56.4,1U(117:78.6)

Article XXVI.—REMARKS ON AND DESCRIPTIONS OF NEW FOSSIL UNIONIDÆ FROM THE LARAMIE CLAYS OF MONTANA.

By R. P. Whitfield.

Plates XXXVIII–XLII.

The few species of *Unio* included in this article are from the Laramie clays, 130 miles northwest of Miles City, Montana, from a bed located about 180 feet above the Fort Pierre shales, and consequently well above the recognized Cretaceous horizon.

The shells are fairly well preserved and retain the nacreous coloring to a great extent, though the outer epidermal coating is usually absent and not infrequently the prismatic outer layer is partly absent or frequently crumbles on being washed. The clay beds in which they are found are horizontal, and usually undisturbed, except by the weathering and washing consequent upon the weathering.

These shells are from near the same locality as the six species described in Volume XIX of this Bulletin (pp. 483–487), but come from a somewhat higher level above the Pierre, being at about 400 feet above the shale. Among those previously described, three of the species so closely resemble living species known from the western river water-shed, that I gave them names indicating these resemblances. In this lot occur four others that have similar resemblances, namely, *U. biæsopoides* from *U. æsopoides* of the first lot, differing from it in having a double line of nodes along the umbonal slope, instead of only one. The others resemble respectively *U. pyramidatus*, *U. cylindricus*, *U. cornutus* and *U. gibbosus*.

Among other species common in the same localities and clays one of the most abundant forms is usually referred to *U. danæ* Meek and Hayden but which I think is much more closely allied to *Unio gibbosus* Barnes, of the Ohio and Mississippi Rivers. It differs materially from Meek's figures of *U. danæ*, in not possessing the radiating striæ shown quite conspicuously there as given in Vol. IX, Geol. Surv. Territories, pl. 41, figs. 3*a* and 3*c*, but do not appear on C. A. White's fig. 2*a*, plate 27, Contributions to Palæont., 1880, but do appear on those copied from Meek's in White's, 'Non Marine Mollusca', Third Ann. Rept. U. S. Geol. Surv., 1881–82, pl. 17, figs. 1 and 2, but again do not on those given on pl. 18, figs. 1 and 2.

These Laramie shells from this Montana locality, are so closely similar

to those from the Ohio River localities that I propose to designate them by the name *U. gibbosoides.*

Considering all the similarities between these Laramie fossils and their representative species in the Mississippi and Ohio water-sheds, I venture to state that these further western waters of the Laramie times were the original home of much of the *Unio* fauna of these more eastern recent localities.

From this locality, 130 miles northwest of Miles City, Montana, we have the following species, represented by closely allied forms, some of them so nearly like the living species, that it would do but little violence to specific features, to state they were the same, namely:

Unio æsopiformis	resembles	*U. æsopus* Green.
Unio letsoni	"	*U. cornutus* Barnes.
Unio cylindricoides	"	*U. cylindricus* Say.
Unio gibbosoides	"	*U. gibbosus* Barnes.
Unio pyramidatoides	"	*U. pyramidatus* Lea.
Unio retusoides	"	*U. retusus* Lam.
Unio verucosiformis	"	*U. verrucosus* Barnes.

Unio biesopoides, n. sp.

PLATE XL FIG. 7, and PLATE XLI, FIG. 8.

Shells like those of *U. æsopoides* in all essential particulars, internal and external; except that it presents two distinct lines of nodes leading from near the beaks backwards to the posterior basal angle instead of only a single line of nodes as also in the recent or living species *U. æsopus,* the second line being on the umbonal angle.

Locality and *formation.*— Laramie beds, 130 miles northwest of Miles City, Montana, 180 feet above Pierre shales. Barnum Brown, collector.

Unio pyramidatoides n. sp.

PLATE XLI, FIGS. 1-5.

Shell somewhat resembling the living *U. pyramidatus* in general features, but more erect, narrower across the body of the shell, in an anterior-posterior direction, and without the sulcus on the posterior umbonal slope; or at least having it less developed or very narrow and shallow, while the posterior margin is flattened and the umbonal ridge decidedly angular and often subcarinate; the lunule being quite small or usually nearly obsolete, and the beaks, when not eroded, show a decided zigzag or doubly V-shaped system of corrugation. Internally the shells are remarkably heavy and thickened, making the teeth and all internal features even larger and proportionally thicker and deeper than in the living representative species. The posterior lateral teeth are usually more curved.

Locality and *formation.*— Laramie beds, 130 miles northwest of Miles City, Montana, 180 feet above Pierre shales. Barnum Brown, collector.

