STERKIANA

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ANNOUNCEMENT

STERKIANA is named after Dr. Victor Sterki (1846-1933) of New Philadelphia, Ohio, famed for his work on the Sphaeriidae, Pupillidae, and Valloniidae. It is fitting that this serial should bear his name both because of his association with the Midwest and his lifelong interest in non-marine Mollusca.

The purpose of STERKIANA is to serve malacologists and paleontologists interested in the living and fossil non-marine Mollusca of North and South America by disseminating information in that special field. Since its resources are modest, STERKIANA is not printed by conventional means. Costs are kept at a minimum by utilizing various talents and services available to the Editor. Subscription and reprint prices are based on cost of paper and mailing charges.

STERKIANA accepts articles dealing with non-marine Mollusca of the Americas in English, French, or Spanish, the three official languages of North America. Contributors are requested to avoid descriptions of new species or higher taxa in this serial as the limited distribution of STERKIANA would probably prevent recognition of such taxa as validly published. Papers on distribution, ecology, and revised checklists for particular areas or formations are especially welcome but those on any aspect of non-marine Mollusca will be considered.

STERKIANA will appear twice a year or oftener, as material is available. All correspondence should be addressed to the Editor.

SUBSCRIPTIONS: 50¢ per number; subscriptions may be entered for not more than 4 numbers in advance; please make checks and money orders payable to the Editor.

STERKIANA est une collection de travaux sur les Mollusques extra-marins des deux Amériques, distribuée par un groupe de malacologues du centre des Etats-Unis. STERKIANA publie des travaux en anglais, en français et en espagnol acceptés par le conseil de rédaction. Prière d'adresser toute correspondance au Rédacteur.

ABONNEMENT: 50¢ le numéro, par chèque ou mandat payable au Rédacteur.

STERKIANA es una coleccion de trabajos sobre los Moluscos extra-marinos viventes y fosiles de las dos Americas, editada por un grupo de malacólogos de los Estados Unidos centrales. Contenirá en el porvenir trabajos en inglés, francés, y español que serán acceptados por la mesa directiva. La correspondencia deberá ser dirigida al Editor.

PRECIO: 50¢ el número.

CHANGES IN THE MOLLUSCAN FAUNA OF WHITE LAKE, LANARK AND RENFREW COUNTIES, ONTARIO, AFTER THIRTY YEARS.

A. La ROCQUE

Department of Geology, Ohio State University, Columbus.

My first visit to White Lake took place in the early thirties in the company of no less a guide than Chief Justice Francis R. Latchford of Toronto He had seen some of my early papers on Mollusca in the Canadian Field-Naturalist and we had corresponded, b ut one fine day which I have unfortunately neglected to record, he walked into my office in the old Victoria Memorial Museum in Ottawa and we talked Mollusca for a long while. Since he was spending the summer with his son in Ottawa, we decided to go collecting the following Sunday and I left him the choice of locality. He decided on White Lake and we spent the day there. That excursion proved most enjoyable and I had a first-hand demonstration of Judge Latchford's knowledge of the habitat of Sphaeriidae and of his expert use of a Walker scoop-dredge. White Lake made such a favorable impression on me that I decided I would collect it thoroughly at the first opportunity, which came in September (7-13) of 1935. The specimens collected then are now in the National Museum of Canada collections and I list them from my field note book below.

In July, 1965, on a prospecting trip for shell marl with one of my graduate students, I returned to White Lake and spent a few hours collecting Mollusca and marl from the bottom of the lake. The marl fauna will be reported upon later. The object of this paper is to point out an addition to the molluscan fauna of White Lake and an apparent change in the abundance of other species. The most remarkable feature of White Lake this summer (1965) is the extraordinary abundance of a viviparid snail, tentatively identified as the European *Viviparus viviparus* Linn., which seems to have taken over most of the lake. Further details on its occurrence are given below. In the following list the 1935 situation for each species is compared with that of 1965.

Anodonta grandis (Say). In 1935 a few live specimens were collected from muddy bays and a great many more were seen in muskrat heaps along shore. In 1965 no live specimens were collected but the species must still survive in the lake as dead shells with the animal still present were noted floating near shore in masses of waterweed along with shells of other species.

Elliptio complanatus (Dillwyn). In 1935 a few live specimens were noted and the species was well represented in muskrat heaps with *Anodonta grandis*. In 1965 the species is probably still to be found alive in the lake as dead but fresh specimens were collected near the outlet, on the shore just below the retaining wall of the dam there.

Sphaerium cf. *S. simile* (Say). In 1935 many specimens of this species or a near relative were collected alive with a Walker scoop-dredge, following the example of Judge Latchford's earlier collecting. Whether they should be referred to *S. simile* (Say) or *S. sulcatum* (Lam.) is still doubtful. In 1965 no live specimens of *Sphaerium* were seen but it must be said that no dredging was done for them. Smaller species of *Sphaerium* may turn up in the marl.

Pisidium sp. In 1935 several live specimens of species of this genus were obtained. None

was seen in 1965 but again this may be due to lack of specific searching with a dredge. Abundant specimens, so far unidentified, were noted in the marl collected from the bottom of the lake.

Valvata tricarinata Say. This was noted in 1935 collections but not in 1965. Several bleached and long-dead specimens were collected from the marl.

Viviparus cf. *V. viviparus* Linn. In 1935 not a single specimen of this species was noted. It was introduced into the lake, probably with other material dumped out from aquaria for tropical fish. When this happened, I am unable to say as few malacologists have visited White Lake in the last thirty years. If anyone interested in shells had collected there during that time the species would have attracted his or her attention because of its relatively large size and banding. It is possible that it has been scarce enough to escape attention until recently but it is most conspicuous at present. It lives in large numbers on all kinds of bottom, in exposed and protected situations, with and without vegetation, in water less than one foot to as much as 10 feet deep. The concentration of individuals varies from one part of the lake to another. In many places it was estimated to be as many as 10 per square foot, in others only one per square yard. *Viviparus* seemed to occupy the bottom of the lake to the exclusion of almost everything else. Nevertheless, all is not well with this enormous population. Dead shells, only half grown, are more numerous than living ones in most places and it proved difficult to find full-grown specimens. One is tempted to speculate that the species has achieved a period of phenomenal increase and that factors which we can only theorize upon are beginning to reduce the population. In any event, the increase has adversely affected other species of the lake, as this account will show.

Amnicola limosa (Say). The species was collected alive in 1935. Not a single live specimen was seen in 1965. This may be due to lack of intensive collecting this summer, of course, but it still seems to be scarcer than it might.

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BINNEY REPRINT

With the following page in this number of STERKIANA we continue the reprint of Binney's *Land and Freshwater Shells of North America* (1865) which was started in the previous number (No. 18, p. 21-50).

As noted previously, this valuable work is being reprinted by permission of the authorities of the Smithsonian Institution to whom the Editor reiterates his thanks.

The entire text is being reset as cost of fac-simile reproduction would be prohibitive.

In the course of resetting this work, a few problems arose, some of them foreseen - e.g. the reprinting of figures - and some unforeseen - e.g. the variety of type fonts used in the original and not available to STERKIANA. A word on the solutions adopted may not be amiss.

The position of each figure in the text is indicated by number in the appropriate position. Each figure will be reproduced photographically and figures grouped on plates in serial order. The first of these plates should be ready to appear in the next number of STERKIANA.

The variety of type fonts used in the original text is nothing short of amazing. It has proved to be impossible to duplicate - or even to approach - this in the reprint so all headings have been set as centered or side heads of the same size. We hope that this necessary expedient will not prove too distasteful to the reader.

Instalments of this work will appear in future issues of STERKIANA as space permits.

8270 28 Bet. Pike L. & Ft. Union. Gov. J.J. Stevens. .....
8485 2 Mo. of Yellowstone. ..... Cabinet series.

Limnaea palustris, Müll.--Shell oblong conic, gradually acuminated, reticulate with transverse lines and longitudinal wrinkles; whirls rather more than six; spire acutely terminated; suture moderately impressed; aperture shorter than the spire; labrum, inner sub-margin, reddish obscure; labium, calcareous deposit rather copious, not appressed at base, but leaving a linear umbilical aperture; body whirl on the back longer than the spire.

Fig. 60

Inhabits Canandaigua Lake.

Var. *a*. Whirls simply wrinkled across, the calcareous deposit at base appressed to the surface of the whirl.

This species was found by Mr. A. Jessup; it bears the most striking resemblance to *L. palustris*. The variety was found by the same enterprising mineralogist at Morristown, New Jersey. I have subsequently received specimens from Mr. S. B Collins, of New York, who procured them in a marsh near the Saratoga Springs. (Say, J.A.N.S.) The fold of the columella is much more profound than that of *umbrosus*. (Say, Am. Conch.)

Helix palustris, Müller, &c., Rackett, Tr. Linn. Soc. XIII, 42 (1822).

Limnaeus elodes, Say, Journ. Ac. Nat. Sc. Phil. II, 169 (1821); Am. Conch. IV, pl. xxxi, f. 3; ed. Chenu, 44, pl. viii, f. 3.--Küster in Ch. ed. 2, 42, pl. vii, f. 17-21.

Limnaea elodes, Gould, Inv. of Mass. 221, f. 146, 147 (1841).--Adams,

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Shells of Vermont, in Thoms. Hist. 153 (1842). --Anonymous, Can. Nat. II, 199, fig. (1857).

Limnaea fragilis (not of Linnaeus),[1] Haldeman, Mon. 20, pl. vi, xv, f. 1 (1842); 53, pl. xiv, f. 1--DeKay, N. Y. Moll. 68, pl. iv, f. 68 (1843).

Limnaea palustris, Müller *(Buccinum)*, &c.--Sheppard (1829), Tr. Lit.. Hist. Soc. Quebec, I, 196.

Limnaea nuttalliana, Lea, Pr. A.P.S. II, 33 (1841); Tr. Am. Phil. Soc. IX, 9 (1844). Obs. II, 9.--Küster (*Limnaeus*) in Ch. ed. 2, 38, pl. vii, f. 5.

Limnaea plebeia, Gould? (see below).

Limnaea expansa, Haldeman, Mon. 29. pl. ix, f. 6-8 (1842); Suppl. to part I, p. 3 (1840). --DeKay, N.Y. Moll. 75 pl. xxxvi, f. 348 (1843). --Küster *(Limnaeus)* in Chemn. ed. 2, 39, pl. vii, f. 6, 7.

Ranging from New England, through Pennsylvania and Kansas, to California and Oregon. Very numerous in British America, reaching a high latitude, as shown by specimens from Hudson's Bay and Fort Resolution.

Mr. Say suggests the identity of *L. elodes* with the European *L. palustris*. I have no doubt of it, the species being one of the circumpolar forms common to the three continents. I have given the original description above, and Fig. 60 is a fac-simile of one of Say's. It is a very variable species, sometimes scarcely to be distinguished from *L. reflexa*, as remarked under that species (p. 39). *Limnaea plebeia* is also referred to under *L. reflexa* (p. 40). Dr. James Lewis unites *L. catascopium* and *L. emarginata* to *L. elodes*.

Limnaea nuttalliana appears to me a form of this species. My opinion is based on a careful examination of specimens so labelled by Mr. Lea. The original description here follows, and a drawing of the original specimen. So little does this figure (62) correspond with *L. palustris* that, judging by it alone, I should be inclined to reverse my opinion of the identity of *nuttalliana* with *palustris*. It is one of the points to which attention must be directed. No. 8256 and 8257 were labelled *L. nuttalliana* by Mr. Lea. One of them is here figured (Fig. 61). No. 8318 and 8474 are also this form.

Fig. 61.

Limnaea nuttalliana.--Shell ovately conical, rather thin, striate, subdiaphanous, pale brown, imperforate; spire rather short; apex red;

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[1] *L. fragilis*, of Linnaeus, is synonymous with *L. stagnalis*.

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sutures impressed; whirls six, convex; aperture ovate, inflated, banded within. Oregon. My cabinet and cabinets of Prof. Nuttall and Dr. Jay. Diam. .50; length .95 inch.

A fine, rather robust species, rather resembling *L. elodes*, Say, but shorter and more inflated, and having a larger and more curved fold. The aperture is rather more than one-half the length of the shell, and is retuse at the lower part. Under the lens may be observed very minute revolving striae. The band within the aperture is removed from the edge of the lip, and is broad and brown. The lip is not reflected. *(Lea.)*

A recent visit to Prof. Haldeman has enabled me to examine the two original specimens, the only ones known, from which were drawn the description of *Limnaea expansa*. Believing them accidental variations only, I add them to the synonymy of *Limnaea elodes*. The Oregon specimen, 8573 of the collection, most nearly resembles this form. A fac-simile of Haldeman's figure and a copy of his description here follow:--

Limnaea expansa.--Shell short, smooth, translucent, and fragile; body whirl inflated; spire as long as the aperture, and rapidly attenuated to an acute apex; whirls five, somewhat flattened; suture shallow, but very distinct. Color brownish ochre-yellow.

Fig. 63.

Found only in Vermont.

I owe the opportunity to describe this new species to Dr. Gould, who gave me specimens, and the information that they are from Vermont. It differs from *L. elodes* in having a polished surface, expanded aperture, obsolete lines of growth, translucency, and a deeper fold upon the columella. It cannot be confounded with any other species. *(Haldeman.)*

It must constantly be borne in mind that I cannot pretend at this time to speak very positively in regard to the synonymy of the North American Limnaeidae. My conclusions are the best I can arrive at with my present material. It is a point to be decided in future whether *L. nuttalliana* and *L. expansa are* synonyms of *L. palustris*.

Fig. 64.

The forms referred to this species are shown in Fig. 64.

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Fig. 65 will be of interest, as it is copied from Moquin-Tandon's figure of *Limnaea palustris* of France. Fig. 65.

Reeve points out the strong resemblance, if not identity, of the European and American shells.

Fig. 66 represents some of the forms of this variable species which are represented in the Smithsonian collection.

(Fig. 66.)

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.

8123 8 Monterey, Cal. ....
8123 6 Interior Oregon. Com. Wilkes .....
8269 6 Yellowstone River. Col. Vaughn .....
8271 8 Mohawk N.Y. Dr. J. Lewis .....
8272 8 Oskosh, L. Winnebago, A.C. Barry ....
8273 5 Fairhaven, Vt. Dr. J. Lewis .....
8274 4 Marietta, O. W. Holden? .....
8275 2 Lake Winnipeg. R. Kennicott .....
8276 13 Scarboro' Me. Dr. J. Lewis .....
8277 1 Four Mile Creek, Oswego ....
8278 6 Roxbury, Mass. Dr. J. Lewis .....
8279 6 Nimahaw River. K.T. Wm. T. Magraw 'Swamps'
8280 10 Summer Lake, O. ....
8281 16 Near Chimney River. Wm. T. Magraw. 'Swamps.'
8282 9 Mohawk, N.Y. Dr. J. Lewis. .....
8283 14 Grand Rapids, Mich. ....
8284 20 Sing Sing, N.Y. Rev. R.J.W. Buckland. .....
8285 14 Mohawk, N.Y. Dr. J. Lewis .....
8286 2 Lake Winnipeg. R. Kennicott. .....
8287 2 Milwaukee, Wis. I.A. Lapham. .....
8288 6 Port Huron, Mich. Prof. S. F. Baird. '*umbrosa*,' I. Lea.
8289 14 Grindstone Creek. ....
8290 2 Lake of the Woods. R. Kennicott. ...
8291 23 Grindstone Creek. ....
8464 50 Platte Riv. at Ft. Kearney Neb. Capt. J. H. Simpson, With animal in alcohol.
8467 28 Chilencynck Depot, Puget Sound. A. Campbell. With animal in alcohol.
8477 5 Grand Rapids, Mich. ....
8568 2 Pacific Coast. ....
8735 12 San Francisco. Rowell. In alcohol.

8736 4 Clear Lake, Cal. Dr. Veatch. ....
8739 2 San Francisco. Rowell. .....
8953 6 Ft. Simpson, Br Am R. Kennicott .....
8573 1 Oregon. .... *(expansa,* Hald.?)
8958 .. Ft. Resolution. R. Kennicott. ....
9072 20+ " "
9073 20+ " "
9136 20+ " "

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9138 10 Mohawk N.Y. Dr. Lewis .....
9176 30+Vermont J.E. Chittenden. .....
9180 10 Lynn, Mass. Dr Prescott. .....
8256 16 Apple Creek lat. 47° ... *nuttalliana,* teste Lea.
8257 4 Big Sioux ..... "
8318 50 Mo. of the Yellowstone. .. "
8474 1 Big Sioux ..... "
9286 1 Otter Tail Creek, Min. ....
9288 15 Upper Mackenzie. ....
9291 11 Great Slave Lake. ....
9237 5 Wright's L., Cal. .... *nuttalliana,* teste Lea.
9239 4 Klamath Marsh O. Dr. J. S. Newberry. *nuttalliana,* teste Lea.
9246 1 Rhett L., Cal. .... *nuttalliana,* teste Lea.
9241 8 Benicia. Dr. J. S. Newberry .....
9289 20 Yukron, mo of Porcupine. R. Kennicott. .....

Limnaea proxima, Lea.--Shell acutely conic, rather thin, closely and irregularly striated, horn-colored, minutely perforated; spire sub-elevated, sharpened at the apex; sutures deeply impressed; whirls seven convex; aperture sub-inflated, sub-elliptical, banded within, columella slightly plicate.

Fig. 67.

Arroya San Antonio, California: Dr Trask. *(Lea.)*

Limnaea proxima, Lea, Proc. Ac. Nat. Sci. Phila. VIII, 80, (1856).

The above is Mr. Lea's description. Fig. 67 is drawn from No. 9204 of the collection, determined by him. The rapid enlargement of the whirls in width appears to be the chief characteristic of this species.

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.

9204 4 San Francisco. Judge Cooper. Authentic - one fig'd.
9195 .. California. " Named by I. Lea.

Limnaea desidiosa, Say.--Shell oblong subconic; whirls five, very convex, the fourth and fifth very small, the second rather large, suture deeply indented; aperture equal to or rather longer than the spire; labium, calcareous deposit copious, not perfectly appressed at base, but leaving a very small umbilical aperture.

Fig. 68.

Inhabits Cayuga Lake. Length 7-10 of an inch.[1]

Found by Mr. Augustus Jessup. It is closely allied to *L. elodes,* but the whirls are more convex, one less in number, and the two terminal ones are proportionally smaller; the callus of the labium, also, near its inferior termination, is applied still more closely to the surface of the body whirl. *(Say.)*

Limnaea desidiosa, Say, Journ. A. N S. II, 169 (1821); Long's Ex. II,

[1] See remarks under *L. humilis*

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263; Am. Conch. VI, pl. 1, f. 5; ed. Binn. 66, pl lv, f. 3.--Adams, Shells of Vermont, 154 (1842).--DeKay, N. Y. Moll. 73, pl. v, f. 78 (1843).--Küster in Ch. ed. 2, 47, pl. viii, f. 22/26 *(Limnaeus).*--Gould, Inv of Mass 219, f. 150 (1841).--Haldeman, Mon. p. 31, pl. x; p. 48, pl. xiii, f. 16-18 (1842).--Anony. Can. Nat. II, 198, fig. (1857).

Limnaea acuta, Lea, Tr. Am. Phil Soc. V, 114, pl. xix, f. 81 (1837); Obs. I, 226.

Limnaea obrussa, Say, J. A. N. Sc V, 123 (1825); Binney's ed. 113.--DeKay, N. Y. Moll. 75 (1843).

Limnaea philadelphica, Lea, Proc. Am. Phil. Soc. II, 32 (1841); Tr. IV, 8 (1844); Obs. IV, 8.

Limnaea fusiformis, Lea, Pr. Am. Phil. Soc. II, 33 (1841); Tr. IX, 10, (1844); Obs. IV, 10.

From New England to Kansas.

An authentic specimen of *L. desidiosa,* in the Academy's collection, is drawn somewhat larger than nature in Fig. 68.

Mr. Haldeman places *L. obrussa* in the synonymy of *L. desidiosa.* Say's description here follows, and a drawing of an authentic specimen from the Academy at Philadelphia.

Limnaea obrussa.--Shell oblong, rather slender, pale yellowish testaceous; whirls five, slightly rounded; apex acute; suture deeply impressed; aperture not dilated, within pure white; columella with the sinus of the fold very obvious (*Lister,* pl. 114, f. 8?). Total length nine-twentieths of an inch; aperture one-fourth; breadth nearly one-fifth.

Fig. 69.

All the individuals that have occurred were covered with an earthy slime. They inhabit a small rivulet below the fish-ponds at Harrowgate, the seat of my friend Mr. J. Gilliams. *(Say.)*

The descriptions of *L. philadelphica, fusiformis,* and *acuta* here follow, as well as figures of them drawn from Mr. Lea's original specimens, excepting *L. acuta,* which is copied from his original figure. Haldeman and DeKay both place *L. acuta* in the synonymy of *L. desidiosa.* Specimens labelled *L. philadelphica,* by Mr. Lea, are in the Smithsonian collection from the Yellowstone River. Küster, *l.c.* places *obrussa, acuta,* and *philadelphica* in the synonymy.

Haldeman refers doubtfully *L. casta* to this species. It appears to me, however, rather a synonym of *L. columella.*

The name L. fusiformis *is preoccupied by* Sowerby (Min. Conch. II, 155, pl. clxix, 1818).

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Limnaea acuta, Lea.--Shell elevated, thin, smooth, dark-brown; spire attenuate; whirls six, aperture subovate.

Fig. 70. Pond four miles north of Philadelphia. Diam. .3, length .7 inch.

This delicate species, though attenuate, is not so much so as the *exilis,* herein described. Its whirls are more convex and the body whirl larger, the aperture being about one-half the length of the shell. Several specimens were found by me, some years since, in a very small pond near the Falls of Schuylkill. Since then this pond has occasionally dried up, and I have not been able to find others. Although there are other ponds near to this, which other species inhabit, I have never been able to discover the *acuta* in any other spot. *(Lea.)*

Limnaea philadelphica, Lea.--Shell ovately-conical, thin, striated, shining, diaphanous, rather golden, imperforate; spire rather elevated; sutures much impressed, whirls five, convex; aperture narrow-elliptical.

Fig. 71. *Hab.* River Schuylkill, near Philadelphia. My cabinet and cabinets of P.H. Nicklin, and Dr Griffith. Diam .20, length .48 of an inch.

This species is about the size of, and is allied to *plica* and *griffithiana,* herein described, and to *modicella,* Say. It has a more elongated aperture than *griffithiana,* has a smaller fold than *plica,* and is higher in the spire than *modicella.* The aperture is about half the length of the shell. I procured many specimens west of Philadelphia. Dr. Griffith informs me that he found them south of the city. *(Lea.)*

Limnaea fusiformis Lea.--Shell fusiform, rather thick, closely striate, pale yellow, imperforate; spire rather short; sutures slightly impressed; whirls six, flattened; aperture narrow-elliptical.

Fig. 72. *Hab.* Niagara River Lewistown, New York: Tobias Wagner. My cabinet, and cabinets of P.H. Nicklin, and Tobias Wagner. Diam. .35, length .60 of an inch.

Among a number of interesting shells collected by T. Wagner, during a long journey in the interior of our country, were several specimens of this species, which has not been, I believe, before noticed. It is found with, and is somewhat allied to, *L. desidiosa,* Say. It differs in being more fusiform, having a larger aperture, and flatter whirls, and in being imperforate. It is about the size of, and re-

sembles, *L. casta,* herein described. It differs in being less elevated in the spire, in the whirls being more flattened, in having a distinct and curved fold, and in being imperforate. The aperture is nearly two-thirds the length of the shell. The last two whirls are disposed to be wrinkled. *(Lea.)*

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(Fig. 73, across top of page)

Fig. 73 gives, at one view, the forms which I have referred to the synonymy of this species. Fig. 74.

Fig. 74 represents the European representative of *L. desidiosa.* It is copied from Moquin-Tandon's figure of *L. truncatula.*

Cat. No ; No. of Sp.; Locality.; From whom received; Remarks.

8310 4 Minnesota. I. A. Lapham .....
8311 11 Grand Rapids, Mich. Dr. J. Lewis.
8312 8 " " "
8313 34 Apple Creek, lat. 47º.. ....
8314 4 Loup Fork. ....
8315 8 ..... Dr. J. Lewis. Calcareous tufa. Fossil.
8316 36 Mohawk, N. Y Dr. J. Lewis. .....
8317 29 Westbrook, Me. " .....
8470 25 Mohawk, N. Y " Alcohol.
8476 1 ..... W. G. Binney. .....
8526 4 Yellowstone River. Dr. F. V. Hayden. Cabinet series.
8591 2 .... *philadelphica,* teste Lea.

Limnaea emarginata, Say.--Shell rather thin, translucent; volutions four, very convex; body whirl large; suture deeply impressed, spire somewhat eroded; mouth two-thirds of the length of the shell. Length nearly four-fifths of an inch; of the mouth, half an inch.
Fig. 75. Inhabits lakes of Maine.

This species was discovered by Mr. Aaron Stone. It is a rather larger and considerably wider shell than *L. catascopium,* and the emargination visible on a profile view of the umbilical groove is far more profound. In general obesity it has a resemblance to *L. inflatus,* Brong. It was first sent to me by Mr. Aaron Stone, from the lakes of Maine. Dr. Bigsby presented me with a specimen which he obtained in Upper Canada; and I have recently received several from Mr. Titian Peale, also found in Maine, one of which is double the size of the figure represented in our plate 55, fig. 1. *(Say.)*

Limnaea emarginata, Say, Journ. Acad. Nat. Sc. II, 170 (1821); Long's Ex. II, 63; Amer. Conch. VI, pl. lv, f. 1 (1834) --Binney's ed. 67, 211, pl. lv, f. 1.--Haldeman, Mon. 10, pl. ii (1841).--DeKay, N. Y.

