum) basteroti* (Nyst, 1845). L-51 7,5,127,2. Lüllingen (151 m), x 45. Protoconch. 2, *Strioterebrum (Strioterebrum) ronaldi* sp. nov. SMF 327510, (L-39 7,5,127,1), holotype. Lüllingen (139 m), x 45. Protoconch. 3, *Strioterebrum (Strioterebrum) ariei* sp. nov. SMF 327505 (K-90 7,5,127,3), holotype. Kevelaer (90 m), x 45. Protoconch. 4, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich, 1854). (L-42 7,5,129,1) Lüllingen 1 (42 m), x 45. Protoconch. 5, *Strioterebrum (Strioterebrum) fabritzi* sp. nov. SMF 327509 (L-48 7,5,129,2), paratype. Lüllingen 1 (48 m), x 45. Massive protoconch. 6, *Strioterebrum (Strioterebrum) fabritzi* sp. nov. SMF 327508, (K-95 7,5,129,2), paratype. Kevelaer (95 m), x 45. Small protoconch. 7, Original label of *Terebra foveolata* from the collection of the Museum für Naturkunde, Berlin, apparently not the handwriting of Beyrich. 8, Label with the handwriting of Beyrich from the collection of the Bundesamt für Geowissenschaften, Berlin. 9, Original label of *Terebra hoernesi* from the collection of the Roemer-Pelizaeus Museum, Hildesheim, handwriting of Hermann Roemer. 10, Second label of *Terebra hoernesi* from the collection of the Roemer-Pelizaeus Museum, Hildesheim, author of handwriting unknown.

RGM Division Cenozoic Mollusca, Nationaal Natuurhistorisch Museum Naturalis, Leiden, The Netherlands;
SMF Senckenberg Museum und Forschungs Institut, Frankfurt am Main, Germany.

Systematic Palaeontology

Family Terebridae Adams, 1853
Genus *Strioterebrum* Sacco, 1861

Strioterebrum basteroti (Nyst, 1845)
Figures 1/1, 2/1-4

1845 *Terebra basteroti* Nyst, p. 582.
1854 *Terebra foveolata* Beyrich, p. 118, pl. 6, fig. 15a-b.
1872 *Terebra basteroti* Nyst - Koenen, p. 52, (?partim).
1925 *Terebra (Myurella) basteroti* Nyst - Kautsky, p. 195 (partim).
1952 *Terebra (Myurella) basteroti* Nyst - Glibert, p. 138, pl. 10, fig. 9.
1972 *Strioterebrum basteroti* (Nyst) - Nordsieck, p. 118, pl. 30, fig. 200 (partim).
1984 *Strioterebrum (Strioterebrum) basteroti* (Nyst) - Janssen, p. 337, pl. 13, fig. 8, pl. 77, figs. 1, 2.

Distribution — Borehole Kevelaer: common in the lowest samples (Hemmoorian interval); Borehole Lüllingen: in the lowest samples (lowest Reinbekian interval); Winterswijk-Miste, Dingden (Feinsand); Borehole Borchelhof, (samples between 99-105 m and 108-111 m, Behrendorfian interval); Borehole Heilshoop HL2 (sample 170 m from Vierlandian strata).

Description — Variable-shaped species, average height 19 mm. The slightly stocky protoconch consists of four and a half to five slightly convex whorls, which are completely smooth. Sometimes, the first half whorl contains a few faint ribs, especially on the upper half. The protoconch – teleoconch transition is not very distinct. The slim, high-turreted teleoconch may possess more than 10 whorls, which are only slightly convex. The surface is glossy. The axial ornament consists of many strong, slightly ophistocyrth ribs, which are more or less triangular in cross section. The spiral ornament consists of a notch at about one third of the height of the whorl and is generally only pronounced between the axial ribs. Normally, the notch develops only after several whorls, but it is not always present. Most specimens lack additional spirals, thus they do not correspond with the holotype but with a form which in the literature often is described as *Strioterebrum foveolata* (Beyrich, 1854). Below the spiral notch, the holotype of *S. basteroti* has a sculpture of approximately eight spiral riblets, which are separated by very narrow furrows. Above the spiral notch, they are only very weakly pronounced. The base of the bodywhorl, however, is covered with regular spirals. The growth lines have the same orientation as the axial ribs. The aperture narrows at the apical end and turns at the lower end into the channel, which is retracted.

