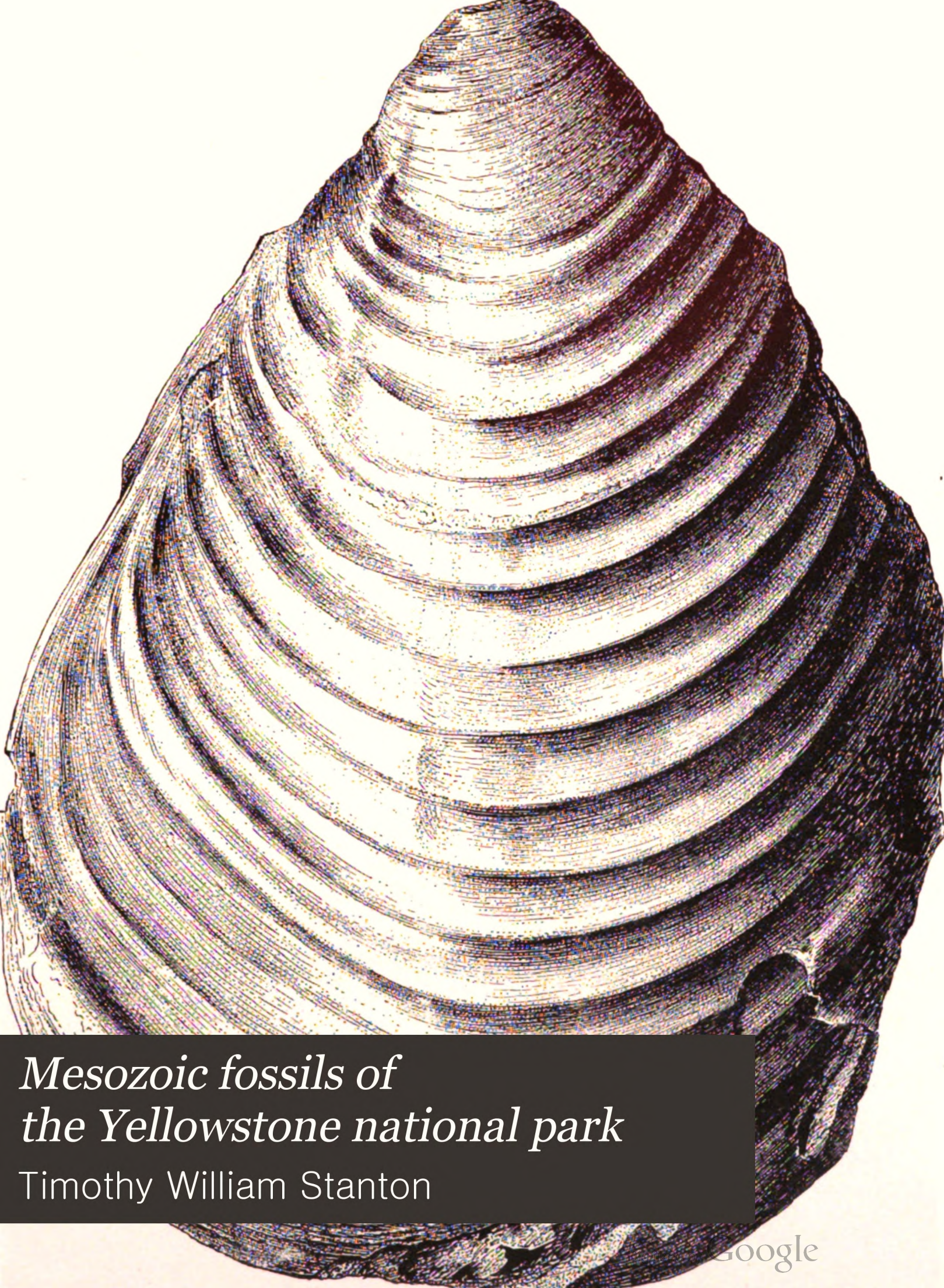

Mesozoic fossils of the Yellowstone national park

Timothy William Stanton

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OF THE

YELLOWSTONE NATIONAL PARK

BY

T. W. STANTON

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CHAPTER XIII.

MESOZOIC FOSSILS.

By T. W. STANTON.

The Mesozoic fossils obtained in and near the Yellowstone National Park and submitted to me for study include 78 species of invertebrates, of which 31 are Cretaceous, 46 are Jurassic, and 1 is from beds of supposed Triassic age. The number of species from a single horizon is not large enough to be dignified with the designation "fauna," excepting, perhaps, in one or two cases; yet the study of these fossils and the comparisons made with known horizons have led to some general results that are worthy of brief discussion. The subject will be treated by geological horizons, and after reviewing the general considerations an annotated list of the species with descriptions of new forms will be given.

TRIASSIC.

The Teton formation, of supposed Triassic age, yielded a few specimens of a Lingula at a locality on the summit of Quadrant Peak. This fossil resembles *Lingula brevirostris* M. and H., from the Jurassic of the Black Hills, but in the absence of other fossils it should be given little weight in determining the age of the beds. Linguloid shells are so slightly differentiated that it would not be safe to distinguish, by them alone, even between Paleozoic and Mesozoic. The determination of the age of this formation must, for the present at least, rest on the evidence of stratigraphy and lithology. The paleontologist can only say that the underlying beds yield Carboniferous fossils, while the overlying formation has a well-developed Jurassic fauna.

The only marine Triassic fossils that have been found in the Rocky Mountain region are from the Lower Trias, beneath the "Red Beds" in southeastern Idaho.[1] The very few fossils that have been obtained from the Red Beds farther south (in New Mexico and southern Colorado) seem to be of fresh-water origin.

In California and Nevada, however, marine Triassic beds are well developed, and have yielded a varied fauna which is as yet mostly undescribed.

JURASSIC.

The Jurassic fossils form much the largest and most important part of the Mesozoic collection. The fauna is not large, but most of the species are abundantly represented, and in number of species it compares favorably with the Jurassic of other parts of the Rocky Mountain region. The collections are from many localities in two general areas—one, which yielded the most fossils, in the northwest corner of the Park, on the headwaters of Gardiner and Gallatin rivers and near the Yellowstone; the other on the slopes of Sheridan Peak and farther southwest of Snake River.

The fossils from all these localities evidently belong to a single fauna, though two zones are recognizable, distinguished more by lithological differences than by faunal peculiarities. The upper zone of arenaceous limestone has yielded an abundance of *Rhynchonella gnathophora*, *R. myrina*, *Ostrea strigilecula*, *Camptonectes pertenuistriatus*, *C. bellistriatus*, and a few other forms. Most of these also occur in the underlying calcareous clays and marly limestones associated with many other species, of which the most abundant are *Pleuromya subcompressa*, *Pholadomya kingi*, and *Gryphæa calceola* var. *nebrascensis*.

The same fauna is represented in the beds just beyond the northern limits of the Park, at Cinnabar Mountain, where fossils that are included in the present report were obtained by Dr. A. C. Peale in 1872. These were identified and some of the species named by Prof. F. B. Meek,[2] but it was not until 1880 that they were illustrated and more fully described by Dr. C. A. White.[3] Still earlier Captain Raynolds had brought back *Gryphæa calceola* var. *nebrascensis* and a few other fossils of this horizon from

[1] See White, Triassic fossils of southeastern Idaho: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, pp. 105–118.

[2] Ann. Rept. U. S. Geol. Surv. Terr. for 1872, pp. 471–474.

[3] Idem for 1878, pp. 143–153, Pls. XXXVII and XXXVIII.

Wind River Valley, and they were described by Meek and Hayden,[1] who had previously[2] announced the discovery of Jurassic fossils from the Black Hills. These Black Hills fossils are fully described and illustrated in the Paleontology of the Upper Missouri. Subsequent geological explorations and surveys have shown that the marine Jurassic is widely distributed in South Dakota, Wyoming, Montana, Idaho, and Utah, and have made considerable additions to the fauna that have been described by White,[3] Hall and Whitfield,[4] Meek[5] and Whitfield.[6] All of these authors seem to have assumed that the fossils they described belonged to a single fauna. At least they made no attempt to recognize distinct horizons in the Jurassic. The meagerness of the fauna—usually only a few species having been obtained at any one locality—was perhaps sufficient reason for not making attempts of this kind. Prof. Alpheus Hyatt's recent comprehensive studies of the earlier Mesozoic faunas of the United States, and especially of California, where all the greater divisions of the Jura are developed, have led him to express the opinion that both the Upper Jura (Callovian or Oxfordian) and the Middle Jura (Oolite) are represented in the Rocky Mountain region.[7] In the former he places the Jurassic of the Black Hills, and of Red Buttes and Aurora, Wyoming, with probably some localities in Utah. Of the Middle Jura he says: "The Oolite certainly seems to have been found by Dr. Peale near the lower canyon of the Yellowstone in Montana, and out of the few fossils from Utah described by Dr. White some are closely similar to those of the inferior Oolite at Mount Jura."

It has already been stated that this collection of Dr. Peale's belongs to the same horizon that is represented in the Park. It contained the following species:

Ostrea strigilecula.
Gryphæa planoconvexa.
Camptonectes platessiformis.
Pinna kingi.
Gervillia montanaensis.
Modiola subimbricata.
Trigonia americana.
Trigonia montanaensis.
Astarte meeki.
Cypricardia haguei.
Pleuromya subcompressa.
Pholadomya kingi.
Goniomya montanaensis.

[1] Proc. Acad. Nat. Sci. Phila., 1861, p. 437, and Paleontology of the Upper Missouri, 1865, pp. 74 and 80.
[2] Proc. Acad. Nat. Sci. Phila., 1858, pp. 46, 49–59.
[3] U. S. Geog. and Geol. Expl. West of 100th Meridian, Vol. IV, Pt. I, 1875.
[4] U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, 1877.
[5] Idem, Pt. I, 1877, and Simpson's Rept. Expl. Great Basin, Utah, 1876.
[6] Newton and Jenney's Rept. Geol. Black Hills of Dakota, 1880, pp. 344–382.
[7] Bull. Geol. Soc. Am., Vol. III, 1892, pp. 409–410.

Besides the species named, there are fragments of two species of ammonites, and several other forms are represented by casts or other imperfect material. All of the species named in this list, excepting *Goniomya montanaensis*, occur at various localities in the Park, as shown in the annotated list of species (pp. 608–631).

Comparatively few Jurassic fossils are known from Utah, and they are probably all from one horizon. According to the various reports published, as well as personal observation in both the northern and southern parts of the Territory, the fossiliferous zone is a calcareous bed near the base of the local Jurassic sections. In Weber Canyon it has yielded *Cucullæa haguei*, *Pleuromya subcompressa*, *Pentacrinus asteriscus*, and a few other forms; in Thistle Canyon the peculiar *Lyosoma powelli* was obtained, and in a collection made by Mr. Robert Forrester on San Rafael River I have recognized *Trigonia americana* and *Pholadomya kingi*, all of which occur in the Park. For these reasons I regard all of the fossiliferous Jurassic beds now known in Utah as belonging to the same horizon that is so well represented in the Yellowstone National Park.

The question still remains whether the Jurassic of the Black Hills belongs to a higher horizon. There are some facts in favor of the opinion that the Jurassic fossils of the two regions may not be contemporaneous. For example, a number of the most abundant species in the Yellowstone National Park region, such as *Pleuromya subcompressa*, *Pholadomya kingi*, and *Cypricardia haguei*, have not been reported from the Black Hills. The Yellowstone species of Trigonia, Modiola, and Gervillia are also distinct. *Pseudomonotis* (*Eumicrotis*) *curta*, which is one of the most abundant species in the Black Hills, is represented in the Park collection by a single doubtful specimen. No example of *Cardioceras cordiforme* has been found in the Yellowstone National Park, and several other common Black Hills forms are either absent or rare there.

