DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

BULLETIN 391

THE DEVONIAN FAUNA OF THE OURAY LIMESTONE

BY

E. M. KINDLE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

CONTENTS.

ILLUSTRATIONS.

THE DEVONIAN FAUNA OF THE OURAY LIMESTONE.

By E. M. KINDLE.

INTRODUCTION.

The first discovery of a Devonian fauna in Colorado was made by F. M. Endlich in 1875, during his survey of the San Juan district. The collections made by Endlich were studied by Meek, who assigned them to the Upper Devonian. The references to this fauna which appeared during the twenty-five years succeeding its discovery express conflicting views as to its age. C. A. White considered it Carboniferous, while Schuchert compared its most characteristic species with Lower Devonian forms, and agreed with Meek, assigning the fauna to the Devonian. Various other references to this fauna and its age are noted and summarized in more recent papers by Spencer,[a] Cross,[b] and Girty,[c] whose collections afforded ample material for the determination of the age of the beds. Discussion by Girty of the evidence which these collections furnished has established clearly the Devonian age of the fauna.

In 1900 the strata holding this fauna were named by Spencer the Ouray limestone.[d] More recently Cross has shown that another Devonian formation—the Elbert—which contains an interesting fish fauna, immediately underlies the Ouray limestone,[e] and rests upon a quartzite of supposed Cambrian age. The lower limit of the Devonian fauna of the Ouray limestone has thus been clearly defined in southwestern Colorado by Cross's work. Its upper limit and its relations to the succeeding fauna, however, are not so clearly shown in the literature. The papers of Cross and Girty record both a Carboniferous and a Devonian fauna from the Ouray limestone. But whether the two could be sharply separated and were limited to distinct parts of the formation, or whether the earlier merged with the later fauna, seems not to have been determined.

[a] Am. Jour. Sci., 4th ser., vol. 9, 1900, pp. 125–133.
[b] Am. Jour. Sci., 4th ser., vol. 18, 1904, pp. 244–252.
[c] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, pp. 31–36.
[d] Am. Jour. Sci., 4th ser., vol. 9, 1900, p. 126.
[e] Am. Jour. Sci., 4th ser., vol. 18, 1904, pp. 245–252.

The purposes of this paper will be to set forth the stratigraphic relations of the two faunas to each other in the several Colorado sections studied, and to add to the known Devonian fauna of the Ouray limestone a number of new species and a new genus which have been recognized in the collections studied. These collections include, in addition to those made by me in Colorado, two from New Mexico. I am indebted to Mr. Frank Springer for the loan of one of these. The other collection, made by L. C. Graton and C. H. Gordon, was referred to me for determination and furnished the first recorded evidence of the Devonian fauna of the Ouray limestone in New Mexico.[a]

NOMENCLATURE AND STRATIGRAPHIC RELATIONS.

The type locality of the Ouray limestone is just south of the town of Ouray, Colo. The name, which was originally applied to beds in which only Devonian fossils had been found, was given by Spencer, who defined the formation as follows:[b]

> The series below the Carboniferous consists typically of three members, a sandstone or quartzite at the base, a shale series, and a massive limestone. Of these, the lowest is frequently wanting through nondeposition, and the middle member is also sometimes very thin or entirely absent. The formation name, Ouray limestone, is proposed for the only member of the section which is definitely shown by its fossils to be of Devonian age from the prominent occurrence in the vicinity of Ouray, at the junction of Canyon Creek with the Uncompahgre River. No names will be proposed for the lower formations at present, since for purposes of mapping it may prove necessary to include them under a single name.
>
> Above the Devonian there is apparent conformity of deposition, but the occurrence of Upper Carboniferous fossils within a few feet of the Devonian limestone, and the absence of any fauna comparable with the Lower Carboniferous fauna from the Gunnison region and from Tourtelotte Park, suggest a gap in deposition which represents the whole of the Lower Carboniferous. There is, however, a possibility that there may be a few feet of unfossiliferous limestone above the true Devonian, and not differentiated from it, which is really of Lower Carboniferous age. Such a lack of lithological difference would be quite analogous to the relations observed between the two formations in other places.

When the Ouray was defined by Spencer the earliest known fauna succeeding the Devonian was that of the Molas formation, of Pennsylvanian age. At a later period Girty found fossils of Mississippian age in the Ouray on the south slopes of the San Juan Mountains.[c]

After the dual character of the fauna had been ascertained, the limestone continued to be treated as a lithologic unit.[d] Close examination, however, of the section at Ouray shows that the faunal differences of the upper and lower parts of the limestone there are not without corresponding lithologic differences, which, though

---

[a] Am. Jour. Sci., 4th ser., vol. 21, 1906, pp. 390–395.
[b] Am. Jour. Sci., 4th ser., vol. 9, 1900, p. 126.
[c] Ouray folio (No. 153), Geol. Atlas U. S., U. S. Geol. Survey, 1907, p. 3.
[d] Folios 125, 130, 131, 153, Geol. Atlas U. S.

relatively inconspicuous, are yet so marked that they would perhaps have led Spencer to make distinct formations of them, had the extreme unlikeness of the upper and lower faunas been known when the formation was defined. The character of these is shown in the following section:

Section at Ouray, Colo.

	Feet.
Ouray limestone:	
4. Light bluish-gray to nearly white limestone	70±
3. Dark gray, often nearly black limestone, heavy bedded and somewhat arenaceous and magnesian in lower part; fine grained, of sublithographic texture and lighter shade of gray in upper part	60
Elbert formation:	
2. Reddish calcareous shale and interbedded greenish-blue limestone	0–15
Unconformity.	
Algonkian:	
1. Quartzite and black slates dipping 90°.	

While Devonian fossils are very rare at the type locality of the Ouray limestone, Mississippian fossils are not uncommon, although none had been found at the time the formation was named. The following Mississippian fauna, which was identified by Girty, was collected from the upper part of the limestone:

Menophyllum ulrichanum.	Productus lævicosta.
Menophyllum sp.	Productus semireticulatus.
Rhipidomella thiemei?	Productella concentrica?
Schuchertella n. sp.	Spirifer centronatus.
Chonetes illinoisensis.	Straparollus sp.

Although no fossils were found by me in the lower part of the Ouray limestone at Ouray, its position and lithologic characteristics clearly show its identity with the beds holding a Devonian fauna at localities both to the south and north.

In the Needle Mountains quadrangle the physical differences between the upper and lower parts of the formation are less marked than at Ouray, and the discrimination of two formations on lithologic grounds for the purpose of areal mapping would be difficult and possibly impracticable. But even here the lower limestones, as stated by Cross,[a] are more arenaceous than the upper beds. Spencer notes that this fact is recognized in quarrying stone for smelting purposes, the lower beds not being utilized because too siliceous. I found no trace of the Ouray fauna above the base of the large quarry south of Rockwood, although it is abundant a few feet below the floor of the quarry, in limestone which, though strongly resembling the quarried beds, is considered too siliceous for metallurgical use. In the section at the quarry three-fourths mile south of Rockwood 5 to 10 feet of

[a] Needle Mountains folio (No. 131), Geol. Atlas U. S , U. S. Geol. Survey, 1905, p. 4.

drab or rusty shale and shaly limestone separate the Devonian and Carboniferous beds of the Ouray formation, but this convenient lithologic boundary marker of the two horizons is not recognizable in some of the other near-by sections.

Although the Devonian and Carboniferous portions of the Ouray limestone are distinguished by comparatively slight lithologic differences in southwestern Colorado, they show very pronounced differences in the Grand River valley in northern Colorado. These differences seem to be of formational value, and for the purposes of detailed geologic work will doubtless require the subdivision of the Grand River equivalent of the Ouray limestone into two formations. The character of the lithologic differences of the upper and lower portions of the Ouray limestone of the Grand River region is seen in the following section:

Section 3 miles above Shoshone on Grand River.

	Feet.
Ouray limestone:	
11. Massive light to blue-gray, frequently oolitic limestone with small brachiopods	110±
10. Dove-gray, mostly massive, fine-textured limestone, thin to heavy bedded, apparently without fossils	150±
9. Dark, lead-gray, impure and somewhat lumpy and shaly, nonmagnesian limestone, forming prominent cliffs full of fossils	50
Elbert formation:	
8. Covered (shaly limestone?)	6
7. Quartzite	5
6. Green argillaceous shale	10
5. Quartzite	2
4. Greenish lumpy sandstone	5
3. Gray siliceous magnesian limestone	5
2. Light-colored quartzite	6
Cambrian (?):	
1. Very dark, hard, steel-gray magnesian limestone	15

The dark-gray limestone (9) of this section contains a rich Devonian fauna which shows an assemblage of species very similar to that commonly found in southern Colorado. It is to this darker and more argillaceous part of the limestone series that the Devonian fauna is restricted in all of the sections examined. The following list shows the character of the fauna found in this limestone:

Streptelasma.	Camarotœchia endlichi.
Schuchertella chemungensis var.	Athyris coloradensis.
Productella coloradensis n. sp.	Spirifer whitneyi.
Productella laminatus n. sp.	Spirifer whitneyi var. animasensis.
Schizophoria striatula var. australis n. var.	Bellerophon.
Camarotœchia contracta?	Naticopsis (Isonema) humilis.

The beds containing this fauna are sharply distinguished lithologically from the fine-grained limestone that lies immediately above

them by the shaly tendency which they show. No fossils were found in this overlying limestone, but it is supposed to belong to the Carboniferous.

Fossils of Carboniferous age were found in the lighter-colored limestone (11) which terminates the section. The small collection made represents a fauna among which Dr. Girty recognized the following species:

Eumetria verneuiliana.	Bellerophon sp.
Dielasma? sp.	Straparollus sp.

The 33 feet of shale and quartzite, beds 2 to 7, lying at the base of the Ouray limestone, are probably the equivalent of the Elbert formation of southwestern Colorado. No fossils were found in these beds in any of the Grand River sections, and this correlation is based on the lithologic resemblance and similiarity of position in the section of the shaly and arenaceous beds which precede the Ouray limestone in southwestern and northern Colorado.

Perhaps the best place in the Grand River region to see Devonian and Carboniferous limestones in their relations to the rest of the section is near Glenwood, where all the formations from the granite up to and including the "Red Beds" may be studied. The lower portion of the section follows:

Section on south side of Grand River one-fourth mile above Glenwood.

	Feet.
7. Buff and drab shales, probably unconformable on 6	400+
Ouray limestone:	
6. Light to bluish-gray nonmagnesian limestone, coarsely crystalline or sometimes oolitic	160
5. Very dark nonmagnesian limestone, with *Camarotœchia endlichi* and other fossils abundant in lower 25 feet; the rest mostly barren	40
Elbert formation:	
4. Gray shales and thin-bedded interlaminated limestone and sandstone	50
Cambrian?:	
3. Thin-bedded to massive, arenaceous, dark-gray magnesian limestone	75
Cambrian:	
2. Pale-brownish to buff quartzite, with some greenish beds containing numerous fucoid-like impressions	600±
Algonkian?:	
1. Granite	75+

The Devonian fauna is abundant in the 40 feet of limestone marked 5 in the section, but is confined to that bed, no trace of it having been found either above or below.

The thickness of the Ouray limestone is at some places much less than it is in the sections that have been given. Sections in which the formation approaches its minimum thickness were observed in

the Silverton quadrangle, in southern Colorado. One of these is given below:

Section at Cataract Gulch, 2½ miles south of Silverton, Colo.

	Feet.
Molas formation:	
6. Red calcareous and conglomeratic shale	15
Ouray limestone:	
5. Light-gray limestone	30
4. Dark-gray, rather impure, fine-textured limestones, ranging from saccharoidal to sublithographic in texture	55
Elbert formation:	
3. Hard, cherty, and calcareous beds, thinly bedded and banded in lower part with thin red shale bands	18
Cambrian:	
2. Gray to purple quartzite and conglomerate	40
Unconformity.	
Algonkian:	
1. Schists and quartzites, highly inclined.	

