Annals and Magazine of Natural History: Series 2

Publication details, including instructions
for authors and subscription information:
<http://www.tandfonline.com/loi/tnah08>

XXVIII.—Notes on Permian fossils: -Palliobranchiata

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Published online: 26 Oct 2009.

To cite this article: William King (1856) XXVIII.—Notes on Permian fossils: -
Palliobranchiata, Annals and Magazine of Natural History: Series 2, 17:100,
333-341, DOI: [10.1080/00222935608697519](https://doi.org/10.1080/00222935608697519)

To link to this article: <http://dx.doi.org/10.1080/00222935608697519>

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different kinds of individuals (male and female) are produced by the parent, to which all other aberrations can be reduced. But reference may be made to the system of alternate generations, which reaches up into the class of insects (in the Aphides and the Psychidean genus *Talæporia*); and that amongst these, individuals are produced immediately from the female parent (the so-called nurses) which are quite different from the neuters. The neuter ants are to be compared with these; from which however they again recede, in never being capable of reproduction.

EXPLANATION OF PLATE III.

Representing the four different forms of *Æcopthora pusilla*.

Fig. I. The FEMALE.—1. Natural size; 2. magnified ten times; 3. side-view; *a*¹. the pronotum; *a*². the side-piece of the prothorax; *b*¹. the mesonotum; *b*². the scutellum; *b*³. the side-piece of the mesothorax; *c*¹. the first segment of the metanotum; *c*². the hinder segment of the same, with the spinules; *d*. the first joint of the abdominal pedicle; *e*. the second joint of the same; 4. the labrum; 5. the mandible; 6. the fore-leg; *b*. tibia; *c*. the pectinate hook; *d*. the tarsus; 7. the claws.

Fig. II. The MALE.—1. Magnified ten times; 2. fore tibia with tarsus; 3. its hook, more highly magnified.

Fig. III. The SOLDIER.—1. Natural size; 2. ten times magnified; 3. side-view, in the attitude of gnawing a piece of meat; 4. mandible; 5. the rest of the trophi; *a*. mentum; *b*. maxillæ; *b*¹. the stipes; *b*². the palpus; *b*³. the sheath; *c*¹. the tongue; *c*². its palpi; 6. the last four joints of the antennæ.

Fig. IV. The LABOURER.—1. Natural size; 2. magnified ten times; 3. the mandibles; 4. the antennæ; 5. the fore-leg; 6. the claw-joint of the same; 7. the middle leg.

XXVIII.—*Notes on Permian Fossils:—Palliobranchiata.* By WILLIAM KING, Professor of Mineralogy and Geology in Queen's University, Ireland (Q. C. Galway); Corresponding Member of the Natural History and Medical Society of Dresden, &c.

(Concluded from p. 269.)

Family Rhynchonellidæ, Gray, 1848.

Genus RHYNCHONELLA, Fischer de Waldheim.

IN one of Mr. Davidson's usual valuable papers lately published*, he has been led to question the existence of the genus *Rhynchonella* during the Permian period. The query evidently has reference to the uncertainty hitherto prevailing as regards the

* "A few Remarks on the Brachiopoda," Ann. and Mag. of Nat. Hist. Dec. 1855.

generic position of the so-called *Terebratula Geinitziana* discovered by De Verneuil in the Permians of Russia*. This species, or rather a shell occurring in Germany first noticed by Geinitz†, and stated to be identical with it, has lately been placed in *Camarophoria*‡, though the original description given by M. de Verneuil is somewhat in favour of the Russian type being considered a *Rhynchonella*.

Mr. Davidson no doubt was led by his inherent cautiousness to query the Permian existence of *Rhynchonella* from the uncertainty named; but as this genus is well known to characterize both the Carboniferous and the Saliferous systems, this fact alone would have been considered of sufficient force *by some* to warrant their positively concluding that it existed during the Permian period.

Rhynchonella ? *Geinitziana* §, De Verneuil. Pl. XII. figs. 7-11.