Unio pyramidellus n. sp.

PLATE XL, FIGS. 3 AND 4.

Shell small, very erect, from beak to base, and mostly less than one and one fourth inches high; disc of the valves rather depressed convex, with a slight sulcus crossing from the beak to the posterior angle quite near the posterior margin. Beak proportionally heavy, tumid, directed forward; anterior margin slightly concave, posterior margin slightly convex, basal margin broadly rounded. Internal features thickened, hinge plate and lateral tooth in the right valve large, the plate broad and slightly concave in the best preserved valve, and the lateral tooth much curved and thickened. Cardinal tooth triangular, proportionately large, cuneiform above, below divided by three vertical grooves, the socket having four ridges to fit against the large tooth of the opposite valve. Anterior muscular impression small, but deep, the secondary small and shallow, close to the former. Posterior impression long, narrow and moderately distinct. Surface of the disc smooth except for distinct growth lines.

The shells are poorly preserved and mostly much distorted by compression, but all show a much bent hinge plate and strong teeth, the cardinal tooth being low down near the middle of the anterior border, and the long lateral tooth and posterior scar extending below the middle of the height.

Locality and formation.— Laramie beds, 130 miles northwest of Miles City, Montana, 80 feet above Fort Pierre shales. Barnum Brown, collector.

Unio gibbosoides n. sp.

PLATE XL, FIGS. 1 AND 2.

Shell transverse, compressed, much wider than high, and resembling in nearly all respects *U. gibbosus* of Barnes, as it occurs in the Ohio and Mississippi Rivers at the present time, both externally and internally.

It has been commonly referred to as *U. danæ* Meek & Hayden which it closely resembles, but it never shows the radiating striæ which that species quite generally does, passing obliquely backward across the valves from the beaks to the basal boarder along the depressed middle portion of the valves. In most other respects the two species are closely allied.

Locality and position.— In Laramie Clay, about 120 feet above Pierre shales, on Snow Creek, on the Missouri River, in Montana.

Unio subtrigonalis n. sp.

PLATE XL, FIGS. 5 AND 6.

Shells small, triangular, ventricose cuneate, pointed behind, seldom exceeding an inch and an eighth in an anterior and posterior line, sharp and subangular on the umbonal ridge, with a nearly vertical posterior slope, which is slightly sulcated in front of the umbonal ridge; otherwise the disc is smooth or marked only by growth lines; base broadly rounded; beaks anterior, moderately heavy. On the interior the hinge plate is abruptly bent at some distance behind the beak, and the lateral teeth are thin and erect, while the cardinals are heavy and much corrugated. Anterior muscular imprint small but moderately deep, the posterior scar elongate, faintly marked and situated on the inside of the vertical cardinal slope.

The species is exceedingly like *Corbicula subtrigonalis* C. A. White, externally; but is decidedly and unmistakably a *Unio*, and not a *Corbicula*.

Locality and formation.— In Laramie ferruginous marls, 130 miles northwest of Miles City, Montana, 80 feet above Pierre shales. Barnum Brown, collector.

Unio cylindricoides n. sp.

PLATE XXXVIII, FIGS. 1–7; PLATE XXXIX, FIGS. 1–3.

Shell attaining a moderately large size, the adult shell being fully as large as full-grown specimens of the living *U. cylindricus*, which it resembles in size, form and general features, except in lacking the characteristic sculpturing of the surface. The largest individual in the collection was, when entire, fully four and one fourth inches in length. The shells are externally decidedly elongate-rhombic, much swollen along the umbonal ridge, which is sometimes quite angular. The beaks are enrolled and placed well forward, but not terminal, the outline of the figure being highest below the middle of the height anteriorly, while the living form is generally highest centrally. Posteriorly the reverse is the general rule in the fossil form, highest above the center and sharply rounded. The middle of the disc is broadly sulcated from the beaks to the basal margin, the sulcus covering the entire middle third of the shell.

No surface sculpturing exists on the larger specimens, but on the young and medium sized individuals, there is a system of raised ridges indicating or foreshadowing all of the markings of the living examples of *U. cylindricus*, except the nodes on or near the umbonal ridge, posteriorly to the end of the shell.

Internally all the features of the living form are present and so closely similar that it seems unnecessary to recapitulate them.

Locality and formation.— In muddy shales of the Laramie formation, 130 miles northwest of Miles City, Montana, 180 feet above Pierre shales. Barnum Brown, collector.

Unio letsoni n. sp.

PLATE XLII, FIGS. 1–4.