It will be noted that the dark, somewhat impure limestones (4 of the section), which are referred to the Devonian, have here about their usual thickness, while the lighter Carboniferous portion of the limestone series is very much thinner than usual, owing no doubt to the unconformity which Cross has recognized [a] between the Ouray limestone and the shales which follow it. Though the upper beds of the Ouray are reduced in thickness here, probably by erosion, the Mississippian fauna is present in division 5 of the section. The Carboniferous species collected are *Menophyllum?* sp., *Spirifer centronatus,* and *Straparollus laxus?*

The Carboniferous fauna of the Ouray limestone has been correlated by Girty [b] with a fauna of Mississippian age occurring in the Leadville limestone of central Colorado and in the Millsap limestone of the Front Range. Leadville limestone, as the name was used by Spurr [c] in the Aspen district, included two types of limestone which probably represent the Devonian and Carboniferous portions of the limestone of the Glenwood section. The Leadville limestone of the Crested Butte region [d] is reported to be of Carboniferous age. It is probable, however, that the lower part of the formation contains a Devonian fauna, for Devonian fossils are known from the adjacent Gunnison region.[e] The fossils indicate the equivalence of the Millsap limestone and the beds containing the Carboniferous fauna of the Ouray limestone, as there is no evidence of a Devonian fauna in the former.

---

[a] Ouray folio (No. 153), Geol. Atlas U. S., U. S. Geol. Survey, 1907.

[b] Girty, G. H., Carboniferous formations and faunas of Colorado: Prof. Paper U. S. Geol. Survey No. 16, 1903, p. 209.

[c] Spurr, J. E., Geology of the Aspen mining district, Colorado: Mon. U. S. Geol. Survey, vol. 31, 1898.

[d] Eldridge, G. H., Anthracite-Crested Butte folio (No. 9), Geol. Atlas U. S., U. S. Geol. Survey, 1894, p. 6.

[e] Girty, G. H., Devonian fossils from southwestern Colorado: Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 36.

The shales and thin-bedded limestones lying at the base of the Ouray limestone in the Glenwood section are supposed to be the equivalent of the "Parting" quartzite[a] and of the Elbert formation.[b] No fossils have been found in them, however.

The quartzite series at the base of the Grand River sections (2 of the Glenwood section) contains a Cambrian fauna which is represented in the collections of C. D. Walcott. Both the Ordovician and the Silurian faunas appear to be absent from the section.

In southwestern Colorado the Elbert formation of the Devonian also rests upon quartzites which are considered by Cross[c] to be of the Cambrian age.

Although the Devonian fauna is surprisingly similar in Colorado and New Mexico, the formations in which it occurs are entirely unlike in the two regions. The fauna is found in a shale in New Mexico. Gordon and Graton[d] have given the following description of the Devonian sediments in New Mexico:

> The formation (Devonian), which has a maximum thickness of 465 feet, consists almost wholly of shales and presents two well-marked divisions, the lower composed of black carbonaceous fissile shales and the upper of blue shales which weather to a buff or brownish-red color and are more or less calcareous. In Sierra County the black shales are from 100 to 200 feet thick, but at times vary greatly in thickness within short distances, due to the uneven character of the limestone surface upon which they rest. No fossils have been discovered in these lower or black shales. At Lake Valley they have heretofore been included in the lower Carboniferous. In the same region the upper or blue-shale division has a thickness of 50 to 100 feet and in places is highly fossiliferous, notably at Kingston and 2 miles east of Hillsboro, where the beds contain brachiopods in profusion.

It appears from this description that the stratigraphic equivalent in New Mexico of the Ouray limestone of Colorado is a blue shale 50 to 100 feet thick resting on black shales of undetermined age, which are included in the Devonian by Gordon and Graton. These black shales, according to those authors, rest on the Silurian in some places, on Ordovician rocks in others.

COMPARISON OF THE TWO FAUNAS IN THE OURAY LIMESTONE.

The unlikeness of the two faunas included in the Ouray limestone is well shown by the following lists of the earlier and later faunas, based on collections made by me at the principal collecting points. In the first list are included all known species from the earlier or Devonian fauna. The second list comprises the fossils which appear in the

---

[a] Emmons, S. F., Geology and mining industry of Leadville, Colo.: Second Ann. Rept. U. S. Geol. Survey, 1882, p. 216.

[b] Am. Jour. Sci., 4th ser., vol. 18, 1904, pp. 245–252.

[c] Ouray folio (No. 153), Geol. Atlas U. S., U. S. Geol. Survey, 1907.

[d] Gordon, C. H., and Graton, L. C., Lower Paleozoic formations in New Mexico: Am. Jour. Sci., 4th ser., vol. 21, 1906, p. 394.

several sections of the Ouray limestone above the Devonian fauna. While the latter list is by no means complete, it indicates plainly the general character and age of the fauna.

Devonian fossils in the Ouray limestone.

Zaphrentis sp.
Spirorbis sp.
Crania ourayensis n. sp.
Leptæna rhomboidalis Wilckens.
Schuchertella chemungensis (Conrad).
Schuchertella coloradensis n. sp.
Productella coloradensis n. sp.
Productella coloradensis var. plicatus n. var.
Productella laminatus n. sp.
Productella spinigera n. sp.
Productella hillsboroensis n. sp.
Productella depressa n. sp.
Schizophoria striatula var. australis n. var.
Camarotœchia (Plethorhyncha) endlichi (Meek).
Eunella sp.
Camarotœchia contracta (Hall)?
Pugnax pugnus Martin.
Athyris coloradensis Girty.
Spirifer whitneyi Hall.
Spirifer whitneyi var. animasensis (Girty).
Spirifer notabilis n. sp.
Spirifer coniculus Girty.
Spirifer sp.
Reticularia spinosa n. sp.
Syringospira n. gen.
Syringospira prima n. sp.
Meristella barrisi Hall?
Orthonota sp.
Glossites cf. lingualis Hall.
Leptodesma acutirostrum?
Leptodesma eolus n. sp.
Mytilarca sp. a.
Mytilarca sp. b.
Aviculopecten sp.
Bellerophon sp.
Straparollus cf. clymenioides Hall.
Euomphalus cf. eurekensis Walcott.
Naticopsis? (Isonema) humilis Meek.
Naticopsis gigantea Hall and Whitfield?
Coleolus sp.
Orthoceras (Spyroceras?) cf. crotalum.

Carboniferous fossils from the upper part of the Ouray limestone.[a]

	Rockwood.	Ouray.	Silverton.	Shoshone.
Menophyllum? sp			X	
Menophyllum ulrichanum		X		
Schuchertella inflata var	X			
Schuchertella n. sp		X		
Chonetes illinoiensis	X	X		
Productus lævicosta		X		
Productus semireticulatus		X		
Productus pustulosus	X			
Productus winchelli?	X			
Productus parviformis	X			
Productella concentrica	X	?		
Rhipidomella thiemei?	X	X		
Dielasma burlingtonense	X			
Dielasma? sp				X
Composita humilis?	X			
Spirifer centronatus	X	X	X	
Spirifer aff. peculiaris	X			
Spiriferina solidirostris	X			
Reticularia hirta	X			
Eumetria verneuiliana	X			X
Bellerophon sp	X			X
Straparollus sp	X			X
Straparollus laxus?			X	

The absolute unlikeness of the two faunas listed above is obvious. Not a single species is common to both, although they characterize the lower and upper parts of what has been considered the same forma-

[a] All the species in this list were determined by Dr. G. H. Girty from collections made by me.

tion. That the two faunas nowhere intermingle or occupy a common horizon is plainly indicated by the absence from the two lists of any species occurring in both. Generally, if not always, the two faunas are separated in the sections by beds which are apparently quite barren. It would seem that the Devonian fauna terminates abruptly with these barren beds and that none of its species survived until the appearance of the Carboniferous fauna in the region. The Carboniferous fauna, according to Girty,[a] represents the fauna of the Madison limestone of Wyoming and Montana and of the lower "Wasatch" limestone of Utah. This fauna Girty considers to be of Mississippian age.[b]

The presence of two faunas of character so unlike in the same formation, representing respectively an Upper Devonian and a Mississippian horizon, afford good and sufficient grounds for subdividing the formation wherever the lithologic differences are well marked. The lithologic plane of cleavage for such a separation has been pointed out for some sections in preceding pages. Simplicity and precision in the nomenclature of the rocks and the faunas concerned seem to justify the use of separate names in the Grand River Valley, where the rocks of the Carboniferous and Devonian portions are easily discriminated on lithologic grounds, and such a subdivision will doubtless be found necessary when a detailed survey of this region is undertaken.

DISTRIBUTION OF THE FAUNA.

When the Ouray fauna was described and illustrated by Girty some years ago it was not known outside of Colorado. The recent collections of Springer and of Gordon and Graton show that it is present in southern New Mexico with the same facies as in southern Colorado. In northern Colorado it extends north of Grand River for an undetermined distance. Sections of the lower Paleozoic in southern Wyoming which I have studied indicate the absence of the fauna there, so that it probably does not extend much if at all north of the Colorado line. It has thus a geographic range from north to south of about 475 miles.

To the west, in Utah and Nevada, the Devonian sections which have been studied show faunas totally unlike that of the Ouray. The fauna which represents the Devonian in Arizona is likewise distinct from the Devonian fauna of the Ouray. It may be inferred from this that the Ouray fauna extends little if at all to the west of the western boundary of Colorado and New Mexico, though it is known to occur in a rather wide north-south belt in the western half of Colorado. East of the Rocky Mountain front the fauna is not known, but it is possible that it is present in the lower part of the limestone series

[a] Personal communication.

[b] Prof. Paper U. S. Geol. Survey No. 16, 1903, pp. 162–170.

which is referred to the Carboniferous in this region. In the Williams Canyon section at Manitou Springs the nonmagnesian limestone with an Ordovician fauna is followed by 25 feet of buff magnesian limestone. About 80 feet of light-gray limestone, mostly nonmagnesian, follows the magnesian limestone, and contains a few Carboniferous fossils. The species collected are *Cranæna subelliptica* var. *hardingensis* and *Spirifer centronatus*. The slight lithologic difference between the upper 80 feet of the limestone, which is known to be of Carboniferous age, and the 25 feet resting upon the Ordovician suggests the possibility that the Devonian fauna of the Ouray may eventually be found below the Carboniferous fauna in some of the sections east of the Front Range. But so far as our present knowledge goes the fauna does not extend east of the Front Range of the Rockies.

In the area of its distribution in western Colorado the Ouray limestone appears as a surface formation in comparatively small areas. Later sediments, eruptive rocks, and deformation combined have operated to make its occurrence at the surface not very common. It has been recognized, however, by its characteristic fossils at a few widely separated points between the White River Valley and the Durango quadrangle, which may be regarded as representing the approximate north-and-south limits of its distribution in Colorado. Within this area Ouray fossils are known from the Crested Butte quadrangle,[a] from the vicinity of Salida,[a] and some other points. In some areas the Ouray limestone seems to be barren of fossils. This is the case in the Silverton quadrangle, where both I and the geologists who mapped the quadrangle failed to find Devonian fossils.[b] The lithologic resemblance of the limestone just above the Elbert formation to the Devonian limestone elsewhere seems, however, to leave no doubt of its Devonian age.

The very close resemblance of the Devonian fauna of Colorado to that of New Mexico indicates that it represents the same marine basin in both areas. That this basin may have been interrupted over a part of northern New Mexico by land areas seems to be indicated by the observations of Gordon and Graton, who state[c] that the pre-Cambrian complex in the northern half of New Mexico is overlain by sediments, the oldest of which are of Carboniferous age.

