

Article VI.—TERTIARY MOLLUSCA FROM NEW MEXICO AND WYOMING.

BY T. D. A. COCKERELL.

PLATES VIII—X.

The collections obtained by the staff of the American Museum in 1912 have added to our knowledge of Western Tertiary Mollusca in several ways; while certain old specimens have been brought to light, and found to include two new Helicoid forms, one of gigantic size. The present paper offers descriptions of seven species which seem certainly to be new, and places a sixth in what appears to be its correct genus. With the exception of the great *Helix hesperarche*, which seems to be allied to West Indian forms, the new species are related, in some cases apparently closely, to the present fauna of the United States.

The question may be raised, how far we are justified in our generic determinations of fossil land shells. Frequently the characters of the shell seem quite convincing, but it must be admitted that absolute certainty is difficult to attain without the soft parts. The genus *Ashmunella*, so well developed in Arizona and New Mexico, has a shell like that of *Polygyra*, while the soft anatomy tells quite another story. Had *Ashmunella* become extinct, the species if found in the Tertiary strata would certainly have been referred to *Polygyra*, and it probably would have occurred to nobody to doubt the reference. While writing this paper, I have received from Lt.-Col. Godwin-Austin a paper on South African Zonitid snails, in which he points out that the South African species formerly referred to *Helicarion*, prove on examination of the soft parts to belong to a distinct (endemic) subfamily, with several well-defined genera. Facts of this sort point to the great antiquity of snail-faunæ, and while in one sense tending to cast doubt on our generic references of fossils, in another may be said to support them,—that is, to support the opinion that when fossil snails appear to be related to living genera of the same general region, they are actually (perhaps with some exceptions) so related.

ENDODONTIDÆ.

Pyramidula ralstonensis n. sp.

Diameter max. 7, min. 6; alt. $4\frac{1}{2}$ mm.; whorls $5\frac{1}{2}$, rounded, sutures deep; apical whorl and a half smooth, without sculpture; remaining whorls with very strong, regular, oblique riblets, about 6 to a mm. a short distance from the aperture, 11 or 12

to a mm. on the third whorl; no sign of any depressed line above the suture; umbilicus widely open, about $1\frac{1}{2}$ mm. diameter, but exposing very little of the penultimate whorl; the beginning of the last whorl shows a slight obtuse peripheral angulation, which is soon lost. There was evidently no distinct keel, even in the young.

Ralston Beds; top of red-beds. Three miles southeast of mouth of Pat O'Hara Creek, Wyoming (W. S., Sept. 22, 1912). One specimen.

A very pretty little species, with all the characters of a *Pyramidula* (subg. *Discus* Fitz.), and so far as anything shows, closely related to our modern forms. The very characteristic ribbing, the rounded whorls, the form of the umbilicus, &c. all agree; but it seems to me that the apical (embryonic) whorl is distinctly smaller than in the modern shells. Among the western fossils, "*Hyalina*" *nebrascensis* M. & H. has a slight resemblance to our shell, but has fewer whorls, with the last whorl much deeper, and more expanded at the aperture. *Pyramidula ralstonensis* was found with a great quantity of *Goniobasis carteri* Conrad, and smaller numbers of a *Vivipara* which I cannot at present separate from *V. wyomingensis* Meek, although they are small for that species.¹ With these were also found two species of rather large helicoid shells; one, so far as its poor condition permits us to judge, appears to be *Oreohelix megarche*; the other, with broadly rounded whorls, is strongly suggestive of *Helix nacimientensis*, or of the Asiatic genus *Macrochlamys*, but better specimens are much to be desired.

UROCOPTIDÆ.

Holospira grangeri n. sp.

Length of incomplete shell about 10 mm.; width in middle 4 mm.; ten whorls visible, first four together 2.5 mm. of the length of shell; first six, 4 mm., first eight nearly 7 mm.; apex obtuse; whorls not very convex; sculpture consisting of coarse strong ribs, 6 to 1 mm. on eight whorls; base of shell unknown.

Torrejon Formation, East Fork of Torrejon Arroyo, New Mexico, July–August, 1912 (*Granger and Stein.*)

I am really at a loss to know how to separate this from *Holospira ferrissi* Pilsbry, living today in Arizona! Were the shells perfect, no doubt differences would be found, but certainly there appears to be the closest resemblance. This is the species figured by White in Bull. 34, U. S. Geol. Survey, pl. v, f. 10, and referred by him with doubt to *H. leidyi* Meek. Figs. 8 and 9, on the same plate, also referred to *H. leidyi*, seem

¹ Genuine *V. wyomingensis* comes from the Bridger. The shells of *Vivipara* have remained for ages without substantial modification, but no doubt if we had fresh specimens, with the epidermis, color-characters and soft parts, several Tertiary species could be recognized, which are at present impossible of satisfactory definition.

to represent a different species, with finer sculpture. If either of these figures represents the real *H. leidyi*, which is very doubtful, it will be 8 and 9 (two views of the same shell).

