GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, LL.D., F.R.S., F.G.S., DIRECTOR.

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME I.

—BY—

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST, G. & N. H. S. C.

PART I.—Report on the Invertebrata of the Laramie and Cretaceous Rocks of the Vicinity of the Bow and Belly Rivers and adjacent localities in the North-West Territory.

PRINTED FOR THE GOVERNMENT OF CANADA.

DAWSON BROTHERS, PUBLISHERS,
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Under the general title of "Contributions to Canadian Palæontology" it is proposed to publish, from time to time, such papers as cannot be conveniently included in either of the volumes on the Palæozoic or Mesozoic Fossils of Canada now in course of preparation. These papers and the plates which illustrate them will be paged and numbered consecutively, and an index will be prepared for each volume as soon as completed.

The part now presented contains a descriptive report on the fossils collected by Dr. G. M. Dawson and other officers of the Survey in the years 1881–84, both inclusive, from the Laramie and Cretaceous rocks of the Bow and Belly River district. It consists of eighty-nine pages of letterpress, illustrated by eleven lithographic plates.

ALFRED R. C. SELWYN.

Geological and Natural History Survey Office,
Ottawa, 4th Aug., 1885.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

1. *Report on the Invertebrata of the Laramie and Cretaceous rocks of the vicinity of the Bow and Belly Rivers and adjacent localities in the North-West Territory.*

The present paper is intended primarily as a palæontological supplement or appendix to Dr. G. M. Dawson's "Report on the Region in the Vicinity of the Bow and Belly Rivers," published in 1885 in the "Report of Progress" of the Survey for 1882-83-84. It is mainly based upon collections made by Dr. Dawson and Messrs. R. G. McConnell, J. B. Tyrrell and T. C. Weston in the years 1881-84, but in order to make it as complete a presentation as possible of the present state of our knowledge of the invertebrate fauna of the Laramie and Cretaceous rocks of the Canadian North-West, it contains also a revision of the species from these formations obtained by Dr. Dawson in 1874 in his capacity of Geologist to H. M. North American Boundary Commission, and identifications of a few Cretaceous fossils collected by Prof. Macoun in 1879.

Dr. Dawson's Report, in the volume referred to, contains several short lists of fossils, but these as there stated "are to be regarded as provisional only," and may be considered as superseded by the present paper.

The species are enumerated or described, as the case may be, in a stratigraphical and descending order corresponding as nearly as possible to the grouping and nomenclature in Dr. Dawson's Report. The only exceptions to this mode of arrangement occur in the case of a few of the specimens from the Laramie basin north of the typical region near the Belly River. In this northern part of the basin it has so far been impossible to correlate the sub-divisions of the Laramie with those of the Belly River and vicinity.

The writer desires to acknowledge his obligations to Dr. C. A. White, of the Smithsonian Institute, Washington, for a direct comparison of a number of Canadian specimens with the types of several of his own and of Mr. Meek's species in the museum of that institution, and for various and valuable critical suggestions.

A. FROM THE WESTERN LARAMIE.

(1.) From the Porcupine Hill Series.

No fossils have yet been obtained from the Porcupine Hill Series proper, though it is probable that a systematic search would result in the discovery of fossiliferous beds. In the sandstones and shales of Shaganappie Point, two miles west of Calgary, however, Sir William Dawson collected a few remains of the shells of fresh water mollusca in 1883. The deposits at this place are on the horizon of those of the Porcupine Hill Series of the southern part of the district, though for reasons which will be stated more at length in connection with the St. Mary R. Series, the definition of the sub-divisions of the Laramie has not been attempted on the northern part of the map which accompanies Dr. Dawson's report. The genera or species indicated at this locality appear to be somewhat as follows, so far as they can be ascertained :—Three detached valves of a *Sphærium* or *Leptesthes*, the largest of which may be conspecific with the *Sphærium recticardinale* of Meek & Hayden, but the characters of the interior of all three are unknown: fragments of a *Physa*, probably of that form of *P. Copei*, White, which will be described and figured in the present paper as the variety *Canadensis ;* casts of the interior of the shell of a *Goniobasis* (?) ; *Viviparus Leai*, Meek & Hayden ; and a single specimen of a shell which is either an unusually large form of a new species of *Valvata* which will be found described a little farther on under the name of *V. filosa*, or a species of *Patula*.

(2.) From the Willow Creek Series.

In the clays, sandstones and indurated sands of this sub-division of the Western Laramie, fossils appear to be scarce and are usually not well preserved. The only localities at which any were collected are on the Upper Belly River seven miles above the mouth of the Old Man River, and on the Upper Belly River near Slide Out, by Mr. R. G. McConnell in 1881. The species from the locality first mentioned are—an apparently new species of *Unio* ; fragments of a small bivalve perhaps referable to the genus *Sphærium* ; crushed examples of a new species of *Patula*, which will be described a little farther on, under the name *P. obtusata*, from much better specimens collected from the "St. Mary River Series" on the Old Man River ; and a few badly preserved casts of a *Goniobasis*, which is probably only a variety of the *G. tenuicarinata* of Meek and Hayden. On the Upper Belly River near Slide

Out the only fossils collected are a few casts of a *Unio* which are not sufficiently perfect to be identified. A few fragments of Unios and other fresh water shells were noticed at some other localities, but no specimens were collected.

The supposed new species of *Unio* from near the mouth of the Old Man River may be described as follows :

Unio Albertensis. (N. Sp.)

Plate 1, fig. 1.

Shell very inequilateral, strongly compressed at the sides and thickest near the mid-length, so that the outline of the closed valves as seen from above is regularly lanceolate : lateral outline transversely subelliptical : length about twice the maximum height : height almost exactly twice the greatest thickness. Anterior and posterior extremities both rounded at the margin, and of nearly equal breadth : anterior side very short : posterior side considerably elongated, about three times as long as the anterior : ventral margin and superior border almost straight and nearly parallel for the greater part of their length,—the former rounding upwards obliquely and rather abruptly, and the latter sloping downwards in an equally abrupt and obliquely convex curve, at each end. Beaks very small and inconspicuous, placed about half way between the centre and the anterior termination of the valves.

Surface concentrically striated : test rather thin : characters of the interior unknown.

Length, seventy millimetres : maximum height, thirty-six mm. : greatest thickness, eighteen mm.

Upper Belly River, Alberta, N. W. T., seven miles above the mouth of the Old Man River, R. G. McConnell, 1881 : one nearly perfect specimen with the test preserved on both valves and entirely free from the matrix.

(3.) From the St. Mary River Series and lower portion of the Laramie generally.

In the southern portion of the district included in the geologically-coloured map of the region in the vicinity of the Bow and Belly Rivers, the Laramie, on lithological grounds, is clearly separable into three subdivisions, as described in Dr. G. M. Dawson's report already referred

to. In the district embraced by the northern part of the map it has been found difficult to carry out a similar lithological subdivision of the formation, and no attempt has been made to indicate such subdivisions on the map. Still further northward, in the district from which the greater number of the fossils collected by Mr. J. B. Tyrrell were obtained, it becomes quite impossible to distinguish the three subdivisions above referred to. The mollusca from this district, however, are for the most part from the lower portion of the Laramie, and consequently from a horizon nearly or quite equivalent to that occupied in the typical region by the St. Mary River Series. In the present paper, under the heading A. of the "Western Laramie" and in section 3, the species collected from the St. Mary River Series proper will be separately designated as such. The remainder are from the lower portion of the Laramie in its northern extension, with the exception of six species from the same northern region, which occupy positions so far up in the Laramie that the beds in which they occur may possibly represent the Willow Creek or Porcupine Hill Series. These again will be specially designated, though they are included in the present section for convenience of description. With the exception of these last-mentioned species, the mollusca here described or enumerated in section 3 of subdivision A may be considered as representing the fauna of the lower part of the Laramie of the region.

LAMELLIBRANCHIATA.

ANOMIA PERSTRIGOSA. (N. Sp.)

Plate 1, fig. 2.

Upper valve (assuming that the shell is an *Anomia*) moderately convex, irregular in outline, and varying from subcircular to obliquely subovate, sometimes slightly arcuate and curved to the left. Beaks marginal, small, but in some specimens rather prominent.

Surface marked by radiating raised lines, a few of which, at distant but irregular intervals, are conspicuously broader and more prominent than the rest. Under an ordinary simple lens, these radiating lines are seen to be subnodulous, in consequence of their passing over the faint concentric lines of growth. Under valve and characters of the interior of the upper unknown.

Upper Belly River, twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; St. Mary River Series: three specimens.

The muscular impressions and hinge dentition of this shell being unknown, it is, of course, not quite certain whether it is an *Anomia* or not. Dr. C. A. White, who has seen the specimens, thinks it is a *Placunanomia*, of the subgenus *Monia*, Gray.

OSTREA GLABRA, Meek and Hayden.

Ostrea glabra, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 146.
Ostrea Wyomingensis, Meek. 1873. Rep. U. S. Geol. Surv. Terr. for 1872, p. 508. Illustrated by Dr. C. A. White on pl. 20 of Contr. to Pal. (U.S. Geol. Surv., 1880), Nos. 2 to 8.
Ostrea arcuatilis, Meek. 1873. Rep. U.S. Geol. Surv. Terr. for 1872, p. 477.
Ostrea glabra, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 509, pl. 40, figs. 2, a, b, c, d.
Ostrea insecuris, White. 1876. Powell's Rep. Geol. Uinta Mts., p. 112. Illustrated on pl. 21 of Dr. C. A. White's Contr. to Pal., Nos. 2 to 8.
Ostrea glabra, White. (as of M. & H.) 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2 to 8, p. 56.
Ostrea glabra, White. (as of M. & H.) 1883. Rev. Non-Marine Foss. Moll. N. Am., pls. 9, 10, 11 and 12.

Bow River, mouth of East Arrow-wood Creek, G. M. Dawson, 1881: Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; St. Mary River Series. High River five miles above the forks, R. G. McConnell, 1882: Forks of Devil's Pine and Three Hills Creeks, also Red Deer River, near 8th correction line, J. B. Tyrrell, 1884. Oyster Creek, N. W. branch of the north fork of the Old Man River, G. M. Dawson, 1884. This last locality is in a nearly isolated basin in the mountains, and the horizon is not certainly that of the St. Mary River Series.

Most of the specimens from these localities belong to the variety *Wyomingensis*.

A single valve of an oyster collected by Prof. Macoun from a layer of limestone in the Hand Hills, in Township 28, Range 17, west of the 4th Meridian, may also be referable to this variable species.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. (as of E. & S.) 1876. Rep. U.S. Geol. Surv. Terr., vol, IX., Rep. Inv. Cret. & Tert. Foss. U. Miss. Cy., p. 510. pl. 40, figs. a, b, c, d.
" " White. 1883. Rev. Non-marine Foss. Moll. N. Am., pl. 12, figs. 2–5.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881, and T. C. Weston, 1883, not uncommon ; in basal beds of St. Mary River Series. Upper Belly River, twenty-two miles above the mouth of the Waterton, R. G. McConnell, 1881 ; St. Mary River Series : one valve.

Perhaps a variety of the preceding species, as suggested by Dr. C. A. White.

Unio Danæ, Meek and Hayden.

Unio Danæ, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX, p. 145.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 517, pl. 41, figs. 13, a, b, c.

Bow River, mouth of East Arrow-wood Creek (base of section), also Bow River, four and eight miles west of Blackfoot Crossing, G. M. Dawson, 1881 ; St. Mary River Series.

Belly River, west of crossing of MacLeod-Benton Trail, and Little Bow River, five miles below crossing of Blackfoot Trail, R. G. McConnell, 1881 ; St. Mary River Series.

Pincher Creek, T. C. Weston, 1883 ; St. Mary River Series. Knee Hills Creek, Township 29, Range 22, west of 4th Principal Meridian, J. B. Tyrrell, 1884.

In a conversation with the writer, Dr. C. A. White expressed the opinion that the *Unio Danæ*, *U. subspatulatus* and *U. Deweyanus* of Meek & Hayden are all varietal forms of one species, and it is upon this hypothesis that the fossils from the above mentioned localities are all referred to *U. Danæ*. Some of these specimens from the Canadian North-west are fairly typical representatives of the *U. Danæ*; some again are more like *U. subspatulatus*, while others possess characters apparently intermediate between these two varieties or nominal species.

Unio senectus, White.

Unio senectus, White. 1877. Bull. U.S. Geol. Surv. Terr., vol. III., p. 600.
" " " 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 69, pl. 28, figs. 1 a, b, c.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 19 figs. 1, 2.

Bow River, two miles below the mouth of Jumping Pound River, G. M. Dawson, 1881: three imperfect but characteristic casts, two of

which have been sent to the author of the species, who confirms the correctness of their identification.

CORBICULA CYTHERIFORMIS, Meek & Hayden.

Cyrena (Corbicula ?) cytheriformis, Meek & Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 176.
Corbicula cytheriformis, M. & H. *Ib.*, p. 432.
Corbicula cytheriformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, &c., p. 520, pl. 40. figs. 5 a, b, c, d, e.
" " White. 1880. U.S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 74, pl. 21, figs. 4 a, b, c, d.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 31. pl. 22, figs. 1–6.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883. From the basal beds of the St. Mary R. Series.

CORBICULA OCCIDENTALIS, Meek & Hayden.

Plate 1, figs. 3 & 3a.

Cyrena occidentalis, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII. p. 116.
Corbicula occidentalis, Meek. 1869. *Ib.*, vol. XII, p. 432.
Corbicula (Veloritina), Bannisteri, Meek. 1873. Rep. U.S. Geol. Surv. Terr. for 1872, p. 513.
Corbicula occidentalis, Meek & Hayden. G. M. Dawson. 1875. Rep. Geol. & Res. of Reg. in Vic. of 49th. Par., p. 133.
Corbicula occidentalis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 521, pl. 40, figs. 6a, b, c.
Corbicula occidentalis, White. (as of M. & H.) 1880. U.S. Geol. Sur. Terr. Contr. to Pal., Nos. 2–8, p. 75, pl. 21, figs. 3 a, b, c.
Corbicula occidentalis, White. (as of M. & H.) 1883. Rev. Non-Marine, Foss. Moll. N. Am., p. 31, pl. 17, figs. 6, 7 & pl. 23 figs. 1–6.

St. Mary River, two miles north of the 49th Parallel,—and four miles west of the St. Mary River; G. M. Dawson, 1874, H. M. North American Boundary Commission; St. Mary R. Series.

Bow River, mouth of East Arrow-wood Creek, (top of section) G. M. Dawson, 1881; Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883, very abundant. All St. Mary R. Series.

Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; at both places probably from the St. Mary R. Series, but in a disturbed region.

Oyster Creek, N. W. branch of the north fork of the Old Man River ; G. M. Dawson, 1884. See note to same place under *Ostrea glabra*. Red Deer River, near the 8th correction line,—and forks of the Devil's Pine and Three Hills Creeks ; J. B. Tyrrell, 1884.

The specimens from these localities, which are somewhat variable in shape, appear to be nearly intermediate in their characters between *C. occidentalis* and *C. cytheriformis*, and it is doubtful to which of these species they should be referred. According to Meek, the shell of *C. occidentalis* is "subtrigonal in form, with height and length about equal," whereas that of *C. cytheriformis* is said to be "transversely ovate subtrigonal, or varying to sub-circular, but always a little longer than high." In the Canadian specimens, some of which are very perfect and measure fully one inch and three quarters in their two lateral diameters, the outline is distinctly subtrigonal and the height and length are either equal or else the height slightly exceeds the length. As compared also with the published figures of the two species, the specimens from the Canadian North-West are much more like those of *C. occidentalis* than those of *C. cytheriformis*.

CORBICULA OBLIQUA. (N. Sp.)

Plate 1, figs. 4, 4 a and 4 b.

Shell compressed convex, the thickness through the closed valves being about one-third less than the maximum height inclusive of the beaks : obliquely sub-ovate, usually a little longer than high and very inequilateral. Anterior side extremely short, its margin either slightly concave or vertically truncated under the beaks above, and rounding abruptly or declining rapidly and convexly into the ventral margin below : posterior side moderately elongated, obtusely pointed at the base, its upper margin forming one continuous, obliquely convex curve which extends from the beaks to the base ; ventral margin semi-ovate. Beaks small, anterior and nearly or quite terminal, almost erect, their extreme apices only being curved inwards, forwards and a little downwards.

Surface concentrically striated : characters of the interior unknown.

Length of the most perfect specimen collected, twenty-six millimetres : maximum height of the same, twenty-two mm. : thickness through the closed valves, fifteen mm.

Rye-Grass flat, Old Man River, (one perfect specimen, with the test preserved on both valves) and Bow River, eight miles west of Blackfoot Crossing, (a well preserved cast of a left valve), G. M.

Dawson, 1881. Upper Belly River, twenty-two miles above the mouth of the Waterton, (two left valves), and Little Bow River, opposite the mouth of Snake Valley, (one right valve with the test preserved), R. G. McConnell, 1881. All from the St. Mary R. Series.

The lateral compression of the valves and their extreme obliquity, coupled with the small size and nearly terminal position of the beaks, seem to afford a ready means of distinguishing this shell from the *Corbicula occidentalis* of Meek and Hayden.

SPHÆRIUM RECTICARDINALE, Meek and Hayden.

Sphærium recticardinale, Meek and Hayden. 1860. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 176.
Sphærium recticardinale, Meek. 1876. Rep. U. Geol. Surv. Terr., vol. IX, p. 527, pl., 43, figs. 3, a, b.

Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881; St. Mary River Series: one nearly perfect specimen and seven single valves.

(CORBULA PERUNDATA, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 116.
Corbula perundata, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4, a, b, c, d.

South or First Branch of the Milk River, N. W. T., G. M. Dawson, 1874, H. M. American Boundary Commission: a few single valves from a loose piece of concretionary limestone.* According to Dr. C. A. White, *C. perundata* is only a variety of *C. subtrigonalis*, M. and H.)

CORBULA PERANGULATA. (N. Sp.)

Plate 1, figs. 5, 5 a and 5 b, and plate 2, fig. 1.

Shell compressed laterally, moderately convex, thickest a little in front of the middle and narrowing regularly as well as gradually to the posterior end but very abruptly so to the anterior, so that the outline of the closed valves as seen from above is ovately lanceolate.

* These are the specimens referred to on page 37 C and in a foot note to page 126 C of Dr. Dawson's Report on the Bow and Belly River country published in 188 .

Anterior side very short, obliquely and convexly subtruncated at its extremity above and in the middle, but obtusely sub-angular below at its junction with the ventral margin: posterior side elongated and produced into a long and narrow pointed beak, which is either straight or curved slightly upwards and whose upper margin is strongly angulated. Ventral margin semi-ovate, very moderately convex, curving upwards somewhat more rapidly at the anterior than at the posterior end, but very gently at both, the posterior half being often nearly straight or even faintly concave: superior border descending abruptly and obliquely in front of the beaks and confluent with the margin of the anterior end in one unbroken line which descends obliquely from the beaks to the base,—descending gradually behind the beaks in either a straight line or with a shallowly concave curve to the upper termination of the posterior side: beaks obliquely flattened on all sides, placed in advance of the middle, that of the right valve curved inwards and downwards, that of the left erect but somewhat incurved and with a slight forward inclination. Posterior area large and very distinctly defined, flattened at a right angle to the valves and in some cases shallowly excavated, broadly lanceolate in outline as viewed from above, and bordered by the strong keel which also forms the upper margin of the beaked posterior extremity of each valve.

Surface marked with a few coarse and rather distant but irregularly disposed lines of growth, with much finer and close set concentric striæ between them. Test rather thick: hinge teeth as in *Corbula* proper, muscular impressions unknown.

Dimensions of a full sized and perfect specimen: length, forty millimetres: maximum height, twenty-five millimetres: thickness through the closed valves, nineteen millimetres. The maximum thickness of another specimen of the same length and height is only sixteen millimetres.

In young individuals the anterior end of the shell is regularly rounded, and the posterior area is not so much flattened down as it is in the young shell. The beaked posterior side is usually pointed at its extremity, but in some specimens there is a distinct truncation at its extreme tip.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883, extremely abundant. Upper Belly River, twenty-three miles above the mouth of the Waterton, and Scabby Butte, seven miles north of the confluence of the Belly and Old Man Rivers; R. G. McConnell, 1881. All from the St. Mary R. Series.

A very distinct species, apparently belonging to the same section of the genus as the *Corbula pyriformis* of Meek. Specimens of the latter shell from the Bear River Laramie of S. W. Wyoming, kindly for-

warded by Dr. C. A. White for comparison, are distinctly pyriform in outline as viewed from above, the closed valves being very ventricose anteriorly,—the beaks of both valves are gibbous and curved strongly inwards, while the posterior area, though tolerably well defined is small and narrow. In *C. perangulata*, on the other hand, the outline as viewed from above is ovately lanceolate, both beaks are obliquely flattened and the posterior area is large and broad. The external aspect of *C. pyriformis*, as Mr. Meek has pointed out, is like that of a *Neæra*, whereas the outside of the present species has more the look of a *Leda*.

Dr. Dawson states that the beds characterized by a great abundance of this species, together with *Ostrea glabra, var. Wyomingensis* and *Corbicula occidentalis* (or *C. cytheriformis*) occur at the very base of the Laramie, and that these deposits may even be regarded as forming a passage between that formation and the summit of the marine Cretaceous. These beds are most characteristically developed in parts of the south western portion of the district embraced by the geological map before referred to, where they frequently occur in the disturbed strata of the foot-hill region. They have been recognized as far north as a few miles west of Blackfoot Crossing on the Bow River.

Panopæa simulatrix. (N. Sp.)

Plate 2, figs. 2 and 2a.

Shell slightly inequivalve, the umbo of the right valve being a little larger and more tumid than that of the left: valves compressed at the sides, thickest on the anterior umbonal slopes and narrowing very gradually to the posterior end but more rapidly to the anterior: posterior termination gaping: lateral outline elliptic ovate, the length being fully twice the maximum height inclusive of the beaks, and the posterior side a little longer, narrower and more pointed than the anterior. Umbones broad, obtuse and depressed: beaks small, subcentral but placed a little in advance of the middle, that of the right valve curved inwards and downwards with a slight inclination forwards, that of the left valve curved inwards and a little forwards but not downwards: ligament apparently short and external.

Surface concentrically striated: inner layer of the test not nacreous: hinge teeth and muscular impressions unknown.

Length of the most perfect example collected, (the one figured) fifty-two millimetres: greatest height of the same, twenty-five mm.: thickness of the same, sixteen and a half.

The specimen from which the above description was made and which

is therefore intended as the type of the species, was collected by Mr. J. B. Tyrrell in 1884 from the south bank of Knee Hills Creek, in Township 29, Range 22, west of the 4th Meridian.

Ten imperfect and badly preserved casts of shells which are probably referable to this species, were collected by Dr. G. M. Dawson in 1881, five at Rye-Grass flat on the Old Man River, and five at the mouth of East Arrow-wood Creek, on the Bow River; all from the St. Mary River Series. Mr. R. G. McConnell collected a similar cast on the Belly River, twenty-three miles above the mouth of the Waterton, in 1881. Some of the specimens collected by Dr. Dawson and Mr. McConnell, are broader in front and shorter than the type, and in others the beaks are placed much further forwards.

In referring these shells to the genus *Panopæa* rather than to *Anodonta* or *Unio* the writer has been influenced by the following considerations: first, that the valves gape at the posterior end; secondly, that they are slightly inequivalve, and lastly, that the inner layer of the test is not nacreous. The specific name is suggested by the close resemblance that the most perfect specimen presents to a narrow form of *Mya arenaria*.

Panopæa curta. (N. Sp.)

Plate 2, fig. 3.

Shell compressed laterally, about one-fourth longer than high, and nearly equilateral; posterior end gaping. Anterior side broad and about as long as the posterior, narrowing obliquely and convexly both above and below, and obtusely subangular or somewhat pointed a little below the middle; posterior side also broad, truncated almost vertically at its extremity in the right valve, but somewhat more rounded in the left. Ventral margin broadly and regularly rounded, most prominent in the middle; superior border descending rapidly and obliquely in front of the beaks, at first nearly straight and horizontal behind them, but ultimately forming an abruptly rounded junction with the outer margin of the posterior end above; beak of the right valve very nearly central, broad and moderately prominent, incurved, with a slight inclination forward; beak of the left valve a little smaller and more depressed.

Surface marked with rather coarse and irregularly disposed concentric striæ or lines of growth. Hinge teeth and muscular impressions unknown.

Length of the most perfect specimen known, forty-eight millimetres;

maximum height of the same, thirty seven; exact thickness not ascertainable.

Forks of Devil's Pine and Three Hills Creeks, J. B. Tyrrell, 1884: two specimens.

Perhaps only a broad and short variety of the preceding species. From the same locality Mr. Tyrrell collected seven specimens of a shell which may possibly represent a form intermediate between this and *P. simulatrix*, but they are so imperfect and badly preserved that it is impossible to state to what genus they should be referred.

GASTEROPODA.

LIMNÆA TENUICOSTATA, Meek and Hayden.

Limnœa tenuicostata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 119.
Limnœa (*Acella*) *tenuicostata*, M. and H. 1860. Ib., p. 431.
Limnœa (*Pleurolimnœa*) *tenuicostata*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 534, pl. 44, figs. 13, a, b, c.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian; J. B. Tyrrell, 1884; several characteristic but not very perfect specimens.

Mr. Tyrrell states that the fossils from this locality are from beds which are probably higher in the Laramie than those from which most of the other species here described under the heading A 3 were collected, but the precise relationship of these beds with the subdivisions adopted in the more southerly portion of the district has not yet been determined.