Remarks — This species only appears in the samples assigned to Hemmoorian and lowest Reinbekian intervals. It is the only species which has been clearly identified so far; the definition of a lectotype (Glibert, 1952) makes an unequivocal identification possible. Janssen (1984) recognized a second morph within populations assigned to *S. basteroti* by earlier authors (Koenen, 1872; Kautsky, 1925; Anderson, 1964). *Strioterebrum foveolatum* Beyrich, 1884, has been synonymized with *S. basteroti* (*e.g.*, Koenen, 1882; Kautsky, 1925; Anderson, 1964; Janssen, 1984). Already Beyrich (1854) emphasised the high morphological similarity. Dr. Aberhan from the Museum für Naturkunde der Humboldt-Universität in Berlin kindly made the holotype of *Strioterebrum foveolatum* (MB.Ga.1980) available for study. This specimen is in all details identical to smooth forms of *S. basteroti*. Unfortunately, the protoconch of the holotype is missing. Also, the declared location "aus einem Bohrloche bei Bocholt" is not very specific. But we can assume that the type specimen originates from Hemmoorian or lowest Reinbekian intervals, given the presence of this species in these intervals in boreholes in the region.

Strioterebrum hoernesi (Beyrich, 1854)
Figs 3/4, 4/6-10

1854 *Terebra hörnesi* Beyrich, p. 115, pl. 6, figs. 13a, b, 14a, b.
1872 *Terebra hörnesi* Beyrich - Koenen, p. 51 (partim).
1964 *Strioterebrum hoernesi* (Beyrich) - Anderson, p. 319, pl. 45, fig. 277.
1983 *Strioterebrum (Strioterebrum) hoernesi* (Beyrich) - Janse & Janssen, p. 137, text fig. 10, pl. 3, fig. 19.

Distribution — Borehole Lüllingen: common in all samples

except for the lowermost Reinbekian intervals; borehole Kevelaer: more or less common, except for the lowermost Reinbekian and Hemmoorian intervals; Stemerdink, Wassink, Stemerdink-drill hole, Dingden (Feinsand and Glimmerton).

Description — A variable-shaped species with a characteristic protoconch. The relatively small, but very stocky protoconch consists of approximately four, slightly convex, smooth whorls. The protoconch – teleoconch transition is marked by the occurrence of ophistocyrth riblets, giving that area an inflated whorl profile. The slim, high-turreted teleoconch consists of more than 10 whorls, the whorl profile of which is nearly flat. The surface is usually glossy, but quite pale. Spiral ornament is usually lacking, but on some specimens a slight spiral depression at about one third to one fourth the height of the whorl occurs that is also expressed on the axial ribs. Whorls are ornamented with a variable number of distinct, elevated axial ribs, which are flatter on early teleoconch whorls where they resemble irregular folds. On the early teleoconch whorls these ribs are strong, resulting in a convex whorl profile. The ribs are vertical in the rear part of the whorl and then swing forward in a slightly sickle-formed manner. Growth lines have a similar orientation as the axial ribs. The aperture narrows at the apical end and turns at the lower end into the channel, which is twisted backwards. Average height 26.4 mm.

Remarks — The species *Strioterebrum hoernesi* was first described by Beyrich in 1854. Subsequent authors (Koenen, 1872; Kautsky, 1925; Glibert, 1952; Sorgenfrei, 1958; Janssen, 1984) recorded the species from Vierlandian to Gramian strata of northern Germany. In the Lüllingen and Kevelaer boreholes specimens appearing from the Vierlandian to the lowest Reinbekian intervals can be clearly separated from material from younger intervals and are thus considered as different species. The differences are mainly in the protoconch and in the first teleoconch whorl, that are much narrower in the older form. The description and the figures of Beyrich (1854) are not sufficient to answer the question which of the two stratigraphic forms is the authentic *S. hoernesi*. Beyrich's material comes from the "Thon von Bersenbrück und aus Dingden bei Bocholt" so it is highly probable, that the stratigraphic younger species is the true *S. hoernesi*. Material of *S. hoernesi* was neither found in the Beyrich collection at the Bundesanstalt für Geowissenschaften in Berlin Spandau nor at the Institut für Palaeontologie der Humboldt-Universität in Berlin. The material described and figured by Beyrich (1854) originated, however, from the collection F. and A. Roemer and was probably returned to them. In the Roemer collection, at the Roemer-Pelizaeus Museum in Hildesheim, there is a little box with five specimens of this species with two labels. It is safe to say, that one of the labels (Fig. 1/9) was written by H. Roemer, the second has an unknown handwriting (Fig. 1/10), certainly not that of Beyrich. The biggest specimen is completely destroyed by pyrite oxidation, another three are seriously damaged. Only one specimen is in good condition. Furthermore, as the sizes of the specimens do not correspond with the description of Beyrich, it is very likely, that it is not the original material of Beyrich's description. Therefore the type material must be considered as lost. As there has been a lot of confusion in the literature regarding this species and some other Hemmoorian forms of *Strioterebrum*, it is necessary to establish a neotype. The material from Hildesheim originates from the same collection and from the same site as the original types, so the remaining specimen in good condition is herewith designated as neotype of this species. Locus neotypicus is Bersenbrück (clay pits near Woltrup/ Bersenbrück), stratum neotypicum are the Twistringen beds that are of a lower Reinbekian (Middle Miocene) age.