HELICIDÆ.

Oreohelix (Radiocentrum) nacimientensis (White).

The very fine material of this species obtained by Messrs. Granger and Stein at the same time and place as *Holospira grangeri*, brings out the unexpected fact that the nuclear whorls have exactly the same radial sculpture as *O. megarche* C. & H., from which *Helix nacimientensis* differs principally in the elevated spire and rounded whorls. In typical specimens the body whorl is broadly and obtusely rounded; not angled or carinate; but the shells vary like the Jamaican *Pleurodonte acuta goniasmos* (Proc. Acad. Nat. Sci. Phila., LXIII, pls. IX, X, XI), and one specimen (var. *steini*, n. var.) has the periphery sharply angulate to the end, the shell having a max. diam. 32.5 mm. This particular specimen shows the nuclear sculpture very well, but it is also apparent on more normal shells. *Radiocentrum* was evidently the original form of *Oreohelix*, although today it includes only a few species. (cf. Pilsbry, Proc. Acad. Nat. Sci. Phila., 1905, p. 283.)

Polygyra (?) petrochlora n. sp.

Shell with diam. max. 20, min. 18.5 mm.; alt. 14 mm.; spire low-conical, about 3.5 mm.; periphery broadly rounded, not angulate or keeled; nuclear whorls smooth, the rest of shell with rather coarse very irregular oblique lines of growth, but no spiral lines, nor any depressed line above the quite deeply impressed suture; nuclear whorls rather large, diameter of first at end about 1 mm., of second (so far as exposed) no greater, but of third 1.5 mm., and of fourth, 2; whorls 6½; aperture strongly compressed, longer than wide; peristome not well preserved, but there was evidently a well-defined thickened lip, which was reflected round the narrow umbilicus. In the type specimen, although the apex is smooth, an excessively fine radial lineolation can be detected for about 1.25 mm. about the end of the first whorl and the beginning of the second.

"Marked 'Puerco, 1896'; probably Torrejon Formation." [New Mexico.]

The four shells examined are in a greenish to bright green rock, different from that containing the other Torrejon materials. They are accompanied by a small *Unio* with very convex valves, too imperfect to describe. I have been puzzled to know where to place these shells. At first I thought to refer them to *Gastrodonta*, which they resemble in general form, the shape of the aperture, and the nuclear whorls. I am not sure that this is not their proper place, but the evidently thick lip, reflected around the narrow umbilicus, rather suggests *Polygyra* or some allied form. The irregular striation

is also more like *Polygyra* than *Gastrodonta*, the sculpture of which is regular though often strong. So far as the general form and the shape of the aperture go, the shells might well belong to the group of *Polygyra columbiana*, and they are in fact extraordinarily like the John Day fossil *P. dalli*.

***Helix hesperarche* n. sp.**

Shell subglobose, with broadly rounded whorls; base somewhat flattened; umbilicus narrow but deep; spire very obtuse; embryonic whorls very large, but increasing slowly. Whorls about $4\frac{1}{2}$. Diam., max. 59, min. 56 mm.; alt. about 44 mm.; width of umbilicus about 7 mm.; the rather narrow aperture about 33 mm. long and 20 wide. Width of whorls at end, in mm., (1.) 4, (2.) 5, (3.) 8.5, (4.) about 11.5. The specimen is an internal cast, and nothing of the shell-structure is preserved.

"Either Puerco or Torrejon; probably Torrejon." [New Mexico]. (Amer. Mus. Nat. Hist., from the Cope collection.)

This gigantic shell, referred to *Helix* in the old broad sense, is wholly unlike anything known from the same region previously, living or fossil. It has rather a Zonitoid aspect, so far as the general build and form of aperture go. Thus in lateral view it has nearly the outline of *Macrochlamys dugasti* Morelet, from Siam, except that the outer lip of the aperture bulges less above. Seen from above, however, there is at once observed a great difference in the number of whorls and size of the nuclear whorl. I believe that the real relatives of *H. hesperarche* are the West Indian Helicidæ; thus in specimens of *Pleurodonte jamaicensis* (Gmel.) and *Thelidomus aspera* (Fér.) which I collected at Mandeville, Jamaica, I observe the very same large nuclear whorls, although the general form of the shells is different. There is, in the formation of the nuclear whorls, a striking resemblance to *Helix woodwardi* Edw. and *H. etheridgei* Edw., from the Oligocene of the Isle of Wight, which Taylor (Monog. Brit. Land and F. W. Moll., part 16, p. 205) figures and refers to the Asiatic genus *Helicostyla*. Although our shell is much broader and more depressed, with a different aperture, in its obtuse spire, rounded whorls and perhaps in the form of the umbilicus it resembles "*Helicostyla*" *pseudoglobosa* (d'Orb.) of the English Oligocene.