ACELLA. (Species undeterminable.)

A few fragments of an *Acella* were collected by Dr. G. M. Dawson in 1874 and 1881 from the North or Second Branch of the Milk River, in the St. Mary R. Series.

Dr. C. A. White, to whom these specimens were sent, regards them as distinct from his *A. Haldemani*, but they are too imperfect to admit of an accurate description of their characters.

PHYSA COPEI, White.

Plate 2, figs. 4 and 4a.

Physa Copei, White, 1877. Bul. U.S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2–8, p. 85, pl. 24, figs. 4a and b.
" " 1883. Rev. Non-Marine Foss. Moll., N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

Bow River, eight miles west of Blackfoot Crossing; Gooseberry Cañon, St. Mary River, and St. Mary River, three miles north of the 49th Parallel, G. M. Dawson, 1881. Pincher Creek, crossing of Mill Creek and Fort MacLeod Trail, G. M. Dawson and R. G. McConnell, 1881, and T. C. Weston, 1883. All from the St. Mary R. series.

High River, one mile below the Forks, R. G. McConnell, 1882.

Mouth of Blind Man River, J. B. Tyrrell, 1884; from the same geological horizon and from the same beds as *Limnæa tenuicostata*.

A few specimens of a large *Physa* were collected at the above-mentioned localities, which seem to correspond very well with Dr. White's descriptions and figures of *P. Copei*, especially in the character "spire short, less than one-third the entire length," and in the fact that the "diameter of the body volution is almost equal to one half the entire length of the shell. The number of volutions in *P. Copei* is indeed stated to be about four, but Dr. White's figures show that the apex as well as the outer lip of the type of that species are very imperfect. In unbroken Canadian specimens of the shell now under consideration the number of volutions is six or seven, but the three apical whorls are exceedingly slender and fragile, and consequently may have been broken off in Dr. White's specimens, as they most frequently are in those from the Bow and Belly River district. Seven of the most perfect specimens from Pincher Creek and one example from Gooseberry Cañon were sent to Dr. White for examination, who reports upon them as follows, in a letter to the writer: "These all seem to belong to *P. Copei*. I think that if they had reached the size of my type specimens the last whorl would have been proportionately larger than your specimens present."

PHYSA COPEI, var. CANADENSIS. (Var. Nov.)

Plate 2, figs. 5, 5 b and 5 a.

Shell large, attaining to a length of fully two inches, narrowly subovate or ovately subfusiform in outline: length rather more than twice

the maximum breadth: outer whorl, as measured close to the aperture, a little longer than the spire. Volutions six or seven, the first three or four slender and increasing slowly in size, the two next, especially the last but one, increasing rapidly both in length and breadth, each being obliquely and very gently convex: suture well defined but not very deeply impressed: outer whorl moderately convex, about one-third longer than broad, and broadest a little above the middle. Aperture rather more than one half the entire length of the shell, a little more than twice as long as wide, narrowly subovate or semiovate, contracted and acutely angular above, broader and usually more rounded but in some specimens bluntly pointed below: outer lip thin and simple: columella bearing a narrow, prominent and oblique fold near its base, the fold in some specimens being bordered below with a rather deep groove: columellar callus broad and closely adherent, except at its extreme base, where it is slightly separated from the main body of the shell in such a way as to form a minute and narrow kind of umbilical chink or perforation.

Surface nearly smooth, marked only with the faint and somewhat distant lines of growth common to most species of this genus.

Length of a large and nearly perfect specimen, fifty-three millimetres: maximum breadth of the same, twenty-two mm.: length of body whorl, as measured close to the outer lip, thirty mm. In a slightly smaller specimen which shows the characters of the aperture better, the length of the aperture is twenty-five mm. and its maximum width only ten.

Pincher Creek, crossing of Mill Creek and Fort MacLeod Trail, very abundant, G. M. Dawson and R. G. McConnell, 1881, and T. C. Weston, 1883. Gooseberry Cañon, St. Mary River, frequent, G. M. Dawson, 1881: Second or North Branch of the Milk River, G. M. Dawson, 1881. All from the St. Mary R. Series.

During the past four years upwards of two hundred specimens of one or more species of *Physa*, whose relations to forms already described are extremely puzzling, have been collected by officers of the Survey in the Laramie Formation of the Canadian Northwest. Out of these specimens it is possible to select a few which have a large and long body whorl, and a very short acutely acuminate spire, and these cannot at present be distinguished from the *Physa Copei* of White.

By far the larger number, however, whose characters are more minutely described above, have a much longer spire, though it apparently never quite equals the outer whorl in length. Such specimens seem to be very nearly related to the *Bulinus disjunctus* of White, and have been doubtfully referred to that species in Dr. Dawson's report, though in *B. disjunctus* the length of the spire is said to be "a little more than

half that of the whole shell." Thirty of the best specimens of this peculiar form, from Pincher Creek and Gooseberry Cañon, have been examined by Dr. White, who writes that he "cannot satisfactorily identify them with *B. disjunctus* nor with any other published species."

Still, these comparatively long-spired forms, and those with a short spire which have already been identified with *P. Copei* are connected by so many intermediate gradations that the writer is convinced that they cannot be separated specifically, and that the former can only be regarded as a well-marked but not very constant variety of the latter. The whole of the Physas that have so far been collected from the Canadian Laramie appear to the writer to belong to one variable species. If the identification of any of them with *P. Copei* be correct, the whole must be considered as varieties of that species, and if incorrect the whole of the specimens here described and figured may be designated simply as *P. Canadensis*. By whatever name they may be called, their extreme variability suggests the idea that *Bulinus disjunctus* and *B. atavus* of White may also prove to be varietal forms of *P. Copei*.

A unusually narrow form of the variety *Canadensis* occurs at Pincher Creek, in which the whorls are so much flattened laterally that the maximum breadth of the shell is considerably less than half its entire length. Such specimens as these, one of which is represented by figure 5a of Plate 2, approach very nearly in shape to *B. atavus*, and it is worthy of note that at Pincher Creek they occur associated with undoubted examples of *Viviparus prudentius*, White, as *B. atavus* does in the valley of Crow Creek in Northern Colorado.

Judging by the figure in Pictet's "Traite de Paléontologie," and by that in Zittel's "Handbuch der Paleontologie," *P. Copei, var Canadensis* seems to be rather nearly related to the *Physa nobilis* of Michaud, from the French Lower Eocene, but the original description and figures of that species are unfortunately not accessible to the present writer.

Dr. Paul Fischer* restricts the use of the name *Bulinus*, Adanson, to a group of shells with very convex whorls and an obtuse apex, and removes that genus from the family Physidæ on account of its different odontophore. It is in accordance with this view and in spite of its close resemblance to *B. disjunctus* that the present shell is regarded as a *Physa* rather than a *Bulinus*.

* Manuel de Conchyliologie. Vol. I. p. 509. Paris, 1881.

ACROLOXUS RADIATULUS. (N. Sp.)

Plate 3, figs. 1 & 1a.

Shell depressed conical, very slightly elevated, the height being about one-fourth the maximum breadth: apex eccentric, inclined distinctly to the left and placed about half way between the centre and the posterior end: base, or margin of aperture, ovate in outline, not quite one-third longer than broad, rounded in front and somewhat pointed behind.

Surface marked by minute concentric lines of growth, which are crossed by numerous, closely disposed and almost equally minute radiating raised lines, both of which are too small to be seen without the use of a lens.

Length of the only specimen collected, five millimetres and a half: maximum breadth, four mm.: approximate height, from apex to base, about one mm.

Mouth of Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, J. B. Tyrrell, 1884. From the same geological horizon and from the same beds as *Limnæa tenuicostata*.

ACROLOXUS MINUTUS, Meek and Hayden.

Velletia minuta, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 120.
Ancylus (*Acroloxus*) *minutus*, M. & H. 1860. Ib., p. 432.
Acroloxus minutus, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 543 pl. 44, fig. 10. Illustrated also in Dr. White's Rev. Non-Marine Foss. Moll. N. Am., pl. 24, fig. 27.

North or Second Branch of the Milk River, G. M. Dawson, 1874, H. M. North American Boundary Commission. Gooseberry Cañon, St. Mary River, and Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881. Pincher Creek, T. C. Weston, 1883. One or two specimens from each locality. All from the St. Mary R. Series.

The identification of these little shells with the species named above is not altogether satisfactory, first, on account of the vagueness of Mr. Meek's definition of the characters of *A. minutus*, and secondly, because of his statement that the specimens from the upper Missouri country, decribed under that name "may possibly belong to more than one species." Some of them may perhaps be referable to *A. radiatulus*.

PATULA ANGULIFERA. (N. Sp.)

Plate 2, figs. 6, 6 a, and 6 b.

Shell sublenticular, deeply umbilicated, periphery thin, angular and rather distinctly keeled : upper side very gently convex or very obtusely conical, nearly flat, the spire being raised only a little above the outer whorl. Volutions four, the first and second rounded above, the third and fourth flattened somewhat obliquely; lower side rather more convex than the upper, narrowing obliquely and somewhat convexly to the umbilical margin: umbilicus about one-third of the entire diameter of the base, deep, conical and obtusely subangular at its margin. Aperture trapezoidal, widest at a right angle to the axis of the shell, the columellar side being nearly parallel with the lower half of the outer lip, which latter is thin and simple.

Surface marked with minute and closely arranged striæ, which cross the whorls transversely, and which are arched forwards on the upper surface.

Maximum breadth of the only specimen collected, sixteen millimetres : height or depth of the same, as measured from the apex to the umbilical margin, eight mm.

Pincher Creek, T. C. Weston, 1883; St. Mary R. Series: a nearly perfect and tolerably well-preserved specimen.

This angulated and keeled shell seems to bear somewhat the same relations to the ordinary species with a rounded periphery that the recent *Patula Cumberlandiana* of Lea does to *P. alternata.*

PATULA OBTUSATA. (N. Sp.)

Plate 2, figs. 7, 7a and 7b.

Shell depressed, subdiscoidal, very moderately convex both above and below, the height being less than one half the greatest breadth : spire obtuse, nearly flat and raised but little above the highest level of the outer whorl. Volutions four to five, rounded, slender, and rather closely embracing, so that the upper surfaces only of those of the spire are exposed to view, except perhaps in the umbilical cavity : suture distinct but not very deep: outer whorl narrowly rounded at the periphery, moderately convex and retreating obliquely to the umbilical margin below : umbilicus about one-third the diameter of the base, deep and with steep sides, but with a rounded margin. Aperture (as seen in the few specimens collected, which may not be adult shells) apparently

almost circular but shallowly emarginate on the columellar side by the encroachment of part of the last whorl but one: outer lip thin and simple.

Surface marked with fine transverse striations.

Greatest breadth of the largest specimen collected, thirteen millimetres: height of the same, five mm.; width of umbilicus of do., about four mm. and a half.

Old Man River, twelve miles below Fort MacLeod (two large specimens) and two miles above Rye-Grass flat, (five smaller ones) all collected by G. M. Dawson, in 1881, from the St. Mary R. Series. As already remarked on page 2, two specimens of this species were collected by R. G. McConnell in 1881, from the "Willow Creek Series" on the Belly River, seven miles above the mouth of the Old Man R.

There are so many points of resemblance between this species and the next that it is perhaps doubtful whether the shells described above are correctly referred to the genus *Patula*. They may be immature individuals of a new species of *Anchistoma*. In Dr. G. M. Dawson's report on the geology of the Bow and Belly River district, they are indicated under the name *Selenites*, by the present writer, on account of their supposed resemblance to the recent *Selenites concavus*, which is the *Helix concava* of Say.

ANCHISTOMA PARVULUM. (N. Sp.)

Plate 3, figs. 2, 2a & 2b.

Shell very small, subdiscoidal, nearly flat above and rather strongly convex below: volutions six, very slender, narrow and coiled on nearly the same plane, increasing very slowly in size and so closely embracing that the upper surfaces only of those of the spire are visible: first, second and third volutions about as much elevated as the outer whorl, the fourth and part of the fifth sunk to a slightly lower level: suture narrow, not very distinct: outer whorl flattened above and subangular at the periphery: umbilicus small but deep, about one-third or a little less than one-third of the entire basal diameter. Aperture exceedingly narrow and contracted, its outer margin, as viewed laterally, produced above into a small and narrowly rounded lobe next to the suture, and obliquely truncated below the middle, with an oblique constriction or narrow groove immediately behind the truncated portion. Characters of the interior of the aperture unknown.

Surface apparently almost smooth, but the surface markings are not well preserved.

Maximum breadth, four millimetres: height or depth, about two.

Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881; St. Mary River Series.

The only specimen collected is a well preserved cast of the interior, with nearly all the test preserved except that which originally formed the outer margin of the aperture. In the cast this margin appears to be unbroken, but still it is possible that the specimen may not represent a fully adult shell. The species is referred to Klein's genus *Anchistoma* in the sense in which Stoliczka and Fischer use the word, also on account of its apparent generic affinities with the three species of *Anchistoma* described by Stoliczka in the "Cretaceous Gastropoda of Southern India," though it may be a small *Polygyra*. The upper portion of the aperture of the *A. Arrialoorense* of Stoliczka seems to be singularly like that of the present species.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden.

Plate 3, fig. 3.

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.
Bulimus Nebrascensis, Meek and Hayden. Ib.
Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 553, pl. 44, figs. 8, a, b, c, d.

Rosebud River, Township 27, Range 25, west of 4th Principal Meridian, one perfect and exquisitely preserved specimen, also, Three Hills Creek, Township 30, Range 23, west of 4th Meridian, a few examples associated with *Campeloma producta* White; at both localities collected by Mr. J. B. Tyrrell in 1884.

The dimensions of the specimen from the Rosebud River, which is of average size, are as follows: length, twenty-four millimetres: maximum breadth, nine mm.: length of last whorl, as measured near the aperture, twelve mm.

Although the specimens collected by Mr. Tyrrell are nearly twice the size of Meek's types and have a slightly more produced spire, they agree so closely in every other respect with the description and figures of *T. limnæiformis* that they are believed to be only a large local variety of that species.

MELANIA WYOMINGENSIS, MEEK.

Melania (*Goniobasis?*) *Wyomingensis* Meek. 1873. Rep. U. S. Geol. Surv. for 1872, p. 516.

Melania larunda, White, 1876. Powell's Rep. Geol. Uinta Mts., p. 131.

Melania Wyomingensis, (Meek) White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 95, pl. 28, figs. 6a and b. Figured also on Pl. 26, figs. 1, 2 and 3 of Dr. White's Rev. Non-Marine Foss. N.A.

Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881: two characteristic specimens and two fragments. This species comes from the basal beds of the Laramie referred to in connection with the description of *Corbula perangulata*.

GONIOBASIS NEBRASCENSIS, Meek and Hayden.

Plate 3, figs. 4 and 4a.

Melania Nebrascensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 124.

Goniobasis Nebrascencis, M. and H. (White). 1875. Rep. Geogr. and Geol. Surv. W. of 100th Mer., Washington. p. 213, pl. 12, figs. 9a, b, c.

Goniobasis Nebrascensis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 565, pl. 43, figs. 12, a-h.

Goniobasis Nebrascensis, M and H. (White). 1883. Rev. Non Marine Moll. N. Am., p. 57, pl. 26, figs. 15 and 16.

Shell elongated, narrowly subovate, length a little more than twice the maximum breadth, spire about one-half the entire length, base imperforate. Volutions six or seven, those of the spire obliquely and very moderately convex or somewhat compressed laterally; suture not very distinct; outer whorl rather strongly convex in the middle, narrowing rapidly and unequally below. Aperture subovate, broader than long, angular above and narrowly rounded below; outer lip thin, simple, and with a shallow sinus above the middle.

Surface presenting a silky appearance to the naked eye, but, when examined with a lens, the sculpture is seen to consist of a minute and regular decussation caused by very minute and densely arranged transverse striæ, which are crossed by equally crowded and minute revolving lines.

Length of one of the most perfect specimens, twenty millimetres; maximum breadth of the same, eight millimetres; length of the outer volution, ten.

North or Second Branch of the Milk River ("nodular layer"), G. M. Dawson, 1874, H. M. North American Boundary Commission. Old Man River, two miles above Rye-Grass flat, and St. Mary River, three miles north of the 49th Parallel, G. M. Dawson, 1881. All from the St. Mary R. Series.

As the few Canadian specimens that have yet been collected seem to represent a rather peculiar variety of the species, an original description and a figure of one of the best preserved and most perfect specimens collected by Dr. Dawson is here given.

GONIOBASIS TENUICARINATA, Meek and Hayden.

Plate 3, figs. 5 and 5a.

Melania tenuicarinata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX, p. 137.
Goniobasis tenuicarinata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 566, pl. 43, figs. 14, a, b, c.

Bow River, two miles below the mouth of Jumping Pound River, G. M. Dawson, 1881; a few beautifully preserved specimens.

GONIOBASIS TENUICARINATA, Meek and Hayden, VAR.

Plate 3, figs. 6 and 6a.

Shell turreted, moderately elongated, the length being rather more than twice the maximum breadth; spire somewhat longer than the outer volution; base either imperforate or possibly with a very narrow fissure in place of the umbilicus. Volutions seven, the first, second, and third slender but rather ventricose, the three succeeding ones angulated and bearing a distinct narrow and prominent keel a little above the middle, their sides obliquely flattened above the keel and moderately convex or compressed in a direction nearly parallel to the axis below it; suture distinct. Outer whorl angulated and carinated considerably below the centre, strongly convex just below the keel, and narrowing gradually to the base. Aperture broadly subovate, pointed above and narrowly rounded below.

Sculpture consisting of numerous and very closely arranged minute revolving lines, which are too small to be visible to the naked eye, in addition to the spiral keel.

Length, twenty-one millimetres; maximum breadth, nine millimetres; length of outer volution, ten.

Two miles above Rye-Grass flat and twelve miles below Fort MacLeod on the Old Man River; also Gooseberry Cañon on the St. Mary River; G. M. Dawson, 1881. Pincher Creek, T. C. Weston, 1883. All from the St. Mary R. Series.

The specimens from the Bow River, which are here regarded as probably representing the most typical form of *G. tenuicarinata*, have convex and scarcely angulated whorls, the later ones of the spire being encircled with three or four rather distant, spiral raised lines, and the outer whorl by six or seven. Under a lens also, the surface of the volutions in this form is seen to be marked by crowded and minute transverse raised lines, at right angles to the spiral ones.

The shells from the localities indicated above seem to form a well-marked variety of *G. tenuicarinata*, which differs from the Bow River and more typical form in having the whorls always rather distinctly angulated above the middle, in the fact that the spiral raised lines are obsolete except the single raised line or minute keel upon the angle, and in the minute sculpture, which consists of exceedingly fine revolving impressed lines, instead of transverse raised striæ.

HYDROBIA.

A number of minute and slender fossil shells which appear to belong either to this or to some closely allied genus, were collected by G. M. Dawson at the North or Second Branch of the Milk River in 1874 and 1881; on the Old Man River, two miles above Rye-Grass flat, in 1881; and by Mr. T. C. Weston at Pincher Creek, in 1883; from the St. Mary R. Series. They rarely exceed three millimetres in length, and most of them are mere casts of the interior of the shell, though in some specimens the whole or part of the inner layer of the test is preserved. Some of them are considerably elongated and narrow in proportion to their length, and such specimens appear to be rather nearly related to the *Hydrobia recta* of White, though they are not quite so slender. Others again are comparatively shorter and more conical, and these are difficult to separate from the *H. Utahensis* of White and similar forms, but the whole of the specimens are too imperfectly preserved to be satisfactorily determined, and it is doubtful even how many species they represent.

CAMPELOMA PRODUCTA, White.

Campeloma (*Lioplax ?*) *producta*, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21–27.

Three Hills Creek, Township 30, Range 23, west of 4th Principal Meridian; J. B. Tyrrell, 1884: abundant.

Judging by Canadian specimens, this shell seems to the writer to be much more nearly related to some of the smooth N. American species of *Pleurocera*, such as *P. subulare*, Lea, *P. neglectum*, Anthony and others, than to the Viviparidæ.

VIVIPARUS PRUDENTIUS, White.

Viviparus prudentius, White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2–8, p. 98, pl. 28, figs. 5 a and b.
Viviparus prudentius, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 61, pl. 25, figs. 17,18.

Gooseberry Cañon, St. Mary River, G. M. Dawson, 1881, and Pincher Creek, T. C. Weston, 1883; from the St. Mary R. Series: rather common at both localities.

VIVIPARUS LEAI, Meek and Hayden.

Paludina Leai, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 121.
Vivipara Leai, Meek and Hayden. 1860. *Ib.* vol. XII., p. 185.
Viviparus Leai, Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 577, pl. 44, figs. 6, a, b, c, d.
Viviparus Leai, M. and H. White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 61, pl. 27, figs. 10–14.

Bow River, four miles west of Blackfoot crossing, abundant, and well preserved; St. Mary River, at Gooseberry Cañon, and three miles north of the 49th Parallel, common; Old Man River, two miles above Rye-Grass flat; G. M. Dawson, 1881. Belly River, twenty-three miles above the mouth of the Waterton; R. G. McConnell, 1881. Pincher Creek, T. C. Weston, 1883. All from the St. Mary R. Series.

Blind Man River, near 5th Principal Meridian, J. B. Tyrrell, 1884: from a slightly higher geological horizon than *Limnæa tenuicostata*.

VALVATA FILOSA. (N. Sp.)

Plate 3, figs. 7 and 7a.

Shell small, depressed turbinate, spire raised very little above the highest level of the outer whorl: volutions three, regularly rounded; suture distinct and deep: umbilicus rather less than one-third of the diameter of the base: aperture circular: outer lip thin and simple. Surface of the outer volutions marked by closely and regularly arranged, transverse and somewhat flexuous thread-like raised lines, which are too minute to be visible without the aid of a lens. Test very thin and fragile.

Maximum breadth, about three millimetres: height considerably less, but not ascertainable with much exactitude, all the specimens having either the upper or the under side buried in the matrix.

Pincher Creek, T. C. Weston, 1883, St. Mary R. Series: not uncommon, but with the delicate test rarely preserved.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, J. B. Tyrrell, 1884: from the same beds as *Limnæa tenuicostata*.

Some casts of a small *Valvata* from the North or Second Branch of the Milk River, which are referred to *Planorbis* or *Valvata subumbilicata* of Meek & Hayden, by Dr. G. M. Dawson, on page 131 of his "Report on the Geology and Resources of the Region in the vicinity of the 49th Parallel," are probably referable to this species.

This little shell appears to belong to a well-marked section of the genus, which has several tertiary as well as recent representatives, and which Fitzinger has proposed to separate under the name *Gyrorbis*. Its sculpture and shape are not unlike those of the *Valvata Leopoldi* of De Boissy, from the French Eocene, as figured by Pictet (Traite de Paléontologie, atlas, pl. 58, fig. 21), and Chenu (Manuel de Conchyliologie, vol. 1, fig. 2229), but the Canadian species has much the narrower umbilicus of the two.

Among recent shells *V. filosa* is very closely allied to the *V. striata* of Dr. Lewis, which is common in the Province of Quebec, and which in the writer's judgment, is quite distinct from the *V. sincera* of Say.

VALVATA BICINCTA. (N. Sp.)

Plate 3, figs. 8, 8a and 8b.

Shell depressed turbinate or subdiscoidal, spire raised very little above the highest level of the outer whorl in some specimens, its apex

sunk a little below that level in others: outer whorl bicarinated or encircled by two narrow and minute but prominent thread-like spiral keels, one of which is placed on or about the middle of the upper surface, and the other around the umbilical margin. Volutions three or three and a half, those of the spire exposed only on the upper or posterior surface, the first and earliest part of the second regularly rounded in the middle; suture distinct and deep. Outer volution flattened above, with a downward inclination, on the inner side of the keel, rounded on its outer side and at the periphery: umbilicus deep, conical and about one-third the entire basal diameter. Aperture rounded in some specimens, somewhat rhomboidal in others, possibly from vertical compression, outer lip thin and simple.

Surface marked by minute, densely crowded and flexuous, transverse raised striæ, in addition to the spiral keels, but the former are too small to be made out without the use of a lens.

Maximum breadth, five millimetres: height not ascertainable with much accuracy, but evidently much less than the breadth.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, rather abundant and associated with the preceding species. From the same geological horizon as *Limnæa tenuicostata.*

It is possible that *V. bicincta* may prove only a variety of *V. filosa*, but at present no intermediate forms have been collected.

B. FROM THE LARAMIE OF THE SOURIS RIVER DISTRICT.

(This is a northern extension of the Fort Union Laramie not at present proved to be stratigraphically continuous with the Western Laramie proper. The specimens here described from the Souris River are from localities in the immediate vicinity of the 49th Parallel near the intersection of the 103rd Meridian. See Geol. and Res. 49th Parallel, p. 86 *et seq.*, and Report of Progress Geol. Survey Can. 1879-80 p. 16 A.)

Unio priscus, Meek and Hayden.

Unio priscus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 117.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 516, pl. 43, figs. 8 a, b, c, d.

Wood End Depôt, Souris River, G. M. Dawson, 1874, H. M. North American Boundary Commission: five or six well preserved but very imperfect specimens, in which only the beaks and the anterior half of

the test is preserved. Two casts of a *Unio* collected by Dr. Dawson at Pyramid Creek, in the same year and under the same auspices, may possibly also belong to this species.

CORBULA MACTRIFORMIS, Meek and Hayden.