Strioterebrum ariei sp. nov.
Figs. 1/3, 3/1-2

1872 *Terebra basteroti* Koenen, p. 52 (?partim).
1925 *Terebra (Myurella) basteroti* Koenen - Kautsky, p. 195 (partim).
1964 *Strioterebrum basteroti* (Koenen) - Anderson, p. 319, pl. 45, fig. 276 (?partim).
1972 *Strioterebrum basteroti* (Koenen) - Nordsieck, p. 118, pl. 30, fig. 200 (partim).
1984 *Strioterebrum (Strioterebrum)* sp. Janssen, p. 338, pl. 13, fig. 10, pl. 77, figs 3-6.

Locus typicus — Borehole Kevelaer, depth 90-95 m b.s.

Stratum typicum — Hoerstgen beds, Middle Miocene, upper Hemmoorian, Oxlundian.

Derivatio nominis — Named after Arie W. Janssen, who recognized first that this form is not identical to *Strioterebrum basteroti.*

Holotype — SMF 327505 (*ex* GWC 7,5,127,3).

Paratypes — SMF 327506 (1 specimen from borehole Kevelaer, 90 m depth), SMF 321968 (same locality) (ex GWC K-95 7,5,127,3); RGM 225 566, RGM 226 145, RGM 226 146, RGM 226 147 (each 1 specimen) from Winterswijk-Miste (Netherlands, Aalten member, Miste bed, Miocene, Hemmoorian); GWC, unnumbered lot (14 specimens), from borehole Kevelaer, 90-95 m depth, Hoerstgen beds, Miocene.

Distribution — Kevelaer, common in the lowest samples (Hemmoorian), Winterswijk-Miste, Dingden (Feinsand), borehole Borchelhof, 102-105 m (lower Hemmoorian), Woltrup near Bersenbrück (Anderson, 1964).

Diagnosis — *Strioterebrum* with a relatively large protoconch, usually with a distinctly pronounced spiral notch below the suture, with many fine spiral threads, and, as a common rule, a dull surface.