---

[a] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 36.

[b] Silverton folio (No. 120), Geol. Atlas U. S., U. S. Geol. Survey, 1905, p. 4.

[c] Am. Jour. Sci., 4th ser., vol. 21, 1906, p. 395.

DESCRIPTION OF FAUNA.

CŒLENTERATA.

ZAPHRENTIS sp.

Plate I, figures 1–1a.

Corallum simple, turbinate, moderately curved. Exterior marked with numerous irregular undulations and wrinkles of growth and fine concentric striæ. Height of mature specimen about 50 mm. Diameter of calyx about 25 mm. Depth of calyx 14 mm. The sides of the calyx descend abruptly, leaving a broad flat space at the bottom. The fossette begins near the center and extends to the inner margin of the rim of the calyx. The lamellæ number about 220. The alternate lamellæ are weak and extend but a short distance beyond the margin of the corallum. The stronger set are twisted at the center.

Locality.—Hillsboro, N. Mex.

VERMES.

SPIRORBIS sp.

A smooth-shelled species of this genus is occasionally seen attached to the shells of brachiopods and corals. The imperfection of the material will not permit a more detailed description of the species.

Locality.—Hillsboro, N. Mex.

BRACHIOPODA.

CRANIA OURAYENSIS n. sp.

Plate I, figures 2, 2a.

Shell subcircular in outline. Dorsal valve somewhat domelike without distinct apex, the shell being broadly rounded in the apical region. Length slightly greater than breadth, and twice the height. Surface smooth.

A single smooth-shelled valve from Rockwood probably represents a ventral valve of this species. It is moderately concave, with an irregularly sloping surface. Muscular scars unknown. The absence of a pointed apex distinguishes this species from *Crania leoni* of the Chemung.

Locality.—Type from Rockwood, Colo.; another specimen from Endlich Mesa.

LEPTÆNA RHOMBOIDALIS Wilckens.[a]

Plate I, figure 3.

This species, which is unknown in Colorado, appears to be rather rare elsewhere; only two specimens have been found. These show the valves much less geniculate than in the usual type of the species.

Locality.—Hillsboro, N. Mex.

SCHUCHERTELLA CHEMUNGENSIS (Conrad).

Plate III, figures 2–4a.

Orthothetes chemungensis Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 40, Pl. III, figs. 1–2.

Orthothetes chemungensis var. Girty,[b] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 40, Pl. III, figs. 4–5.

The variable character of this species is well known. This is especially manifest in the striæ, which are of three general types. In one of these the striæ are subequal, fine, and threadlike, as in the variety figured by Girty.[c] In another variety fine and coarse striæ alternate more or less regularly. In a third variety, which has been observed at only one locality, the striæ are arranged in fascicles of three or four fine striæ separated by much coarser ones.

This species, though common at many of the Colorado localities, does not appear in the collection from New Mexico.

Locality.—Glenwood, Rockwood, and southwest of Mount Eolus, Colorado.

SCHUCHERTELLA COLORADENSIS n. sp.

Plate III, figures 5–6a; Plate IV, figure 1.

Orthothetes chemungensis? Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, Pl. III, fig. 3.

Shell approximating a semicircular outline. Ventral valve with area extremely elevated; in one specimen height of area is equal to three-fourths of width; in the other height and width are about equal. The two sides of the valve are unsymmetrical and irregular in growth. The beak is twisted laterally and directed backward, but not incurved. Deltydium and area transversely striated. Surface marked by rather closely placed radiating striæ of uniform size. Dorsal valve unknown.

Only two specimens of this fossil are known. They occur in association with numerous specimens of *S. chemungensis*, but none of the latter show any individuals which approach the form here described in the height of the area. The greater width as compared with the length also distinguishes *S. chemungensis* from this form. The

[a] For synonymy, see Schuchert, Charles, A synopsis of American fossil Brachiopoda: Bull. U. S. Geol. Survey No. 87, 1897, p. 240.

[b] For earlier synonymy, see Bull. U. S. Geol. Survey No. 87.

[c] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, Pl. III, figs. 4–6.

slightly incurved beak of *Schuchertella extensus* distinguishes that shell from the present species.

Locality.—Rockwood, Colo.

PRODUCTELLA COLORADENSIS n. sp.

Plate IV, figures 2–8.

Productella semiglobosa Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 42, Pl. III, figs. 7–10.

The specimens which were provisionally identified by Girty[a] with Nettleroth's species—*P. semiglobosa*—together with a number of other specimens, have been compared with Nettleroth's types by me. The resemblance between the specimens from the Falls of the Ohio and the Colorado specimens is rather close, but the differences appear to be sufficient to justify distinguishing the western form as a new and hitherto undescribed species.

Mature specimens of *P. coloradensis* generally show a slight tendency toward a sinus in the ventral valve; generally this amounts only to a flattening across the middle of shell, but in some shells a distinct sinus is present, as shown in Plate IV, figure 5. In *P. semiglobosa* there is no such flattening, the shell presenting a regularly circular outline in front. The Colorado form is slightly more arched, the beak being rather more strongly incurved and the shell descending more abruptly in front. However, the Colorado and the Louisville species are very closely allied, particularly in the scattered irregular spine bases of circular outline. Prominent ears similar to those of the Colorado specimens are preserved on one of the Louisville shells. The more arcuate form and greater tendency to a geniculate front are the chief distinguishing features of this species.

Round spine bases mark the anterior two-thirds of the shell; on well-preserved specimens small round tubercles which do not seem to have been spines take the place of these in the umbonal region. In exfoliated shells small round pits mark the mold of the shell under the spine bases, indicating a thickening of the shell on the inner side at the base of the spines. In a few specimens the natural mold exhibits narrow elongated pits corresponding to similar elevations on the interior of the ventral valve; these, however, do not appear on the outer surface of the valve. Fine concentric lines of growth mark the surface of well-preserved shells. Prominent concentric wrinkles mark the ears and less distinctly the umbonal region. They are absent or indistinct on the anterior two-thirds of the shell.

The dorsal valve is distinctly geniculate in front and moderately concave in the middle and posterior portion. The surface is marked by small shallow pits about corresponding in number to the spine

[a] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 43.

bases of the opposite valve. The cardinal process has two short, slightly diverging prongs.

This fossil is rather common in the Ouray Devonian fauna.

Locality.—Glenwood, Shoshone, Rockwood, Gunnison, Salida, Durango, Colo.

PRODUCTELLA COLORADENSIS var. PLICATUS n. var.

Plate IV, figures 9–12.

The collections from New Mexico contain a variety of *Productella coloradensis* which is distinguished from the typical form by the presence of a low and rather wide plication in the shallow sinus of the ventral valve. The plication becomes recognizable first about one-fourth to one-third the distance from the beak to the front, with the first appearance of the sinus, as a low rounded swelling, sometimes barely discernable, in the middle of the latter. Three to six spine bases mark the crest of the fold. These are present in some shells where the fold is not recognizable and by their linear arrangement indicate the axis of the obsolescent fold. Along the anterior half of the fold the striæ of growth are distinctly curved backward in crossing the fold; posteriorly their course is scarcely interrupted. *P. coloradensis* is represented by only one or two individuals in the collection from New Mexico, but the variety *plicatus* is common. In the collections from Colorado the variety is correspondingly rare. At least two of the Colorado specimens, however, distinctly represent this variety.

Locality.—Shoshone and Rockwood, Colo., and Hillsboro, N. Mex.

PRODUCTELLA LAMINATUS n. sp.

Plate IV, figures 13–14.

Shell rather small, subhemispheric in outline, with hinge line slightly shorter than greatest width of shell, and cardinal angles rounded.

Ventral valve moderately convex; beak small, slightly overarching the hinge line. Surface studded with slender, closely placed spines, and marked by a series of 12 to 18 prominent concentric lamellose bands, having a width of from 1 to 1½ mm. each, and by very fine concentric striæ. Pedicle valve unknown. This species resembles in its numerous fine spines the next described species, *P. spinigera*, but the uniform character and regular spacing of the lamellose bands and the less highly arched ventral valve distinguish it from that form. The prominent lamellose bands, indeed, distinguish it sufficiently from any other species.

Locality.—Shoshone, Colo.

PRODUCTELLA SPINIGERA n. sp.

Plate V, figures 1–4.

Shell rather small, subhemispheric in outline.

Ventral valve moderately concave; beak small and slightly overarching the hinge line. Entire surface covered by closely set short slender spines or by small tubercles marking their bases. Some specimens are marked by strong lamellæ of growth; in others these are indistinct or absent. In the former class the lamellæ have given rise to a more or less regular concentric arrangement of the spines; in the latter no very definite concentric alignment is apparent.

Dorsal valve slightly concave. The entire surface is covered with fine short spines like those of the opposite valve. The spines on both valves are pressed closely against the shell and point toward the front and lateral margins.

The interior of the dorsal valve is shown in a specimen believed to belong to this species. The inner surface is rugose or finely granulated. A fine threadlike septum beginning about 1 mm. from the cardinal process extends one-third the distance to the front. The two lobes of the cardinal process coalesce in front, giving a horseshoe-like outline opening in front. There are traces of auxiliary processes at the sides of the two divisions of the cardinal process, giving a suggestion of a quadripartite process like that in *Strophalosia*. In one of the specimens in which the two valves are attached the cardinal process shows a distinct V shape from the dorsal view. In this specimen, which is one of the types, the two divisions of the process are not connected anteriorly, as in the previously described specimen. The minute character and general distribution of the spines distinguish this species from any with which it might be compared except *P. laminatus*, which is distinguished from it as stated in the description of that species.

Locality.—Hillsboro, N. Mex.

PRODUCTELLA HILLSBOROENSIS n. sp.

Plate V, figure 6.

The collection contains four specimens of what is apparently a new *Productella*. None of these are complete enough to show the outline.

Shell large, depressed convex. The ventral valve is entirely covered with short, slender closely placed spines or spine bases. The spines lie close against the shell as in the preceding species. Surface striæ are absent or extremely indistinct. The ventral valve is uniformly but very slightly convex.

The dorsal valve is slightly concave and is without spines. Somewhat corrugated concentric wrinkles are present on both valves in

one specimen. A median septal ridge extending half way to the front is present on the interior of the dorsal valve.

This shell resembles the preceding species *P. spinigera*, in the small size and close distribution of the spines on the ventral valve, but the smooth dorsal valve, depressed character, and greater size, distinguish the two sharply. The sinuate front of *P. depressa* distinguishes it from *P. hillsboroensis*.

Locality.—Hillsboro, N. Mex.

PRODUCTELLA DEPRESSA n. sp.

Plate V, figures 5–5a.

A single specimen of a large ventral valve which appears to be specifically distinct from any of the previously described species may be characterized as follows:

Shell large, broader than long, the proportion being about 11 to 8. The ventral valve is only moderately convex in the median portions, depressed as compared with most species of *Productella*, and has broad flattened ears. A broad and rather deep sinus marks the anterior third of the shell, giving it a sinuate front. The beak and umbone are small and inconspicuous. The entire surface, with the possible exception of the umbonal region, which is exfoliated, is marked by small elongated spine bases pointing forward. These are rather numerous in the anterior portion of the shell and are comparatively scarce on the ears. Concentric wrinkles and very fine striæ of growth complete the surface markings.

This species may be compared with *P. bialveata*, *P. boydi*, and *P. lachrymosa* var. *lima* of the Chemung, each of which is characterized by a sinus in the ventral valve. The limitation of the spines to the marginal region in the first species, however, distinguishes it from *P. depressa*. In *P. boydi* the sinus extends to the beak, instead of being limited to the anterior portion of the shell, as in this species. It seems also to have a greater proportional breadth at the hinge line than in *P. boydi*. The gibbous character of the ventral valve of *P. lachrymosa* var. *lima* distinguishes it from *P. depressa*, whose broad depressed valve has just been described. A similar and still more striking contrast exists between this species and *P. coloradensis*, which is associated with it.