Corbula mactriformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 117.
Corbula (Potamomya) mactriformis, M. & H. 1860. Ib. vol. XII., p. 432.
Corbula mactriformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 528, pl. 43, figs. 7, a-f.

Wood End Depôt, Souris River, G. M. Dawson, 1874, H. M. North American Boundary Commission: several perfect valves and a few fragments, associated in the same beds with *Unio priscus*.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden.

Plate 3, figs. 3a and 3b.

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.
Bulinus Nebrascensis, Meek and Hayden. Ib.
Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p 553, pl. 44, figs. 8, a, b, c, d.

Wood End Depôt, Souris River,—and Pyramid Creek, G. M. Dawson, 1874, H. M. North American Boundary Commission. Six specimens from the first named locality and one fragment from the second.

GONIOBASIS TENUICARINATA, Meek and Hayden.

Melania tenuicarinata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil. vol. IX., p. 137.
Goniobasis tenuicarinata, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 566, pl. 43, figs. 14, a b, c.

Pyramid Creek, G. M. Dawson, 1874, H. M. North American Boundary Commission, one specimen.

CAMPELOMA PRODUCTA, White.

Campeloma (Lioplax ?) producta, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21–27.

Wood End Depôt, Souris River, abundant, and "Great Valley," about one hundred miles west of Wood End, on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission. Short Creek, Souris River, A. R. C. Selwyn, 1880.

VIVIPARUS TROCHIFORMIS, Meek and Hayden.

Paludina trochiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 122

Vivipara trochiformis, Meek and Hayden. 1860. Ib., vol. XII., p. 185.

Viviparus trochiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 580, pl. 44, figs. 2 a–e.

Souris River, four miles east of Roché Percée, and Great Valley, about one hundred miles west of Wood End Depôt, on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission.

VIVIPARUS LEAI, Meek and Hayden.

Paludina Leai, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 121.

Vivipara Leai, Meek and Hayden. 1860. Ib., vol. XII., p. 185.

Viviparus Leai, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 577, pl. 44, figs. 6, a, b, c, d.

Souris River, four miles east of Roche Percée, G. M. Dawson, 1874, H. M. North American Boundary Commission. Short Creek, Souris River, A. R. C. Selwyn, 1880.

C. FROM THE "FOX HILLS" AND "FORT PIERRE" GROUPS OF THE UPPER CRETACEOUS.

The reasons for not considering the fossils from these two formations separately are thus given in the following memorandum prepared by Dr. Dawson. "In the district embraced by the geological map of the region in the vicinity of the Bow and Belly Rivers, published in the "Report of Progress" of the Canadian Survey for 1882-84, it is generally impossible to separate the Fox Hills and Fort Pierre series. In the map referred to, these series are consequently represented by a single colour. In a few places, generally situated in the south-western part of the district, the Fox Hills Group is clearly recognizable in the form of massive beds of sandstones, which on the St. Mary's River were observed to be about eighty feet in thickness. In other parts of the region the dark-bluish or coffee-coloured shales of the typical Fort Pierre Group become interbedded with sandstones, lose their dark colour, and pass imperceptibly upwards into the base of the Laramie. This is well seen in the vicinity of Rye-Grass flat, on the Old Man River. The change from marine to fresh water conditions, in these cases, occurs in this series of transitional beds, and when the fresh water character becomes pronounced, the fossils are found to be characteristically Laramie, to the exclusion of the marine Cretaceous forms of the underlying beds. When the Fox Hills Group is represented by massive sandstones, fossils of any kind are rarely present. Most of the fossils which form the subject of the present report have been collected in the district above defined, but the remarks above made with regard to the unsatisfactory character of the stratigraphical grounds for the separation of the Fox Hills and Fort Pierre Groups are generally equally applicable to the contiguous districts to the east and north, from which a portion of the fossil mollusca were derived."

BRACHIOPODA.

LINGULA NITIDA, Meek and Hayden.

Lingula nitida, Meek and Hayden. 1861. Proc. Ac. Nat. Sc. Phil., vol. XIII., p. 443.

" Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 9, pl. 28, figs. 18a, b.

Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway T. C. Weston, 1884; abundant: Old Wives Creek, Township 10, Range 11, west of third Principal Meridian, R. G. McConnell, 1884: one specimen.

LAMELLIBRANCHIATA.

OSTREA PATINA, Meek and Hayden.

Ostrea patina, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 277.
" " " G. M. Dawson, 1875, Rep. Geol. and Res. Reg. Vicin. 49th Parallel, p. 110.
Ostrea (? Gryphæa) patina, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 16, pl. 10, figs. 2a, b—a, b, bis, and 3 e–f, also pl. 11, varieties.

White Mud River (sometimes called Frenchman's Creek) near the 49th Parallel and south of Woody Mountain, G. M. Dawson, 1874, H.M. North American Boundary Commission: abundant and well preserved.

OSTREA INORNATA, Meek and Hayden.

Ostrea inornata, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 181.
" Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 14, pl. 10, fig. 4.

St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881: one perfect and apparently typical specimen.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. 1876. (But doubtfully as of E. and S.) Rep. U.S. Geol. Surv. Terr., vol. IX., p. 510, pl. 40, figs. 1a, b, c, d. Figured also on pl. 12, figs. 2–5, of Dr. C. A. White's Rev. Non-marine Foss. Moll. N. Am., Washington, 1883.

A number of valves of a small oyster which agree perfectly with Meek's description and figures of *O. subtrigonalis* were collected by G. M. Dawson in 1881 on the banks of the Belly River at the mouth of the St. Mary River, in rocks overlying the coal and occupying a position at the base of the shales of the Fort Pierre Group. Similar specimens were collected by Dr. Dawson in 1883 at Milk River Ridge in rocks of precisely the same geological horizon. The Belly River specimens are narrowly arcuate and more or less mytiloid in outline, while their lateral margins are usually but not always minutely crenulated. The lower valve is shallow, and either free or with a small scar of attachment, while the upper valve is flat.

CHLAMYS NEBRASCENSIS, Meek & Hayden.

Pecten Nebrascensis, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 87.
Chlamys Nebrascensis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol IX., p. 25, pl. 16, figs. 6, a, b, c.

East branch of the Poplar River on the 49th Parallel (the locality where the Woody Mountain Astronomical Station was established, *vide* page 107 of Dr. Dawson's Report on the Geology and Resources of the country in the vicinity of the 49th Parallel), G. M. Dawson, 1874, H. M. North American Boundary Commission : a perfect single valve whose outer surface is buried in the matrix.

Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884 : two single valves with the test almost entirely exfoliated.

PTERIA LINGUIFORMIS, Evans and Shumard. (Sp.)

Avicula linguiformis, Evans and Shumard. 1854. Proc. Ac. Nat. Sc. Phil., vol. II., p. 163.
" " Meek. 1859. Hinds' Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 6.
Pteria linguiformis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 32, pl. 16, figs. 1, a, b, c, d.

Elbow of South Saskatchewan, Prof. H. Youle Hind, 1858, Dr. R. Bell, 1873, and Prof. Macoun, 1879. South Saskatchewan, fifteen miles west of Swift Current Creek, R. G. McConnell, 1882, and Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884; abundant.

PTERIA (OXYTOMA) NEBRASCANA, Evans and Shumard.

Avicula Nebrascana, Evans and Shumard. 1857. Trans. Ac. Sc. St. Louis, vol. I., p. 38.
" " Meek. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 7.
Pteria (Oxytoma) Nebrascana, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 34, pl. 16, figs. 3 a, b, and pl. 28, fig. 12.

"South Branch of the Saskatchewan," Prof. H. Y. Hind, 1858. South Saskatchewan opposite Swift Current Creek, R. G. McConnell, 1882.

Pteria (Pseudoptera) fibrosa, Meek and Hayden, Var.

Plate 4, fig. 1.

Avicula? fibrosa, Meek and Hayden, 1856. Proc. Ac. Nat. Sc. Phil., p. 86.
Pholadomya fibrosa, M. and H. 1856. Ib. 286.
Avicula (Pseudoptera) fibrosa, Meek. 1873. Sixth Rep. U.S. Geol. Surv. Terr., p. 489. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 36, pl. 17, figs. 17, a, b, c, d. Whitfield (as of M. and H.). Palæontology of the Black Hills of Dakota, p. 386, pl. 7, fig. 5.

Shell nearly equivalve, strongly compressed at the sides, obliquely sub-ovate and about one-third higher than long. Posterior margin sloping downwards and backwards in a broadly-convex, oblique curve from the posterior end of the hinge-line to the narrowly rounded base: anterior margin retreating obliquely backwards and downwards under the beaks, with a slightly and doubly sinuous outline in some specimens and a shallowly sigmoid one in others. Hinge-line short and straight: anterior and posterior wings quite obsolete: beaks small, anterior, terminal, curved inwards and forwards: posterior area large, broad, obliquely and sinuously flattened, bounded on each valve by a minute, narrow and moderately prominent plication, which extends from the posterior side of the beaks to the corresponding extremity of the basal margin.

Surface nearly smooth, but marked with a few, faint and distant, rounded concentric undulations. On the posterior area, too, in addition to the minute radiating fold which bounds it, there are two similar but distant radiating folds, which become obsolete towards the hinge near the outer margin of each valve, and between the innermost of these and the boundary of the area there is a short and not very deep radiating groove or narrow sinus, which also becomes obsolete towards the hinge line. Character of the interior of the valves unknown.

Length of the most perfect specimen, nineteen millimetres; height of the same, thirty-one mm.

Bow River, below Horse-Shoe Bend, G. M. Dawson, 1881: two well preserved and nearly perfect casts of the interior of the shell. These specimens differ from the typical form of *Pteria (Pseudoptera) fibrosa* in the much greater lateral compression of the valves, especially in the umbonal region, and in their nearly smooth surface. They can scarcely be considered, however, as indicating anything more than a local and rather well-marked variety of that species, of which it has been thought desirable to prepare an original description and a figure.

The distinction between *Pseudoptera*, Meek, and *Meleagrina*, Lamarck, is not very clearly defined, and it is possible and by no means improbable that the present species may be congeneric with the *Meleagrina antiqua* of the Chico group of California and with the *M. amygdaloidea* of the Middle Cretaceous of Skidegate Inlet in the Queen Charlotte Islands.

Inoceramus altus, Meek.

Inoceramus altus, Meek. 1871. Dr. Hayden's Rep. U.S. Geol. Surv. Terr., p. 302.
" " " 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 43, pl. 14, figs. 1, a, b.
" " " Whitfield (as of Meek). Pal. Black Hills Dakota, p. 391, pl. 9, fig. 11.

East Fork of the Milk River, G. M. Dawson, 1874, H.M. North American Boundary Commission: a number of well-preserved but much distorted specimens, from a boulder. Most of these agree fairly with Mr. Meek's and Prof. Whitfield's descriptions and figures of *I. altus*, but one of them is strikingly like Prof. Whitfield's figure of a shell which he regards with doubt as possibly a variety of the *I. Vanuxemi* of Hall and Meek, on pl. 7, fig. 10, of the "Palæontology of the Black Hills of Dakota."

Inoceramus Barabini, Morton.

Inoceramas Barabini, Morton. 1834. Synops. Org. Rem., p. 62, pl. 17, fig. 3 (pl. 13, fig. 11?).
Inoceramus gibbus, Tuomey. 1854. Proc. Ac. Nat. Sc. Phila., vol. VII., p. 170.
Inoceramus cuneatus, Meek and Hayden. 1860. Ib., 181.
Inoceramus Crippsii? var. *Barabini*, Morton. Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 49, pl. 13, figs. 1, a, b, c, and pl. 12. fig. 3.
Inoceramus Barabini, Whitfield. Pal. Black Hills Dakota, p. 398, pl. 7, fig. 7 and pl. 9, fig. 8.

Twelve miles east of White Mud River (or Frenchman's Creek), G. M. Dawson, 1874, H. M. North American Boundary Commission: seven specimens. Elbow of South Saskatchewan, Prof. J. Macoun, 1879: two good specimens and two imperfect ones.

INOCERAMUS SAGENSIS, var. NEBRASCENSIS, Owen.

Inoceramus Sagensis, Owen. 1852. Geol. Rep. Min., Iowa and Wiscons., p. 582, pl. 7, fig. 3.
Inoceramus Nebracensis, Owen. 1852. Ib., p. 582, pl. 8, fig. 1.
Inoceramus Sagensis, var. *Nebrascensis*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 52, pl. 13, figs. 2a, b.
Inoceramus Sagensis, Whitfield. Pal. Black Hills Dakota, p. 393,, pl. 7, fig. 12, and pl. 8, fig. 2.

St. Mary River, about ten miles from its mouth, G. M. Dawson, 1881: one rather large but imperfect specimen which closely resembles Owen's figure of the type of *I. Sagensis*. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882 and 1883: three very large specimens, two of which are upwards of a foot in length, by fully fourteen inches in height, as measured obliquely in the direction of the main axis of the valves.

In the largest individuals the concentric undulations become obsolete in the basal or anterior two-thirds of the shell, and the test, which is only about two millimetres thick near the ventral margin, is nearly smooth, and only faintly and concentrically striated on its outer surface. The outline of the largest and most perfect of the Swift Current specimens, which appear to belong to the variety *Nebrascensis*, is singularly like that of Sowerby's figure of *I. latus*, Mantell, in vol. VI., p. 159, tab. 182, fig. 1 of the Mineral Conchology.

INOCERAMUS TENUILINEATUS, Hall and Meek.

Plate 5, figs. 1 and 1 a.

Inoceramus tenuilineatus, Hall and Meek. 1854. Mem. Am. Ac. Arts and Sci., Boston, vol. VIII., p. 387, pl. 2, figs. 3a, b.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 57. pl. 12, fig. 6.
Inoceramus tenuilineatus, Whitfield. (as of H. and M.) Pal. Black Hills Dakota, p. 400, pl. 9, figs. 12, 13.

Blood Indian Creek, longitude 110° west,—also Elbow of the South Saskatchewan River, Prof. J. Macoun, 1879: two fine specimens, which belong to that form of the species in which the concentric undulations are unusually strong and well-defined, from each of these localities.

GERVILLIA RECTA, Meek and Hayden.

Gervillia recta, Meek and Hayden. 1861. Proc. Ac. Nat. Sc., Phil., vol. XIII, p. 441.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 66, pl. 29, figs. 1 a, b.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: one nearly perfect and very typical specimen, with fragments of others in the same hand specimen of rock.

GERVILLIA RECTA, var. BOREALIS. (Var. nov.)

Plate 4, figs. 2, 2 a and 2 b.

Shell large and thick, attaining to a length of fully six inches, inequivalve, the left valve being usually compressed convex and obliquely flattened posteriorly and immediateiy under the posterior wing, but rarely rather strongly convex, while the right valve is uniformly almost flat: lateral margins of the valves not distinctly tortuous.

Main body of the shell, exclusive of the posterior wing or alation, elongated and narrow, about three times as long as high, very obliquely sublanceolate or semi-lanceolate in outline, its upper boundary, under the posterior alation, being nearly straight, and its lower margin very broadly and convexly arched: posterior extremity generally subtruncated almost vertically. Including the posterior alation, the maximum height is nearly equal to one-half the entire length. Posterior wing large and long, occupying more than one-half the entire length, its posterior margin obliquely and concavely emarginate: anterior wing almost obsolete, small, angular and pointed in front. Hinge-line long and straight, between one-half and two-thirds the entire length in the largest specimens: beaks minute and inconspicuous, anterior but not quite terminal.

Surface marked with a few, irregularly disposed, concentric lines of growth. Cartilage pits apparently six, the three anterior ones separated by intervals of about equal breadth with themselves, the three posterior ones much more distantly disposed.

Muscular scars very faintly impressed and not perceptibly excavated. Posterior muscular scars very large, elongated in a direction nearly parallel with the longer axis of the valves, narrowly ovate, acutely pointed above and narrowly rounded below, their pointed extremities

placed immediately under the posterior termination of the hinge and their outer margins close to and parallel with the upper margin of the posterior ends of the valves. Anterior muscular scars about half as large as the posterior, and narrowly elongated in nearly the same direction, pointed above and below, broadly convex on their outer and straight on their inner sides, placed high up in and partly across the angles formed by the hinge-line and the anterior margins.

Belly River, west of the mouth of the St. Mary River, G. M. Dawson, 1881: and Belly River, near the mouth of the St. Mary River, R. G. McConnell, 1881: St. Mary River, near the Police Fort, T. C. Weston, 1883: South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882 and 1884. Lorne Crossing of the Red Deer River, Township 35, Range 16, west of 4th Principal Meridian: and Berry Creek, Section 31, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884. One or two more or less perfect but usually very large specimens from each of these localities.

This variety, if indeed it be sufficiently well marked to be called a variety, appears to differ chiefly from the type of the species in its much larger size and in the proportionately greater length of its posterior wing. One of the specimens collected by Mr. Tyrrell on the Red Deer River, which is five and a half inches in length, apart from the greater proportionate length of its posterior alation, is so like Meek's figure of *G. recta* that it can scarcely be separated from that species even as a variety. It is not improbable that Meek's types of *G. recta* are immature shells and that the specimens from the Canadian North-West, which are very characteristic of the Fort Pierre Group of that region, may represent merely the adult form of the species.

Modiola attenuata, Meek and Hayden.

Mytilus attenuatus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 86.
Modiola attenuata, Meek and Hayden. 1860. Ib., vol. XII., p. 427.
Volsella attenuata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 74, pl. 28, figs. 8a, b.

St. Mary River, near its confluence with the Belly River, T. C. Weston, 1883: abundant. Three miles north of Ross Coulée, near Irvine Station on the Canadian Pacific Railway, T. C. Weston, 1884.

MODIOLA (BRACHYDONTES) DICHOTOMA. (N. Sp.)

Plate 4, figs. 3 and 3a.

Shell equivalve, rather strongly convex when adult, thickest on the rounded umbonal ridge, which is moderately prominent and tolerably well defined as far as the middle of the valves, but which widens and gradually becomes obsolete towards and at the posterior end of the base: maximum thickness about equal to the height in fully grown specimens and about one-fourth less than the height in immature ones. Lateral outline somewhat variable in different specimens, the largest being subelliptical with a slightly arcuate base, while those which are not quite full-grown are narrowly subtrapezoidal; length about twice the maximum height. Anterior side narrow and extremely short, its margin retreating abruptly, obliquely, and more or less convexly downwards and inwards; posterior side considerably elongated and much broader than the anterior, broadest a little behind the middle, its superior border broadly arched in the largest specimens and faintly and obtusely subangular at the termination of the hinge line behind in smaller individuals, its basal margin shallowly arcuate or nearly straight, and its extremity narrowly rounded below the middle. Beaks small, anterior, terminal or very nearly terminal.

Surface marked by a few concentric lines of growth, and by numerous minute, rounded, radiating ribs, which curve upwards and outwards and are distinctly dichotomous on the posterior area, but which are apparently not so distinctly dichotomous below the umbonal ridge.

Dimensions of a perfect cast of the interior of the largest specimen collected: length, twenty millimetres; maximum height, ten mm.; thickness through the closed valves, seven mm. and a half. A smaller right valve with the test preserved is eleven mm. in length, and seven in its greatest height.

St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883; two casts of the interior and a perfect right valve, with most of the test preserved.

NUCULA CANCELLATA, Meek and Hayden.

Nucula cancellata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 85.

" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 102, pl. 28, figs. 13a, b, c, d, e.

St. Mary River, eleven miles above its mouth, G. M. Dawson, 1881:

one perfect and beautifully preserved specimen, with the test preserved on both valves and entirely freed from the matrix.

YOLDIA SCITULA, Meek and Hayden.

Pl. 5, fig. 2.

Nucula scitula, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 84.
Leda scitula, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Leda (*Yoldia*) *scitula*, M. and H. 1860. Ib., p. 428.
Yoldia scitula, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 110, pl. 28, fig. 9.

Twelve miles east of White Mud River, on trail to Woody Mountain, one well preserved right valve, and 49th Parallel, on the east branch of the Poplar River (the place called "Woody Mountain Astronomical Station" on page 107 of Dr. Dawson's Report on the Geology and Resources of the Country in the Vicinity of the 49th Parallel): a mould of the exterior of a left valve: both collected by G. M. Dawson in 1874, while on the staff of H.M. North American Boundary Commission.

The identification of these two specimens is not entirely satisfactory, their characters agreeing better with Meek's descriptions than with his figures of *Y. scitula*. Meek's latest statement in regard to that shell is that its posterior side is "subangular or very narrowly rounded in outline," but in the figure the posterior side is represented as subangular above. In both of the specimens collected by Dr. Dawson the posterior side is very narrowly rounded, both above and below, and there is no trace of any angularity above.

YOLDIA EVANSI, Meek and Hayden.

Nucula Evansi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 84.
Leda Evansi, Meek and Hayden. 1860. Ib., vol. XII, p. 185.
Leda (*Yoldia*) *Evansi*, Meek and Hayden. 1860. Ib., p. 429.
Yoldia Evansi, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 111, pl. 28, figs. 10, a, b, c.

South Saskatchewan, fifteen miles west of the mouth of Swift Current Creek, R. G. McConnell, 1882: a single right valve. Old Wives' Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: several imperfect and not very well preserved specimens.

LUCINA OCCIDENTALIS, Morton.

Tellina occidentalis, Morton. 1842. Jour. Ac. Nat. Sc., Phil., vol. VIII, p. 210, pl. 11, fig. 3.
Mould of *Lucina?* Owen. 1852. Rep. Geol. Surv. Wisc., Iowa and Minn., pl. 7, fig. 8.
Lucina occidentalis? Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 272. Not *Lucina occidentalis*, Reeve, 1850.
" " Meek (as of Morton). 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 134, pl. 17, figs. 4, a, b, c, d.

Bull Pound Creek, Section 3, Township 26, Range 14, west of 4th Principal Meridian, J. B. Tyrrell, 1884: ten specimens, with both valves and the test preserved. Old Wives' Creek, Township 10, Range 11, west of 4th Principal Meridian, R. G. McConnell, 1884: two small specimens which belong to the form to which Hall and Meek gave the name *L. subundata.*

The largest individuals from Bull Pound Creek are exactly like Meek's representations of *Lucina occidentalis* on plate 17, figures 4 a and 4 b, of the ninth volume of the United States Geological Survey of the Territories, but the smaller ones correspond quite as closely to his figures of *L. subundata* on the same plate. The few Lucinæ which have yet been collected from the Fort Pierre Group of the Canadian North-West, however, all clearly belong to a single species, and it is extremely probable that *L. subundata* is only the young of *L. occidentalis*, as Mr. Meek has suggested may be the case. In reference to these two nominal species and to the variety *ventricosa*, Mr. Meek remarks (on page 136 of the volume last cited), "it may be possible that all three of the types here described are merely varieties or represent different ages of the same species. Indeed, I confess that I am not altogether satisfied with the conclusion that they belong to more than one species; but having already separated them, it is perhaps better to continue this arrangement than to unite the whole under one name doubtfully."

TANCREDIA AMERICANA, Meek and Hayden.

Hettangia Americana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 274, and (1860) Ib., vol XII., p. 185.
Tancredia Americana, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 142 pl. 38, figs. 1, a, b, c, d, e, f, g, h.

Berry Creek, Section 31, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884: one adult specimen with the valves spread out on a piece of sandstone.

CYPRINA OVATA, Meek and Hayden.

Cyprina ovata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX., p. 144.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 146, pl. 129, figs. 7 a, b, c, and woodcut, fig. 8.

VARIETY ALTA. (Var. nov.) Plate 5, fig. 3.

Shorter than the typical form and broader in the direction of its height.

Belly River, near and a little west of the mouth of St. Mary River, also below Horse Shoe Bend, G. M. Dawson and R. G. McConnell, 1881; St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883: extremely abundant and well preserved at each of these localities, the prevalent form being apparently the var. *alta*.

St. Mary River, west of MacLeod Benton Trail, R. G. McConnell, 1881, mostly the *var. alta*. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: the typical form apparently most prevalent. Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884: many casts of the interior of shells of the typical form and a few of the *var. alta*.

An exceedingly abundant and characteristic species in the Canadian North-west. The specimens are often very perfect and beautifully preserved, and the variety *alta* seems more common than the type, though the two forms are usually if not invariably found associated together at each of the localities from which the species has been collected.

CORBICULA OCCIDENTALIS, Meek and Hayden.

(For the synonymy, &c., of this species see page 7).

A few imperfect and badly preserved specimens of a *Corbicula* which are apparently referable to this species were collected by Dr. G. M. Dawson in 1883, at the base of the Fort Pierre Group, at Milk River Ridge, associated with an abundance of *Ostrea subtrigonalis*, and with a fragment of a *Unio*.

PROTOCARDIA SUBQUADRATA, Evans and Shumard.

Plate 5, figs. 4, and 4 a.

Cardium subquadratum, Evans and Shumard. 1857. Trans. Ac. Nat. Sc. St. Louis, vol. 1, p. 39.

Protocardia (Leptocardia) subquadrata, Meek (as of E. and S.). 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 175, pl. 29, figs. 8a, b, c, d, e.

South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: very abundant. Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: not uncommon. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway., T. C. Weston, 1884: a number of casts of the interior of the closed valves. Four miles south of Battle River, Township 38, between Ranges 12 and 13, west of 4th Meridian, J.B. Tyrrell, 1884.

Some badly preserved, imperfect and immature specimens of a small *Protocardia* collected by G. M. Dawson on the Smoky River, in 1879, which were referred by the writer to the *P. rara* of Evans and Shumard in a provisional list of the fossils of that locality on page 124 B. of the "Report of Progress" of the Canadian Survey for 1879-80, most probably also belong to the present species.

