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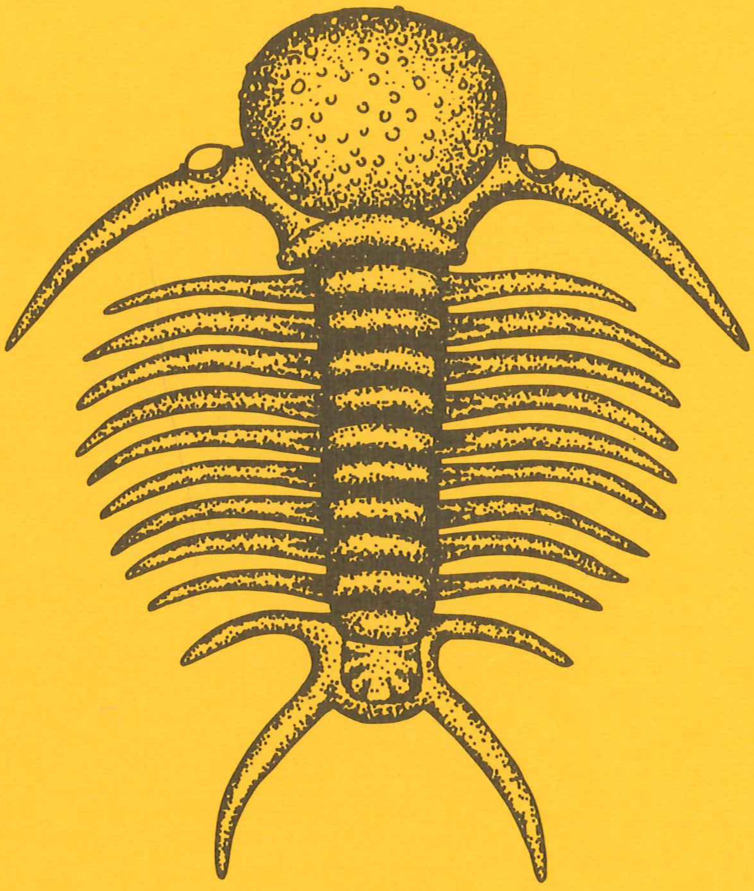

NEOBEYRICHIA FROM THE SILURIAN OF BJÄRSJÖLAGÅRD SCANIA, SWEDEN

EWA SÄLL

LUND 1986 NR 10

GEOLOGISKA INSTITUTIONEN LUNDS UNIVERSITET

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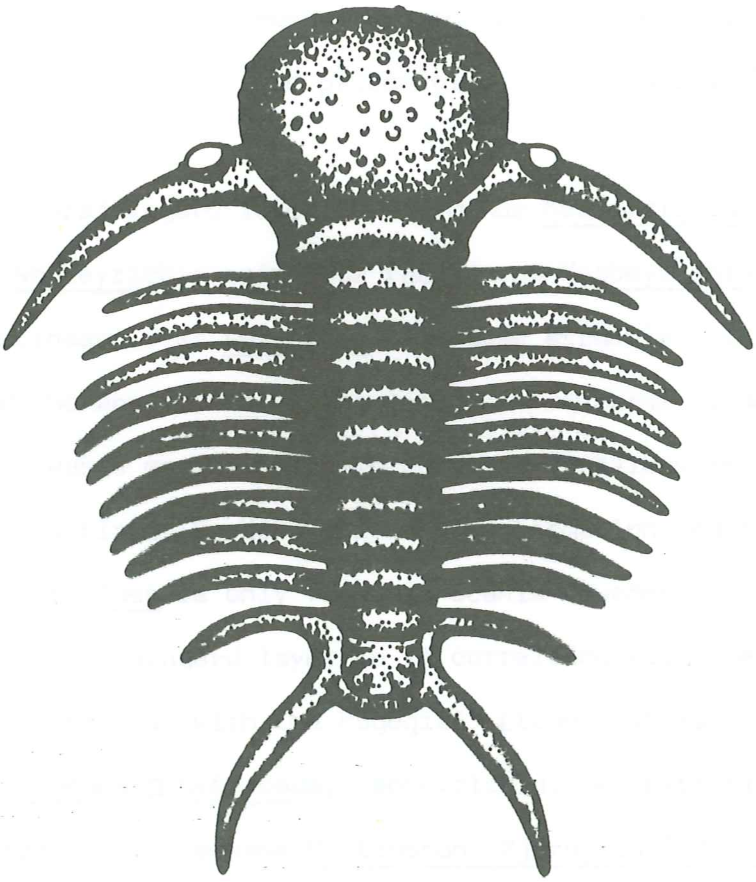

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Neobeyrichia from the Silurian of Bjärsjölagård, Scania, Sweden.

Ewa Säll

Säll, Ewa. 1984 12 31: *Neobeyrichia* from the Silurian of Bjärsjölagård, Scania, Sweden. Examensarbete i Geologi vid Lunds universitet. Historisk geologi och paleontologi, Nr. 10 pp. 1-15

In Bjärsjölagård layer 1b the genus *Neobeyrichia* is represented by *Neobeyrichia spinulosa* (Boll) and *Neobeyrichia regnans* Martinsson. *N. spinulosa* dominates strongly. It is here redescribed and the appearence of the last moulting stage is described. *N. spinulosa* was a marine, benthic species. Previous reports of *N. spinulosa* from Gotland (Sweden) and Denny's Formation (eastern USA) are wrong. *N. spinulosa* is only found in Scania (Sweden).