Three large fragmentary ventral valves which probably belong to this species are present in the collection from Glenwood.

Locality.—Shoshone, Colo.

SCHIZOPHORIA STRIATULA var. AUSTRALIS n. var.[a]

Plate I, figures 4–8; Plate II, figures 1–5a; Plate III, figure 1.

Schizophoria striatula Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 39.

The New Mexican specimens of this species show a notably lower area in the ventral valve than its Iowa and New York representatives. They differ also from the type of the species found in the Eastern States in the extremely gibbous character of the umbonal region of their dorsal valve, which is in many specimens projected back of and over the hinge line.

The specimens vary widely among themselves with reference to the depth of the sinus at the front, but this variation is mainly a developmental feature, the sinus being slightly indicated in young shells and very deep in mature specimens. Many specimens in argillaceous limestones reach a very large size. One such shell measures 60 mm. in width and 46 mm. in length. The New Mexican specimens are not notably larger than the forms which are usually seen in Iowa.

CAMAROTŒCHIA (PLETHORHYNCHA) ENDLICHI (Meek).

Plate VII, figures 1–2; Plate VI, figures 10–11a.

Rhynchonella endlichi Meek, Bull. U. S. Geol. and Geog. Survey Terr., 2d ser., No. 1, 1875, p. 46. White, Twelfth Ann. Rept. U. S. Geol. and Geog. Survey Terr., 1883, p. 133, Pl. XXXVI, fig. 2; Pl. XXXIII, fig. 4.

Camarotœchia endlichi Girty, Second Ann. Rept. U. S. Geol. Survey, pt. 2, 1902, p. 756, Pl. VI, figs. 1–4; Pl. IX, fig. 1.

This species has been described and figured by both Meek and Girty. The only additional contribution to the knowledge of the species which is presented here concerns its geographic distribution. *C. endlichi*, which heretofore has not been known outside of Colorado, has been found to be equally abundant in the Devonian fauna of southern New Mexico—to be, indeed, one of the most abundant and characteristic forms of the Devonian fauna of the Ouray in Colorado and New Mexico. It has been found in practically every locality in which the Ouray Devonian fauna is known in these two areas. The species as it occurs in New Mexico shows no notable difference from the well-known form in southern Colorado. In neither of these localities, however, has the species reached the enormous size which it attains farther north along Grand River, where specimens are not uncommon with a length of 60 mm. or more.

Locality.—Glenwood, Shoshone, Rockwood, and Mount Eolus, Colo.; Kingston, Lake Valley, and Hillsboro, N. Mex.

[a] For a complete synonymy of this species previous to 1900 see Bull. U. S. Geol. Survey No. 87.

EUNELLA sp.

Plate IX, figures 6, 6a.

Shell very small, spatulate in outline. The ventral valve is slightly more convex than the dorsal. A narrow linear depression extends from the beak to the front. Surface apparently smooth and impunctate. Dorsal valve is marked by a narrow linear sinus similar to that in the ventral valve. The only specimen seen has a length of $2\frac{3}{4}$ mm. and a breadth of $2\frac{1}{2}$ mm. The very small size of the shell suggests that it may be a young individual. Although evidently a new species, the slight imperfections of the single specimen makes desirable the collection of other specimens before a specific name is proposed.

Locality.—Glenwood, Shoshone, Rockwood, Colo.; and Hillsboro, N. Mex.

CAMAROTŒCHIA CONTRACTA (Hall)?

Plate VI, figures 1–2a.

Atrypa contracta Hall, Geology of New York, IV; Survey Fourth Dist., 1843, Table 66, figs. 2, 3.

Atrypa laticostata Hall (non Phillips), Idem, 1843, Table 66, fig. 1.

Rhynchonella (*Stenocisma*) *contracta* Hall, Pal. New York, IV, 1867, p. 351, pl. 55, figs. 26–39.

Rhynchonella contracta Herrick, Bull. Denison Univ., III, 1887, p. 39, pl. 10, fig. 9; Idem, IV, 1888, p. 23, pl. 11, fig. 21.

Camarotœchia contracta Hall and Clarke, Pal. New York, VIII, pt. 2, 1893, p. 192, pl. 57, figs. 28–32, 49.

Camarotœchia contracta? Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 57, Pl. VII, figs. 2–4.

The writer follows Girty in referring provisionally to this species a *Camarotœchia* which appears to show no differences that clearly distinguish it from the *C. contracta* of the Chemung formation. Well-preserved specimens from New Mexico occurring in shales show two small subtriangular deltidial plates and a foraminal opening above them. The absence of a pointed ventral beak in all specimens examined seems to indicate that this opening involved the extremity of the beak. Neither the description and figures of the New York species nor the material available permit the comparison of this feature in the eastern and western specimens.

Locality.—Glenwood, Shoshone, Rockwood, Colo.; Hillsboro, N. Mex.

PUGNAX PUGNUS Martin.

Plate VI, figures 3–8a.

Conchyliolithus (*Anomites*) *pugnus* Martin, Petrefacta Derbiensia, 1809, Table 22, figs. 4, 5.

Terebratula pugnus Sowerby, Min. Conchology, 1825, pl. 425, figs. 1–6.

Rhynchonella pugnus Davidson, Mon. British Carb. Brach., Pal. Sic., 1860, p. 97, pl. 32, figs. 1–15; Williams, Am. Jour. Sci., 3d ser., XXV, 1883, p. 99; Walcott,

Mon. U. S. Geol. Survey, vol. 8, 1884, p. 155, Pl. XIV, fig. 7; Clarke, Bull. U. S. Geol. Survey No. 16, 1885, p. 73; Whiteaves, Cont. Canadian Pal., I, 1891, pp. 230, 290.

?*Rhynchonella pugnus* Dawson, Acadian Geology, 3d ed., 1878, p. 295.

Pugnax pugnus Hall and Clarke, Pal. New York, VIII, pt. 2, 1893, p. 203, pl. 60, figs. 6–10.

The excellent material representing this species shows certain slight departures from the specific characters generally ascribed to it, as will be seen from the following description:

Shell transversely ovate and elevated in front. The proportions of length and breadth are about as 6 to 7. Ventral valve slightly concave in the umbonal region, but nearly flat on either side of the sinus. Beak of ventral valve pointed and incurved over beak of opposite valve. A broad sinus, very deep in front, begins about one-fourth the distance from the beak to the front and bends sharply upward as a broad linguiform extension into the opposite valve. From two to four strong radiating plications generally occupy the sinus, and two rounded plications are present on each side of it; all of these become obsolete before reaching the beak. The plications in the sinus arise in some shells independently; in others the later plications are the result of bifurcation.

The dorsal valve is greatly elevated at the front of the fold, from which it slopes abruptly downward to the lateral margins and more gently forward to the beak. The fold is marked by three to five plications, which are sharply angular at the front but are rounded posteriorly. These generally become obsolete about one-third of the distance from the beak to the front. They generally increase through bifurcation. From two to three rounded plications which are developed only near the margin of the shell are present on each side of the sinus. The line of contact between the plications and their intermediate troughs forms a series of very acute angles along the anterior margin of the valves.

In some well-preserved specimens the surface of both valves is covered by fine radiating striæ. This seems to be a somewhat evanescent character, as the striæ are not clearly discernible on other well-preserved specimens. The radiating striæ have been observed on specimens of *P. pugnus* from the Ithaca fauna of New York and Pennsylvania, although absent from the Iowa specimens which have been examined. The radiating striæ are probably not specific characters in these specimens. They appear to show a temporary and local development of a tendency to radiate striation which became fully developed in the Carboniferous in such forms as *Pugnus missouriensis*. Some shells show indistinct, somewhat lamellose, concentric striæ.

The largest individual observed, which appears to represent a gerontic shell, differs somewhat from the above description in the

greater number and prominence of the plications. There are fourteen on each valve, five of which occupy the fold and four the sinus. The lateral plications are well developed nearly to the beaks. This specimen has a length of 20 mm. and a breadth of 28 mm.

This species is represented by 16 individuals.

Locality.—Hillsboro and Lake Valley, N. Mex.

ATHYRIS COLORADENSIS Girty.

Plate VI, figure 9.

Athyris coloradensis Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 46, Pl. V, figs. 5–11.

Athyris vittata var. Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 47, Pl. V, fig. 12.

This species, as pointed out by Girty, is one of the most abundant and generally present species in this fauna throughout its distribution in Colorado. It is likewise a common species in New Mexico, but the specimens from that Territory are smaller than the Colorado specimens, resembling in this respect *Athyris brittsi*, to which they are closely allied.

The collections from New Mexico show specimens intermediate in size between ordinary specimens of *A. coloradensis* and the small form figured and provisionally referred by Girty to *A. vittata* var.[a] I am inclined, therefore, to regard the specimen figured by Girty as a young specimen of *A. coloradensis*, as he has suggested might be the case. The absence of a fold and sinus seems also to favor this supposition.

Locality.—Glenwood Springs, Shoshone, Rockwood, Colo.; and Hillsboro, N. Mex.

SPIRIFER WHITNEYI Hall.

Plate VIII, figures 2–5a.

Spirifer whitneyi Hall, Geol. Survey Iowa, I, pt. 2, 1858, p. 502, pl. 4, fig. 2; Hall and Clarke, Pal. New York, VIII, pt. 2, 1893, pp. 24, 57, pl. 30, figs. 18, 19.

Spirifera whitneyi Hall, Pal. New York, IV, 1867, pp. 243, 417; Second Ann. Rept. New York State Geologist, 1883, pl. 55, figs. 18, 19; Tschernyschew, Mém. Comité Géol. St.-Pétersbourg, III, 1887, p. 60.

Shell rather large, valves strongly and about equally convex. Ventral valve with deep, broad, and rounded sinus marked by 15 to 18 dichotonizing plications, most of which are derived through bifurcation from the two plications limiting the sinus at the beak. Beak strongly incurved over a low area in specimens from New Mexico. In Grand River specimens the beak is but slightly incurved and the area high. The area is vertically striated. A convex deltydium

[a] Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, Pl. V, fig. 12.

covering the sides and upper half of the delthyrium is present in some specimens. A narrow, deep groove separates it from the area.

Dorsal valve with an elevated and sharply delimited fold, which is marked by 15 to 20 dichotonizing plications. Surface of shell marked by 25 to 30 plications on each side the fold and sinus. These are broad and flat in the anterior half of the shell, with very narrow interspaces. The plications in one specimen from Glenwood Springs have a breadth of 2 mm. at the front, with interspaces of about 0.5 mm. between the plications. The surface of the plications is covered with extremely fine radiating striæ, which are crossed by equally fine concentric striæ. The fine radiating striæ seem to be an evanescent character, and are entirely absent on some very well preserved specimens. They are perhaps nowhere so well developed as on Iowa specimens of *S. whitneyi*. These finer markings, though rarely seen, have been observed on a few individuals from both New Mexico and Grand River, Colorado. The presence of the fine radiating striæ on the plications seems to indicate the identity of the form under consideration with *S. whitneyi* of the Iowa Devonian rather than with *S. disjunctus* of the Eastern States.

Comparison of the Colorado and New Mexican shells with specimens of *S. whitneyi* from Iowa shows the latter to have more rounded and narrower plications as well as a smaller and less robust shell than the Rocky Mountain forms. In view of the extremely variable character of the *S. disjunctus* type, however, it seems undesirable to introduce a new specific name on account of these differences. The figures show average-sized specimens, but some individuals from Grand River reach a length of 58 mm.