On the other hand, there is a considerable list of species common to the two regions, among which may be mentioned:

Pentacrinus asteriscus.
Rhynchonella myrina.
Rhynchonella gnathophora.
Ostrea strigilecula.
Gryphæa calceola var. nebrascensis.[1]
Camptonectes bellistriatus.
Camptonectes platessiformis.
Avicula wyomingensis.
Belemnites densus.

[1] The Black Hills specimens of this species are all small.

Many of the species that are considered distinct are closely related. It should be remembered, also, that we know only fragments of the fauna that must have existed at that time if it approached in size those that are now living. Whitfield records only 43 species from all the Black Hills country, and we now have about the same number from the Yellowstone region. If more exhaustive collections were made in both districts, it is probable that the list of common species would be considerably increased, but even as the record stands it shows rather close relationship of faunas. Possibly the lowest Jurassic beds in the Yellowstone region may be slightly older than the lowest in the Black Hills, but the difference in age can not be great—not great enough, as it seems to me, to put them in different divisions of the Jura. Throughout all the Rocky Mountain region, wherever marine Jurassic strata are found they are only a few hundred feet in thickness and they rest directly on the Triassic "Red Beds" or on older formations. It does not seem possible that Upper Jurassic marine beds could have been deposited in the Black Hills and Wyoming without leaving any traces in the Yellowstone, Montana, and Utah—that is, the stratigraphic relations and the geographic distribution of the marine Jurassic of the Rocky Mountain region are in favor of the idea that all of these deposits were made contemporaneously in a single sea.

CRETACEOUS.

Dakota (?) formation.—The collection shows that several horizons of the Cretaceous are represented in the Park. The lowest of these, according to the geologists, is a thin bed of limestone, not far above the local base of the Cretaceous section, that is filled with fresh-water gastropods and a few Unios. This fauna at once suggests a comparison with the fresh-water forms (*Lioplacodes veternus* and *Viviparus gilli*) from beds of supposed Jurassic age overlying the marine Jura in Wind River Valley, Wyoming, but these forms are not represented in the Park collections.

The few species obtained do not show their generic characters very distinctly; still it is evident that they are not closely related to the fresh-water Bear River fauna of southwestern Wyoming nor to the few fresh-water forms known from the Dakota of Nebraska, both of which seem to hold about the same stratigraphic position as this bed. There is one other possibility, and that is that the Lower Cretaceous Kootanie formation is

represented here. It has been recognized by means of its fossil plants at Great Falls, Montana, and in the Black Hills, but its fresh-water mollusks are almost entirely unknown, and the few that have been seen are entirely different from these. All that can now be said concerning the age of these fossils is that they come from a bed that is conveniently referred to the Dakota on account of its stratigraphic position. I have named three of the most common forms of gastropods from this bed, so that they may be definitely referred to, although they are rather obscure and unsatisfactory species.

Colorado formation.—The marine Cretaceous beds on Snake River one-fourth to one-half mile above the mouth of Sickle Creek may be directly correlated with the upper part of the Colorado formation as it is developed on the Missouri River near Fort Benton. The locality near Sickle Creek has yielded:

Inoceramus undabundus M. and H.	**Inoceramus flaccidus White.**
Inoceramus umbonatus M. and H.	**Baculites asper Mort. (?)**
Inoceramus acuteplicatus n. sp.	**Scaphites ventricosus M. and H.**

All of these, except the third and fourth, occur together in the upper part of the so-called Fort Benton shales on the Missouri, and associated with them are *Inoceramus exogyroides* M. and H., *I. deformis* Meek, *I. tenuirostris* M. and H., *Veniella mortoni* M. and H., and *Pholadomya papyracea* M. and H., and a few undescribed species.

This well-characterized zone was included in the Fort Benton shales by Meek and Hayden when they gave that name to the "No. 2" of their Cretaceous section, and they regarded all these dark shales near Fort Benton as the equivalent of the shales underlying the Niobrara limestone in Nebraska, Kansas, Colorado, and elsewhere. The fact is, however, that the Niobrara also is represented by shales in this upper Missouri region, and the fossils indicate that this zone is really the equivalent of the upper portion of the Niobrara. The evidence for this statement rests on the occurrence of several of the above species in the Niobrara limestone and overlying shales of Colorado and in the equivalent Austin limestone of Texas, and also on the absence of all these species except *Veniella mortoni* from beds lower than the Niobrara in the same region and elsewhere. In Colorado *Inoceramus deformis* is the most characteristic species of the Niobrara limestone. Recently Mr. G. K. Gilbert has collected *Inoceramus umbonatus* from shales in the Niobrara above the limestone near Pueblo,

Colorado, and it is probable that the type of *I. flaccidus* came from about the same horizon. *I. umbonatus* and *I. exogyroides* are reported from the Austin limestone of Texas, and *Baculites asper* (?) occurs in the same formation. The European *I. involutus*, which is very closely related to, if not identical with, *I. umbonatus*, is also confined to the Emscher Mergel, according to Schlüter, which appears to be the homotaxial equivalent of the Niobrara.

The fact that within the Colorado formation experience has shown the various species of Inoceramus to be good guide fossils for the different zones gives this evidence of a few species greater weight than it would have otherwise.

The name Colorado formation has come into general use for the combined equivalents of the Fort Benton and Niobrara, and it is a very convenient term, especially in the regions where the lithological differences are not clearly marked.

A fragment referable to *Scaphites ventricosus*, obtained on the southeast spur of Electric Peak, makes it probable that the shales there also belong to the upper part of the Colorado formation. The same horizon is represented at Cinnabar Mountain, just north of the Park, though no Cretaceous fossils from that place are included in these collections. Professor Meek examined fossils obtained there in 1872 and listed[1] *Scaphites ventricosus*, *Baculites asper* (?), and undetermined species of Thracia, Trigonia, Inoceramus, and Ostrea.

There are two other localities in the northern part of the Park, on Fan Creek and the north branch of Gardiner River, that have yielded an abundance of *Ostrea anomioides*, a species that occurs in the Colorado formation at several localities in Montana.

Montana formation.—The Fort Pierre and Fox Hills divisions of the Meek and Hayden section are frequently combined under the name Montana formation for reasons similar to those that caused the union of the Fort Benton and Niobrara. In the western part of the Rocky Mountain Cretaceous area it is often difficult to draw a sharp line between even these two broader divisions. The lower part of the section is distinctively Colorado and the upper part distinctively Montana, but there is frequently a doubtful zone in which the faunas are more or less blended. This is especially true in northern Utah, at Coalville, and in western Wyoming, where both the

[1] Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 475.

Colorado and Montana formations contain several heavy beds of sandstone with closely related littoral faunas.[1] It is evident that the seashore remained in that region throughout nearly all of Upper Cretaceous time, giving the shallow waters and sandy bottom favorable to the continuance of the littoral fauna that was early established there. The Colorado formation is easily recognized in these sections by the occurrence of a number of widely distributed characteristic species, but for some unexplained reason very few of the species that characterize the Montana formation farther east and north occur there.

This phase of the Cretaceous is well developed on Hams Fork, in western Wyoming, and it extends northward from there nearly to the southern boundary of the Park, for it is well represented in the collection from a sandstone on Glade Creek and at other localities near Snake River in the same region. Fossils are abundant, but only about 20 species were obtained. Judging from the fauna, the horizon is not very far from that of the Colorado shales near Sickle Creek—probably a little above them—and it is provisionally referred to the lower part of the Montana formation. Several of the species occur at Coalville, Utah, and in southwestern Wyoming, and some of them there range down into the Colorado formation.

More thorough collecting from all the Cretaceous beds exposed in the Yellowstone National Park, and a little farther north and east, will probably give both phases of the Upper Cretaceous faunas in one section and enable us to assign these sandstones to a more definite place in the standard Upper Cretaceous section.

In the following list of species references are usually given only to the first description and to publications in which the species is figured. For fuller references consult Boyle's Catalogue of American Mesozoic Invertebrates: Bull. U. S. Geol. Surv. No. 102.

[1] See, for a fuller discussion of this subject, The Colorado formation and its invertebrate fauna: Bull. U. S. Geol. Surv. No. 106, pp. 37–46.

ANNOTATED LIST OF SPECIES, WITH DESCRIPTION OF NEW FORMS.

TRIASSIC (?) SPECIES.

LINGULA sp. undet.

A few specimens of Lingula from beds on the summit of Quadrant Peak, supposed to be of Triassic age, closely resemble the Jurassic *Lingula brevirostris* M. and H. from the Black Hills.

JURASSIC SPECIES.

ECHINODERMATA.

PENTACRINUS ASTERISCUS Meek and Hayden.

Pentacrinus asteriscus Meek and Hayden, 1858: Proc. Acad. Nat. Sci. Phila., p. 49. White, 1875: Geogr. and Geol. Surv. W. 100th Meridian, Vol. IV, Pt. I, p. 162, Pl. XIII, figs. 6*a*, *b*. Clark, 1893: Bull. U. S. Geol. Surv. No. 97, p. 26, Pl. III, figs. 2*a–d*.

Pentacrinites asteriscus Meek and Hayden, 1865: Palæont. Upper Missouri, p. 67, Pl. III, figs. 2*a*, *b*, and fig. in text. Whitfield, 1880: Geol. Black Hills Dakota, p. 345, Pl. III, figs. 1, 2.

Pentacrinus whitei Clark, 1893: Bull. U. S. Geol. Surv. No. 97, Pl. III, figs. 4*a–c*.

This species, which is known only from portions of the columns, occurs in collections from divide between Fawn Creek and Gallatin Valley, from the slopes of Mount Sheridan, and from west of Snake River, north of Berry Creek.

The joints of the columns vary in diameter, in thickness, and in the depth of the reentrant angles, but they do not vary more in these respects than do the different portions of the stem in a single individual of a recent Pentacrinus. The joints of the upper part of the column are always thinner, more distinctly star-shaped, and differ in all other details from those of the lower portion.

The name *P. whitei* was proposed by Prof. W. B. Clark for large, thin joints with deep reentrant angles, but the author of the species informs me that he has abandoned the name for reasons similar to those just given, and in a forthcoming monograph of the Mesozoic Echinodermata of the United States he will refer all the known American Jurassic Pentacrini to *P. asteriscus*.

ECHINOIDEA.

Fragmentary casts of one or more species of echinoids were obtained near the lower canyon of the Yellowstone River and at a locality north of Berry Creek, a tributary of Snake River. They are doubtless new species, but they are not sufficiently well preserved for generic determination, and we must therefore wait for additional and better material.

BRACHIOPODA.

RHYNCHONELLA MYRINA Hall and Whitfield.

Rhynchonella myrina **Hall and Whitfield, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, p. 284, Pl. VII, figs. 1–5. Whitfield, 1880: Geol. Black Hills Dakota, p. 347, Pl. III, fig. 6, *not* fig. 7.**

The type of this species is a finely plicate shell with about eight plications in the median sinus. In Prof. R. P. Whitfield's later publication he has united with it the much more coarsely plicate forms, with only three or four plications in the median sinus, that have usually been referred to *R. gnathophora*. As the numerous specimens in the present collection do not show the intermediate varieties of form and sculpture, I prefer to treat them as distinct species.

Typical *R. myrina* occurs at a number of localities in the northwest corner of the Park and near Snake River southwest of it, in the hard arenaceous limestone.