Shell rather below medium size for the genus, circular or broadly transversely oval in outline, and quite ventricose, but not globular. Beaks moderately large, nearly central, slightly oblique and but little enrolled. Surface of the shells highly ornamented except on the antero-basal quadrant, where there are only strong concentric lines of growth. Along the center of the valves from beak to base, there runs a line of strong heavy nodes usually numbering four on adult shells, where the height from beak to base will be about or a little more than one and a half inches, or nearly four cm. where the transdiameter, from anterior to posterior of the outline will be about, or over, four and a half cm., or somewhat more than one and three-fourths inches. Posterior to the median line of nodes and on the umbonal third of the shell there is always a double set of oblique depressed lines which give to this part of the shell the structure of a very coarse file. On the posterior half of the shell there is a system of oblique undulations or plicæ, which extends from the posterior side of the median line of nodes, gradually turning backwards and extending to the posterior margin of the valve and to the cardinal and basal edges of the shell, growing larger with the increasing growth of the valve. On the larger valve figured, these plications are sixteen in number, those of the beak portion being quite small and strongly curved towards the hinge. Between this set of markings and the central ridge there is usually another set of small ridges running between the starting of the posterior plicæ and the central ridge, passing from the ends of the posterior ridge towards the anterior basal border and forming with the posterior plicæ a series of very acute angles. These acute-angled ridges are most distinct on young individuals, often becoming faint from erosion on the older ones. On a single young individual of about an inch in height, there occur two small accessory nodes on each side of what would be the second node of the line on larger specimens.

Interiorly the valves are deep, and of a brownish pearly color. The cardinal teeth are well developed, the hinge plate wide, the laterals curved and moderately high, and the space between the cardinals and the laterals somewhat flattened. The muscular scars are distinct and rather deep.

Locality and formation.— Laramie beds, 180 feet above Pierre shales, 130 miles northwest of Miles City, Montana. Barnum Brown, collector.

This species in many of its features somewhat closely resembles or typifies *U. cornutus* Barnes of the Mississippi and Ohio water-sheds, and forms another species with closely related resemblances. The species is named in honor Dr. E. J. Letson, the eminent conchologist in charge of the Collection of the Buffalo Society of Natural History, Buffalo, N. Y.

Unio corbiculoides n. sp.

PLATE XLI, FIGS. 6 AND 7.

Shell small, rather below the average of the genus, subcircular in outline, ventricose, smooth, except for growth lines and two faint ridges shown on the posterior

cardinal slope and so obscure as to readily escape observation. A few faint corrugations are seen on the posterior surface of the beaks. Length of the shell, from the anterior to the posterior margin, slightly exceeding the height from beak to base. Posterior margin slightly flattened vertically, which on single valves has a tendency to give a somewhat subquadrangular outline, scarcely perceptible on the uncompressed shell. Lunular space deeply sunken, narrow, but very marked and distinct; ligamental area deep, sharply margined. Beaks tumid when not eroded, faintly corrugated.

Interiorly the hinge plate is strongly bent, the lateral teeth curved, the cardinals strong and proportionally heavy, none of them have these features well enough preserved to present details. Muscular scars faint and the shells rather thin.

Locality and formation.— Laramie group, 130 miles northwest of Miles City, Montana, 80 feet above Pierre shales. Barnum Brown, collector.

EXPLANATION OF PLATE XXXVIII.