***Helix chriacorum* sn. sp.**

Shell about 6 mm. diameter, helicoid, with about $4-4\frac{1}{2}$ whorls; spire obtuse, very low-conical; sutures little impressed; last whorl broadly rounded, not at all keeled; the whole shell ornamented with very oblique sharp riblets, very regular, six to a mm. on last whorl, leaving the suture at an angle of perhaps 50° .

The label simply states "Torrejon; exp. 1912." The locality is in northern New Mexico.

A remarkable little shell, perhaps related to *Pyramidula* or *Oreohelix*, but the fine sharp riblets remind one of those on *Vallonia*.

ZONITIDÆ.

Gastrodonta coryphodontis n. sp.

Shell alt. $11\frac{1}{2}$, diam. $10\frac{1}{2}$ mm.; whorls 6; diameter of exposed part of fourth whorl about 2 mm.; apical whorl and a half, or rather more, with strong but fine regular oblique riblets, about 10 to a mm.; rest of shell with the usual rather weak oblique striæ, about as in *G. ligera*, but leaving the suture more obliquely; last whorl slightly to decidedly subangulate at the periphery, the angulation more marked in immature shells.

Five miles southeast of mouth of Pat O'Hara Creek, Clark's Fork Basin, Wyoming; above red-banded beds; probably base of Wasatch formation (*W. Stein*, 1912).

Found in quantity, with equal numbers of *G. sinclairi* (*G. evanstonensis sinclairi* Ckl.), from which it is easily distinguished by the more rapidly increasing whorls, although there is much general resemblance. Good specimens of the living *Gastrodonta intertexta* Binney (Columbia, Mo., *Dodds*) show fine sculpture on the nuclear whorls, finer than that of *G. coryphodontis*, yet essentially similar, and quite distinct from that on the rest of the shell. I therefore feel some assurance that the shell now described is really a *Gastrodonta*. I am now satisfied that *Helix evanstonensis* White is quite distinct from *G. sinclairi*, as well as from *G. coryphodontis*.

UNIONIDÆ.

Unio wasatchensis n. sp.

Shell oblong, about 60 mm. long and 33 high; moderately inflated; subtruncate anteriorly and posteriorly; umbonal region little prominent, strongly sculptured with regular undulating concentric ridges, about ten in number; ventral line nearly straight; growth lines strong; dentition not heavy. The level of the umbo is about 16 mm. from anterior end.

Wasatch; Big Horn Basin, Wyoming (Amer. Mus. Nat. Hist.). No other details given.

This appears to be the last member in the western Tertiary strata of a group of *Unio* better developed in the Upper Cretaceous. It is distinguished by the oblong or long oval form, beak, strongly sculptured with concentric ridges, and the more or less evident presence of two raised lines on each side passing from the umbo toward the posterior end. Excellent examples of this type are *Unio vetustus* Meek (Ann. Rept. U. S. G. S., 1882, pl. 7) and *Unio subspatulatus* Meek and Hayden, as illustrated by Stanton, (Bull. 257, U. S. G. S., pl. xiii, f. 1.). The dorsal raised lines are not always evident in the Wasatch species, but in some specimens they can be distinctly

seen. The cretaceous species have the dorsal outline decidedly convex, but in *Unio mendax* White, formerly confused with *U. vetustus*, the dorsal outline is straight or almost, owing to a greater development of the posterior dorsal region. *U. mendax* comes from Utah, and was found in coal bearing strata at Wales. So far as I am able to learn, it is probably of Fort Union age. *U. wasatchensis* is certainly close to *U. mendax*, but it differs constantly by the greater development of the anterior end, so that the umbones are not so near that end of the shell. It also appears to have the anterior lateral teeth considerably less massive than in *U. mendax*, though our material does not show the dentition well.

Many of the smaller shells accompanying the type of *U. wasatchensis* are long and narrow, more pointed posteriorly, suggesting some forms of the European *Unio pictorum*. As these agree in sculpture with the typical *wasatchensis*, and in the considerable series before me it appears impossible to sharply separate two groups of shells, I assume that all belong to a single species.