Locality.—Hillsboro, N. Mex.; Shoshone and Glenwood Springs, Colo.

SPIRIFER WHITNEYI var. ANIMASENSIS (Girty).

Plate IX, figures 1–3a.

Spirifer disjunctus var. *animasensis* Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 48, Pl. IV, figs. 1–10.

This variety represents a type which can generally be distinguished from the preceding by its smaller size, the more elevated area of the ventral valve, the slightly twisted and but slightly incurved ventral beak, and the more rounded plications. Perfectly preserved specimens from New Mexico which seem to be identical with this variety, as described by Girty from Colorado, show granulose plications covered with very fine radiating striæ. These finer markings, which are not preserved on specimens from the limestone, seem to ally this variety with *S. whitneyi* rather than with *S. disjunctus*. There is wide variation in the character of the area of the ventral valve. This

variation includes specimens in which the area is moderately concave, vertical, and inclined forward.

Locality.—Hillsboro, N. Mex., and Rockwood, Colo.

SPIRIFER NOTABILIS n. sp.

Plate VII, figures 3–6c.

Spirifer bimesialis Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 55.

Shell moderately gibbous, terminating laterally in slender mucronate extensions; width three or four times the length. A triangular delthyrium covered by a convex deltidium reaches to the beak of the ventral valve. The small pointed beak of the ventral valve is incurved over the delthyrium.

The valves are distinctly gibbous in the median region and show a slightly concave profile between this and the extended mucronate expansions. A rather narrow fold and sinus extend from the beak to the front of valves. A plication is in some shells present in the bottom of the sinus. The fold is generally marked by a slight median depression which is obsolete in the posterior third of the fold. This depression is absent in the fold of the specimen from New Mexico. The two plications limiting the sinus are much stronger than those on either side.

The surface of each valve is marked by 24 to 30 plications. Of these three to six on either side of the fold and sinus originate at the hinge near the beaks and diverge toward the front of the valves after the usual manner in *Spirifer*. The remainder of the plications, which lie between these and the extremities of the hinge, have the remarkable peculiarity of extending forward normal or nearly normal to the hinge line. These lateral plications have, moreover, the peculiarity of being of the same or greater size at the hinge line than at the front, being thus much stronger and more prominent at the hinge line than the others. In some specimens one of the strong nodelike outer plications adjacent to the finer series coalesces with one of the latter a short distance from the hinge line. The diverse directions of growth of the two series of plications result in three or four of the outer series bending abruptly in conformity with the direction of the diverging series on coming into contact with them. The plications are crossed by a series of lamellose striæ which are exfoliated in most specimens.

The peculiar series of plications on the mucronate expansion of the shell distinguish it from any other *Spirifer* known to me. In other respects it closely resembles *Spirifer bimesialis* Hall.

Locality.—A dozen specimens are present in the collection from Glenwood Springs, Colo., where it occurs in a rather argillaceous limestone. The only other locality where it has been found is Kingston, N. Mex.

SPIRIFER CONICULUS Girty.

Plate VII, figure 7.

Spirifer coniculus Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 47, Pl. V, figs. 1–4.

New material makes possible the addition of a few details not given in the original description of this species.

One specimen appears to indicate a convex deltidial plate over the high narrow delthyrium of the ventral valve. The high vertically striated area of this valve is vertical in some shells, but generally curved backward toward the beak. The thin dental plates which extend across the rostral cavity from the area of the ventral valve continue for about one-fourth of the distance from the beak to the front of the valve and are connected by a transverse plate.

The coarse radiating plications, of which there are eight to ten on each side of the fold and sinus, became almost if not entirely obsolete near the beaks. The best-preserved specimens show that extremely fine radiating striæ covered the entire surface of the shell. These are generally not preserved. As pointed out by Girty, this shell bears but slight resemblance to any other Devonian *Spirifer*. It is a comparatively rare species and is known only in southwest Colorado.

Locality.—Rockwood and 4 miles to the southwest, Mount Eolus, Colorado.

SPIRIFER sp.

Associated with *Camarotœchiá endlichi* in the Rockwood section is a coarsely plicated *Spirifer* represented by a single ventral valve, in the collection. This *Spirifer* is rather closely related to *Spirifer centronatus*, which occurs in the Carboniferous fauna of the same section. It is characterized by about 12 coarse plications on each side of the sinus and three very indistinct plications in the sinus reaching halfway to the beak. It seems to be distinguished from *S. centronatus* as it occurs in the Carboniferous of Colorado by the broader sinus with weaker plications and the less convex ventral valve.

Locality.—North of Rockwood, Colo.

RETICULARIA SPINOSA n. sp.

Plate IX, figures 4–5.

Shell small or medium sized, semielliptical in outline. The valves are moderately ventricose, the ventral being somewhat more ventricose than the dorsal. The hinge line is shorter than the greatest width of the shell; extremities rounded. Each valve has a vertically striated area. The length of the area of the ventral valve is about two and one-half times its height. The area of the dorsal valve is

comparatively narrow, its length being six or seven times its width. A delthyrium reaching to the beak is present in each area. The two are of equal width but differ in height according to the inequality of the two areas. A convex deltidial plate covers the ventral delthyrium.

A broad shallow sinus and a low median fold occupy the ventral and dorsal valves; both are indistinct or obsolete in the umbonal region but are in general fairly well defined at the front. In some specimens the fold is not distinguishable by elevation or otherwise from the rest of the valve.

The entire surface of the shell is covered with regular concentric rows of short acicular spines about 1 mm. in length directed toward the front and lateral margins. Where these have been removed, as is generally the case, short, nearly round spine bases mark their position. From 20 to 40 of the concentric rows mark the surface of the shell. The spine bases show more or less tendency to an arrangement in radiating lines. Exfoliated shells preserve strong concentric lamellose ridges marking the position of the concentric spine bases.

This species is represented by six specimens, all from New Mexico.

Reticularia setigera Hall is rather closely related to this species, but the figures of *R. setigera* indicate that the lamellose striæ on it are much wider apart than in *R. spinosa*.

This shell bears considerable resemblance to the shell from the Eureka district, Nevada, figured by Walcott as *Spirifer undifera* var. There is an essential difference between the two, however, in the much coarser character of the fimbriate spines which mark the lamellose striæ in *Reticularia undifera* var. The same difference, together with the entire absence of plications, seems to distinguish it from all the forms called *Reticularia undifera* in the United States. *Reticularia spinosa* has a strong resemblance to and may prove to be identical with *Spirifer curvatus* Schlotheim from the Middle Devonian of England.

Locality.—Hillsboro, N. Mex.

SYRINGOSPIRA n. gen.[a]

Diagnosis.—Shell rather large, and of subpyramidal contour. The entire surface is plicated. Ventral valve with a high vertical area, divided medially by a delthyrium reaching to the apex. A comparatively flat deltidium is sometimes present. The dental lamellæ diverge slightly toward the front of the shell but before reaching it they curve toward the median plane and unite. These plates are also united a short distance within the delthyrium by a thin transverse plate which extends from the apex of the shell nearly or quite to the hinge line, thus forming a closed space or tube extending the length of

[a] The resemblance of this genus to the genera *Syringothyris* and *Spirifer* has suggested the formation of its name from the names of these two genera.

these two processes which increases gradually in size from the apex of the valve toward the dorsal valve.

This genus, though somewhat closely related to *Syringothyris*, represents a type generically distinct from it, as appears from the following considerations: The syrinx, which is the distinguishing characteristic of *Syringothyris*, is developed from the transverse plate and consists of a split tube except in one or two species where it appears to be solid. This tube as it approaches the opposite valve decreases in size, terminating in a point in some shells. *Syringospira*, however, has a closed instead of a split or solid tube. It represents an inclosure formed by the junction of the dental lamellæ on the anterior side and the transverse plates uniting these on the posterior side, instead of a distinct process developed from the latter, as in *Syringothyris*. The distinct character of this feature in the two genera is also illustrated in the tendency to increase in diameter at the lower end in *Syringospira* and to terminate in a point in *Syringothyris*.

The strongly plicated fold and sinus of this genus distinguish it from most of the species of *Syringothyris*, all but two of the described species having the fold and sinus smooth. Neither the punctæ nor the "twilled cloth" marking of *Syringothyris* have been observed in this genus.

The type of the genus is *S. prima*.

SYRINGOSPIRA PRIMA n. sp.

Plate VII, figures 8–8d; Plate VIII, figures 1–1a.

Shell large, subpyramidal in outline, with a dorsal valve of the spiriferoid type and a ventral valve resembling *Cyrtia* in the high flat area. Greatest width of the shell is at the hinge line, where it about equals the height. Ventral valve with a very high area inclined slightly forward. The area is vertically striated with striæ of uniform size. A few of these coalesce in passing toward the hinge line. One specimen shows a deltidium which apparently covered the long narrow delthyrium to the hinge line. It is absent in the other, the transverse plate crossing the delthyrium 2 mm. below the plane of the area near its middle. The long tubular inclosure formed by the junction of the transverse plate with the dental lamellæ and of the latter with each other on the anterior side of the valve is pear shaped in cross section, the narrowest portion being at the transverse plate. The surface of the ventral valve is entirely covered with coarse, closely placed, low rounded plications. There are about 60 to 70 of these, of which 15 to 20 occupy the sinus. The plications are crossed by fine concentric striæ which in some shells develop into a series of imbricating lamellæ. The sinus is broad and poorly defined, being in a few specimens nearly flat at the front, which is produced into the fold of the opposite valve.

The dorsal valve is moderately concave with a distinct fold. The length varies from a little less to a little more than half the width. About 70 low rounded plications mark the surface, 24 of which occupy the fold. They are crossed by concentric, somewhat lamellose striæ. All the plications on the fold originate by bifurcation from two primary plications at the beak. On the lateral slopes bifurcation occurs rarely if at all.

Only two specimens of the species are known.

Locality.—Hillsboro, N. Mex.

MERISTELLA BARRISI Hall?

Plate IX, figures 7–9a.

Meristella barrisi Hall, Thirteenth Rept. New York State Cab. Nat. Hist., 1860, p. 84; Pal. New York, IV, 1867, p. 304, pl. 49, figs. 5–22; ? ?Tschernyschew, Mém. Comité Géol. St.-Pétersbourg, III, 3, 1887, p. 55, pl. 9, figs. 12, 15; pl. 13, figs. 1, 2. Hall and Clarke, Pal. New York, VIII, pt. 2, 1895, pl. 43, figs. 25, 26; pl. 44, figs. 27–30.

The collections from New Mexico contain about two dozen specimens of a shell which does not appear to be distinct from *M. barrisi* of New York. They are slightly broader than the New York form, the breadth being generally about equal to the length, but in other respects they resemble it closely, as the figures will indicate.

Locality.—Hillsboro, N. Mex.

PELECYPODA.

ORTHONOTA sp.

Plate X, figure 6.

Shell small, subcylindrical in the vicinity of the beaks, somewhat compressed posteriorly. The length is a little more than three times the height. Cardinal line straight, but overhung by the incurved umbones. Umbonal slope indicated by a low subangular ridge extending to the postinferior extremity. The postcardinal slope is marked by a low ridge which is about one-third the distance from the cardinal line to the postumbonal ridge posteriorly. The character of the posterior and anterior extremities of the shell are not shown by the specimens.

This shell is represented by two specimens. It is doubtless new, but the naming of the species is deferred till more complete description is possible.

Locality.—Rockwood and 4 miles southwest of Mount Eolus, Colorado.

GLOSSITES cf. LINGUALIS Hall.

Plate X, figure 1.

Glossites lingualis Hall, Pal. New York, I, pt. 5, II, 1885, p. 497, Pl. XL, figs. 16, 19; Pl. XCVI, figs. 9-11.