PROTOCARDIA BOREALIS. (N. Sp.)

Plate 6, figs. 1, 1 a, 2, 2 a, and 3.

Shell of medium size for the genus, specimens varying from a little less than an inch to an inch and five-eighths in length; valves rather strongly convex, thickest just above the mid-height; lateral outline varying in different specimens from rounded subquadrangular to obliquely and broadly subovate; length slightly exceeding the maximum height. Anterior side very short, its extremity regularly rounded; posterior side rather longer than the anterior, its extremity somewhat obliquely sub-truncated above, and rather narrowly rounded at the base below. Superior border descending very abruptly in front of the beaks, nearly straight and parallel to the ventral margin behind, cardinal margin short, ventral margin nearly straight in the middle and for the greater part of its length; umbones broad, oblique, and obtusely angular behind; beaks placed in advance of the middle (in some specimens very near to the anterior margin) curved inwards and downwards with a slightly forward inclination.

Surface nearly smooth but marked with very fine and closely arranged concentric striæ, also by a few distant lines of growth, which latter are waved and toothed on the posterior area, where they are crossed by obscure, rounded, radiating ribs. These ribs, though obsolete above, are sufficiently well marked below to cause an interlocking of the margins of the valves at the posterior end of the base.

Hinge dentition unknown; anterior and posterior muscular scars nearly equal in size, the anterior broadly subovate and higher than broad, the posterior somewhat pointed both above and below; pallial line not clearly indicated.

Dimensions of an average individual: length, twenty-three millimetres; maximum height, twenty-one mm. and a-half; thickness through the closed valves, seventeen mm. A large cast of the interior of a shell, from near Ross Coulée, which is probably referable to this species, measures forty-one millimetres in length by thirty-nine in height.

St. Mary River, near its junction with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883: very abundant. St. Mary River, W. of MacLeod Benton Trail, R. G. McConnell, 1881, and South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884, associated with *P. subquadrata.*

CALLISTA (DOSINIOPSIS) DEWEYI, Meek and Hayden.

Plate 6, figs. 4, 5, and 5 a.

Cytherea Deweyi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 83.
Meretrix Deweyi, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Callista Deweyi, Meek and Hayden. 1861. Ib., vol. XIII., p. 143.
Callista (Dosiniopsis) Deweyi, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 182, pl. 17, figs. 15a, b, c, d, e.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: five specimens, some of which shew the hinge dentition well, and others the pallial sinus. Hill south of Big Plume Creek, Township 8, Range 5, west of 4th Principal Meridian, R. G. McConnell, 1883: nine unusually perfect examples of a shell which is probably only a large form of *C. Deweyi*, but which, in shape and size, approaches very closely to the *C. Owenana* of Meek and Hayden.

In the "Palæontology of the Black Hills of Dakota" (page 416) Prof. Whitfield places *C. Deweyi* among the synonyms of Morton's

Cytherea Missouriana, but with a query, and calls the latter shell *Dosinia Missouriana*. Under the circumstances it is thought best to retain Meek and Hayden's name for the Canadian specimens, first, because they are much more like Meek's figures of *C. Deweyi* than they are to either Morton's or Whitfield's figures of *Cytherea* or *Dosinia Missouriana*, and secondly, because they clearly do not belong to the genus *Dosinia*.

MACTRA (CYMBOPHORA) WARRENANA, Meek and Hayden.

Mactra Warrenana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 271.
Mactra (Cymbophora) Warrenana, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 208, pl. 30, figs. 7, a, b, c, d.

South Saskatchewan, five miles above Swift Current Creek, R. G. McConnell, 1883: two specimens. Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1883; a single left valve.

MACTRA (CYMBOPHORA) GRACILIS, Meek and Hayden.

Mactra gracilis, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.
Mactra (Cymbophora) gracilis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 209, pl. 17, figs. 18a, b.

East Branch of the Poplar River, on the 49th Parallel (the place called "Woody Mountain Astronomical Station" on page 107 of Dr. Dawson's "Report on the Geology and Resources of the country in the vicinity of the 49th Parallel"), G. M. Dawson, 1874, H.M. North American Boundary Commission: abundant and well preserved.

LIOPISTHA (CYMELLA) UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 81.
Liopistha (Cymella) undata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

St. Mary River, near its junction with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883. South Saskatchewan, opposite mouth of Swift Current Creek, R. G. McConnell, 1882: very abundant.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: abundant. Berry Creek, Township 25, Range 12, and four miles south of Battle River, Township 38, between Ranges 12 and 13, both west of 4th Meridian, J. B. Tyrrell, 1884. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884: abundant.

A very common and widely distributed species in the Upper Cretaceous rocks of the Canadian North West.

Neæra Moreauensis, Meek and Hayden.

Corbula Moreauensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 83.
Neæra Moreauensis, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX. p. 239, pl. 17, figs. 11a, b, c.
" " Whitfield (as of Meek), Pal. Black Hills, Dakota, p. 420, pl. 11, fig. 31.

Old Wives Creek, Township 10, Range 11, west of Third Principal Meridian, R. G. McConnell, 1884: two specimens.

Panopæa subovalis. (N. Sp.)

Plate 6, figs. 6 and 6 a.

Shell nearly equivalve, rather strongly convex, most prominent a little above the middle, and slightly in advance of the mid-length, obliquely compressed behind; lateral outline transversely and broadly suboval; length not quite one-third more than the maximum height; posterior termination of the valves gaping. Anterior side a little shorter than the posterior, its outer margin subangular at its junction with the superior border above, and retreating obliquely and rapidly both inwards and downwards in a broadly convex curve to the base below; posterior side abruptly contracted, its margin nearly straight above but rounding up very rapidly from the base below, its gaping termination narrow and subtruncated somewhat obliquely above the middle of the valves. Ventral margin broadly and convexly arched, rounding up rapidly at each extremity: superior border descending gradually in front of the beaks, and nearly straight behind; umbones moderately prominent; beaks placed a little in advance of the middle, apparently rather small and incurved, with a slightly forward inclination.

Surface markings of the test unknown, but the cast of the interior of the valves is marked by faint broad undulations. On a minute fragment of the test which happens to be preserved, there are indications of raised concentric striations.

Dimensions of the only specimen collected: Length, seventy-six millimetres (or about three inches); height, inclusive of the beaks, fifty-five mm.; maximum thickness through the closed valves, thirty-five mm.

Four miles south of Battle River, Township 38, between Ranges 12 and 13, west of 4th Meridian, J. B. Tyrrell, 1884: one cast of the interior of the united valves.

An apparently well marked species, characterized principally by its regularly inflated valves and its transversely broad suboval form, also by the abrupt contraction of its narrowly gaping posterior margin, and by the angularity of its anterior margin above.

Pieces of fossil wood which are completely riddled with the burrows of a species of *Teredo* or *Turnus* were collected by Mr. Tyrrell at the same locality and date as *Panopæa subovalis*. The posterior termination of each of these burrows is sphœrical in form, but as the shape and sculpture of the valves of the mollusk which made them are unknown, it is impossible to say to what species or even to what genus they should be referred.

GASTEROPODA.

HAMINEA OCCIDENTALIS, Meek and Hayden.

Bulla occidentalis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 69. (Not *B. occidentalis*, A. Adams, of earlier date.)

Bulla Nebrascensis, Meek and Hayden. 1861. Proc. Ac. Nat. Sc. Phil., vol XIII., p. 427.

Haminea occidentalis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 271, pl. 18, figs. 11a, b, and 12a, b.

Blood Indian Creek, north of the Red Deer River and twenty miles east of the Hand Hills, Prof. Macoun, 1879: one well preserved cast of the interior of the shell. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: a similar cast. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: four specimens, two of them with large portions of the test well preserved.

A cast of the interior of the shell of a very narrowly cylindrical

species of *Cylichna*, which appears to be undescribed, but which does not afford sufficient characters for a satisfactory diagnosis, was collected by Mr. T. C. Weston, in 1884, three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway.

ACTÆON ATTENUATUS, Meek and Hayden.

Actæon (Solidula?) attenuatus, Meek and Hayden. 1858. Proc. Ac. Nat. Sc. Phil. vol. X., p. 54.
Solidula attenuata, Meek and Hayden. 1860. Ib., vol. XII., pp. 185 and 424.
Actæon attenuatus, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 281, pl. 19, figs. 17a, b.

Old Wives' Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: one good specimen with the test preserved.

CINULIA CONCINNA, Meek and Hayden.

Actæon concinnus, Hall and Meek. 1854. Mem. Ac. Arts and Sc., Boston, vol. V. (N. S.), p. 390, pl. 3, fig. 4.
Avellana subglobosa, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 64.
Avellana concinna, Meek. 1859. Hind's Rep. Saskatch. and Assinib. Expl. Exped. Toronto, p. 184.
Cinulia concinna, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII, p. 425.
Cinulia (Oligoptycha) concinna, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 284, pl. 31, figs. 6 bis., a, b, c.

Twelve miles east of White Mud River (or Frenchman's Creek), G. M. Dawson, 1873-74, H.M. North American Boundary Commission.

Elbow of South Saskatchewan, Prof. J. Macoun, 1879. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884. Not uncommon at each of these localities.

This species was first collected in Canada by Prof. H. Youle Hind in 1858, at "Two Creeks, on the Assiniboine."

ANISOMYON ALVEOLUS, Meek & Hayden.

Helcion alveolus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 68.
Anisomyon alveolus, Meek and Hayden. 1860. Am. Jour. Sc. & Arts, vol. XXVIII., (2nd series), p. 35.
Anisomyon alveolus, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 292, pl. 18, figs. 4, a, b.

White Mud River (or Frenchman's Creek), near the 49th Paralle and south of Woody Mountain, G. M. Dawson, 1874, H. M. Nort American Boundary Commission: one imperfect specimen.

ANISOMYON CENTRALE, Meek.

Plate 7, figs. 1, 1 a, and 2, 2 a.

Anisomyon centrale, Meek. 1872. Rep. U. S. Geol. Surv. Terr. for 1870, p. 312.
" " White. 1876. U. S. Expl. & Surv. W. of 100th Merid., p. 194, pl. 18, fig. 8.
" " White. 1877. Hayden's U. S. Geol. & Geogr. Surv. Terr. Idaho and Wyoming, p. 303, pl. 9, figs. 1a, b, c & d.

Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: four large and well preserved casts of the interior of the shell.

No two of these specimens are alike either in shape or in surface markings, although they all agree to a certain extent in their conical form, elevated apex and in their being marked with from four to six radiating furrows. In two of these casts the apex is nearly central, but in the other two it is placed very near to the anterior end, and these latter approach rather nearly to the *A. borealis*, Morton (sp.), especially to the specimen figured under that name by Prof. Whitfield on plate 12, fig. 23 of the "Palæontology of the Black Hills of Dakota." Moreover, in each of the specimens collected by Mr. McConnell, the radiating furrows differ both in number and in their relative position. In one of the casts, too, there is a distinct and rather prominent ridge, which extends from the beaks backward to the posterior end of the base, and this is quite wanting in the other three.

In reference to Colorado specimens of *A. centrale*, Dr. C. A. White makes the following remarks, which are quite as applicable to those from Old Wives Creek. "This species seems to be at least as distinct from any of other published forms as they are from each other, but specific variation in this genus is evidently very great. Indeed, I

think one cannot examine the original types of the published species and the collections subsequently made, together with the original descriptions and illustrations given by Mr. Meek in the publications of the United States Geological Survey of the Territories, without entertaining serious doubts whether more than two or three out of the seven published species of this genus from the Cretaceous strata of the United States are well founded."

LUNATIA CONCINNA, Hall & Meek. (Sp.)

Natica concinna, Hall & Meek. 1856. Mem. Am. Ac. Arts & Sc. Boston, vol. V., p. 384, pl. 3, figs. 2a, b, c, d.
Natica Moreauensis, Meek & Hayden. 1856. Trans. Ac. Nat. Sc. Phil., vol. VIII., p. 64 & ib., p. 282.
Natica (*Lunatia*) *Moreauensis*, Meek & Hayden. 1860. Ib., vol. XII., p. 422.
Lunatia concinna, Hall & Meek. (Sp.) Meek. Rep. U. S. Geol. Terr., vol. IX., p. 314, pl. 32, figs. 11a, b, c.

Elbow of the South Saskatchewan,—also Blood Indian Creek, north of the Red Deer River and twenty miles east of the Hand Hills, Prof. J. Macoun, 1879: one good specimen from the former locality, and two remarkably well preserved and large examples from the second.

The *Natica obliquata* of Hall and Meek, specimens of which were collected by Prof. H. Youle Hind at Two Creeks, on the Assiniboine, in 1858, is probably only a variety of this species.

ANCHURA AMERICANA, Evans and Shumard. (Sp.)

Rostellaria Americana, Evans and Shumard. 1857. Trans. St. Louis Ac. Sc., vol. I., p. 42. (Not R. *Americana*, d'Orbigny, 1826.)
Aporrhais Americana, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 423.
Anchura (*Drepanocheilus*) *Americana*, Meek. 1864. Smithson. Check-List N. Am. Cret. Foss., p. 19.
" " " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 325, plate 32, figs. 8, a, b.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858. Ross Creek, near Irvine Station, on the Canadian Pacific Railway, R. G. McConnell, 1883; three specimens. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian (two or three fragmentary examples), and North Woody Mountain, on a branch of Old Wives Creek, in Township 6, Range 4, west of the same Meridian, R. G. McConnell, 1884; five fine specimens.

The specimens collected by Prof. Hind, which are in the Museum of the Survey, are extremely small, but those since obtained by Mr. McConnell are much larger, and one of them is almost adult and shows part of the expanded outer lip.

VANIKOROPSIS TUOMEYANA, Meek and Hayden. (Sp.)

Natica Tuomeyana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc.. Phil., vol. VIII. p. 270.
Naticopsis Tuomeyana, Meek and Hayden. 1860. Ib., vol. XII., p. 423.
Vanikoropsis Tuomeyana, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 332, pl. 39, figs. 2 a, b.

Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884; four or five specimens. These are not more than half the size of the type of the species figured by Meek, and are probably not full grown shells, as they have not developed the "large, strong, oblique folds or plications".....on th body volution," which are said to characterize the adult shell.

CEPHALOPODA.

BACULITES COMPRESSUS, Say.

Baculites compressus, Say. 1821. Am. Jour. Sc. & Arts, vol. II., p. 41.—Morton. 1834. Synops. Org. Rem. Cret. Gr. U. S., pl. 9, fig. 1; and Jour. Ac. Nat. Sc. Phil., vol. VIII., p. 211.—Hall and Meek. 1854. Mem. Amer. Ac. Arts & Sc., Boston, vol. V. (N. S.) p. 400, pl. 5, fig. 2 and pl. 6, figs. 8 and 9.—Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 421.—Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 400, pl. 20, figs. 3, a, b, c.

Creek twelve miles east of White Mud River (or Frenchman's Creek) and White Mud River near the 49th Parallel, also East Branch of the Poplar River, on the 49th Parallel (the place mentioned on p. 107 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the 49th Parallel" as that "where the Wood or Woody Mountain Astronomical Station was established"), G. M. Dawson, 1874, H. M. North American Boundary Commission. Elbow of South Saskatchewan, Prof. J. Macoun, 1879. Bow River, below Horse Shoe bend, and Belly River, five miles above Coal Banks, G. M. Dawson, 1881. St. Mary River, west of Mac Leod-Benton Trail, R. G. McCon-

nell, 1881,—and Belly River, twenty-two miles and a half above the mouth of the Waterton, R. G. McConnell, 1882. Milk River Ridge,—and Red Deer River, above crossing of Lord Lorne Trail, R. G. McConnell, 1882. Ross Creek, near Irvine Station, on the Canadian Pacific Railway, R. G. McConnell, 1883. Bull Pound Creek, Sections 3 and 15, Township 26, Range 14, west of 4th Principal Meridian; Battle River, Township 38, between Ranges 12 and 13; and Berry Creek, Township 25, Range 12: J. B. Tyrrell, 1884.

The specimens from these localities appear to correspond well with the published descriptions and figures of *B. compressus*, and are characterized by their strong lateral compression, by their nearly smooth surface, and by the acute primary lobes in each septum. On page 107 of his British North American Boundary Commission Report, Dr. Dawson has quoted *Baculites ovatus* as occurring also at Wood Mountain Astronomical Station, but the specimens thus identified, which are in the Museum of the Survey, seem to the writer, on the whole, to accord better with the characters of *B. compressus*, though some of them appear to be almost intermediate between that species and *B. ovatus*.

Baculites grandis, Hall & Meek.

Baculites grandis, Hall and Meek. 1854. Mem. Am. Ac. Arts & Sc., Boston, vol. V. (N. S.), p. 402, pl. 7, figs. 1 and 2; pl. 8, figs. 1 and 2; and pl. 6, fig. 10.

" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 398, pl. 33, figs. 1. a, b, c, and woodcut fig. 53.

East Fork of Milk River, in drift boulders, G. M. Dawson, 1874, H. M. North American Boundary Commission: two large specimens, the most perfect of which measures three inches and a quarter in its diameter, as measured from the siphonal to the antisiphonal side, at its largest extremity, by two inches and a half in its maximum lateral diameter.

According to Dr. Dawson,* "the valley of the East Fork of Milk River, where it crosses the Line, is wide and trough-like, with scarped banks about forty feet in height. The cliffs are composed entirely of drift deposits, and it maintains this character as far up and down as I have been able to examine it. Many fragments of Cretaceous fossils and large masses of fossiliferous ironstone, are found in the bed of the stream and in the clay banks; and so large a proportion of the drift is formed of the redistributed matter of the Cretaceous clay-shales, that it seems probable that they exist here at no very great depth. *Baculites grandis* is among the fossils, and was not elsewhere observed; there

* Rep. Geol. and Res. Reg. Vic. 49th Parallel, p. 114.

are also a few species which are probably derived from the lower beds of the Tertiary."

Specimens which appear to differ from those from the East Fork of Milk River only in being a little smaller, have since been collected at the following localities. St. Mary River, eleven miles above its mouth, G. M. Dawson, 1881; and Belly River, near the St. Mary River, R. G. McConnell, 1881. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882; and Lorne Crossing of the Red Deer River, Section 24, Township 25, Range 16, west of 4th Principal Meridian, J. B. Tyrrell, 1884. None of the specimens from these localities, however, shew the septation and hence there may be a doubt whether they are correctly referred to *B. grandis* or not, but they seem to differ from the Baculites here referred to *B. compressus* in being thicker laterally, in having the antisiphonal side distinctly flattened, and in being marked by coarse and distant transverse undulations.

Scaphites abyssinus, Morton. (Sp.)

Ammonites abyssinus, Morton. 1841. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 209 pl. 10, fig. 4.
Scaphites Mandanensis?, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 281.
Scaphites abyssinus, Meek & Hayden. 1860. Ib., vol. XII., p. 420.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 441, pl. 35, figs. 2a, b & 4.

White Mud River, about twenty miles west of the crossing of Wood Mountain and Cypress Hills trails, R. G. McConnell, 1884: one perfect, adult and well preserved specimen, which is much more like Meek's figure 2a of *S. abyssinus* on plate 35 of his "Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri country, in volume IX. of the U. S. Geological Survey of the Territories," than it is to Morton's figure of the type of that species.

Scaphites Nicolleti, Morton. (Sp.)

Ammonites Nicolletii, Morton. 1841. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 209, pl. 10, fig. 3.
" " Owen. 1852. Rep. U. S. Geol. Surv. Wiscon., Iowa and Minn., pl. 8, fig. 1.
Scaphites (Ammonites) comprimis, Owen. 1852. Ib., p. 580, pl. 7, fig. 4.
Scaphites Nicolletii, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 281.
Scaphites Nicolletii, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 435, pl. 34, figs. 4a, b, c & 2a, b.

Creek twelve miles east of White Mud River (or Frenchman's Creek),

G. M. Dawson, 1874, H. M. North American Boundary Commission: one well preserved but imperfect specimen. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: two nearly perfect specimens, which in this instance correspond better with Morton's figure of the type of his *A. Nicolletii*, than with Meek's subsequent illustrations of the same species.

Scaphites nodosus, Owen.

Scaphites (*Ammonites ?*) *nodosus*, Owen. 1852. Rep. Geol. Surv. Iowa, Wiscon. and Minn., p. 580, pl. 8, fig. 4.—Meek & Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 420.—Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX. pp. 426-430, pl. 25, figs. 1a, b, c; 2a, b, c; and fig. 4: also pl. 26, figs. 1a, b, c.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858: two imperfect and not very large specimens. Elbow of the South Saskatchewan, Prof. J. Macoun, 1879: one fine specimen which measures nearly five inches in its maximum diameter. South Saskatchewan, mouth of Swift Current Creek, R. G. McConnell, 1882: one specimen nearly as large as that collected by Prof. Macoun. West end of the Cypress Hills, R. G. McConnell, 1883: a medium sized example.

Scaphites subglobosus. (N. Sp.)

Plate 7, fig. 3, and plate 8, all the figures.

Shell strongly inflated, subglobose but narrowly and deeply umbilicated in the centre, attaining to a large size, the largest example collected, which is entirely septate, being nearly five inches in its maximum diameter, while the maximum breadth of its aperture, which is identical with the greatest lateral convexity, is three inches and a half. Volutions broadly rounded on the periphery and middle of the sides, but much more narrowly convex on their inner or umbilical sides, increasing rapidly in breadth laterally, but not so rapidly in diameter from the siphonal to the antisiphonal side,—closely involute and so deeply embracing that the whole of the inner ones are concealed, except in the largest individuals, in which a considerable portion of the last volution but one is exposed in the umbilical cavity: umbilicus about one-fourth of the entire diameter, with steep sides and an obliquely rounded and ill-defined margin. Aperture transversely reniform, nearly twice as broad as high and rather deeply emarginated by the encroachment of the preceding volution.

Surface marked by transverse and nearly straight ribs, which increase in number either by bifurcation or intercalation, especially in half grown and very young shells, so that there are often twice or perhaps three times as many on the centre of the periphery as on the umbilical margin. In specimens which measure about two inches in their greatest diameter and in still smaller ones, there is a row of distantly arranged small nodes on each side near the periphery of the outer volution and a faint tendency towards the same kind of sculpture around the umbilical margin. In the largest specimens, however, these rows of nodes are entirely obsolete. Septation, as far as it can be made out, apparently very like that of *Scaphites nodosus*.

East Branch of the Poplar River, on the 49th Parallel, (the locality where the Wood Mountain Astronomical Station was established) G. M. Dawson, 1874, H. M. North American Boundary Commission : one large but rather imperfect specimen. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884 : one large and nearly perfect specimen and several others varying from less than one inch to two inches in their greatest diameter.

The characters which are most relied upon for the separation of this species from *S. nodosus*, Owen, are the much greater size of the former and its more nearly globose form. The septation of both of these forms, indeed, appears to be much alike, and very young shells of *S. subglobosus* have a somewhat similar sculpture to *S. Conradi*, but in large individuals of the former the ribbed surface of the outer volution is entirely free from nodes.

PLACENTICERAS PLACENTA, Dekay. (Sp.)

Ammonites placenta, Dekay. 1828. Ann. N. Y. Lyc. Nat. Hist., vol. ii., p. 278, pl. 5, fig, 2 (3 by mistake).—Morton. 1829. Journ. Ac. Nat. Sc. Phil., vol. VI., p. 195 ; and Am. Journ. Sc. and Arts, vol. XVIII., pl. 2, figs. 1, 2 and 3 ; also, 1834, Synops. Org. Rem. Cret. Form. U. S., p. 36, pl. 2, figs. 1 and 2.

Placenticeras placenta, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 465, pl. 24, figs. 2a, b.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858. White Mud River, (or Frenchman's Creek) on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission : one large and characteristic fragment. Blood Indian Creek, longitude 111° west, Prof J. Macoun, 1879 : one large specimen and two or three fragments. St. Mary River, near its mouth, G. M. Dawson, 1881 : one specimen which measures upwards of seventeen inches in diameter,

and Belly River, west of St. Mary River, G. M. Dawson, 1881 : two fragments ; also, St. Mary River, west of MacLeod Benton trail, R. G. McConnell, 1881, three good examples, averaging about six inches in diameter. Lake south of Milk River, (a large fragment) and South Saskatchewan, opposite Swift Current Creek, (a large and perfect specimen fifteen inches in diameter) R. G. McConnell, 1882. Red Deer River, above crossing of Lord Lorne trail, R. G. McConnell, 1882, (one large fragment) and J. B. Tyrrell, 1884, a similar but smaller specimen.

PLACENTICERAS PLACENTA, var. INTERCALARE.

? Ammonites syrtalis, Morton. 1834. Synops. Org. Rem. Cret. Gr. U. S., p. 40, pl. 16 (14 by mistake), fig. 4.

Ammonites placenta, var. *intercalaris*, Meek & Hayden. 1860. Proc. Ac. Nat. Sc., Phil., vol. XII., p. 117.

? Ammonites Tamulicus, Blanford. M. S. S. 1862. Mem. Geol. Surv. India, vol. VI., p. 118.

? Ammonites Guadaloupæ, Stoliczka. 1865. Palæont. Indica, vol. I., p. 90, pl. 47, figs. 1 and 2, and pl. 48, fig. 1. Not *A. Guadaloupæ*, Rœmer.

Placenticeras placenta, var. *intercalare*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 468, pl. 23, figs. 1a, b, c.