Bjärsjölagård layer 1b is correlated with the Hamra beds of Gotland and here also with the Pagegiai Etage (Latvia) by the presence of *N. regnans*. □ Ostracoda, Neobeyrichia, Neobeyrichia spinulosa (Boll), Neobeyrichia regnans Martinsson, Bjärsjölagård, Scania, Sweden, Silurian.

Ewa Säll, Department of Historical Geology and Palaeontology, Sölvegatan 13, S-223 62 Lund, Sweden.

Bjärsjölagård is located in central Scania (Sweden). The locality is mainly a limestone quarry.

In Bjärsjölagård layer 1b, two species of Neobeyrichia were found: Neobeyrichia spinulosa (Boll) and Neobeyrichia regnans Martinsson. Both species have been reported from this locality before (Grönwall 1897, Moberg and Grönwall 1909, Martinsson 1967). Bjärsjölagård layer 1b is correlated with the Hamra beds of Gotland (Martinsson 1967, 1977).

Neobeyrichia spinulosa (Boll) was first described in 1856 as Beyrichia spinulosa. The description was made from an exampel found in an erratic block of "Graptolitengestein", found in the Neubrandenburg district. Boll (1862) suggested to change the name into the more suitable Beyrichia nodulosa. Two more findings of N. spinulosa have been made from erratic blocks, one in Romehnen (Reuter 1885) and one in Muggelheim (Krause 1891).

In Scania Neobeyrichia spinulosa has been found not only in Bjärsjölagård but in Klinta and Ramsåsa (Grönwall 1897) as well. A few specimens have been found in Skarhult (Hede 1919, Martinsson 1967).

On Gotland N. spinulosa has been reported from many localities from Hemse beds up to Hamra beds (Hede 1920, Krause 1891).

Bastin and Williams (1914) reported one specimen from Denny's Formation in eastern USA, which however is incorrectly determined (see p. 13). N. spinulosa and several of its synonymies are listed in Ulrich and Bassler (1909).

Neobeyrichia regnans is typical of Hamra beds on Gotland but has also been found in Sundre beds (Martinsson 1962). N. regnans has also been reported from the Pagegiai Etage in Latvia (Gailite 1964, 1965, 1967).

Material and Measurements

The material was collected by Professor Anders Martinsson and the neobeyrichids were sorted out by Barbara Zbikowska. The samples have been collected at some dumps that contains quarried waste material from the Bjärsjölagård quarry.

The material has been prepared and measured in a stereomicroscope with measuring lenses.

Out of the 580 neobeyrichiid specimens examined, 509 were found to be Neobeyrichia spinulosa and 50 Neobeyrichia regnans. The others were poor to identify below generic level because of their bad state of preservation. Carapace held together have been counted as two specimens. Only the measured values for N. spinulosa have been considered, since the number of N. regnans was too small. Fourteen of the measured carapaces were red or black from iron transformation.

The length of the hinge line and the height from the hinge line to the ventral side through the anterior sulcus were measured. The length/ /height values of N. spinulosa have been plotted against each other (Fig. 1). The most deformed specimens are not represented in the figure. There is a linear connection between the increase in length and in height for the smaller specimens. For the larger specimens there is also a linear connection but the values along another regression line. Regression lines have been calculated for specimens of moulting stages 8 and 9, one (line 1) for all specimens ($y = 0{,}36 + 0{,}81\ x$) and one (line 2) for females only ($y = 0{,}49 + 0{,}83\ x$).

In figure 2 the length of the hinge line in N. spinulosa has been plotted against the number of specimens of each size. The length values have been rounded up to one decimal to facilitate the interpretation. Clearly defined maximas are found at 1,3 mm, 1,6 mm, 2,0 mm and 2,5 mm. These maximas correspond well to Brook´s law: $L_n = L_1 \cdot k^{n-1}$ where k is the growth factor = 1,26; L_1 is the length of the initial carapace and L_n is the length of the n-th moulting stage (Spjeldnaes 1951). Calculations of Brook´s law have resulted in 9 moulting stages for N. spinulosa (Fig. 1). The first three moulting stages have been calculated on theoretical grounds, as clearly defined maximas were not found.

In figure 3 one example of N. spinulosa is reproduced to show the outstanding features of the carapaces.

One specimen of medium size from each moulting stage has been selected and its contoures have been drawn (Fig. 4).

Females exist in size corresponding to moulting stage 8 and 9. Males outnumbers females in moulting stage 8, but in moulting stage 9 males are rare. The amount of females in the last two moulting stages is approximately constant but the number of males is sharply reduced in the last (Fig. 2).

Tabell 1 shows different dates for the material. The figures are delt with in the discussion.

The number of right- and left valves of N. spinulosa were counted and when the corresponding valves were found together the largest one was registrated (Tab. 2). In 63% of the cases the right valve was the largest in length and in 58% of the cases the left valve had the largest height.