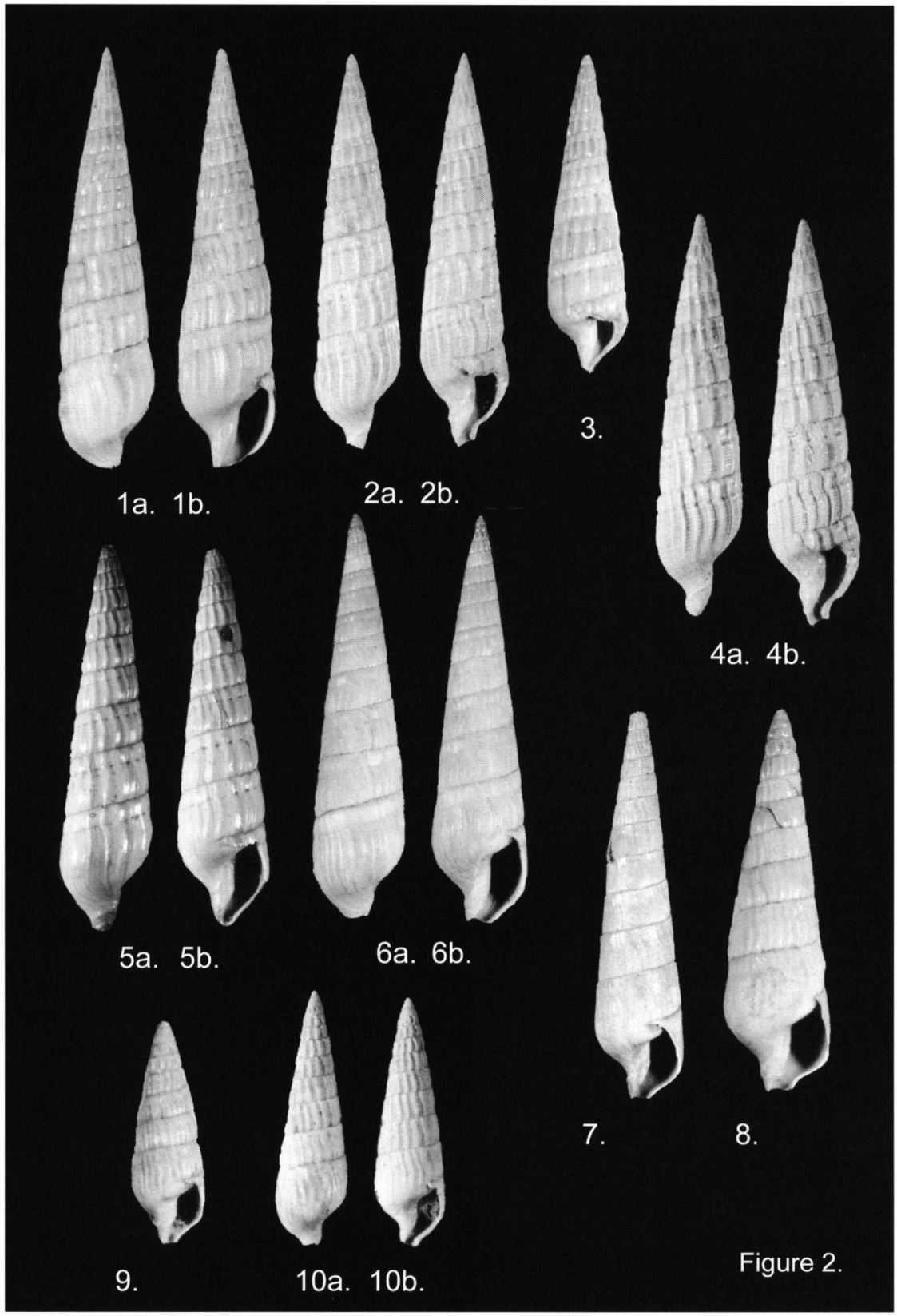

Figure 2.

Figure 2. 1, *Strioterebrum (Strioterebrum) basteroti* (Nyst, 1845) forma *foveolata*. Kevelaer (95 m), x 4 (K-95 7,5,127,2), a = frontal view, b = rear view. 2, *Strioterebrum (Strioterebrum) basteroti* (Nyst, 1845). Lüllingen 1 (54 m), x 4 (L-54 7,5,127,2) typical form, a = frontal view, b = rear view. 3, *Strioterebrum (Strioterebrum) basteroti* (Nyst, 1845). Lüllingen (157m), x 5.5 (L-57 7,5,127,2). Form with weak spiral sculpture. 4, *Strioterebrum (Strioterebrum) basteroti* (Nyst, 1845). Lüllingen 1 (57 m), x 4 (L-57 7,5,127,2) typical form, a = frontal view, b = rear view. 5, *Strioterebrum (Strioterebrum) foveolata* (Beyrich, 1854). Bocholt, type specimen from the collection Beyrich, Institut für Paläontologie am Museum für Naturkunde in Berlin, x 4, a = frontal view, b = rear view. 6, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich 1854). Lüllingen 1 (33 m), x 3 (L-33 7,5,129,1). a = frontal view, b = rear view. Specimen with weak ribs. 7, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich 1854). Lüllingen 1 (39 m), x 3 (L-39 7,5,129,1). 8, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich 1854). Lüllingen 1 (48 m), x 5.5 (L-48 7,5,129,1). Ribs with narrow interspaces. 9, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich 1854). Kevelaer (75 m), x 5.5 (K-75 7,5,129,1). Ribs with very narrow interspaces. 10, *Strioterebrum (Strioterebrum) hoernesi* (Beyrich 1854). Neotype. x4, Bersenbrück, collection Roemer in Roemer-Pelizaeus-Museum (Hildesheim). A= frontal view, b= rear view.

Description — The relatively big and plump protoconch consists of approximately four smooth, bulbous whorls. Only on the last half protoconch whorl a few opisthocyrt riblets develop. The protoconch-teleoconch transition is poorly defined. The slender, high-turreted teleoconch may contain over 10 whorls, whose profile is straight and nearly parallel to the shell's axis. Compared to *S. basteroti*, the surface is duller. Spiral ornament consists of a spiral notch or a distinct depression at two thirds to three quarters of the height of the whorl and is also developed on the axial ribs. Spiral ornamentation usually develops on the early teleoconch whorls. The whorl can be covered with up to forty very fine wire-like spirals, which are also developed on the base of the bodywhorl. The axial ornament normally consists of a high number, up to 30, distinct ribs per revolution, which are erect subsuturally, and are prosocyrth below the spiral notch. The orientation of the growthlines is that of the axial ribs. The aperture narrows at the apical end and turns at the lower end into the channel, which is retreated backward. Average height in the Kevelaer material 24.1 mm. The largest specimens studied from Winterswijk-Miste are up to about 40 mm. The holotype has a height of 23.6 mm.