It is only lately that any specimens of the German fossil, which Geinitz has referred to the present species, came under my observation; it required, however, but a very brief examination of them to feel convinced that they belong to an undoubted *Rhynchonella*, and a species unsurpassed either in beauty or histological interest. The specimens alluded to were obtained out of the dark-coloured Zechstein of Röschen, one of the German localities famous for Permian fossils.

Confining ourselves to the species represented by the German specimens, there cannot be any doubt of its being a true *Rhynchonella*; as its large valve is furnished with two well-developed rostral plates, and the opposite or small valve with the usual median one. But what constitutes the peculiar interest of this shell is, that both valves are as distinctly and regularly perforated as those of any *Terebratulidæ*.

But I am assuming that the German specimens belong to the species *Rhynchonella Geinitziana*. Be this as it may, there is no doubt on my mind of their being the same as those procured by Dr. Geinitz at Gera, and identified by him in his 'Versteinerungen' (*loc. cit.*) with the Russian species named. I cannot help thinking, however, that they represent a different species. De Verneuil describes his shell as having its slightly elevated ribs "obsolete or completely effaced near the beak;" and Count Keyserling's testimony is to the same effect, representing them as "sehr obsolete||;" but all the specimens from Röschen, although

* Geology of Russia, vol. ii. pp. 83, 84, pl. 10. fig. 5 a, b.

† Die Versteinerungen des deutschen Zechsteingebirges, p. 12. pl. 4. fig. 41.

‡ Schauroth, Beitrag, 1854.

§ Geinitz, *loc. cit.*

|| Reise in das Petschora-Land, p. 241, 1846.

possessing about the same number of ribs as the Russian type, have the entire umbonal region of both valves distinctly ribbed; besides, the ribs appear to be more flattened. Moreover, I entertain a suspicion that in the Russian shell the small valve is decidedly more rounded posteriorly; and I am also led to suspect that its valves are not so obviously perforated,—a character which I think could not have escaped the observation of M. de Verneuil or Count Keyserling. However, for the present, I am content with having simply pointed out what I consider to be some important differences, leaving it for others to confirm or overthrow my suspicions.

The Rösens shell is subpentagonal; and, compared with most species of the genus, it may be said to have slightly convex valves, both being only somewhat tumid posteriorly: the small valve, however, has its anterior half rather strongly elevated, and its sides sloping somewhat rapidly. The mesial sinus, or ridge, terminates in front without giving any very abrupt wave to the anterior margins: the wave is decided, but regular. The ribs amount to about four or five in the sinus, and nine or more on the lateral areas: they are broad, flat, evenly rounded, and separated from each other by a narrow, line-like sulcation. The rostral plates project forward about one-fourth the length of the shell, with rather a strong divarication. The median plate extends a little further along the small valve. The point of the umbone is sharp and somewhat projecting; and the foramen is small. The perforations are large, and separated from each other by an interspace about equalling twice their own diameter: they give the surface of the shell a finely granulated structure; and appear to decrease a little in size as they pass outwardly through the capillary fibres, which are exceedingly fine*. This interesting species has not yet been found out of Germany.

* In my 'Monograph' it is stated, that I noticed the existence of perforations in every species of *Rhynchonella*, as well as other Brachiopods, that had passed under my observation: hence I was led to make the statement—"in short, I doubt their absence in any Brachiopod whatever" (*op. cit.* p. 110, &c.). Dr. Carpenter, in his chapter "On the Intimate Structure of the Shells of Brachiopoda," appended to Mr. Davidson's 'Monograph' of British fossil species of this Class, having deemed it necessary to animadvert somewhat strongly on the above piece of scepticism (*vide op. cit.* pp. 31, 32 & 35—*notes*), I have been induced to make the following observations:—Although Dr. Carpenter's researches, as detailed in his "Report on the Microscopic Structure of Shells," published in the volume of the British Association Meeting for 1844, were generally considered as leading to most important results; yet it is well known that many regarded them as too initiative to be unreservedly accepted in all their totality. Not that Dr. Carpenter was in any respect to blame; for it was conceived, that fossilization had so obliterated the tissue of many shells as to render a detection of it an impossibility; and it was also conceived that some shells

Genus CAMAROPHORIA, King.