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Moll. 73, pl iv, f. 77 (1843) --Küster in Ch. ed. 2, 44, pl. viii, f. 8-10 *(Limnaeus). Limneus ontariensis,* Muhlfeldt in Küster. *Limnaea serrata,* Haldeman, *l. c.*

It is said to have been found from New England to Washington Territory.

Considerable doubt exists regarding this variable shell, and its identity with *L. catascopium.* It is referred to that species by Stimpson (Shells of N. E. 33) and Gould (Lake Superior). Subsequently it has been referred to *L. elodes,* by Lewis (Boston Proc. V, 122). I have, therefore, given several figures of it in addition to the description of Mr. Say, leaving the question of its specific weight to be decided when more material has been collected. Fig. 75 is a copy of Mr. Say's original figure in the American Conchology. Fig. 77 is copied from one of Haldeman's, drawn from an authentic specimen of Mr Say. A larger, better developed form, presented to the Smithsonian (No. 9144), by Prof. Haldeman, is drawn in Fig. 78; while a somewhat pecu-
Fig. 76. Fig. 77. liar form is copied from Haldeman in Fig. 78. He suggests for it the name *L. serrata,* should it prove distinct, and describes it as characterized by elevated lines and undulating peritreme.

Küster, *l. c.*, places in the synonymy of *emarginata* a var. A, *L. ontariensis,* Muhlf., in litt., with an ovate-conic shell, acuminate, whirls convex, the last ovate, aperture semi-oval.

Fig. 79 gives, at one view, the various forms of *L. emarginata*.

(Fig. 79)

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Cat. No.; No. of Sp.; Locality.; From whom received.; Remarks.

8302	5	Madison, Wis.	I.A. Lapham. .....
8303	5	Lake Winnipeg.	R. Kennicott .....
8304	54	....	....
8305	9	....	....
8480	3	.....	..... Cabinet series
9128	8	Wisconsin.	Dr. J Lewis.
9144	1	.....	Prof. Haldeman. (Fig. 76.)
9161	2	Owasco Lake, N.Y.	Mrs. H W. Parker. .....
9166	1	Madison, Wis.	I.A. Lapham. .....
9183	1	.....	Gen. Totten. .....
9253	4	Lake Superior.	Newberry. .....
9284	11	Otter Tail Creek, Min.	Kennmcott.

Limnaea catascopium.--Shell thin, horn color, red, or blackish; whirls four or five, the first large and generally the remainder darker and rapidly decreasing to an acute apex and wrinkled across; aperture large, oval, not three-fourths the length of the shell Length seven-tenths of an inch.

Fig. 80.

Fig. 81.

Inhabitant yellowish, sprinkled with small, often confluent, paler dots; tentacula two, broad, pyramidal; eyes black, placed at the base of the tentacula; tail obtuse, rounded or emarginate, not so long as its shell Pl. 2. fig. 3.

It is with much hesitation that we adopt a a new specific name for this shell, having always heretofore considered it the same as the *L. putris* of authors (which has been, perhaps, mistaken for the *Helix limosa* of Linné). As far as we can ascertain, the principal difference appears to be in the more oblique revolution of the whirls in the European species, and the more abrupt termination of the spire.

Inhabits the Delaware River and many other waters of the United States, in considerable numbers, and may be found plentifully, during the recess of the tide, about the small streams through which the marshy grounds are drained, in company with several other shells. When kept in a vessel of water, like others of its kind it will proceed not only up the sides of its prison, but also along the surface of the water, the shell downward, with regularity of motion and apparent ease. In this case the reverted base of the animal is concave; and as the surface of the water is compelled to a corresponding concavity, the pressure of the atmospheric column will account for the sustentation of the animal (whose specific gravity is much greater than that of the water) in this singular position. It occasionally crawls to the margin of the water to inhale a supply of air; with this object the foramen is protruded to the surface, and opened with an audible snapping sound, similar to that produced by the resilience of the nib of a pen.

Fig. 82.

Its European analogue is the *L. peregrum*, L., from which it may be distinguished by a deeper fold of the columella,

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and a more acute curvature of the inferior portion of the aperture. Pl. 55, fig. 2. (*Say.*)

Limnaea catascopium, Say, Nich. Ency. pl 11, f. 3 (1817), 1818, 1819); Am. Conch., VI, pl. lv, f. 2 (1834); ed. Binney, 45, 211, pl. lxx, f. 3; pl. lv, f. 2.--Haldeman, Mon. 6, pl. i (1841).--Gould, Inv. of Mass. 223 (1841).--DeKay, N. Y. Moll. 67, pl. vi, f. 80 (1843).--Mrs. Gray, Fig. Moll. An. cccx, f. 7.--Küster in Ch ed 2 *(Limnaeus)*, 46, pl. viii, f. 15-21.--Potiez et Michaud, Gal. des Moll. I, 216, pl. xxi, f. 3-4.--Anon. Can. Nat. II, 201, fig. (1857).

Limnaea cornea, Valenciennes, Humb. & Bonpl. Rec. 1833, II, 251.

Limnaea pinguis, Say, J. A. N Sc. V, 123 (1825); ed. Binney, 114 (not of Dohrn, Pr. Zool. Soc. 1858, 134).

Limnaea virginiana, Lamarck, An. s. Vert. VI, 160.--Deshayes in Lam. 8, 411; ed. 2, III, 416; Enc. Meth. Vers, II, 362 (1830).--Delessert, Rec des Coq. xxx, 4 (1831).

Limnaea sericata Ziegler, teste Haldeman.

Helix catascopius, Eaton, Zool. Text-Book, 195 (1826).

Binney, p. 54

This species is exceedingly abundant in the Delaware River. No. 9207 of the collection shows some of its variable forms. It has also been noticed from New England to Lewis River, and abounds in high latitudes in the British Possessions.

Limnaea pinguis, Say, is still represented by authentic specimens in the Academy's collection, one being drawn in my Figure 83. Say's description is given below. Mr. Haldeman agrees with me, and DeKay doubtfully places it in the synonymy of *L. catascopium*.

Limnaea pinguis, Say.--Shell oval, rather ventricose, pale dirty-yellowish; whirls nearly four, rapidly diminishing to the apex, which is dull fulvous; suture moderate, spire rather more than half the length of the aperture; aperture large; labrum with the inner margin a little thickened Total length eleven-twentieth, aperture rather more than seven-twentieth, breadth seven-twentieth inch.

Fig. 83.

Proportionally shorter and much more dilated than other species of the country, with the exception of *L. macrostomus*, from which it is readily distinguished. It inhabits the Delaware and Schuylkill Rivers near Philadelphia, in company with *L. catascopium*. *(Say.)*

Limnaea cornea is referred to *L. catascopium* by Haldeman and Gould, and also by Ferussac (Bull. Zool. 1835, 33). I have seen no authentic specimen, but give a translation of the original description below.

Limnaea cornea, Valenciennes *(l.c.)*.--Shell ovate-conic, thin, subpellucid; whirls five, lightly striate; aperture not expanded.

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This little *Limnaea* is but slightly ventricose; the aperture is hardly as large as in the following species (L. *navicula*). The height of the last whirl is double that of the four other whirls taken together. Whirls with fine striae, parallel to the right lip. Aperture oval, its vertical diameter equalling two-thirds of that of the last whirl; breadth only one-half the length.

Color yellowish horn. Length 9 lines. Environs of Philadelphia *(Valenciennes.)*

Binney, p. 55

I have seen no authentic specimen of *L. virginiana*, and should hardly refer it to this species. It is, however, doubtfully placed in the synonymy by Haldeman. The original description of Lamarck and figures of Delessert here follow. It is referred to *L. columella* in Beck's Index. Dr. Gould tells me that specimens of *L. columella*, in the Leyden Museum, are labelled *L. virginiana*.

Limnaea virginiana, Lamarck.--Shell ovate-ventricose, very thin, diaphanous, longitudinally wrinkled, grayish; whirls five, the last longer than the spire; labrum turned backwards.

Fig. 84.

Hab. Fresh-waters of Virginia. Its thinness renders it very fragile. 15 lines long. *(Lamarck.)*

In addition to the synonymy already given above, Haldeman and DeKay refer to this species *L. decollata (q.v.)*. Lewis (Bost. Proc. VI, 122) places *L. catascopium* and *emarginata in the synonymy of L. elodes*. Küster, *l. c.*, quotes, as synonyms of *L. catascopium*, the following: *L. pinguis, L. cornea, L virginiana*.

Fig. 80 and 82 are fac-similes of those of Mr. Say. Fig. 81 is from a specimen taken in the Delaware River

The lingual dentition of *Limnaea catascopium* is figured in Fig. 85. There are 105 rows of teeth, 34 laterals in each row.

(Fig. 85)

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Fig. 86 represents specimens in the collection, some of which bear a resemblance to forms of *L. catascopium*, though the more globose among them would hardly be referred to that species. So variable are the species of this genus that I have hesitated in proposing a specific name for them. They were collected by Dr. Hayden, at Grindstone Creek (No. 8304 of collection).

Fig. 86.

Cat. No	No. of Sp.	Locality.	From whom received.	Remarks.
8308	7	Delaware River.	.....	.....
8309	31	Mohawk, N. Y.	.....	.....
8478	7	Delaware River	Dr. J. Lewis.	Cabinet series.

Binney, p. 56

9133	50	Erie Canal. Dr. J. Lewis. .....
9065	100	Moose Factory. Drexler. .....
8975	..	Lake Utah. Capt. Burton. .....
9134	20+	..... Dr. J. Lewis. .....
9207	20	Delaware River. Binney. .....
9329	2	Halifax. W. Stimpson. .....

Limnaea caperata, Say.--Shell suboval, a little oblong, obscurely yellowish-horn color; spire half the length of the mouth; apex acute; whirls slightly wrinkled across, and with very numerous, equal, subequidistant, elevated, minute, revolving lines; suture not very deeply impressed; aperture rather dilated; fold of the labium not profound.

Fig. 87.

Inhabits Indiana.

The remarkable character of this species consists in the numerous revolving lines with which the surface is marked, but these are so minute as to require the aid of a magnifier to bring them to view. It was found on land subject to inundation, near New Harmony, by Dr. Troost. *(Say.)*

Limnaeus caperatus, Say, New Harmony Diss. II, 230 (1829); Descr. 23; Binney's ed. 148; Küster in Ch. ed. 2, 47, pl. viii, f. 27-30.

Limnaea caperata, Haldeman, Mon. 34, pl. xi, f. 1-9 (1842).--Adams, Shells of Vermont, 154 (1842).--DeKay, N Y. Moll. 69, pl. iv, f. 66, 69; pl. v, f. 79 (1843).--Mrs. Gray, Fig. Moll. An. pl. cccx, f. 8.

Limnaea umbilicata, Adams, Am. Journ. Sc. [I], XXXIX, 374 (1840); Boston Journ. Nat. Hist. III, 325, pl. iii, f. 14 (1840).--Gould, Invert. of Mass. 218, f. 149 (1841).

This species is found in the British Possessions as far north as Hudson's Bay and through the northern tier of States from New England to Lake Superior. The form known as *L. umbilicata* is found along the northern tier of States to Michigan, has been

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quoted from Louisiana, catalogued by Adams from Jamaica, and placed by Poey in the synonymy of *L. cubensis*, Pfr.

No. 8429 of the collection has Prof. Adams's label '*L. umbilicata.*' I follow Haldeman and Küster in considering it a synonym of *L. caperata*, giving below a copy of Adams's figure and description.

Binney, p. 57

Limnaea umbilicata.--Shell rather strong, brown ovate, with slight striae of growth, and more slight numerous, irregular, revolving, impressed lines; whirls five convex; suture deeply impressed; spire two-fifths of the length of the shell, conic, subacute at the apex, angle of its opposite sides about 65°; body whirl inflated, subglobular; aperture ovate, its plane, also the line of its length at angles of about 15° with the axis of the shell, three-fifths as long as the shell; labrum thin, inner margin dark-brown inner submargin thickened with a light pink deposit; columella strong, reflected and spread over an umbilicus, which is rather large, but not profound and formed chiefly by the reflection of the columella; fold of the latter inconspicuous. Length .28 breadth .17 inch. Cabinets of the Boston Soc. Nat. Hist., of Middlebury College, of Mr. Shiverick and my own. New Bedford.

Fig. 88.

For this species I am indebted to Mr. Shiverick who obtained numerous specimens. It resembles *L. caperatus*, Say but in Say's species the aperture is but one-half the length, the revolving lines are raised, more distinct and numerous, the umbilicus is rather less, and there is one more whirl. *(Adams.)*

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.

8291	11	Mohawk, N Y. Dr. J. Lewis.
8292	1	Goose Island, Mich. ....
8293	18	New York. Dr. J. Lewis. .....
8484	6	.... Cabinet series.
9071	2	Hudson's Bay. Drexler. .....
8247	6	Milwaukee, Wis. I.A. Lapham. .....
8248	7	Westfield, Mass. Dr. J. Lewis. .....
8249	3	..... W. G. Binney. *umbilicata*, teste Adams.

Limnaea vahlii, Beck & Möll.--Shell ovate-oblong; spire convex conic, rather obtuse; whirls about six; suture somewhat deep; aperture longer than a half the length of the shell. Length 9'''. *(Möller).*

Fig. 89.

Limnaea vahlii, Möller (1842), Ind. Moll. Gr. 4.--Küster in Ch. ed. 2, 27, pl. v, f 8-10.

Binney, p. 57

Limnophysa vahlii, Beck, teste Möller.

From a specimen received from Möller, and deposited in the collection Fig. 89 was drawn. The species is

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given by name only in Rink's Greenland p. 76, by Mörch, with the following varieties:--

Var. α *nitens (L. pingellii*, Bk. & Möll.)
Var. β *leucostoma (L. gronlandica*, Jay's Cat.)
Var. γ *malleata.*
Var. δ *parva;* peristome often unattached, with an elevated parietal line. *(Mörch.)*

Of these synonyms, *Limnaea grönlandica* is unknown to me. I find no description of it, though it is mentioned by name in Beck's Index Moll. Gr. p 4, and by Mörch, Moll. Grön. p. 70.

Fig. 90 is drawn from an authentic specimen of *L. pingelii*, in the collection of the Smithsonian Institution. I have given Möller's description below, with a separate synonymy and museum register, in case it should have erroneously been placed in the synonymy of *L. vahlii*.

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.
8816 2 Greenland. ..... Cabinet series, Fig. 89.

Limnaea pingelii, Beck.--Shell ovate-elongate; spire conic, rather acute; whirls five; suture deep; aperture shorter than half the length of the shell; narrowly rimate. Length 6, 5'''. *(Möller.)*

Fig. 90. *Limnaea pingelii, Beck*, Möller, Ind. Moll. Gr. 5 (1842).--Küster, Ch. ed. 2, 27, pl. v, f. 11, 12.
Limnaea vahlii, Mörch, pars, Rink's Gr. 76.
Greenland (see last species).

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
8817 1 Greenland. ..... Cabinet series, Fig. 90.

Binney, p. 58

Limnaea wormskioldii, Mörch.--Intermediate species. Shell umbilicate, very solid; spire elongate, acute; suture deep; aperture semilunar; peristome sometimes disconnected. *(Mörch.)*

Limnaea wormskioldii Mörch, Moll. Grönl. 76 (Rink's Greenl.).

I can find no fuller description or any further information regarding this species.

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Limnaea holbollii, Beck & Möll. (Index Moll. Gr. 5 (1842).--Mörch, Moll. Gr. 76.

I can find no description of this species. Fig. 91 is drawn from a specimen in the collection received from Möller. Fig. 91.

Since writing the above I have met with a figure of the species in Küster, Chemn. ed. 2, 28, pl. v, f. 13-15, and the following description:--

Shell broadly rimate, ovate conic, rather thin, shining horn-colored, striate; spire conical, truncated, suture rather profound, whirls convex; aperture ovate, shorter than one-half of the shell's length; peristome straight, its columellar termination white, with an obsolete fold Height 5-6'''; breadth 2½-3'''. *(Küster.)*

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.
8815 3 Greenland ..... Cabinet series, Fig. 91.

Limnaea adelinae, Tryon.--Shell thin, semitransparent, body whirl large, wide, convex; spire small, consisting of five convex volutions, attenuating rapidly to an acute apex, sutures impressed; inner lip thin, reflected, but not covering the umbilical fissure, which is narrow; columella twisted; color light horn, polished within the aperture, outer lip tinged with red within. Length 14, greater diameter 8½; of aperture, length 9, breadth 5 mill. Fig. 92.

San Francisco, California: Rev. J. Rowell. My cabinet and cabinet of Mr. Rowell.

This shell is nearly allied to *L. catascopium*, Say, and perhaps more nearly to *L. intermedia*, Mich., of Europe. From the former it may be distinguished by being more fragile, more transverse, with a smaller, more rapidly attenuating spire, but principally by the presence of an umbilical fissure, which in *catascopium* is entirely concealed by the appression of the labium. In this and other respects it is very near to *L. intermedia* which, however, has a shorter spire, of fewer volutions. I name this species after my sister, Miss Adeline S. Tryon, who has evinced much interest in conchological pursuits. *(Tryon.)*

Limnaea adelinae, Tryon, Proc. Phila. A. N. S. 1863, 149 pl. i, f 12.

The original description and figure are copied above.

Cat. No.; No. of Sp.; Locality.; From whom received; Remarks.
9335 4 Piscados, Cal. G. W. Tryon. .....

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Limnaea vitrea, Haldeman.--Shell ovate, extremely thin and delicate; surface smooth and polished; lines of growth very fine; aperture ample; the labium presents w well marked fold, and is not appressed anteriorly; spire short.

Ohio? Missouri?

Foreign analogue, *L. tenuis*, Bronn.

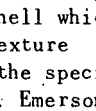
Fig. 93.

This species presents us with a shell which is probably thinner in texture than that of any other we have. For the specimens figured I am indebted to Mr. G. B. Emerson, President of the Boston Society of Natural History. *(Haldeman.)*

Limnaea vitrea, Haldeman, Mon. pt. 4, cover, p. 3; p 47, pl. xiii, f. 14, 15 (1842).--De Kay, N. Y. Moll. 75 (1843).

Fig. 93 is copied from Haldeman, whose description is given above.

Limnaea traskii, Tryon.--Shell elongated, the spire drawn out and apex acute; whirls six, convex, almost shouldered, sutures deeply impressed; aperture small, oval, labrum well rounded, labium slightly rounded, not appressed below, not covering the umbilicus, which, though small, is very distinct. Color light horn or cinereous. Length 16, diam. 8; of aperture, length 7, diam. 5 mill.

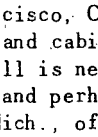
Fig. 94.

Mountain Lake, California: Rev. J. Rowell. My cabinet, and cabinet of Mr. Rowell.

At first I was disposed to regard this shell as a variety of *L. proxima*, Lea, but a comparison with the type specimens of that species shows the following differences: the volutions are not so oblique, and are more rounded, the aperture is also more rounded, and the shell is umbilicated. Named in honor of Dr. J. B. Trask, one of the pioneers of California Conchology. *(Tryon.)*

Limnaea traskii, Tryon, Proc. Phila. A.N.S. 1863, 149, pl. i, f. 13.

The above are copies of the original description and figure of this species.

Limnaea pallida, Adams.--Shell moderately elongate, ovate-fusiform, very pale horn color, semi-transparent, not very thin, with fine, irregular striae of growth, without revolving striae; whirls about five and a half, moderately convex; suture well impressed; spire four-ninths of the length of the shell, acutely conic, its opposite sides containing an angle of about 45°, subacute at tip; body whirl not much enlarged, somewhat produced below; aperture five-ninths of the length of the shell, subovate-acute above, angle of its plane with the axis of the shell about 15°, of its length with the axis about 10°; labrum not thickened internally;

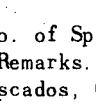
Fig. 95.

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fold of the columella distinct, but not very large; umbilicus rather small. Length .48 inch; breadth .22 inch. Cabinets of the Boston Soc. N. H.; of Middlebury College; of Dr. A. A. Gould, of Boston; of J G. Anthony, of Cincinnati; and my own.

Habitat and station. This species was found in considerable numbers at Storeham, Vt., on the shore of Lake Champlain, clinging to rocks and stones.

This species most resembles *L. acuta*, Lea,

of which, however, I have not seen a specimen. That shell, in a very brief description, is said to be delicate, smooth, and dark-brown, while this is rather strong striate, and of a very pale horn color, in living specimens, like the weathered shells of kindred species. The figure represents the columella of the *acuta* as intruding upon the aperture, which is not the case with this shell. *(Adams.)*

Limnaea pallida, Adams, Am. Journ. Sc. [I], XXXIX, 374 (1840); Bost. Journ. Nat. Hist. III, 324, pl. iii, f. 13 (1840); Shells of Vermont, 153 (1842).--Haldeman, Mon. 45, pl. xiii, f. 11-13 (1842).--DeKay, N. Y. Moll. 69, pl. iv, f. 67 (1843).

Found from New England to Michigan, and apparently in California. Mr. Lea quotes it from San Antonio Arroya.

Fig. 95 is a fac-simile of one of Adams's figures, accompanying his description, which is also copied above.

It must not be confounded with *L. pallida* Guer.

Cat. No.; No. of Sp.; Locality.; From whom received.; Remarks.
8244 3 ....
8490 1 ....., Phila. Acad. Nat. Sc. Cabinet series.
8733 11 San Francisco. Rowell. .....

Limnaea bulimoides, Lea.--Shell ovately-conical, rather thin, smooth, shining, diaphanous, brownish-yellow, slightly perforate; spire rather short; sutures small, whirls five, slightly convex, aperture ovate. Fig. 96.

Oregon: Prof. Nuttall. My cabinet, and cabinet of Mr. Nuttall. Diam. .22, length .38 inch.

Among the shells taken by Prof. Nuttall, in his journey over the Rocky Mountains, was this small species, the aperture of which is formed very much like a *Bulimus*. The deposit of the columella is wide, and nearly covers the perforation, which consequently is very small. The aperture is nearly half the length of the shell, and the fold obsolete. Several of the specimens although the substance of the shell is thin, have the apex eroded, some of the superior whirls being entirely gone. I have not observed this to be the case in other *Limnaeae*. *(Lea.)*

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Limnaea bulimoides, Lea, Proc. Am. Phil. Soc. II 33 (1841); Trans. IX, 9 (1844); Obs. IV, 9.--Haldeman, Mon. 44, pl. xiii f. 9, 10 (1842).--DeKay, N. Y. Moll. 75 (1843).

To Mr. Lea's original description I have added Fig. 96, copied from an authentic specimen. Among the specimens in the collection Nos. 8525 and 8870 were determined by Mr. Lea.

Found by Dr. Hayden, in his explorations of the Yellowstone, and at several points in the Pacific States.

I have seen specimens strongly resembling *Bulimulus pilula*.

Cat. No.; No. of Sp.; Locality.; From whom received.; Remarks.
8525 6 Grindstone Creek. ..... Named by I. Lea. Cab. series.
8570 6 Columbia River, near Fort Vancouver. ....
8730 10 San Francisco, Rowell. .....

Limnaea solida, Lea.--Shell acutely conical, solid, smooth, horn color; spire rather turreted; whirls five; columella reflected; aperture subovate.

Hab. Wahlamat, near its junction with the Columbia River: Prof. Nuttall. My cabinet, and cabinet of Prof. Nuttall. Diam 5-20th, length 8-20th of an inch. Fig. 97.

A single specimen of this species was among the shells given to me by Prof. Nuttall. It differs from any species which I know, in being more solid. In this specimen the interior is brownish. *(Lea.)*

Limnaea solida, Lea, Trans. Am. Phil. Soc. VI, 94, pl. xxiii, f. 91 (1839); Obs. II, 94. --Haldeman, Mon. 36, pl. xi, f. 10-13 (1842). --DeKay, N. Y. Moll. 75 (1843).

Limnaea apicina, Lea, Trans Am. Phil. Soc. VI, 102, pl. xxiii, f. 94 (1839); Obs. II, 102.--Küster in Ch. ed. 2 *(Limnaeus)*, 48, pl. viii, f. 31-33.

Dr. Gould quotes *L. apicina* from Oregon.

Haldeman places *L. apicina* in the synonymy of *L. solida*, as does also DeKay and Küster. Copies of the descriptions and figures of both species are given.

Limnaea apicina, Lea.--Shell obtusely conical, rather solid, smooth, horn colored; spire rather short; whirls four; columella reflected, aperture subovate.

Fig. 98.

Hab. Wahlamat, near its junction with the Columbia River: Prof. Nuttall. My cabinet, and cabinet of Prof. Nuttall. Diam. .3, length .4 of an inch.

This small species is rather more globose than usual. It is distinguished by a dark apex. Within the outer lip there is a dark-brown band. *(Lea.)*

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Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
8523 11 30 m. w. of Ft. Kearney. ...; ....

Limnaea humilis, Say.--Shell ovate-conic, thin, translucent, with slight wrinkles; volutions nearly six, convex, terminal one very minute; suture well indented; aperture about equal in length to the spire; labium with an obvious plate of calcareous deposit; a distinct and rather open umbilical aperture; color pale reddish-white or yellowish-white. Total length seven-twentieths inch.

Fig. 99.

Inhabits South Carolina.

Of a dozen specimens sent me by Mr. Elliott, none exceeded the limit here assigned to the species. It differs much from any other species I have seen; a variety of it, sometimes quite black, was found by Dr. McEuen, at Oswego, on the Susquehanna. It may be useful here to remark that, in consequence of a typographical error in the first part of the second volume of this work, the species above described may be confounded with the *desidiosus*. The length of that shell is erroneously stated to be seven-twentieths of an inch, instead of seven-tenths, its true length. *(Say.)*

Limnaea humilis, Say, Journ. A.N.S. II, 378 (1822); Binney's ed. 110.--Haldeman, Mon. 41, pl. xiii, f 1-8 (1842).--DeKay, N. Y. Moll. 71, pl. iv, f. 71 (1843).