Discussion — *Strioterebrum ariei* and *S. basteroti* disappear in the North Sea Basin during the earliest Reinbekian. The latter species first occurs in Vierlandian strata, *S. ariei* has its first occurrence in lower Hemmoorian strata. *Strioterebrum ariei* has, like *S. basteroti*, axial ribs of very variable strength of the ribs and a variable number of spiral ribs. It can be distinguished from *S. basteroti* by a few constant characteristics. The protoconch of *S. basteroti* is smaller and more slender. The number of spirals is markedly higher than that of *S. basteroti*. The spirals of *S. basteroti* are wide with narrow interspaces, whereas in *S. ariei* they are very slender and wire-like. *Strioterebrum ariei* always has a dull surface in contrast to the glossy surface of *S. basteroti*. The former species shows a certain resemblance with *S. pliocenicum* (Fontannes, 1881) from the French Pliocene, but that species has, at least compared with the illustration, far less spirals. I think that *S. pliocenicum* belongs in a completely different lineage, because it appears much later than *S. ariei* disappears.

Strioterebrum fabritzi sp. nov.

Figs 2/5, 3/6-7

1872 *Terebra hörnesi* Koenen, p. 51 (partim).
1925 *Terebra hörnensi* [sic] Koenen - Kautsky, p. 194, pl. 12, fig. 23.
1952 *Terebra (Terebra) hoernesi* Koenen - Glibert, p. 136, pl. 10, fig. 6.
1958 *Terebra hörnesi* Koenen - Sorgenfrei, p. 295, pl. 65, fig. 214.
1984 *Strioterebrum (Strioterebrum)* cf. *hoernesi* Koenen - Janssen, p. 337, pl. 13, fig. 9, pl. 77, figs. 7-8.

Locus typicus — Borehole Kevelaer, 95 m depth.

Stratum typicum — Hoerstgen Beds, Middle Miocene, upper Hemmoorian, Oxlundian.

Derivatio nominis — Named after Gerhard Fabritz, Krefeld.

Holotype — SMF 327507 (ex GWC K-90 7,5,129,2).

Paratypes — GWC K-95 7,5,129,2 (1 specimen from borehole Kevelaer, 95 m); SMF 327 509 (ex GWC L-48 7,5,129,2: 1 specimen from borehole Lüllingen, 48 m); SMF 327 508 (1 specimen from borehole Kevelaer, 95 m), RGM 225 565, RGM 226 149 and RGM 226 150, all containing a single specimen from Winterswijk-Miste, Aalten member, Miste Bed, Middle Miocene (Hemmoorian, Oxlundian); GWC, unnumbered lots: borehole Kevelaer (233 specimens from 80-95 m) and Lüllingen (137 specimens from 48-57 m).

Distribution — Borehole Lüllingen: common in the lowest samples, lowermost Reinbekian; Borehole Kevelaer: common, only in the Hemmoorian and lowermost Reinbekian intervals; Winterswijk-Miste, Aalten Member, Miste Bed, Hemmoorian; Dingden (Feinsand), lowest Reinbekian, borehole Borchelhof Northern Germany, 108-111m, 99-102m, lower Hemmoorian, Heilshoop in Northern Germany, 170m, Vierlandian.

Diagnosis — A *Strioterebrum* with a relatively big protoconch, high number of whorls with an indistinct depression below the suture and, at least on the early teleoconch whorls, axial ribs, that grade into low folds on subsequent whorls.