St. Mary's River, near its mouth, G. M. Dawson, 1881 : a nearly perfect and exquisitely preserved specimen, about five inches and a half in diameter, with the test preserved. In this specimen the double row of small nodes or tubercles which forms the outer boundary of the periphery and the single row which encircles the umbilicus on both sides of the shell are moderately well developed, but the row on the outer half of each of the sides is almost obsolete. Berry Creek, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884 : one imperfect specimen, in which all the rows of nodes and tubercles are fully developed.

D. FROM THE BELLY RIVER SERIES.

Dr. Dawson's views on the stratigraphical position of the "Belly River Series" are fully stated in pages 118–126 C, of the Report of Progress of the Canadian Survey for 1882–83–84. It is there explained that this name has been used to designate a considerable thickness of beds which occupy a position below the shales of the Fort Pierre Group, or at least below an upper portion of these shales. The beds of the "Belly River Series" are estuarine throughout, and differ in this respect from those described as occurring below the shales of the Fort Pierre Group in the Missouri region proper. Owing to the differences between the section in the Bow and Belly region and that on the Missouri, the exact stratigraphical position of the "Belly River Series" was for a long time considered doubtful, but Dr. Dawson has, on stratigraphical grounds, become convinced that it occupies the horizon assigned to it in his report. It may be added that Mr. R. G. McConnell, who assisted Dr. Dawson in the geological work, fully concurs in this opinion.

In the course of the explorations two sets of beds were at first distinguished, and these were provisionally recognized as the "pale" and "yellow" series respectively. These have now been united under the name "Belly River Series," the first named being the upper and the second the lower part of the series. It should be stated, however, that while (according to Dr. Dawson) the evidence is indubitable and precise as to the fact of the position of the pale or upper portion of these shales, that affecting the yellow or lower beds is somewhat less definite. The bearing of all the facts is discussed in the report above cited, and need not be repeated.*

The molluscan fauna of the pale or upper beds is comparatively scanty, though vertebrate remains, which have not yet been reported on, are somewhat abundant. It is unfortunate that the rather extensive collection of mollusca made from these beds by Mr. T. C. Weston at a locality in Milk River Ridge which proved unusually rich in fossils, and which was specially revisited in 1883 for the purpose of collecting them, was subsequently lost in transit. The yellow and supposed lower beds often contain great quantities of molluscan remains, and a number of species are represented.

* In this connection it seems desirable to state that all the notes on the stratigraphical position and lithological peculiarities of the formations mentioned in the present paper were supplied by Dr. G. M. Dawson. Judging by their respective invertebrate faunæ, it would seem impracticable to separate the "Belly River Series" from the Laramie and more especially from the "Judith River Group," on purely palæontological evidence. (J. F. W.)

(1.) FROM THE PALE OR UPPER PORTION OF THE SERIES.

LAMELLIBRANCHIATA.

OSTREA GLABRA, Meek and Hayden.

(The synonymy of this species and references to the publications in which it was described will be found on page 5.)

Near Bull's Head, R. G. McConnell, 1883: a number of detached valves on a slab of limestone. Saskatchewan Coal Mines, near Medicine Hat, T. C. Weston, 1884: abundant.

OSTREA SUBTRIGONALIS, Evans and Shumard.

(For references to the publications in which this shell was described and figured, see also page 5.)

Woodworth Mine, Medicine Hat, R. G. McConnell, 1883: from the base of this portion of the series, common and associated with the preceding species.

PTERIA (OXYTOMA) NEBRASCANA, Evans and Shumard. (Sp.)

(For references to publications in which this species was described see page 31.)

Milk River Ridge, R. G. McConnell, 1882: a cast of a left valve, with a considerable portion of the test preserved.

MYTILUS SUBARCUATUS, Meek and Hayden.

Mytilus subarcuatus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil. vol. VIII., p. 276.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 69, pl. 38, figs. 2a, b.

South Saskatchewan, eight miles below the Red Deer River, R. G. McConnell, 1883: a few small but perfect specimens, the largest of which is not more than twelve millimetres or about half an inch in length.

CRENELLA (?) PARVULA. (N. Sp.)

Plate 9, fig. 1.

Shell small for the genus, (assuming it to be a *Crenella*) apparently not exceeding a quarter of an inch in length by one-third less in height, moderately inflated but very tumid in the umbonal region, lateral outline tranversely elliptic subovate, very narrow at the anterior end and increasing rapidly in breadth, or rather in height, to the posterior. Anterior side extremely small, its margin subtruncated almost vertically under the beaks: posterior side much longer and broader, its extremity regularly rounded. Beaks anterior, terminal and recurved.

Surface nearly smooth and marked only with very fine and close set concentric striæ, which are not visible without the use of a lens. Characters of the interior of the valves unknown.

Length of the largest specimen collected, six millimetres; maximum height of the same, four mm.; exact thickness through the closed valves not ascertainable with much accuracy.

Milk River Ridge, R. G. McConnell, 1882: three perfect single valves, with the test preserved on each.

It is possible that this little shell should be placed in Conrad's genus *Arcoperna** rather than in *Crenella*. If radiating striæ or costæ or a cancellate sculpture are essential characters of the latter genus, then it is clear that the present shell cannot be a *Crenella*. The only North American species to which the *C.* (?) *parvula* bears much resemblance is the *Modiola granulato-costellata* of Rœmer,† from the Texan Cretaceous, but this latter shell, as its specific name implies, has the outer surface of the valves marked with numerous, equal and granulated, radiating lines. Judging by the published figures, the *Crenella elegantula* of Meek and Hayden,‡ from the Fox Hills Group of Deer Creek and the Yellowstone River, is as broad or high anteriorly as it is posteriorly, and its surface is said to be marked with bifurcating radiating striæ.

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* Am. Journ. Conch., vol. I., p. 140, pl. 10, fig. 14.

† Die Kreidebildungen von Texas, p. 54, pl. 7, figs. 12 a, b, c.

‡ Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Invert. Cret. and Tert. Foss. U. Miss. Cy., p. 75, pl. 28, figs. 6, a, b, c

ANODONTA PROPATORIS ? White.

Plate 9, figs. 2 and 2 a.

Anodonta propatoris, White. 1877. Bull. U. S. Geol. Surv. Terr., vol. III., p. 601.
" " White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 61, pl. 24, figs. 2a, b, c and d.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 23, pl. 19, figs. 6, 7, 8 and 9.

Forty-ninth Parallel, six miles west of the first or South Branch of the Milk River, G. M. Dawson, 1874, H. M. North American Boundary Commission : one good specimen. Big Island bend, on the Belly River, G. M. Dawson, 1881 : a few badly preserved casts of the interior of the shell. Milk River Ridge, R. G. McConnell, 1882 : six casts of the interior of the united valves, with large portions of the thin test preserved. South Saskatchewan, eight miles above the mouth of the Red Deer River, R. G. McConnell, 1883 : abundant. Red Deer River, Township 21, Range 12, west of 4th Principal Meridian, R. G. McConnell, 1883 : two small casts. Near Bull's Head, R. G. McConnell, 1883 : three casts of the interior of the adult shell.

The characters of the interior of the valves are not at all clearly shewn in any of the specimens from these localities. The hinge line appears to have been thin and edentulous, but it is impossible to ascertain definitely whether the pallial line had a sinus or not.

The form and surface markings of the exterior of the shell, which is nearly all that the Canadian specimens shew, are as much like those of the so-called *Thracia ? subtortuosa* of Meek* as those of *Anodonta propatoris*, and it is not at all unlikely that some if not all of the fossils now under consideration should be referred to the former species rather than to the latter.

All the specimens collected by Dr. Dawson and Mr. McConnell prior to 1883 were at first and for a long time supposed by the writer to be conspecific with *T. subtortuosa*. This opinion, too, seemed to be confirmed by the circumstance first that their tests showed scarcely any traces of an inner nacreous layer, and secondly by the fact that at Milk River Ridge they were obtained from a series of beds which hold *Mactra alta* (which occurs with *T. subtortuosa* at the mouth of the Judith River in Montana), and such other marine types as *Pteria*

* Rep. U. S. Geol. Surv. Terr., vol. IX., p. 223, pl. 36, fig. 5.

Nebrascana, the *Crenella parvula* here described, and an undescribed gasteropod belonging apparently to the genus *Aporrhais* or *Anchura*.

On the other hand, at each of the localities at which these fossils were collected they are invariably and directly associated with numerous examples of one or more species of *Unio*, and at the South Saskatchewan and near Bull's Head with large *Physæ*. All the specimens of the present shell, too, which Mr. McConnell obtained at the South Saskatchewan in 1883, and which have most of the inner layer of the test preserved, are brilliantly nacreous, and young individuals, from more than one Canadian locality, are remarkably like Dr. White's figures of the young of *A. propatoris*.

Unio primævus, White.

Unio primævus, White. 1877. Bull. U. S. Geol. Surv. Terr., vol. III., p. 599.
" " White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 70, pl. 29, figs. 3a and b.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 14, figs. 4 and 5.

Branch of East Fork of Milk River, Township 1, Range 27, west of 3rd Principal Meridian, R. G. McConnell, 1883: one specimen with both valves, but with most of the outer layer of the test exfoliated.

Unio Danæ, Meek and Hayden.

Unio Danæ, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX, p. 145.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 517, pl. 41, figs. 3, a, b, c.

South Shore of the Belly River above Coal Banks, T. C. Weston, 1883: four specimens, which are very variable in form.

Unio consuetus. (N. Sp. ?)

Plate 9, figs. 4 and 4 a.

Shell rather large, moderately convex, (the maximum thickness through the closed valves as compared with their height being about as three to five) transversely elongated, a little more than twice as long as high, very inequilateral, the anterior side being extremely short, and the posterior much produced; superior and inferior borders very

nearly parallel for the greater part of their length. Margins of both extremities evenly rounded in some specimens, but in others the posterior end is bluntly pointed just below the middle. Superior border descending obliquely, convexly and abruptly in front of the beaks, nearly straight and horizontal, but slightly convex behind them: ventral margin also nearly straight except at the immediate extremities,—apparently never concavely arcuate near the centre; sides of the valves also never concave near the midlength below. Beaks very small, depressed, ill defined and approximated, placed very near the anterior margin but not quite terminal.

Surface marked with the usual concentric lines of growth. Hinge dentition unknown.

Dimensions of the most perfect specimens collected: length, one hundred and fifteen millimetres, or a little more than four inches and a half: height of the same, fifty-one mm. In this individual, which is a little distorted and twisted to one side, the valves are partially open, so that the exact thickness through them is difficult to ascertain, but in another specimen which appears to belong to the same species and whose valves are closed, the maximum height is fifty millimetres, and the greatest thickness of both united is about thirty.

The species attains to a still larger size than this, for a cast of the interior of the valves from another locality measures fully one hundred and thirty-five millimetres in length, by sixty-five in height.

Milk River Ridge, R. G. McConnell, 1882: one very large and nearly perfect cast of the interior of both valves. Red Deer River, Township 21, Range 12, west of 4th Principal Meridian, R. G. McConnell, 1883: one perfect specimen with the whole of the test preserved, three imperfect but well preserved specimens, and one cast of the interior.

Some casts of a large *Unio*, which are probably also referable to this species, were collected by G. M. Dawson in 1874, six miles west of the first branch of the Milk River, while attached to H. M. North American Boundary Commission; also, in 1881, on the Bow River, ten miles below Grassy Island,—and by Mr. McConnell, in 1883, on the South Saskatchewan, eight miles above the mouth of the Red Deer River.

So few perfect specimens of this shell have yet been obtained that its specific relations are by no means clear. The specific name suggested for it, which must be regarded as purely provisional, is intended to convey the idea that its characters are of a very *ordinary* kind and ones that are shared by it in common with many fossil and recent species of *Unio*. It may be only an unusually large variety of *Unio Danæ*, but appears to be proportionately broader in the direction of its height than that shell is, its ventral margin is not distinctly arcuate, if at all, and its flanks are never shallowly concave near the midlength

below. The type and only specimen known of the *Unio Albertensis* of the "Willow Creek Series," described on page 3, looks very much like an immature shell, and it is not impossible that *U. consuetus* may ultimately prove to be the adult state of that species. There is also a considerable resemblance between the only perfect specimen known of *U. consuetus* and the *U. Couesi* of Dr. C. A. White, as figured on plate 27 of his "Contributions to Palæontology," (Nos. 2–8) published at Washington in 1880, under the auspices of the U. S. Geological Survey.

SPHÆRIUM FORMOSUM? Meek and Hayden, VAR.

Plate 9, fig. 3.

Cyclas formosa, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII. p. 115.
Cyclas fragilis, Meek and Hayden. Ib.
Sphærium formosum, Meek and Hayden, 1860. Ib., vol. XII. p. 185.
" " " " " G. M. Dawson, 1875. Rep. Geol. and Res. Vic. 49th Parallel, p. 119.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 526., pl. 43, figs. 4, a, b, c.

Shell small, moderately convex, most prominent above the middle, in the umbonal region, a little longer than high; anterior side short and narrowly rounded; posterior side broader and slightly rounded or very faintly subtruncated vertically, or at nearly a right angle to the postetior end of the hinge line, at its extremity. Superior border straight and nearly parallel with the ventral margin behind the beaks,—descending abruptly, obliquely and somewhat concavely in front of them; ventral margin broadly and regularly rounded; umbones tumid, beaks obtuse, raised very little above the highest level of the hinge margin and placed slightly in advance of the middle.

Surface marked with numerous, minute, close-set and regularly disposed concentric, raised striæ, which can scarcely be seen without the aid of a lens; also by a few distant lines of growth. Hinge dentition and muscular impressions unknown.

Length of the most perfect specimens, six millimetres and a half; maximum height of the same, five mm., and a half.

Ed. Mahan's Coulée, G. M. Dawson, 1881: apparently abundant but very badly preserved. Belly River, eight miles above Coal Banks, T. C. Weston, 1883, a few single valves.

By an accidental oversight no mention was made of this little *Sphærium* in the enumeration of the fossils of the "Western Laramie"

in section A, on page 9. It, however, was first discovered on the Second or North Branch of the Milk River, in 1874, by G. M. Dawson, as stated in his British North American Boundary Report, in rocks which he has since designated as the St. Mary River Series.

It is doubtful whether this *Sphærium* should be regarded as merely a local variety of the *S. formosum*, or as a distinct species. As compared with Meek's description of *S. formosum*, the specimens collected by Dr. Dawson and Mr. Weston are not nearly so much pointed at the posterior end of the base, nor so obliquely truncated posteriorly, and the cardinal margin, in the Canadian specimens, is more nearly parallel with the ventral.

Mactra (Cymbophora) alta, Meek and Hayden.

Mactra alta, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 271.
Mactra (Cymbophora) alta, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 210, pl. 37, figs. 2, a, b.

Milk River Ridge, R. G. McConnell, 1882: five or six large single valves.

Corbula subtrigonalis, Meek and Hayden.

Corbula subtrigonalis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 116.
Corbula (Potamomya) subtrigonalis, Meek and Hayden. 1860. Ib., vol. XII., p. 432.
Corbula subtrigonalis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 529, pl. 40, figs. 3, a, b. Illustrated also on pl. 19, figs. 10–17, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am.

Peigan Creek, Township 7, Range 6. west of 4th Principal Meridian, R. G. McConnell, 1883: a small piece of rock containing a few detached valves of this species.

Corbula perundata, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 116.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530. pl. 40, figs. 4 a, b, c, d.

With the preceding, of which, as already remarked on page 9, Dr. C. A. White thinks it only a variety;—also near the U. S. Boundary line, on a branch of the east fork of the Milk River; at both places collected by R. G. McConnell in 1883.

GASTEROPODA.

PHYSA COPEI, White.

Physa Copei, White. 1877. Bul. U. S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2–8, p. 85, pl. 24, figs. 4 a and b.
" " 1883. Rev. Non-Marine Foss. Moll. N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

South Saskatchewan, eight miles above the mouth of the Red Deer River, R. G. McConnell, 1883: a few specimens with the test preserved. Near Bull's Head, same collector and date: two large casts of the interior.

Imperfect specimens of a few additional species of gasteropoda, which are either too badly preserved to be determined, or properly characterized if new, were obtained at various localities from this subdivision of the Belly River Series.

One of these is an elongated, spiral and evidently marine shell, from Milk River Ridge, which is most likely the young of a new species of *Aporrhais* or *Anchura*, but which may be a *Scalaria*. It has at least six rounded and ventricose shells with a deep suture, and its sculpture consists of strong and straight ribs, which cross the volutions transversely but somewhat obliquely, and there are no indications of any spiral or revolving markings.

A second elongated, spiral shell, which occurs in the Belly River above Coal Banks and at Milk River Ridge, may be an extreme variety of *Goniobasis tenuicarinata*, or perhaps a new species of *Spironema*. It also has about six very ventricose whorls and a deeply excavated suture, but its volutions are sub-angular above, and the sculpture of its later whorls consists of four small spiral raised ridges.

Fragments of a large *Viviparus* which is probably *V. Conradi* were collected by Mr. McConnell in 1883 on the South Saskatchewan, eight miles above the Red Deer River and on the Red Deer River, while numerous perfect opercula, which resemble those of *Viviparus* and *Campeloma* except in being smaller, thicker and apparently calcareous, were obtained by Mr. T. C. Weston in the same year from the Belly River, eight miles below Coal Banks.

(2.) From the Lower or Yellowish and Banded Portion of the Series.

LAMELLIBRANCHIATA.

Anomia micronema, Meek.

Anomia micronema, Meek. 1875. Bull. U.S. Geol. Surv. Terr., 2nd Ser., No. 1, p. 43.
" " Meek. White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2–8, p. 57, pl. 25, figs. 2, a, b, c, d. Illustrated also on pl. 12 (figs. 6–11), of Dr. White's Rev. Non-Marine Foss. N. Am. Washington, 1883.

South Saskatchewan, half a mile below the forks of the Bow and Belly Rivers, T. C. Weston, 1883: one perfect well-preserved specimen of the upper valve.

Ostrea glaba, Meek and Hayden.

(The full synonymy of this species and references to the publications in which it was described are given on page 5.)

South Saskatchewan, one mile below the mouth of the Bow River, G. M. Dawson, 1881, and T. C. Weston, 1883; also South Saskatchewan, six miles below the mouth of Bow River, and thirty-five feet above the water level, G. M. Dawson, 1881. North Bank of the Milk River, five miles below Pā-kow-kī Coulée, and south bank of Milk River, above Pā-kow-kī Coulée, forty and a hundred feet above the water level, G. M. Dawson, 1881.

Abundant and associated with *Corbula subtrigonalis and C. perundata* at each of these localities. Some of the specimens are very typical, others belong to the variety *arcuatilis*, Meek, and one from the South Saskatchewan comes very near to the *O. inornata* of Meek and Hayden from the Fort Pierre Group.

Anodonta parallela? White.

Anodonta parallela, White. 1878. Bul. U.S. Geol. Surv. Terr., vol. IV., p. 709.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 62, pl. 24, fig. 3 a.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 23, pl. 19, fig. 5.

South Saskatchewan, one mile below the mouth of Bow River, T. C. Weston, 1883: one imperfect and badly preserved specimen, whose identification with the above named species is consequently somewhat doubtful.

UNIO PRISCUS, Meek and Hayden.

Plate 10, fig. 3.

Unio priscus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 117.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 516, pl. 43, figs. 8 a, b, c, d.

Belly River, two miles above Woodpecker Island, G. M. Dawson, 1881: an imperfect but beautifully preserved right valve, which is almost certainly specifically identical with the similarly imperfect specimens from the Laramie of the Souris River District, already referred to this species on pages 26 and 27.

The "small, very regular, concentric wrinkles" on the beaks and "the two small, raised radiating lines which extend from the back part of the beaks obliquely backward and downward across the postero-dorsal region of the immediate umbones," which, according to Meek, are among the distinguishing characters of *U. priscus*, are extremely well shown in most of the specimens from the Canadian Laramie and Belly River Series. Both of these characters, however, are said to be common to *U. priscus* and to the *U. vetustus* of Meek from the Bear River Laramie, but on page 165 of the U. S. Geol. Surv. of the 40th Parallel under Prof. Clarence King (Washington, 1877), Mr. Meek states that he has "long suspected" that the latter shell "may possibly be identical" with the former.

A perfect but very immature specimen of a *Unio* collected by Mr. Weston in 1883 from the South Saskatchewan, one mile below the mouth of the Bow River, which measures only eighteen millimetres in its greatest length, and which is figured on plate 10, is possibly also referable to *U. priscus*, though it agrees quite as well with the description of *U. vetustus* and even better with the figures.

UNIO DANÆ, Meek & Hayden.

Unio Danæ, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 145.
" Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 517, pl. 41, figs. 13, a, b, c.

Belly River, north-west angle of Driftwood Bend, G. M. Dawson, 1881: abundant, typical and well preserved.

UNIO DEWEYANUS, Meek & Hayden.

Unio Deweyanus, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 145.
" Meek. 1867. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 519, pl. 41, figs. 2, a, b, c. Illustrated also on pl. 17 (figs. 4 and 5) of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am. Washington, 1883.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883 : a few rather imperfect specimens.

As already stated on page 6, Dr. C. A. White is of the opinion that *U. Deweyanus* is only a variety of *U. Dancæ*.

UNIO SUPRAGIBBOSUS. (N. Sp.)

Plate 10, fig. 1.

Shell compressed at the sides, the maximum convexity being apparently less than half the greatest height, though all the specimens so far collected are more or less crushed laterally,—rather tumid a little behind the mid-length and below the middle in some individuals, so that the outline of a section through the centre of the closed valves at a right angle to their length would be very nearly lenticular : a little longer than high, and very inequilateral : lateral outline obliquely and broadly subovate : superior border gibbous behind the beaks : posterior end of the base always somewhat pointed. Anterior side very short, its margin abruptly and more or less broadly rounded or receding obliquely and abruptly inwards and downwards from a little above the middle into the base below : posterior side much longer than the anterior, its extremity obliquely truncated above and in the middle and narrowly rounded or bluntly pointed at the base below. Superior border broadly and convexly arched behind the beaks and probably winged when quite perfect : ventral margin broadly semiovate, usually much straighter behind than in front : umbonal region not distinctly defined as such and flattened laterally ; beaks small, inconspicuous, depressed considerably below the highest level of the superior border, and placed very near the anterior end but not quite terminal.

Surface concentrically striated. Hinge dentition and muscular impressions unknown.

Dimensions of the most perfect specimen collected : maximum length, sixty millimetres : greatest height of the same, about forty-six mm. : approximate thickness through the closed valves, about twenty mm.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: six nearly perfect but somewhat distorted specimens.

The lateral outline of this shell is a little like the young examples of *Unio gonionotus* figured by Dr. C. A. White on plate 26, figs. 2 c, d, e, of his "Contributions to Palæontology," Nos. 2-8 (U.S. Geol. Surv., Washington), but the posterior and postero-basal margins of the latter species are represented as coarsely plicated and its superior border as forming a subangular junction with the posterior margin behind. The present species also seems to be nearly related to the *U. Haydeni* of Meek from the Bridger Group of Wyoming,

UNIO SENECTUS, White.

Plate 10, fig. 2.

Unio senectus, White. 1877. Bull. U.S. Geol. Surv. Terr., vol. III., p. 600.
" " " 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 69, pl. 28, figs. 1 a, b and c.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 19, figs. 1, 2.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: one specimen which measures seventy millimetres in its greatest length by forty mm. in its greatest height, and five small specimens the largest of which is thirty-six millimetres long and twenty high.

The largest individual collected at this locality seems to differ a little from the type of *U. senectus* first figured by Dr. White in being subtruncated somewhat obliquely at the posterior margin rather than regularly rounded, and some of the smaller examples (such as the one represented on plate 10) have both umbonal slopes on each valve rather distinctly defined. These slight and apparently inconstant variations from the normal form, however, are obviously not of specific importance.

CORBICULA OCCIDENTALIS, Meek and Hayden.

(References to the publications in which this species was described are given on page 7.)

North side of the Milk River, five miles below Pā-kow-kī Coulée, G. M. Dawson, 1881: a number of well-preserved and nearly perfect single

valves which are all quite empty and show the hinge dentition, muscular impressions and the small shallow subangular pallial sinus very clearly.

The specimens from this locality are slightly different in shape from those from the "Western Laramie" mentioned on page 7, but the *Corbiculæ* from the Milk River are also almost exactly intermediate in their characters between *C. occidentalis* and *C. cytheriformis*.

SPHÆRIUM FORMOSUM? Meek and Hayden, Var.

(A description of this shell, with references to the publications in which *S. formosum* was described, will be found on page 61.)

Belly River, east side of Driftwood Bend, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. A few single valves from each of these localities.

CORBULA SUBTRIGONALIS, Meek and Hayden.

Corbula subtrigonalis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII. p. 116.

Corbula (*Potamomya*) *subtrigonalis*, Meek and Hayden. 1860. Ib., vol. XII., p. 432.

Corbula subtrigonalis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 529, pl. 40, figs. 3, a, b.

" " White (as of Meek). 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8. p. 80, pl. 25, figs. 6, a, b, c, d, e.

" " White. 1883. Rev. Non-Marine Foss. N. Am., p. 36, pl. 19, figs. 11–15.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881. North side of Milk River, five miles below Pā-kow-kī Coulée, and south side of Milk River, one mile above the mouth of Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881.

South side of the Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Abundant at each of these localities.

CORBULA PERUNDATA, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 116.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4, a, b, c, d.

Creek "about fourteen miles north-eastward from the most eastern of the Three Buttes," G. M. Dawson, 1874; very abundant: see page 122 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the Forty-ninth Parallel. Abundant also at all the localities at which *C. subtrigonalis* has yet been collected at this horizon in the "Belly River Series." As already stated on page 9, Dr. C. A. White thinks that *C. perundata* is not specifically distinct from *C. subtrigonalis*.