If, as appears probable, *U. mendax* is characteristic of the Fort Union, and *U. wasatchensis* is its successor in the Wasatch, these shells may be of considerable value in stratigraphic work.

These shells differ from typical (European) *Unio* in the beak sculpture, which is gently undulating, but not at all double-looped or zigzag. There is a general resemblance in beak-sculpture to the modern *Lampsilis ochracea* (Say) but in the fossil shells the ridges are much more numerous. It is quite possible that the fossils belong to *Lampsilis*, but in the absence of the soft parts this cannot be definitely determined.¹

Since the above was written, two broken specimens have come to hand, with the following data: typical Knight formation; Evanston Wasatch; mouth of Stowe Creek; 200 ft. (clay); W. G., June 13, 1906. One of these specimens, although broken in front, is otherwise beautifully preserved, showing the strong sculpture and the dorsal raised lines very well. The anterior lateral teeth in these shells are large, hardly at all smaller than those of *U. mendax*, but the shape is that of *wasatchensis*.

¹ Ortman (Annals Carnegie Museum, VIII, 1912, p. 228) states that it is absolutely impossible to classify Najades by the shells alone. "It is true that certain types of shell are characteristic within smaller groups. . . . but if we come to compare the subfamilies and families, we find that various types of shell turn up in them again and again. This goes so far that certain species resemble each other so much externally that they have been confused or placed together even by our greatest authorities, while they actually may belong to entirely different groups according to the soft parts."

EXPLANATION OF PLATES.

PLATE VIII.

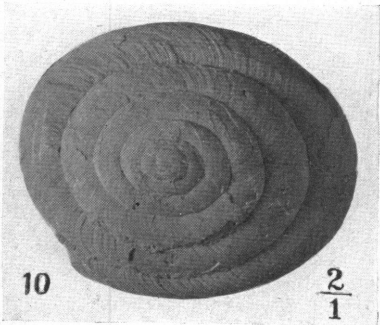
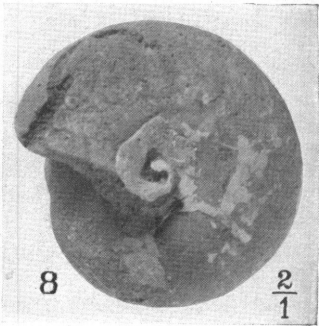
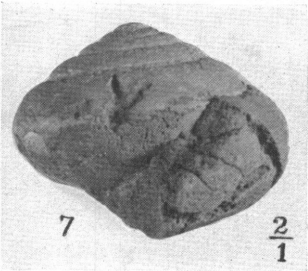
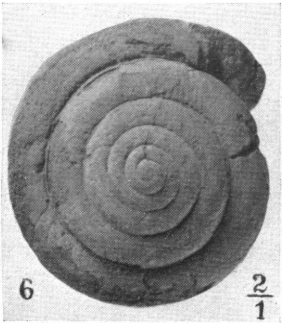
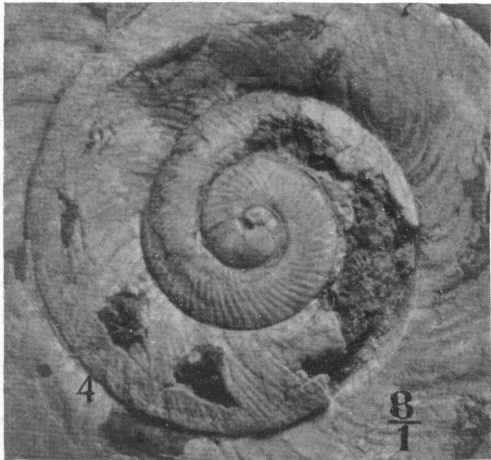
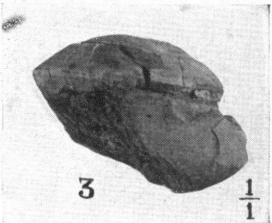
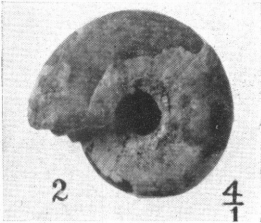
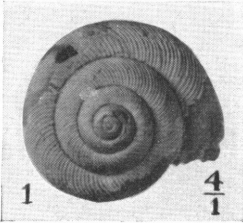
- Figs. 1, 2. *Pyramidula ralstonensis*.
Figs. 3, 4. *Oreohelix nacimientensis*.
Fig. 5. *Holospira grangeri*.
Figs. 6, 7, 8, 9. *Polygyra* (?) *petrochlora*. Type.
Fig. 10. *Polygyra* (?) *petrochlora*. Cotype.