Limnaeus modicella, Say, J. A. N. Sc. V, 122 (1825); Binney's ed. 113.--Gould, Inv. of Mass. 218, f. 151 (1841).

Limnaea linsleyi, DeKay, N.Y. Moll. 72, pl. iv, f. 74 (1843).--Linsley, Shells of Conn. Am. Journ. Sc. I , XLVIII, 282 (1845).

Limnaea parva, Lea, Proc. Am. Phil. Soc. II, 33 (1841); Tr. IX, 11 (1844); Obs. IV, 11.

Limnaea plica, Lea, Proc. Am. Phil. Soc. II, 33 (1841); Tr. IX, 10; Obs. 8¼, 10 (1844).

Limnaea griffithiana, Lea, *l. c.*, II, 33 (1841); IX, 8 (1844); Obs. IV, 8.

Limnaea planulata, Lea, *l.c.*, II, 33 (1841); IX, 9 (1844); Obs. IV, 9.

Limnaea rustica, Lea, *l.c.*, II, 33 (1841); IX, 10 (1844); Obs. IV, 10.

Limnaea exigua, Lea, *l.c.*, II, 33 (1841); IX, 9 (1844); Obs. IX, 10.

Limnaea curta, Lea, *l.c.*, II, 33 (1841); IX, 11 (1844); Obs. IV, 11.

Ranges from Maine to Georgia, and from Kansas to Lake Superior.

Fig. 99 is drawn from an authentic specimen in the collection of the Philadelphia Academy.

Haldeman places *L. modicella* in the synonymy of *L. humilis*. I have given below the original description and a figure (Fig. 100) of an authentic specimen, also from the Philadelphia Academy.

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Limnaea parva is placed doubtfully, by Haldeman, in the synonymy of *L. humilis*. I have so placed it after an examination of the description and the type which is drawn in Fig. 102.

Mr. Lea also quotes *L. exigua* from San Antonio Arroya. No. 8523 of the collection, from the Yellowstone River, is labelled *L. curta* by Mr. Lea. These and the other species of the same author, given in the synonymy, are all drawn below, the figures being in each case from the original specimen. The original descriptions, also, are given.

Of *L. linsleyi*, also, I give the original description and a fac-simile of the original figure.

Binney, p. 64

Limnaea modicella, Say.--Shell blackish, not elongated; whirls rather more than four, convex; suture deeply impressed; apex acute; aperture very regular, the labium and labrum being sub-equally curved; the fold of the columella rather slight. Total length seven-twentieths of an inch, breadth one-fifth; length of the aperture one-fifth. Fig. 100.

Smaller than any of the specmes I have hitherto described. It was found by Dr. M'Euen, at Oswego, on the Susquehanna River, near the State of New York. *(Say.)*

Limnaea curta.--Shell subturreted, rather thin, shining, subdiaphanous, yellow, perforate; spire elevated; sutures impressed; whirls six, convex; aperture small, elliptical.

Hab. Cincinnati, Ohio: T. G. Lea. Poland, Ohio: Dr. Kirtland. My cabinet, and cabinets of T. G. Lea and Dr. Kirtland. Diam. .18, length .32 of an inch. Fig. 101.

A very small, erect species, resembling, in the form of the aperture, a *Bulimus,* the fold being scarcely perceptible. In its general outline it resembles a *Paludina* more than most *Limnaeae.* In these characters it is allied to *L. bulimoides* herein described. The aperture is rather more than one-third the length of the shell, and the last whirl is wrinkled. The columella is thickened, and reflected over the perforation. *(Lea.)*

Limnaea parva.--Shell subturreted, thin, smooth, diaphanous, horn color, subperforate; spire elevated; sutures impressed; whirls five, convex; aperture elliptical.

Hab. Cincinnati, Ohio: T. G. Lea. My cabinet, and cabinet of T.G. Lea. Diam. .12, length .22 of an inch. Fig. 102.

This is the smallest species which has come under my notice. In general form it resembles *L. curta,* herein described. It is rather less inflated, has a longer aperture, and is diminutive.

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The perforation, too, is smaller, and the columella more curved. The two specimens before me have the superior whirls black from the deposit of the oxide of iron. The aperture is about half the length of the shell. *(Lea.)*

Binney, p. 65

Limnaea plica, Lea.--Shell turreted, rather thin, yellow, striate, imperforate; spire rather elevated; sutures impressed; whirls five, convex; aperture small elliptical.

Hab. Tennessee: Dr. Troost. My cabinet, and cabinet of Dr. Troost. Diam. .18, length .38 of an inch. Fig. 103.

A small species with a large incurved fold. It resembles *L. exigua,* herein described, in size, but in the form of the columella it is entirely different. The aperture is about half the length of the shell.

Limnaea planulata, Lea.--Shell ovately conical, thin, smooth, subdiaphanous, brown, perforate; spire rather short; sutures impressed; whirls five, convex; aperture small, ovate. Fig. 104.

Hab. White Sulphur Springs, Virginia: P. H. Nicklin. My cabinet, and cabinet of P.H. Nicklin. Diam. .15, length .35 of an inch.

Several specimens of this small species are before me, one of them considerably larger than the others and possessing one more whirl. The whirls are inflated, but flattened in the middle. This gives a roundness to their superior part. The perforation is small and the fold scarcely observable. The aperture is less than half the length of the shell, and contracted. *(Lea.)*

Limnaea exigua, Lea.--Shell subfusiform, thin, striated, diaphanous, pale yellow, perforate; spire rather short; sutures impressed; whirls five, rather convex; aperture elliptical. Fig. 105.

Hab. Tennessee: Dr. Troost. My cabinet, and cabinet of Dr. Troost. Diam. .15, length .35 of an inch.

This is a small species about the size of *L. plica,* herein described, and in outline resembling it. It differs, however, altogether, in the columella, which is nearly, and the fold scarcely observable. The aperture is about one-half the length of the shell, and contracted at the lower part. *(Lea.)*

Limnaea rustmca, Lea.[1]--Shell subfusiform, thin, imperforate; spire rather elevated; sutures impressed; whirls five, rather convex; aperture narrow elliptical. Fig. 106.

Hab. Poland, Ohio: Dr. Kirtland. My cabinet, and cabinet of Dr. Kirtland. Diam. .15, length .35 of an inch.

A single specimen only of this was received with some other

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[1] H. & A. Adams (II, 253) catalogue a *Limnaea rustica*, Andrz, but whether it has priority of publication or not, I do not know.

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species. It is a small and rather slender species, with a regular tapering spire and an aperture about half the length of the shell. The whole shell is covered over with a red coating of the oxide of iron, giving it a rough aspect. *(Lea.)*

Limnaea griffithiana, Lea.--Shell ovately conical, thin, substriate, shining, somewhat diaphanous, yellowish horn-color, perforate; spire rather short; sutures impressed; whirls five, convex; aperture elliptical.

Fig. 107.

Hab. Charlotte Lake, Columbia County, New York: Dr. Griffith. My cabinet, and cabinets of Dr. Griffith and Philadelphia Museum. Diam. .20, length .30 of an inch.

Rather a small species, differing from most in the form of the mouth, which is nearly a perfect ellipse. In a perfect specimen before me, the aperture within the margin of the lip is thickened by a raised line. The aperture is not quite one-half the length of the shell. I name it after R.E. Griffith, M.D., who seems to be the only person who has observed it. *(Lea.)*

Limnaea linsleyi, DeKay.--Shell ovate, subventricose; whirls five, rounded, and rapidly attenuated to the apex; suture deep; aperture oblong-oval, longer than the spire. Pillar-lip with a broad calcareous deposit, the lower portion reverted, and partially covering the umbilicus. Lip thin, forming a shoulder at its junction with the preceding whirl. Body-whirl towards the margin of the outer lip, flattened as in *megasoma*, and impressed with deep incremental striae which are evident from within. Color: Epidermis chestnut, often obscured by a blackish subvillous pigment. Length, 0.25; aperture, 0.15.

Fig. 108.

This shell has affinities of form with *catascopium*, and more especially with the variety which is designated by Say as *L. pinguis*. That varietyiis, however, represented as having a moderate suture, and the whirls nearly four. I have ventured to impose upon it a new name, expressive of my obligations to the Rev. Mr. Linsley, of Stratford, who furnished me with the specimens from his neighborhood. *(DeKay.)*

(FIG. 109.)

Fig. 109 gives, at one view, the various forms which I have referred to *L. humilis*.

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Cat. No.	No. of Sp.	Locality.; From whom received. Remarks.
8258	15	Northern Georgia. A. Gerhardt .....
8259	28	Big Sioux. Dr. F.V. Hayden? .....
8260	8	Northern Georgia. A. Gerhardt. *'L. sylvestris,'* A. Gerh.
8261	7	Otsego County, N.Y. Dr. J. Lewis.
8262	11	....
8263	14	Yellowstone River? ....
8264	19	N. Georgia. A. Gerhardt. .....
8265	64	Yellowstone River. ....
8266	6	Milwaukee, Wis. I.A. Lapham. ....
8267	14	N. Georgia. A. Gerhardt. *'L. riparius,'* A. Gerhardt.
8268	20	..... W.G. Binney .....
8486	4	Georgia. A. Gerhardt.
8523	1	Yellowstone River. Dr. F. V. Hayden. Named *'curta'* by I. Lea.

Limnaea ferruginea, Haldeman.--Shell ovate-conic, thin in texture and diaphanous, with four convex whirls, distinct suture, and well-marked columellar fold; aperture oval, about as long as the spire; labium appressed, ferrugineous.

Oregon. Mr. Nuttall. Fig. 110.

Closely allied to *L. humilis*, but may be distinguished by the want of an umbilic, and the well-defined fold on the columella. *(Haldeman.)*

Limnaea ferruginea, Haldeman, Mon. pt. III, p. 3 of cover (1841), 49, pl. xiii, f. 19, 20 (1842).--DeKay, N Y. Moll. 75 (1843).

The above description and figure are copied from Haldeman.

SUBGENUS LEPTOLIMNEA, SWAINSON.

Shell nearly cylindrical; spire thick, lengthened; aperture small.

H. & A. Adams use *Omphiscola*, Rafinesque, as the name of this section. I protest against the use of the name in any other sense than proposed by Rafinesque (see spurious species of *Limnaea*). Beck's section *Omphiscola* corresponds with *Leptolimnea*, and he would be quoted for it had he used a new name.

Limnaea kirtlandiana, Lea.--Shell turreted, thin, irregularly striate, pale horn-color, imperforate; spire attenuate; sutures impressed; whirls six, slightly convex; aperture narrow-elliptical.

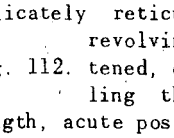
Fig. 111.

Habitat: Poland, Ohio: Dr. Kirtland. My cabinet, and cabinets of Dr. Kirtland and T.G. Lea. Diam. .26, length .70 of an inch.

Many years since, Dr. Kirtland sent me several specimens of this shell. I am not aware of its having yet been de-

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scribed. It may have been mistaken for *L. acuta*, being about the size and having the aspect of that shell. It may be distinguished from it by having a longer and narrower body whirl, and a shorter and narrower aperture. The fold on the columella is smaller and the outer lip less curved. It is a smaller species than the *reflexa*, Say, has one whirl less, and the mouth is longer. In other characters it resembles it, if the reflected lip be excepted. The aperture is rather less than half the length of the shell. Most of the specimens have an obscure brown line within the margin of the outer lip. The body whirl is disposed to be flattened, and is irregularly wrinkled. Under the lens, the fine striae which usually are found in the *Limnaeae*, may be observed beautifully displayed over the whole shell. The superior portion of all the specimens sent, have more or less deposit of the oxide of iron, which gives them the appearance of having two colors. *(Lea.)*

Limnaea kirtlandiana, Lea, Proc. Am. Phil. Soc. II, 33 (1841); Trans. IX, 12; Obs. IV, 12 (1844).

No. 8527 of the collection, so labelled by Mr. Lea, are from Apple Creek, lat. 47°.

Mr. Lea's description and a figure drawn from his type are given above.

Cat. No ; No. of Sp.; Locality.; From whom received. Remarks.
8527 1 Apple Creek, lat. 47°. Dr. F. V. Hayden. Cab. series. Named by I. Lea.

Limnaea lanceata, Gould.--Shell moderate, thin, diaphanous, horn-colored, attenuated, delicately reticulated with incremental and revolving striae; whirls six, flattened, quite oblique, the last equalling three-fourths of the shell's length, acute posteriorly; columella fold conspicuous, acute, scarcely spiral; labrum with a submarginal chestnut band. Length 4/5, breadth ¼ inch.

Fig. 112.

North shore of Lake Superior, 'Pic Lake,' where it was collected by Prof. Agassiz.

Next to *L. gracilis* this is the most delicate species we have. It may be compared with *L. attenuata* and *L. reflexa*, from both of which it differs in the flatness of its whirls, in its aperture, which is proportionally much longer and narrower, and in being only about half their size. It is much like large specimens of *Physa hypnorum* reversed. *(Gould.)*

Limnaea lanceata, Gould, Proc. Boston Soc. Nat. Hist. III, 64 (1848); in Agassiz' Lake Superior, 244 pl. vii, f. 8-9; Otia, 206.

In addition to Gould's original description, I am able to add

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Fig. 112, drawn from his type, which he sent me for this purpose. No. 9126 of the collection was presented by Prof. Agassiz, from among the original lot collected by him.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
9126 1 Lake Superior. Prof. Agassiz. Type.

SUBGENUS ACELLA, Hald.

Shell very slender, spire attenuated, whirls flattened, oblique; aperture produced, expanded, without fold.

Limnaea gracilis, Jay.--Shell very slender, with from four to six flat and very obliquely revolving whirls; suture distinct; lines of accretion fine; labium unattached, without fold; aperture ovate, spread out, and rounded at both ends. Color nearly white. Fig. 113.

This is the most slender species of *Limnaea* known, and was discovered by Prof. Emmons in Lake Champlain.

Prof. Adams mentions a specimen in his cabinet one inch in length, and in the convexity of the penult whirl only .15 inch diameter. The last whirl is scarcely broader, except across the lips, both of which are expanded. Although nearly seven times longer than the average breadth, it has only four and a half whirls. *(Haldeman.)*

Limnaea gracilis, Jay, Cat. 3d ed. 112, pl. i, f. 10, 11 (1839).--Adams, Shells of Vermont, Thom. Vt. 153, pamphlet, 3 (1842).--DeKay, N. Y. Moll. 70, pl. iv, f. 73 (1843).--Haldeman, Mon. 50, pl. xiii, f. 21 (1842).

Acella gracilis, Chenu, Man. de Conch. II, 480, f. 3545.

The species has also been quoted from Wisconsin, Ohio, and Michigan. Fig. 113 was photographed from nature and on to the wood. The following are Jay's description and figure:-- Fig. 114.

Essex County, N.Y. I am indebted to Prof. Benedict, of Burlington, Vt., for two specimens of this very slender and fragile *Limnaea*. *(Jay.)*

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8524 10 Schuyler's Lake, N.Y. Dr. J. Lewis. Cabinet series.
9127 1 New York. Dr. J. Lewis.
9068 20 Otsego County, N.Y. Dr. J. Lewis.

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SPURIOUS SPECIES OF LIMNAEA.

Limnaea decisa, Say, Nich. Ency. ed. 1 and 2, pl. 2, f. 6 = *Melantho decisa.*
Limnaea heterostropha, Say, Nich. Ency. pl. i, f. 6 = *Physa heterostropha.*
Limnaea subcarinata, Say, Nich. Ency. pl. i, f. 7 = *Lioplax subcarinata.*
Limnaea virginica, Say, Nich. Ency. pl. i, f. 4 = *Melania virginica.*
Limnaea vivipara, Say Nich. Ency. pl. i, f. 5 = *Vivipara contectoides.*

I find *Limnaea nigrescens, gracilis*, and *reticulata* mentioned as new species by DeKay in N.Y. Zoological Report of Dec. 20, 1839, p. 32. I know of no other mention or any description of the species.

Limnaea heterostropha is mentioned by name only in Adams' List of Fresh Pond Shells. *Physa heterostropha* being also mentioned, I do not know to what species he may refer. (Silliman's Journ. (I), XXXVI, 392.)

Limnaea ovata, Lam. is mentioned in the Catalogue of Shells of Massachusetts, 1838, p. 37. I do not know what species is referred to under this name.

Woodward (Man. 399) quotes *Limnaea truncatula* from the Canadian region, referring it doubtfully to *L. decollata*. (See remarks under *L. desidiosa.)*

Among the writings of C.S. Rafinesque occur some descriptions of *Limnaeidae* which I repeat here. I translate them from the Podrome de 70 nouveaux genres d'animaux, &c., in the Journal de Physique, de Chemie, et d'Histoire Naturelle, LXXXVIII, June, 1819. However little claim to accuracy the writings on American conchology of this author may possess, it seems to me we are bound to acknowledge and examine carefully all his published descriptions, rather than entirely ignore their existence, as some would do.

Omphiscola, l. c. p. 423.--Differs from *Lymnula (Lymnea*, Auct.) by its inferior lip being detached from the colu-

mella and divided from it by a long umbilicus. Family of *Limnidae*. Many lacustrine and fluviatile species.

Espiphylla, l.c.--Differing from *Lymnula (Lymnea*, Auct.) by its rounded aperture and its claviform tentacles carrying the eyes at their end. Family *Lymnidae*. Only one lacustrine species, *E. nympheola*.

Cyclemis, l. c. p. 424.--Differs from *Lymnula* by its rounded shell of two or three slightly oblique whirls. Aperture large, almost round. Animal like that of *Espiphylla*? Two lacustrine species, *C. minutissima* and *C. olivacea*.

Lomastoma, l. c.--Shell acute, pyramidal. Aperture oblong, base obtuse, summit sharp, entirely surrounded by a detached, marginal, acute lip, which is decurrent and inflected at the junction of the summit; no operculum or umbilicus. Animal unknown. Singular genus of the family *Lymnidae*? One only known species, *L. terebrina*. Shell subulate, smooth,

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four whirls, pale red; aperture one-third the shell's length, breadth one-third of its length. Very rare. In brooks.

Limnaea lubricoides, Lea, of Nebraska Territory, is catalogued without description by Mr. Lea in Warren's Report on Nebraska. (Ex. Doc. H. of Rep. 2d Sess. 35th Cong. 1858-9, Vol. II, part 3, p. 724.) No description of any such species has been published.

Limnaea corrugata is quoted, without description, from Georgia, by Sowerby in Tankerville Coll. p. 42 (1825), *Helix corrugata, Budgin* MS. being given as synonym.

Limnaea petitii, Beck, Newfoundland. No description. Index, p. 113.

Omphiscola pugio, Beck (Index) is mentioned from Mexico, without description.

Limnaea rugosa, Valenciennes, appears an immature specimen of some *Bulimulus*. I give below a copy of the original description, and an outline of the original figure. According to Ferussac (Bull. Zool. 1835, p. 33), it is his *Cochlogena dombeiana*. See also Pfeiffer, Symb III, 83.

Limnaea rugosa, Valenciennes.--Shell ovate-conic, thin, white, with an obsolete yellowish band; whirls with very numerous furrow-like wrinkles. Fig. 115.

This species has six whirls, of which the last is twice as long as the others; ventricose; surface wrinkled by numerous longitudinal ridges, which are not exactly parallel to the edge of the right lip; they are still apparent on the fifth whirl, but on the fourth are mere fine striae, while the three first whirls have neither striae or folds.

Aperture an elongated ellipse, slightly narrowed towards the base, its transverse diameter being but one-half the longitudinal; right lip thin and sharp. Within the traces of the external ridges of the last whirl are visible.

Columella thin, edge rounded, thrown back on the last whirl so as to form a very small umbilicus. Color white, with transverse reddish band, parallel to the suture, on the middle of the last whirl. Length 14 lines.

Hab. Mexico (Bonpland). *(Valenciennes.)*

Limnaea rugosa, Valenciennes, in Humb. & Bonp. Rec. d'Obs. II, 250, pl. lvi, f. 5 (1833).--Haldeman, Mon. 15, pl. iii, f. 4, 5 (1841).--DeKay, N. Y. Moll. 75 (1843).

Limnaeus rugosus Küster, in Ch. ed. 2, 38, pl. viii, f. 3, 4.

Limnaea conoidea, Say, and *L. lineata*, Say, are mentioned by name by H. & A. Adams, Gen. Rec. Moll. II, 253. I know of no descriptions of such species by that author.

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Limnaea plicata, Lea, mentioned by name only in the Canadian Geological Report for 1858, by Mr. D'Urban, is, I suppose, *L. plica*, Lea.

Limnaea fossaria is quoted without description from Canada, &c., by J. de C. Sowerby in

Binney, p. 72

Richardson's Fauna Boreali-Americana, III, 316 (1836).

Limnaea merostoma, Rav. Cat. p. 11, err. typ. for *macrostoma.*

Limnaea platystoma, Haldeman.--Shell thin, transparent, and globose; composed of four whirls, the last of which constitutes nearly the entire shell; aperture 2/3 the entire length, very wide posteriorly; labium and labrum nearly parallel. Length ½ inch.

Fig. 116.

Hab. Vermont. *(Haldeman.)*

Limnaea platystoma, Haldeman, Suppl. to Mon. Pt. I, p. 2 (1840).

The above is Haldeman's description, and Fig. 116 is from his type. No. 9131 was presented by him. Thus we have all the information extant regarding the species. As Prof. Haldeman's original label refers the shells to Maine or Marseilles, it must be considered a doubtful inhabitant of America.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
9131	1	Maine or Marseilles.	Haldeman.	Fig. 116, type.

Limnaea alternata, Say, mentioned by name only by Bell (Can. Geol. Rep. for 1858) is unknown to me, as is also *L. opacina,* Bell.

FOSSIL SPECIES OF LIMNAEA

I am indebted to the kindness of Dr. Meek for the following list of fossil species:--

Limnaea vetusta, Meek, Proc. Acad. Nat. Sc. 1860, 314,

Limnaea similis, Meek, Proc. Acad. Nat. Sc. 1860, 314.

Limnaea diaphana, Evans & Shumard, Proc. Acad. Nat. Sc. VIII, 1860, 165.

Limnaea nebrascensis, Evans & Sh. Proc. Acad. Nat. Sc. VIII, 1860, 165.

Limnaea tenuicostatus, Meek & Hayden, Proc. Acad. Nat. Sc. 1860, 117.

Limnaea meekiana, Evans & Shumard, MSS.

Limnaea? multistriata, Meek & Hayden, Proc. Acad. Nat. Sc. 1860, 431.

Limnaea (Limnophysa) galbana, Say.--Shell subovate; whirls nearly five, very convex; suture very deeply impressed; apex acute; body whirl a little flattened in the middle; aperture not dilated; columella with the sinus of the fold very obvious. Length three-tenths of an inch; aperture rather more than half the whole length.

Fig. 117.

For this shell I am indebted to Mr. Nuttall, who obtained it in a marl pit near Franklin, New Jersey. He

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considers it fossil, as well as numerous specimens of *Planorbis campanulatus, Valvata tricarinata,* and *Physa heterostropha,* found with it. I have never seen a recent specimen, but the present corresponds with some individuals belonging to the Philadelphia Museum, also said to be fossil. *(Say.)*

Limnaeus galbanus, Say, Jour. Acad. Nat. Sc. Phila. V, 123 (1825): Binney's ed. 114.

Limnaea galbana, Haldeman, Mon. 51, pl. xiii, f. 22, 23.

Mr. Say's type, still preserved in the Philadelphia Academy is drawn in Fig. 117. I have heard of no other locality than that given by Say.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
9340	10	New York	Dr. Lewis.	.....

--------?

-----? *berendti,* Pfeiffer. Fig. 118 is drawn from a curious shell lately received by the Smithsonian Institution from Mirador, sixty miles west from Vera Cruz, under the name of *Physella berendti,* Pfr. It belongs to a new genus, but *Physella* is preoccupied by Haldeman.

Fig. 118.

Cat. No.	No. of Sp.	Locality.	From whom received	Remarks.
9357	2	Mirador, Mex.	Dr. Berendt.	One fig.

Binney, p. 73

POMPHOLYX, Lea.

Tentacles short, stout, rounded. Mantle[1]--? Foot short, bluntly rounded posteriorly.

Shell dextral, depressed-globose, translucent, horn-colored; spire short, obtuse, last whirl very wide, ventricose; aperture very large, wide, subcircular, expanded; inner lip thickened, outer lip acute.

Jaw --- ?

Lingual membrane --- ?

---

[1] I have seen only specimens in alcohol. From these it appears that the only known species cannot be a *Limnaea*, as its tentacles are not flattened and triangular. The eyes are at the place usual in Limnaeidae.

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Pompholyx effusa, Lea.--Shell small, striate, roundly gibbous, rather thin, effuse, reddish horn-colored; whirls five, flattened above, convex below; aperture subrotund, dilated, within white, spotted.

Fig. 119.

Sacramento River: Dr. Trask. *(Lea.)*

Pompholyx effusa, Lea, Proc. Phila. Acad. VIII, 80, (1856); Jour. de Conch. 2d series, II, 208 (trans.), 1857.--H. & A. Adams, Gen. Rec. Moll. pl. cxxxviii, f. 11.

Fig. 119 is drawn from Mr. Lea's type.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
9242 5 Pitt River. Dr. Newberry. Type.

CARINIFEX.

Tentacles -- ? Mantle --- ? Foot -- ?

Shell dextral, spiral, inflated, angular, horn-colored; spire terraced, whirls numerous, angular, visible above, last whirl very large, broad above, very rapidly attenuated below; umbilicus funnel-shaped; aperture triangular,

Binney, p. 74

broad above, narrow below; inner lip slightly thickened; outer lip thin, acute, angular above, flexuose.