RHYNCHONELLA GNATHOPHORA Meek.

Pl. LXXII, figs. 1–4.

Rhynchonella gnathophora **Meek, 1864: Geol. Surv. California, Palæont., Vol. I, p. 39, Pl. VIII, figs. 1*a–f*.**

Rhynchonella gnathophora **? Hall and Whitfield, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, p. 284, Pl. VII, fig. 6.**

Rhynchonella myrina **(H. and W.) Whitfield, 1880: Geol. Black Hills Dakota, p. 347, Pl. III, fig. 7, *not* fig. 6.**

Rhynchonella **sp. Meek and Hayden, 1865: Palæont. Upper Missouri, p. 71, Pl. III, fig. 4.**

The specimens referred to this species have nearly the same outlines as *R. myrina*, but they are somewhat more capacious and much more coarsely plicate. The type of *R. myrina* has thirty plications on each valve, with

eight in the median sinus, while the plications on these shells vary from fourteen to twenty, with three or four in the median sinus, three being much the more common number. A few specimens have only two.

I have not seen Meek's types from the Jurassic of California, but specimens from the Mormon sandstone near Taylorsville (probably Meek's original locality) have been kindly loaned by Professor Hyatt for comparison. These are larger than any of the Utah or Yellowstone specimens, and none of them has less than four plications in the median sinus, but in all other respects they agree quite closely. All the figured specimens from the Black Hills and Rocky Mountain region above referred to have been examined, and I have no doubt of their specific identity. In Yellowstone National Park, where the species is very abundant in the upper zone of the Jurassic and occasionally occurs in the underlying shales, the specimens are usually small, many of them being no larger than the one from the Black Hills figured by Meek and Hayden.

It is known from northwestern Colorado and from the Uinta Mountains, Utah, and it occurs in the Park near the northern and Lake heads of Fawn Creek; on south slope of ridge south of Gray Mountain; south side of Fan Creek Pass; on saddle at head of Fawn Creek, northeast of Monument Peak, in beds 100 feet above principal fossiliferous horizon of Jurassic; in saddle west of south head of Gardiner; 4 miles north of second crossing of Snake River, at 7,500 feet elevation; on hill northeast of Mount Everts; on ridge south base of northwest slope of Flat Mountain; at Mammoth Hot Springs, on main terrace.

PELECYPODA.

OSTREA STRIGILECULA White.

Ostrea strigilecula White, 1875: U. S. Geog. and Geol. Surv. W. 100th Meridian, Vol. IV, Pt. I, p. 163, Pl. XIII, figs. 3*a–d*. 1884: Fourth Ann. Rept. U. S. Geol. Surv., p. 289, Pl. XXXV, figs. 9–11. Whitfield, 1880: Geol. Black Hills Dakota, p. 348, Pl. III, figs. 8–12.

Specimens referable to this small and somewhat obscure species were collected from almost every locality with *Rhynchonella gnathophora* and on northeast spur of peak west of mouth of Coulter Creek; west end of ridge southeast of Mink Creek; Mount Sheridan; lower limestone on Fawn Creek plateau; east end of northeast spur from Signal Peak; saddle in ridge west of south head of Gardiner.

OSTREA ENGELMANNI Meek.

Ostrea engelmanni Meek, 1860: Proc. Acad. Nat. Sci. Phila., p. 311. 1876: Simpson's Rept. Expl. Great Basin, Utah, p. 355, Pl. III, fig. 6. Meek and Hayden, 1865: Palæont. Upper Missouri, p. 73, figs. A, B. White, 1884: Fourth Ann. Rept. U. S. Geol. Surv., p. 289, Pl. XXXIV, figs. 3, 4.

A few fragments and immature specimens of this species were obtained near the head of drainage of northeast valley of Fan Creek and top of hill 3 miles southeast of Gravel Peak.

GRYPHÆA PLANOCONVEXA Whitfield.

Pl. LXXII, figs. 9 and 10.

Gryphæa planoconvexa, Whitfield 1876: Ludlow's Rept. Reconnaissance from Carroll, Montana, to Yellowstone Park, p. 142, Pl. II, figs. 9 and 10.

Shell of medium size, subcircular in outline; attached valve moderately convex with rather prominent beak, and in most specimens with an obscure shallow furrow which separates a rather broad triangular lobe from the body of the shell; upper valve varying from nearly flat to deeply concave; surface marked only by lines of growth and irregular concentric undulations. The cartilage pit is very broad and shallow.

An average specimen measures 57 mm. in length, 50 mm. in height, and 27 mm. in thickness of the two valves united.

This form was mentioned by Meek[1] as "Gryphæa, a small species of the form of *G. dilatata*." It also resembles some varieties of the Upper Cretaceous *G. vesicularis* and *Ostrea patina*. Whitfield's type, from the Bridger Mountains, Montana, is somewhat more convex than any of our specimens, and the figure does not show any furrow or lobe, but I have no doubt that it is the same variable species.

The specimens figured are from near lower canyon of Yellowstone River, collected by Dr. A. C. Peale, and ridge southwest of second crossing of Snake River, collected by Mr. W. H. Weed. It was also obtained on north slope of ridge north of Gray Mountain; on divide at head of Fawn Creek; ridge west of south branch of headwaters of Gardiner, and near Snake River 3 miles west of mouth of Coulter Creek.

[1] Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472.

GRYPHÆA CALCEOLA var. NEBRASCENSIS Meek and Hayden.

Pl. LXXII, figs. 5–7.

Gryphæa calceola var. *nebrascensis* Meek and Hayden, 1861: Proc. Acad. Nat. Sci. Phila., p. 437. 1865: Palæont, Upper Missouri, p. 74, Pl. III, figs. 1*a–e* and figs. A–E on p. 75. Whitfield, 1880: Geol. Black Hills Dakota, p. 349, Pl. III, figs. 13–16. White, 1884: Fourth Ann. Rept. U. S. Geol. Surv., p. 290, Pl. XXXV, figs. 1–5.

This is one of the most abundant species in the lower fossiliferous zone of the Yellowstone National Park Jurassic, occurring in the collection from south slope of ridge south of Gray Mountain; south end of northeast spur of Signal Peak; east side of Fan Creek Pass; head of north fork of Fawn Creek; saddle in ridge west of south branch headwaters of Gardiner; summit of wagon road between Sentinel Butte and Terrace Mountain, 1 mile from head of Swan Lake Valley; hills west of Snake River, 4 miles south of second crossing; on north side of old road to Mammoth Hot Springs, and slopes of Mount Sheridan.

The species was originally described from the Wind River Mountains and from the Black Hills, though the specimens from the latter locality are all very small. Similar small specimens, however, are very abundant in the Park collections.

LIMA CINNABARENSIS n. sp.

Pl. LXXII, fig. 8.

Shell small, obliquely elongate oval in outline; beaks large and prominent; hinge line short, the triangular ears being small and inconspicuous; anterior side straight or slightly concave; posterior side broadly convex and prominent; surface marked by lines of growth and by about twenty prominent rounded radiating ribs, which are not quite equal in breadth to the spaces between them.

The species is represented by only two right valves, the larger of which is figured. It measures 16 mm. in its greatest dimension, obliquely downward and forward from the beak, and 10 mm. across the middle of the shell at right angles to that line; convexity about 4 mm.

No American Jurassic species has been described with which this should be compared, except, perhaps, the form from Sigutlat Lake, British Columbia, referred by Whiteaves to *Lima duplicata* Sowerby, from which

Lima cinnabarensis is distinguished by its simple equal ribs. It has more resemblance to the Cretaceous *Lima utahensis* of the Colorado formation.

Locality: Cinnabar Mountain, Montana, where it is associated with *Pleuromya subcompressa*, *Pholadomya kingi*, *Trigonia montanaensis*, etc.

Genus CAMPTONECTES (Agassiz) Meek.

Shells belonging to this genus are very abundant in the Jurassic of the Rocky Mountain region. In Yellowstone National Park almost every Jurassic locality has yielded specimens, but in many cases they are fragmentary or mere casts that can not be assigned to species with any confidence. Five American Jurassic species have been described, of which three at least are sufficiently well characterized to be easily distinguished when good specimens are examined. These are *Camptonectes bellistriatus* (to which a new variety is added below), *C. platessiformis*, and *C. stygius*.

The types of *C. extenuatus* are casts in sandstone that show neither sculpture nor the forms of the ears. It may be a distinct species, but it is more probable that it is either the young of *C. bellistriatus* or the form afterwards named *C. pertenuistriatus* by Hall and Whitfield. I do not feel quite certain that the latter is distinct from *C. bellistriatus*, young specimens of which when slightly exfoliated would be very similar; but in the present collection there are many specimens that can be most conveniently referred to *C. pertenuistriatus*, and the name is therefore retained. All of the species mentioned excepting *C. stygius* are represented in these collections.

CAMPTONECTES BELLISTRIATUS Meek.

Pl. LXXII, fig. 12.

Pecten bellistriata Meek, 1860: Proc. Acad. Nat. Sci. Phila., p. 311.

Camptonectes bellistriatus Meek and Hayden, 1865: Palæont. Upper Missouri, p. 77, figs. A–D. Meek, 1876: Simpson's Rept. Expl. Great Basin, Utah, p. 356, Pl. III, figs. 3*a–d*. Hall and Whitfield, 1877: Rept. U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, p. 289, Pl. VII, fig. 13. Whitfield, 1880: Geol. Black Hills Dakota, p. 351, Pl. IV, figs. 6–11.

? *Camptonectes extenuatus* (M. and H.) Hall and Whitfield, 1877: Rept. U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, p. 290, Pl. VII, fig. 18.

Imperfect specimens that appear from general form and details of sculpture to agree with this well-known species were collected at head of Fawn Creek, upper bed; divide between Fawn Creek and Gallatin Valley;

south slope of ridge south of Gray Mountain; saddle in ridge west of south branch of headwaters of Gardiner; north side of Norris road pass; hill southwest of second crossing of Snake River; west end of ridge southeast of mouth of Mink Creek, and 1 mile from head of Swan Lake Valley, on north side of road to Mammoth Hot Springs.

As supplemental to the published descriptions, it may be stated that the left valve is considerably more convex than the right and that both valves have the same sculpture. The smooth right valve figured by Whitfield[1] is either exfoliated or, possibly, another species. The anterior ear in that figure is different in form from that of *C. bellistriatus*, as may be seen on comparison with our figure of a specimen identified by Meek from the Bighorn Mountains.

The small specimen figured by Hall and Whitfield as *C. extenuatus* is an immature left valve of this species or of *C. pertenuistriatus*.

CAMPTONECTES BELLISTRIATUS var. DISTANS n. var.

Pl. LXXII, fig. 13.

This variety, as far as known, is smaller than the typical form of the species, from which it differs in having the radiating, impressed, punctate lines less closely arranged and consequently fewer in number, and it also differs in the outlines of the ears. The anterior ear is comparatively broader, with a narrower and deeper byssal notch, and the posterior ear is somewhat smaller and slightly less oblique. Left valve of this variety unknown.

The specimen figured, which is from near the source of Gardiner River, has the following dimensions: Height, 38 mm.; greatest length, 38 mm.; length of hinge line, 19 mm.

The variety has also been collected east of Small Lake, head of Fawn Creek, and in north wall of Fawn Creek.

CAMPTONECTES PERTENUISTRIATUS Hall and Whitfield.

Pl. LXXII, fig. 11.

Camptonectes pertenuistriatus Hall and Whitfield, 1877: Rept. U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. II, p. 291, Pl. VII, fig. 17.

