

FAUNA OF THE FLORENA SHALE OF THE GRAND SUMMIT SECTION OF KANSAS, AND REMARKS ON THE DEVELOPMENT OF DERBYA MULTISTRIATA MEEK AND HAYDEN.

F. C. GREENE.

The Grand Summit section of Cowley county, Kansas, has been famous as one of the classic collecting grounds of Kansas and many large collections have been made there. It could probably be classed as Permo-Carboniferous, very near the base of the Permian. The region was first studied by Broadhead in 1882 and the account published in 1883 or 1884. He says, "We now come to speak of the 'Permian' or limestones of the 'Flint Hills,' reaching, in Elk, Greenwood and the eastern half of Butler and Cowley counties, from 1185 to 1700 feet above the sea, including about 500 feet thickness."*

Only the top part of Broadhead's section concerns us. Numbering from top down, it is as follows:†

1. 134 feet, including beds of impure drab limestone, shaly and crumbling, with occasional shale beds, with red shales 30 feet from bottom.

2. 5 feet of bluish-drab or drab limestone containing many good characteristic fossils, including *Eumierotis hawni*, *Myalina perattenuata*, *Aviculopecten occidentalis*, etc. (This bed is persistent wherever its associated strata are found.)

3. 10 feet of shales, the lower red.

4. 10 feet of rough limestone.

5. 27 feet of shales with thin shaly limestone beds.

6. 4 feet of flag-like limestone; a good building stone.

7. 8 feet of shelly buff magnesian limestone.

8. 4 feet of shaly *Fusulina* limestone.

9. 4 feet of cherty limestone; abundant in *Fusulina cylindrica*, the fossils often appearing in relief; the chert of deep blue.

*Trans. St. Louis Acad. Sci., Vol. IV., Pt. 3, pages 486-487.

†Loc. Cit.

10. 18 feet limestone and shales abounding in *Fusulina cylindrica*.
11. 2 feet drab magnesian limestone.
12. 28 feet shaly sandstone.

He considered all above number twelve of this section as Permian which would make the base of the Permian about the horizon of the Emporia limestone of the recent geologists.

"Mr. George I. Adams has also described in a somewhat general way the section along the line of railway through Moline, Grenola, Cambridge, and Winfield."¹

In 1896 Prof. Prosser hastily examined this section. He determined number 27 of this section to be the lower part of the Strong limestone. The Strong or Wreford is now supposed to be the base of the Permian.

In the field season of 1904 Prof. Beede made a detailed section at Grand Summit as follows:²

29. Shales, blue with calcereous sheets and millions of fossils	15 feet 0 inches
28. Limestone, blue clayey	1 " 0 "
27. Shales, blue, yellow above.....	5 " 0 "
26. Shales and shaly limestone.....	5 " 0 "
25. Limestone, somewhat massive, weathering light.....	8+ " 0 "
24. Shales, calcareous, and impure limestone.....	7 " 0 "
23. Shales, clayey, with calcareous layer; very fossiliferous	7+ " 0 "
22. Limestone, clayey, nodular, and clay shales. Some fossils	3 " 0 "
21. Shales, yellow and blue with calcareous lenses, sea urchins	5 " 0 "
20. Covered, five feet to.....	8 " 0 "
19. Shales, red	5 " 0 "
18. Shales, blue	1 " 0 "
17. Limestone, blue, massive	1 " 0 "
16. Shales, yellow and red (foot of limestone near base) ..	10 " 0 "
15. Limestone, massive in one layer	3 " 0 "
14. Shales, yellowish, calcareous	1 " 4 "
13. Limestones, shaly	1 " 0 "

¹Prosser: "The Permian and Upper Carboniferous of Southern Kansas." Kan. Univ. Quar., Vol. VI, No. 4, 1897. Series A.

²Beede and Sellards, Stratigraphy of the Eastern Outcrop of the Kansas Permian. The American Geologist, Vol. XXXVI, August, 1905, pages 83-111.