In part, *Modiomorpha? amygdalina* (Winchell) Hall, Prel. Not. Lamellibranchiata, 2, 1870, p. 78.

In part, *Modiomorpha? amygdalina* (Winchell) Hall, Pal. New York, V, Pt. I, 1883, pl. 40, figs. 12-20.

Not *Sanguinolites amygdalinus* Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 13.

Allorisma sp. Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 59.

Shell of medium size, outline elongate subelliptical. Length twice the height. Cardinal line slightly arcuate. Lower margin gently rounded. Anterior end somewhat produced, abruptly rounded from about the middle of the height to the lower margin. Beaks small and closely appressed, scarcely elevated above the cardinal margin and placed in the anterior third of the shell. A barely discernible depression marks the outer half of the shell below the beaks. The postcardinal slope is marked by a narrow flattened area. The remainder of the surface shows a moderate and uniform convexity. The surface is marked by concentric undulations which probably represent fascicles of striæ. The shell is entirely exfoliated, so that finer surface markings if ever present are not observed.

So far as the material permits comparison this shell appears to be identical with the Chemung species of New York.

Locality.—Durango quadrangle, Colorado.

LEPTODESMA ACUTIROSTRUM Hall?

Plate X, figure 2.

Leptodesma acutirostrum Hall, Pal. New York, V, pt. 1, 1884, p. 234, pl. 91, fig. 21.

A single left valve is doubtfully referred to this species, with which it is closely related if not identical. The shell is of medium size; outline as shown by figure. The body makes an angle of about 42° with the hinge line. Beak anterior. The anterior margin bends sharply backward from the point of the beak, and in joining the gentle curvature of the ventral margin makes a distinct concavity in the margin of the shell below and posterior to the beak. Margin broadly rounded below, continuing in to the posterior margin. The left valve is slightly gibbous in the umbonal and postumbonal region, but is only moderately convex in the lower part. Wing not sharply defined from the rest of the body, the margin oblique or making a straight line near the cardinal line.

The specimen is represented by a mold which does not show the character of the surface markings.

Locality.—Rockwood, Colo.

LEPTODESMA EOLUS n. sp.

Plate X, figure 3.

Shell small and very oblique. Length nearly twice the height. The body is narrow with a nearly uniform width below the ears and makes an angle of about 30° with the hinge line.

The anterior ear is rounded below and separated from the nearly straight antero-basal margin by a poorly defined sulcus. A second faint sulcus posterior to this extends from the beak to the lateral margin nearly at right angles to the hinge line. Posterior wing small, acutely pointed, and flattened.

Beak at the anterior third depressed and directed forward. The body is distinctly elevated along a line from the beak to the posterior extremity. From this ridgelike elevation the surface of the left valve slopes abruptly to the posterior wing and the posterolateral margin, and more gently to the anterolateral margin.

No surface markings are preserved. The right valve is unknown.

This shell resembles *L. lichas* of the Chemung, but has a narrower body which makes a more acute angle with the hinge line.

Locality.—Four miles southwest of Mount Eolus, Colorado.

MYTILARCA sp. *a*.

Plate X, figure 4.

Two small species of *Mytilarca* are represented in the collection by imperfect left valves.

Species *a* shows the following features: Shell small, the ventral margin straight. Dorsal margin moderately rounded in the middle portion, bending rather abruptly in the upper part toward the beak. The maximum elevation of the shell is very near the ventral margin, along a line extending forward from the beak parallel to the ventral margin. From this axis of maximum elevation the shell slopes abruptly, almost vertically, to the ventral margin on one side; on the other side the slope is very gradual and regular to the dorsal margin, making in profile a nearly straight line. This species bears some resemblance to *M. carinata* of the Chemung.

Locality.—Rockwood, Colo.

MYTILARCA sp. *b*.

Plate X, figure 5.

Shell small, with outline as shown in figure. Unlike the form just described, the ventral margin is curved and rounds gently into the anterior margin. The greatest convexity of the shell is in the postumbonal region, which slopes rather abruptly to the ventral margin. Toward the anterior margin the slope is gradual and uniform and continues thus to the middle of the dorsal margin; between this point and

the hinge the uniform slope changes to a slight concavity between the upper dorsal margin and the elevated umbonal region. Neither the character of the hinge line nor the beak is clearly shown in the specimen. Right valve unknown.

Locality.—Rockwood, Colo.

AVICULOPECTEN sp.

The genus is represented by two or three species, but the material is too poor to justify figuring or description.

Locality.—Rockwood and 4 miles southwest of Mount Eolus, Colorado.

GASTROPODA.

BELLEROPHON sp. undet.

Plate X, figures 7–8.

Bellerophon sp. Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 62.

The imperfect material representing a species of *Bellerophon* in the Ouray limestone has been described by Girty as follows:

Shell large, very gradually expanding, not flaring at the aperture. Umbilicus open. Volutions somewhat flattened above, so that a transverse section at any point would be elliptical. Slit band in the form of a narrow ridge, not much elevated, traversing the median dorsal line. The surface is marked by transverse, lamellose ridges, about 1 mm. broad, which appear to be but little deflected as they cross the dorsal ridge.

One large specimen measures about 60 mm. on its longest diameter. The others are somewhat smaller.

This species evidently belongs to the genus *Bellerophon* as restricted by Waagen, and seems to be related to *B. pelops* of the "Corniferous" limestone. The poor preservation of the material hardly admits of further comparison than this.

Formation and locality.—Specimens of a *Bellerophon* which is probably identical with the species noted by Girty were found at the following localities: Shoshone, Rockwood, and southwest of Mount Eolus, Colorado.

STRAPAROLLUS cf. CLYMENIOIDES Hall.

Plate X, figure 10.

Euomphalus clymenioides Hall, Desc. New Species Fossils, etc., 1861, p. 266.

Euomphalus clymenioides Hall, Fifteenth Ann. Rept. New York State Cab. Nat. Hist., 1862, p. 54.

Euomphalus (*Straparollus*) *clymenioides* Hall, idem, p. 166, Pl. VI, figs. 1, 2.

Euomphalus clymenioides Hall, Illus. Devonian Fos., 1876. Cephalopoda, Pl. LXX, figs. 1–5.

Euomphalus clymenioides Hall, idem, Gasteropoda, Pl. XVI, fig. 15.

Euomphalus (*Straparollus*) *clymenioides* Hall, Pal. New York, 1877, V, pt. 2, p. 62, Pl. XVI, fig. 15; Pl. XVII, figs. 1–5.

Straparollus clymenioides? Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 61, Pl. VII, figs. 7–8.

Girty's description of this shell as it occurs in the Ouray limestone is as follows:

> Shell attaining a rather large size, discoidal, section across the peritreme nearly circular. Volutions gradually expanding, rather numerous, tangent: The spire is depressed below the plane of the outer volutions, so that the upper side of the shell is slightly concave, while the lower side is still more so.
>
> The largest specimen observed has a diameter of about 35 mm.
>
> The form upon which the description just given is based is not common in the Ouray limestone, and not well preserved. I think the characters cited are warranted by the material examined, and they indicate a species closely related to Hall's *Straparollus clymenioides*.

This shell seems to show a close resemblance to *S. clymenioides* as indicated by Girty, but when it is possible to compare perfect material representing the two forms it is probable that they will be found to be distinct species. The associated fossils indicate that the Colorado shell belongs to a very late horizon of the Devonian, while the New York shell with which it is compared is found in the Schoharie grit and the "Upper Helderberg" limestone. This rather wide separation of the two forms in the geologic column points toward the probability that they will prove to be distinct species.

Locality.—Four miles southwest of Mount Eolus, Colorado.

EUOMPHALUS cf. EUREKENSIS Walcott?

Plate X, figure 11.

Euomphalus eurekensis Walcott, Mon. U. S. Geol. Survey, vol. 8, 1884, p. 185, Pl. XVI, figs. 2–2a.

This collection contains a single specimen which is closely related to if not identical with this species and may be described as follows: Shell large, discoidal, increasing very gradually in size from the aperture to the apex, which is depressed below the level of the upper surface of the outer volution. The outer volution is not quite in contact with the second. The shell is broadly umbilicate and is coiled nearly in one plane. The upper surface of the inner volutions is in nearly the same plane as the upper surface of the outer volution. The outer whorl of the shell is slightly ovate in cross section, the greater diameter being in the direction of the plane of the periphery of the shell. Volutions about three, aperture very slightly expanded. Surface marked by strong sublamellose transverse striæ. The specimen has a diameter of 60 mm.

The imperfect preservation of the aperture of the specimen prevents close comparison of this portion of the shell with that of *Euomphalus eurekensis*. The absence of surface markings in the types of the latter also prevents comparison of this feature in the Colorado and Nevada shells.

Locality.—Shoshone, Colo.

NATICOPSIS? (ISONEMA) HUMILIS Meek.

Plate X, figure 9.

Isonema humilis Meek, Proc. Acad. Nat. Sci., Philadelphia, 1871, p. 79.
?Naticopsis lævis Hall and Whitfield, Desc. New Species Fossils, 1872, Pl. XII, figs. 3-5 (not *N. lævis* Meek, 1871).
?Naticopsis lævis Hall and Whitfield, Twenty-third Ann. Rept. New York State Cab. Nat. Hist., 1873, Pl. XII, figs. 3-5 (not *N. lævis* Meek, 1871).
Naticopsis? (Isonema) humilis Meek, Geol. Survey Ohio, Pal., Vol. I, 1873, p. 214, Pl. XIX, figs. 1a-1c.
Naticopsis? (Isonema) humilis Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 60, Pl. VII, figs. 9-11.

The rather poor material referred to this species is either identical with or very closely related to Meek's species which was described from the Middle Devonian of Ohio.

Locality.—Southwest of Mount Eolus and Lime Mesa, Colorado.

NATICOPSIS GIGANTEA Hall and Whitfield?

Naticopsis gigantea Hall and Whitfield, Twenty-third Ann. Rept. N. Y. State Cab. Nat. Hist., 1873, p. 238, Pl. XII, figs. 8-10.
Naticopsis gigantea Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 60.

No new material representing this species has been found. The resemblance of the specimens studied by Girty to *N. gigantea* is as strong as could be expected in badly exfoliated shells. Their size and general form point very strongly to the identity of this shell with Hall and Whitfield's species, but the identity of the two can hardly be regarded as fully established until better material has been procured.

Locality.—Engineer Mountain and Durango quadrangles, Colorado.

COLEOLUS sp. undet.

Plate X, figure 13.

Tube circular and tapering very gradually from the base. Surface markings unknown. The tube is slightly curved in the upper part in some specimens, apparently straight in others. The largest specimen observed has a maximum diameter of 10 mm. No complete specimens are present in the material under examination. The largest has a length of 40 mm. and a maximum diameter of 5 mm.

This fossil is known from but one locality, where it occurs in a limestone.

Locality.—Four miles southwest of Mount Eolus, Colorado.

CEPHALOPODA.

ORTHOCERAS (SPYROCERAS?) cf. CROTALUM Hall.

Plate X, figure 12.

Orthoceras sp. *c* Girty, Twentieth Ann. Rept. U. S. Geol. Survey, pt. 2, 1900, p. 63.

Six specimens in the collection represent a species which may be characterized as follows: The shell is an orthocone tapering regularly and gradually toward the apex. Transverse section circular and siphuncle central. The septa are rather closely placed, generally 1½ to 3 mm. apart.

The shell is marked by strong rounded transverse annulations separated by a space equal to about one-third the diameter of the shell, or 3 to 5 mm. apart. No other surface markings are preserved. The largest specimen has a diameter of 15 mm. None of the six specimens show either extremity of the shell.