Among the 509 valves of N. spinulosa measured, 235 were left valves and 274 were right valves.

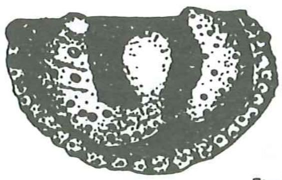


Fig.3

Fig. 3. Neobeyrichia spinulosa. X 20

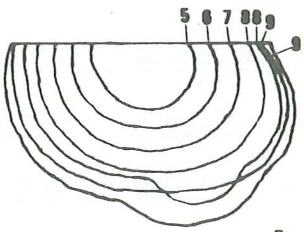


Fig.4

Fig. 4. The contours of different moulting stages and sexes of Neobeyrichia spinulosa showing the systematic increase in size and the change of outline. X 20

Tab. 1. Statistics for Neobeyrichia spinulosa (Boll)

Neobeyrichia spinulosa (Boll)

Amount of carapace	509	Valves from moulting stage 1	-
Righthand valves	274	Valves from moulting stage 2	-
Lefthand valves	235	Valves from moulting stage 3	-
Right valve longest	45	Valves from moulting stage 4	2
Left valve longest	26	Valves from moulting stage 5	27
Right valve highest	29	Valves from moulting stage 6	57
Left valve highest	40	Valves from moulting stage 7	125
Males and tecnomorfs	468	Males from moulting stage 8	115
Females	41	Males from moulting stage 9	14
Valves found together	79		

Neobeyrichia (Neobeyrichia) spinulosa (Boll 1856)

1856 - Beyrichia spinulosa - Boll p. 323; Fig. 3

1856 - Beyrichia nodulosa Boll - Boll p. 131; Pl. 1, Fig. 6

1885 - Beyrichia dubia m. - Reuter p. 648; Pl. 26, Fig. 22

1888 - Beyrichia Lindströmi var. expensa Mihi - Kiesow p. 6; Pl. 1, Figs. 7-8

1891 - Beyrichia nodulosa Boll - Krause p. 500; Pl. 32, Fig. 11

1909 - Beyrichia nodulosa Boll - Moberg & Grönwall p. 60; Pl. 4, Fig. 10

non 1914 - Beyrichia spinulosa Boll - Bastin & Williams p. 2; Pl. 16, Fig. 27

1919 - Beyrichia nodulosa Boll - Hede p. 134; Pl. 5, Fig. 10

1962 - Neobeyrichia (Neobeyrichia) spinulosa (Boll 1856) - Martinsson p. 18, Fig. 3c

1962 - Neobeyrichia (Neobeyrichia) expansa (Kiesow 1888) - Martinsson p. 26, Fig. 8 A-B.

The carapace has three dorsoventrally running lobes out of which the posterior one (L3) is the largest (Fig. 3). Sulci are deeply incised (Fig. 5A).

The lobes are ventrally connected; L2 is connected to L3 more broadly than L1 to L2 where the connection is just a thin ridge.

L1 is thin and reaches dorsally out over the hinge line. The posterior margin is steep. The anterior margin more flattened.

L2 is the smallest lobe and is predominantly inclined forward.

L3 is the largest lobe and reaches from a centroventral position further along the ventral margin up to the hinge line (at the same time its width increase). Antero-dorsally L3 is furnished with a large, clearly defined knob. Two furrows run across the lobe. The margin towards L2 is steep.

Both L1 and L3 are ornamented with knobs smaller than the large knob on L3. L2 and sulci are smooth.

The edge has tubercles resembling strings of pearls (Fig. 5B). Antero-ventrally these are arranged in double rows where the outermost row is the most dominant. The posterior tubercles are larger than the anterior ones. The distance between the posterior tubercles are longer than the distance between the anterior ones.

The marginal furrow is deep and has a centro-ventral depression.

The size of the shells varies a lot within the different moulting stage (Fig. 2). The largest shell found is 2,8 mm long.