GASTEROPODA.

RHYTOPHORUS (?) GLABER. (N. Sp.)

Plate 10, figs. 4 and 4*a*, *b*, *c*.

Shell (when adult or nearly adult) ovately subfusiform, its length being about twice its maximum breadth: spire conical, moderately elevated: axis and base imperforate. Volutions about six, increasing rapidly in size, those of the spire obliquely compressed at the sides, the one next to the body whorl being moderately convex and the earlier ones much less so: suture lightly impressed. Body whorl large and long, though its length is rarely or never quite twice as great as its maximum breadth, obliquely compressed next to the suture, most prominent and somewhat shouldered a little above the middle, below which it narrows gradually into the more or less pointed or very narrowly rounded base. Aperture elongated and narrow, pointed both above and below, but most acutely so above: columella bearing at least one fold, which is prominent, oblique and situated at a short distance from the base: outer lip thin and apparently simple.

Surface polished, nearly smooth, marked only by minute and parallel lines of growth, which are faintly, minutely and shallowly curved backwards immediately next to the suture. Test rather thin.

Length of an average sized adult specimen, twenty-nine millimetres: maximum breadth of the same, fifteen mm.: length of the body whorl, twenty.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South side of the Milk River, one mile above Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Apparently common at each of these localities.

At Driftwood Bend a number of specimens were collected which appear to be very young or half grown shells of this species. These differ from adult or nearly adult examples in being narrowly fusiform, with an attenuated and extremely slender spire not unlike that of an *Acella*. One of these, which is figured on plate 10, fig. 4*c*, and which measures about ten millimetres in length, has as many as seven volutions, the first three of which are exceedingly slender, fragile and apparently non-persistent. The body whorl also of these half grown shells is often concavely but shallowly constricted next to the suture.

This shell is very doubtfully and only provisionally referred to Meek's genus *Rhytophorus*. It differs materially from the two described and typical species (the *R. priscus* of Meek and the *R. Meeki* of White) in the total absence of the "small, oblique, short folds around the top of the somewhat shouldered whorls" which suggested the generic name and which may or may not be an essential character. According to Meek* "a slight curve in these little folds or costæ indicates the presence of a faint sinus in the lip near the suture, somewhat as in *Sehizostoma*, Lea, but much less deeply defined," and the type species is said to have "one rather strong oblique fold" on the columella below, "and a much smaller less oblique one about half way up the aperture." In the present species there is a similar slight curve in the lines of growth next to the suture, and a correspondingly oblique fold in the columella below, but the aperture of all the specimens is so much filled up with the matrix that it is at present impossible to ascertain whether there was a second fold or not, without great risk of injury to the specimens. It may be that the present shell is more nearly related to the South American fresh water genus *Chilina* than it is to *Rhytophorus*.

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*U. S. Geol. Expl. 40th Parallel under Prof. Clarence King, vol. IV., p. 175.

PLANORBIS PAUCIVOLVIS. (N. Sp.)

Plate 10, fig. 5.

Shell very small, discoidal, thin, nearly flat or slightly concave on one side and apparently somewhat more convex near the circumference and depressed in the centre on the other. Volutions four, slender and increasing very slowly in size, their dorso-ventral diameter being not much greater than their breadth from side to side,—closely coiled but not very deeply embracing, so that the greater part of all the inner whorls is exposed to view, at any rate on the left or flattened side. Body whorl angulated at the junction of its left or flattened side with the periphery.

Surface markings unknown, the outer layer of the test being exfoliated in the only perfect specimen collected.

Maximum diameter of the largest specimen, about two millimetres and a half: greatest breadth of the same, approximately, three-quarters of a millimetre.

Belly River, near its junction with the Bow River, G. M. Dawson, 1881: two small and very badly preserved specimens. South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: one apparently adult and nearly perfect specimen and a smaller one.

The only perfect and tolerably well preserved example of this shell that has yet been obtained has most of the right side buried in the matrix.

PHYSA COPEI, White.

Physa Copei, White. 1877. Bul. U. S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U.S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 85, pl. 24, figs. 4a and b.
" " 1883. Rev. Non-Marine Foss. Moll. N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

Belly River, near its junction with the Bow River, G. M. Dawson, 1881: one very small specimen. South Saskatchewan, six miles below the mouth of the Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: an embryonic example not quite three millimetres in length. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: a full grown individual, more than an inch and a half long.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.

Bulimus Nebrascensis, Meek and Hayden. Ib.

Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 553, pl. 44, figs. 8, a, b, c, d.

South Saskatchewan, six miles above the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: one nearly perfect specimen with the test preserved, and twelve casts of the interior of the shell.

The specimens from the Western and Souris River Laramie which have been referred to *T. limnæiformis* on pages 20 and 27 have sometimes as many as seven volutions rather than "from five to six," though in other respects they agree very well with Meek's description of that species, especially in their polished surface which is said to be marked only "by very fine, nearly obsolete lines of growth," in their moderately elevated spire which is represented as "a little obtuse at the immediate apex," and in the fact that their apertures and spires are nearly equal in length.

Premising that *Thaumastus* (Albers) is only a subgenus of *Bulimulus* (Leach) it is also to be noticed that the spires of such specimens as those figured on plate 3, whose nuclear whorls are exquisitely preserved, are much more like those of many recent species of *Bulimulus* from the West Indies and South America, when examined under a lens, than they are like those of any of the living species of *Goniobasis*.

Dr. C. A. White, to whom the originals of figures 3, 3a and 3b on plate 3 were submitted, was at one time inclined to think that they should possibly be regarded as a variety of the *Goniobasis invenusta* of Meek and Hayden, but if that view be correct, then *G. invenusta*, as suspected by Meek, can scarcely be a true *Goniobasis* and probably not even a fresh water shell. It may be that *T. limnæiformis*, *G. invenusta* and *Limnæa compactilis*, Meek, are more closely allied, both generically and specifically, than their names would lead the student to suppose.

The specimens collected by Dr. Dawson from the Belly River Series on the South Saskatchewan evidently belong to the same species as those from the Western and Souris River Laramie, though those from the first mentioned locality are a little larger and their spires are rather more produced in proportion to the entire length of the shell.

VELATELLA BAPTISTA, White.

Velatella baptista, White. 1878. Bull. U. S. Geol. Surv. Terr., vol. IV., p. 715.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 89, pl. 29, figs. 6 a, and b.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 52, pl. 23, figs. 16–20.

Coulée "about fourteen miles north-eastward from the most eastern of the Three Buttes," near the Forty-ninth Parallel, G. M. Dawson, 1874, H.M. North American Boundary Commission. The place mentioned on page 122 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the Forty-ninth Parallel," &c.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South Saskatchewan six miles below the mouth of the Bow River, G. M. Dawson, 1881. South side of Milk River, one mile above the mouth of Pā-kow-kī Coulée, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Apparently common at each of these localities.

Some of the specimens correspond almost exactly with Dr. White's descriptions and figures of the type of *V. baptista*, though the callus on the columellar side and the outer lip seem to be thickened to an unusual degree, while other individuals can scarcely be distinguished from the very nearly related *Velatella patelliformis* of Meek.

MELANIA ? INSCULPTA, Meek.

Plate 10, fig. 6.

Melania ? insculpta, Meek. 1873. Rep. U. S. Geol. Surv., p. 515.
Goniobasis insculpta, G. M. Dawson, as of Meek. 1875. Rep. Geol. and Res. reg. vic. Forty-ninth Parallel, p. 122.
Melania ? insculpta, Meek. White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 94, pl. 20, fig. 4 a.
Melania insculpta, White. (as of Meek) 1883. Rev. Non-Marine Foss. Moll. N Am., p. 54, pl. 26, figs. 4 and 5.

Coulée "about fourteen miles north-eastward from the most eastern of the Three Buttes" and near the Forty-ninth Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commisson : four specimens.

South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881; two fine

examples, one of which is nearly perfect, and fully an inch and a half in length. North side of Milk River, five miles below Pā-kow-kī Coulée, —and south side of Milk River, one mile above the mouth of Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881 : several specimens from each of these localities.

Dr. C. A. White's figures of this species, which are the only ones yet published, are taken from imperfect specimens, and do not give quite as clear an idea of its characters as Mr. Meek's original description does. The specimen from the South Saskatchewan represented on plate 10, is nearly perfect and has nine volutions preserved.

GONIOBASIS SUBTORTUOSA, Meek and Hayden.

Plate 10, fig. 7.

Melania subtortuosa, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 136.

Goniobasis ? subtortuosa, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 569, figs. 75 and 76 in text and pl. 42 figs. 17, a, b.

" " White (as of Meek). 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 94.

" " White (as of Meek). 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 57, pl. 27, fig. 34.

Shell elongate conical, the length being about twice as great as the maximum breadth, the apical portion rather slender: volutions six or seven, increasing somewhat gradually in size, those of the spire prominent, angulated and bearing a small but distinct spiral keel a little below the middle of their exposed surfaces, this keel being bordered beneath by a narrow groove which is well defined on the last whorl of the spire but which becomes less distinct on the body-whorl: suture deep in consequence of the prominence and angularity of the volutions. Body-whorl very little less than one half the entire length, and a little broader than long, angulated and distinctly keeled just above the middle, obliquely flattened between the suture and the keel and strongly convex at the base: axis imperforate or very nearly so. Aperture rhombic subovate, pointed above and narrowly rounded below.

Surface marked with close-set, regularly disposed and somewhat flexuous striations which cross the whorls transversely, but with no revolving markings other than the spiral keel, except one or two very faint and distant lines on the body-whorl near the keel.

Length of the most perfect specimen collected, eighteen millimetres :

maximum breadth of the same, as measured across the centre of the body-whorl, ten mm.: length or height of body-whorl, not quite nine mm.

Belly River, two miles above Woodpecker Island,—and Belly River, east side of Driftwood Bend, G. M. Dawson, 1881. South Saskatchewan, one mile above the mouth of the Bow River, T. C. Weston, 1883. Apparently not unfrequent at each of these localities.

The description given above and the figure on plate 10 are both taken from an unusually perfect and well preserved specimen collected by Mr. Weston on the South Saskatchewan. In Mr. Meek's diagnosis of the characters of *G. subtortuosa* the number of volutions is said to be "about five" and his measurements and figures of that shell do not correspond at all well with the proportions and contour of the Canadian specimens. Dr. C. A. White, however, who has kindly compared the fossil obtained by Mr. Weston with the specimen described and figured by Meek, informs the writer that the former is "without doubt the *G.* (?) *subtortuosa* of Meek and Hayden," and adds that Meek's type of that species is "imperfect and partially crushed," and that it would not warrant a definite determination of the number of whorls.

The only species with which the present shell is at all likely to be confounded is the *Cassiopella turricula* of White, but the latter is stated to have nine or ten volutions, its base is said to be distinctly umbilicated, and the spiral keel which encircles its spire is represented as placed considerably below the middle of each whorl.

It is difficult to see how *G. subtortuosa* can be separated generically from such living species as the *G. acutocarinata* of Lea and other forms belonging to that section of the genus.

Hydrobia subcylindracea. (N. Sp.)

Plate 10, fig. 8.

Shell very small, narrowly elliptic-subovate, rather slender, the length being about one-third greater than the maximum breadth: volutions five, those of the spire very gently convex, their sides being compressed somewhat obliquely; last whorl of the spire nearly or quite equal to the body whorl in breadth or convexity: suture distinct: spire about twice as long as the aperture and rather obtuse at its immediate apex. Body-whorl comparatively narrow, subcylindrical above and imperforate at the base: aperture obliquely subovate, somewhat pointed above: outer lip simple and rather thin.

Surface smooth and polished.

Greatest length, three millimetres and a half: maximum breadth or convexity, a little over one mm.: length (or height) of body-whorl, about one mm.

Belly River, east side of Driftwood Bend, G. M. Dawson, 1881: one nearly perfect specimen with the test preserved. North side of Milk River, five miles below Pā-kow-kī Coulée, G. M. Dawson, 1881: a cast of the interior of the shell.

This little species appears to be much slenderer than any of the North American fossils which have been referred to the genus *Hydrobia* with the exception of the *H. recta* of White,* and the latter shell has a totally different outline to the present one, is said to attain to a length of eighteen millimetres and to have apparently twelve or more volutions.

Viviparus Conradi, Meek and Hayden.

Paludina Conradi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 122.

" " Meek and Hayden. 1860. Ib., vol. XII, p. 185.

" " Meek, 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 579, pl. 42, figs. 15, a, b, c, d.

" " White. (as of M. and H.) 1880. U. S. Geol. Surv. Contr. to Pal., Nos. 2-8, p. 100.

" " White (as of M. and H.). 1883. Rev. Non-Marine Foss. N. Am., p. 61, pl. 24, figs. 4, 5 and 6.

South Saskatchewan, six miles below the mouth of the Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: large and abundant. South side of Milk River, one mile above the mouth of Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881: one specimen. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: not unfrequent.

* Described on p. 132 of Powell's Rep. on the Geology o.' the Uinta Mountains, and figured on plate 27, fig. 38, of Dr. C. A. White's Review of the Non-Marine Fossil Mollusca of N. America.

CAMPELOMA MULTILINEATA, Meek & Hayden.

Paludina multilineata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 120.

Vivipara multilineata, Meek and Hayden. 1860. Ib., vol. XII, p. 85.

Vivipara Nebrascencis, Meek and Hayden. 1860. Ib., p. 430.

Melantho multilineatus, Meek. 1863. In Prof. Gill's paper on the *Viviparidæ*, Proc. Ac. Nat. Sc. Phil., vol. XV, p. 7.

Campeloma multilineata, Meek. 1866. In Conrad's Smithsonian Eocene List.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 586, pl. 44, figs. 1, a, b.

" " White. (as of M. & H.) 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 101, pl. 28, figs. 4a, b.

" " White. (as of M. & H.) Rev. Non-Marine, Foss. Moll. N. Am., p. 63, pl. 27, figs. 1–7.

Belly River, east side of Driftwood Bend,—and South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level; G. M. Dawson, 1881: a few more or less perfect specimens from each of these localities. North side of Milk River, five miles below Pā-kow-kī Coulée, G. M. Dawson, 1881: two well preserved examples.

Some of the specimens from the Belly River show the "slight angularity at the distal side of the larger volutions" indicated in Dr. White's latest figures of the species and his explanations thereof, but those from the South Saskatchewan are more like the type originally figured by Meek and some are very near in their character to *C. vetula*, which, however, Meek thought might be a mere variety of *C. multilineata*.

CAMPELOMA PRODUCTA, White.

Campeloma (*Lioplax*?) *producta*, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21–27.

South Saskatchewan, one mile below the mouth of Bow River, T. C. Weston, 1883: abundant.

From the collections made so far it would appear that *Ostrea glabra* and *O. subtrigonalis*, *Unio Dancæ*, *U. senectus* and *U. priscus*, *Corbicula occidentalis*, *Sphærium formosum?* var., *Physa Copei*, *Thaumastus limnæiformis*, *Campeloma producta* (and possibly *Corbula perundata*) are common to the Canadian Laramie and Belly River Series.

E. FROM THE "LOWER DARK SHALES" OF DR. DAWSON'S REPORT.

These are obviously Cretaceous but their exact horizon in the upper division of that formation has not yet been ascertained with much certainty.

Of the eleven species of fossils which have so far been collected from them, seven or eight seem to be identical with forms that are elsewhere regarded as characteristic of the Fort Pierre or Fox Hills Group, but the presence in these shales of *Scaphites Warreni*, var. *Wyomingensis*, and possibly of *Ostrea congesta*, may indicate that they occupy a slightly lower position in the series.

Dr. Dawson states* that on the Milk River, at the mouth of Pā-kow-kī Coulée these shales undoubtedly and directly underlie the yellowish beds of the Belly River Series.

LAMELLIBRANCHIATA.

OSTREA CONGESTA, Conrad.

Ostrea congesta, Conrad. 1843. Nicollet's Rep. of Expl. in the Northwest, p. 167.
" " Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. VIII. (n. s.), p. 405.
" " Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 286.
" " Hall. 1856. Pacific R. R. Reports, vol. III., p. 100, pl. 1, fig. 11.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 13, pl. 9, figs. 1, a, b, c, d, e, f.

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: a few exfoliated and badly preserved valves on two small slabs of limestone.

West flank of West Butte, Montana, in the Sweet Grass Hills and close to the international boundary line, G. M. Dawson, 1881: one perfect under valve, attached by its whole lower surface to a fragment of the outer layer of the test of a large *Inoceramus*.

These specimens are for the most part too imperfect to be identified with much certainty, though they agree very well with Meek's descrip-

*Geol. and Nat. Hist. Surv. Canada, Rep. Progress, 1882-83-84,—Report on the Region in the Vicinity of the Bow and Belly Rivers, N. W. T., p. 117c.

tion of *O. congesta*, and appear to be essentially similar to the fossils from the Pembina Escarpment which Dr. Dawson has referred to that species on page 79 of his British North American Boundary Commission Report.

Pteria (Oxytoma) Nebrascana, Evans and Shumard.

Avicula Nebrascana, Evans and Shumard. 1857. Trans. Ac. Sc. St. Louis, vol. I. p. 38.
" " Meek. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 7.
Pteria (*Oxytoma*) *Nebrascana*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 34, pl. 16, figs. 3 a, b, and pl. 28, fig. 11.

Rocky Spring Ridge, near MacLeod Benton Trail; Milk River, about three miles west of crossing of MacLeod Benton Trail; and west flank of West Butte, Montana, in the Sweet Grass Hills, near to the international boundary line; G. M. Dawson, 1881: a few recognizable specimens from each of these localities.

Nucula cancellata, Meek and Hayden.

Nucula cancellata, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 85.
" " Meek. 1876. Rep. Geol. Surv. Terr., vol. IX, p. 102, pl. 28, figs 13 a, b, c, d, e.

Milk River, at the mouth of Pā-kow-kī Coulée, and Milk River, four miles east of the crossing of MacLeod Benton Trail, G. M. Dawson, 1881: apparently common at both of these places. The specimens are precisely similar both in shape and sculpture to the beautiful fossil mentioned on pages 37-38.

Mactra (Cymbophora) gracilis, Meek and Hayden.

Mactra gracilis, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.
Mactra (*Cymbophora*) *gracilis*, Meek. 1876. Rep. U. S. Geol. Surv. Terr IX, p. 209, pl. 17, figs. 18, a, b.

Milk River, at the mouth of Pā-kow-kī Coulée, G. M. Dawson, 1881: one very imperfect specimen with only small fragments of the test preserved.

LIOPISTHA (CYMELLA) UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 81.
Liopistha (*Cymella*) *undata*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

Milk River, four miles east of MacLeod Benton Trail, G. M. Dawson, 1881: five well characterized specimens.

CORBULA PERUNDATA? Meek and Hayden:

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 116.
" " Meek. 1876. Rev. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4 a, b, c, d. Figured also on plate 19, figs. 16 and 17, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am.

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: a badly preserved right valve which is somewhat doubtfully referred to this species.

CORBULAMELLA GREGARIA, Meek & Hayden.

Corbula? yregaria, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 84.
Corbulamella gregaria, Meek & Hayden. 1857. Ib., vol. IX., p. 143.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 247, pl. 17, figs. 13, a, b, c, d.

West flank of West Butte, Montana, in the Sweet Grass Hills, near the international boundary line, G. M. Dawson, 1881: a number of perfect specimens crowded together in a small hand specimen of rock. It is only upon the weathered outward surface of the rock, however, that the outlines of the united valves can be clearly made out, and the characters of the interior of the latter are entirely unknown.

GASTEROPODA.

ENTALIS PAUPERCULA, Meek and Hayden.

Dentalium pauperculum, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 178.

Entalis? paupercula, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 269, pl. 18, fig. 14.

Milk River, at the mouth of Pā-kow-kī Coulée, G. M. Dawson, 1881: one specimen.

Since the pages in which the fossils of the Fox Hills and Fort Pierre Groups are enumerated were printed, a few specimens of a smooth *Dentalium* which is probably also referable to *Entalis paupercula* were obtained from rocks which represent one or other of these horizons, by breaking up small pieces of limestone collected by R. G. McConnell in 1884 at Old Wives Creek, Township 10, Range 11, west of the 3rd Principal Meridian.

PYRIFUSUS NEWBERRYI, Meek and Hayden.

Fusus Newberryi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 66.

Fusus (*Pyrifusus?*) *Newberryi*, Meek and Hayden. *Ib.*, vol. XII., p. 421.

Pyrifusus (*Neptunella*) *Newberryi*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 346, pl. 31, figs. 6, a, b, c, d, e, f.

West flank of West Butte, Montana, in the Sweet Grass Hills, and near the Forty-ninth Parallel, G. M. Dawson, 1874, (H. M. North American Boundary Commission) and 1881: one adult but not very well preserved specimen and two or three immature ones.

CEPHALOPODA.

BACULITES ASPER, Morton.

Baculites asper, Morton. 1834. Synopsis Org. Rem. Cret. Gr. U. S., p. 43, pl. 1, figs. 12 and 13; and pl. 13, fig. 2. Gabb. 1860. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 394, pl. 3, fig. 4.

Baculites asperoides, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 421 (without description).

Baculites asper, Morton? Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 404, pl. 39, figs. 10 a, d (not b, c).

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881; apparently rather abundant. West flank of West Butte, Montana, but close to the Forty-ninth Parallel, G. M. Dawson, 1881.

These fossils evidently belong to the same species as those from Montana which Mr. Meek referred doubtfully to the *B. asper* of Morton. The most perfect of the specimens collected by Dr. Dawson is slender, with an ovate section, and measures about five inches and a half in length. It tapers very gradually and, as Mr. Meek observes, "is ornamented on each side, near the antisiphonal margin, both on the septate and non-septate portions, by a row of rather distantly separated, node-like prominences, that show the faintest perceivable tendency to extend obliquely forward and toward the siphonal side, as undulations, parallel to the lines of growth."

SCAPHITES WARRENI, Meek and Hayden.

Scaphites Warreni. Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 417; and *Ib.*, p. 420.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 420, pl. 6, fig. 5, and wood cuts, figs. 61, 62 and 63 on p. 421.

West flank of West Butte, Montana, near the Forty-ninth Parallel, G. M. Dawson, 1881: abundant but usually imperfect and badly preserved. One of the specimens from this locality, however, is nearly perfect and corresponds almost perfectly with Meek's figures of the variety *Wyomingensis*, and two others although immature are well preserved and very little broken. Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: four specimens.

F. EXACT GEOLOGICAL HORIZON UNCERTAIN.

"The species included under this general title are from several localities in the Foot-Hills and Rocky Mountains where the beds are much disturbed, and as the sections have not yet been worked out in detail there is no satisfactory stratigraphical evidence as to the positions which these deposits occupy in the series." G. M. Dawson. With the exception of the first-named, which is possibly from the Laramie Formation, the whole of the species are undoubtedly Cretaceous.

LAMELLIBRANCHIATA.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. 1876. (But doubtfully as of E. and S.) Rep. U. S. Geol. Surv. Terr., vol. IX., p. 510, pl. 40, figs. 1, a, b, c, d. Figured also on pl. 12, figs. 2–5, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am., Washington, 1883.

Middle Fork of the Old Man River, about two miles above the mouth of the North Fork, G. M. Dawson, 1883: a number of specimens of the shell of a small oyster which appear to be referable to this species.

These shells are not quite as typical forms of *O. subtrigonalis* as those from the Belly River indicated under that name on page 30, and some have very much the appearance of small examples of *Ostrea glabra*, especially of the variety *arcuatilis*, Meek. It may be that both species are represented at the locality first mentioned.

OSTREA CONGESTA, Conrad.

Ostrea congesta, Conrad. 1843. Nicollet's Rep. of Expl. in the Northwest, p. 167.
" " Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. VIII. (n. s.), p. 405.
" " Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 286.
" " Hall. 1856. Pacific R. R. Reports, vol. III., p. 100, pl. 1, fig. 11.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 13, pl. 9, figs. 1, a, b, c, d, e, f.

Waterton River, a few miles below the lake, G. M. Dawson, 1881: about half a dozen badly preserved specimens.

PINNA LAKESII, White.

Pinna lakesii, White. 1879. Rep. U. S. Geol. Surv. Terr. for 1877, p. 181.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 17, pl. 11, figs. 1a and b.

South branch of the South Fork of the Old Man River, G. M. Dawson, 1883: one very well preserved but not quite perfect cast of the interior of the closed valves.

VOLVICERAMUS EXOGYROIDES, Meek and Hayden. (Sp.)

Inoceramus exogyroides, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 26.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 46, pl. 5, figs. 3, a, b, c.

South branch of Drywood Fork, Waterton River, G. M. Dawson, 1881: a cast of the interior of a rather small specimen of the left or convex valve (the only valve known), with large portions of the somewhat thick test preserved. Entrance to North Kootanie Pass (from shales), G. M. Dawson, 1883: a larger cast of the interior of the left valve, but with not a fragment of the test remaining.

INOCERRAMUS UNDABUNDUS, Meek and Hayden.

Inoceramus undabundus, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 26.
" " Meek. 1876. Rep. U. S. Surv. Terr., vol. IX., p. 60, pl. 3, figs. 2, a, b.

Highwood River, ten miles west of the first fork, R. G. McConnell, 1882: two very large but not quite perfect single valves, in a dark or blackish shale. North-West branch of North Fork of the Old Man River, about four miles below the mouth of Oyster Creek, in a thick band of dark shale; G. M. Dawson, 1883: one small but nearly perfect left valve.