Cf. *Camptonectes extenuatus* Meek and Hayden, 1865: Palæont. Upper Missouri, p. 78, Pl. III, fig. 6.

The original type in the National Museum is a young individual,

[1] Geol. Black Hills, Pl. IV, fig. 10.

slightly flattened by pressure and somewhat exfoliated. The radiating striæ are barely visible under a lens, and they are considerably exaggerated in the original enlarged figure. It differs from typical examples of *C. bellistriatus* in its more slender form and smoother surface, the radiating striæ being almost obsolete, though it is sometimes difficult to determine whether this is a natural feature or due to exfoliation. The doubt as to its identity with *C. extenuatus* has already been mentioned.

In the Park it is most common in the upper fossiliferous band of the Jura, occurring on Gardiner River southeast of Electric Peak; south slope of ridge south of Gray Mountain; saddle west of south head of Gardiner; west of Snake River, 4 miles south of second crossing; top of hill 3 miles southeast of Gravel Peak, northwest of Flat Mountain; ridge south of Mammoth Hot Springs, on main terrace; east slope of Mount Sheridan, and ridge south of Mount Sheridan.

CAMPTONECTES PLATESSIFORMIS White.

Camptonectes platessiformis White, 1876: Geol. Uinta Mountains, p. 93. 1880: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, p. 143, Pl. XXXVII, fig. 5*a*.

Camptonectes extenuatus (M. and H.) Whitfield, 1880: Geol. Black Hills Dakota, p. 353, Pl. IV, fig. 4.

Not *Camptonectes? extenuatus* Meek and Hayden, 1865: Palæont. Upper Missouri, p. 78, Pl. III, fig. 6.

This species is more slender than *C. bellistriatus*, the height from beak to base being considerably greater than the length, and it is apparently somewhat more convex. The sculpture is coarser than in the typical form of that species, but the radiating lines are somewhat more closely arranged than in the variety *distans*. The most important difference, however, is in the ears, which in the left valve are very large and have the form of right-angled triangles, so that the hinge line is almost as long as the greatest length of the shell. No good specimens of the right valve have been seen, but an internal cast from the lower canyon of the Yellowstone shows that it has a deep byssal sinus, and that the posterior ear is nearly rectangular, instead of having the very oblique form seen in *C. bellistriatus*. From *C. pertenuistriatus* this species may be easily distinguished by its much coarser sculpture and by differences in outline.

The specimen figured by Whitfield in the Geology of the Black Hills as *C. extenuatus* is clearly identical with *C. platessiformis*, as may be seen

by comparing the two specimens. After studying the types of *C. extenuatus* I can see no reason for referring to it this coarsely sculptured form, which also differs in outline. As has already been stated, the types of *C. extenuatus* are unrecognizable casts in sandstone, showing neither the sculpture nor the form of the ears. It is probably either *C. bellistriatus* or *C. pertenuistriatus*, and in consideration of this doubt I prefer to use the later name, *C. pertenuistriatus*, because it is better characterized.

The figured specimens of *C. platessiformis* above referred to came from the south base of Aquarius Plateau, southern Utah, and east of Belle Fourche River, near Bear Lodge, Black Hills. Those in the present collection were obtained near the head of southeastern valley of Fan Creek; north side of Fan Creek Pass; top of hill 3 miles southeast of Gravel Peak, and near the lower canyon of the Yellowstone.

Avicula (Oxytoma) wyomingensis n. sp.

Pteria (*Oxytoma*) *munsteri* (Bronn) Meek and Hayden, 1865: Palæont. Upper Missouri, p. 80, figs. *a–b*.

Pteria or *Avicula mucronata* Meek and Hayden, 1865: Ibid., p. 81, suggested name for the species in case it proves distinct.

Avicula (*Oxytoma*) *mucronata* (M. and H.) Whitfield, 1880: Geol. Black Hills Dakota, p. 357, Pl. IV, figs. 1, 2.

Not *Oxytoma mucronata* (Meek) Whiteaves, 1884: Geol. Surv. Canada, Mes. Foss., Vol. I, pp. 238 and 251, Pl. XXXI, fig. 9, Pl. XXXIII, fig. 6.

Not *Avicula mucronata* Gabb, 1864: Palæont. California, Vol. I, p. 30, Pl. V, fig. 27.

A new name is proposed for this fairly well known species for the following reasons. In Meek and Hayden's original work it was provisionally referred to *A. munsteri*, with the statement that it would probably prove to be distinct, and if so it should be named *Pteria mucronata*. A comparison with figures of *A. munsteri* shows that they are not identical in either form or sculpture, and later authors have recognized the American fossil as a distinct species under Meek and Hayden's suggested name. This name can not be used for it, however, because it was previously applied by Gabb to an entirely different species from the Triassic of California.

The fossil from the Lower Cretaceous of Queen Charlotte Islands referred to this species by Whiteaves seems to me to be specifically distinct.

The collections from the Yellowstone National Park contain only two small immature specimens from the foothills at the base of north slope of

Flat Mountain. It was originally described from Wind River Valley, Wyoming, and it also occurs in the Black Hills. The type is Meek's figured specimen, No. 1893, United States National Museum collection.

PSEUDOMONOTIS CURTA (Hall)?

Avicula (?) custa Hall, 1852: Stansbury's Rept. Gt. Salt Lake Exp., p. 412, Pl. IV, figs. 1*a*, *b*.

Eumicrotis curta (Hall) Meek and Hayden, 1865: Palæont. Upper Missouri, p. 81, Pl. III, figs. 10*a–d*.

Pseudomonotis (*Eumicrotis*) *curta* (Hall) Whitfield, 1880: Geol. Black Hills Dakota, p. 354, Pl. III, figs. 20–25.

A single imperfect specimen from summit of ridge between Red and Basin creeks is doubtfully referred to this species. The hinge and umbonal region are wanting, and the identification is based simply on general form and surface sculpture of the fragment. The species is abundant in the Jurassic of the Black Hills. The original spelling of the specific name *custa* seems to have been a typographical error that was corrected by Meek, and the form *curta* has since been followed.

GERVILLIA MONTANAENSIS Meek.

Gervillia montanaensis Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472. White, 1880: Idem for 1878, p. 145, Pl. XXXVII, figs. 1*a* and *b*.

Distinguished by its large size and its long posterior wing. The types are from near the lower canyon of the Yellowstone, and it has been collected on divide between Fawn Creek and Gallatin Valley; east side of Fan Creek Pass; Cinnabar Mountain, and summit of ridge between Red and Basin creeks, near Sheridan Peak.

GERVILLIA sp.

A smaller and much more slender species of Gervillia is represented by fragments from east end of northeast spur from Signal Peak, stream bed west of Quadrant, jr., and saddle in ridge west of south head of Gardiner River.

MODIOLA SUBIMBRICATA Meek.

Modiola (*Vulsella*) *subimbricata* Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472.

Volsella subimbricata White, 1880: Idem for 1878, p. 145, Pl. XXXVII, figs. 2*a–c*.

This species seems to be widespread, but not very abundant at any

place. A few specimens were obtained on divide between Fawn Creek and Gallatin Valley; saddle in ridge west of south head of Gardiner; hills west of Snake River 4 miles south of second crossing; top of hill 3 miles southeast of Gravel Peak; ridge between Basin and Red creeks, and slopes of Mount Sheridan.

PINNA KINGI Meek.

Pinna kingi Meek, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 131, Pl. XII, figs. 9, 9*a*.

A few fragments of this species were obtained in ridge west of south head of Gardiner, and on north side of old road between Terrace Mountain and Sentinel Butte. The species was described from Weber Canyon, Utah.

CUCULLÆA HAGUEI Meek.

Pl. LXXIII, fig. 1.

Cucullæa haguei Meek, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 134, Pl. XII, figs. 1*a*, *b*.

The type of the species came from Weber Canyon, Wasatch Range, Utah. In Meek's figure the radiating striæ of the body of the shell are somewhat exaggerated and the concentric lines are not given quite as much prominence as they usually have. On most of the Yellowstone National Park specimens the radiating lines are prominent and widely separated on the anterior third, and are numerous on the umbones, but all excepting the anterior ones usually fade out before reaching the middle of the shell. The fine, regular, closely arranged concentric lines cover the whole valve.

Some of the casts show the horizontal teeth at both ends of the hinge line characteristic of Cucullæa, but there are no traces of the ridge bordering the posterior muscular impression that is seen in typical species of that genus.

The specimen figured is from a locality near Sentinel Butte. The species is also represented in the collection from north side of Fan Creek Pass; saddle in ridge west of south head of Gardiner River; summit of wagon road between Sentinel Butte and Terrace Mountain; Cinnabar Mountain, and west side of Snake River north of Berry Creek.

TRIGONIA AMERICANA Meek.

Trigonia americana Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472. White, 1880: Idem for 1878, p. 148, Pl. XXXVIII, fig. 1*a*, *b*.

A single specimen from ridge northwest of second crossing of Snake

River. The type came from Spring Canyon and lower canyon of the Yellowstone, Montana.

TRIGONIA ELEGANTISSIMA Meek.

Pl. LXXIII, fig. 2.

Trigonia elegantissima Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 474.

Shell small, subtrigonal in outline, moderately convex, with prominent, acute, recurved beaks; posterior umbonal ridge prominent, angular, and curved; anterior end broadly rounded; posterior end subangular below at the extremity of the umbonal ridge and forming a convex slope to the beak above; escutcheon not distinctly marked; posterior area depressed and bearing numerous equal, fine, radiating lines; remainder of surface with regular, closely arranged, small concentric ribs that show a tendency to bend downward toward the front.

Length of figured specimen, 21 mm.; height, 14 mm.; convexity of single valve, 4 mm.

This species is closely related to *T. americana*, from which it differs in outline, and more especially in having much smaller and more numerous concentric ribs. In specimens of *T. americana* no larger than the type of this species the spaces between the ribs are at least a millimeter wide.

Meek's original description, given in a footnote to the list of fossils from Devils Slide, Cinnabar Mountain, Montana, is as follows: "A small species of the type of *T. costata*, but having the concentric or horizontal costæ on the sides of the valves very delicate, closely arranged, and but slightly larger than the radiating ones on the posterior dorsal region, or corselet. The valves are rather compressed, about one-fourth longer than wide, and have the posterior umbonal slopes acutely angular." A single valve corresponding to this description, but not labeled, is in the original collection from Cinnabar Mountain studied by Meek, and this is probably his type. The specimen figured was collected at the same place by Mr. W. H. Weed.

TRIGONIA MONTANAENSIS Meek.

Trigonia montanaensis Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472.
White, 1880: Idem for 1878, p. 247, Pl. XXXVIII, fig. 2*a*.

The types are from the locality near the lower canyon of the Yellowstone. A few specimens were obtained 1 mile from Swan Lake Valley,

north of old road to Mammoth Hot Springs; Cinnabar Mountain; saddle in ridge west of south branch of Gardiner River; south slope of ridge south of Gray Mountain, and east end of northeast spur from Signal Peak.

ASTARTE MEEKI n. sp.

Pl. LXXIII, figs. 3–5.

Shell of medium size, subcircular in outline, moderately convex; beaks prominent, median in position; dorsal margin descending rapidly from the beaks, with a convex curve behind and slightly excavated in front; anterior, posterior, and ventral margins forming a regular curve; surface marked by numerous fine, regular, concentric costæ. Margin crenulate within.

One of the types, an average-sized specimen, has the following dimensions: Length, 16 mm.; height, 14 mm.; convexity of single valve, about 3 mm. The largest specimen in the collection is 23 mm. in length and 20 mm. in height. Associated with these there are several more elongated shells, one of which is figured, that I was at first inclined to regard as a distinct species, but it is probable that the difference in form is due to distortion by pressure.