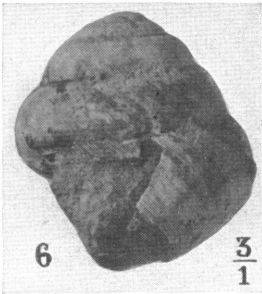
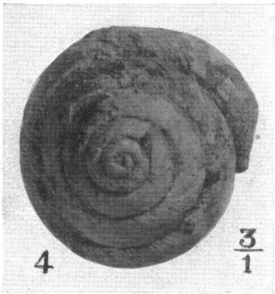
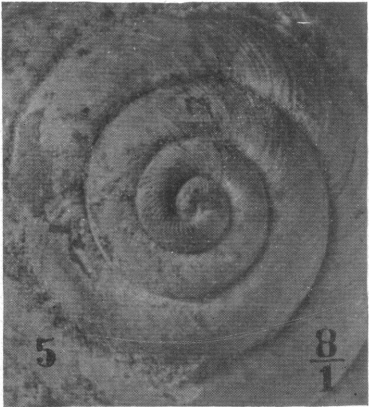
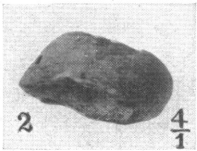
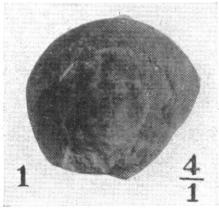
PLATE IX.

- Figs. 1, 2, 3. *Helix chriacorum*.
Figs. 4, 5, 6. *Gastrodonta coryphodontis*.

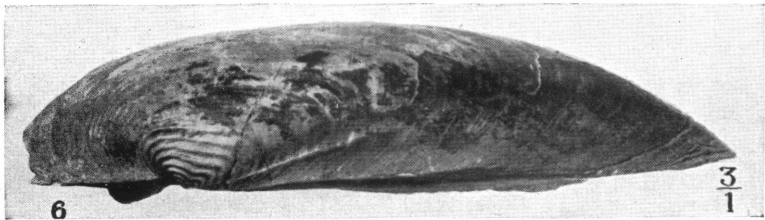
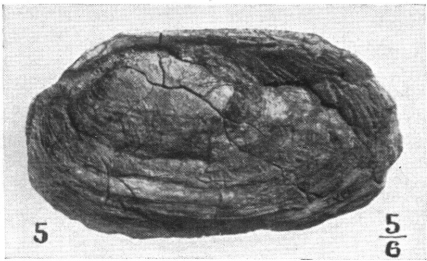
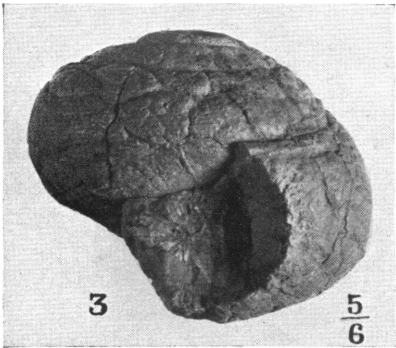
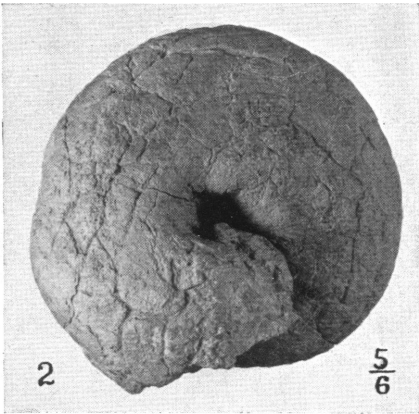
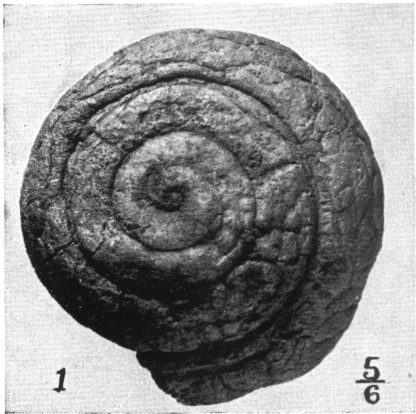
PLATE X.

- Figs. 1, 2, 3. *Helix hesperarche*.
Figs. 4, 5, 6. *Unio wasatchensis*.





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