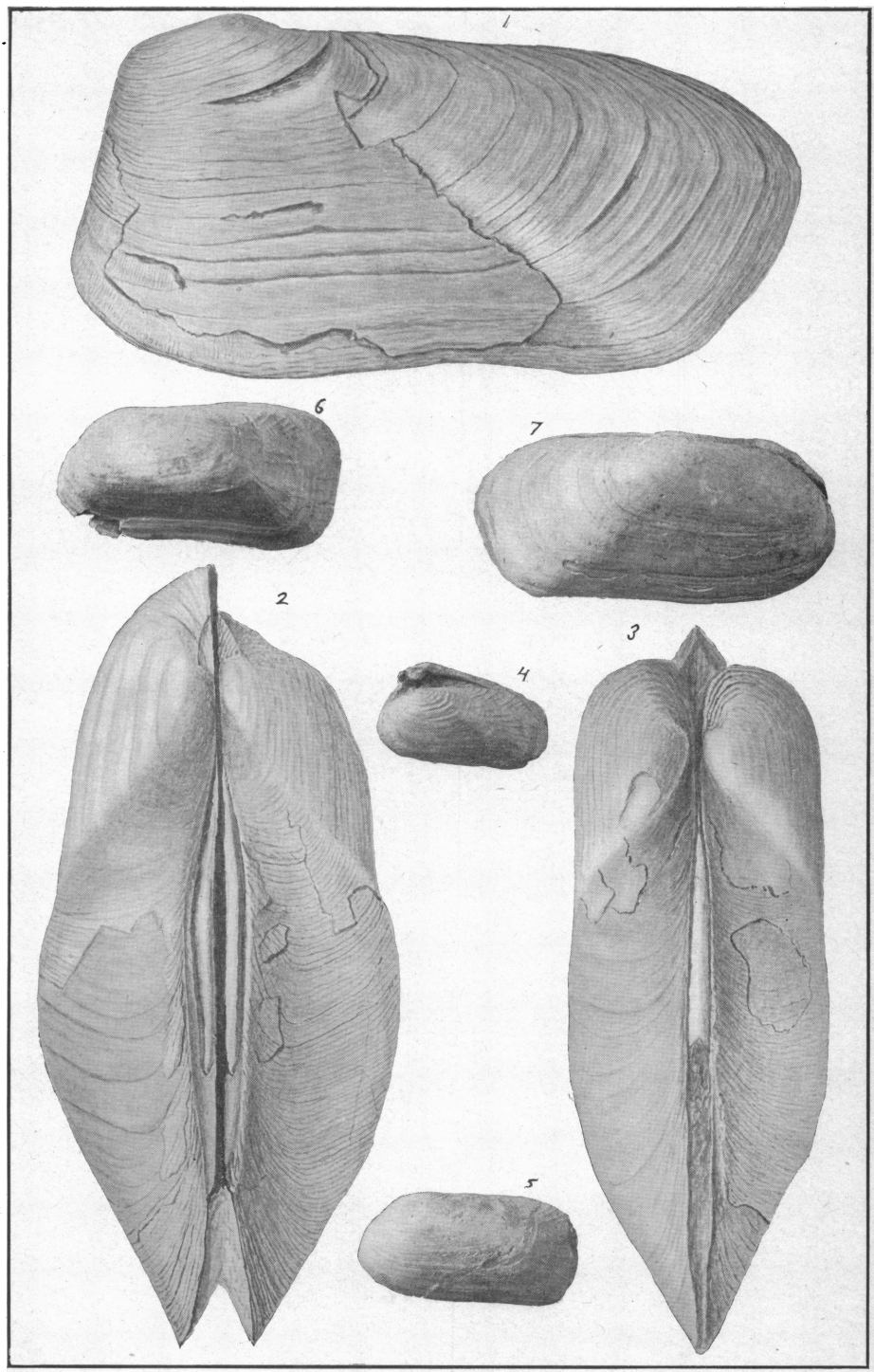
UNIO CYLINDRICOIDES n. sp. Page 626.

Fig. 1. View of the left valve, natural size, preserving a patch of the outside shell.

Fig. 2. Cardinal view of another specimen, natural size. The anterior end of the right valve is considerably broken. This shell probably being a female is much more ventricose than the other.

Fig. 3. Cardinal view of a male shell. The shell has mostly lost the outer prismatic layer.

Figs. 4–7. Views of four shells of different sizes or ages, on which the natural sculpturing is more or less preserved, but is not fully shown, as the photographs fail to show them. On the umbonal ridge the line of nodes was expected to be visible but is not.