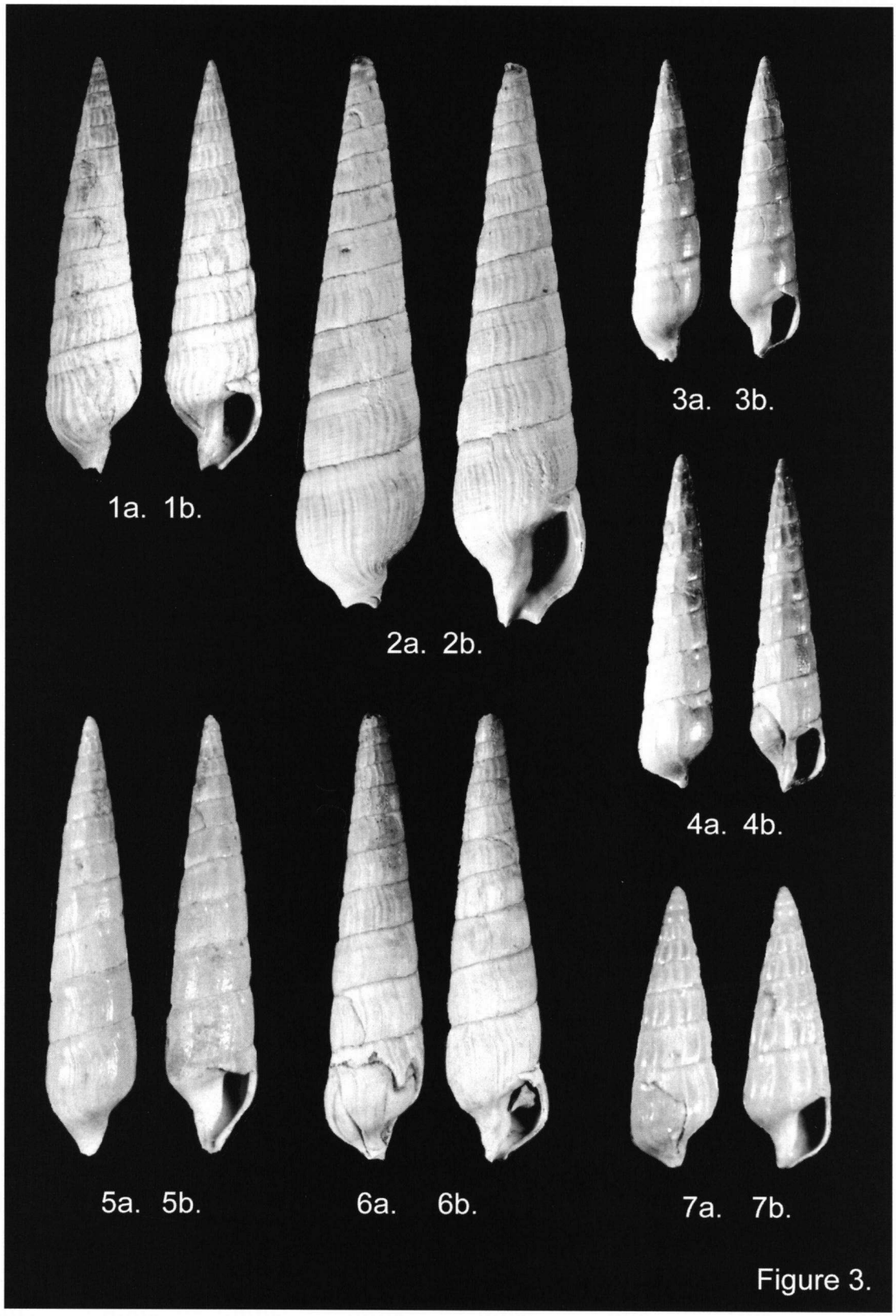

Figure 3.

Figure 3. 1, *Strioterebrum (Strioterebrum) ariei* sp. nov. SMF 327505 (holotype). Kevelaer (90 m), x 2.5 (K-90 7,5,127,3), a = frontal view, b = rear view. Specimen with strong ribs. 2, *Strioterebrum (Strioterebrum) ariei* sp. nov. SMF 327506 (paratype). Kevelaer (95 m), x 3.5 (K-95 7,5,127,3), a = frontal view, b = rear view. Specimen with weak ribs. 3, *Strioterebrum (Strioterebrum) ronaldi* sp. nov. SMF 327510 (holotype). Lüllingen (139 m), x 4 (L-39 7,5,127,1), a = frontal view, b = rear view. 4, *Strioterebrum (Strioterebrum) ronaldi* sp. nov. SMF 327512 (paratype). Lüllingen (133 m), x 4 (L-33 7,5,127,1), a = frontal view, b = rear view. 5, *Strioterebrum (Strioterebrum) ronaldi* sp. nov. SMF 327511. Lüllingen (136 m), x 4 (L-36 7,5,127,1), a = frontal view, b = rear view. Specimen with a weak sculpture and relatively high whorls. 6, *Strioterebrum (Strioterebrum) fabritzi* sp. nov. SMF 327507 (holotype). Lüllingen 1 (51 m), x 2.5 (L-51 7,5,129,2), a = frontal view, b = rear view. 7, *Strioterebrum (Strioterebrum) fabritzi* sp. nov. SMF 327508 (paratype). Kevelaer (95 m), x 5.5 (K-95 7,5,129,2), a= frontal view, b = rear view.

Description — A variably shaped species with a variable-shaped protoconch. The protoconch is big to very big (diameter up to 1.7 mm), elongate and consists of five to six smooth, bulbous whorls. The onset of the teleoconch is marked by the appearance of prosocyrth ribs. The slender teleoconch may contain over 10 whorls, which are straight sided; early teleoconch whorls may be slightly subrounded. The surface of the shell is often a bit shiny, but relatively pale. A spiral ornament is usually lacking. There can be a very weak depression between two thirds and three quarters of the height of the whorl, which is developed on the axial ribs as well. Usually, whorls are covered with widely spaced and distinctly raised axial ribs, which flatten on later teleoconch whorls where they become irregular folds. In case a spiral depression is lacking, the axial ribs cover the entire whorl and are ophistocyrth. The growth lines have the same orientation as the axial ribs. The aperture narrows at the apical end and turns at the lower end into a channel, which is twisted backward. Average height of the material is 27.4 mm, the holotype is 25.1 mm high.