Jaw --- ? Lingual membrane --- ?

The general appearance of the shells for which the generic name of *Carinifex* is proposed would place them among the *Limnaeidae*. Nothing is known of the generic characteristics. The base of the shell resembles somewhat *Taphius*, but that subgenus has the upper surface of *Planorbis*, flattened, spire sunken, whirls rounded.

Fig. 120.

Carinifex newberryi, Lea.--Shell light horn-colored, depressed, turreted, very minutely striated, above and below acutely carinated, broadly and deeply umbilicated, whirls five, flat; aperture large, light horn-colored, subtriangular.

Klamath Lake and Canoe Creek, California: Dr. J. S. Newberry. *(Lea.)*

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Planorbis newberryi, Lea, Proc. Phila. Acad. Nat. Sc. 1858, 41.

Fig. 121. Fig. 120 is drawn from the original specimen in Mr. Lea's cabinet. A more elevated form is figured also.

Fig. 122.

It has also been found in Clear Lake, California.

Another form of this species is figured in Fig. 122. It is less carinated, much more rounded in the whirls, but apparently identical with *C. newberryi*. It is from Pitt River, California.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
8726 .. Clear Lake, Cal. Dr. Veatch. Named by Lea. Cab. ser.
8727 .. " " Named by Lea.
9254 21 Klamath Lake. Dr. Newberry. Type.
9256 15 Canoe Creek, Cal. " .....
9341 6 Pitt River, Cal. Dr. Cooper. Type.
9342 1 " " " Figured.

Binney, p. 75

PHYSA, Draparnaud.

Tentacles slender, setaceous. Mantle covering part of the shell, the margin fringed or digitate. Foot long, acuminate behind. Fig. 123.

Shell sinistral, oblong, thin, and polished; spire acute; aperture oval, rounded anteriorly, not dilated; inner lip spread over the last whirl, simple in front; outer lip acute.

Jaw single, superior, chevron- Fig. 124. shaped.

Lingual membrane.....?

This genus is widely distributed over the globe, and is numerous in species in this country, where it extends more southerly than *Limnaea*. In its habits it is more active than the other *Limnaeidae*, both in walking and in gliding, shell downwards, on the surface of the water.

It will be seen in the generic descriptions of *Physa* and *Bulinus* that the former name is restricted to those species having a digitated mantle, and the latter applied only to those whose

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mantle is simple. As Adanson founded his genus on a species having a simple mantle, his name is retained for the last section, leaving Draparnaud's[1] later name for the first section. Thus any confusion of synonymy is avoided.

Physa lordi, Baird.--Shell thin, quite large, corneous, tumid, gibbous, aperture large; outer lip acute, marked with an external white or brownish line; external surface very minutely decussated; whirls six, the first two minute, tinged with black,
Fig. 125. the last swollen, four Fig. 126. times the size of the others. Length from ¾ to 1 inch, breadth from ½ to ¾.

Lake Osoyoos, British Columbia. *(Brit. Mus.)*

Binney, p. 76

This species is one of the largest of the genus, and is much swollen and gibbous. The outer lip is generally marked with a streak of brown edged with white, which mark is left in those specimens which are of older growth, leaving a white callous-looking line of growth edged with brown, nearly in the centre of the last whirl, which is very large--being about four times the size of all the others put together. The two upper whirls, which are very small, are of a black color. The surface of the shell is finely decussately striated.

The *Physa heterostropha* of Say abounds in the Sumas Prairie, on the Fraser River; but its place seems to be taken on the higher ground towards the Rocky Mountains by the *Ph. lordi (Baird.)*

Physa lordi, Baird, Proc. Zool. Soc. London, 1863, p. 68.

I have given above the original
Fig. 127. description of this species and Figs. 125 and 126, copied from advance proofs of the plates illustrating the British Boundary Commission Report. Fig. 127 is drawn from a specimen collected by the American Commission of the same Survey.

This is the largest North American species of *Physa* yet described.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
9310 2 E. of Ft. Colville, W.T. N. W. Boundary Surv. Fig. 127.

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[1] Draparnaud did not make this distinction in the genus, but his first species has a fringed mantle.

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Physa gabbi, Tryon.--Shell large, thin, closely striated with the lines of growth; body whirl inflated, its upper
Fig. 128. half flattened, so that Fig. 129. the labrum appears angulated in the middle; spire moderate, apex acute, whirls six, convex, with distinct sutures. Color light corneous, very much polished within; whirls six, convex, with distinct sutures.

Color light corneous, very much polished within; lip margined with red. Length 25, diam. 13; of aperture 15, breadth 3 mill.

Mountain Lake, Cal.: Rev. T. Rowell. Santa Ana River, Los Angelos County, Cal.: Wm. Gabb. My cabinet, and cabinets of Mr. Rowell and Mr. Gabb.

Several specimens of this fine large species were communicated to me by my friend Mr. Wm. Gabb, after whom I take great pleasure in naming it. It is a much larger, thinner species than *Ph. heterostropha*, Say, and is at once distinguished by the peculiar flattening of the superior portion of the body whirl. The same character will also distinguish it from *Ph. bullata*, Gld., in which species the aperture, moreover, is proportionally longer. *(Tryon.)*

Physa gabbi, Tryon, Proc. Phila. Acad. Nat. Sc. 1863, 149, pl. i. f. 14.

This is a very well-marked species. Fig. 128 is copied from the original figure of Mr. Tryon, whose description is given above. Another figure also is given.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
9336 4 California. G. W. Tryon. .....

Physa gyrina, Say.--Shell heterostrophe, oblong; whirls five or six, gradually acuminating to an acute apex; suture slightly impressed; aperture more than one-half, but less than two-thirds the length of the shell; labrum a little thickened on the inner margin. Length rather less than one inch.

Fig. 130.

Inhabits waters of the Missouri.

Of this species I found two specimens at Bowyer Creek, near Council Bluff. It differs from *P. heterostropha* in magnitude, in having a more elongated spire, and less deeply impressed suture. *(Say.)*

Physa gyrina, Say, J.A.N.S. II, 171 (1821).--Binney's ed. 67.--Haldeman, Mon. 32, pl. iii, f. 1-6 (1843).-?DeKay, N. Y. Moll. 79, pl. v, f. 87 (1843).--Chemnitz, ed 2, 20, pl. v, f. 7-10.--Adams, Shells of Vermont, 154 (1842).

Physa elliptica, Lea, Tr. Am. Phil. Soc. V, 115, pl. xix, 83 (1837); Obs.

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I, 227.--DeKay, N. Y. Moll. 77, excl. syn. *cylindrica*, err. typ. (1843).--Chemnitz, ed. 2, 22, pl. iii, f. 20-22.

Physa hildrethiana, Lea, Pr. Am. Phil. Soc. II, 32 (1841); Trans IX, 7 (1844); Obs. IV, 7.

It is mentioned in catalogues, &c., as inhabiting a wide area, the extreme points being Vermont, San Francisco, Michigan, Georgia, Louisiana and Utah.

Mr. Say's type of *Physa gyrina* is still preserved in the Academy at Philadelphia. It is drawn in Fig. 130.

No. 8108 of the collection was labelled *Ph. elliptica*, by Mr. Lea. It does not appear to me distinct from this species, in the synonymy of which it is also placed by Haldeman. A copy of Lea's original description and figure here follow. The name has also been used by Parreyss.

Physa elliptica, Lea.--Shell sinister elliptical, very thin, pellucid, chestnut colored, shining; spire rather short; whirls four; outer lip margined; aperture narrow. Diam .2, length .5 inch.

Fig. 131.

Hab. -----: T. G. Lea. My cabinet.

This species is less inflated and more of a chestnut color than any I am acquainted with. Its color is almost reddish, and the light-colored margin of the outer lip is remarkable. The aperture is rather contracted, and the whole shell somewhat elongate. *(Lea.)*

Physa hildrethiana, Lea, also appears to me to be a synonym of Physa gyrina. Mr. Lea's description and a figure of his original specimen here follow.

Physa hildrethiana, Lea.--Shell elliptical, somewhat compressed, long, somewhat pellucid; spire obtusely elevated; whirls five; lip margined; aperture long, compressed.

Hab. A lake in Illinois: Dr. Hildreth. Diam. .40, length .75 of an inch.

Binney, p. 78

This species is among the largest, and is perhaps the most remarkable *Physa* yet observed in this country. The aperture is little more than half the length of the shell. The apex is very obtuse, and the whole shell is somewhat cylindrical. A single specimen was brought by Mr. Nicklin from Dr. Hildreth, and I name it after him, as he seems first to have observed it. *(Lea.)*

Fig. 132.

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Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8073	12	South Carolina. W. Stimpson. .....
8074	33	Grindstone Creek. ....
8075	36	Utah Territory. ....
8076	11	....
8077	33	Farwell's Mills, Madison, Wis. S.F. Baird. .....
8078	50	St. Louis. ....
8079	8	Ann Arbor, Mich. W.G. Binney. .....
8080	12	St. Clair River. ....
8081	3	Michigan. ....
8082	3	Racine, Wis. S. F. Baird. .....
8084	2	Milwaukee, Wis. S.F. Baird. .....
8085	5	Utah. Capt. J. H. Simpson. .....
8086	10	.... Cabinet series.
8520	2	..... W.G. Binney. .....
8729	1	San Francisco. Rowell. Cab. ser. W. Coast.
9094	50	Grand Rapids, Mich. Dr. Lewis. *P. hildrethiana,* teste Lewis.
9167	1	Michigan. W. G. Binney. .....
8108	64	Grand Rapids, Mich. Dr. J. Lewis. *P. elliptica,* Lea.
8109	1	Indiana. W. G. Binney. Named by I. Lea.
8516	7	Michigan. Dr. J. Lewis. Named by Dr. R. E. Griffith.
9209	14	Uniontown, Ala. Dr. Showalter. Cab. ser.

Physa ampullacea, Gould.--Shell large, ovate-ventricose, thin, fragile, shining, horn-colored; spire elevated, acute; whirls six, last one inflated; suture decidedly impressed; aperture broadly ovate, five-sixths the length of the shell; labrum thin, submargined with red; columella quite flexuous, covered with callus. Length 1, breadth 10/20 to 11/20 inch.

Fig. 133.

Found in Oregon by Dr. J. G. Cooper.

Binney, p. 79

Distinguished by its large size, inflated form, and delicate structure; sometimes the form is somewhat cylindrical. It accords most nearly with Haldeman's plate iii, f. 9, which was given him as *P. sayii,* Tappan. It is much more delicate, and less polished than *P. heterostropha,* Say, and the aperture is less elongated. *(Gould.)*

Fig. 134.

Physa bullata, Gould, Proc. Bost. Soc. Nat. Hist. V, 128 (1855); Otia, 216 (not of Pot. et Mich.).

Physa ampullacea, Gould in litt.

Found also in Lake Oyosa, Washington Territory by Dr. Cooper, one of whose specimens is figured above. (Fig. 133.)

The name proposed by Dr. Gould for this species being preoccupied by Potiez and Michaud, I, 223, 1838, he suggests that adopted above.

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Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8574	4	....
8722	5	....
9170	2	Oregon. Dr. J. G. Cooper. Original ex'm named by Gould.
9264	2	Rhett Lake, Cal. Dr. Newberry. .....
9267	11	Upper Klamath Lake. " .....

Physa sayii, Tappan.--Shell sinistral, ovate, color brownish-yellow or chestnut; whirls five; the first large, the others small, terminating in an acute, dark brown apex; aperture large, four-fifths of the length of the shell; translucent. Length 1, breadth 7/10 inch.

I first found this shell, May, 1837, in a small lake called Lake Pipin, which is separated about fifty rods from the Cuyahoga River, in Franklin Township, Portage County, Ohio, the same locality where wws found the *Anodonta pepiniana,* Lea. All the shells of this species hitherto found were dead, although much time was spent in examining for live ones, in May, 1837, and June, 1838. A few only were found, and are in the cabinets of Mrs. Say, Dr. Kirtland, Dr. Ward and myself. *(Tappan.)*

Fig. 136.

Binney, p. 80

Physa sayii, Tappan, Amer. Journ. Sc. (I), XXV, 369, pl. iii, f. 3 (1839).

I am unacquainted with this species. Judging from the description and figure, which I have copied above, I should not agree with Haldeman in placing it in the synonymy of *P. ancillaria*.

Physa vinosa, Gould.--Shell thin, ovate-globose, red, with minute spiral striae and thin epidermis; spire obtuse; whirls four, the last very large; aperture ovate-lunate, three-fourths the shell's length, liver brown within; columella straight and thin. Length ¾, lat. ½ inch.

Fig. 137.

Brought by Dr. C. T. Jackson from the Lake Superior region.

A remarkably inflated species, most like *P. ancillaria*, Say, but is not shouldered or widest behind the middle, nor tapering anteriorly. It is well distinguished by its thin structure, striated surface, wine-red color externally, and liver-brown internally. *(Gould.)*

Physa vinosa, Gould, Proc. Bost. Soc. N. H. II, 263, fig. (1847); in Agassiz' Lake Sup. 244, pl. vii, f. 10-11 (1850); Otia, 201.

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No. 9096 of the collection was presented by Prof. Agassiz from the original lot collected by him. Gould's description and figure are copied above.

Fig. 138.

It has been catalogued from Michigan.

The lingual teeth of the lateral rows of *Physa vinosa* are represented in Fig. 138.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
9096	1	Lake Superior.	L. Agassiz.	Original lot. Type.
9160	2	Owasco Lake. N.Y.	Mrs. H. W. Parker.	(Really *P. vinosa?*)

Physa ancillaria, Say.--Shell heterostrophe, sub-globose, pale yellowish; whirls rather more than four, very rapidly attenuated; spire truncated, hardly elevated beyond the general curve of the surface; suture not impressed; aperture but little shorter than the shell, dilated; labrum a little thickened on the inner margin. Length more than one-half of an inch.

Fig. 139

Binney, p. 81

The spire of this species is unusually short, truncated at tip like the *Paludina decisa*, nob.; and the suture is so inconspicuous as to give rise to the name which I have chosen for it. My brother, B. Say, obtained it in the Delaware River, near Easton, and Mr. Jessup collected numerous specimens in the Connecticut River, above Hartford. It may be distinguished from *P. heterostropha*, nob., by the shorter and truncated spire, inconspicuous suture, as well as by the more obtusely rounded junction of the labrum with the base, and by the general form. *(Say.)*

Physa ancillaria, Say, Jour. Acad. Nat. Sc. V, 124 (1825); Binney's ed. 114.--Haldeman, Mon. 27, pl. iii, f. 1-10 (1843).--Gould, Invert. 213, f. 142 (1841).--Adams, Shells of Vermont, 154 (1842).--DeKay, N. Y. Moll. 78, pl. v, 90 (1843).--Chemnitz, ed. 2, 20, pl. xii, f. 12-13.--Chenu, Man. de Conch. II, 480, f. 3550.--Anon. Can. Nat. II, 211, fig. (1857).

Physa obesa, DeKay, N. Y. Moll. 78, pl. v, f. 86 (1843).

This species appears to range from New England to Louisiana.

It is very numerous in the Delaware River at Burlington, on the muddy shores left bare at low tide. The animal burrows into the mud as soon as left by the water, and remains concealed until its return. On the piers of the wharves it crawls downwards with the fall of the tide and upwards again as it rises, thus keeping always near the surface.

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Physa obesa, DeKay, appears to me identical with this species, judging only from his description and figure here copied.

Physa obesa, DeKay.--Shell ventricose; when young, very thin and fragile. Whirls four to five, rapidly attenuated to a minute

Binney, p. 82

Fig. 140. and slightly elevated polished apex. Body whirl inflated, with its upper surface near the suture depressed, and forming an obtuse angle with the lower portion; suture semicanaliculate. Surface polished, with minute incremental lines. Aperture elliptical. Color pale horn. Length 0.5, of aperture 0.4 inch.

This species wws communicated to me by Dr. Budd, who obtained it from the Mohawk and Hoosic Rivers, Rensselaer County. I have since received from the same gentleman specimens eight-tenths of an inch long and quite solid with a stout callus. Some naturalists who have seen it are disposed to consider it as identical with *P. ancillaria*. Fig. 141. *(DeKay.)*

Haldeman refers *Physa sayii*, Tappan, to *P. ancillaria*. I have considered it as distinct.

The lateral teeth of the lingual membrane of *Physa ancillaria* are represented in Fig. 141, as well as the line formed by one transverse row of the teeth.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8096	9	Loup Fork. ....
8097	2	Hudson River. Dr. J. Lewis. .....
8098	5	Cherry Creek. ....
8099	2	....
3523	6	30 m. w. of Fort Kearney. ....
8100	2	Ohio. S. M. Luther. .....
8101	9	Little R., near Shawneetown. .....
8102	17	Ruby Valley. Capt. J. H. Simpson. ...
8103	10	Hudson River, Albany. Dr. J. Lewis.
8104	8	St. Louis, Mo. .....
8105	3	Salisbury, Conn. W. G. Binney.
8106	8	Maine. Dr. J. Lewis. Var.
8107	5	Yellowstone River? Col A. Vaughan.
8515	3	New York. Dr. J. Lewis. Cabinet series.
8517	1	Hiram, Ohio. ....
9208	8	Delaware River. W.G. Binney. .....

Physa osculans, Haldeman.--Shell ovate or subglobose, ashy-red, thin; whirls five, suture impressed; aperture wide. Shell allied to *P.*

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heterostropha, and presenting nearly the same varieties; translucent; texture very thin; lines of accretion fine; aperture wide, columella thick, with the fold obsolete, or but slightly impressed. Fig. 142

Mexico? India?

Specimens of this shell were presented to the Academy of Natural Sciences by Dr. M. Burrough, and Mexico is given as the native country, but as this enterprising traveller also made collections in India, it is not impossible that they may be from the latter country. In either case, the species appears to occur in too great abundance to allow us to suppose that it is now characterized for the first time. Fig. 13 is from a specimen in Dr. Jay's collection, and may be a distinct species. *(Haldeman.)*

Physa osculans, Haldeman, Mon. p. 29, pl. ii; f. 13, excl. f. 11, 12 (=*heterostropha*) (1843).

Subsequent researches have left no doubt of the habitat being Mexico.

The specimens figured on Plate 2, Figs. 11 and 13, of Haldeman's Monograph were subsequently referred to *Physa heterostropha*. I have, therefore, retained the name *osculans* (as he suggests) for the Mexican form with narrower aperture and more pointed spire. My figure is copied from his figure 13. See also remarks under *Physa heterostropha*.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8978	..	San Felipe Springs. Beale. .....
9009	..	Mexico. Acad. Nat. Sc. Phila. ....
9141	4	City of Mexico. Lt. Beale. .....

Physa mexicana, Philippi.--Shell imperforate, ovate, inflated, light horn-color, thin, dull and not shining, very finely wrinkled; the apical whirls occupy one-fourth of whole length; mouth wide; columellar fold broadly expanded, almost in the centre of the aperture.

Shell ovate, inflated, formed by five whirls, and covered with fine broken microscopic wrinkles, parallel to the lines of growth, which prevents the surface from being shining. Whirls tolerably arched, forming a depressed suture, last whirl Fig. 143.

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globose. Mouth longitudinally ovate, wide, the inner lip tolerably widely folded, the columella below the fold is appressed, prominent and rimmed--in one individual of only 6½''' the outer lip is furnished with a smoky, reddish thickening. Height 8¾''', breadth 5¾'''; ap. 7''' long. 3¼''' broad.

Hab. Mexico. *(Küster.)*

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Physa mexicana, Philippi in Küster, Chemn. ed. 2, p. 5, pl. i, f. 3-4.

I can give no other information regarding this species than that furnished by the original description copied above. One of Küster's figures also is given. The specimens in the collection no doubt are to be referred to the species.

Cat. No.	No. of Sp.	Locality; From whom received. Remarks.
8092	10	City of Mexico. ....
8093	8	Texas. Lieut. Couch. Cabinet series.
8519	2	City of Mexico. ....

Physa heterostropha, Say.--Shell sinistral, subovated; color pale yellow, chestnut or blackish; whirls four, the
Fig. 144. first large, the others Fig. 145. very small, terminating rather abruptly in an acute apex; aperture large, somewhat oval, three-fourths of the length of the shell, or rather more; within of a pearly lustre, often blackish; lip a little thickened on the inside, and tinged with dull red.

Inhabits with the first species (*L. catascopium*), and almost as numerous. Pl. I, Fig. 6.

Animal resembles that of *Limnaea catascopium,* but is of a darker color and longer than its shell, the tentacula also are longer and setaceous; tail acute. The mantle is trifid at the base of the pillar lip, and at the upper corner of the aperture; deposits eggs the beginning of May; eggs enveloped by a transparent gelatinous substance; the nucleus, after a few days, appears of a pale or milk-white color, and not so well defined as those of *L. catascopium.* *(Say.)*

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Limnaea heterostropha, Say, Am. ed. Nich. Enc. pl. i, f. 6 (1817, 1818, 1819): Binney's ed. 46, pl. lxix, f. 6.

Physa heterostropha, Say, Jour. Acad. Nat. Sc. II, 172 (1821): Binney's ed. p. 68.--Haldeman, Mon. p. 23, pl. ii, f. 1-9 (1843).--Gould, Invert. p. 211, f. 141 (1841).--Adams, Shells of Vt. 154 (1842).--Deshayes in Lam. An. sans Vert. VIII, 402; ed. 2, III, 412.--DeKay, N. Y. Moll. p. 76, pl. v, f. 82 (1843).--Chemnitz, ed. 2, p. 7, pl. i, f. 7, 8.--Mrs. Gray, Fig. Moll. An. pl. cccx, f, 9.--Potiez et Michaud, Gal. des Mol. I, 224, pl. xxii, f. 15, 16.--Anony. Canada Nat. II, 209, fig. (1857).

Physa fontana, Haldeman, Mon. pt. 2, p. 3 of cover (1841).

Physa cylindrica, Newcomb in DeKay, N. Y. Moll. 77, pl. v, f. 82 (1843).

Physa aurea, Lea, Trans. Am. Phil. Soc. VI, 18, pl. xxiii, f. 106; Obs. II, 18 (1839).--DeKay, N. Y. Moll. 80, pl. v, f. 89 (1843).

Physa plicata, DeKay, N.Y. Moll. p. 78, pl. v, f. 85 (1843).

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Physa osculans, Haldeman, Mon. part, f. 11, 12.

Physa striata, Menke, Syn. Méth. ed. 2, p. 132 (1830), teste Haldeman.

Physa subarata, Menke, Syn. Méth. ed. 2, p. (1830), teste Haldeman.

Physa charpentieri, Küster in Chemn. ed. 2, p. 23, pl. iv, f. 4-6.

Physa philippi, Küster in Chemn. ed. 2, p. 19, pl. iii, f. 3-6.

Physa inflata, Lea, Proc. Am. Phil. Soc. II, 32: Trans. IX, 7; Obs. IV, 7.

Helix heterostrophus, Eaton, Zool. Text-Book, 195 (1826).

Bulla crassula, Dillwyn, Conch. tab. 1, 487, No. 36 = *fontinalis,* Chemnitz, Conch. IX, 33, pl. ciii, f. 879, 880, var. 3.--Gmelin, Syst. 3407.--Schroter, Einl. t. I, 261, *Helix* No. 84.

Cochlea neritoides, Lister, Conch. pl. cxxv, f. 34.

Of this species I have seen specimens from Texas and Georgia, and from as far north as Great Slave Lake. It ranges from the Atlantic to the Pacific. It is our most common species.

Mr. Say's types are still in the collection of the Philadelphia Academy. One is drawn in Fig. 144.

Binney, p. 85

Physa fontana, formerly described as distinct, is referred to this species by Haldeman (Mon. p. 26). His description here follows:--

Physa fontana.---Animal dark fuliginous, foot as long as the shell; shell ovate, translucent, composed of three convex turns; apex eroded; suture well marked; labium nearly straight, with a slight fold; color yellowish-brown. Length ¼ inch.

Inhabits cold springs in Pennsylvania.

Closely resembles *P. fontinalis* of Europe, but the foot is shorter. *(Haldeman.)*

Among the shells figured by Haldeman as *Physa osculans* appear some of this species. He says of them:

Physa osculans.--The United States specimens of this shell will merge into *P. heterostropha.* One specimen, Fig. 146. supposed to be from the West, is in reality from Mexico. This appears distinct, and may retain the name until I learn more about it. Although the aperture is narrow, some specimens in the Academy's collection have it very wide.

My opinion of the identity of *Physa striata* and *Physa subarata,* of Menke, is founded on his description alone, having seen no authentic specimens. His words are:--

Physa striata, Menke.--Shell ovate, subopaque, reddish horn colored; last whirl longitudinally, elegantly and lightly striated; spire short, obtuse; internal margin of the labrum doubled, the exterior obsolete,

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white, the interior within the throat acute, red, showing a band without. Length 6½, breadth 4 lines.

Hab. Goshen, Mass. *(Menke.)*

Physa subarata.--Shell ovate, pellucid, ashy horn-color; last whirl ventricose, somewhat furrowed transversely; spire short, acute; labrum thickened within. Length 5, breadth 3 lines.

Binney, p. 86

Hab. Near Cincinnati in the Ohio River. *(Menke.)*

Not having seen authentic specimens of the following species, my opinion of their identity with *Physa heterostropha* is based on a study of the original descriptions and figures here copied.

Physa cylindrica, Newcomb.--Shell remarkably solid, sinistral, cylindrical. Whirls four, rapidly diminishing to the sub-acute apex. Surface moderately smooth, and polished with incremental lines. Suture impressed; outer lip with a sinuous margin, nearly straight, forming an acute angle with the body, effuse beneath; body whirl not convex, but rather flattened and cylindrical. Aperture narrow above, moderately dilated and elongated beneath. Columella smooth, arched with a conspicuous callus reflected over the umbilicus. Light rusty, or opaque rusty white; outer lip with a rusty sub-margin within. Length 0.5, of aperture 0.35.