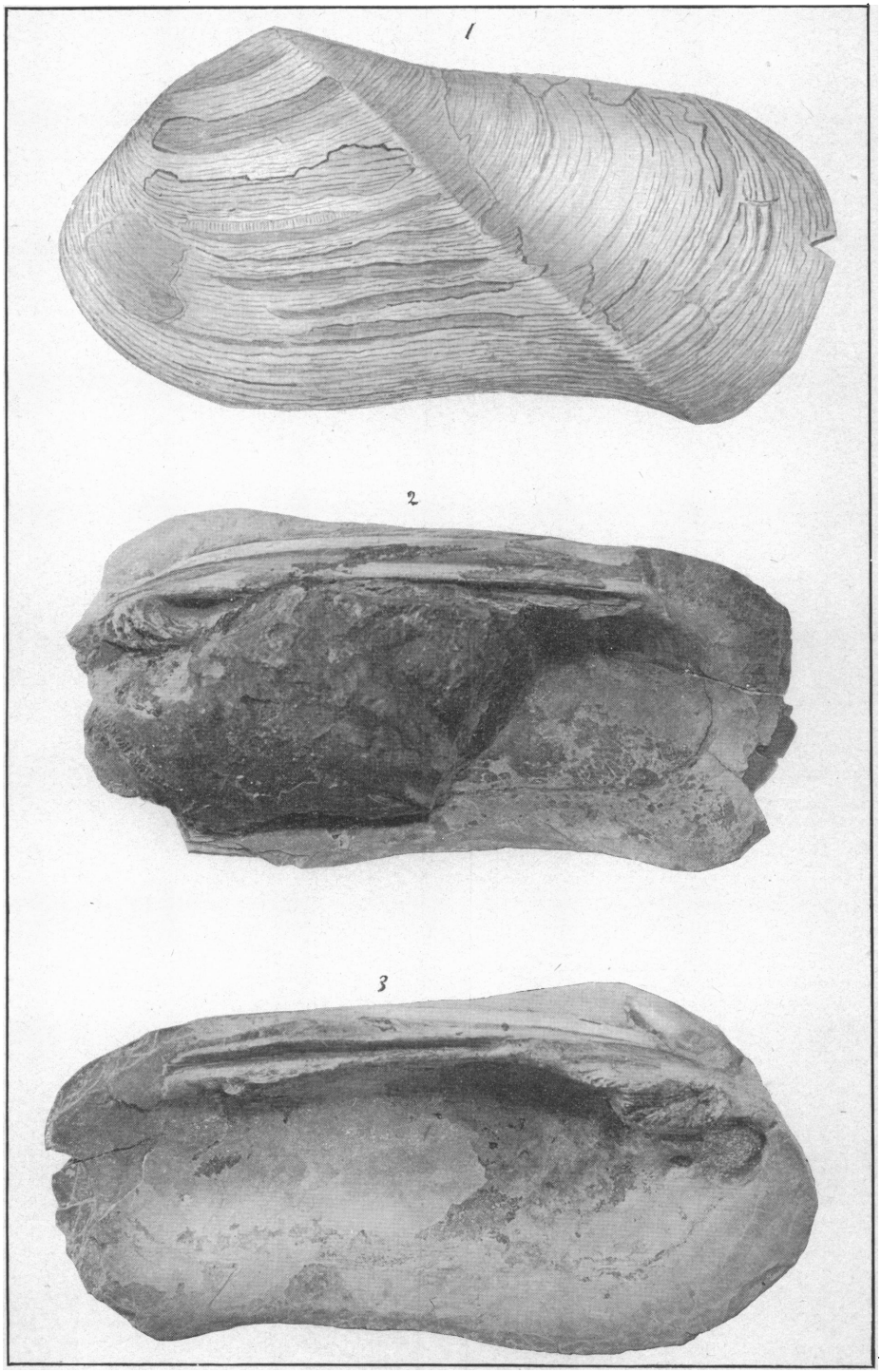
New Fossil Unionidæ.

EXPLANATION OF PLATE XXXIX.

UNIO CYLINDROCOIDES n. sp. Page 626.

Fig. 1. Left valve of the specimen shown in Plate XXXVIII, Fig. 2, natural size, showing the difference in what is supposed to represent a female form of the species; compare with Figs. 1 and 3, Plate XXXVIII. The outside of the shell has the surface more or less destroyed by decay.

Figs. 2 and 3. Views of the interior of the valves, right and left, of the same specimen represented in Fig. 1, where the outline is more or less restored. The figures show the teeth and muscular scars. Fig. 2 contained a partial cast of black chert when the photograph was made but which was subsequently removed.



NEW FOSSIL UNIONIDÆ.

EXPLANATION OF PLATE XL.

UNIO GIBBOSOIDES n. sp. Page 625.

Fig. 1. Outside view, natural size, of an entire right valve, showing the general features.

Fig. 2. View of the interior of another and slightly smaller valve.

UNIO PYRAMIDELLUS n. sp. Page 625.

Fig. 3. Exterior, natural size.

Fig. 4. Interior of the same specimen, natural size.