Discussion — The protoconch in specimens referred to by earlier authors as *Strioterebrum hoernesi* is small in the older stratigraphic intervals and big and more convex in younger stratigraphic intervals. The stratigraphic youngest specimen (Lüllingen, 48 m) contains a very big and inflated protoconch. Janssen (1984) recognised correctly that this form is not identical with *S. hoernesi* (Beyrich, 1884). The two forms have successive stratigraphic ranges. The theory that this species is possibly an extreme form of *S. basteroti* (Janssen, 1984, p. 338) is not tenable because the protoconch of *S. basteroti* is distinctly more slender.

Strioterebrum ronaldi nov. sp.
Figs 3/3-5

Holotype— SMF 327510 (ex GWC L-39 7,5,127,1).

Locus typicus — Borehole Lüllingen, depth 39 m.

Stratum typicum — Bislich beds, Middle Miocene, Reinbekian.

Derivatio nominis — Named after Dr. Ronald Janssen, Forschungsinstitut Senckenberg, Frankfurt, who helped me in many discussions.

Paratypes — SMF 327 511 (borehole Lüllingen, 36 m) and SMF 327 512 (borehole Lüllingen, depth 33 m); GWC 7,5,127,1: 15 specimens from borehole Kevelaer, 60-75 m; GWC 7,5,127,1: 430 specimens from borehole Lüllingen, 18-51 m.

Distribution – Lüllingen (18-51 m) a few hundred specimens; Kevelaer, (60-75 m: Bislicher Schichten); Dingden (Feinsand), not very common; Tornesch (17-25 m), upper Miocene, not very common.

Diagnosis — A relatively small and slender *Strioterebrum* (H/W ratio = 4.3), with a slender protoconch consisting of five whorls; teleoconch lacking spiral ribs and with only weakly pronounced, fold-like axial ribs.

Description — The slim protoconch consists of approximately five smooth, subrounded whorls. Only on the last half protoconch whorl a few weak axial riblets may develop. The protoconch-teleoconch transition is poorly defined. The slender, high-turreted teleoconch may contain over 10 whorls that are very slightly restricted directly above the lower suture. The shell's surface is glossy and contains a variable number (about 10-20) of axial ribs that are orthocline. They are fold-like on early teleoconch whorls and become lower and may disappear completely on later teleoconch whorls. Growth lines are, like the axial ribs, ophistocyrth. Only a very subdued depression that develops some whorls after the protoconch-teleoconch boundary may exist on the lower third of the whorl. The aperture narrows at the top and turns at the lower end into a channel, which is twisted backwards. Average height 16.9 mm; height of holotype 13.3 mm.

Discussion — This species occurs only in samples of Reinbekian and younger age. It is surprising, that in spite of the abundance, it has never been mentioned in the literature before. With certainty it has always been confused with *S. hoernesi*, which is also found in Reinbekian deposits. *Strioterebrum ronaldi* can be distinguished from that taxon by the more slender protoconch, the generally smaller size and the reduced ornament. The protoconch is very similar to that of *Strioterebrum basteroti*, the latter, however, reaching much larger sizes and containing a completely different ornament.

Discussion and concluding remarks

The distribution of *Strioterebrum* species in the Kevelaer

and Lüllingen boreholes is provided in Table 1. The stratigraphic distribution of the species in the North Sea Basin Miocene is provided in Figure 4.

Kevelaer	K95	K90	K85	K80	K75	K70	K65	K60
Strioterebrum ariei	13	4						
S. basteroti	22	24	33					
S. fabritzi	95	72	63	5				
S. hoernesi				1	20	16	9	14
S. ronaldi				2	7	5	3	

Lüllingen	L57	L54	L51	L48	L45	L42	L39	L36	L33	L30	L27	L24	L21	L18
S. basteroti	7	8	7	1										
S. fabritzi	59	19	37	23										
S. hoernesi				33	23	33	25	9	15	67			38	
S. ronaldi			3	3	8		65	8	97	243			1	2

Table 1. Occurrence of *Strioterebrum* species in borehole Kevelaer and in Borehole Lüllingen.