Compared with *Astarte packardi* White this species is proportionally somewhat more elongate, less convex, and the concentric sculpture is much finer and more regular. The species was first noticed by Meek, who mentioned it as "Astarte (?)" in a list of Jurassic fossils collected by Dr. Peale near the lower canyon of the Yellowstone.[1] It occurs in the collections from head of Gardiner, Sentinel Butte, Cinnabar Mountain, west side of Snake River north of Berry Creek.

ASTARTE sp.

Another species of Astarte is represented by fragmentary specimens which show the specific features fairly well, but as they are not sufficient for a good illustration the species has not been named. It is a very elongate form, with strong, regular, concentric ridges. In its younger stages, as shown by the lines of growth, it is a short subtriangular form, but later it rapidly increases in length and the posterior end becomes obliquely truncate. It occurs on the divide at head of Fawn Creek, Sentinel Butte, Cinnabar Mountain, and near lower canyon of Yellowstone River.

[1] Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472.

TANCREDIA? KNOWLTONI n. sp.

Pl. LXXIII, fig. 6.

Shell small, obliquely subovate in outline; beaks prominent, submedian; dorsal margin behind the beaks descending rapidly to the broadly rounded posterior end, which is most prominent below; anterior end rounded, most prominent above, somewhat more narrow than the posterior end; ventral margin gently convex; posterior umbonal ridge with a tendency to become angular; surface marked by fine lines of growth.

Length, 15 mm.; height, 12 mm.; convexity of single valve, about 2 mm.

The hinge is unknown and the generic reference is based merely on external form. The species seems to be congeneric with the species from the Black Hills referred to Tancredia by Whitfield, though the difference in outline prevents its reference to any of his species.

From shales on north side of road near Sentinel Butte, collected by Prof. F. H. Knowlton.

PROTOCARDIA SHUMARDI Meek and Hayden.

Cardium shumardi Meek and Hayden, 1860: Proc. Acad. Nat. Sci. Phila., p. 182.
Protocardia shumardi Meek and Hayden, 1865: Palæont. Upper Missouri, p. 98, figs. A and B in text.

The collection contains several specimens of a small Protocardia that seem to belong to this Black Hills Jurassic species. They have the outlines of that species, though some of the shells are nearly twice as large as the figure of the type. The body of the valve is marked only by fine lines of growth, and the posterior area bears about eight to twelve radiating ribs that are broader than the interspaces.

Collected on the divide between Fawn Creek and Gallatin Valley; head of north fork of Fawn Creek; Sentinel Butte, and Cinnabar Mountain.

CYPRINA? CINNABARENSIS n. sp.

Pl. LXXIII, figs. 7 and 8.

Shell of medium size, moderately convex, subcircular in outline, with prominent submedian beaks; dorsal margin excavated in front of the beaks, gently sloping behind, and in both cases passing gradually into the rounded ends; posterior end in some individuals slightly straightened, so as to become

almost vertically subtruncate; ventral margin broadly rounded; surface sculpture unknown. There is a very obscure posterior umbonal ridge, and the muscular and pallial impressions are not clearly shown on the cast.

One cast showing impression of part of hinge has three strong cardinal teeth, of which the posterior one is very long and oblique. The specimen is not in condition to show whether lateral teeth are present.

Height of an average shell, 28 mm.; length, 32 mm.; convexity of two valves united, 15 mm. The largest specimens in the collection have the corresponding dimensions about one-fifth greater.

The only described American Jurassic species with which this need be compared is *Dosinia jurassica* Whitfield, which is a smaller, more convex species, with less prominent beaks and slight differences in outline. It is not probable that the two species are closely related.

Collected from Cinnabar Mountain; divide between Fawn Creek and Gallatin Valley; east end of northeast spur from Signal Peak; saddle in ridge west of south head of Gardiner River; head of Fawn Creek northeast of Monument Peak, and ridge between Basin and Red creeks, near Sheridan Peak.

CYPRINA? IDDINGSI n. sp.

Pl. LXXIII, fig. 9.

Shell small, convex, suboval in outline; beaks rather prominent, submedian; dorsal margin sloping gently from the beak to the posterior end, slightly excavated in front of the beak and descending rather more rapidly; anterior and posterior ends broadly and almost equally rounded; ventral margin gently convex; posterior umbonal slope with a subangular ridge extending from the beak to the postero-basal margin; surface with obscure lines of growth and a few irregular concentric undulations near the free margin.

Length of largest specimen, 24.5 mm.; height, 18.5 mm.; convexity of both valves, about 12 mm.

This species differs from *C. cinnabarensis* in its smaller size, proportionally greater convexity, more elongate form, narrower posterior end, less prominent beaks, and more distinct umbonal ridge. Its generic position is doubtful, as its hinge characters are entirely unknown.

From saddle at head of Fawn Creek northeast of Monument Peak,

and (the type) from west end of ridge southeast of mouth of Mink Creek, where it was collected by Professor Iddings.

CYPRICARDIA? HAGUEI n. sp.

Pl. LXXIII, figs. 11–13.

Shell large, inflated, subquadrate in outline; beaks very prominent, strongly curved inward and forward, approximate, and projecting far beyond the hinge line; posterior umbonal slope with a prominent angular ridge descending from the beak to the postero-basal angle and dividing the surface of the shell into two distinct areas, of which the posterior is obliquely flattened, while the rest of the shell is pretty evenly convex; dorsal margin, exclusive of beaks, gently descending behind and excavated in front; anterior end broadly rounded; posterior end obliquely truncate; ventral margin almost straight; surface sculpture not known, but probably consisting only of lines of growth.

The two figured specimens, both of which are probably somewhat distorted in different directions, give the following measurements:

Length.	Height.	Convexity of both valves.
mm.	*mm.*	*mm.*
52	49	40
65	52	40

The shorter specimen is more nearly of normal proportions than the other.

The species is represented by about twenty-five specimens, all of which are internal casts, and, as the details of the hinge have not been satisfactorily made out, the generic reference is only provisional. Impressions of a part of the hinge show the presence of two or three strong cardinal teeth and make it reasonably certain that the shell belongs to the Cyprinidæ. The casts also show the adductor muscular impressions and the pallial line. The anterior scar is rather large, semilunar, and (on the cast) much elevated, while the posterior one is somewhat smaller and scarcely at all elevated.

There are no American species with which this need be compared, but *Cypricardia bathonica* d'Orb., as figured by Morris and Lycett in Mollusca

of the Great Oolite, Pt. II, p. 75, Pl. VII, fig. 8, seems to be a closely related form.

It occurs at east end of northeast spur from Signal Peak; saddle in ridge west of south branch of head of Gardiner; head of Fawn Creek northeast of Monument Peak and Cinnabar Mountain. Specimens collected by Dr. Peale at Devils Slide, Cinnabar Mountain, were labeled and listed by Meek[1] as "Cucullæa."

PHOLADOMYA KINGI Meek.

Pl. LXXIV, figs. 1–3.

Pholadomya kingi Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 473.
White, 1880: Idem for 1878, p. 150, Pl. XXXVIII, figs. *a* and *b*.

This abundant species varies considerably in sculpture, and the fact that almost every specimen in the collection is distorted in various ways by pressure causes it to appear much more variable in both form and sculpture than it really is.

The type specimen figured by White, which is itself somewhat distorted, has eleven radiating costæ on the central region of the valve, though they are not quite so prominent as they are represented in the drawing above referred to. Most of the specimens from the Park have fewer (usually not more than eight or nine) costæ, and on flattened specimens these are sometimes barely visible.

Pholadomya nevadana Gabb, from the Lias of Volcano, Nevada, is evidently a related species, and Professor Hyatt[2] has treated *P. kingi* as a synonym of it. Compared with Gabb's figure and description, however, *P. kingi* is smaller and more slender and has the beaks farther from the anterior end. The costæ also are differently arranged. Professor Hyatt has compared for me specimens of the Yellowstone form with those from California referred to *P. nevadana*, and he is now inclined to regard them as distinct. It is at least safer to keep them separate until direct comparison can be made with Gabb's type, which seems to be lost, or with specimens from the original locality.

The species occur in the collection from divide between Fawn Creek and Gallatin Valley; east end of northeast spur from Signal Peak; saddle

[1] Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 474. [2] Bul. Geol. Soc. Am., Vol. V, p. 418.

in ridge west of south branch head of Gardiner; head of Fawn Creek northeast of Monument Peak, Cinnabar Mountain.

PHOLADOMYA INÆQUIPLICATA n. sp.

Pl. LXXIV, fig. 4.

Cf. *Pholadomya multilineata* Gabb, 1869: Am. Jour. Conchology, Vol. V, p. 10, Pl. V, fig. 6.

Shell small, ventricose, elongate suboval in outline, with prominent approximate beaks situated near the anterior end; anterior and ventral margins forming a nearly regular curve, which is most prominent a little behind the middle; posterior end rounded, slightly subtruncate above; surface marked by about twenty radiating costæ that vary both in size and in distance from each other and cover the whole valve, excepting a very small space in front and a larger one in the postero-dorsal region.

Length, 39 mm.; height, 31 mm.; convexity of both valves, 24 mm.

Pholadomya multilineata, which is associated with *P. nevadana*, seems to be about as closely related to this species as *P. nevadana* is to *P. kingi*. *P. multilineata* is larger than *P. inæquiplicata*, has more numerous costæ (about thirty, according to Gabb), and is more angular at the posterior end, besides differing somewhat in other details of outline.

Only a few specimens were collected on divide between Fawn Creek and Gallatin Valley, where it is associated with *P. kingi*.

HOMOMYA GALLATINENSIS n. sp.

Pl. LXXIV, figs. 6 and 7.

Shell of medium size, oblong subcylindrical; beaks rather prominent, incurved, approximate, and situated near the anterior end of the shell; dorsal margin in front of the beaks declining rapidly to the broadly rounded anterior end, which passes by a gentle curve into the nearly straight dorsal margin. Surface marked by lines of growth and irregular concentric undulations. The posterior end gapes slightly.

Length, 85 mm.; height, 42 mm.; convexity of both valves, 36 mm.

This species apparently belongs to the subgenus Homomya as defined in Zittel's Handbuch der Palæontologie, but Fischer does not recognize the group and divides the species that have been referred to it between Arcomya and Pleuromya. The specimens from Yellowstone National Park do not

show the structure of the hinge nor other details of the interior that are used as generic characters.

The type is from the divide between Fawn Creek and Gallatin Valley. The species is represented by nine other examples from Fan Creek Pass, head of Gardiner; saddle in ridge west of south branch of head of Gardiner; head of Fawn Creek northeast of Monument Peak, and Cinnabar Mountain.

PLEUROMYA SUBCOMPRESSA Meek.

Pl. LXXIV, figs. 8–11.

Myacites (Pleuromya) subcompressa Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 472. 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 136, Pl. XII, figs. 6, 6*a*.

Myacites subcompressus (Meek) White, 1880: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, p. 151, Pl. XXXVIII, figs. 5*a–e*.

This most abundant species, which was originally described from Weber Canyon, Utah, is represented by several hundred specimens, from every Jurassic locality in the Park region at which fossils were collected from the lower argillaceous limestone and shale. Almost every specimen is more or less distorted, and every variation in form is seen that a thin-shelled elongate species can be made to assume when embedded in soft strata and subjected to pressure. In addition to these accidental distortions, it is evident that the species is naturally quite variable in both form and sculpture, some individuals being nearly smooth while others are marked by rather strong concentric plications. Extreme variations approach the plicate *Pleuromya weberensis* Meek on the one hand and the nearly smooth elongate *Pleuromya newtoni* Whitfield on the other. The extent and directions of variation are fairly well shown by White's figures above cited, though some of these forms are slightly modified by pressure.