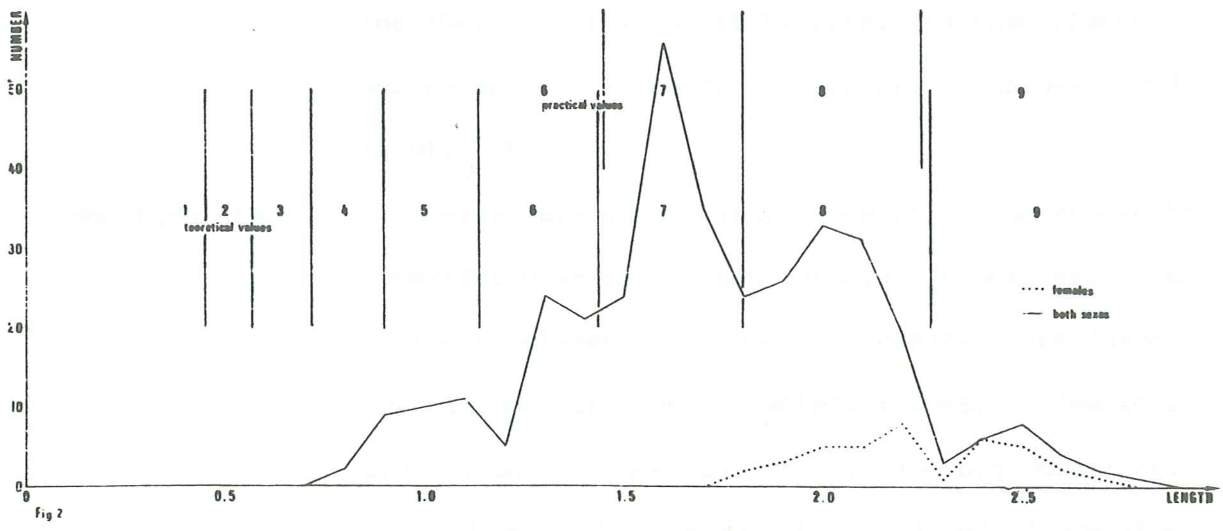


Fig. 2. Relation between length and number of specimens of <u>Neobeyrichia spinulosa</u>. The numbers marks the values for different moulting

stages. The theoretical values are calculated by extrapolation from Brook´s law.

The crumina is oval and ventrally compressed. On the ventral side some longitudinal furrows are found at the extreme inner part (fig. 5A). Tiny, widespread knobs are found all over the crumina.

The width is normally 60 - 70% of the height.

Moulting stages (Fig. 6, Tab. 2)

The smallest of the moulting stages (1, 2 and 3) were not found in the material.

Moulting stage 4: Only one carapace was found, with its postero-dorsal part broken off. The left carapace is somewhat higher than the right one, both are hyaline. The tubercles on the ventral margin are poorly developed in the anterior and antero-ventral parts. The big knob on L3 is only indicated. (Fig. 6F)

Moulting stage 5: 27 shells were identified. The outmost row of tubercles along the ventral margin is developed but not as real tubercles and the innermost row is merely indicated. The shell is still a bit hyaline. In some places on L1 and L3 knobs are found. The crossing furrows of L3 are faint. (Fig. 6E)

Moulting stage 6: 57 shells were identified. Some of the antero-ventral tubercles have not turned into real tubercles. The distance between the posterior tubercles are larger than the distance between the anterior ones. A few knobs are present on the lobes L1 and L3. The big dorsal knob of L3 is developed. The margins of L1 and L3 are steep towards L2. The crossing furrows of L3 are also developed

The marginal furrow has deepened and the centro-ventral depression is developed. The specimen reproduced is badly chosen because of the lack of knobs on L3. (Fig. 6D)

Moulting stage 7: 125 shells were identified. The central part of the carapace containing the lobes is raised and the characters from stage 6 are pronounced. L2 is proportionally narrowed. (Fig. 6C)

Moulting stage 8 and 9: 115 males of moulting stage 8 (Fig. 6A) and 14 males of moulting stage 9 (Fig. 6B) were identified. 37 females were found with a range in size suitable for both moulting stage 8 and 9. The dorsal knob and the tubercle rows are even more prominent than before. The males are higher than the females (Fig. 1). The crumina is placed anteriorly and has its upper part placed in the centro-ventral depression. The crumina of a small female is rounder than that of a bigger female.

Discussion

The material has been collected from a probably thick sequence. It has not been possible to define its thickness since the material was found in heaps of loose material. This implies that the carapaces might originally come from many different environments. The increase in size of the carapace is not dependent on the environment since ostracodes have a well developed capacity for storing great amounts of calcium carbonate; $CaCO_3$ (Scott 1961). If there were to be a lack of $CaCO_3$ this would show in the thickness of the shell and not in the parameters such as height and length, that have been analyzed here. The increase in size is constant (Fig. 4). The spreading of the values for Neobeyrichia spinulosa in Fig. 1 is therefore not dependant on the environment but caused by the small accurracy with the measuring in a stereomicroscope can be carried out in. A displacement in moulting time can also explain the diffuse appearence of the limits between the different moulting stages. The evolution that might have occurred within the species can also cause the diffuse limits.