Camarophoria globulina, Phillips*.

The occurrence of this species in Germany has not yet been recorded except by Professor M'Coy, who states that he found numerous specimens of it from Glücksbrunn in Count Münster's collection (now in the Cambridge University Museum) under the manuscript name *Terebratula bisinuata*†.

Camarophoria multiplicata, King‡.

Schauroth records the occurrence of this species in the lower Permians of Germany, without, however, stating its locality. Geinitz represents two specimens in his 'Versteinerungen' (pl. 4. figs. 48, 49) apparently the same. M'Coy unites it with *C. Schlotheimi*; but I must still adhere to the opinion that both are specifically distinct on the grounds stated in my Monograph.

* King's Monograph, p. 120. pl. 7. figs. 22-25.

† British Palæozoic Fossils, p. 443.

‡ Monograph, p. 121. pl. 7. figs. 26-32, pl. 8. figs. 1-7.

were more prone than others to become thus altered. In the genus *Rhynchonella*, it is true, no one had, that I am aware of, discovered any perforations; but after carefully examining a number of fossil species I was led to believe, that certain very minute dark points, which I observed here and there dispersed over the surface of their valves, were the remains of orifices belonging to extremely minute perforations. I may have been deceived as to the nature of much that my "Stanhope" revealed to me; but will any one absolutely say that I was so in all cases, now that it is known that perforations do indisputably exist in *Rhynchonella*? *Geinitziana*? A few words as to *Rhynchonella psittacea*—the only species, from its occurring in the recent state, that was likely to settle the question raised by my remarks. I did not examine this species; but I was acquainted with Dr. Carpenter's account of its histology, which account, since I am compelled to defend myself, I must say seemed to me a very faulty one. Had I been imbued with the same spirit which Dr. Carpenter manifested when writing his animadversions, I might have severely criticised it; but I valued his general observations too highly to indulge in any criticisms of the kind. Dr. Carpenter's description of the shell-tissue of *Rhynchonella psittacea* is so far from correct, that I naturally inferred he must have been equally in error in concluding it to be without perforations. Referring to Dr. Carpenter's first "Report," paragraphs 37 & 38, it will be seen that the tissue of this species is described as consisting of sharply folded "laminæ of extreme tenuity;" and it is stated that the "sharp foldings" produce an appearance as if the laminæ were "traversed by a very regular series of lines." In paragraph 36, this conformation is described as "a peculiar variety of the plicated membranous structure." Now I may be permitted to state that this is quite an erroneous description of the shell-tissue of *Rhynchonella psittacea*; since it does not consist of "laminæ of extreme tenuity" with "sharp foldings;" but of *closely packed fibres* precisely analogous to the "capillary fibres" or "fibrous tissue," noticed in my 'Monograph' as con-

Family Spiriferidæ, King, 1846.

Genus SPIRIFER, J. Sowerby.

Spirifer Permianus, King*.

Schauroth has found this well-marked species in the Zechstein dolomite of Pössneck: it is represented under fig. 6 in his 1st 'Beitrag.'

Genus MARTINIA, M'Coy.

Martinia Clannyana, King†.

This small species, which is extremely rare in the North of England, appears to be rather abundant in the Zechstein dolomite of Pössneck, where it was first discovered by Schauroth. It is noticed and figured by him in his 'Beitrag' of 1853. I procured from Dr. Krantz several examples, most of which are

* Monograph, p. 133. pl. 9. figs. 18-24.

† Monograph, p. 134. pl. 10. figs. 11-13.