Fig. 147.

This specimen was communicated by Dr. Newcomb, who obtained it from Red Creek, Wayne County. I have received the same shell under the name of *P. elliptica,* Lea; but it does not agree with his description. *(DeKay.)*

Physa aurea, Lea.--Shell sinister, rather inflated; golden color, pellucid, shining; spire rather short; whirls four; outer lip margined; aperture somewhat inflated. *Habitat.* Hot Spring, Bath County, Virginia: P. H. Nicklin. My cabinet, and cabinet of P. H. Nicklin. Diam. .3, length .5 inch.

Fig. 148.

Mr. Nicklin informed me that he found the *Physa aurea* in a little watercourse by which a hot and a cold spring discharge their mingled waters. The former exhibits a temperature of 106° and the latter of about 56° of the scale of Fahrenheit. Near the meeting of the waters, one side of the little stream is cold and the other side hot; and multitudes of these beautiful *Physae* are to be found on both sides of the line of junction, availing themselves of the power which the locality affords of changing their climate according to their fancy. *(Lea.)*

Physa plicata, DeKay.---Shell moderately

Binney, p. 86

solid, subovate, elongate, symmetrical. Whirls four to five, rapidly attenuated to the apex. Surface with equidistant, longitudinal, and obsolete inequidistant transverse raised

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lines; suture distinct. Pillar-lip with a broad nacreous deposit. Aperture more than two-thirds of the total length, acutely oval. Amber, but coated with a black pigment; before this is removed, the aperture is bluish iridescent. Length 0.6-0.8, of aperture 0.2-0.3 inch. Fig. 149.

This description is from specimens of the largest size, obtained from a pond on New York Island. It moves like *P. heterostropha,* with great celerity on the surface of the water, with its mouth downward. In some specimens the revolving and longitudinal lines are so distinct, particularly the former, that the surface of the body whirl appears covered with distinct square facets. Some naturalists consider it only a variety of *heterostropha.* It differs in many important particulars from that species, but I regret that I have not been enabled yet to examine the animal. *(DeKay.)*

Physa charpentieri, Küster.--Shell ovate-conic, semi-transparent, smooth, shining, yellowish; whirls five, flattened; aperture oblique; columella subplicate, peristome thickened.

Shell small, ovate, conical, very transparent, shining, smooth, dark yellow; spire depressed conical, whirls almost flat, scarcely separated by the suture, increasing moderately. The body whirl decreasing in size toward its base, which is like an inverted cone; mouth yellowish, tolerably wide, somewhat oblique; outer lip arched, acute and thickened within by a flesh-colored callus, which is visible on the exterior as a bright yellow band; columella convex, with an elevated fold, which is thin, broad, and sinuose. Height 4½, breadth 2½; aper. 3'' 'long. Fig. 150.

Habitat. Baltimore: received by Mr. Bergrath v. Charpentier. *(Küster.)*

Physa philippi, Küster.--Shell ventricose-ovate, acute, striate, shining, diaphanous,

Binney, p. 87

yellowish horn color; spire short, conoid, rather acute; whirls five, rapidly increasing, convex; aperture elongate-ovate; columella concave; white, peristome sharp, with a ruddy band within. Fig. 151.

Resembling in its general appearance *Physa heterostropha,* and in its straight axis and edge of the aperture, yet there are differences enough to distinguish it as a distinct species. The shell is ventricose, ovate, thin, and almost transparent, with waving wrinkles and yellowish horn-color. The apical whirls are rather short, comprising almost one-third of the length of the shell, increase rapidly in size, and are flattened convex, with a somewhat deep suture; body whirl ventricose; inner lip arched, rather wide; mouth long, ovate, almost as broad as long; columella concave, white, arcuate, and separated by a sinus from the

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termination of the outerlip, peristome adherent, somewhat arched, acute, with a reddish callus within. Height 7½, breadth .4; aperture 5'' ' long.

To the young of this species, or a variety, I refer a shell of which three specimens were sent to me from the Stuttgard Museum, as *Ph. heterostropha.* The shell is almost transparent, rather less ventricose, very shining, but corresponds with the above description in the form of the mouth, the axis, the reddish callus within the lip, and the curved reticulations. Height 5½, breadth 3'' . (Fig. 5 is six times the natural size.)

Hab. North America *(Küster.)*

Physa inflata, Lea, whose description is given below, appears to me a synonym of *Ph. heterostropha.* Fig. 152 is drawn from his type.

Physa inflata, Lea.--Shell inflated, dark, somewhat pellucid; spire somewhat elevated, acutely conical; whirls five; outer lip margined and inflated; aperture wide.

Hab. Virginia, between the Salt Sulphur and the Sweet Springs: Ph. Nicklin. My cabinet, and cabinet of Fig. 152.

Binney, p. 88

Mr. Nicklin. Diam. .48, length .65 of an inch.

Two specimens were taken by Mr. Nicklin in a small stream which crosses the road in a gap in the main chain of the Alleghany Mountain between the Salt Sulphur and the Sweet Springs in Virginia. The gap is nearly level for several miles, and some of the streams run to the west and some to the east. This species seems to me to differ from any with which I am acquainted. It is perhaps most nearly allied to *P. heterostropha* (Say), but has a shorter aperture and is more inflated. *(Lea.)*

Dr. Gould tells me that a specimen of *Ph. heterostropha* in the Garden of Plants is labelled *Ph. arctistropha*, Jan. Villa (Disp. p. 32) quotes *Ph. cubensis*, Pfr., as a synonym of *Ph. heterostropha*.

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Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.

8047	3	Near Red River. R. Kennicott.
8048	2	Black Hills.
8049	5	Fort Peirce.
8050	31	Big Sioux.
8051	3	Milwaukee, Wis. I. A. Lapham.
8052	43	Mohawk. N.Y. Dr. J. Lewis. Vars.
8053	16	Southern Illinois. R. Kennicott.
8054	1	Toledo, O. F. A. Bossard.
8055	57	Rubey Valley. Capt. J.H. Simpson, Army in Utah.
8056	4	Lac des Mille Lacs to L. of the Woods. R. Kennicott.
8057	8	Platte River. N.T.
8058	11	Centre County, Pa.
8059	7	Mohawk, N.Y. Dr. J. Lewis.
8060	4	Chattanooga, Tenn. A. Gerhardt.
8061	9	Erie Canal, N.Y. Dr. J. Lewis.
8062	8	Nolachucky R., E. Tenn.
8063	6	Milwaukee, Wis. I.A. Lapham.
8064	23	Mohawk N.Y. Dr. J. Lewis.
8065	12	Maine. "
8066	17	Northern Georgia. A. Gerhardt.
8067	10	Hiram, O. S.M. Luther.
8068	14	20 miles f. Ft. Kearney.
8069	11	Marietta, O. W. Holden.
8070	1	.... Fossil?
8071	10	Westfield, Mass. Dr. J. Lewis.
8072	5	Owasco Lake, near Auburn, N.Y. Dr. J. Lewis.
8083	4	Hiram, O. S. M. Luther.
8465	2	Southern Utah. Capt. J.H. Simpson.

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8466	80	Chiloncynck Depot. A. Campbell. ....
8513	2	Southern Utah. Capt. J.H. Simpson.
8956	1	Northern Georgia. Dr. Jones.
9090	100+	Mohawk, N.Y. Dr. Lewis.
9091	20+	Grand Rapids, Mich. "
9092	20+	Mohawk, N.Y. "
9099	3	San Francisco. Judge Cooper.
9101	1	Wwshington Territory. "
9104	20+	Mohawk, N.Y. Dr. Lewis.
8974	..	Lake Utah. Capt. Burton.
9179	50	Vermont. Chittenden.
8528	1	Virginia. W.G. Binney. *P. aurea*, Lea.
9267	2	Isle La Crosse. R. Kennicott.
9268	2	Great Slave Lake. "
9269	1	Peace River. "
9261	8	Virginia. Dr. English.
9263	3	Hell Gate River. Dr. Newberry.

Physa fragilis, Mighels.--Shell very thin and fragile, translucent, horn-color, obliquely ovate; whirls four; last whirl campanulate, suture deeply impressed at the enlargement of the last whirl; spire usually less than one, sometimes only one-fourth part of the length of the shell; labrum very thin, advanced; labium tumid with a thin, loosely adherent lamina. Length, .55 inch; greatest breadth, .4 inch; divergence, 90°.

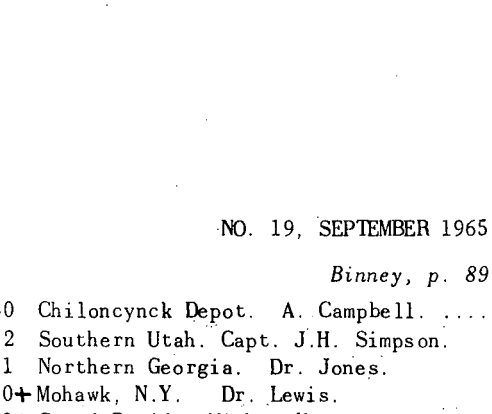
Fig. 153.

Animal of a very obscure, light-green color; whole surface of the body covered with oblong dark spots; foot shorter than the shell, lanceolate; tentacles nearly white, rather long, very slender; mouth blood-red. Its motions are exceedingly rapid; very timid withdrawing itself on the least alarm. It is very tenacious of life, at least it is not easily *starved*. Three specimens are now before us in a tumbler of water, November 10th, where they have remained since the first of July. The water has not been changed more than half a dozen

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times, yet they are as brisk as when first taken; and moreover they have grown at least one-quarter. Exuviae white, abundant, vermicular.

Cabinets of Boston Society of Natural History, Amherst and Middlebury Colleges, Mons. Largillier, S. S. Haldeman, J. W. Mighels, and C. B. Adams.

Binney, p. 90

Hab. Monmouth, Maine: discovered in a millpond, after the water was drawn off, by Mr. N. T. True, to whom we are indebted for specimens.

This species is distinguished from *P. heterostropha* by the campanulate aperture, which is constant, shorter spire tumid labium, and by its remarkable tenuity. *(Mighels.)*

Physa fragilis, Mighels, Proc. Bost. S.N.S., I, 49 (1841).--Mighels & Adams, Bost. J.N.H. IV, 44, pl. iv, f. 12 (1842).--Haldeman, Mon. p. 31, pl. iv, f. 11-13 (1843).--DeKay, prelim. Cat. N. Y. Moll. anno 1839, p. 32?

Dr. Foreman catalogues *Ph. fragilis* from the District of Columbia.

I have seen no authentic specimen of this species, which is admitted by Haldeman as distinct. I am inclined to believe it a variety of *Ph. heterostropha.* The original description and figure are copied above.

Physa semiplicata, Küster.--Shell ovate, shining, semi-transparent, horn-colored; whirls five, convex, regularly wrinkled or grooved, the last smooth below; aperture broad; columella concave, subplicate; peristome straight, acute.

Fig. 154.

A species readily recognized by its peculiar sculpturing; the shell is longitudinally-ovate, shining, transparent, horn-colored; the apex is somewhat depressed, obtusely ovate, whirls arched, separated by a depressed transversely wrinkled suture; body whirl large, ventricose, rapidly decreasing towards the rounded base, with delicate incremental striae and longitudinally grooved on its upper half; mouth moderately high, and especially towards the base, broad; outer lip thin, straight, acute, curving and obtusely rounding below; columella short, concave, folded; fold broad, rather thin, white. Height 5, breadth 3"'.

Hab. Unknown. I once received a single specimen among some small American sea shells. *(Küster.)*

Physa semiplicata, Kuster in Ch. ed. 2, p. 24, pl. iv, f. 7-9.

I can give no information regarding this species further than that contained in the original description and figure copied above.

Binney, p. 90

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Physa costata, Newcomb.--Shell ovate globular, horn-colored or reddish corneous; whirls four, the last inflated and roundly angulated above, armed with ten to fourteen prominent longitudinal ribs; apex acute; spire short; aperture ovate.

Mus. Cal. Ac. N. S. My cabinet.

For this curious species of *Physa* we are indebted to Dr. Veatch, who collected several specimens at Clear Lake, California, most of them, however, immature. This is the only species provided with regularly arranged costae that I have seen, and this character alone will be sufficient to separate it from all other described species of the genus. *(Newcomb.)*

Physa costata, Newcomb, Proc. California Ac. Nat. Sc. II, 104.

I have seen no specimen of this species, that sent me by Dr. Newcomb having been lost at sea.

Physa solida, Philippi.--Shell perforate, longitudinally ovate, solid, pale horn-color; whirls arched, apical whirls pointed, comprising one-third the whole length of the shell; mouth narrowed by the thickening of the lip; columella not folded.

This is the heaviest species known to me, and is composed of six moderately arched whirls. The surface is sometimes reticulated, owing to the striae of growth being crossed by other lines, which are owing partly to delicate lace-like prominences, and partly to a different degree of transparency of the shell. Suture tolerably defined. Mouth longitudinally ovate, columellar fold quite indistinct; the inner lip thick, adherent, forming an umbilicus; columella arcuate. Also the outer lip is thickened just within by a brownish-red callus, which appears white from the outside. Height 7¼"', breadth 4¾"', high, 2 1/3"' broad.

Fig. 155.

Hab. New Orleans: my brother.

Binney, p. 91

Physa gyrina, Say, differs in having a thin, transparent shell, a shorter apex, as does also *Physa heterostropha,* Say, which has an obtuse apex; *Ph. acuta,* Dr., which resembles it in form, is smaller, thinner, and has an apex comprising only one-fourth of the whole length of the shell. *(Philippi.)*

Physa solida, Philippi in Chemn. ed. 2, p. 6, pl. i, f. 5, 6.

Of this species I have no fuller information than that contained in the original description and figure copied above.

The specific name appears to be preoccupied by Potiez and Michaud, Gal. des Moll. I, 227 (1838).

Physa virginea, Gould.--Shell slender and delicate, thin and shining, of a milk-white or porcelain-white color; spire about one-third the length of the shell, sharply pointed, of five or more moderately convex

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whirls, the last of which has a faintly angular appearance near the suture. Aperture narrow and elongated, two-thirds the length
Fig. 156. of the shell, acute behind. Columella short, delicate, slightly sinuate, folded. Length 3/5, diam. 1/3 inch.

Sacramento River, California: Budd.

A very well-marked species, of a porcelain-like structure and color, which appears not to be the consequence merely of blanching. It is less slender than *Ph. hypnorum,* and more like *Ph. gyrina,* Say, or *Ph. rivalis,* in form, but is a far more delicate shell, and one of the most elongated species. *(Gould.)*

Physa virginea, Gould, Proc. Boston S.N.H. II, 215 (1847); U.S. Ex. Ex. Moll. p. 120, f. 138, 138a (1852); Otia, 43.

Fig. 156 is drawn from a specimen lent me by Dr. Gould. Specimens have recently been added to the collection of the Smithsonian.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
8122 10 San Francisco.

Binney, p. 92

8507 .. ..
8569 3 River Sacramento. ..... Cabinet series.
8728 3 San Francisco. Rowell.

Physa humerosa, Gould.--Shell subrhomboid solid, smooth and white; spire acute; whirls five, tabulated; aperture equalling one-half to two-thirds the shell's length, rounded posteriorly; labrum expanded; columella scarcely plicate, callus hardly perforated. Length ½ to 7/10, breadth 3/8 inch.

Found by Dr. Thomas H. Webb and
Fig. 157. by W. P. Blake in the Colorado Desert and at Pecos River.

The broadly tabulated whirls, with the acute, elevated spire, and foldless columella clearly distinguish this species. It is like *P. tabulata,* Gould, and the variety figured by Haldeman, as *P. ancillaria* (fig. 7), which he regards as a monstrosity; the deep suture and simple columella distinguish it from that species. *(Gould.)*

Physa humerosa, Gould, Proc. Bost. Nat. Hist. V, 128 (1855); Otia, 216; Pac. R.R. Rep. V, 331, pl. xi, f. 1-5; Prelim Rep. 23 (1855).

It has also been found at San Diego. The shell figured was presented by Dr. Gould to the Philadelphia Academy.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
8113 4 Des. of Colorado R., Cal. Lt. R. M. Williamson. Dead shells.
8114 2 Creek leading to Desert, Cal.
3252 1 San Diego. P.R.R. Cabinet series.

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Physa pomilia, Conrad.--Shell with four volutions, horn-colored and polished; spire short conical; body whirl ventricose; aperture patulous. *Remark.* It resembles *Ph. heterostropha,* Say, but is much smaller and thinner.

Randon's Creek, near Claiborne, Alabama, adhering to limestone rocks. *(Conrad.)*

Physa pomilia, Conrad, Am. Journ. Sc. [I], XXV, p. 343 (1834).--DeKay, N. Y. Moll. 81 (1843).--Müller, Syn. Test. 1834 Prom. p. 35 (1836).

Binney, p. 93

I have not seen this species, and have not been able to gather any further information regarding it.

Physa virgata, Gould.--Shell moderate, solid, smooth, elongate-ovate, ash-colored with longitudinal olivaceous stripes; spire elevated, acute; whirls four to five, well separated; aperture lunate, two-thirds the shell's length; columella moderately folded, but with a heavy callus, within yellowish - red. Length 2/5, breadth ¼ inch.

Fig. 158.

Found by Dr. T. H. Webb, in the river Gila, and near San Diego.

Quite remarkable, as being the only species yet known which has variegated coloration. The stripes are found on some part of every shell, and many are prettily ornamented throughout. In size and proportions it may be compared with *Ph. microstoma*, Hald. *(Gould.)*

Physa virgata, Gould, Proc. Bost. Soc. Nat. Hist. V, 128 (1855); Otia, 216.

Also found at Los Angelos. An authentic specimen is figured above.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
4285	5	San Diego.	.....	Cabinet series.
4400	5	.....	.....	.....
8723	3	Los Angelos, Cal.	Cab. Acad. Nat. Sc.	

Physa troostiana, Lea.--Shell elliptical, rather thick, yellow-brown, smooth; spire obtuse; sutures slightly impressed; whirls five, slightly convex; lip margined, thickened within; aperture small ovate, contracted.

Hab. Near Nashville, Tennessee: Dr. Troost. My cabinet, and cabinet of Dr. Troost. Diam. .25, length .45 of an inch.

Fig. 159.

This is a short obtuse species, about the size of *P. aurea*, Nob. The substance of the shell is very thick for the genus, and it is much more thickened within the margin than any species I have observed. The line along the margin of the lip is of a reddish-brown. The indentation of the columella is lower than usual. The aperture is about two-thirds the length of the shell. *(Lea.)*

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Physa troostiana, Lea, Tr. Am. Phil. Soc. ix, 7; Obs. IV, 7 (1844); Proc. II, 32 (1841).

Fig. 159 is drawn from the original specimen.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
9266	15	.....	.....	Teste Lea.

Physa triticea, Lea.--Shell subfusiform, pellucid, polished, reddish-chestnut; spire short, subacute; sutures sub-impressed; whirls four, sub-constricted; aperture elongate, with a line within.

Fig. 160.

Shasta County, California: Dr. Trask. *(Lea.)*

Physa triticea, Lea, Proc. Acad. Nat. Sc. Phila. VIII, 80 (1856).

Mr. Lea's description is given above. My figure is drawn from a shell collected by Dr. Cooper, and determined by Mr. Lea, now in the Smithsonian collection.

Cat. No.	No. of Sp.	Locality.	From whom received.	Remarks.
9097	3	California.	Judge Cooper.	One figure. Type.
9268	3	.....	.....	.....

Physa concolor, Haldeman.--Shell oval, spire produced, with the apex pointed; aperture oval, narrow, with the columella fold distinct. Color honey yellow.

Fig. 161.

Characterized by a single specimen brought from Oregon by Mr. Nuttall. *(Haldeman.)*

Physa concolor, Haldeman, Mon. pt. III, p. 3, cover (1841); p. 30, pl. ii, f. 10 (1843). --DeKay, N. Y. Moll. 81 (1843).

I have seen no specimens of this species. Fig. 161 is a copy of that of Haldeman.

Binney, p. 94

SUBGENUS PHYSELLA, Hald.

Shell globose, spire short; aperture elongate, very wide; columella with the fold well marked.

Physa globosa, Haldeman.--Shell globose, translucent; spire very short and rounded; aperture very long and wide, occupying considerably

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more than half the entire area of the shell; fold well marked; whirls three. FOREIGN ANALOGUE. *Amphipeplea involuta.*

This small species inhabits the submerged rocks in the rapids at the mouth of Nolachucky River, in Tennessee, under such circumstances as to convince me that it does not breathe the free air. I procured but two individuals, the shells of which are sufficiently translucent to exhibit light circular dots upon the black ground of the mantle--a common character in this genus. *(Haldeman.)*

Fig. 162.

Physa globosa, Haldeman, Mon. pt. 4, p. 4 of cover (1842); p. 38, pl. v, f. 10-12 (1843); Journ. Acad. Nat. Sc. Phila. VIII, 200 (1842); Pr. A. N. Sc. I, 78 (1841).--DeKay, N.Y. Moll. p. 81 (1843).

Physella globosa, Chenu, Man. de Conch. II, 281, f 3551.

The description and figure given above are copied from Haldeman, the latter enlarged.

SUBGENUS PHYSODON, Hald.

Shell solid, smooth, elliptical; outer lip thick; columella toothed.

Physa microstoma, Hald.--Shell elliptic, composed of four flattened whirls, separated by a distinct but very shallow suture; substance of the shell thick; spire shorter than the aperture, and ending in a point; aperture narrow elliptic, with a continuous peritreme, and the labium much thickened anteriorly; columella with two nacreous elevations or obtuse teeth. Color light brownish-ochraceous; columella and external periodical (varicose) bands, white, whilst the corresponding internal bands are chestnut.

Fig. 163.

Binney, p. 95

Kentucky and Ohio.

This is a remarkable shell, and readily distinguished from all the American species of *Physa,* hitherto described, by the teeth upon the columella. *(Haldeman.)*

Physa microstoma, Haldeman, Mon. p. 39, pl. iv, f. 12-14 (1853); Suppl. to pt. 1, p 2 (1840).

Physiodon microstoma, Chenu, Man. de Conch. II, 481, f. 3552.

Fig. 163 is a fac-simile of one of Haldeman's. His description is given above.

Cat. No.; No. of Sp.; Locality.; From whom received. Remarks.
9095 1 Kentucky. Haldeman. Type.

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SPURIOUS SPECIES OF PHYSA.

Physa ampullaria, Say, is mentioned by name only by Lea in Expl. of Nebraska, &c., House Doc. 2d Sess. 35th Cong. 1858-9, vol. II, pt. iii, p. 724. It may be a misprint for *ancillaria.*

Physa rivalis is catalogued without description by J. de C. Sowerby (in Richardson's Fauna Boreali-Americana, III, 315 (1836), as is also

Physa turrita with *Physa elongata,* Say, and *Bulla hypnorum,* Linn. as synonyms.

Physa scalaris, Jay.--The shell is white, semi-transparent, and very fragile; the sutures of the whirls are very angular, and of the same character with the *Ampullaria scalaris,* D'Orb. It was presented to me by Count Castelnau, whose researches in this country will, without doubt, add much interesting matter to our knowledge of natural history.

Fig. 164.

Hab. Everglades of Florida. *(Jay.)*

Paludina scalaris, Jay, Cat. ed. 3d, 1839, p. 112, pl. i, f. 8, 9.--Reeve, Con. Icon. fig. (1863).

Physa scalaris, Haldeman, Mon. 34, pl. iv, f. 9 (1842).

CHECKLIST OF FRESHWATER MOLLUSKS[1] OF NORTH CAROLINA

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There has been a good deal of collecting of freshwater mollusks in North Carolina over the years, but very little has been published. This checklist is largely based on: 1) collections made by the author, 2) a survey of the upper Neuse River drainage by Walter (1956), and 3) shells preserved in the Academy of Natural Science Museum in Philadelphia and in the Museum of Zoology of the University of Michigan. The latter include material sent by C. S. Brimley to Bryant Walker in the early 1900s, collections of Calvin Goodrich after he had retired and come to live in North Carolina, and recent material sent by Leslie Hubricht. Rehder (1949) reported on mollusks collected along the coast, and D. G. Frey on collections from Lake Waccamaw in 1947 (letter).

North Carolina is divided into three regions,--Mountain, Piedmont, and Coastal Plain. Most of the river systems drain into the Atlantic Ocean, but in the mountains the headwaters of the Pigeon, New, Watauga, French Broad, Little Tennessee, and Hiwassee are part of the Mississippi drainage system. In the Atlantic drainage, beginning at the north, the Roanoke-Chowan rises in Virginia, the next three, - Tar, Neuse, and Cape Fear, - rise in the Piedmont and lie entirely within North Carolina, while the Yadkin, Catawba, and Broad rise in the mountains and flow into South Carolina. There are a few natural lakes in the Coastal Plain, Lake Waccamaw in Columbus Co. being one of the most important, but most lakes are man made. Greenfield Lake in Wilmington is one of these.

Distribution is indicated either by drainage system (see map, fig. 1) or by county. Also the source of the records, either author, collector, or museum is given.

CLASS PELECYPODA

Family Unionidae

1. *Alasmidonta heterodon* (Lea).-- Neuse dr. (Walter, Mich.); Tar dr. (Mich.); Lake in Guilford Co. (Dawley).

2. *Alasmidonta marginata varicosa* (Lamarck).-- Rocky R., Cape Fear dr. (Mich.); Buncombe Co. (Phila.)

3. *Alasmidonta raveneliana* (Lea).- French Broad, type loc. (Simpson); Pigeon and Nolichucky R. (Mich.)

4. *Alasmidonta undulata* (Say).-- Neuse dr. (Walter, Mich., Phila.); Cape Fear dr. (Mich.); Uwharrie R., Catawba R. (Phila.)