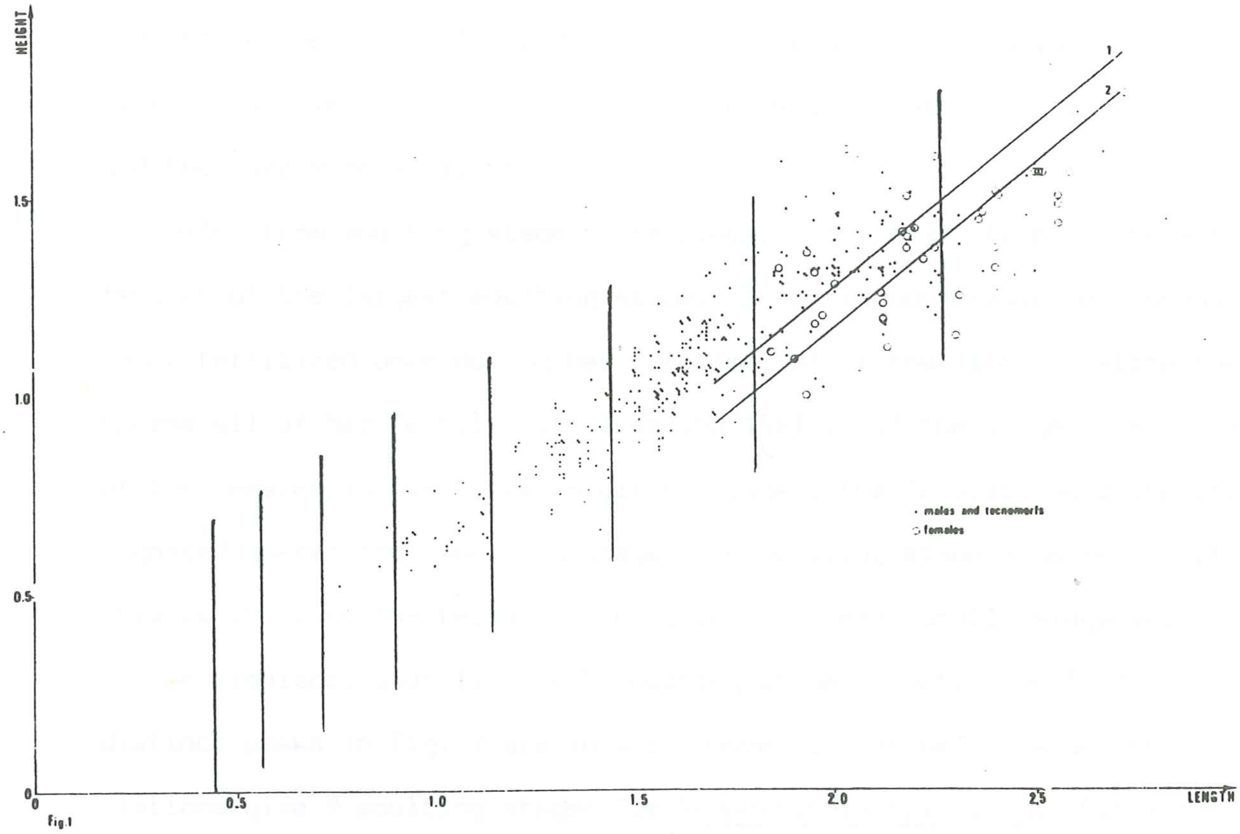


Fig. 1. Relation between length and height in Neobeyrichia spinulosa. Regression line 1 is made for adult specimens and regression line 2 for females only.

The points in Fig. 1 badly assemble along a straight line, a curve would be more suitable. This due to the change in the length-height relation that occurs when the females develope a crumina (Martinsson 1973). The regression line 1 is clearly above but parallell to regression line 2. This indicates that the height gets smaller in relation to the length when the crumina develops.

Ostracodes are able to reproduce either syngamicly or parthenogenetically (Kesling 1961). The occurrence of females in size corresponding to both moulting stage 8 and 9 might show that Neobeyrichia spinulosa could have been fertile already in a small size. The distinct dominance of females in size like the last moulting stage might show that the reproduction has become more parthenogenetical dominated from being more or less dependent on syngamical reproduction when smaller. The ratio encountered between males and females can be a bit misleading since females often have more solid carapace than males (Whatley et al. 1982), and thus are more easily fossilized.

Males from moulting stage 8 are probably too small to copulate with females of the largest moulting stage. An ostracode female only needs to be fertilized once during her lifetime, after that she can store the sperms all of her fertile life (Kesling 1961). If the large size range of the females is due to two moulting stages, the females could use impregnated sperms from moulting stage 8 in moulting stage 9 as well. If this is the case the reproduction could have been totally syngamic.

Beyrichiacea usually have 9 moulting stages (Martinsson 1973). The distinct peaks in fig. 2 are in accordance with Brook's law and the calculations give 9 moulting stages for Neobeyrichia spinulosa. Since the growth factor k = 1,26 (Brook's law) almost exactly is in accordance with the peaks, the unexact collection is of minor importance for the distribution.

The tecnomorfs can stay inside the crumina until moulting stage 3 (Spjeldnaes 1951), and when they leave the crumina they are very thin and fragile in their first moulting stages. The shell thickness and thereby the chance of preservation increases with age. The lack of tecnomorfs from the first moulting stages might be due to: unfavourable qualities for preservation, presence of moulting stages inside the crumina, sorting by streams and the coarseness of the meshes of the sieve used for washing. The bad fossilization qualities can also explain why there are just a few carapaces found from moulting stage 4. There should have been a negative relationship between age and amount of carapaces found, since the number of specimens of the first moulting stages are larger than the number of survivers that die from old age. The lack of youngsters makes the curve normal distributed instead (Fig. 2), (Boucot 1981).

The right valves of Neobeyrichia spinulosa are often a little larger than the left valves. Since the right hand valves therefore must be the enclosing one, they are also the strongest (Whatley et al. 1882) in N. spinulosa (Tab. 2). The right valves are also more abundant in the material (Tab. 2).

Tab. 2. Limits for the size in the different moulting stages in Neobeyrichia spinulosa (Boll) in mm.