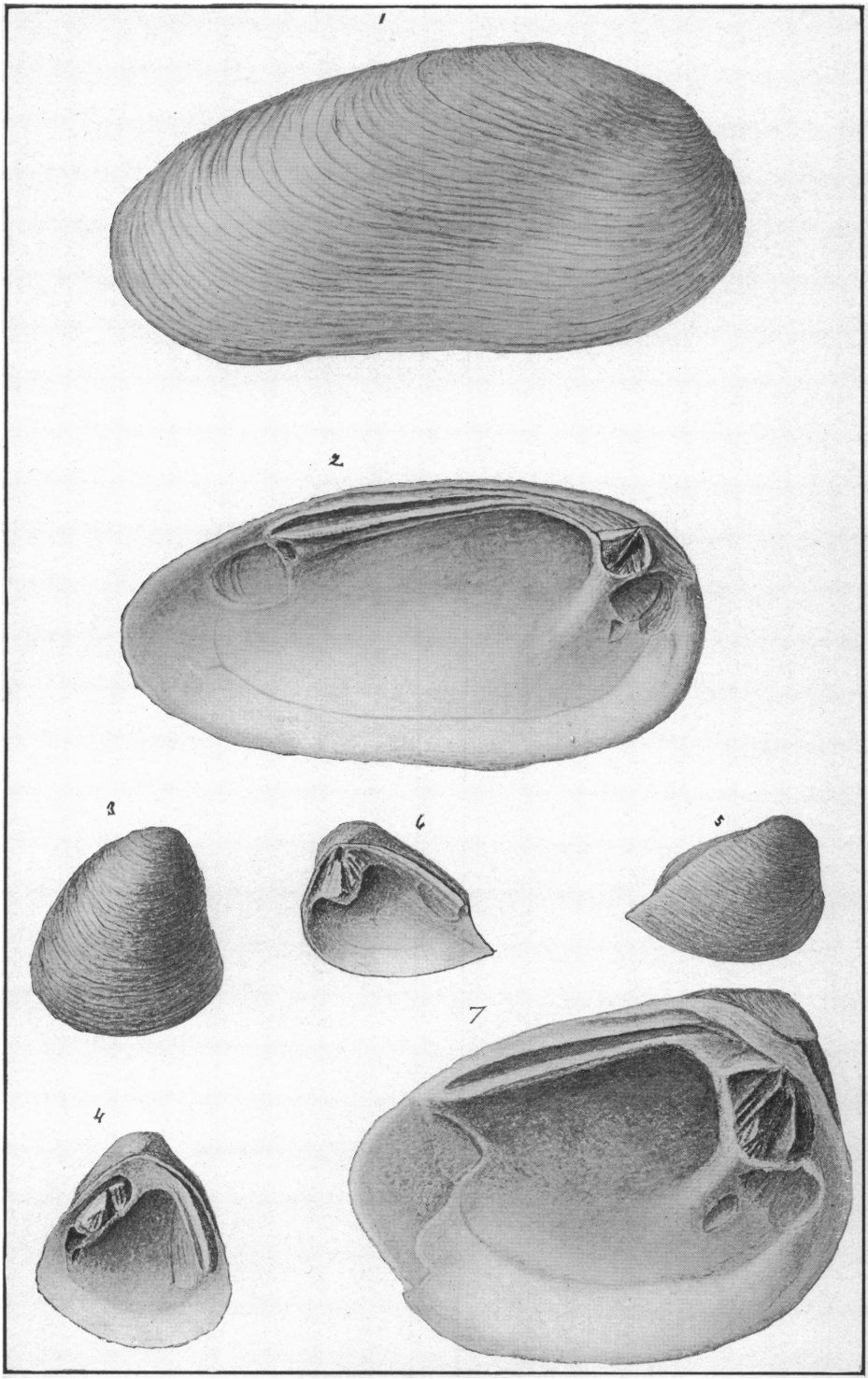
UNIO SUBTRIGONALIS n. sp. Page 626.

Fig. 5. Exterior view, natural size, of a very perfect valve.

Fig. 6. Interior view, natural size, of the same valve.

UNIO BIDESOPOIDES, n. sp. Page 624.

Fig. 7. Interior view, natural size, of a nearly perfect large valve. For exterior view see Plate XLI, Fig. 8.



NEW FOSSIL UNIONIDÆ.

EXPLANATION OF PLATE XLI.

UNIO PYRAMIDATOIDES n. sp. Page 624.

Fig. 1. Exterior view, natural size, of a left valve showing the general features of a narrow form of the species, and the corrugated beak.

Fig. 2. Posterior view of the same, showing the flattened posterior side and ligamental area.

Fig. 3. Interior of a small valve of the species.

Fig. 4. Interior of a left valve showing the very heavy cardinal tooth and thick lateral tooth.