The close resemblance of this shell to *Orthoceras crotalum* was pointed out by Girty; but with the material at hand I am unable to state whether or not it possesses the longitudinal striæ characterizing the surface of that shell. For a similar reason there is some doubt as to whether it should be assigned to Hyatt's genus *Dawsonoceras* or *Spyroceras*, both of which include annulated forms. If the supposition which is here entertained, that this species is identical with or closely related to *O. crotalum* of Hall, be correct, it of course belongs with the latter genus. The transverse annulations and other features which are preserved agree precisely with those of *O. crotalum*.

Locality.—Durango quadrangle and Rockwood, Colo.

PLATES.

PLATE I.

PLATE I.

(All figures on this and the following plates are natural size unless otherwise stated.)

ZAPHRENTIS sp.

Figures 1–1a. Lateral view and calyx. Hillsboro, N. Mex.

CRANIA OURAYENSIS n. sp.

Figures 2–2a. Surface and profile views of ventral valve of type specimen. Endlich Mesa, Colorado.

LEPTÆNA RHOMBOIDALIS.

Figure 3. Exterior of ventral valve. Kingston, N. Mex.

SCHIZOPHORIA STRIATULA var. AUSTRALIS n. var.

Figures 4–8. Five individuals showing the increasing gibbosity of the dorsal valve with maturity. Lake Valley, N. Mex.

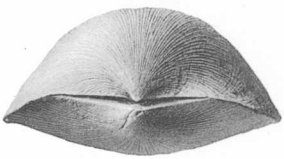
2

2a

4

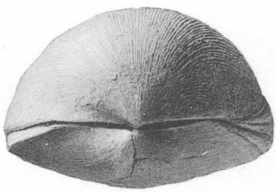
1

5



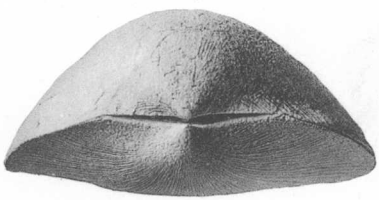
6

1a



7

3



8

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE II.

PLATE II.

SCHIZOPHORIA STRIATULA var. AUSTRALIS n. var.

Figures 1–5. Ventral views of specimens figured on Plate I (figures 4–8), showing variation in depth of sinus.

Figures 1a–5a. Anterior views of the same individuals, showing the development of the sinus at the front from a nearly straight line in immature individuals to a highly arched line in gerontic shells.

1

1a

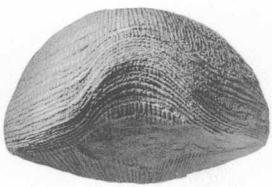
2

2a

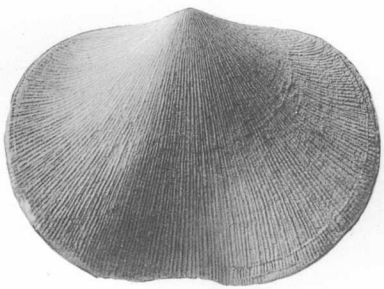
3

3a

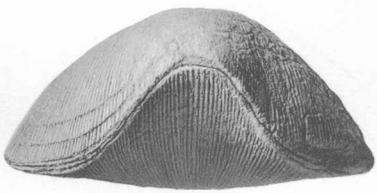
4



4a



5



5a

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE III.

PLATE III.

SCHIZOPHORIA STRIATULA var. AUSTRALIS n. var.

Figure 1. Muscular impression of ventral valve. Glenwood, Colo.

SCHUCHERTELLA CHEMUNGENSIS.

Figure 2. Portion of a ventral valve showing striæ and distorted beak, × 2. Rockwood, Colo.
Figure 3. Dorsal valve, × 2. Rockwood, Colo.
Figure 4. Area of ventral valve. Rockwood, Colo.
Figure 4a. Surface of ventral valve.

SCHUCHERTELLA COLORADENSIS n. sp.

Figure 5. Exfoliated ventral valve of type specimen.
Figure 5a. Side view of the same specimen.
Figure 5b. Area of ventral valve. Rockwood, Colo.
Figure 6. Side view of ventral valve of another specimen.
Figure 6a. Area of ventral valve. Rockwood, Colo.

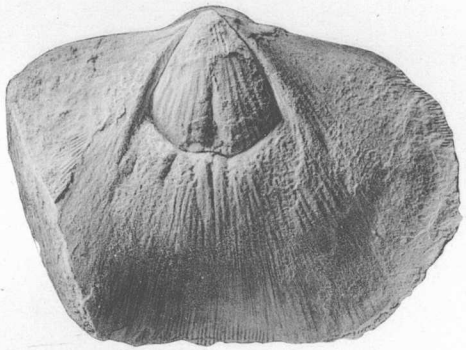
4

4a

5

5a

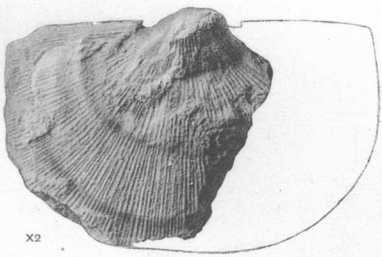
5b



1

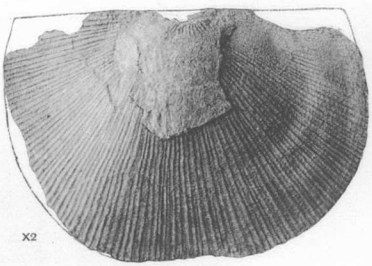
6

6a



x2

2



x2

3

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE IV.

PLATE IV.

SCHUCHERTELLA COLORADENSIS n. sp.

Figure 1. Partly exfoliated ventral valve of type specimen showing striæ, × 2. Rockwood, Colo.

PRODUCTELLA COLORADENSIS n. sp.

Figures 2–4. Three ventral valves. Rockwood, Colo.
Figure 2a. Side profile view of ventral valve.
Figure 5. Ventral valve of the type specimen. Rockwood, Colo.
Figure 5a. Side profile view of type specimen.
Figures 6 and 7. Views of the interior of two dorsal valves. Rockwood (7) and Mount Eolus (6), Colorado.

PRODUCTELLA COLORADENSIS (?) n. sp.

Figure 8. Ventral valve showing a short plication near the front. Rockwood, Colo.

PRODUCTELLA COLORADENSIS var. PLICATUS n. var.

Figure 9. Ventral valve of type specimen. Kingston, N. Mex.
Figures 10, 10a. Front profile and side views of specimen. Kingston, N. Mex.
Figures 11, 11a. Ventral and dorsal views of another individual. Kingston, N. Mex.
Figure 12. Ventral valve of a large exfoliated individual. Shoshone, Colo.

PRODUCTELLA LAMINATUS n. sp.

Figure 13. Ventral valve of the type specimen. Shoshone, Colo.
Figure 14. View of a ventral valve of a small individual. Shoshone, Colo.

2

2a

3

4

5

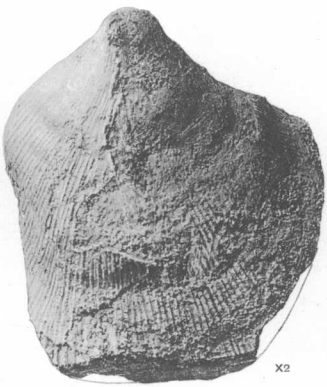
6

8

7

5a

9



1

x2

10

11

10a

11a

13

14

12

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE V.

PLATE V.

PRODUCTELLA SPINIGERA n. sp.

Figures 1, 1a. Ventral valve of type specimen. Kingston, N. Mex.
Figures 2, 2a. Dorsal and side profile views of another specimen. Kingston, N. Mex.
Figure 2b. Ventral valve, × 2.
Figure 3. Interior of dorsal valve. Kingston, N. Mex.
Figure 4. Fragmentary ventral valve, × 2. Kingston, N. Mex.

PRODUCTELLA DEPRESSA n. sp.

Figures 5, 5a. Ventral valve showing exfoliated surface and side profile. Shoshone, Colo.

PRODUCTELLA HILLSBOROENSIS n. sp.

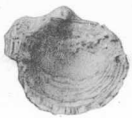
Figure 6. Fragmentary ventral valve with very small spine bases.

CAMAROTŒCHIA CONTRACTA?

Figure 7. Dorsal view of a specimen tilted slightly forward to show plates below beak. The ventral beak is broken in such a way as to erroneously indicate a round foramen, × 3. Lake Valley, N. Mex.

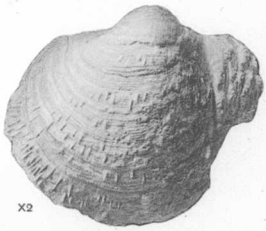
1

1a



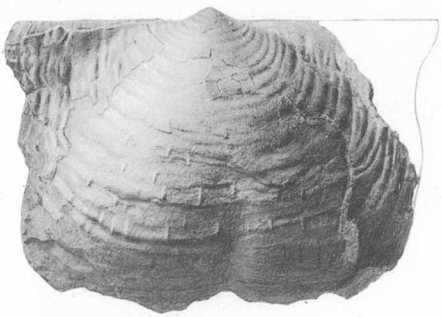
2

2a



2b

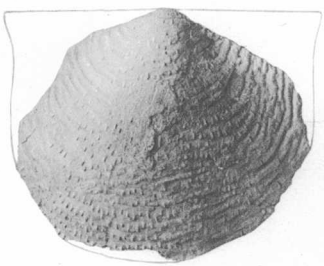
4



5

3

5a



6

7

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE VI.

PLATE VI.

CAMAROTŒCHIA CONTRACTA?

Figures 1, 1a. Dorsal and front profile views of a specimen with the plications slightly rounded by slight exfoliation. Lake Valley, N. Mex.

Figures 2, 2a. Dorsal and front profile views of a shell with sharp angular plications. Lake Valley, N. Mex.

PUGNAX PUGNUS.

Figure 3. Front profile view. Lake Valley, N. Mex.

Figures 4, 4a. Dorsal, front, and ventral views of an individual. Lake Valley, N. Mex.

Figure 5. Front profile view of another shell. Lake Valley, N. Mex.

Figures 6, 6a, 6b. Three views of a small specimen showing the minimum number of plications. Lake Valley, N. Mex.

Figures 7, 7a. Front and ventral views of specimen with prominent lateral plications. Lake Valley, N. Mex.

Figures 8, 8a. Views of the largest and most abundantly plicated shell observed. Lake Valley, N. Mex.

ATHYRIS COLORADENSIS.

Figure 9. Ventral valve of a small individual. Lake Valley, N. Mex.

CAMAROTŒCHIA ENDLICHI.

Figures 10, 10a. Dorsal and ventral views of a rather large shell. Mount Eolus, Colorado.

Figures 11, 11a. Front and ventral views of average-sized shells. Lake Valley, N. Mex.


1


1a


2


2a


3


4


4a


4b


5


7


7a


9


8


6

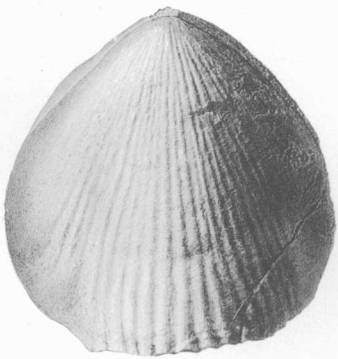

8a

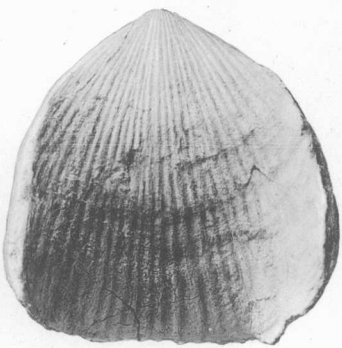

6a


11


6b


11a


10


10a

OURAY FAUNA

PLATE VII.