Neobeyrichia spinulosa (Boll)

	Theorethical	Practical
Moulting stage 1	0,45	-
Moulting stage 2	0,45-0,57	-
Moulting stage 3	0,57-0,72	-
Moulting stage 4	0,72-0,90	0,70-
Moulting stage 5	0,90-1,14	-1,20
Moulting stage 6	1,14-1,44	1,20-1,40
Moulting stage 7	1,44-1,80	1,40-1,80
Moulting stage 8	1,80-2,27	1,80-2,30
Moulting stage 9	2,27	2,30

The occurrence of many more females than males in the last moulting stage might depend on the parthenogenetical propagation (see above), but also on the thicker carapace of females (Whatley et al. 1982).

Ornamented carapace, as the carapace of N. spinulosa, indicates a marine environment (Benson 1961). The lack of spines, the ventrally lattened crumina and the short tubercles show, at any rate for the female, a benthic way of living as crawlers. The large crumina can serve, besides for broodcare, as stabilizer to prevent the carapace from falling over. The increasing ornamentation increases the turbulence surrounding the carapace and prevents transportation (Boucot 1981). The males were probably more active through being lighter and less ornamented.

Bjärsjölagård 1b is correlated with the Hamra beds on Gotland (Marttinsson 1975). Neobeyrichia regnans (Fig. 7) is found in both places, N. regnans also occurs at the base of Sundre beds (Martinsson 1975). N. regnans has also been reported from the Pagegiai Etage upwards at least up to Hamra (Martinsson 1967).

The occurrence of Neobeyrichia spinulosa on Gotland is doubtful (Martinsson 1962). The same seems to be true for the report of its existence in Denny's Formation (Bastin & Williams 1914), since the reproduced specimen badly fit Boll's description from 1856.

Acknowledgement

I am very grateful to the late Professor Anders Martinsson at the University of Uppsala who initiated this work. I would also like to thank my friends at the University of Lund who helped me through the hard times in finishing this paper. A special thanks to Dr. Anita Löfgren, Dr. Louis Liljedahl and Sara Nyman who read the first version of the manuscript. The photos were made by Dr. Sven Stridsberg.

References

Bastin, E.S. & Williams, H.S., 1914: Description of the eastport quadrangle. Geological Atlas of the United States No. 192. 15 pp.

Benson, R.H., 1961: Ecology of ostracode assemblages. Treatise on Invertebrate Paleontology Q. 56-63

Boll, E., 1856: Brieflische Mitteilungen 3. Herr Boll an Herrn Beyrich. Zeitschrift der Deutschen geologischen Gesellschaft 8. 321-324

Boll, E., 1862: Die Beyrichieden der Norddeutschen Silurischen Gerölle. Archiv des Vereins der Freunde der Naturgeschichte in Mecklenburg 16. 131-133

Boucot, A.J., 1981: Principles of bentic marine paleoecology. 463 pp. Academic Press, London.

Gailite, Lilita (ГАЙИТЕ, ЛИЛИТА) 1964: Das Problem der biostratigraphischen Einteilung des oberen Silurs Lettlands. ИЗВЕСТИЯ АКАДЕМИИ НАУК ЛАТВИСКОЙ CCP 11. 65-72

Gailite, Lilita (ГАЙИТА, ЛИЛИТА) 1965: Die stratigraphische

Verbundenheit der Ostracoden der Familie Beyrichiidae in den silurischen Ablagerungen Lettlands. Известия Академии наук Латвиской ССР 2.68-74

Gailite, Lilita (Гайлите ,Лилита) 1967: Die Stratigraphie und die Ostrakoden des Silurs im zentralen Baltikum. Unpubliched thesis from the Geological Institute of Riga. 21pp.

Grönwall, K., A., 1897: Öfversikt af Skånes yngre öfversiluriska bildningar. Geologiska Föreningens i Stockholm Förhandlingar 19. 188-244.

Hede, J. E., 1919: Om en förekomst af colonusskiffer vid Skarhult i Skåne. Geologiska Föreningens i Stockholm Förhandlingar 41. 113-160.

Hede, J. E., 1920: Gotlands silurstratigrafi. Sveriges Geologiska Undersökning C 305. 100pp.

Kesling, R. V., 1961: Reproduction of ostracoda. Treatise on Invertebrate Paleontology Q. 17-19.

Kiesow, J., 1888: Ueber Gotländische Beyrichien. Zeitschrift der Deutschen geologischen Gesellschaft 40.1-17.

Krause, A., 1891: Beitrag zur Kenntniss der Ostracodenfauna in silurischen Diluvialgeschieben. Zeitschrift der Deutschen geologischen Gesellschaft 43. 488-557.

Martinsson, A., 1962: Ostracodes of the family Beyrichiidae from the Silurian of Gotland. Bulletin of the Geological Institution of the University of Uppsala 41. 369pp.

Martinsson, A., 1967: The succession and correlation of ostracode faunas in the silurian of Gotland. Geologiska Föreningens i Stockholm Förhandlingar 89. 350-386.

Martinsson, A., 1973: Vad man kan göra med palaeocopa ostracoder. Fauna och flora 4. 147-155.

Martinsson, A., 1977: Palaeocope ostracodes. The Silurian-Devonian Boundary. IUGS Series A, 5. 327-332.

Moberg, J. C., & Grönwall, K. A., 1909: Om Fyledalens Gotlandicum. Meddelanden från Lunds Geologiska Fältklubb B. 3. 86pp.