INOCERAMUS PROBLEMATICUS, Schlotheim.

Ostracites labiatus, Schlotheim. 1813. Bronn's Jahrbuch, vol. VII., p. 93.
Mytilites problematicus, Schlotheim. 1820. Petræfactenk., vol. I, p. 302.
Mytiloides labiatus, Brongniart. 1822. Cuv. Oss. foss., pl. 3, fig. 4, in Geol. des env. de Paris.
Inoceramus mytiloides, Mantell. 1822. Geol. of Sussex, p. 215, pl. 27, fig. 2, and pl. 28, fig. 2.
" " Sowerby. 1823. Min. Conch., vol. V, p. 62, pl. 442.
" " Goldfuss. 1836. Petræfact. Germ., vol. II., p. 188, pl. 113, fig. 4.
Inoceramus problematicus, d'Orbigny, 1843. Pal. Franc., Terr., Cret., vol. III., p. 510, pl. 406. Meek and Hayden, 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 119.
? Inoceramus pseudomytiloides, Schiel. 1855. Pacific Railway Reports, vol. II., p. 108, pl. 3, fig. 8.
Inoceramus labiatus, Stoliczka. 1871. Pal. Indica, vol. III., Cret. Pelecyp. S. India., p. 408, pl. 29, fig. 1.
Inoceramus problematicus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol IX, p. 62, pl. 9, figs. 3, a, b.

Mill Creek, at mill west of Fort McLeod, in thin pieces of brittle and fissile shale, G. M. Dawson, 1881, and T C. Weston, 1883: a few perfect but flattened single valves. Dr. Dawson informs the writer that these *Inocerami* from Mill Creek come from a band of dark shales in the disturbed foot hill region. These shales, however, immediately overlie or underlie a series of sandstones which hold plants apparently identical with those of the Dakota Group. It is probably in the continuation of the same band of shales that the fossils from the entrance to the North Kootamie Pass came.

Characteristic specimen of the typical *I. problematicus* have also been recognized in pieces of a drab or yellow-grey limestone collected by Mr. J. W. Spencer in 1874 on the Swan River, N. W. T.

PHOLADOMYA PAPYRACEA, Meek and Hayden.

Pholadomya papyracea, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 27.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 217, pl. 5, figs. 4, a, b.

North West branch of North Fork of the Old Man River, about four miles below the mouth of Oyster Creek, G. M. Dawson, 1883: one specimen.

CEPHALOPODA.

SCAPHITES WARRENI, Meek and Hayden.

Scaphites Warreni, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p.p. 177 and 420.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 420, pl. 6, fig. 5.

Highwood River, ten miles west of first fork, R. G. McConnell, 1882: four fine specimens of an unusually large form of the species, the largest of which measures nearly three inches in length, in the direction of the longer axis of the ellipse, by about one inch and a half in its greatest lateral diameter. Entrance to North Kootanie Pass, G. M. Dawson, 1883: one specimen. North West branch of North Fork of the Old Man River, about four miles below Oyster Creek, G. M. Dawson, 1883: an imperfect but large and very ventricose specimen, which is nearly two inches broad although no part of the deflected portion is preserved.

SCAPHITES VERMIFORMIS ? Meek and Hayden.

Scaphites vermiformis, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 22.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 423, pl. 6, figs. 4, a, b.

North West branch of North Fork of the Old Man River, G. M. Dawson, 1883: two nearly perfect specimens and two fragments. Entrance to the North Kootanie Pass, G. M. Dawson, 1882: several large fragments.

These specimens appear to differ from those from the same localities which are here referred to *S. Warreni*, in having the deflected portion much shorter, and in their coarser ribs, the larger ones of which usually (though not invariably) bear a row of rather prominent nodes on the outer half of each side. These nodes, however, are frequently not developed, and it may be that the shells now under consideration should be regarded as only a coarsely ribbed variety of *S. Warreni*.

CRUSTACEA.

HOPLOPARIA? CANADENSIS, Whiteaves.

Plate 11.

Hoploparia? Canadensis, Whiteaves. 1884. Proc. and Trans. Royal Soc. Canada, vol. 2, p. 237.

Highwood River (a tributary of the Bow River), ten miles west of the first fork, R. G. McConnell, 1882: one specimen.

The following is a copy of the original description of this interesting fossil.

"The specimen originally consisted of an elongate-oval and flattened concretionary nodule of soft argillite, with a small piece broken off from one end, but enough of the matrix has been removed to show most of the carapace and the upper surface of a few of the abdominal segments. The anterior extremity of the carapace, with the rostrum, is unfortunately not preserved, and the tail, with some of the posterior abdominal segments, was broken off when the nodule was found. The ambulatory feet are preserved, but it was found to be scarcely possible to remove the soft shale from around them without running the risk of spoiling the specimen.

The carapace, like that of most of the macrura, is elongated and comparatively narrow, with nearly parallel sides, and, when perfect, its length must have been about twice as great as its breadth. A little in advance of the midlength a single, broadly V-shaped, deep and rather wide groove or furrow crosses the carapace transversely. The posterior half of the carapace is depressed and rather distinctly three-keeled in a longitudinal direction, though it is most likely that these appearances are mostly or wholly due to a considerable and abnormal compression from above. Be this as it may, in the specimen collected by Mr. McConnell, a central keel, or narrow but prominent raised ridge, which is about three times as broad posteriorly as it is anteriorly, and which is bounded on each side by a deep and angular furrow, extends from the posterior end of the carapace to the centre of the V-shaped groove which transverses it. This central keel is much more strongly marked than the broad and comparatively obtuse and lateral keels, which latter are placed near the outer margin of each side. The surface of the posterior half of the carapace (and perhaps that of the anterior also) is covered with rather distant, small, isolated conical tubercles, which, under the lens, look as if they might have each borne

a bristle at the summit, and which, occasionally, are surrounded by a minute annulus at the base; and the three keels each have a single series of larger conical tubercles, whose pointed apices are directed forward.

In front of the transverse and V-shaped furrow the carapace is very badly preserved, and the anterior margin with the rostrum is broken off. The two lateral and tuberculated keels appear to be prolonged to within a short distance of the front margin of the carapace, though they are somewhat less distinct in front of the transverse furrow than they are behind it. On the anterior side of the furrow the central keel is absent, and the median portion of this part of the carapace bears a number of comparatively large and prominent, distinct and conical tubercles, which are somewhat peculiarly arranged. Next to the furrow, and in advance of it, in the median line, there are five tubercles arranged in two convergent rows of two pairs and an odd one, which, if connected by lines, would have much the shape of an isosceles triangle, witn its base near to the furrow. Between the space bounded by these five tubercles and each lateral keel, there is a shallowly concave and rather broad depression of the carapace. In front of these five tubercles, again, there are four others and still larger ones (the two anterior ones apparently of considerable size), arranged somewhat in the form of a square, any of whose sides would be greater than the base of the isosceles triangle indicated by the other five.

The upper surface of each of the abdominal segments bears a tubercle in the centre, on its anterior edge, and another one on the margin of each of the sides. The most prominent characteristic of the species, in fact, is the possession of three widely distant, longitudinal and tuberculated keels, which extend over nearly the whole length of the upper surface of the body.

To the right of the carapace, in front, there are indications of what appears to have been a large pinching claw, and, if the appearances presented are correctly interpreted, the sides of the fixed ramus of that claw are also coarsely tuberculated.

Until its exact generic position shall have been settled by the collection of more perfect specimens, it may be convenient to designate the present species as *Hoploparia* (?) *Canadensis*, though it is by no means certain that it belongs to McCoy's genus of that name."

Judging by the invertebrate fossils alone, it would seem probable that the friable and fissile shales at Mill Creek which hold typical example of *Inoceramus problematicus* may represent the "Niobrara

Group" of the Upper Missouri Section. On similar evidence, also, the rocks at the two localities on the Waterton River which have yielded respectively *Ostrea congesta* and *Volviceramus exogyroides;* those at the Highwood River which contain *Inoceramus undabundus* and *Scaphites Warreni;* those on the Northwest branch of the North fork of the Old Man River from which *Inoceramus undabundus, Pholadomya papyracea, Scaphites Warreni* and *S. vermiformis* were collected; and those at the entrance to the North Kootanie Pass which are characterized by *Volviceramus exogyroides, Scaphites Warreni* and *S. vermiformis,*—would appear to be as nearly as possible the Canadian equivalents of the "Fort Benton Group."

In conclusion, it may be remarked that (as already partly stated in the foot-note to page 55) the invertebrate fauna of the "Belly River Series" seems to be essentially the same as that of the "Laramie" of the United States and Canada, unless more than one formation has been confounded under the latter name, and that it is at present scarcely possible to separate the "Lower Dark Shales" of Dr. Dawson's Bow and Belly River Report from the "Fort Pierre and Fox Hills" Groups, on purely palæontological grounds.

PLATE I.

Unless otherwise stated, all the figures are of natural size.

UNIO ALBERTENSIS (page 3).

Figure 1. Side view of the type specimen, shewing the left valve.

ANOMIA PERSTRIGOSA (page 4).

Figure 2. Upper valve of a perfect and well preserved specimen, as viewed from above.

CORBICULA OCCIDENTALIS (page 7).

Figure 3. Side view of a large specimen from Rye-Grass flat, shewing the right valve.

" 3*a*. The same as seen from above.

CORBICULA OBLIQUA (page 8).

Figure 4. Side view of a perfect specimen, from Rye-Grass flat.

" 4*a*. Dorsal aspect of the same.

" 4*b*. Cast of a left valve, with a slightly different outline, from the Belly River.

CORBULA PERANGULATA (page 9).

Figure 5. Side view of a somewhat arcuate example, from Rye-Grass flat.

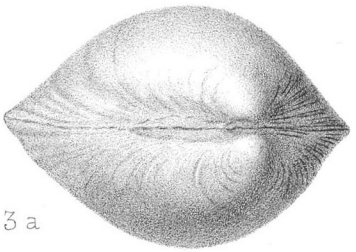
" 5*a*. Dorsal view of the same, to shew the amount of convexity of the closed valves and the excavated posterior area.

" 5*b*. Side view of a younger specimen from the same locality. At this stage of growth the posterior area is not excavated and the posterior extremity is truncated.

1

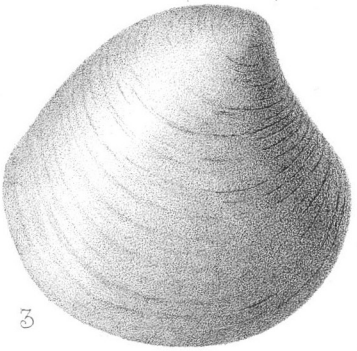
2

4 a



3 a

4



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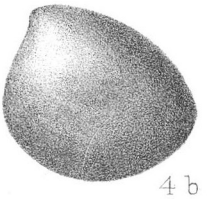
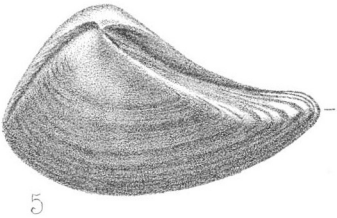


4 b



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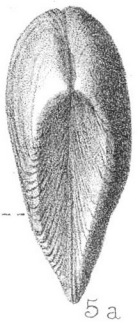
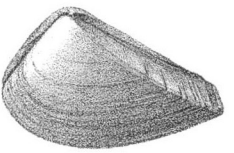


5 a



5 b

PLATE II.

CORBULA PERANGULATA (page 9).

Figure 1. Side view of another adult specimen from Rye-Grass flat, of a shorter and less arcuate form than the one represented on plate 1, fig. 5.

PANOPÆA SIMULATRIX (page 11).

Figure 2. The most perfect specimen collected, as viewed laterally.

" 2*a*. Dorsal view of the same.

PANOPÆA CURTA (page 12).

Figure 3. Side view of the type of this species, from Forks of Devil's Pine and Three Hills Creeks.

PHYSA COPEI (page 14).

Figure 4. Dorsal view of a specimen from Pincher Creek, which has the apex broken off.

" 4*a*. Similar view of a smaller example of the same species, from Gooseberry Canon on the St. Mary River, in which the slender and acuminate spire is perfect.

PHYSA COPEI, Var. CANADENSIS (page 14).

Figure 5. Dorsal view of a large and typical example of this variety, from Pincher Creek.

" 5*a*. Similar view of an unusually narrow variety of this shell, also from Pincher Creek, referred to on page 16 as approaching very nearly in shape to *Bulinus atavus*, White.

" 5*b*. Ventral view of another specimen from the same locality, to shew the characters of the aperture.

PATULA ANGULIFERA (page 18).

Figure 6. The type and only specimen collected, as seen from above.

" 6*a*. Basal view of the same.

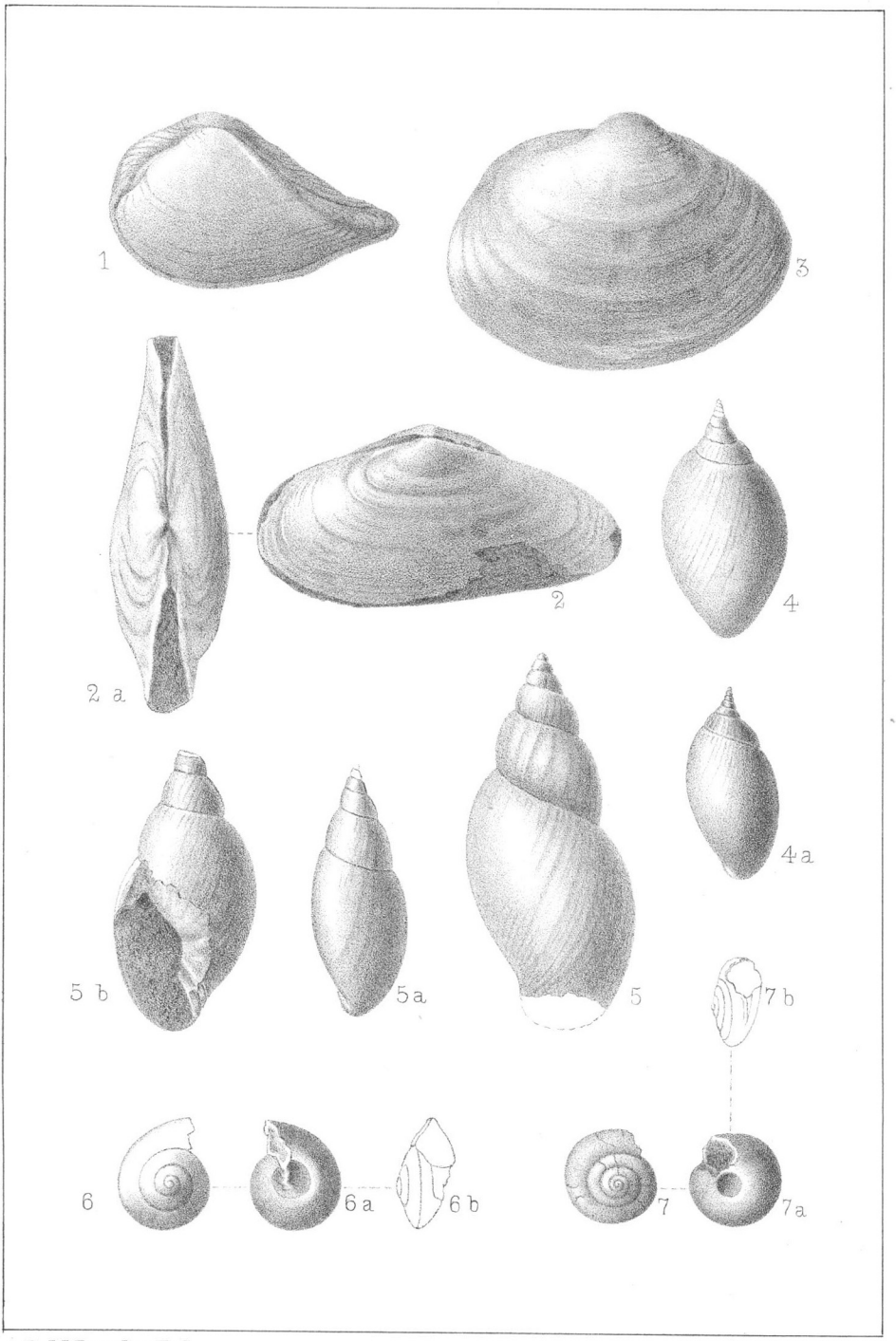
" 6*b*. Outline of the same from another point of view, to shew the comparative height of the shell and shape of the aperture.

PATULA OBTUSATA (page 18).

Figure 7. Upper side of the largest specimen known to the writer.

" 7*a*. Lower side of the same.

" 7*b*. Outline of the same to show the relative height or depth of the shell.



L. M. Lambe, Del.

Mortimer & Co. Lith.

PLATE III.

ACROLOXUS RADIATULUS (page 17).

Figure 1. The type specimen, from the mouth of the Blind Man River, as seen from above and slightly enlarged. The cross-lines to the right indicate the actual size.

" 1*a*. A portion of the surface of the same, still more highly magnified, to shew the details of the sculpture.

ANCHISTOMA PARVULUM (page 19).

Figure 2. View of the upper side of the only specimen known.

" 2*a*. Basal view of the same.

" 2*b*. Another view of the same, to show the proportionate height or convexity of the shell, and the narrow lobe on the upper part of the outer lip.

THAUMASTUS LIMNÆIFORMIS (pages 20 and 27).

Figure 3. Dorsal view of a specimen of a supposed variety of this species, from the Rosebud River.

" 3*a*. Outline of another and apparently more typical specimen, from Wood End Depôt.

" 3*b*. Ventral view of the last, to shew the characters of the aperture.

GONIOBASIS NEBRASCENSIS (page 21).

Figure 4. Dorsal view of a specimen from the St. Mary River.

" 4*a*. Portion of the same magnified, to shew the surface markings.

GONIOBASIS TENUICARINATA (page 22).

Figure 5. Dorsal view of a specimen from the Bow River.

" 5*a*. Enlarged portion of the same, to shew the sculpture of the last volution of the spire.

GONIOBASIS TENUICARINATA, Var., (page 22).

Figure 6. Specimen from Pincher Creek, dorsal view.

" 6*a*. Similar view of another and slightly distorted example from the same locality.

VALVATA FILOSA (page 25).

Figure 7. Magnified representation of a perfect specimen from Pincher Creek, showing the upper surface. The cross-lines on the right indicate the actual size.

" 7*a*. Portion of the surface of the same, still more highly magnified, to shew the sculpture.

VALVATA BICINCTA (page 25).

Figure 8. Specimen from the mouth of the Blind Man River, as seen from above, and considerably enlarged. The cross-lines between this and the next figure shew the actual size of the originals of both.

" 8*a*. Basal view of the same, also enlarged.

" 8*b*. A portion of the surface of the same specimen, still more highly magnified, to shew the details of the surface markings.

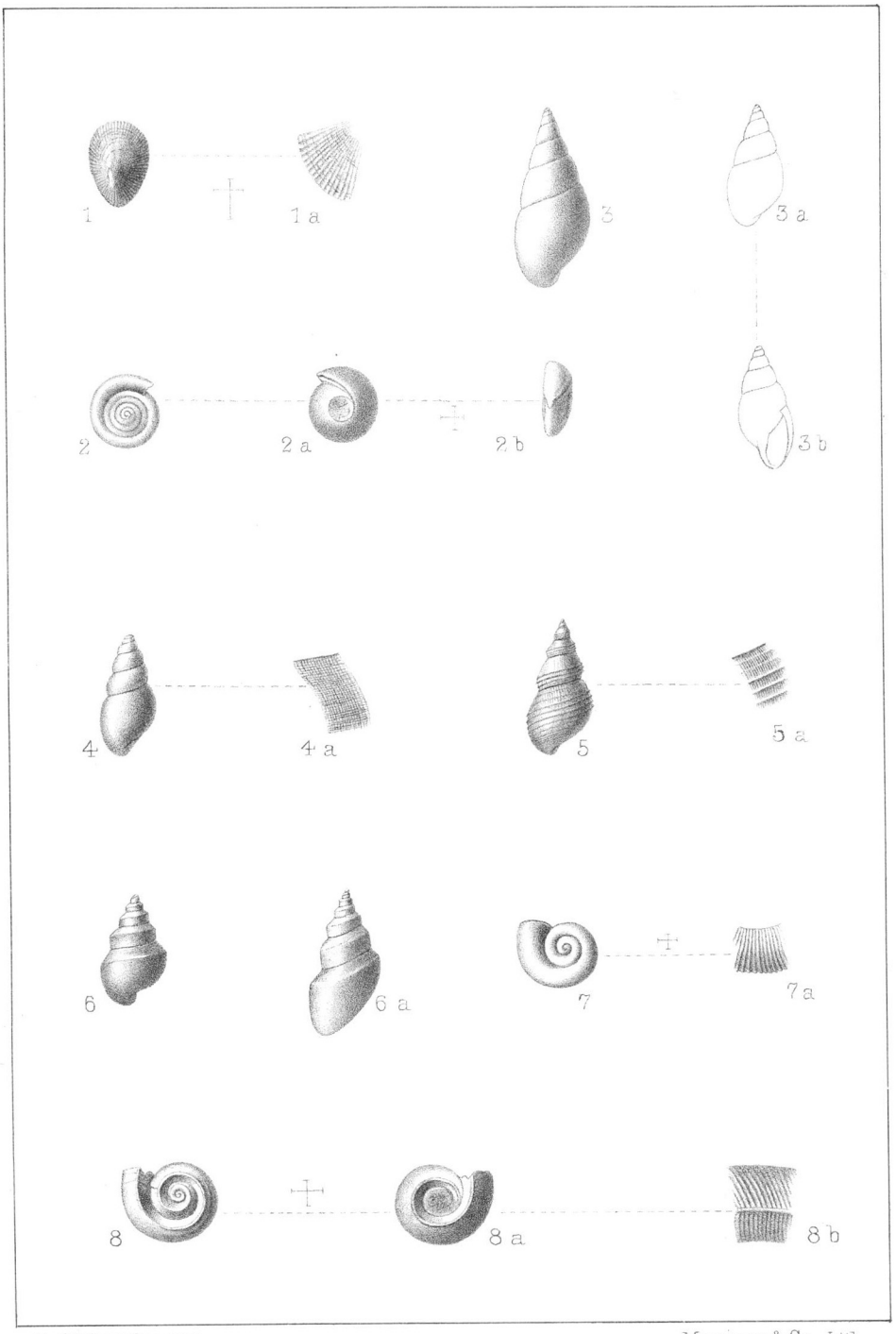

1
1a
3
3a
2
2a
2b
3b
4
4a
5
5a
6
6a
7
7a
8
8a
8b

PLATE IV.

PTERIA (PSEUDOPTERA) FIBROSA, Var., (page 32).

Figure 1. Lateral view of a specimen from the Bow River, shewing the right valve.

GERVILLIA RECTA, Var. BOREALIS (page 35).

Figure 2. Side view of a left valve from the Belly River.

" 2*a*. Cast of the interior of the closed valves, from the South Saskatchewan, shewing the impressions made by the muscular scars of the right valve.

" 2*b*. Interior of a fragment of a right valve, from the Belly River, which shews the cartilage pits of the anterior end of the hinge line.

MODIOLA (BRACHYDONTES) DICHOTOMA (page 37).

Figure 3. Lateral view of a right valve with the test preserved, from the St. Mary River. Considerably enlarged.

" 3*a*. Similar view of a cast of the interior of the closed valves of the shell of a larger and apparently more adult individual, from the same locality. Also considerably enlarged.

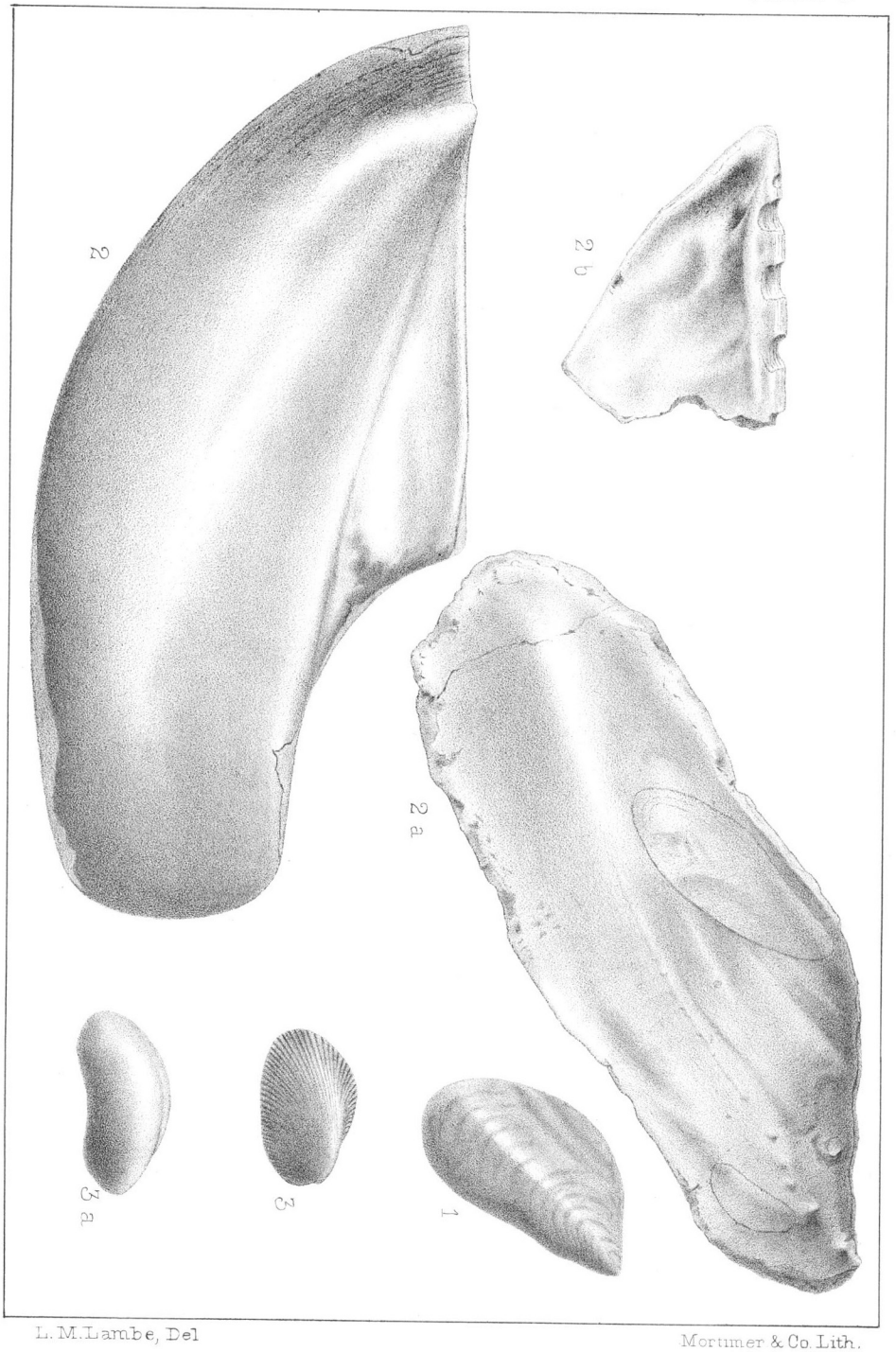

2
2 b
2 a
3 a
3
1

PLATE V.