stituting the valves of those Brachiopods which I examined. Dr. Carpenter's own testimony, which appeared about seven or eight years after the publication of his first "Report," and three years subsequent to the appearance of my notices, will bear me out in the correction just made: "In all the recent *Terebratulidæ* and *Rhynchonellidæ*, and in all the fossil specimens of those groups, as well as of *Spiriferidæ*, *Strophomenidæ* and *Productidæ*, in which there is no indication of metamorphic action, the shell is found to consist of *flattened prisms, of considerable length, arranged parallel to each other with great regularity*" (vide chapter "On the Intimate Structure of the Shells of Brachiopoda," p. 25). The italicization of the concluding portion is my own. It is remarkable that Dr. Carpenter has nowhere, in the chapter from which the above extract has been taken, made the least allusion to "laminæ of extreme tenuity" with "sharp foldings;" nor has he at all acknowledged that others had previously discovered the so-called "flattened prisms" or "capillary fibres," as they are termed in my 'Monograph'! Surely, if my "*doubt*" as to the absence of perforations "in any Brachiopod whatever," warranted the ignoring of the little I have done in the matter, this ought not to have been the case with what has been done by the Vicomte D'Archiac, who undoubtedly was the first to signalize the "fibro-capillary structure" of the Palliobranchs (vide "Rapport sur les fossiles du Tourtia," in Mém. Soc. Géol. de France, 2 sér. vol. ii. 1847). A few days ago I felt myself justified in laying claim to this discovery; for, although I had heard that D'Archiac had written something on palliobranchiate histology, as noticed in the Appendix to my 'Monograph' (p. 244), yet I was not aware that he had ascertained the existence of the fibrous structure until only within the last few days. * * * But let me not forget to acknowledge that I was in error in doubting the absence of perforations "in any Brachiopod whatever;" the account which Dr. Carpenter has given of *Rhynchonella psittacea* in his late chapter is quite conclusive on this point; but I cannot help thinking, from their occurring in *R. ? Genitiziana*, that perforations will yet be found in congeneric species supposed, or stated, to be without them.

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nearly twice the size of the English specimens that have occurred to me: they show a very distinct area in the small valve, with a well-marked deltidial fissure: the deltidium of the large valve is also open. In my diagnosis, this species is described as "nearly smooth;" but two of the Pössneck specimens, particularly one of them, show the surface of the valves to have been crowded with very fine short inclined spines: when these are removed, the surface has very much the appearance of being perforated like some fossil *Terebratulas*.

Martinia Winchiana, King*.

Morris in his 'Catalogue of British Fossils,' 2nd ed., unites this species with the last, a step that would seem to be warranted by the spiniferous character just noticed. But the spines of the present species appear to be much coarser, judging from the very imperfect casts before me: further, the umbone of the large valve appears to be more incurved, and the area not so well defined. Schaueroth figures a specimen from Pössneck, which he identifies with *Martinia Winchiana*, on account of its being covered with spines; but possibly it may be only a specimen of the last species—a suggestion I would make with less doubt if the figure did not show the umbone to be more incurved and the area less defined than in *M. Clannyana*.

Other Permian *PALLIOBRANCHIATA*.

Spirifer alatus, Schlotheim.—This species is considered by many who have noticed it as being inseparable from the *S. undulatus* of Sowerby; but I would urge on those who entertain this view to study the young forms, particularly the specimens represented in my 'Monograph,' pl. 9. figs. 10 & 16, which I consider respectively as representing the young of these two species.

Spirifer multiplicatus, Sowerby, and *S. Jonesianus*, King:—Morris, I perceive, unites these species: perhaps he has had an opportunity of examining specimens which graduate them into each other. Neither species has yet been observed in Germany.

Epithyrus elongatus, Schlotheim. — Specimens occasionally occurring at Glücksbrunn show this to have been a prettily coloured species. Two specimens before me exhibit several dark bands, inter-radiating with others of a lighter colour almost continuously from the umbone to the margin, and increasing in width in their forward progress: in another the dark bands, reduced to mere lines, are only developed near the margins. In my 'Monograph' it is stated, that "Specimens from the carboniferous limestone of Bolland, often identified with *Tere-*

* Monograph, p. 135. pl. 10. figs. 14-17.

bratula hastata, are in no respect different from the ordinary forms of the present species" (*vide* p. 149). On again examining one of the Bolland specimens here referred to, having the nearest resemblance to *Epithyris elongata*, I perceive that the surface of both valves shows much stronger incremental breaks than I have ever seen displayed on any specimens of the Permian species: the valves, too, appear to be thicker.