Reuter, G., 1885: Die Beyrichien der obersilurischen Diluvialgeschiebe Ostpreussens. Zeitschrift der Deutschen geologischen Gesellschaft 37. 621-680.

Scott, H. W., 1961: Shell morphology of ostracoda. Treatise on Invertebrate Paleontology Q. 21-37.

Spjeldnaes, N., 1951:Ontogeny of Beyrichia jonesi Boll. Journal of Paleontology. vol.25, 6. 745-755.

Ulrich, E. O., & Bassler, R. S., 1909: New American Paleozoic Ostracoda. Proceedings of the U.S. National Museum. vol.35. 1646. 277-340.

Whatley, R. C., Trier, K., & Dingwall, P. M., 1982: Some preliminary observations on certain mechanical and biophysical properties of the ostracode carapace. 76-104. In R. H. Bate, E. Robinson, & L. H. Sheppard (eds.): Fossil and recent ostracods. 492pp. Ellis Horwood Limited, Chichester.

Fig. 5. Females of Neobeyrichia spinulosa showing details on the ventral side. 5 A. The furrows on the crumina and the relief Ex. nr. Au 3 X 38. 5 B. The double rows on the anterior part of the carapace. Ex. nr. Au 2A X 42.

Fig. 6. Increase in size during the ontogeny of Neobeyrichia spinulosa. 6 A. Female of moulting stage 8. Ex. nr. Au 3. X 39. 6 B. Male of moulting stage 9. Ex. nr. Au 1D X 42. 6 C. Tecnomorf of moulting stage 7. Ex. nr. Au 1D X 42. 6 D. Tecnomorf of moulting stage 6. The specimen lack the knob on L3. Ex. nr. Au 1C X 42. 6 E. Tecnomorf of moulting stage 5. Ex. nr. Au 1B X 42. 6 F. Tecnomorf of moulting stage 4. Ex. nr. Au 1A X 42.

Fig. 7. Male of Neobeyrichia regnans moulting stage 9. Ex. nr. Au 4 X 42.

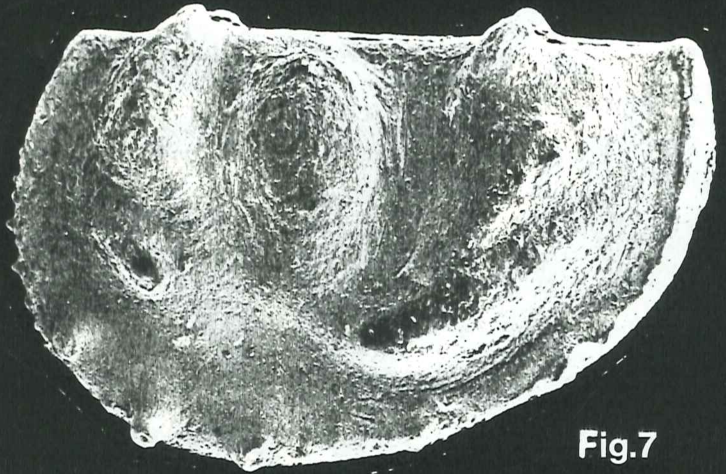
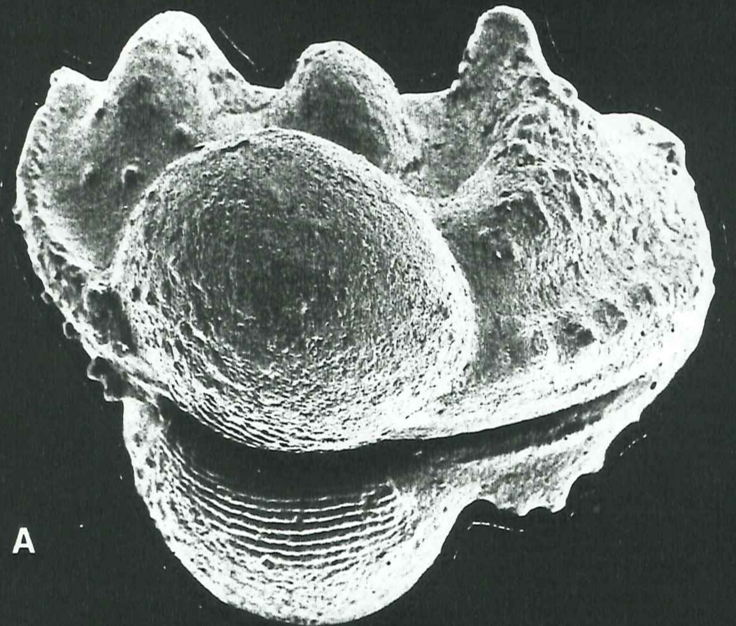