Single specimens representing three or four extreme varieties could be selected that if taken alone might be regarded as distinct species, but when the attempt is made to classify the entire large collection coming from practically one horizon and a limited area, it is found that none of the distinctions will hold good.

The specimens figured show some of the principal variations in form, and were selected from those apparently least modified by accidental distortion. They are from Fan Creek Pass, divide between Fawn Creek and

Gallatin Valley, hills west of Snake River 4 miles south of second crossing, and Cinnabar Mountain.

The general custom of recent authors is followed in using the name Pleuromya instead of Myacites.

THRACIA WEEDI n. sp.

Pl. LXXV, figs. 1–3.

Shell of medium size, thin, compressed, elongate, subelliptical in outline; beaks rather prominent, submedian; dorsal margin sloping rather rapidly and almost equally before and behind the beaks; anterior end broadly rounded, most prominent below; posterior end subtruncate; ventral margin slightly convex, somewhat sinuous toward the posterior end; posterior umbonal ridge narrow and sharply defined; surface marked by irregular concentric undulations and by numerous fine lines of growth.

The specimens selected for illustration, which are of average size, have the following dimensions, respectively:

Length.	Height.	Convexity of both valves.
mm.	*mm.*	*mm.*
29	19	4
26	18	5
34	20	5

All the examples in the collection have suffered more or less accidental compression and distortion in the rocks, so that they show considerable variation in outline, and probably on account of this compression they do not show the posterior gape that they should have if they really belong to the genus Thracia.

The species differs too much in outline and proportions from the two forms of Thracia (?) described from the Jurassic of the Black Hills to require detailed comparison.

The types are from stream bed west of Little Quadrant Mountain and from saddle in ridge west of south head of Gardiner River. Other specimens were collected at head of Fawn Creek, northeast of Monument Peak.

THRACIA? MONTANAENSIS (Meek)?

Pl. LXXIII, fig. 10.

Corimya montanaensis Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 474.

Shell small, subquadrate in outline, convex, with prominent beak situated a little in advance of the middle; dorsal margin nearly straight, declining slightly on each side of the beak; anterior end broadly rounded, forming almost a right angle with the dorsal margin above, and uniting with the convex ventral margin below by a regular curve; posterior end obliquely truncate; posterior umbonal ridge subangular and accompanied by a narrow depressed area or groove; surface marked by lines of growth.

Length, 17 mm.; height, 14 mm.; convexity of single valve, 4 mm.

The above description is drawn from a single valve from "Devils Slide, Cinnabar Mountain, Yellowstone River," which may be the original type named by Meek in the report above referred to, though it was not labeled by him. It was named in a list of fossils from this locality, with a footnote saying that "This is very similar to some varieties of *C. glabra* Agassiz, but it is a smaller, proportionately shorter, and more convex shell, with the anterior margins just in front of the beak more excavated."

ANATINA (CERCOMYA) PUNCTATA n. sp.

Pl. LXXIV, fig 5.

Shell of medium size, not so slender as the typical forms of the subgenus; beak prominent, somewhat in advance of the middle of the shell, directed backward; dorsal margin almost straight and descending slightly in front of the beaks, concave behind; anterior end broadly rounded, subangular above; posterior end much more narrow and rounded, ventral margin slightly sinuous; surface of the shell divided into two distinct areas by a narrow well-defined groove that descends almost vertically from the beak to the ventral margin; anterior area marked by broad concentric ridges and sulcations and by very fine lines of growth, the latter continuing over the posterior area; middle third of the posterior area slightly more convex and prominent than the rest and bearing about nine distinct granular radiating lines. In addition to this sculpture, which is seen on internal casts, a mold of the exterior of the shell shows that the entire surface bears radiating lines of minute tubercles, which are most prominent on the posterior

area, and give the punctate appearance that suggested the specific name, though it can hardly be considered a specific character, since it is common in this and related genera.

The species is represented by three imperfect valves from the divide between Fawn Creek and Gallatin Valley, south slope of ridge south of Gray Mountain, and west side of Snake River north of Berry Creek. The specimen figured, which is from the second locality mentioned, measures 39 mm. in length and 19 mm. in height.

In the well-defined radiating lines of the posterior area this species resembles the Upper Cretaceous forms to which Conrad gave the name Anatimya.

ANATINA (CERCOMYA) sp.

Another species of this genus is represented by a single specimen from the east side of Fan Creek Pass, which is too imperfect for illustration and full description. It is much larger than *A. punctata*, measuring 76 mm. in length, and it differs from that species in the outline of the anterior end and in the entire absence of radiating lines on the posterior area.

GASTROPODA.

NERITINA WYOMINGENSIS n. sp.

Pl. LXXV, figs. 4 and 5.

Shell small, consisting of about two and a half or three rapidly increasing volutions; spire very low and inconspicuous; last whorl slightly shouldered and forming about nine-tenths of the visible bulk of the shell; surface smooth, with rather distinct lines of growth near the aperture, which has the thin sharp outer lip and straight inner lip with broad flattened columella characteristic of the genus. The inner lip is smooth, or nearly so, but the specimens are not in condition to show whether it bears minute denticulations.

Height of the type, 6 mm.; greatest breadth, 6½ mm.

This species has a superficial resemblance to *Neritina? phaseolaris* White from the Jurassic of Utah, but, besides slight differences in form, the columella in that species is not flattened and the inner lip is not straight, so that it has been referred to Lyosoma.

The only other described American Jurassic Neritina is *N. nebrascensis*

M. and H., which is much larger and more slender in form, differing in all its details from this species, which is somewhat similar in form and size to *Neritina pisum* Meek from the Upper Cretaceous of Utah.

The type was collected by Prof. A. C. Gill about 3 miles southeast of Gravel Peak.

LYSOMA POWELLI White.

Neritina powelli White, 1876: Geol. Uinta Mountains, p. 110.
Lyosoma powelli White, 1880: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, p. 153, Pl. XXXVIII, figs. 6*a–d*.

One well-preserved specimen was obtained on saddle at head of Fawn Creek, northeast of Monument Peak, and another on ridge south of Mammoth Hot Springs, on main terrace. The species has not before been reported from any locality excepting at the mouth of Thistle Creek, Spanish Fork Canyon, Utah.

Both Zittel and Fischer are inclined to make Lyosoma a synonym of Otostoma d'Archiac, an Upper Cretaceous subgenus of Nerita, but Lyosoma really has the thin inner lip without any callus or flattening of the columella, while the Cretaceous form has been shown to have the characteristics of Neritina in these respects.

TURRITELLA sp.

A single small specimen from 3 miles southeast of Gravel Peak has the form of this genus, but is insufficient for specific description. It consists of six flattened whorls with channeled sutures.

NATICA? sp.

A naticoid form is represented by imperfect internal casts from Fan Creek Pass, saddle west of south head of Gardiner, head of Fawn Creek northeast of Monument Peak, and near Sentinel Butte.

It is probably undescribed, being very much larger than *Natica? lelia* Hall and Whitfield, which is the only described naticoid shell from the Jurassic of this western interior region.

CEPHALOPODA.

OPPELIA? sp.

Ammonites are rare in the Yellowstone National Park collection, and the few that were obtained are too fragmentary and badly preserved for accurate classification.

One species is represented by, two flattened specimens, about 3 inches

in diameter, from the divide between Fawn Creek and Gallatin Valley. This is a nearly smooth, discoid, involute form, with narrow umbilicus and rounded abdomen. The outer two-thirds of the body whorl appears to have been entirely smooth. On the other third the abdomen is crossed by small ribs, giving it almost a dentate outline; and on earlier stages these ribs are relatively longer and more prominent, passing nearly halfway across the flanks of the shell. In general form and sculpture this species resembles *Oppelia subplicatella* Vacek,[1] from the Oolitic of Cap San Vigilio. The septa are not preserved.

Fragments of larger individuals that may belong to the same species were obtained on Fan Creek Pass, saddle in ridge west of south head of Gardiner, and from Cinnabar Mountain. They are less compressed than the specimens above described, but with the material at hand it is impossible to determine whether this difference is due to accidental distortion. Some of the fragments show strong plications on the abdomen. A large specimen, 8 inches in diameter, from limestone on ridge south of Sheridan Peak, appears to be related to the forms above mentioned, though it is somewhat more involute, and is so much weathered that all the surface characters and the finer subdivisions of the septa have disappeared. The specimen is septate throughout. The septa appear not to have been very complex and the lateral saddles are very broad. It is possible that this specimen should be referred to *Ammonites henryi* M. and H., which it somewhat resembles both in general form and in the septa.

PERISPHINCTES sp.

Collections obtained by Dr. Peale near the lower canyon of the Yellowstone contain fragments of two species of Ammonites that probably belong to Perisphinctes, judging from the sculpture. Fragments of one of these species were also obtained on saddle in ridge west of south head of Gardiner River.

BELEMNITES DENSUS Meek and Hayden.

Belemnites densus Meek and Hayden, 1858: Proc. Acad. Nat. Sci. Phila., p. 58. 1865: Palæont. Upper Missouri, p. 126, Pl. IV, figs. 10*a–c;* Pl. V, figs. 1*a–i*. Meek, 1876: Simpson's Rept. Expl. Great Basin, Utah, p. 358, Pl. III, figs. 4*a, b*. Whitfield, 1880: Geol. Black Hills Dakota, p. 381, Pl. VI, figs. 15–19.

This species, which is abundant in the Jurassic of the Black Hills and

[1] Abhandl. K.-k. geol. Reichsanstalt, Vol. XII, p. 82, Pl. XI, figs. 1–5, 1886.

various localities in Wyoming, is represented in the Yellowstone National Park collection by only a few specimens, from saddle in ridge west of south head of Gardiner; west of Snake River 4 miles south of second crossing and 3 miles south of mouth of Glade Creek.

CRETACEOUS SPECIES.

DAKOTA (?) FORMATION.[1]

PELECYPODA.

UNIO sp. undet.

Several casts of a small species of Unio were collected with the gastropods named below in Three Forks Valley, Montana, and on Fawn Creek Plateau. The species is doubtless new, but the material is insufficient for description.

GASTROPODA.

GONIOBASIS? PEALEI n. sp.

Pl. LXXV, fig. 6.

Shell small, slender, elongate, consisting of about eight convex whorls; apex of spire acute; upper third of each whorl slightly flattened, so that it is most prominent below the middle; suture linear, deeply impressed; surface nearly smooth, being marked only by fine lines of growth, and on some specimens by faint indications of spiral lines. The full form of the aperture is not shown on any of the specimens, but it appears to have been suboval and slightly produced in front. Shell apparently not umbilicated.

Length of an average specimen with eight whorls, 14 mm.; breadth of body whorl, 7 mm.

This species is very doubtfully referred to Goniobasis, though it seems to be related to *G. gracilenta* Meek, from the Judith River beds. In general aspect and in the form of the whorls it resembles some recent species of Pomatiopsis, but the form of the aperture and the absence of an umbilicus separate it from that genus.

The specimen figured was collected by Dr. A. C. Peale in Three Forks

[1] See remarks on pp. 604–605.

Valley, Montana. Other examples were obtained in the Gallatin Range and at several points in the northwestern part of Yellowstone National Park from fresh-water beds of the Cretaceous section of that region.

GONIOBASIS? INCREBESCENS n. sp.

Pl. LXXV, fig. 7.