Epithyris sufflata, Schlotheim.—I have elsewhere stated, that this species "appears to be identical with a shell found in the mountain limestone of Bolland, probably hitherto considered a variety of *E. sacculus*—a distinct, though closely allied species*." M'Coy supposes that the shell here referred to is identical with his *E. virgoide*†; but this is not the case. The Bolland specimen noticed under the last head as resembling *E. elongata* has more affinity to M'Coy's species. I have been led to re-examine the "shell found in the mountain limestone of Bolland," and I cannot but say, that it agrees most remarkably with some specimens of the Permian species, particularly the testiferous one represented under figure 7, pl. vii. of my 'Monograph.' On the other hand, there are specimens figured on the same plate closely approximating to true forms of *E. sacculus* in its mesial depression and emarginate front. The only difference I perceive between the Bolland shell alluded to and the Permian fossil quoted is, that on the former there are faint traces of a few longitudinal lines on the anterior half of the valves. I perceive nothing of the kind on any of the Permian forms, nor do I recognize any on normal specimens of *E. sacculus*. There appears to be no difference between them in their histological perforations.

I have retained the generic name proposed in my 'Monograph' for those *Terebratulidæ* resembling the two species just noticed, in having rostral plates and a shortish loop. Very few palæontologists appear to agree with me in this respect. I intended making some observations on the question; but as Mr. Davidson is now engaged on species belonging to the same group, to be published in the next part of his 'Monograph of British Fossil Brachiopoda,' and feeling confident that he has much important matter to make known as regards their interiors, I prefer deferring them until the appearance of his work. I may then be able to offer a decided opinion, either in favour of, or against, my former views.

Brachiopods appear, for the most part, to be confined to the lowest deposits of the Permian system. In the North of Eng-

* Monograph, p. 150.

† British Palæozoic Fossils, p. 413.

land, scarcely any have been found in beds above what I have termed the "fossiliferous limestone;"—the fossils occurring in the higher members, namely the "brecciated and pseudo-brecciated," and the "crystalline and non-crystalline" limestones*, being principally Gasteropods and Lamellibranchs. The same remarkable fact appears to obtain in Germany; inasmuch as Brachiopods have rarely been noticed hitherto above the true Zechsteins, or dolomites; the overlying beds, namely Rauchwacke, &c., only containing species for the most part identical with fossils occurring in the uppermost North of England Permians†. The consideration of these facts induces me to place the magnesian limestones of Cultra and Tullyconnel in the upper part of the Permian system; as they contain no palliobranchiate fossils. I would likewise place the magnesian limestone of St. Bees' Head on the same parallel, Mr. Binney having discovered therein "casts of *Bakevella*, *Schizodus*, and other shells"‡. The marls in the neighbourhood of Manchester, loaded with similar fossils, I am also disposed to consider as the equivalents of the upper synchronous Permians, whether in England or Germany.

Belmont, near Galway, Feb. 20, 1856.

EXPLANATION OF PLATE XII.

- Fig. 1.* *Productus Geinitzianus*, De Koninck. Large valve a little enlarged : from Gera. 2. Small valve.
Fig. 3. *Productus Schauerothianus*, King. Umbonal view of large valve : twice the natural size : from Røpsen. 4. Front view. 5. Small valve.
Fig. 6. ? *Aulosteges umbonillatus*, King. Interior of small valve, showing muscular impressions *a*, and reniform ditto *b* : a little enlarged. A gutta-percha impression of a specimen from Pössneck.

* Monograph, Introduction, p. xvii.

† M. Robert Eisel, of Gera, son of Professor Eisel, informs me that *Productus Cancrini* (query, *Strophalosia Morrisiana*, var. *Humbletonensis*) occurs in the Grauer Mergelzechstein of that locality. This deposit, and the overlying Rauchwacke, &c., I consider to be equivalent to the brecciated, pseudo-brecciated, crystalline and non-crystalline limestones of the North of England. The former overlie the highly fossiliferous Zechsteins of Germany; and the latter repose on the English fossiliferous and compact limestones. The presence of a Brachiopod so high in the system, corresponds with the occasional occurrence of *Strophalosia Morrisiana* in the breccia of Claxheugh (*vide* 'Monograph,' p. 102); and it seems to be paralleled by the existence, lately made known by Professor Ramsay, of casts of a *Strophalosia*-like shell in the sandstones of Exhall, Warwickshire. These sandstones I am disposed to place much higher in the Permian system than Professor Ramsay seems to sanction (*vide* Quarterly Journal of the Geol. Soc., vol. xi. part 1. p. 198).