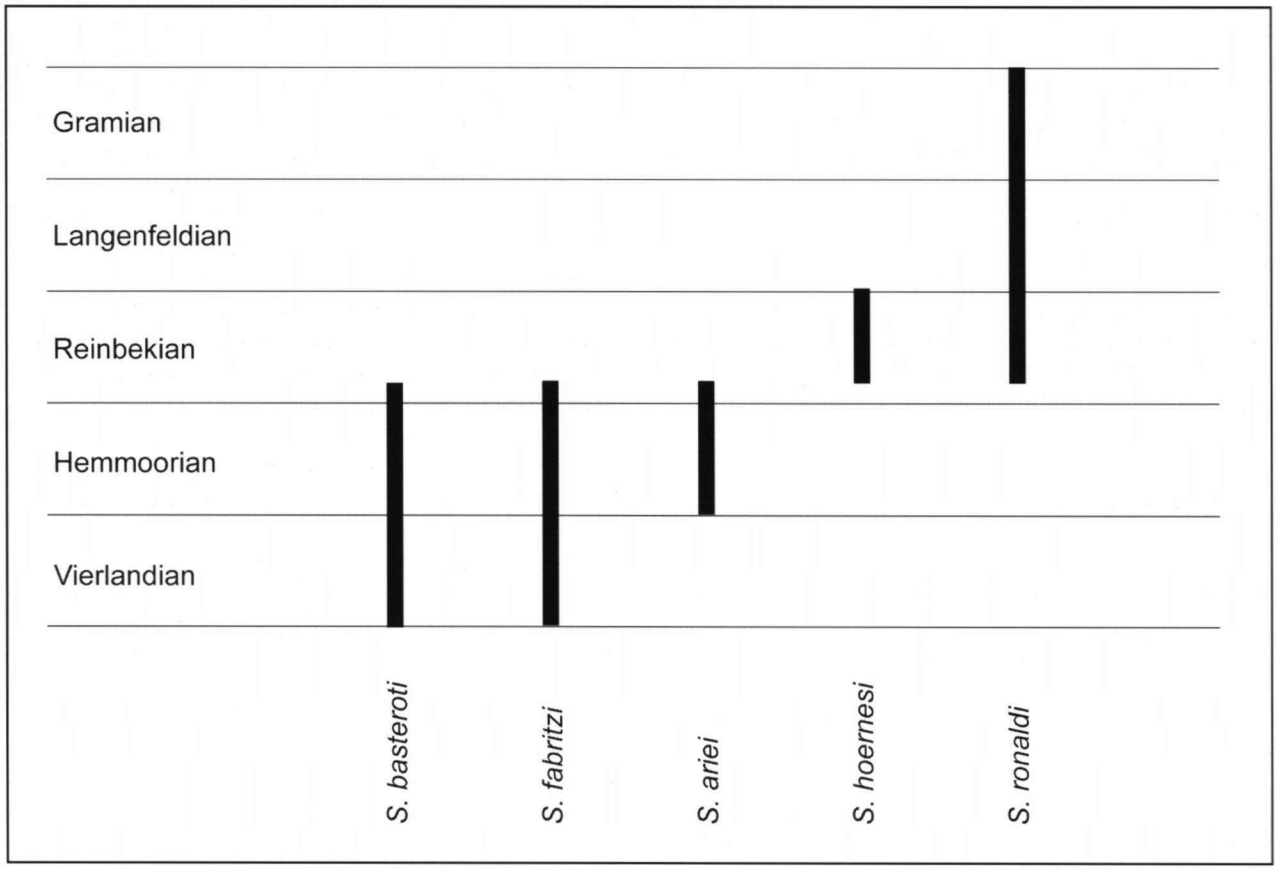

Figure 4. Stratigraphic distribution of *Strioterebrum* species in the Miocene of the North Sea Basin.

In the Hemmoorian and Reinbekian (Middle Miocene) deposits of the North Sea Basin five *Strioterebrum* species occur that are well distinguishable, three of which are described as new in this paper. The earliest occurrence of the genus *Strioterebrum* in the North Sea Basin is from Aquitanian (Lower Vierlandian) strata from Schleswig-Holstein (Hinsch, 1986) and southeastern Holsatia. The latter material yields two species of *Strioterebrum*, *S. basteroti* and *S. fabritzi*. From the earliest Hemmoorian onward these two species are joined by *S. ariei* until the earliest Reinbekian. At that time all three species disappear and are replaced by *S. hoernesi* and *S. ronaldi*, the latter surviving into the Late Miocene (Gramian) of the North Sea Basin. Thus, a complete species turnover occurs at the beginning of the Reinbekian. The co-occurrence of stratigraphically older and younger species in excavation material from the Königsmühle at Dingden (earliest Reinbekian) and in straight flush drilling samples from the same age from Schleswig Holstein almost certainly is due to pooling of material from the different stratigraphic zones. It is completely unclear, where this turnover resulted from but a distinct parallel exists with *Nassarius* species (Wienrich, 2001, 2002; Gürs, 2002). The turnover of the *Strioterebrum* fauna is even more remarkable as the members of this genus have long stratigraphic ranges. Perhaps it is in some way linked to the strong transgression beginning at this time, the Reinbek transgression (Anderson, 1964). The turnover event makes *Strioterebrum* species a valuable biostratigraphic indicator group for the Miocene of the North Sea Basin.

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