5. *Anodonta cataracta* Say.--Lakes and slower

[1] Collecting and travel expenses were met in part by Grants in Aid of the Woman's College Research Council of the University of North Carolina, Nos. 59 and 135.

parts of rivers, Neuse dr. (Walter); Cape Fear dr. (Dawley, Mich.)

6. *Anodonta dolabris Lea.*--Union Co., type loc. (Simpson); Tar. R.; Mecklenberg Co. (Mich.)

7. *Anodonta hallenbeckii* Lea.--Guilford Co. (Dawley, Mich.)

8. *Anodonta imbecillis*-Say.--Neuse dr. (Walter, (Mich.); outlet of Greenfield L. (Mich.)

9. *Elliptio burkensis* (Lea).---Gaston Co. (Mich.)

10. *Elliptio catawbensis* (Lea).--Catawba R., Gaston Co., type loc. (Simpson, Mich.)

11. *Elliptio complanatus* (Solander).--Entire Atlantic drainage.

12. *Elliptio complanatus jejunus* (Lea).--Roanoke R, type loc. (Simpson). Neuse, Cape Fear, Catawba, Yadkin dr. (Mich.)

13. *Elliptio complanatus quadrilaterus* (Lea). --Neuse R., type loc. (Simpson); Tar, Cape Fear dr. (Mich.); Lake Waccamaw (Rehder).

14. *Elliptio complanatus roanokensis* (Lea).--Roanoke R., type loc. (Simpson); Neuse dr. (Walter); Tar, Yadkin, Cape Fear dr. (Mich.)

15. *Elliptio confertus* (Lea).--Neuse dr., Onslow Co. (Mich.)

16. *Elliptic congaraeus* (Lea).---Cape Fear, Neuse, Catawba dr. (Mich.)

17. *Elliptic dilatatus* (Raf.).--French Broad R. (Mich.)

18. *Elliptic dorsatus* (Lea).--Catawba R., type loc. (Simpson, Mich.)

19. *Elliptio errans* (Lea).---Cape Fear dr. (Mich.)

20. *Elliptio fisherianus (Lea).--Lake Waccamaw,* Greenfield Lake (Mich.)

21. *Elliptio forbesiana* (Lea)---Cape Fear, Neuse R. (Mich.)

22. *Elliptio icterinus* (Conrad).-Catawba, Yadkin, Neuse dr. (Mich.)

23. *Elliptic insulsus* (Lea).--Roanoke R., type loc. (Simpson); Tar, Neuse, Cape Fear dr. (Mich.); Lake Waccamaw (Frey).

24. *Elliptio lanceolatus* (Lea).--Tar R. type loc. (Simpson); Cape Fear, Tar dr., Lake Waccamaw (Mich.)

25. *Elliptio livingstonensis* (Lea).--Livingston Creek, Brunswick Co., type loc. (Simpson); Neuse, Tar, Cape Fear dr. (Mich.)

26. *Elliptic merus* (Lea).--Catawba R. (Mich.)

27. *Elliptio micans* (Lea).--Catawba and Deep R., type loc. (Simpson); Catawba, Cape Fear dr. (Mich.)

28. *Elliptio obesus* (Lea).--Rocky R., Chatham Co. (Mich.)

29. *Elliptio perlatus* (Lea).--Lake Waccamaw (Frey).

30. *Elliptio perstriatus* (Lea).--Cape Fear, Catawba dr. (Mich.)

31. *Elliptio productus* (Conrad).---Neuse dr. (Walter); Yadkin dr. (Dawley); Pitt, New Hanover, Brunswick Cos. (Mich.)

32. *Elliptio purus* (Lea).--Neuse R., type loc. (Simpson); Irvin's Creek, Alexander's Pond, Neuse R. (Mich.)

33. *Elliptio sordidus* (Lea).--Catawba, Yadkin dr. (Mich.)

34. *Elliptio spadiceus (Lea).----Yadkin R. (Mich.); Mt. stream, type loc. (Simpson).*

35. *Elliptio strumosus* (Lea).--Yadkin R., type loc. (Simpson, Mich.)

36. *Elliptio subinflatus* (Conrad).--Cape Fear dr. (Mich.)

37. *Elliptio tuomeyi* (Lea)- -Neuse, Yadkin, Catawba dr. (Mich.)

38. *Elliptio viridulus* (Lea).--Neuse R., type loc. (Simpson); Neuse, Tar dr. (Mich.)

39. *Elliptio waccamawensis* (Lea).--Lake Waccamaw, type loc. (Simpson, Mich.)

40. *Lampsilis cariosa* (Say).--Neuse R., Cape Fear R. (Mich.)

41. *Lampsilis conspicua* or *L. radiata conspicua* (Lea).--Yadkin R., type loc. (Simpson); Neuse dr. (Walter, Mich.)

42. *Lampsilis fasciola* Raf.--French Broad R. (Mich.)

43. *Lampsilis ochracea* Say.---Lake Waccamaw

(Mich. Frey, Rehder); Neuse dr. (Walter); Tar R. (Dawley); Roanoke R. (USNM).

44. *Lasmigona charlottensis* (Lea).--Charlotte, type loc. (Simpson); Irwin's Creek (Mich.)

45. *Lasmigona decorata* (Lea).--Cape Fear, Yadkin, Catawba, New R. dr. (Mich.)

46. *Lasmigona subviridis* (Conrad).--Neuse dr. (Walter, Mich.)

47. *Lexingtonia subplana* (Conrad).--Guilford Co. (Dawley).

48. *Ligumia constricta* (Conrad).-Catawba, Cape Fear, Neuse dr. (Mich.); Neuse dr. (Walter).

49. *Ligumia delumbis* (Conrad).--Neuse dr. (Walter, Mich.)

50. *Pleurobema brimleyi* (S. H Wright).--Neuse dr., type loc. (Simpson, Walter, Mich.)

51. *Pleurobema striatulum* (Lea).--Roanoke R., type loc. (Simpson, Mich.); Neuse R. (Mich.)

52. *Strophitus rugosus* (Swainson).--Cape Fear, Neuse dr. (Mich.)

53. *Strophitus undulatus* (Say).---Neuse dr. (Walter); Yadkin dr. (Dawley).

54. *Uniomerus obesus* (Lea).--Cape Fear, Yadkin, Neuse, Catawba dr., Lake Waccamaw (Mich., Phila.)

55. *Villosa concestator* (Lea).---Yadkin R., Rocky R. in Chatham Co. (Mich.)

56. *Villosa lienosa* (Conrad).--Guilford Co. (Dawley),

57. *Villosa modioliformis* (Lea).--Lake Waccamaw (Frey).

58. *Villosa nebulosa* (Conrad).--Hiwassee R. (Mich.)

59. *Villosa ogeecheensis* (Conrad).-Tar, Neuse, Cape Fear, Catawba dr.; Lake Waccamaw (Mich.); Cape Fear, Yadkin dr. (Dawley).

60. *Villosa tenera* (Lea).-- French Broad (Mich.)

61. *Villosa vanuxemensis* (Lea).--Hiwassee dr. (Mich.)

Family Mactridae

62. *Rangia cuneata* (Gray).--Mouth of Pamlico R. and Albemarle Sound (H. Porter, UNC Inst. of Fish. Res., Morehead City).

Family Corbulidae

63. *Polymesoda carolinensis* (Bosc).--Estuary of Neuse R. at New Bern (Walter); Back Creek, Beaufort (Dawley).

Family Sphaeriidae

I have followed Herrington's (1962) revision of the Sphaeriidae except for examples of species in the literature which he does not list.

64. *Eupera cubensis* (Prime).--Lower Neuse R. (Walter).

65. *Pisidium abditum* (Haldeman).--Neuse dr. (Walter), considered a synonym of *P. casertanum* (Poli) by Herrington.

66. *Pisidium compressum* Pfime.--Neuse dr. (Walter).

67. *Pisidium dubium* (Say).--Neuse dr. (Walter).

68. *Pisidium peraltum* Sterki.--Neuse dr. (Walter).

69. *Sphaerium contractum* (Prime) or *Musculium contractum* (Prime).--Neuse dr. (Walter).

70. *Sphaerium lacustre* (Müller).--Guilford Co. (Dawley).

71. *Sphaerium occidentale* Prime.--Guilford Co. (Dawley).

72. *Sphaerium partumeium* (Say) or *Musculium partumeium* (Say).--Neuse dr. (Walter); Guilford Co. (Dawley).

73. *Sphaerium securis* Prime.---Guilford Co. (Dawley).

74. *Sphaerium solidulum* (Prime).--Neuse dr. (Wwlter).

75. *Sphaerium striatinum* (Lamarck).--Guilford, Alamance Cos. (Dawley).

76. *Sphaerium transversum* (Say) or *Musculium transversum* (Say).--Neuse dr. (Walter); Guilford Co. (Dawley).

CLASS GASTROPODA

Family Valvatidae

77. *Valvata bicarinata* Lea.--Lower Neuse (Walter); Bertie Co. (Mich.)

Family Viviparidae

78. *Campeloma decisum* (Say).--Whole state.

79. *Campeloma geniculum* Conrad.---Greenfield Lake, Johnston Co. (Mich.); Lake Waccamaw, Brunswick Co., Charlotte (Phila.)

80. *Campeloma lewisii* Walker.--Lake Waccamaw, (Frey).

81. *Campeloma rufum* Haldeman.---Whole state (Mich.)

82. *Lioplax subcarinata* (Say).---Lake Waccamaw (Frey, Mich.)

Family Hydrobiidae

83. *Amnicola limosa* (Say).--Neuse dr. (Walter).

84. *Clappia virginica* (Walker) or *Somatogyrus virginicus* Walker.--Neuse dr. (Walter); Tar R. (Mich.); Cape Fear dr. (Dawley).

85. *Gillia altilis* Lea.--Tar R., outlet of Greenfield Lake (Mich.); Lake Waccamaw (Frey); French Broad (Dawley).

86. *Gillia crenata* Haldeman.--Greenfield Lake (Mich.)

87. *Lyogyrus dalli* Pils.--Lake Waccamaw (Frey).

88. *Lyogyrus granum* Say.--Chowan R. (Mich.)

Family Pleuroceridae

In a recent paper Morrison (1954) revised the classification of this family and changed the generic name *Anculosa* to *Leptoxis*, *Goniobasis* to *Oxytrema*, and *Nitocris* to *Mudalia*.

89. *Anculosa subglobosa* Say or *Leptoxis subglobosa* (Say).-Hiwassee dr. (Mich. Phila.)

90. *Goniobasis catenaria dislocata* (Ravenel) or *Oxytrema catenaria dislocata* (Ravenel).--Piedmont and Mountains. (Walter, Mich., Dawley, Phila.)

91. *Goniobasis interrupta* (Haldeman) or *Oxytrema interrupta* (Haldeman).--Hiwassee R. (Phila.)

92. *Goniobasis proxima* (Say) or *Oxytrema proxima* (Say).--Mountains and Piedmont.

93. *Goniobasis simplex* (Say) or *Oxytrema simplex* (Say).--Little Tennessee R. (Mich.)

94. *Goniobasis symmetrica* (Say) or *Oxytrema symmetrica* (Say).--Mountains and Piedmont. The relationship of *G. proxima* to *G. symmetrica* is not clear. Walker (1918) includes *symmetrica* as a variety of *proxima*. Goodrich (1950) suggested the possibility that *proxima* is a stunted, mountain form of several species, such as *symmetrica* east of the mountains and *simplex* on the western side. Both *proxima* and *symmetrica* are widely reported, and in my collections I find many lots which contain both the small, smooth, black form *(proxima)* and the larger brown, carinated and striped form *(symmetrica)*.

95. *Goniobasis virginica* (Gmelin) or *Oxytrema virginica* (Gmelin).--Tar R. (Mich.)

96. *Nitocris carinata* Brug. or *Mudalia carinata* (Brug.).--Mountains and Piedmont (Walter, Dawley, Mich., Phila.)

Family Lymnaeidae

97. *Fossaria modicella* (Say).--Neuse dr. (Walter); New R. (Dawley).

98. *Pseudosuccinea columella* (Say).----Whole state (Walter, Dawley, Mich.)

Family Planorbidae

99. *Helisoma anceps* (Menke).--Whole state (Walter, Dawley, Mich., Phila.)

100. *Helisoma magnificum* (Pilsbry).-Greenfield Lake, type loc.

101. *Menetus alabamensis* Pilsbry.--Lake Waccamaw (Mich.)

102. *Menetus dilatatus dilatatus* (Gould).---Piedmont and Coastal Plain (Walter, Dawley, Phila.)

Family Ancylidae

In a review of freshwater limpet snails of North America, Basch (1963) has separated the species found in North Carolina into two genera, *Ferrissia* and *Laevapex*, and combined several of the species.

103. *Ferrissia fragilis hendersoni* (Walker) or *Ferrissia hendersoni* (Walker).--Lake Waccamaw, type loc. (Frey, Mich.); Neuse R. (Walter); Singletary Lake (Basch); Carteret and Guilford Cos. (Dawley).

104. *Ferrissia rivularis* (Say).--Rocky R. at Cedar Falls (Basch).
Ferrissia haldemani (Bourg.) considered a synonym by Basch. Orange Co. (Mich.)

105. *Laevapex diaphanus* (Haldeman).--Neuse R. (Walter); Greenfield Lake (Mich.); Swain Co. (Mich.)

106. *Laevapex fuscus* (C. B. Adams).--Yadkin dr. (Dawley).
The following are considered synonyms by Basch:
Laevapex fuscus eugrapta (Pils.), Wilmington (Mich.)
Ferrissia obscura (Haldeman), Haywood Co. (Mich.)
Ferrissia peninsulae (Pils. & Johnson), Lake Waccamaw (Mich.)

Family Physidae

107. *Physa heterostropha* (Say).--Orange Haywood, New Hanover, Hyde, Durham Cos. (Mich.)

108. *Physa inflata* Lea.--Neuse dr. (Walter); Ashe, Guilford, McDowell Cos. (Dawley).

109. *Physa microstoma Haldeman.---Avery Co.* (Mich.)

110. *Physa pomilia* Conrad.--Buncombe Co. (Mich.)
Physa pomilia hendersoni Clench, Lake Waccamaw (Mich.); Pitt Co. (Dawley).

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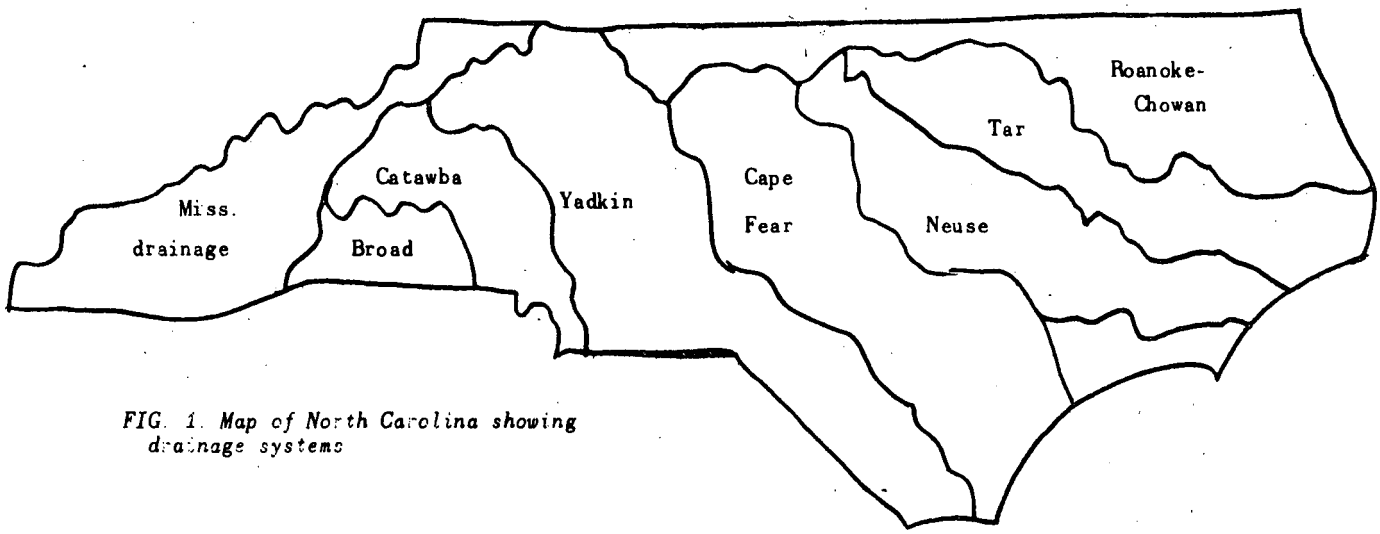

FIG. 1. Map of North Carolina showing drainage systems

Changes in the molluscan fauna of White Lake, Ontario, after thirty years.

Continued from page 2

Lymnaea stagnalis (Linn.) In 1935 this was the most obvious of the larger snails in the lake; there were enormous concentrations of dead shells near the outlet and living specimens were common in the weedy bays of the lake. In 1965 not a single dead shell of *L. stagnalis* was to be seen at the outlet although hundreds of dead *Viviparus viviparus* were in evidence there. A search for living *L. stagnalis* was successful in quiet water near the outlet where the species still survives in small numbers in company with much more numerous *Viviparus*. It can be found in small numbers elsewhere in the lake also, but everywhere *Viviparus* outnumbers it at least five to one.

Bulimnea megasoma (Say). One of the main reasons for visiting White Lake with Judge Latchford (see above) was to collect *B. megasoma*. None was found on that first trip, probably because we did not get into the swampy areas where it lives. In 1935 I made a point of examining several such areas and found *B. megasoma* both living and dead but in small numbers even then. In 1965, the species had disappeared from two suitable areas examined where not even a dead shell could be found

Physa heterostropha Say. This species was present in the lake in 1935 but not abundant. No live specimen was seen in 1965. This seems remarkable when the hardiness of *Physa* in other lakes of the region is remembered.

Helisoma campanulatum (Say). This species was common in water weed in most places in the lake in 1935. Some specimens were also collected on logs and crawling about on the soft marl bottom. Only two live specimens were collected in 1965 and only a few dead shells were noted.

Helisoma anceps (Menke). In 1935 I collected this species at several different places in White Lake, in shallow water 8 to 15 inches deep, on sand and mud. A few specimens were collected alive in 1965 and I had the impression that the abundance of this species had not changed appreciably.

Helisoma trivolvis macrostomum (Whiteaves). This large form of *H. trivolvis* was common in 1935 in protected, muddy bays of White Lake, accompanying *Bulimnea megasoma* and *Anodonta grandis*. No live specimens were seen in 1965 and only a few dead shells were collected.

Gyraulus deflectus (Say) was collected in small numbers in 1935, particularly on the underside of water lily leaves. Not a single specimen was seen in 1965.

To summarize, it would seem that the phenomenal success of *V.* cf. *viviparus* in White Lake at the present time has caused a reduction in numbers of some of the native species. Signs of a downward trend were noted and the fluctuations of *V.* cf. *viviparus* in future should be carefully observed.

Columbus, August 16, 1965.

PLEISTOCENE MOLLUSCAN FAUNA OF THE LAC BLANC DEPOSIT, MATAPÉDIA COUNTY, QUEBEC, CANADA

LIZZIE JACOB SHALLOM

INTRODUCTION

Purpose of Investigation

The purpose of this investigation is to describe the paleoecology of the non-marine Mollusca of the Lac Blanc deposit, Quebec, Canada from quantitative and qualitative data yielded by a systematically collected stratigraphic section.

Emphasis is placed on quantitative changes in species which are reflected in lithology and environment.

Location of deposit

The Lac Blanc deposit lies at the common corner of lots 49 and 50 of the sixth and seventh ranges of Awantjish Township, Matapédia County, Quebec, Canada (Fig 2) (Waddington, 1950).

Method of Investigation

In order to make a quantitative study the Lac Blanc deposit was sampled in successive 2-inch layers throughout the vertical column. This work was done by Joseph F. Schwietering in the summer of 1963.

Pit 1 was dug from the top of the deposit to the base, and samples were numbered from top to bottom (Fig 3). Each sample measured 12 X 12 X 2 inches except for sample 36. Only a partial recovery was made for sample 36, because of the semi-fluid nature of the marl, water in the pit, and caving of sides. Immediately below 36 is a layer of boulders. Each sample was placed in a plastic bag to seal in the moisture. This in turn was placed in another plastic bag. Labels were placed between the two plastic bags to prevent their being destroyed by the moisture in the sediments. The samples were then taken to the laboratory.

In the laboratory the samples were soaked in water for about 24 hours before being sieved. They were then washed through 10-, 20-, and 30-mesh sieves and allowed to dry. The dried samples were placed in containers and labeled. As a rule, 1000 milliliters of sediments were sieved for each sample, although this was increased to 4000 milliliters in some cases, depending on the number of shells that appeared each time.

The 10- and 20-mesh portions were combined and the shells from these picked by hand. The 30-mesh portion was stored for future use. One thousand shells were then picked at random from the selected portion. To evaluate the ecology the species were determined and the quantitative distribution of each species ascertained for each collection.

Acknowledgements

I am highly grateful to my adviser Dr. Aurèle La Rocque, under whose kind guidance and encouragement this work has been carried out. I also thank Phoebe Reigle for her encouragement and Susan Bower for her help in the laboratory work.

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GEOLOGY OF THE AREA

The Lac Blanc deposit in Awantjish Township, Matapédia County, Quebec, Canada, lies between the Matapédia Lake Syncline and the Mitis Lake Syncline running NE-SW. Silurian beds occupy Awantjish Township and that portion of the Seigniory of Lake Matapédia to the east of it. At the southern shore of Matapédia Lake, which apparently marks a fault, lies the eastern limit of this belt of Silurian rocks. Lower Ordovician beds are exposed along the northern shore of the lake.

The Lower Ordovician and Silurian contact shows a general east-northeast trend, about parallel to the Saint Lawrence shore and some 15 miles inland from it, passing a little south of Sainte-Jeanne-d'Arc and Saint-Moïse and through Sayabec.

The Silurian deposits between Sayabec and Val Brillant and farther south towards Saint-Léon, adjacent to Matapédia Lake are at least 3,000 feet thick; they have been divided by Crickmay (1932) into three formations, designated from top to bottom as follows:

1. Saint-Léon formation, 2,500 feet thick, consisting of sandstone, siltstones, shales, limestones, limestone conglomerate and pebble conglomerate.

2. Sayabec formation, 300 to 500 feet thick, mainly argillaceous sandstones and limestones.

3. Val Brillant formation, about 200 feet thick, white quartzites.

The Saint-Léon formation, which is the most widespread of the three, is also the main bed rock of the area under study. It consists mainly of black, fissile, highly argillaceous limestones which in some beds grade into calcareous shales of the same color. They are gray or buff on the weathered surface. The graptolite *Monograptus* is common in these beds. The Notre-Dame Mountains in the southern part of Awantjish Township are composed mainly of beds of this formation, usually with very steep to vertical dip, and similar beds are exposed between Saint-Cléophas and Val-Brillant at the foot of the north slope of the mountains.

The following account of Quaternary glaciation and glacial deposits is taken from de la Rue (1941, pp. 22-23).

The rock outcrops in the area bear very obvious marks of glacial erosion. There is evidence that ice sheets from two different centers passed over the area. The Labrador glacier advanced from the north, and the other, more local sheet, moved northward from the Notre-Dame Mountains.

Coleman (1922) has shown that a lobe of the Labrador glacier advanced as far as the depression now occupied by Matapédia Lake and Valley. De la Rue (1941, p. 22), however, in-

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EXPLANATION OF FIGS. 1-8 OPPOSITE PAGE.

Fig. 1. Sketch map of Gaspé Peninsula, showing Matapédia Lake area with position of Awantjish Township indicated by a dot in Matapédia County.

Fig. 2. Plan of Awantjish Township showing location of Lac Blanc and Lac au Foin indicated by a circle.

Fig. 3. Sketch map of Lac Blanc deposit showing the position of Pit 1, from which samples were taken for the study, and the position of Lac au Foin in relation to Lac Blanc.

Fig. 4. Stratigraphic variation of *Valvata sincera* Say in the Lac Blanc deposit.

Fig. 5. Stratigraphic variation of *Gyraulus parvus* (Say) in the Lac Blanc deposit.

Fig. 6. Stratigraphic variation of *Pisidium casertanum* (Poli) in the Lac Blanc deposit.

Fig. 7. Stratigraphic variation of *Pisidium variabile* Prime in the Lac Blanc deposit.

Fig. 8. Stratigraphic variation of *Fossaria obrussa decampi* (Streng) in the Lac Blanc deposit.