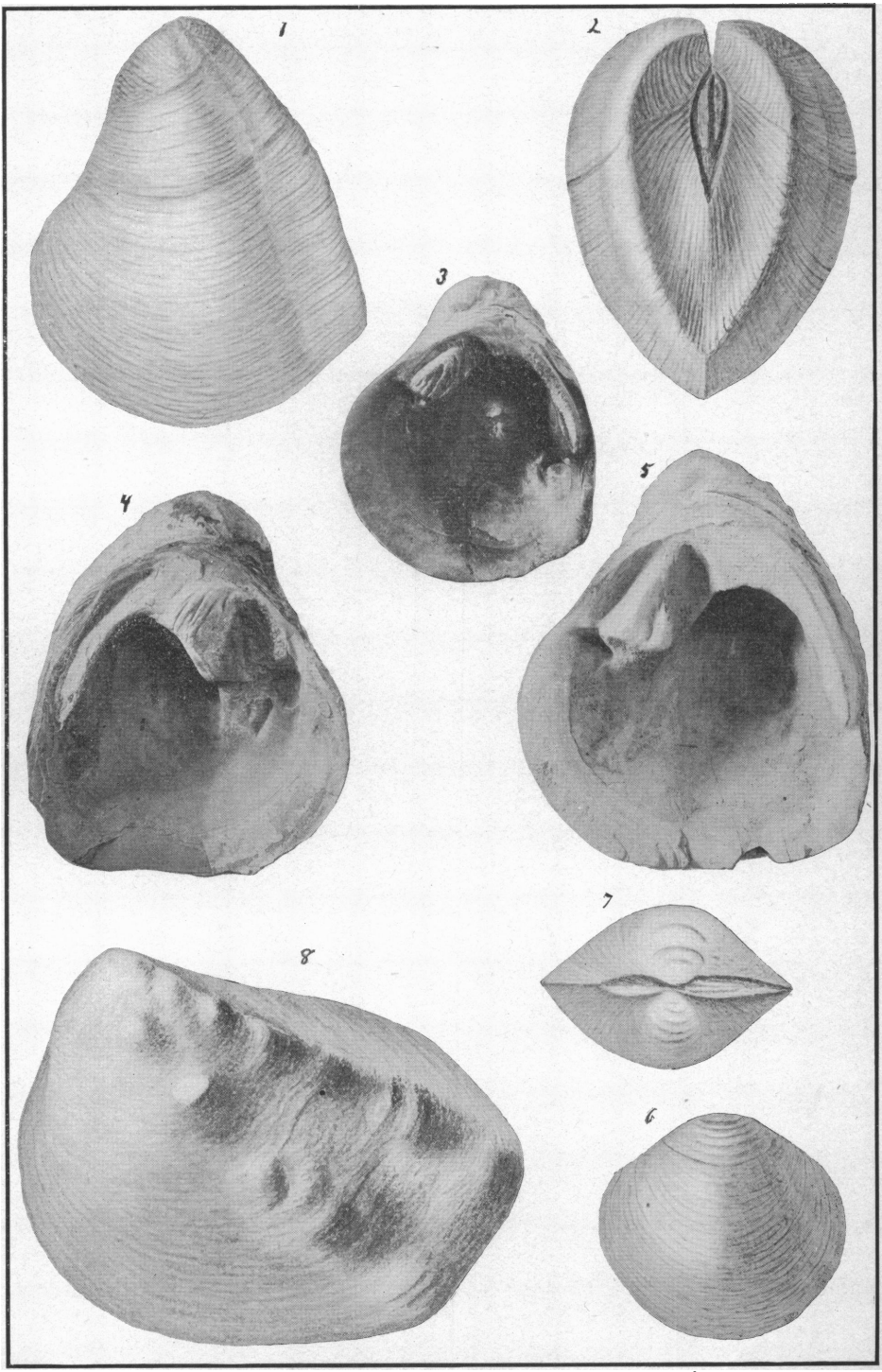
Fig. 5. Interior of a right valve of a larger individual showing the heavy cardinal tooth and the lateral with its corrugated ridge. This figure is of a somewhat broader form than the others, but not as broad as some. The last three figures are from photographs and do not show the features intended to be shown.

UNIO CORBICULOIDES n. sp. Page 627.

Figs. 6 and 7. Two views, natural size, of the only perfect individual of the species preserving the rotundity as well as all the markings of the species.

UNIO BIESOPOIDES n. sp. Page 624.

Fig. 8. View, natural size, of the exterior of a large entire valve, showing the double row of tubercles which characterize the species.



NEW FOSSIL UNIONIDÆ.

EXPLANATION OF PLATE XLII.

UNIO LETSONI n. sp. Page 627.

Fig. 1. View of a young individual entirely covered by the corrugations of the beak portion and only showing two of the central lines of nodes.

Fig. 2. A somewhat older specimen showing three nodes on a line at the center. Perhaps only an abnormal feature.

Fig. 3. View of an almost adult valve showing all the prevailing features of the species, including the central line of nodes which allies it to *U. cornutus*.

Fig. 4. View of another and opposite valve showing four central nodes but much smaller in size; the third is only partially formed and marginal.