12. Shales	0 feet 4 inches
11. Limestones, two thin ones	0 " 4 "
10. Shales	0 " 6 "
9. Limestone, buff to brownish, large <i>Fusulinas</i> and chert in the lower part	6 " 0 "
8. Shales, clayey	1 " 9 "
7. Limestone, shaley to massive	3 " 9 "
6. Shales, yellowish	3 " 3 "
5. Limestones, thin, with shale partings.....	3 " 0 "
4. Limestone, massive, in two layers.....	3 " 4 "
3. Shales, yellowish, with calcareous layers rich in fossils	9 " 0 "
2. Limestone, dark colored, in thin layers, full of <i>pelecypods</i>	4 " 0 "
1. Shales, red and blue, in creek north of the cut. east of the trestle over the small creek.....	11 " 0 "
<hr/>	
Total	132 feet 7 inches

Numbers 24 to 29 inclusive, are of the Neosho member of the Garrison formation, 23 represents the Florena shale, number 22, the Cottonwood limestone,¶ 10 to 21, inclusive, the Eskridge shales, 7 to 9, the Neva limestone and from 6 down to water-level, the Elmdale formation.

The collections upon which this paper is based were made in the summers of '04 and '05 by Prof. Beede and were taken from number 23 of the foregoing section, that is, the Florena shale.

The lists of this fauna which have been published up to the present time include about thirty-nine species. In Beede's Grand Summit collection we find 74 species. In the following list, the numbers given may be taken as representative of the fauna in the southern extension of the formation. The following are found to be the characteristic species:

1. <i>Fusulina</i> sp.....	800
2. <i>Crania</i> cf. <i>modesta</i>	67
3. <i>Seminula</i> <i>argentina</i>	44
4. <i>Productus</i> <i>semireticulatus</i>	39
5. <i>Productus</i> <i>nebrascensis</i>	84
6. <i>Chonetes</i> <i>granulifera</i>	293
7. <i>Derbya</i> <i>crassa</i>	79

¶This statement is based on the field work of Prof. J. A. Yates in 1905.

8. Meekella striaticostata	31
9. Rhombopora sp.....	30
10. Thamniscus sp.....	30
11. Bairdia beedei	100
12. Bairdia beedei abrupta	25
13. Pteria sulcata	128
14. Nuculana bellistriata attenuata	28
15. Aviculopecten occidentalis	40
16. Pelecypod sp.....	200
17. Bulimorpha chrysalis	25
18. Bellerophon sp.....	39
19, 20. Gastropod, two small species	500

This list comprises one species of Foraminifera, seven of Brachiopoda, two Bryozoa, two ostracods, four pelecypods, and four gastropods.

The *Fusulina* can not be said to be characteristic of the formation as a whole as it is very rare farther north. The brachiopods, as a general rule are somewhat larger than normal.

One of the most interesting species in the collection is *Derbya multistriata* Meek and Hayden. We find the first account of this species by Meek, under the name of *Orthisina umbraculum*(?) Schlotheim. He describes it as follows:

"*Orthisina umbraculum*(?) Schlot. sp. Petrefact. I, p. 256, et 2, p. 67. We find in Kansas ranging from 16 to 19 of the foregoing section, many specimens of a large species of *Orthisina*, having almost the form and other characters of *O. umbraculum*, excepting that the striae appear to be more numerous. According to Koninck that species has about 108 striae on each valve, while on our Kansas specimens, we count from 160 to 200; consequently we suspect it to be a distinct but closely allied species. If so we would propose to designate it by the name of *O. multistriatum*. We find it at Fort Riley and at several localities between there and Blue river, also in the same position on Cottonwood creek."**

This species is not very abundant in the Florence shale, but in the shale bed just beneath the Wreford limestone, that is, in a horizon higher than this, it reaches its maximum development and becomes one of the predominating species of that fauna. Its characters are a high cardinal area, and a hinge line shorter than the greatest width of the shell. These char

**Proc. Acad. Nat. Sci. Phil., 1859, p. 26.

acters hold throughout the life history of an individual. Prosser was the first to refer this shell to *Derbya*.††

On referring to de Koninck's figure of his *Orthis umbraculum* Schlotheim,‡ the striking similarity will at once be apparent and by comparing this figure and description with that of Bronn,§§ of the Eifel Devonian (apparently after examining the types), the difference between the typical *O. umbraculum* and de Koninck's specimen, and the similarity of the latter with the American species at once becomes apparent. Koninck's description gives his species 108-109 striae and if this is true, it is hardly identical with the American species as this (and de Koninck's figure) give 160 to 200 on a specimen of the same size. As to the question of the name of the American species, it is distinct from *O. umbraculum* and Meek's term will take precedence for the American form. If they are identical, as seems probable, it will also apply to de Koninck's shell.