INOCERAMUS TENUILINEATUS (page 34).

Figure 1. Side view of a small but nearly perfect cast of the interior of this shell, from the South Saskatchewan, showing the shape and surface undulations of the left valve.

" 1*a*. The same as seen from above, to show the thickness through the closed valves.

YOLDIA SCITULA (page 38).

Figure 2. A right valve, slightly enlarged, with a portion of the outer surface still more highly magnified represented below. The cross-lines also below but a little to the right, indicate the actual size of the specimen.

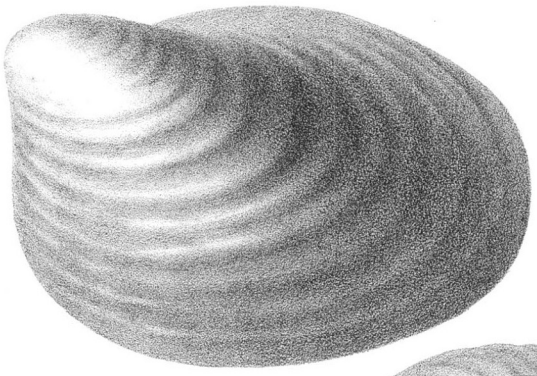
CYPRINA OCCIDENTALIS, Var. ALTA (page 40).

Figure 3. Side view of a perfect left valve.

PROTOCARDIA SUBQUADRATA (page 41).

Figure 4. Side view of one of the most perfect specimens collected, shewing the right valve.

" 4*a*. Outline of the same as seen from above.



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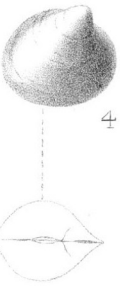
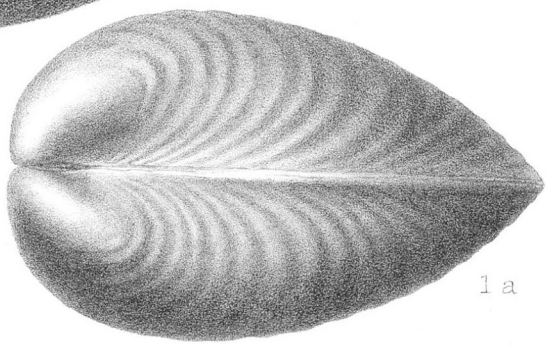


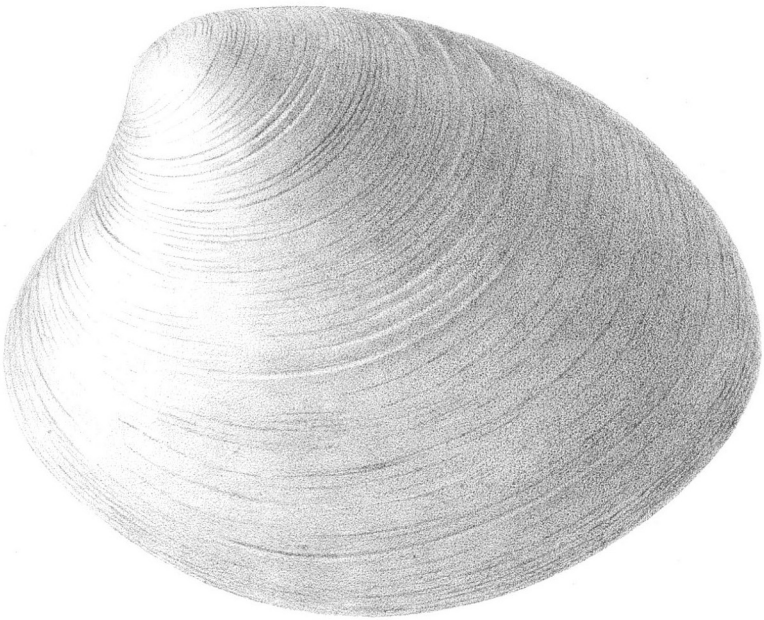
4

4 a



1 a

2



3

L. M. Lambe del[t]

Mortimer & Co. Lith.

PLATE VI.

PROTOCARDIA BOREALIS (page 41.)

Figure 1. Side view of a specimen of average size and normal form, shewing the right valve.

" 1*a*. Dorsal outline of the same.

" 2. Side view of another specimen, in which the valves are unusually tumid and inequilateral.

" 2*a*. Dorsal outline of the last.

" 3. Cast of the interior of a large specimen from Ross Coulée, shewing the outlines of the muscular impressions of the right valve.

CALLISTA (DOSINIOPSIS) DEWEYI (page 42).

Figure 4. Side view of a supposed large variety of this species, from near Big Plume Creek, shewing the left valve.

" 5. Outline of a cast of the interior of another form of the species, from Bull's Head, shewing the impressions of the pallial sinus and muscular impressions of the right valve.

" 5*a*. Outline of portion of a left valve from the same locality as the last, to shew the hinge dentition of that valve.

PANOPÆA SUBOVALIS (page 44).

Figure 6. Side view of the type specimen, shewing the right valve.

" 6*a*. Outline of the same as seen from above, to illustrate the comparative convexity of the shell, the anterior and posterior gaping extremities, and the short ligamental area.

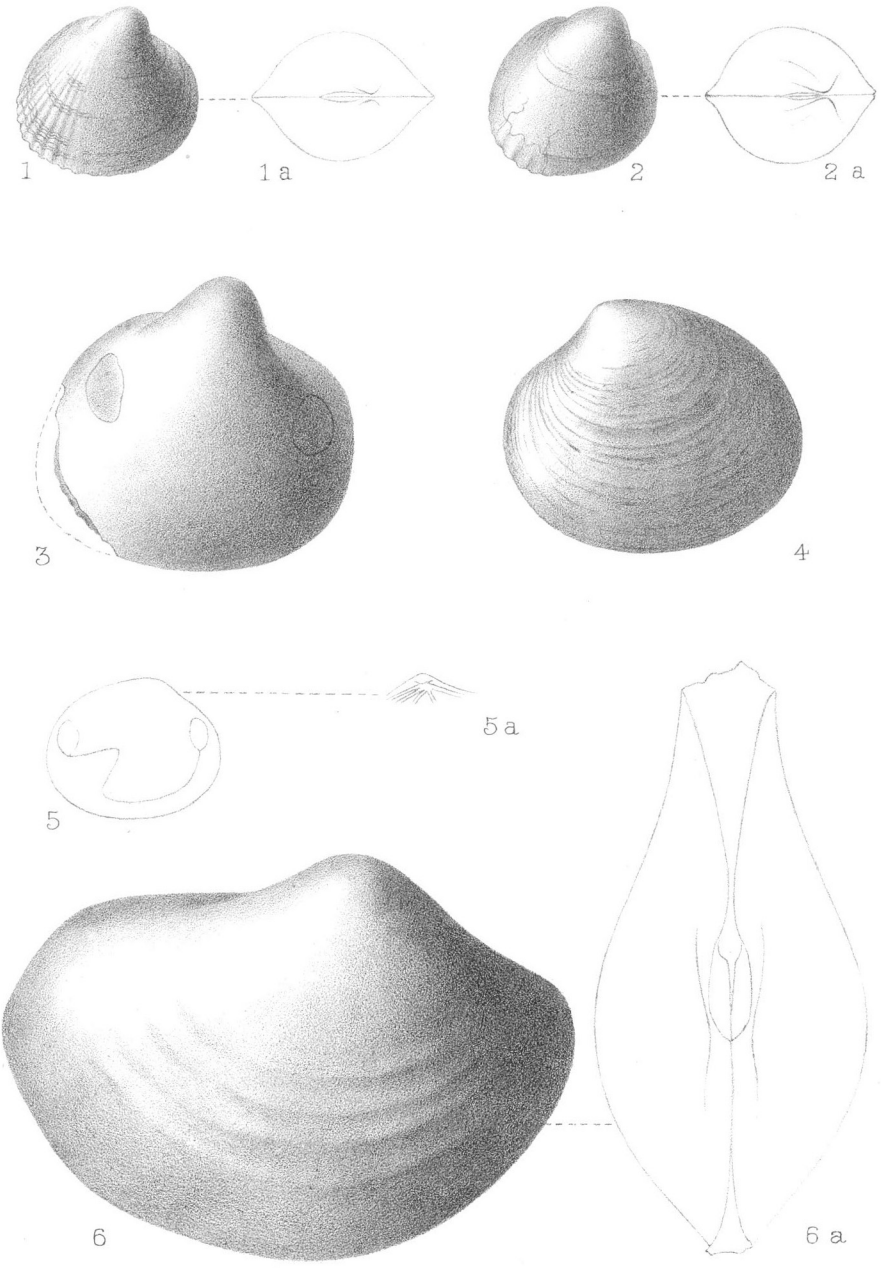

1
1 a
2
2 a
3
4
5 a
5
6
6 a

PLATE VII.

ANISOMYON CENTRALE (page 47).

Figure 1. Side view of a specimen in which the apex is distinctly eccentric.

" 1*a*. The same as seen from above.

" 2. Side view of a specimen in which the apex is nearly central.

" 2*a*. Dorsal aspect of the last.

SCAPHITES SUBGLOBOSUS (page 52).

Figure 3. Side view of a large but entirely septate and worn specimen, from Old Wives Creek, in which the finer surface markings are partly obliterated. This species is more fully illustrated on the next plate.

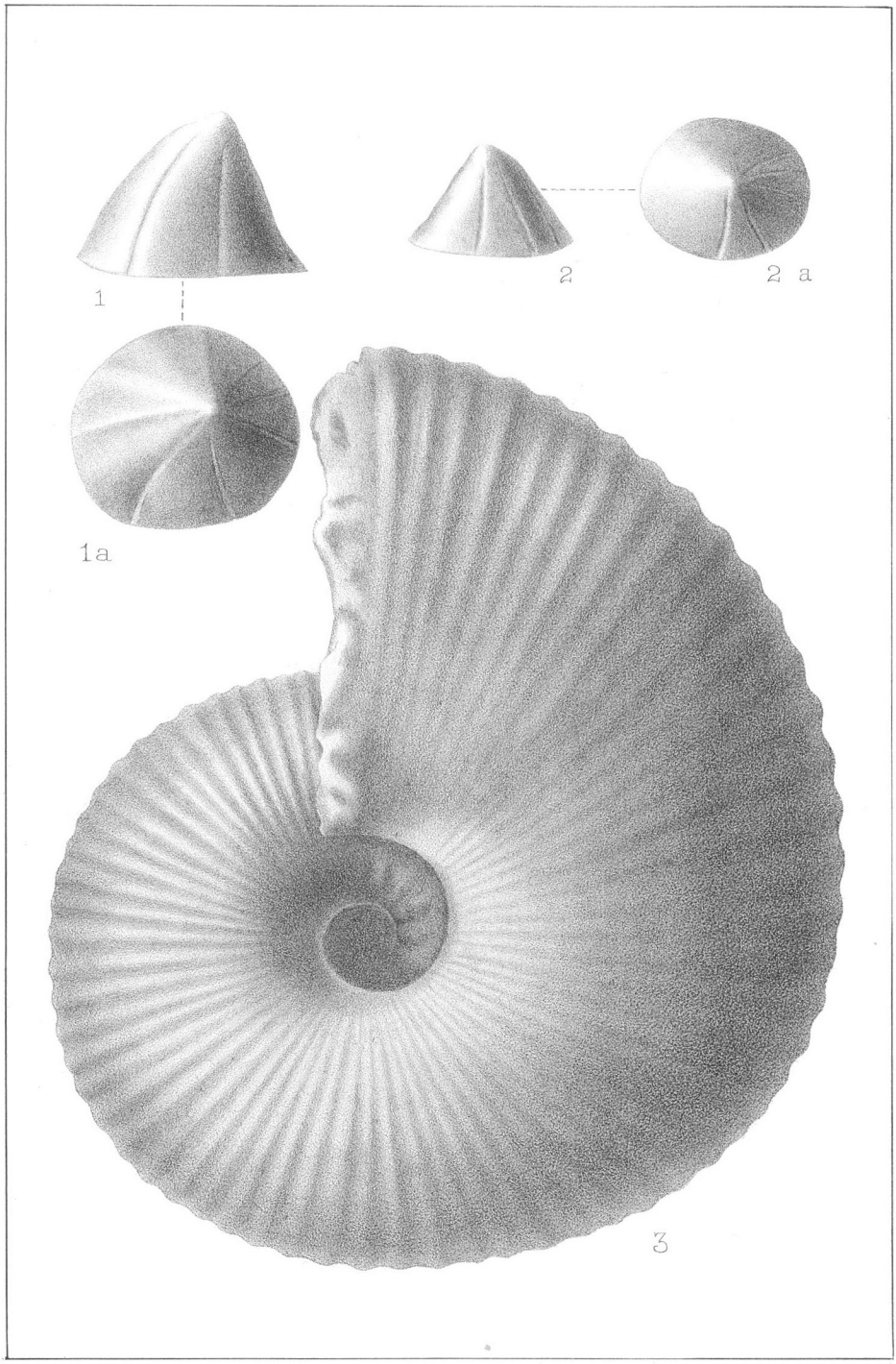

1
2
2 a
1a
3

PLATE VIII.

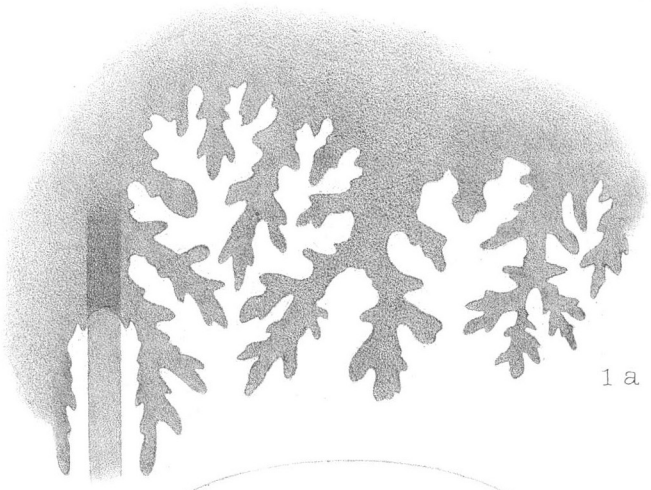
SCAPHITES SUBGLOBOSUS (page 52).

Figure 1. Outline of the aperture of the specimen represented on plate VII., fig. 3, to shew the maximum convexity of the shell at that stage of growth.

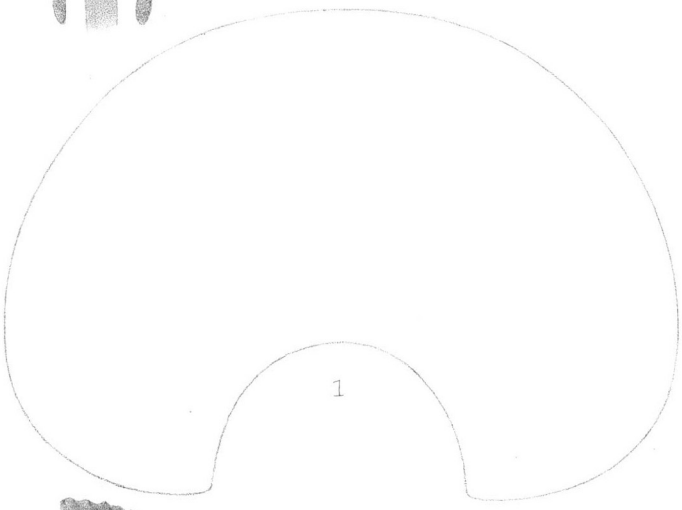
" 1*a*. Portion of a septum of the same specimen. The finer ramifications of the lobes and saddles are partly obliterated by erosion.

" 2. Side view of a smaller but well preserved specimen, to shew the finer surface markings.

" 2*a*. Outline of the aperture of the last.



1 a



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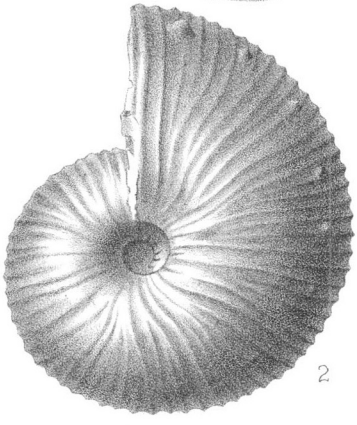

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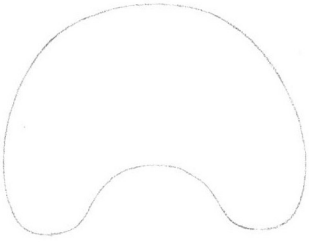


2 a

PLATE IX.

CRENELLA ? PARVULA (page 57).

Figure 1. Side view of a perfect right valve, much enlarged. The cross-lines below (to the right), indicate the exact size.

ANODONTA PROPATORIS (page 58).

Figure 2. Side view of a cast of the interior of a shell from near Bull's Head, which is doubtfully referred to this species, shewing the left valve.

" 2*a*. The same specimen as viewed from above.

SPHÆRIUM FORMOSUM, Var., (page 61).

Figure 3. Lateral outline of a right valve, considerably enlarged. The cross-lines to the right show the natural size of the specimen.

UNIO CONSUETUS (page 59).

Figure 4. Side view of the only perfect specimen collected.

" 4*a*. Dorsal aspect of the same.

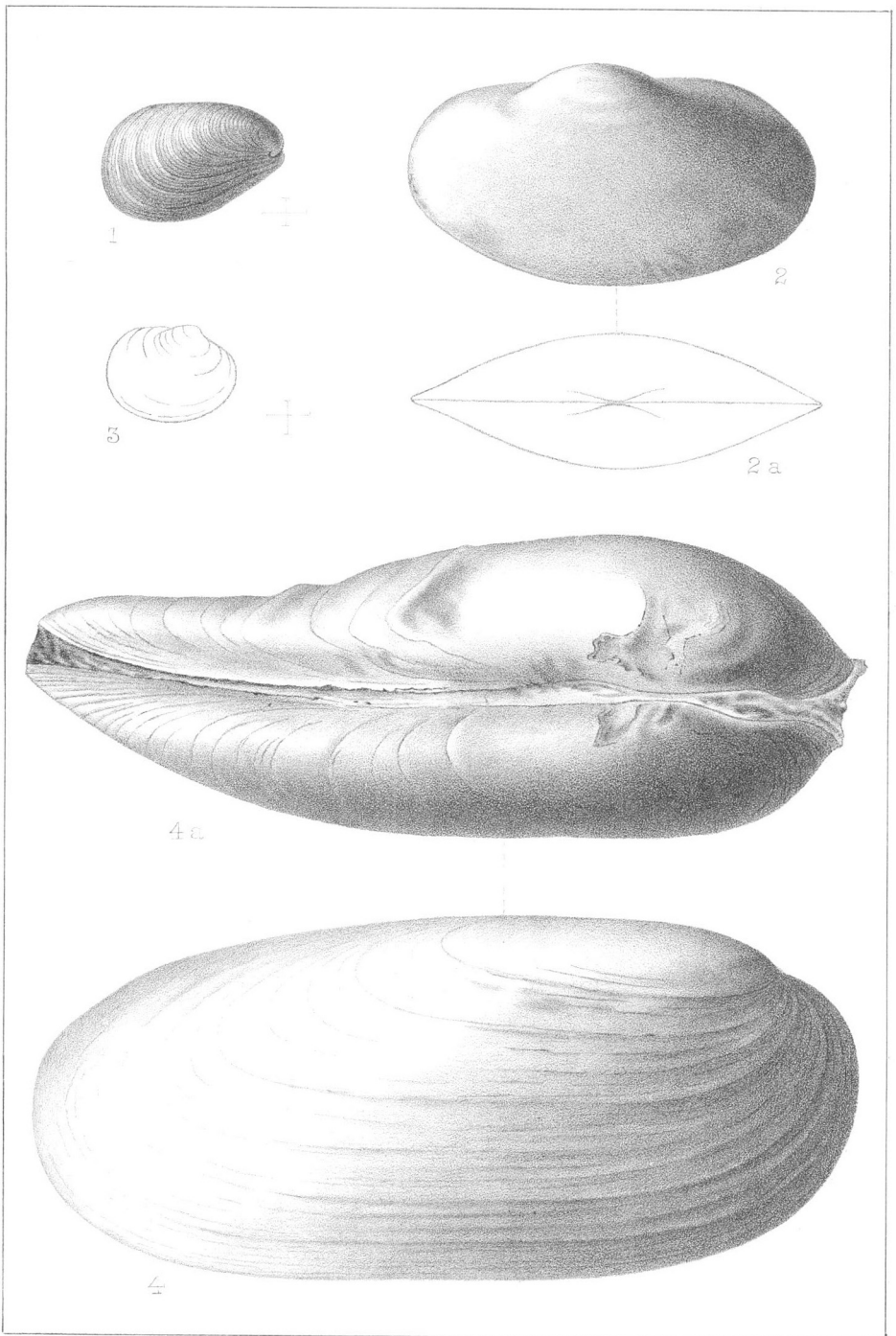

1
2
3
2a
4a
4

PLATE X.

UNIO SUPRAGIBBOSUS (page 66).

Figure 1. Side view of a specimen, shewing the left valve.

UNIO SENECTUS (page 67).

Figure 2. Side view of a supposed small variety of this species, from the South Saskatchewan, shewing the right valve.

UNIO PRISCUS (page 65).

Figure 3. A very young but perfect specimen of a *Unio*, from the South Saskatchewan, which may be referable to this species, but which accords equally well with the characters of *U. vetustus*, Meek. The larger and more typical Canadian examples of *U. priscus* are not figured here, as the species has been well illustrated by Meek and Dr. C. A. White.

RYTOPHORUS (?) GLABER (page 69).

Figure 4. Dorsal view of a nearly perfect specimen with the test preserved.

" 4*a*. Cast of the interior of the shell of a larger individual.

" 4*b*. Half grown shell, with the apex broken off, to shew the sculpture of the body-whorl.

" 4*c*. A very young shell, much enlarged, to shew the narrowly acuminate spire and slender apical volutions at this stage of growth. The cross-lines to the right indicate the actual size.

PLANORBIS PAUCIVOLVIS (page 71).

Figure 5. Left side of the most perfect specimen known to the writer, much enlarged. The cross-lines to the right shew the natural size.

MELANIA (?) INSCULPTA (page 73).

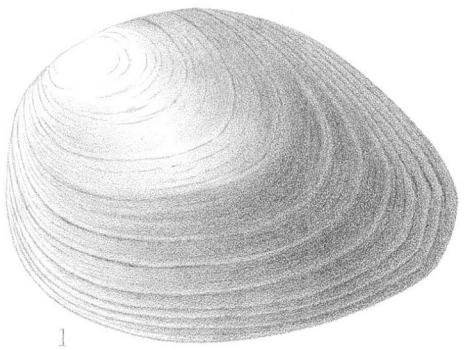
Figure 6. Dorsal view of a nearly perfect specimen from the South Saskatchewan.

GONIOBASIS SUBTORTUOSA (page 74).

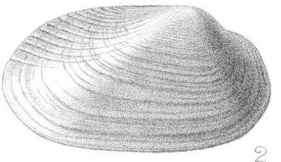
Figure 7. Dorsal view of a perfect and well preserved specimen, also from the South Saskatchewan.

HYDROBIA SUBCYLINDRACEA (page 75).

Figure 8. Ventral or "apertural" view of the type specimen, much enlarged.



1



2

3

4

4 a

4 b

4 c

5

6

7

8

PLATE XI.

HOPLOPARIA (?) CANADENSIS (page 87).

Dorsal view of the type specimen.

L. M. Lambe, Del. Mortimer & Co. Lith.