‡ *Vide* Memoir "On the Permian Beds of the North-West of England," in Mem. of the Lit. and Phil. Soc. of Manchester, vol. xii.

Fig. 7. *Rhynchonella* ? *Geinitziana*, De Verneuil. Umbonal valve: twice the natural size: from Röpsen. 8. Opposite valve. 9. Side view. 10. Rostral plates. 11. View of capillary fibres and perforations: highly magnified.

Table of all the known Permian PALLIOBRANCHIATA.

	Britain.	Germany.	Russia.
1. <i>Lingula Credneri</i> , Geinitz	*	*	...
2. <i>Discina speluncaria</i> , Schlotheim	*	*	...
3. <i>Productus horridus</i> , J. Sowerby	*	*	...
4. — <i>Leplayi</i> , De Verneuil	...	*	*
5. — <i>Geinitzianus</i> , De Koninck	...	*	...
6. — <i>Hemisphærium</i> , Kutorga	...	...	*
7. — <i>Schaurothianus</i> , King	...	*	...
8. <i>Aulosteges variabilis</i> , Helmerson	...	...	*
9. ? — <i>umbonillatus</i> , King	*	*	...
10. <i>Strophalosia excavata</i> , Geinitz	*	*	...
11. — <i>Goldfussi</i> , Münster	*	*	...
12. — <i>Cancrini</i> , De Verneuil	...	? *	*
13. — <i>horrescens</i> , De Verneuil	...	? *	*
14. — <i>Morrisiana</i> , King	*	? *	...
15. — var. ? <i>Humbletonensis</i> , King	*	*	...
16. — var. ? <i>Whitleyensis</i> , King	*	...	...
17. — <i>parva</i> , King	*	*	...
18. — ? <i>lamellosa</i> , Geinitz	...	*	...
19. <i>Chonetes</i> ? <i>sarcinulata</i> , Schlotheim	...	...	*
20. <i>Streptorhynchus pelargonatus</i> , Schlotheim ..	*	*	...
21. <i>Orthis</i> ined., Keyserling	...	...	*
22. <i>Rhynchonella Geinitziana</i> , De Verneuil ...	...	...	*
23. — ? id.	...	...	...
24. <i>Camarophoria Schlotheimi</i> , Von Buch	*	*	*
25. — <i>globulina</i> , Phillips	*	*	...
26. — <i>superstes</i> , De Verneuil	...	? *	*
27. — <i>multiplicata</i> , King	*	*	...
28. <i>Spirifer alatus</i> , Schlotheim	*	*	...
29. — <i>undulatus</i> , Sowerby	*	*	? *
30. — <i>Permianus</i> , King	*	*	...
31. — <i>cristatus</i> , Schlotheim	*	*	...
32. — <i>multiplicatus</i> , Sowerby	*	...	...
33. — ? <i>Jonesianus</i> , King	*	...	...
34. — <i>curvirostris</i> , De Verneuil	...	...	*
35. — <i>Blassi</i> , De Verneuil	...	...	*
36. — <i>rugulatus</i> , De Verneuil	...	...	*
37. — <i>Schrenki</i> , Keyserling	...	...	*
38. <i>Martinia Clannyana</i> , King	*	*	...
39. — ? <i>Winchiana</i> , King	*	? *	...
40. <i>Cleiothyris pectinifera</i> , J. de C. Sowerby ...	*	*	*
41. — <i>Roissyi</i> , L'Eveillé	...	...	*
42. <i>Epithyris elongata</i> , Schlotheim	*	*	*
43. — <i>sufflata</i> , Schlotheim	*	*	*
44. — <i>Qualeni</i> , Fischer de Waldheim	...	...	*
45. <i>Thecidium productiforme</i> , Schaueroth	...	*	...