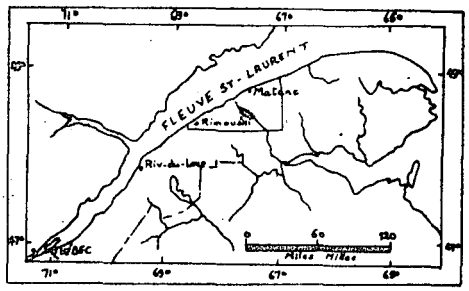

Fig. 1

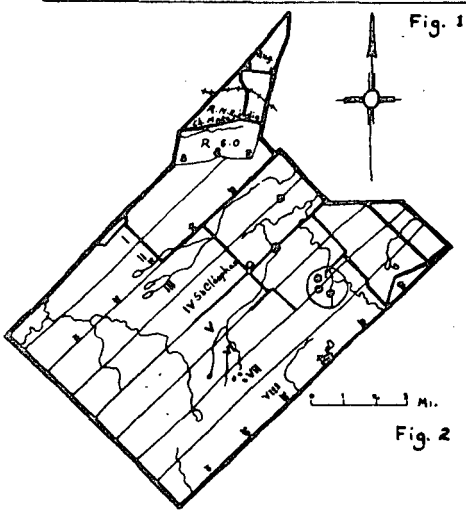

Fig. 2

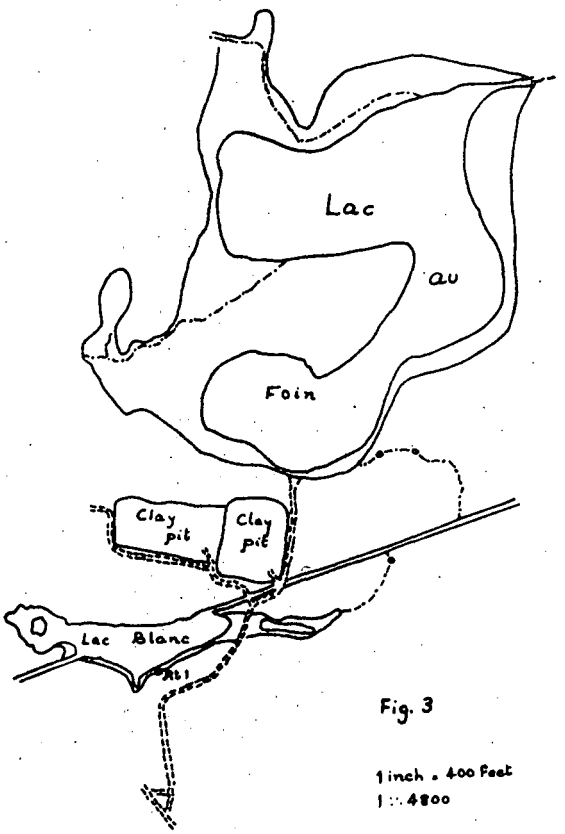

Fig. 3

1 inch = 400 Feet
1 :: 4800

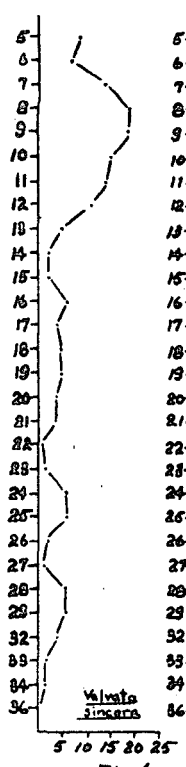

Fig. 4

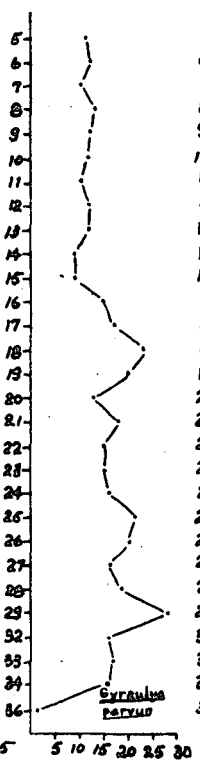

Fig. 5

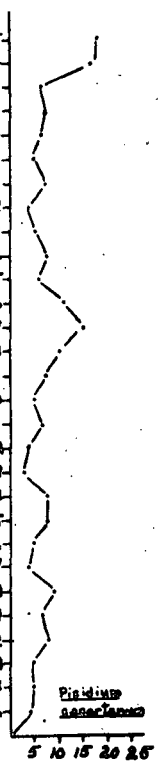

Fig. 6

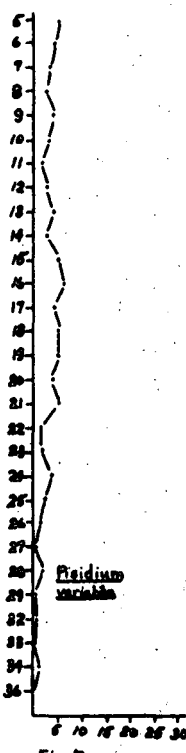

Fig. 7

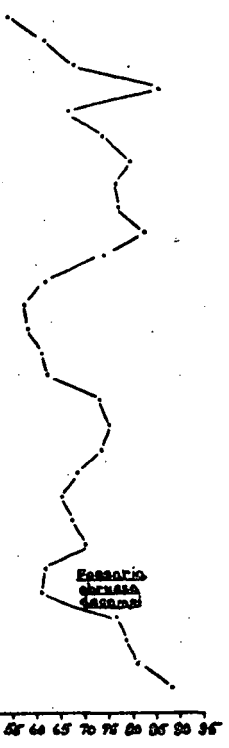

Fig. 8

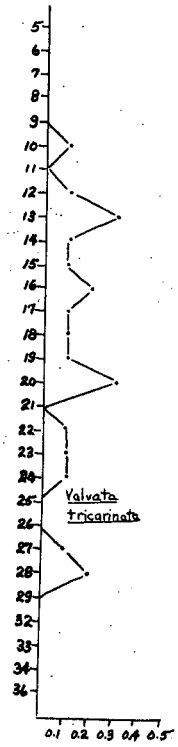

Fig. 9

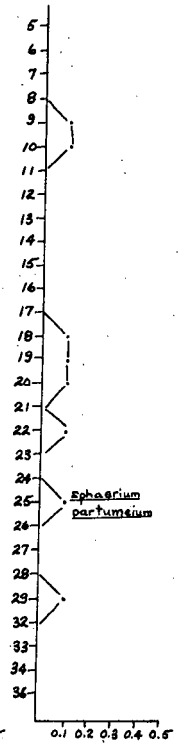

Fig. 10

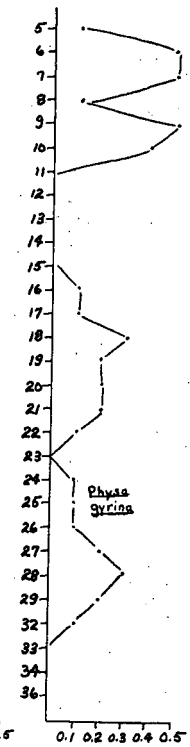

Fig. 11

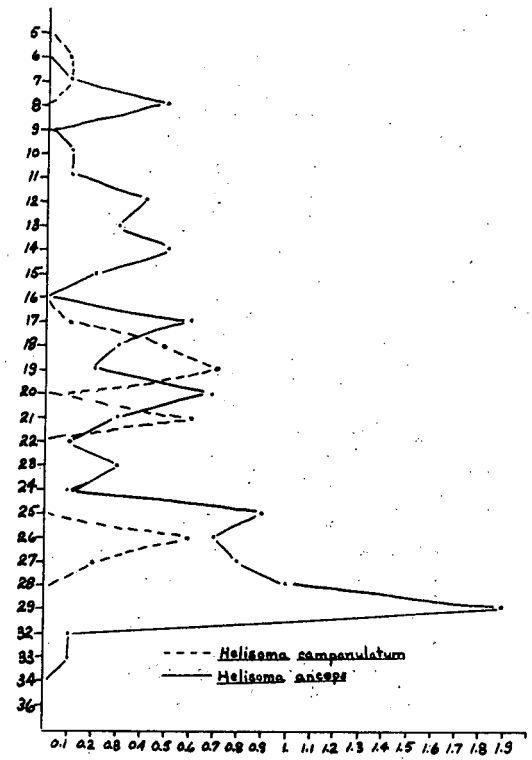

Fig. 12

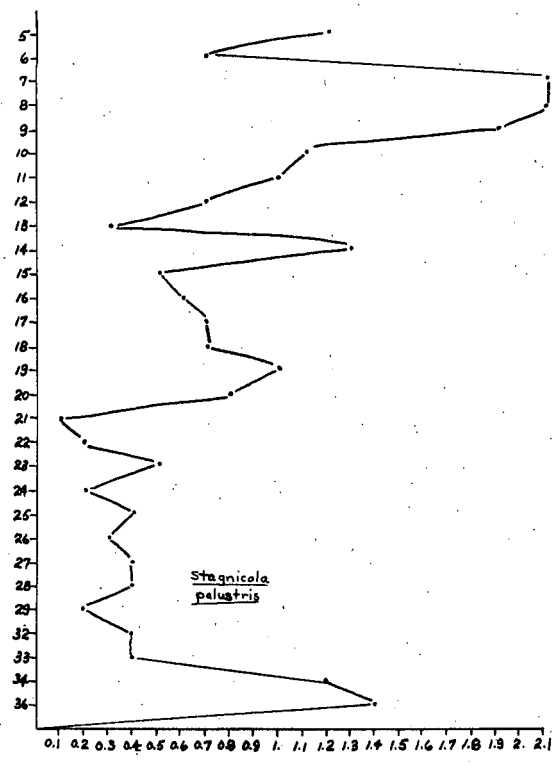

Fig. 13

dicates that the present evidence of this was found in the occurrence, not far southeast of Saint-Cléophas, of erratics of 'Laurentian' rock, granite and gabbro, at an elevation of at least 1,000 feet.

Besides these boulders, the Labrador glacier has left little evidence of its presence in the area, except in the vicinity of the Saint-Lawrence where, along the shore and for a distance inland not exceeding three miles, there are extensive deposits of glacial gravel composed of 'Laurentian' material, as well as numerous erratics up to several feet in diameter.

The Notre-Dame glaciers, from the south, advanced as far as the coast and, on retreat, left a widespread mantle of morainic material seldom more than fifty feet thick. These deposits include gravel, boulder clay, and loose boulders, the latter often of considerable size, larger than any of the 'Laurentian' erratics seen along the Saint-Lawrence shore. The moraines left by this local glacier are composed entirely of material derived from rocks of the immediate region. They consist for the most part of fragments of Silurian sandstone, quartzite, and limestone, and Lower Ordovician quartzite, sandstone, and limestone conglomerate.

According to McGerrigle (1952, p. 41) erratics of Laurentian type are abundant in the western half of the peninsula and particularly in the Matapédia valley, in the Assemetquagan valley and about the heads of the Nouvelle and Causapscal rivers and the middle and upper waters of the Salmon Branch and Grand Cascapédia River.

Coleman (1922) refers to 'morainic hills' in the Lake Matapédia area; however, most of these hills are underlain by stratified gravels (Alcock, 1935) and are now classed as kames.

The valley of Lake Matapédia also displays the hummocky surface typical of kame and kettle topography (McGerrigle 1952, p. 48).

SYSTEMATIC PALEONTOLOGY

General Statement

This chapter gives a summary of data for each species collected from the Lac Blanc deposit, Matapédia County, Quebec, Canada. The short account includes diagnoses of the species as well as some of the important references to them. It also includes information on the ecology, general distribution and geologic range of each species under consideration.

Most of the information given here has been summarized from the data collected by previous workers in Pleistocene non-marine Mollusca in the Department of Geology, Ohio State University. Some of the other valuable references used are Baker (1928), Pilsbry (1948), Herrington (1962), and La Rocque (1953, 1962).

EXPLANATION OF FIGS. 9-13, OPPOSITE PAGE

Fig. 9. Stratigraphic variation of *Valvata tricarinata* (Say) in the Lac Blanc deposit.

Fig. 10. Stratigraphic variation of *Sphaerium partumeium* (Say) in the Lac Blanc deposit.

Fig. 11. Stratigraphic variation of *Physa gyrina* (Say) in the Lac Blanc deposit.

Fig. 12. Stratigraphic variation of *Helisoma campanulatum* (Say), indicated by dotted line, and of *Helisoma anceps striatum* (F. C. Baker), indicated by solid line, in the Lac Blanc deposit.

Fig. 13. Stratigraphic variation of *Stagnicola palustris* (Müller) in the Lac Blanc deposit.

CLASS PELECYPODA

Order Teleodesmacea

Family Sphaeriidae

Sphaerium partumeium (Say) 1822

Cyclas partumeia Say 1822, Jcur. Acad. Nat. Sci. Philadelphia, v. 2, p 380.
Musculium truncatum (Linsley) Baker 1928, F.W. Moll. Wis., pt. 2, p. 356, pl. 99, figs. 21-23.
Musculium partumeium Baker 1928, *Ibid.*, pt 2, p. 354, pl. 99, figs. 24-26.
Sphaerium partumeium Hibbard and Taylor 1960, Mus. Paleont. Univ. Michigan, v. 16, p. 76.
Sphaerium partumeium Herrington 1962, Rev. Sphaeriidae N. Am., p. 23, pl. 1, fig. 5.

Type Locality. Philadelphia.

Diagnosis. Shells small to medium size, somewhat short in outline, walls thin, beaks about central or slightly anterior, low, but little swollen, striae fine and evenly spaced; dorsal margin almost straight, ventral margin well curved; hinge slightly rounded, long, same length as dorsal margin; hinge plate rather long and very narrow, laterals of moderate length; the very low posterior cusps rise more distinctly from the dip, and are distal, cardinals much closer to anterior cusps, weak. *(Condensed from Herrington, 1962, p. 20)*.

Ecology. 'Ponds, swamps, small lakes and slow-moving streams. It has a preference for muddy bottom, and is fairly common.' *(Herrington, 1962, p. 20)*.

General Distribution. CANADA: New Brunswick, Quebec, Ontario (southern part only), Saskatchewan. UNITED STATES: Maine, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Virginia, North Carolina, South Carolina, Tennessee, Mississippi, Alabama, Georgia, Florida, Ohio, Michigan, Indiana, Wisconsin (Baker 1928a: 354), Illinois, Minnesota, Nebraska, Ioww, Missouri, Kansas, Oklahoma, Louisiana, Texas, Montana, California and Nevada.

Geologic Range Early Pleistocene (Late Nebraskan), Sand Draw and Dixon faunas and Late Pleistocene (Jingleboh fauna) in Kansas.

Remarks. This species is rare in the Lac Blanc deposit (Fig. 10).

Pisidium casertanum (Poli) 1791

Cardium casertanum Poli 1791, Test. utr. Sicil. v. 1, p. 65, pl. 16, fig. 1.
Pisidium abditum Baker 1928, F. W. Moll. Wis., pt. 2, p. 407, pl. 103, figs. 1-5.
Pisidium complanatum Baker 1928, *Ibid.*, p. 402, pl. 103, figs. 9-11.
Pisidium griseclum Baker 1928, *Ibid.*, p. 412, pl. 104, figs. 25, 26.
Pisidium neglectum Baker 1928, *Ibid.*, p. 390, pl. 105, figs. 7, 8.
Pisidium noveboracense Baker 1928, *Ibid.*, p. 391, pl. 101, figs. 10-12, 20.
Pisidium politum Baker, 1928, *Ibid.*, p. 404, pl. 102, fig. 19.
Pisidium politum decorum Baker 1928. *Ibid.*, p. 405, pl. 102, figs. 20-22.
Pisidium roperi Bsker 1928, *Ibid.*, p. 400, pl. 102, figs. 23-25.
Pisidium subrotundum Baker 1928, *Ibid.*, p. 409, pl. 101, figs. 21-23.
Pisidium subrotundum pumilum Baker 1928, *Ibid.*, p. 410, pl. 102, fig. 26.
Pisidium superius Bsker 1928, *Ibid.*, p. 397.
Pisidium casertanum Hibbard and Taylor, 1960, Mus. Paleont., Univ. Michigan, v. 16, p. 77, pl. 1, figs. 3-4; pl. 12, fig. 2; pl. 11, figs. 2, 6, 8.
Pisidium casertanum Herrington, 1962, Rev. Sphaeriidae N. Am., p. 33, 34, pl. 4, fig. 1, pl. 7, fig. 7.

Type Locality. Sicily.

Diagnosis. Shell rather long in outline of moderate weight; beaks subcentral to a little farther back; rather fine striae; anterior end moderately long and rounded; posterior end truncate; hinge plate moderately long, laterals distinct, cardinals near anterior cusps. *(Condensed from Herrington, 1962, p. 33)*.

Ecology. *'Pisidium casertanum* has succeeded in adapting itself to a wide variety of habitats. One finds it in bog ponds, ponds, swamps that dry up for several months of the year, swamp-creeks, creeks with considerable current, rivers, and lakes, including the Great Lakes. This is by far the most common species.' *(Herrington, 1962, p. 34)*.

General Distribution. Newfoundland and Labrador to British Columbia, as far north as the Arctic Circle All of the United States except Hawaii, Kentucky, and North Dakota.

Geologic Range. This species ranges from the Pliocene to the Recent and is common in deposits of Wisconsin age.

Pisidium variabile Prime 1851

Pisidium variabile Prime 1851, Proc. Boston Soc. Nat. Hist., v. 4, p. 163.
Pisidium variabile Baker 1928, F.W. Moll. Wis., pt. 2, p. 381, pl. 101, figs. Q-4.
Pisidium variabile Herrington 1962, Rev. Sph. N. Am. p. 50, pl. 3, fig. 4, pl. 1, fig. 4.

Type Locality. Fresh Pond, near Cambridge, Massachusetts.

Diagnosis. Shell heavy, varying from short to moderately long; beaks rather prominent, quite far back and broad; striae coarse to fine; anterior end begins near the proximal side of cusps and descends to where it joins ventral margin with an angle; posterior end broadly rounded, vertical or slightly undercut; hinge long, laterals rather short, cardinals central. *(Condensed from Herrington, 1962, p. 50)*.

Ecology. 'Creeks, rivers, and lakes; usually in still water where soft sediments accumulate.' *(Herrington, 1962, p. 50)*.

General Distribution. Eastern United States north of Virginia; Colorado and northward; Washington, Manitoba, Yukon.

Geologic Range. This species is known only from the Wisconsin and Recent.

CLASS GASTROPODA

Order Ctenobranchiata

Family Valvatidae

Valvata sincera Say 1824

Valvata sincera Say 1824, Rept. Long's Exped., v. 2, p 264, pl. 15, fig. 11.
Valvata sincera Baker 1928 F. W. Moll. Wis., pt. 1, p. 23, pl. 1, figs. 19-22.
Valvata sincera La Rocque 1962, Sterkiana, no. 7, p. 35.

Type Locality. 'Northwest Territory' (Say).

Diagnosis. Shell subglobose-conic, rather solid, 4 whorls, evenly rounded, regularly increasing in diameter; sculpture of fine and regular striae; sutures well impressed; aperture circular; umbilicus round, deep, exhibiting the volutions almost to the apex. *(Condensed from Baker, 1928, p. 23)*.

Ecology. Generally regarded as a lake species, it has been found in deep water in Lake Michigan and Lake Superior. *(Baker, 1928, p. 23)*.

General Distribution. The species ranges from Newfoundland, Quebec, and Maine west to Western Ontario and Manitoba, south to southern Michigan and northern New York.

Geologic Range. The species ranges from the Wisconsin to the Recent, and has been found in many Pleistocene deposits.

Valvata tricarinata (Say) 1817

Cyclostoma tricarinata Say 1817, Jour. Acad. Nat. Sci. Phila., v. 1, p. 13.
Valvata tricarinata Baker 1928, F.W. Moll. Wis., pt. 1, p. 11 pl. 1, figs. 1-3.
Valvata tricarinata Hibbard and Taylor 1960, Mus. Paleont. Univ. Michigan, v. 16, p. 79, pl. V, fig. 14-15.
Valvata tricarinata La Rocque 1962, Sterkiana, no. 7, p. 35.

Type Locality. Delaware River.

Diagnosis. Shell turbinate, thin, translucent, shining; 4 whorls, rapidly enlarging, flattened between the carinae, sloping upward from the carina to the suture on the upper surface; spire elevated but depressed at the apex; sculpture of coarse growth lines more or less equally spaced; sutures distinct, well impressed; body whorl large; with three distinct, sharp carinae, one on the shoulder, one on the periphery, and one on the base, which encircles the round, deep funnel-shaped umbilicus; aperture circular, modified somewhat by the carinae. *(Condensed from Baker, 1928, p. 11-12)*.

Ecology. In Wisconsin, Baker (1928, p. 14) found *Valvata tricarinata* in shallow water to depths exceeding 9 meters. It is found with or without vegetation in both streams and lakes with mud, clay, sand, gravel, and bare-rock bottoms.

General Distribution. Great Slave Lake and the Mackenzie River south and east to New England and Virginia.

Geologic Range. Taylor (1960. p. 32) found *Valvata tricarinata* in a Nebraskan deposit. Deposits of Wisconsin age also contain this species.

Remarks. *Valvata tricarinata* is rare and is absent in many samples of the Lac Blanc deposit. (Fig. 9).

Family Amnicolidae

Amnicola limosa (Say) 1817

Paludina limosa Say 1817, Jour. Acad. Nat. Sci. Phila., v. 1 p. 125.
Amnicola limosa Baker 1928, F. W. Moll. Wis., pt. 1, p. 93, pl. 6, figs. 1-6.
Amnicola limosa La Rocque, Sterkiana, no. 7, p. 34.

Type Locality. Delaware and Schuylkill rivers, Pennsylvania.

Diagnosis. Broadly conic in shape, about 4.5 mm. high, 3 mm. wide, 4.5 whorls; apex blunt; later whorls round and somewhat shouldered, increasing gradually in size; body whorl round; aperture subrotund, mostly basal; umbilicus deeply perforate. *(Condensed from Berry, 1943, p. 23).*

Ecology. It occurs in creeks, rivers, and fresh- and brackish-water lakes. It generally is found in thick beds of *Chara, Potamogeton, Vallisneria,* and *Elodea.* The plants are not used as food, but they harbor rich colonies of diatoms on which the snails feed. *(Berry, 1943, p. 26).*

General Distribution. New England and New Jersey west to Utah, Manitoba south to Texas.

Geologic Range. The species ranges from Late Pleistocene to Recent.

Remarks. This species is rare in the Lac Blanc deposit.

Order Pulmonata

Family Lymnaeidae

Stagnicola palustris (Müller) 1774

Buccinum palustre Müller 1774, Verm. Terr. et Fluv., v. 2, p. 131.
Stagnicola palustris Baker 1928, F.W. Moll. Wis., pt. 1, p. 212.
Stagnicola palustris La Rocque 1962, Sterkiana, no 7, p. 33.

Type Locality. Europe.

Diagnosis. Shell elongate to elongate ovate, thin, covered with growth lines crossed by several elevated spiral lines; whorls 7, rounded, the last usually obese; spire sharp and pointed, aperture varying from ovate to long ovate *(Condensed from Baker, 1928, p. 212-213).*

Ecology. Occurs in both large and small bodies of water. Generally it is found on floating sticks and submerged vegetation, on stones and muddy bottom. It inhabits both clear and stagnant water bodies but prefers one that is not in motion. *(Baker, 1928, p. 215).*

General Distribution. Northern Asia and Europe. North America from the Atlantic to the Pacific, all Canada south to New Mexico, the north central and northeastern States

Geologic Range. It has been recorded from the Kansan to the Recent

Fossaria obrussa decampi (Streng) 1906

Limnaea desidiosa var. *decampi* Streng 1906, Nautilus, v. 9, p. 123.
Galba obrussa decampi Baker 1911, Lym. N. and M. Am., p. 289, pl. 32, figs. 15-22.
Fossaria obrussa decampi Baker 1928, F.W. Moll. Wis., pt. 1, p. 229, pl. 18, figs. 30-33; pl. 16, fig. 12.

Type Locality. Brook's Lake, Newaygo County, Michigan.

Diagnosis. Shell small, oblong, somewhat inflated, subconic, rather solid; whorls 5, rather rapidly enlarging, spire whorls convex, distinctly shouldered near the suture, body whorl much flattened in the middle; spire short, broadly conic, turreted, about a s long as aperture; sutures deeply impressed; aperture long and narrow, somewhat elliptical, rounded below and forming a prominent shoulder above. *(Condensed from Baker, 1928, p. 300).*

Ecology. Baker (1928, p. 300) states that the habitat of *Fossaria obrussa decampi* is the same as that of *Fosssria obrussa* which lives normally in or on the margin of small bodies of water, common on mud flats and debris.

General Distribution. Maine west to Wisconsin; northern Michigan south to northern Illinois.

Geologic Range. This species has been recorded from deposits of Wisconsin age and from living assemblages in Manitoba, Minnesota, and Wisconsin.

Remarks. Some of the shells from the Lac

Blanc deposit included in *Fossaria obrussa decampi* closely resemble *F. galbana*. Between the two there are gradations of shells, which are difficult to place. They are, however, included here under *F. obrussa decampi*.

Family Planorbidae

Gyraulus parvus (Say) 1817

Planorbis parvus Say 1817, Nicholson's Encycl., ed. 1, v. 2, pl. 1, fig. 5.
Gyraulus parvus Baker 1928, F.W. Moll. Wis., pt. 1, p. 374, pl. 23, figs. 27-31, 39.
Gyraulus parvus Baker 1945, Moll Fam. Planorbidae, p. 74, 270, 330, 336.
Gyraulus parvus Hibbard and Taylor 1960, Mus. Paleont., Univ. Michigan, v. 16, p. 100, pl. VI, figs. 2-3, 5-6, 8-9, 11-12, 15.
Gyraulus parvus La Rocque 1962, Sterkiana, no. 7, p. 30.

Type Locality. Delawwre River, near Philadelphia, Pennsylvania.

Diagnosis. Shells ultra-dextral, depressed, with a rounded periphery; growth lines oblique, fine, crowded; whorls about 3½ rapidly enlarging, rounded below the periphery and somewhat flattened above in all the spire whorls; spire flat, first two whorls sunken below the body whorl, sutures deeply impressed; base slightly concave, umbilical region wide and shallow; aperture long-ovate, nearly in the same plane as the body whorl. *(Condensed from Baker, 1928, p. 375)*.

Ecology. Generally found in quiet bodies of water, often of small size, on mud, sandy mud, sand, gravel, or boulder bottoms; on logs and vegetation, in shallow water about a foot up to 4 feet It, however, prefers a habitat which has rather thick vegetation.

General Distribution. Eastern North America east of the Rocky Mountains, from Florida to Alaska and northern Canada.

Geologic Range. According to Hibbard and Taylor (1960, p. 100) it ranges from Middle Pliocene to Recent. It is considered as a common Pleistocene species which has been recorded for the Nebraskan, Aftonian, Sangamon, and Wisconsin.