Shell of about the same length as the preceding, but more robust in form, consisting of only about five rapidly increasing convex whorls; surface nearly smooth, with fine lines of growth; other features, as far as known, the same as in *G.? pealei.*

Length of an average specimen, 13 mm.; breadth of body whorl, 7.5 mm.

Nearly all the specimens are in the form of imperfect internal casts retaining portions of the shell, but of course not showing the generic features fully. It seems to be related to *G.? pealei.*

The type is from the same horizon as the preceding on Fawn Creek, and it occurs in this bed at several localities in that region.

AMNICOLA? CRETACEA n. sp.

Pl. LXXV, fig. 8.

Shell small, conical, consisting of four or five rapidly increasing convex whorls; suture deeply impressed; surface marked only by lines of growth; aperture oval.

Height, 9 mm.; breadth of last whorl, 6 mm.

Occurs with the preceding species on Fawn Creek.

COLORADO FORMATION.

PELECYPODA.

OSTREA ANOMIOIDES Meek.

Ostrea anomioides Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 488. White, 1880: Idem for 1878, p. 10, Pl. XI, figs. 4*a*, *b*. 1884: Fourth Ann. Rept. U. S. Geol. Surv., p. 291, Pl. XXXIX, figs. 4 and 5. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 55, Pl. I, figs. 5 and 6.

This species, which was originally described from the Missouri River below Gallatin, Montana, is abundant in sandy shales near the base of

the Colorado formation on ridge north of north head of Gardiner and on north side of Fan Creek.

INOCERAMUS UMBONATUS Meek and Hayden.

Inoceramus umbonatus Meek and Hayden, 1858: Proc. Acad. Nat. Sci. Phila., p. 50. Meek, 1876: U. S. Geol. Surv. Terr., Vol. IX, p. 44, Pl. III, figs. 1*a*, *b*, *c*; Pl. IV, figs. 1*a*, *b* and 2*a*, *b*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 81, Pl. XVIII, figs. 1 and 2.

One specimen was collected on north bank of Snake River one-fourth mile above the mouth of Sickle Creek. The species is abundant in the shales of the upper part of the Colorado formation on the Missouri River below Fort Benton, Montana, and it has recently been collected by Mr. G. K. Gilbert in the Niobrara shales near Rocky Ford on the Arkansas River below Pueblo, Colorado. It also occurs in the Austin limestone of Texas.

INOCERAMUS UNDABUNDUS Meek and Hayden.

Inoceramus undabundus Meek and Hayden, 1862: Proc. Acad. Nat. Sci. Phila., p. 26. Meek, 1876: U. S. Geol. Surv. Terr., Vol. IX, p. 60, Pl. III, figs. 2*a*, *b*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 84, Pl. XVI, figs. 1 and 2.

Occurs with the preceding at the locality on Snake River, and also on the Missouri below Fort Benton.

INOCERAMUS FLACCIDUS White.

Inoceramus flaccidus White, 1876: U. S. Geog. and Geol. Surv. W. 100th Meridian, Vol. IV, p. 178, Pl. XVI, figs. 1*a* and *b*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 80, Pl. XIII, fig. 1.

Occurs with the preceding, and at the same horizon, one-fourth mile farther up Snake River. It has hitherto been found only in the Niobrara shales near Pueblo, Colorado.

INOCERAMUS ACUTEPLICATUS n. sp.

Pl. LXXV, figs. 9 and 10, and Pl. LXXVI, fig. 1.

Shell large, moderately convex, elongate, with the height much greater than the length; hinge line rather short, oblique to the longer axis of the shell; beak prominent, acute, near the anterior end of the hinge line; anterior side gently convex, posterior nearly straight; base broadly rounded, with a tendency to angulation at the junction with the sides; surface marked

by lines of growth and by regular, narrow, elevated, concentric ridges that are about one-third as wide as the interspaces. These ridges are somewhat stronger on the anterior half of the shell than on the posterior, and in very large specimens they tend to become obsolete, making the basal portion of the shell nearly smooth.

The above description is drawn mainly from a large right valve (Pl. LXXVI, fig. 1) from the Sickle Creek locality. The specimens associated with it and having the same general form and sculpture are all much smaller. These are not distinguishable from specimens from sandstone believed to belong to a higher horizon on Glade Creek. There are small left valves in the collection from both localities, and one of those from Glade Creek is figured. It is proportionally more convex than the right valve, and the beak is more prominent and more curved. The concentric ridges are very prominent on the convex median region, and fade out toward the borders.

The largest type specimen measures 201 mm. in its longest diameter, and 135 mm. at right angles to that line.

This species is related to *I. fragilis* and *I. altus*, all three belonging to the typical section of Inoceramus. It differs from both of them in being more strongly plicate, in its shorter, slightly more oblique hinge line, and in other details of outline.

Locality and position: On Snake River one-fourth mile above the mouth of Sickle Creek, associated with *I. umbonatus*, *Scaphites ventricosus*, etc., in sandy shales of the upper part of the Colorado formation, and near the mouth of Glade Creek in a sandstone supposed to belong to a higher horizon.

Corbula subtrigonalis Meek and Hayden.

Corbula subtrigonalis Meek and Hayden, 1856: Proc. Acad. Nat. Sci. Phila., p. 116. White, 1880: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, p. 80, Pl. XXV, figs. 6*a–f*. White, 1883: Third Ann. Rept. U. S. Geol. Surv., p. 442, Pl. XIX, figs. 10–13. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 123, Pl. XXVII, figs. 7 and 8.

This species and its variety *perundata* were obtained in black shales supposed to belong to the Colorado formation near Electric Peak and on the Cone head of Gardiner River. These forms were originally described from the Laramie, but they are known to range as low as the Colorado formation in southwestern Wyoming.

CEPHALOPODA.

BACULITES ASPER Morton?

Baculites asper Morton, 1834: Synopsis Org. Rem. Cret. Gr., p. 43, Pl. I, figs. 12 and 13; Pl. XIII, fig. 2. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 167, Pl. XXXVI, figs. 4 and 5.

Occurs with *Inoceramus acuteplicatus*, etc., at the locality one-fourth mile above the mouth of Sickle Creek, and is abundant associated with the same fauna on the Missouri River below Fort Benton, in the upper part of the Colorado formation. It is also found at Cinnabar Mountain.

SCAPHITES VENTRICOSUS Meek and Hayden.

Scaphites ventricosus Meek and Hayden, 1862: Proc. Acad. Nat. Sci. Phila., p. 22. Meek, 1876: U. S. Geol. Surv. Terr., Vol. IX, p. 425, Pl. VI, figs. 7*a*, *b*, and 8*a*, *b*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 186, Pl. XLIV, figs. 8–10; Pl. XLV, fig. 1.

Several specimens from the localities above mentioned on Snake River, and a fragment believed to belong to this species from the black shales of Electric Peak.

It occurs well preserved at Cinnabar Mountain just north of the Park, and with the preceding species below Fort Benton.

MONTANA FORMATION.[1]

BRACHIOPODA.

LINGULA SUBSPATULATA Hall and Meek.

Lingula subspatulata Hall and Meek, 1854: Mem. Am. Acad. Arts and Sci., Vol. V, p. 380, Pl. I, figs. 2*a*, *b*. White, 1876: U. S. Geog. and Geol. Surv. W. 100th Meridian, Vol. IV, p. 169, Pl. XV, fig. 4*a*.

Two specimens from sandstone overlying bituminous shale on Rattlesnake Creek, probably same horizon as the remainder of the species mentioned below.

[1] See pp. 606–607 for remarks on the horizon of the following species.

PELECYPODA.

OSTREA SOLENISCUS Meek.

Ostrea soleniscus Meek, 1871: Proc. Am. Philos. Soc., Vol. XI, p. 435. White, 1880: Ann. Rept. U. S. Geol. Surv. Terr. for 1878, p. 9, Pl. XI, figs. 2*a*, *b*. 1884: Fourth Ann. Rept. U. S. Geol. Surv., p. 300, Pl. XLII, fig. 1. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 56, Pl. II, fig. 1; Pl. III, figs. 1 and 2.

This species is abundant in both the Colorado and Montana formations at Coalville, Utah, and in southwestern Wyoming. It was obtained near the second crossing of Snake River, just south of the Park.

OSTREA sp.

A small species related to *O. pellucida* M. and H. occurs at the same locality with the preceding.

ANOMIA sp.

A small species resembling *A. propatoris* White is represented by several casts from Glade Creek, Lizard Creek, and near second crossing of Snake River.

AVICULA NEBRASCANA Evans and Shumard.

Avicula nebrascana Evans and Shumard, 1857: Trans. Acad. Sci. St. Louis, Vol. I, p. 38. *Pteria* (*Oxytoma*) *nebrascana* (E. and S.) Meek, 1876: Rept. U. S. Geol. Surv. Terr., Vol. IX, p. 34, Pl. XVI, fig. 3*a*, *b*; Pl. XXVIII, fig. 11. Whitfield, 1880: Geol. Black Hills Dakota, p. 385, Pl. VII, fig. 4.

Several specimens from the locality near the mouth of Glade Creek. It is a widely distributed species in the Fort Pierre shales of the Montana formation.

AVICULA LINGUÆFORMIS Evans and Shumard.

Avicula linguæformis Evans and Shumard, 1854: Proc. Acad. Nat. Sci. Phila., p. 153. *Pteria linguiformis* (E. and S.) Meek, 1876: Rept. U. S. Geol. Surv. Terr., Vol. IX, p. 32, Pl. XVI, figs. 1*a–d*. Whitfield, 1880: Geol. Black Hills Dakota, p. 384, Pl. VII, figs. 2 and 3.

This species occurs with the preceding on Glade Creek and has about the same geographic and vertical range.

INOCERAMUS ACUTEPLICATUS n. sp.

Numerous small specimens referred to this species from locality near the mouth of Glade Creek. (See description on page 634.)

ARCA sp.

A single imperfect specimen, probably of an undescribed species, from the locality near the second crossing of Snake River.

NUCULA sp.

A cast near mouth of Glade Creek.

CARDIUM PAUPERCULUM Meek.

Cardium pauperculum Meek, 1871: Ann. Rept. U. S. Geol. Surv. Terr. for 1870, p. 306. White, 1879: Idem for 1877, p. 291, Pl. IX, fig. 3*a*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 99, Pl. XXII, figs. 9–12.

Cardium subcurtum Meek, 1873: Ann. Rept. U. S. Geol. Surv. Terr. for 1872, p. 476. 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 152, Pl. XV, fig. 3*a*.

This is the most abundant species in the sandstones near Glade Creek, near second crossing of Snake River, and on Lizard Creek.

It is common in the Colorado formation at Coalville, Utah; in southwestern Wyoming, and in Huerfano Park, southern Colorado. In these localities it is not known to range as high as the Montana formation.

BARODA WYOMINGENSIS Meek.

Tapes wyomingensis Meek, 1871: Ann. Rept. U. S. Geol. Surv. Terr. for 1870, p. 310.

Baroda wyomingensis Meek, 1873: Idem for 1872, p. 493. White, 1879: Idem for 1877, p. 293, Pl. X, figs. 3*a*, *b*.

A single specimen from Glade Creek.

It is possible that this species belongs to Conrad's genus Legumen, described from the Cretaceous of Ripley, Mississippi. I have elsewhere[1] expressed the opinion that Baroda is probably a synonym of Legumen, which is a prior name.

DONAX CUNEATA Stanton.

DONAX(?) OBLONGA Stanton.