On comparison of typical specimens of this shell with the description and figures of Hall and Clarke's *Derbya cyathula* it will be seen that they are all identical. This duplication is due to a habit of Mr. Meek's of describing a species under one term, then at the close of the description stating that in all probability it does not belong to the species referred to but is probably a new species, then proposing the name at the end of the whole description.*

One of the specimens obtained was fortunately covered with young specimens of whose relation there can be no doubt as *Derbya multistriata* is the only *Derbya* in this horizon at Torrence where these specimens were found. The smallest specimen measured a trifle over 1 mm. wide. In a specimen 5 mm. wide the mesial septum is well developed.

The high cardinal area is well illustrated by the measurements of a small specimen. The pedicle valve length was $1\frac{1}{2}$ mm. and width 3 mm. The cardinal area was nearly square and measured 3 mm. x 2 mm., or larger than the pedicle valve. At no time in its development was it seen to have a form identical with the typical adult *D. crassa*.

††Kansas River Section of the Permian and Permo-Carboniferous Rocks of Kansas. Bull. Geol. Soc. Amer., VI, p. 40, 1894.

‡Description des Animaux Fossiles de Koninck, pp. 222-224 and Pl. XIII, fig. 4a, b, c et fig. 7, a, b, c, et Pl. XIII bis, fig. 7, a, b.

§§Lethaea Geognostica Bronn, pp. 368-363 and Pl. II¹, fig. 11, a, b, c.

*Pal. N. Y., Vol. VIII, Pt. I, page 348 Pl. 11b, fig. 2-3.

LIST OF SPECIES.

1. <i>Fusulina</i> sp.....	800
2. <i>Lophophyllum profundum</i> Edwards and Haime.....	1
3. <i>Crinoidea</i> sp. (plates and segments).....	..
4. <i>Cerriocrinus hemisphericus</i> (Shum.).....	1
5. <i>Pholidocidaris</i> sp. (spine).....	..
6. <i>Archeocidaris</i> sp. (spines and plates).....	..
7. <i>Rhombopora lepidendroides</i> Meek	30
8. <i>Stenopora carbonaria</i> (Worthen).....	30
9. <i>Fenestella</i> sp.....	..
10. <i>Fistulipora</i> sp.....	..
11. <i>Streblotrypa prisca</i> Gabb and Horn.....	..
12. <i>Septopora</i> sp.....	..
13. <i>Thamniscus</i> sp.....	30
14. <i>Bryozoa</i> sp.....	..
15. <i>Bryozoa</i> sp.....	..
16. <i>Bryozoa</i> sp.....	..
17. <i>Orbiculoidea convexa</i> (Shum.).....	2
18. <i>Crania modesta</i> White and St. John.....	67
19. <i>Strophalosia</i> sp.....	27
20. <i>Dielasma bovidens</i> (Morton)	8
21. <i>Seminula argentia</i> (Shepard)	44
22. <i>Meekella striatacostata</i> (McChesney)	31
23. <i>Productus semireticulatus</i> (Martin).....	39
24. <i>Productus nebrascensis</i> Owen	84
25. <i>Chonetes granulifera</i> Owen	293
26. <i>Derbya crassa</i> (Meek)	79
27. <i>Derbya robusta</i> (?) (Hall)	1
28. <i>Derbya multistriata</i> (Meek and Hayden).....	9
29. <i>Ambocoelia planoconvexa</i> (Shum.)	10
30. <i>Pugnax utah</i> (Marcou)	4
31. <i>Psuedomonotis hawni</i> Meek	11
32. <i>Myalina kansasensis</i> Shum.....	21
33. <i>Myalina swallowi</i> ? (McChesney)	1
34. <i>Myalina</i> sp.....	1
35. <i>Aviculopinna nebrascensis</i> Beede	2
36. <i>Schizodus wheeleri</i> Swallow	21
37. <i>Schizodus</i> sp.....	2