Remarks. A few mutants are found among the specimens collected from the Lac Blanc deposit, which are also placed in *Gyraulus parvus*.

Helisoma anceps striatum (F.C. Baker) 1902

Planorbis bicarinatus striatus Baker 1902, Nautilus, v. 15, p. 120.
Planorbis antrosus striatus Walker 1918, Synopsis and Cat., p. 96.
Helisoma antrosa striata Baker 1928, F.W. Moll. Wis., pt. 1, p. 328, pl. 19, figs. 28-31.
Helisoma anceps striatum Baker 1945, Moll. Fam. Planorbidae, p. 400.

Type Locality. Coldspring Park, Milwaukee, Wisconsin; Pleistocene.

Diagnosis. Shell small, 3½ whorls, dorsal and ventral carinae distinctly marked, cord-like, elevated; dorsal carina on center of upper side of body whorl; body whorl well rounded umbilicus small, deep; surface of heavy spiral lines which become distinct ridges in many specimens; aperture higher than wide. *(Condensed from Baker, 1928, p. 328)*.

Ecology. According to Baker (1928, p. 328) *Helisoma anceps striatum* is a lake species, which lived in cold water immediately after the retreat of ice sheets. The deposits in which it was found were marl, silt, and peaty marl, a number of deposits indicating its existence in shallow, freshwater lakes, with abundant vegetation.

General Distribution. Pleistocene deposits of Wisconsin, Illinois, Michigan, east to Quebec and south to Ohio and Indiana.

Geologic Range. *Helisoma anceps striatum* is recorded for the Pleistocene, but its exact range in the Pleistocene is not known. It is, however, recorded living today in the lakes of northern Minnesota and Wisconsin.

Remarks. It is not very abundant in the Lac Blanc deposit and is absent from many samples. (Fig. 12).

Helisoma campanulatum (Say) 1821

Planorbis campanulatus Say 1821, Jour Acad. Nat. Sci. Phila., v. 2, p. 166.
Helisoma campanulata Baker 1928, F.W. Moll. Wis., pt. 1, p. 345, pl. 21, figs. 1, 2, 4, 5, 8, 9 13, 14.
Helisoma campanulatum La Rocque 1962, Sterkiana, no. 7, p. 30.

Type Locality. Cayuga Lake, New York.

Diagnosis. Shell ultra-sinistral, discoidal, more or less rounded; whorls 4½, rounded below and subcarinate above, spire flat; sutures deeply impressed; base of shell rounded, exhibiting 2½ volutions with a deep umbilicus in the middle; aperture lunate. *(Condensed from Baker, 1928, p. 346)*.

Ecology. *Helisoma campanulatum* is a species

of lakes, with rocky, sandy, muddy bottom, with or without vegetation. It is also found in quiet parts of rivers and small streams.

General Distribution. Vermont west to North Dakota, south to Ohio and Illinois, northward to Great Slave Lake and Mackenzie drainage.

Geologic Range. It ranges from Late Wisconsin to Recent.

Family Physidae

Physa gyrina Say 1821

Physa gyrina Say 1821, Jour Acad. Nat. Sci. Phila., v. 2, p. 171.
Physella gyrina Baker 1928, F.W. Moll. Wis., pt. 1, p. 449, pl. 27, figs. 30-35, 37-40, pl. 28, figs. 1, 5, 6.

Type Locality. Bowyer Creek, near Council Bluffs, Iowa.

Diagnosis. Shell large, elongate or subcylindrical, rather thick; sculpture of coarse growth lines, whorls 5 to 6, the last rather large, compressed or slightly inflated, spire rather long, acute, whorls well rounded; aperture 5/10 to 7/10 the length of the entire shell. *(Condensed from Baker 1928, p. 450)*.

Ecology. It is characteristic of shallow, stagnant and slow-moving bodies of water.

General Distribution. United States east of the Mississippi except that it ranges into Texas; Eastern Canada (Ontario), northward to Arctic regions.

Geologic Range. Taylor (1960, p. 32, 39) recorded the species from Nebraskan deposits. It is a common species of Late Pleistocene and Recent assemblages.

TERRESTRIAL GASTROPODS

Order Pulmonata

Family Succineidae

Succinea avara Say 1824

Succinea avara Say 1824, Appendix to Long's Second Exped., v. 2, p. 260, pl. 15, fig. 6.
Succinea avara Pilsbry 1948, Land Moll. N. Am., v. 2, pt. 2, p. 837, fig. 455, a-k.
Succinea avara La Rocque 1962, Sterkiana no.7, p. 40.

Type Locality. Northwest Territory.

Diagnosis. Shell slender, fragile; little more than 3 whorls, very strongly convex, sutures deep; aperture ovate, two-thirds the length of the shell or less. *(Condensed from Pilsbry, 1948, p. 837)*.

Ecology. Usually found on vegetable debris thrown up on muddy shores, or on the muddy banks of ditches, often exposed to the sun, also in swampy places in meadows. *(Pilsbry, 1948, p. 839)*.

General Distribution. Mackenzie District south to British Columbia, California and Mexico; east to Quebec, New Brunswick, and Newfoundland, south to Florida.

Geologic Range. This species ranges from Yarmouth to Recent with numerous occurrences recorded for the Wisconsin.

Family Pupillidae

Vertigo ventricosa (Morse) 1865

Isthmia ventricosa Morse, 1865, Ann. Lyc. Nat. Hist. New York, v. 8, p. 207.
Vertigo ventricosa Morse, Binney, 1878, Terr. Moll. v. 5, p. 218.
Vertigo approximans Sterki, 1890, Nautilus, v. 3,p. 136.
Vertigo ventricosa Pilsbry, 1948, Land Moll. N. Am., v. 2, pt. 2, p. 957, fig. 515: 1-3.

Type Locality. Not specified.

Diagnosis. Shell umbilicate, ovate, conic, smooth, apex obtuse; suture deep; whorls 4, convex. Aperture semicircular, with 5 teeth, one prominent on the parietal margin, two smaller on the columellar margin, and two prominent within.

Ecology. In Ontario, Oughton (1948, p. 94, ff.) found *Vertigo ventricosa* in wet locations, such as the floodplains of creeks and rivers, margins of ponds, streams, and marshes. Muchmore (1959, p. 85-88) found it under stones in various woodland areas in New York State. Archer (1934, p. 139) found it common in the limestone talus on Mackinac Island, Michigan. Grimm (1959, p. 126) lists it from around foundations of an old burned house and from fields in Maryland. *(La Rocque, in press)*.

General Distribution. Magdalen Id. and Prince Edward Island; Quebec; New England and New York, west to Ohio, Michigan, and Illinois. Fern Glen, St. Louis, Missouri.

Geologic Range. *Vertigo ventricosa* is reported to occur in loess of Posey Co., Indiana (Goodrich and van der Schalie, 1944, p. 276). Pilsbry (1948), however, does not record it as a fossil.

Remarks. It is a rare species in the Lac Blanc deposit.

Vertigo ovata (Say) 1822

Vertigo ovata Say 1822, Jour Acad. Nat. Sci. Phila., v. 2, p. 375.
Vertigo ovata Pilsbry 1948 Mon. Land Moll. N. Am., v. 2, pt. 2, p. 952, text fig. 513: 1-3, 4, 7.
Vertigo ovata Hibbard and Taylor 1960, Mus. Paleont., Univ. Michigan, v. 16, p. 135, pl. 11, fig. 8.
Vertigo ovata La Rocque 1962, Sterkiana no. 7, p. 41.

Type Locality. Philadelphia, Pennsylvania.

Diagnosis. Spire convexly conic, summit obtuse; whorls increasing rapidly, the last much the largest with a strong crest behind the lip; parietal lamella strong and rather long; angular lamella small; columellar lamella strong; basal fold well developed; upper and lower palatal folds strong.

Ecology. It prefers a moist environment provided by shaded slopes near streams and the shores of ponds. It is found in swampy areas, along stream banks and other bodies of water, and under sticks and flat stones, in meadows with swampy areas and growing *Carex*. The limiting factor for this species is a relatively high moisture requirement.

General Distribution. Labrador west to British Columbia and north to Alaska, south to Florida, Mexico, and the West Indies.

Geologic Range. Early Pliocene to Recent. There are two known Tertiary occurrences, as follows: early Pliocene Laverne local fauna, Beaver County, Oklahoma; middle Pliocene, Buis Ranch local fauna, Beaver County, Oklahoma.

Remarks. *Vertigo ovata* is also a rare species in the Lac Blanc deposit.

COMPOSITION OF FAUNA

General Statement

The non-marine molluscan fauna of the Lac Blanc deposit, Matapédia County, Quebec, Canada, is composed of 15 species, out of which three are sphaeriid clams, three terrestrial and nine freshwater gastropods. The latter include three lung breathers and six gill breathers. An attempt is made to determine how the abundance of any one species would vary with lithology and how it might reflect the fluctuation of the environmental conditions.

In this study it is assumed that the most abundant species are indigenous to the environment, and the rare species are intruders. There are, however, some species in the deposit that occur in small numbers but are still in a suitable environment.

The samples are numbered from the top of the deposit starting with 1.

Lac Blanc Deposit

The number of shells per 1000 milliliters of sediment varies, controlled to a great extent by lithology. The first four samples, starting from the top of the deposit, are unfossiliferous and consist of peat and sod. Sample 5 on the other hand, yielded just 400 shells after sieving the entire sample. Their presence in the sediments, however, can probably be explained because of the appearance of marl in the peat. Swmple 6 yielded 1000 shells in the 1000 milliliters of sediment, probably because of greater percentage of marl to peat. Samples 7 to 22 contained 1000 shells in 1000 milliliters of sediment.

Samples 23 to 34, however, yielded 1000 shells only from a greater volume of sediments. The entire sample collected for 36 was sieved to get 287 shells. This increase in volume of the sediments is probably due to marl being very soft.

Fossaria obrussa decampi (Streng) is the most abundant species in the deposit, never decreasing below 50 percent in any one sample. It is, however, most abundant in sample 36, the oldest sample of the lake, then gradually falls off until sample 32, after which the fall is sharp to sample 29. After 28 there is a gradual rise and fall, the deposit showing the least number for samples 6 and 5 obtained from the top of the deposit. (Fig. 8).

Gyraulus parvus (Say) is next in abundance. In contrast to *Fossaria obrussa decampi*, *Gyraulus parvus* shows the least number for sample 36, then suddenly increases in sample 34, sam-

ple 34 being missing. The numbers of *Gyraulus parvus* specimens are comparatively larger in samples 29 to 16 than in samples 15 to 5 in the deposit. (Fig. 5).

Valvata sincera Say, on the other hand, shows lower percentages towards the bottom of the deposit than towards the top. As a matter of fact *Valvata sincera* is totally absent in sample 36. (Fig. 4.)

Pisidium casertanum (Poli), although not so abundant, is fairly persistent throughout the section. It is comparatively numerous towards the middle than towards the bottom or the top of the section. (Fig. 6).

Pisidium variabile Prime is also present in very small numbers, but very persistent throughout the section. It is, however, absent in the oldest sample of the lake, namely sample 36. (Fig. 7).

Stagnicola palustris (Müller) is also present in very small numbers in the Lac Blanc deposit, but present in all the samples in the section. Comparatively more specimens of *Stagnicola palustris* are found in sample 36, the oldest sample of the lake, and samples 7 and 6 towards the top of the deposit. (Fig. 13).

Helisoma anceps striatum (F. C. Baker) and *Helisoma campanulatum* (Say) are not very abundant in the Lac Blanc deposit, although *Helisoma anceps striatum* is absent from fewer samples than *Helisoma campanulatum;* however, both are absent from sample 36, and *Helisoma anceps striatum* is also absent from sample T. (Fig. 12).

Physa gyrina (Say), besides being rare, is absent from many samples in the vertical section of the Lac Blanc deposit, especially the two oldest samples of the lake, namely samples 36 and 34. (Fig. 11).

Valvata tricarinata (Say) and *Sphaerium partumeium* (Say) are rare in the Lac Blanc deposit; both are totally absent from the samples at the bottom and top of the lake. (Figs. 9 and 10).

One specimen of *Amnicola limosa* (Say) is recorded from sample 11 of the Lac Blanc deposit.

Four specimens of *Vertigo* have been collected from samples 7, 15, 18, and 21. Three specimens of *Succinea* have also been collected from samples 19 and 25. Both of these are terrestrial gastropods, and very rare.

PALEOECOLOGY

General Statement

The purpose of this investigation is the determination of the former environment or paleoecology. This can be reconstructed by using data gathered from the successive molluscan assemblages that lived in the lake.

In reconstructing the Pleistocene paleoecology a great deal of information can be gathered from living species and assemblages. Almost all of the species found in the Lac Blanc deposit have living representatives of the same species or their very close relatives. In making comparisons, however, it may be reliably assumed that a species in the past lived under the same environmental conditions as it does at present. In a quantitative study like this one the most abundant species may be considered native to the section of the deposit under consideration. The uncommon species, on the other hand, may be considered native to the same lake, but an intruder in the restricted area under consideration. The rare species, however, are intruders to the lake itself, probably brought into it by some outside agents.

It has already been pointed out that the number of shells per 1000 milliliter of sediments varies throughout the vertical column of the Lac Blanc deposit. These changes are probably due to changes in the environmental conditions, reflected in changes in lithology.

In the following pages an attempt has been made to reconstruct the paleoecology of the Lac Blanc deposit.

Lac Blanc Deposit

The Lac Blanc deposit is lacustrine and consists of marl and peat. The lacustrine origin of the sediments is proved by the abundance of lake species of the fresh water Mollusca. The presence of marl from the bottom of the lake to sample 5, and of peat from sample 4 to sample 1, indicates that the lake environment has not been stable throughout its existence, but that it fluctuated from a relatively deep, open water environment in which marl was deposited, to a shallow, swampy environment in which peat accumulated.

The presence of more marl than peat in sample 6 and more peat than marl in sample 5, indicates a gradual transition from one type of environment to another. The topmost 8 inches of the Lac Blanc deposit is compact peat with no shells, except for the eggs of land snails, possibly of *Striatura exigua* (Stimpson), *Striatura ferrea* Morse, *Striatura milium* Morse, *Punctum pygmaeum* (Draparnaud), *Strobilops labyrinthica* (Say), and *Vertigo* species, as these species can live in swampy conditions (La Rocque, 1936, p. 51). These eggs in all cases are eggs of living land snails which were laid there after the peat was formed. This peat was probably formed under very swampy conditions in dense vegetation.

Fossaria obrussa decampi, *Pisidium casertanum*, *Stagnicola palustris*, and *Gyraulus parvus* are the species that first appear in the Lac Blanc deposit, the remainder of the recorded species appearing higher in the vertical column.

Fossaria obrussa decampi, however, is the most abundant in the Lac Blanc deposit. It forms 88 percent of the total population in sample 36, the oldest sediments of the lake. *Pisidium casertanum* and *Gyraulus parvus*, although present in small numbers in sample 36, may be considered native to the section of the deposit under consideration, because of their occurrence in every sample after 36 and also because of their steady increase.

The persistence and abundance of *Fossaria obrussa decampi* and *Gyraulus parvus up to sample* 5 of the vertical column of the Lac Blanc deposit, indicates that conditions in the lake, at the site of study, remained uniform. Lac Blanc, at the site under consideration, was probably shallow, with moderate vegetation. It was probably surrounded by an extensive mud flat suggested by the existence of *Fossaria obrussa decampi*, which prefers to live in shallow waters, or out on a mud flat environment.

The relation between *Gyraulus parvus* and *Fossaria obrussa decampi*, however, does not remain constant. Between samples 32 and 28 the percentage of *Gyraulus parvus* increases from 16 to 28 and that of *Fossaria obrussa decampi* drops from 77 to 61 percent. *Fossaria obrussa decampi*, however, again shows an increase in samples 24, 23, and 22 and a corresponding decrease in *Gyraulus parvus* (Figs. 5 and 8). Significant changes like these imply changes in the environment. These changes may not be great, but enough to change the habitat in favor of one species or another. In this case only a small change in depth of water might be enough to bring this about. Assuming that the lake had low mud flats, then a rise in water level of only one meter might change the position of the shoreline by 10 feet or more. This change will tend to decrease the number of *Fossaria obrussa decampi*, and increase the number of *Gyraulus parvus*.

Pisidium casertanum, as already pointed out, is native to the site under consideration in the Lac Blanc deposit. It is adaptable to many habitats and continues to live with *Fossaria obrussa decampi* and *Gyraulus parvus*.

Pisidium variabile is another sphaeriid clam recorded in the Lac Blanc deposit. It is absent in sample 36, the oldest sediments of the lake deposit, and even later does not show any appreciable increase. This is probably due to the presence of unsuitable bottom conditions at the site studied.

Valvata sincera, a deep water species, is absent in sample 36 of the Lac Blanc deposit, and even later does not show any appreciable increase. From sample 12 to sample 8 there is a steady increase in *Valvata sincera* (Fig. 4), accompanied by an increase in *Fossaria obrussa decampi* (Fig. 8), and a decrease in *Gyraulus parvus* (Fig. 5). The fluctuation in numbers of *Valvata sincera* in the section may be due to the number of specimens from the deep water of the lake that were washed into the section of the lake under consideration. The smaller number near the bottom of the section may be due to less vegetation than was available later.

The continued increase of *Fossaria obrussa decampi* is due to the building up of the mud flat from dead vegetation washed into the nearshore areas.

Shells of *Helisoma anceps striatum* and *Helisoma campanulatum* are present in small numbers and in very few samples. The highest percentage for *Helisoma anceps striatum* is 1.9, and that for *Helisoma campanulatum* is 0.7, the lowest for both is 0.1. They more or less alternate with each other; for example, if *Helisoma anceps striatum* shows an increase *Helisoma campanulatum* shows a decrease (Fig. 12). They are, however, intruders to the area under consideration.

Only seven individuals of land Mollusca belonging to two different genera and three different species have been recorded from the area under study. The samples from which they were obtained were near the top of the deposit; *Vertigo ovata* and *Vertigo ventricosa* are both represented by 0.1 percent in the deposit, which can be easily explained by saying that they are intruders from the land environment, and washed in because of their occurrence very close to the lake in moist areas. The intruder

Succinea avara found its wwy into the lake from vegetable debris thrown on the shore where it usually occurs.

The scarcity of land snails also indicates that the area of study was neither very close to the shore nor very far from it.

AGE AND CORRELATION

Exact age determination of the Lac Blanc deposit based on Mollusca alone is far from certain because of the close similarity between these and the living assemblages. Fairly accurate age determination can be made by radiocarbon dating. This was not done in this study because of lack of funds.

Age determination, however, can be obtained on the basis of relation to other sediments of known age. This deposit rests on glacial boulders brought in by Laurentide ice, which is of Wisconsin age (Brummer, 1958, p. 109). This to a certain extent would limit the maximum age of the deposit to a time just after the deposition of the youngest sediments on which they rest.

The time between the deposition of the boulders and the formation of the lake and the arrival of the mollusks is not known. The marl immediately over the boulders contains shells, which indicates that the mollusks invaded the lake as soon as the marl started depositing.

Table 1 has been drawn up to show the general distribution of species in a few Quebec marl deposits, including the Lac Blanc deposit, and Maine deposits both living and fossil (Nylander 1901, 1927, 1941).

TABLE 1. Distribution of species in a few marl deposits of Quebec, including the Lac Blanc deposit, and Maine deposits both living and fossil. (For explanation of abbreviations, see below).

Name of species	1	2	3	4	5	6	7	8
Vertigo sp.	0	0	X	0	0	0	0	0
Vertigo ventricosa (Morse)	0	0	0	X	0	0	0	X
Vertigo ovata (Say)	0	0	0	0	0	0	0	X
Succinea ovalis Say	0	0	X	X	0	0	0	0
Succinea avara Say	0	0	0	X	0	0	0	X
Oxyloma decampi gouldi Pils.	0	0	X	X	0	0	0	0
Strobilops labyrinthica Say	0	0	0	X	0	0	0	0
Gastrocopta pentodon (Say)	0	0	0	X	0	0	0	0
Euconulus fulvus (Müller)	0	0	0	X	0	0	0	0
Zonitoides arboreus (Say)	0	0	0	X	0	0	0	0
Striatura exigua (Stimpson)	0	0	0	X	0	0	0	0
Carychium exile Lea	0	0	0	X	0	0	0	0
Physa heterostropha Say	0	X	X	X	X	X	X	0
Physa gyrina Say	0	0	0	0	0	0	0	X
Stagnicola desidiosa (Say)	0	0	X	X	X	X	0	0
Stagnicola palustris (Müller)	0	0	0	0	0	0	0	X
Lymnaea stagnalis Linn.	0	X	0	0	0	0	0	0
Fossaria obrussa decampi (Str.)	0	X	0	0	0	0	X	X
Fossaria umbilicata (C.B. Ads.)	X	0	0	0	0	0	0	0
Helisoma trivolvis (Say)	X	X	X	X	0	0	X	0
H. anceps (Menke)	0	X	X	0	0	0	0	0
H. anceps striatum (F.C.B.)	0	0	0	0	0	0	0	X
Promenetus exacuous Say	0	0	0	0	0	0	X	0
Gyraulus hirsutus (Gld.)	0	0	0	0	X	0	X	0
G. parvus (Say)	X	X	X	X	X	0	X	X
Armiger crista (Linn.)	0	0	X	X	0	0	0	0
Ferrissia parallela (Hald.)	0	0	X	0	0	0	0	0
Valvata sincera Say	0	0	X	0	0	0	0	X
V. lewisii Currier	0	X	0	0	0	0	X	0
V. tricarinata (Say)	0	0	0	0	0	0	0	X

Name of species	1	2	3	4	5	6	7	8
Amnicola limosa (Say)	0	0	0	0	0	0	0	X
Anodonta fragilis Lam.	0	0	X	X	0	0	0	0
Sphaerium partumeium (Say)	0	0	0	0	0	0	0	X
S. simile (Say)	0	0	X	X	0	0	0	0
S. rhomboideum (Say)	0	X	X	X	0	0	X	0
S. sulcatum (Lam.)	X	X	0	0	0	0	X	0
S. securis (Prime)	0	0	X	0	0	0	0	0
Pisidium adamsi (Prime)	0	0	X	0	0	0	0	0
P. casertanum (Poli)	0	0	0	X	X	0	0	X
P. compressum (Prime)	0	0	X	X	0	0	0	0
P. nitidum contortum (Prime)	0	X	X	0	X	X	0	0
P. nitidum pauperculum Sterki	0	0	X	0	0	0	0	0
P. obtusale Pfr.	0	0	X	X	0	0	0	0
P. lilljeborgii Clessin	0	0	X	X	0	0	0	0
P. nitidum (Jenyns)	0	0	0	X	X	0	0	0
P. variabile Prime	0	X	X	X	X	X	X	X
P. seminulum Sterki?	0	0	0	X	0	0	0	0
P. obtusale ventricosum Prime	0	X	X	X	X	X	0	0
P. walkeri mainense Sterki	0	0	X	X	0	0	0	0
Pisidium sp.	X	0	0	0	0	0	0	0

1. Bonaventure marl deposit, north of Bay Chaleur, Quebec, Canada.
2. Houlton marl deposit, Aroostook Co., Maine.
3. Fossil Mollusca from Barren Brook, Aroostook County, Maine.
4. Living Mollusca from Barren Brook, Aroostook County, Maine.
5. Fossil Mollusca from Lovely Brook, Aroostook County, Maine.

6. Living Mollusca from Lovely Brook, Aroostook County, Maine.
7. Nadeau Lake, Fort Fairfield, Aroostook County, Maine.
8. Lac Blanc deposit, Matapédia County, Quebec, Canada.

X : Species present
O : Species absent.

CONCLUSION

The Lac Blanc deposit in Quebec, Canada, yielded 15 non-marine molluscan species.

The paleoecology of this deposit was reconstructed on the basis of quantitative and qualitative study of the mollusks. The general ecology of the Lac Blanc deposit indicates: (1) Water fairly shallow, 0.5 to 3 meters in depth; (2) soft bottom conditions with vegetation varying in amount from time to time; (3) water neutral to slightly alkaline, ranging in pH from 7 to 8.

Although the above conditions prevailed all through the existence of the lake under consideration, minor changes in the molluscan population reflect small changes in the environment.

The lithology of the deposit varies from marl in the lower 60 inches of the section to peat in its upper 8 inches, with 4 inches of transitional zone in between. Shells were much more abundant in the marl than in the peat; in fact they were totally absent in the upper 8 inches of the section. This indicates that Mollusca preferred a habitat in which marl was being deposited to one in which peat was being formed. The presence of peat indicates that the lake was shallow and acidic towards the end of its existence. Dense vegetation seemed to have little effect on the relative percentage of the molluscan species.

The fact that a given species manages to get into a lake is no guarantee that it will persist. This is very clearly indicated for the Lac Blanc deposit by *Sphaerium partumeium*, *Physa gyrina*, *Helisoma campanulatum*, and *Helisoma anceps striatum*. These species, besides showing low percentages, are totally absent in many samples of the vertical column. *Valvata tricarinata*, another species recorded for the deposit under study, appears in sample 29 and persists until sample 9 (Fig. 9). These are intruders, introduced into the site of study from time to time, from areas close by, but they could neither persist nor multiply because of unsuitable conditions.

The quantitative study of the individuals at small intervals reflected numerous significant changes in the percentage of the same species. These changes, not connected with lithology, are important in terms of depth of water and distance to the shore line. For example in the Lac Blanc deposit the percentages of *Fossaria obrussa decampi* and *Gyraulus parvus* vary throughout the section from sample to sample. This probably indicates an increase in depth of water and shifting of the edge of the lake away from the site of the section.

Of the 15 species recorded for the lake only a few are native to the environment. These occur most abundantly and are the ones relied upon to reconstruct the former environment.

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