PLATE VII.

CAMAROTŒCHIA ENDLICHI.

Figure 1. Anterior profile view. Kingston, N. Mex.

Figure 2. Ventral view of a shell which has been faulted and recemented. Kingston, N. Mex.

SPIRIFER NOTABILIS n. sp.

Figure 3. Dorsal valve. Glenwood, Colo.

Figure 4. Ventral valve of the type specimen. Glenwood, Colo.

Figure 5. Fragmentary dorsal valve. Glenwood, Colo.

Figures 6, 6a. Ventral and dorsal views of a specimen. Lake Valley, N. Mex.

Figure 6b. Beaks and area, showing delthyrium, × 2.

Figure 6c. Dorsal valve, showing fine lamellose striæ. The shell is tilted slightly forward, showing beak and area of ventral valve, × 2.

SPIRIFER CONICULUS.

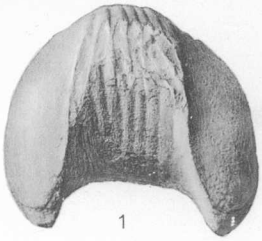
Figure 7. Ventral valve, showing the beak slightly twisted to the right. Mount Eolus, Colorado.

SYRINGOSPIRA PRIMA n. sp.

Figure 8. Area of ventral valve of the type, showing slightly incurved beak of opposite valve. Lake Valley, N. Mex.

Figures 8a, 8b, and 8c. Ventral, dorsal, and side profile views of the type specimen.

Figure 8d. Transverse section of the ventral valve as exposed by the broken apex of the valve, showing the tube and transverse plate.



1

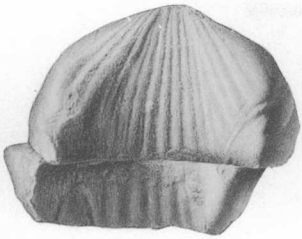
3

4

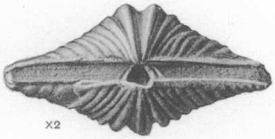
6

5

6a

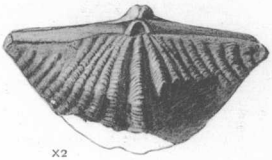


2



x2

6b



x2

6c

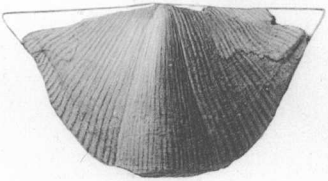
8

7

8d

8c

8a



8b

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE VIII.

PLATE VIII.

SYRINGOSPIRA PRIMA n. sp.

Figure 1. Dorsal valve, showing plications which are eroded near the hinge line.

Figure 1a. View showing lower part of the striated area of a fragmentary shell. Kingston, N. Mex.

SPIRIFER WHITNEYI.

Figures 2, 2a, 2b. Dorsal, ventral, and lateral views of a specimen with strongly incurved beak. Kingston, N. Mex.

Figure 3. Area and deltidial plate. The hinge line is tilted slightly upward. Kingston, N. Mex.

Figure 4. Dorsal view of a specimen with a high area.

Figure 4a. Lateral profile view, showing the high area and slightly incurved beak. Shoshone, Colo.

Figure 5. Dorsal view of a specimen with short hinge line.

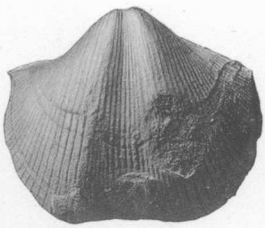
Figure 5a. Side profile view showing an area intermediate in height and curvature between 2b and 4a. Lake Valley, N. Mex.

1

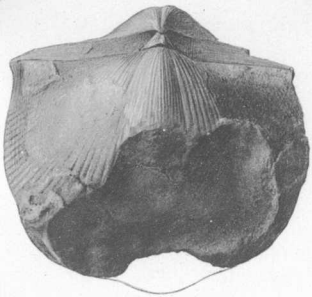
1a

2b

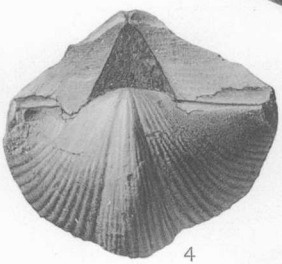
2



2a

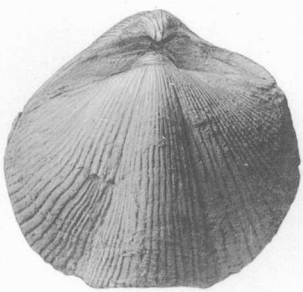


3

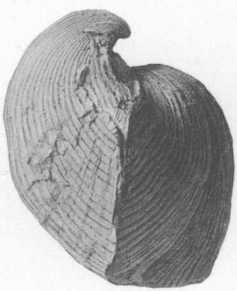


4

4a



5



5a

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE IX.

PLATE IX.

SPIRIFER WHITNEYI var. ANIMASENSIS.

Figures 1, 1a. Dorsal and ventral views of a small specimen showing twisted beaks. Lake Valley, N. Mex.

Figure 2. Dorsal valve. Rockwood, Colo.

Figures 3, 3a. Ventral and side profile views of ventral valve, showing the greatly elevated area of this variety. Rockwood, Colo.

RETICULARIA SPINOSA n. sp.

Figures 4, 4a, 4b. Ventral, dorsal, and side profile views of the type.

Figure 4c. View showing the narrow area, delthyrium, and beaks, × 2. Lake Valley, N. Mex.

Figure 5. Partly crushed specimen showing small spine bases. The figure fails to show the minute spines which are preserved near margin of the shell, × 2. Kingston, N. Mex.

EUNELLA sp.

Figures 6, 6a. Dorsal and ventral views of the only individual observed, × 3. Glenwood, Colo.

MERESTELLA BARRISI?

Figure 7. Ventral view of a specimen showing one of the spires. Lake Valley, N. Mex.

Figure 8. Dorsal, ventral, and front profile views of a specimen. Lake Valley, N. Mex.

Figures 9, 9a. Dorsal and front profile views of another individual. Lake Valley, N. Mex.

1

1a

2

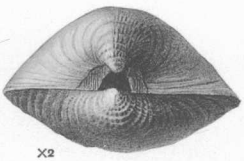
3

3a

4

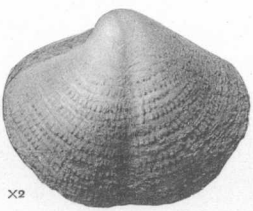
4a

4b



x2

4c



x2

5

x3

6

7

x3

6a

8

8a

8b

9

9a

OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

PLATE X.

PLATE X.

GLOSSITES cf. LINGUALIS.

Figure 1. Exfoliated left valve. Durango quadrangle, Colorado.

LEPTODESMA ACUTIROSTRUM?

Figure 2. Natural mold of left valve. Rockwood, Colo.

LEPTODESMA EOLUS n. sp.

Figure 3. Left valve of the type specimen. Four miles southwest of Mount Eolus, Colorado.

MYTILARCA sp. *a*.

Figure 4. Fragmentary right valve. Rockwood, Colo.

MYTILARCA sp. *b*.

Figure 5. Natural mold of a right valve. Rockwood, Colo.

ORTHONOTA sp.

Figure 6. Imperfect left valve. Rockwood, Colo.

BELLEROPHON sp. undet.

Figure 7. Side view of a natural mold showing umbilicus. Rockwood, Colo.
Figure 8. Natural mold showing dorsal ridge. Rockwood, Colo.

NATICOPSIS? (ISONEMA) HUMILIS.

Figure 9. Spire of an exfoliated shell. Mount Eolus, Colorado.

STRAPAROLLUS cf. CLYMENOIDES.

Figure 10. Whorls. Four miles southwest of Mount Eolus, Colorado.

EUOMPHALUS EUREKENSIS?

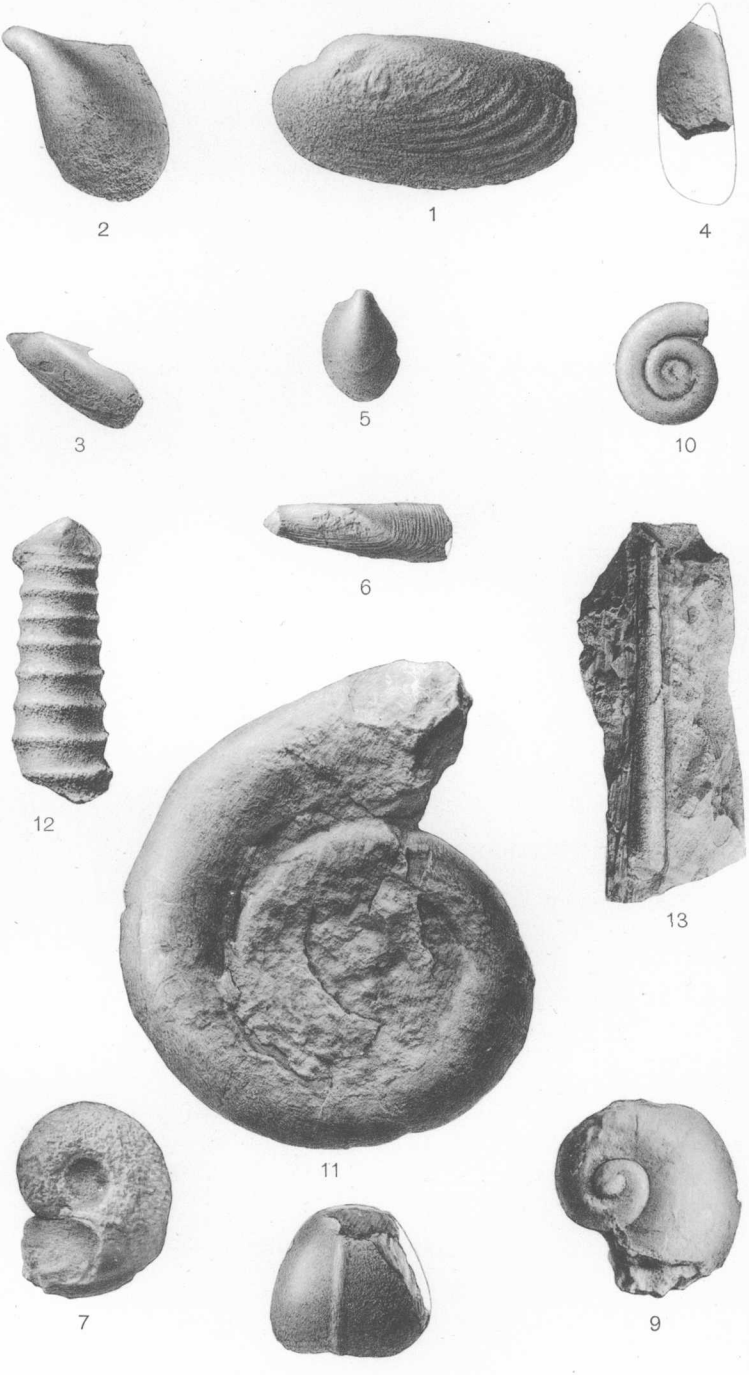
Figure 11. Natural mold of the shell. Glenwood, Colo.

ORTHOCERAS (SPYROCERAS?) cf. CROTALUM.

Figure 12. Type specimen. Rockwood, Colo.

COLEOLUS sp. undet.

Figure 13. Natural mold of a shell. Four miles southwest of Mount Eolus, Colorado.



OURAY FAUNA

CAMPBELL ART CO., ELIZABETH, N. J.

INDEX.

Names in *italic* are those of synonyms; figures in **black face** denote descriptions; figures in *italic* show position of illustrations.

O