Fig.7



A

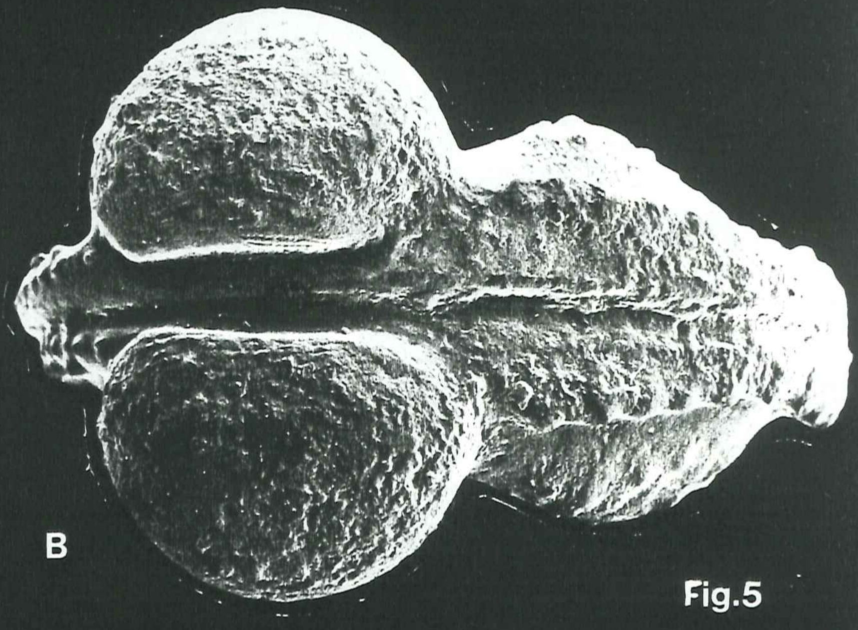


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Fig.5

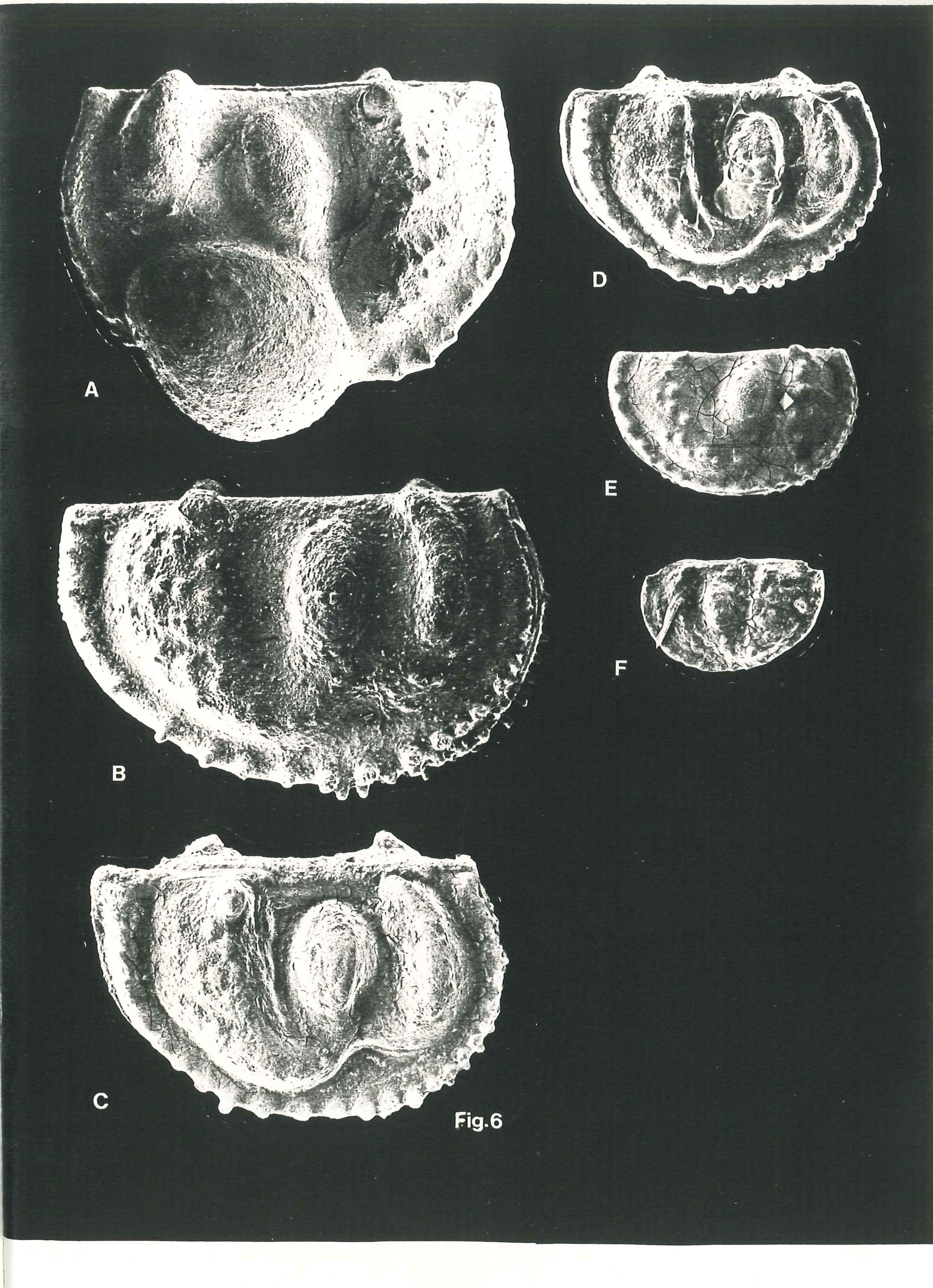

Fig.6

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