Both these species occur on a single hand specimen from near the second crossing of the Snake River. The type of *D. cuneata* was collected in sandstone of the Colorado formation at Old Bear River City, southwestern Wyoming,[2] and *D. oblonga* came from the same horizon at Coalville, Utah. *D. cuneata* occurs also in the Montana formation of the Coalville section.

[1] Bull. U. S. Geol. Surv. No. 106, p. 107.

[2] Idem, p. 110, Pl. XXV, fig. 1.

MACTRA WARRENANA Meek and Hayden.

Mactra warrenana Meek and Hayden, 1856: Proc. Acad. Nat. Sci. Phila., p. 271.
Mactra (Cymbophora?) warrenana (M. and H.) Meek, 1876: Rept. U. S. Geol. Surv. Terr., Vol. IX, p. 208, Pl. XXX, figs. 7*a–d*.

Casts in sandstone apparently belonging to this species are abundant near Glade Creek. The species is widely distributed in the Montana formation.

MACTRA ARENARIA Meek?

Mactra (Trigonella?) arenaria Meek, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 154, Pl. XIV, fig. 5.

This species is abundant in the Montana formation at Coalville, Utah. A single cast that seems to belong to it is associated with the preceding species near Glade Creek.

GASTROPODA.

GYRODES DEPRESSA Meek.

Gyrodes depressa Meek, 1877: U. S. Geol. Expl. 40th Parallel, Vol. IV, Pt. I, p. 159, Pl. XV, figs. 1, 1*a*. Stanton, 1894: Bull. U. S. Geol. Surv. No. 106, p. 135, Pl. XXIX, figs. 11–14.

Common in the sandstones on Glade Creek. It was originally described from the Colorado formation at Coalville, Utah, and is found at the same horizon in Huerfano Park, Colorado. The genus Gyrodes has not hitherto been reported from the Montana formation of the Rocky Mountain region, but it is well represented in beds of the same age in the Atlantic and Gulf border region. In fact, *Gyrodes petrosa* (Morton) from the Ripley formation is scarcely distinguishable from *G. depressa*.

CERITHIUM? sp.

A small, slender form of doubtful affinities, represented by an internal cast from sandstone on Huckleberry Mountain.

PYRULA? sp.

A fragmentary cast from Glade Creek.

CEPHALOPODA.

SCAPHITES cf. VENTRICOSUS Meek and Hayden.

A mere fragment from Glade Creek, resembling this species in sculpture. (See p. 636.)

PLACENTICERAS PLACENTA (DeKay)?

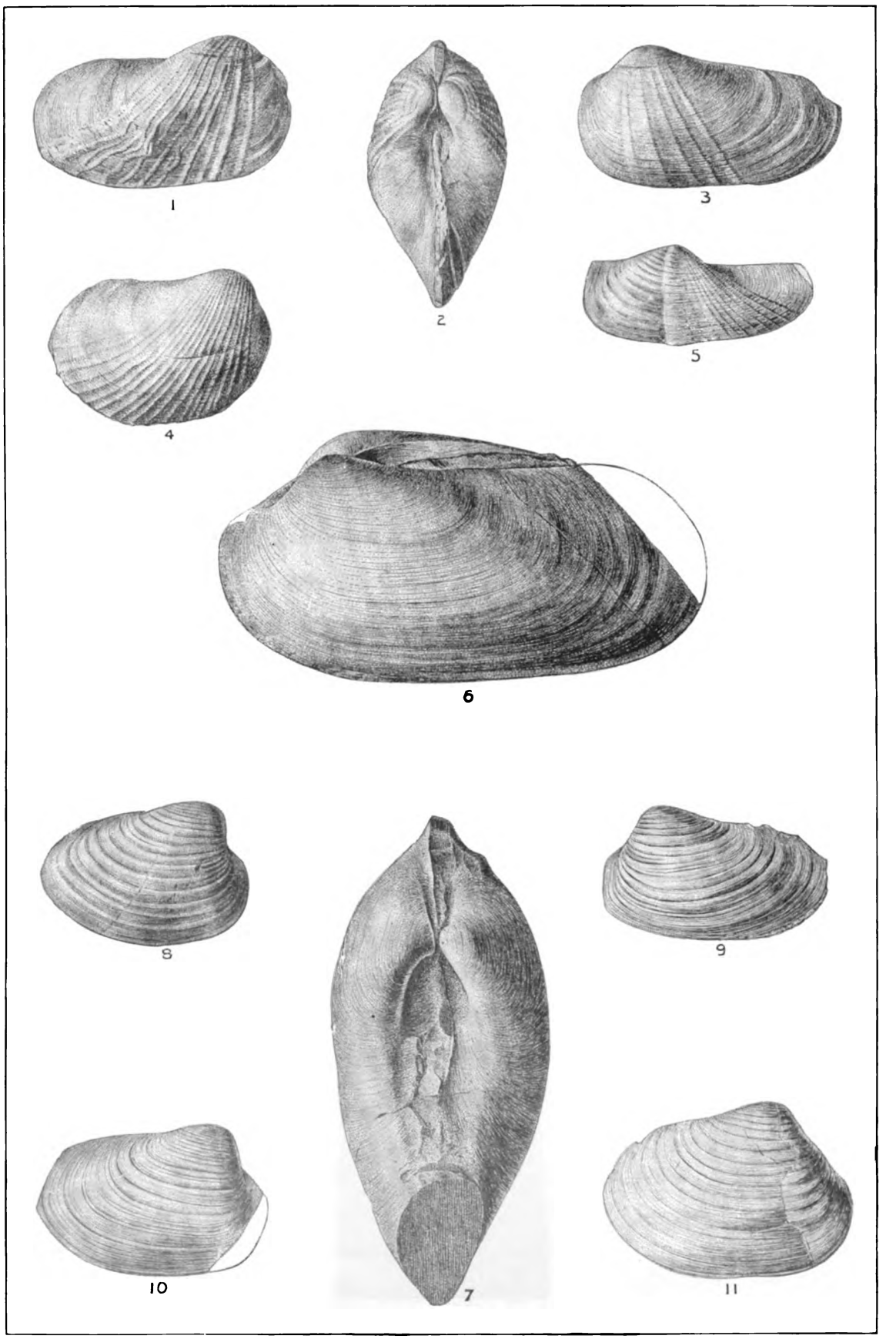
Ammonites placenta DeKay, 1827: Ann. New York Lyceum Nat. Hist., Vol. II, p. 278, Pl. V, fig. 3.

Placenticeras placenta (DeKay) Meek, 1876: Rept. U. S. Geol. Surv. Terr., Vol. IX, p. 465, Pl. XXIV, figs. 2*a*, *b*.

A fragment probably belonging to this well-known species was collected near the second crossing of the Snake River. The species is abundant and widely distributed in the Montana formation and its equivalents, and a few specimens of it, or of a very closely related species, have been obtained in the Colorado formation.

PLATE LXXII.

PLATE LXXIII.



JURASSIC. ELLIS FORMATION.

PLATE LXXV.

PLATE LXXV.

JURASSIC SPECIES.

CRETACEOUS SPECIES.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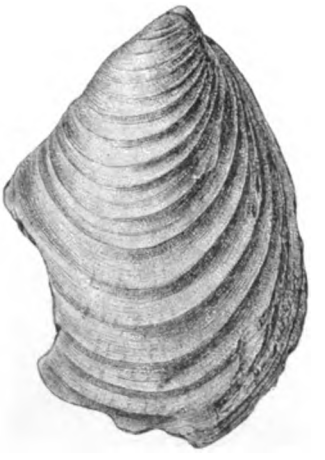
10

JURASSIC AND CRETACEOUS ELLIS, DAKOTA, AND MONTANA FORMATIONS

PLATE LXXVI.

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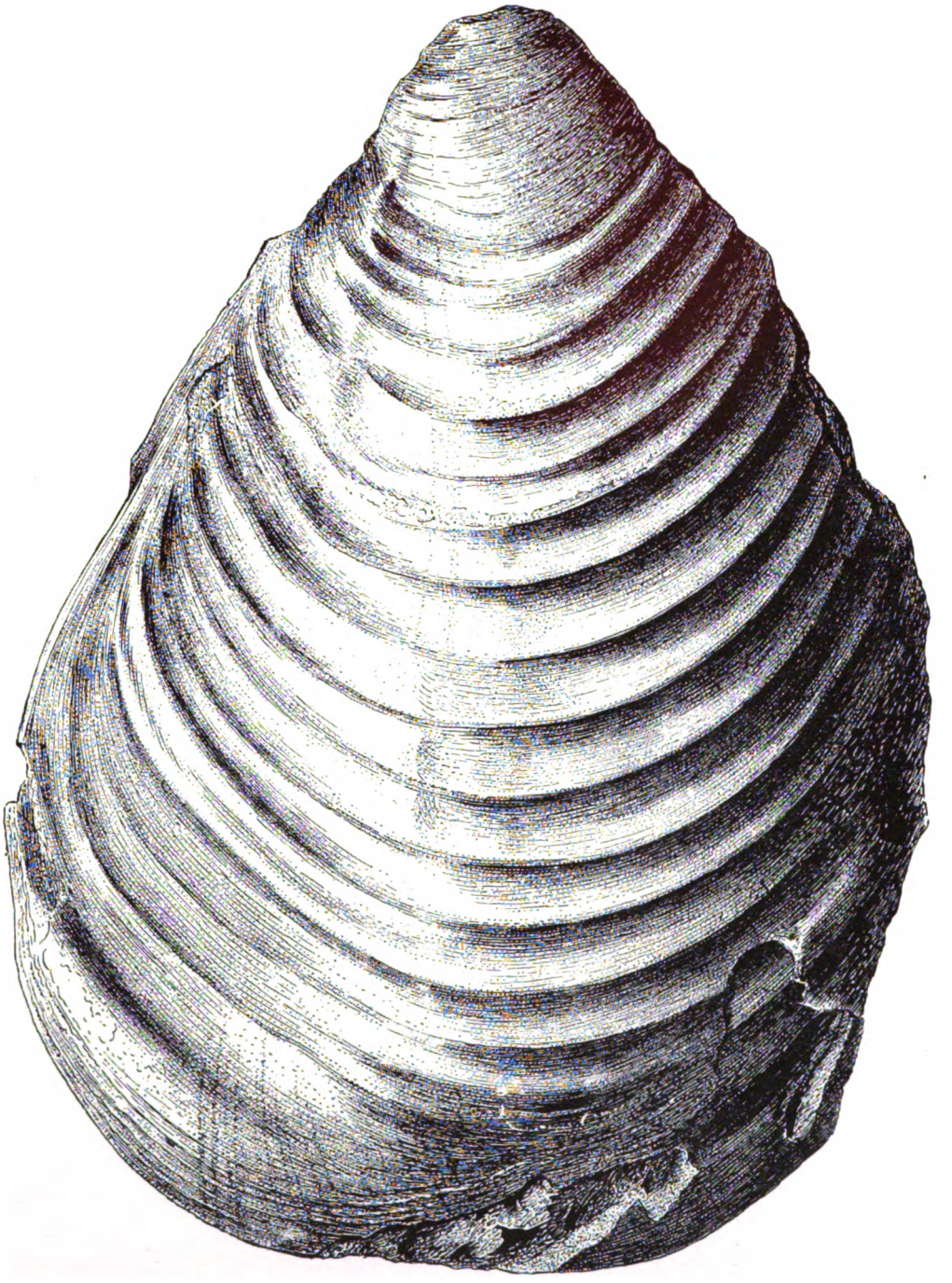
PLATE LXXVI.

FIG. 1. A large right valve, forming the principal type specimen. (See Pl. LXXV for additional figures.)



CRETACEOUS COLORADO FORMATION.