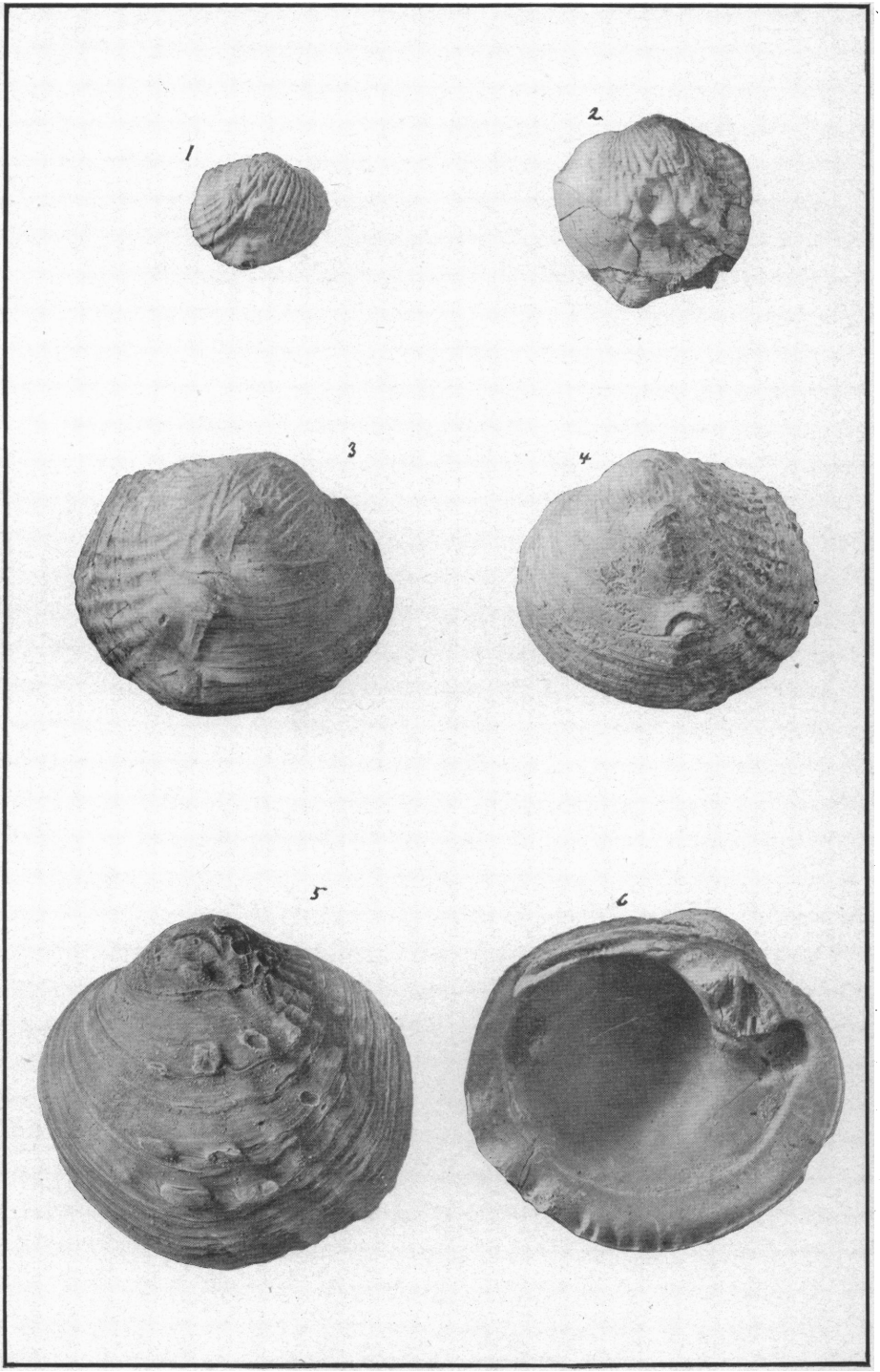
UNIO VERRUCOSIFORMIS *Whitf.*

See Bull. Amer. Mus. Nat. Hist., Vol. XIX, p. 484, pl. xl, fig. 10.

Fig. 5. View of a medium-sized specimen, introduced to correct and explain the imperfect figure in the previous volume of this Bulletin.

Fig. 6. View of the inside of the same valve.

This species has proved to be quite abundant and fairly well preserved, whereas those in the collections of previous expeditions were very poor and scarce, and the one figured was the best obtained at that time. The shell is very rotund and the nodes and plications of the surface are distinct and often well shown.



NEW FOSSIL UNIONIDÆ.