38. <i>Edmondia nebrascensis</i> Meek	1
39. <i>Edmondia reflexa</i> Meek	3
40. <i>Edmondia</i> (?) 2 sp.....	2
41. <i>Allorisma subcuneatum</i> Meek	2
42. <i>Sedgewickia granosum</i> (Shum.)	3
43. <i>Allorisma</i> sp.....	1
44. <i>Aviculopecten maccoyi</i> M. and H.....	1
45. <i>Chaenomya leavenworthensis</i> M. and H.....	1
46. <i>Pteria ohioensis</i> (Herrick)	20
47. <i>Pteria sulcata</i> Geinitz	128
48. <i>Entolium</i> (?) sp.....	1
49. <i>Nucula</i> sp.....	3
50. <i>Nucula ventricosa</i> McChesney	1
51. <i>Yoldia</i> sp.....	5
52. <i>Macrodon</i> sp.....	1
53. <i>Aviculopecten occidentalis</i> (Shum.)	40
54. <i>Nuculana bellistriata attenuata</i> Meek	42
55. <i>Pleurophorus</i> sp.....	1
56. Pelecypod young species	200
57. <i>Bulimorpha chrysalis</i> (Meek and Worthen).....	25
58. <i>Euomphalus catelloides</i> (Conrad)	25
59. <i>Bellerophon carbonaria</i> Cox	3
60. <i>Pleurotomaria</i> sp.....	11
61. <i>Bellerophon</i> sp.....	39
62. <i>Capulus</i> sp.....	1
63. <i>Euconispira</i> sp.....	1
64. Gastropod sp. (<i>Aclis</i> (?)).....	300
65. Gastropod sp.....	200
66. <i>Orthoceritite</i> sp.....	2
67. <i>Bairdia beedei</i> Ulrich and Bassler.....	100
68. <i>Bairdia beedei abrupta</i> U. and B.....	25
69. <i>Kirkbya pinguis</i> U. and B.....	1
70. <i>Paraparchites humerosus</i> U. and B.....	1
71. <i>Beyrichella bolliformis tumida</i> U. and B.....	1
72. Ostracod sp.....	2
73. <i>Griffithides scitula</i> (Meek and Worthen).....	9
74. <i>Cladodus mortifer</i> Newberry and Worthen.....	2

EXPLANATION OF PLATES.

PLATE I.

Derbya multistriata (Meek).

1. a, b, c. Reproduced from de Koninck's, pl. XIII, f. 7, a, b, c.

2. Figure 7a, pl. XIII bis, of de Koninck. These specimens are called "Orthis umbraculum" by him, but are very different from those figured by Bronn, from the Devonian of Eifel, after examining Schlotheim's types.

3a. Specimen below average size, but possessing an unusually high hinge area which is symmetrical, posterior view.

3b. Lateral profile of same specimen.

All figures natural size.

PLATE I.

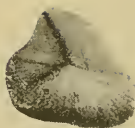
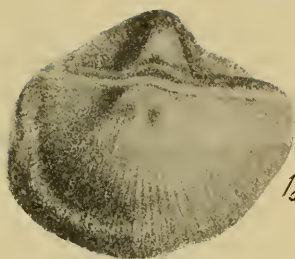


PLATE II.

Derbya multistriata (Meek).

1. Brachial valve of specimen with high area extending nearly backward, due partly to compression.

2. Same view of another specimen with low beak and normal brachial valve.

3. Pedicle valve of another specimen showing surface marks and thirteen young specimens adhering to it. They are of the same species.

3a. Profile of number 3. Pedicle valve uppermost.

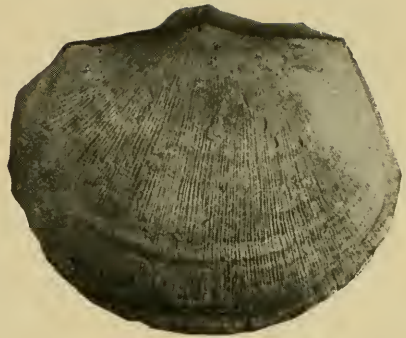
4. A profile of another and smaller specimen with a high and distorted hinge area. Pedicle valve uppermost.

All figures natural size.

PLATE II.



1



2



3



3a



4

PLATE III.

Derbya multistriata (Meek).

1. Brachial valve of a specimen with an extremely elongated beak. Shell adhering to it.
2. Brachial valve of another specimen showing its regular form and the surface marks.
3. Another specimen, profile view, with beak extending backward and twisted to the right.
4. Posterior view of another specimen with a hinge a shade lower than normal.
5. A pen drawing of No. 3 of previous plate. Note the mesial septum in the little specimen, the central one of the three to the right of the beak, which is only five millimeters in diameter.

All figures natural size.

With the exception of figures 1 and 2 of plate I, all specimens are from the top of the Neosho member of the Garrison formation, in the railroad cut on the west side of Grouse creek, near the old station of Torrence, Kansas, a few miles west of Cambridge.

PLATE III.

