STERKIANA

NUMBER 6 COLUMBUS, OHIO FEBRUARY 1962

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.

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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 publiera à l'avenir les travaux en anglais, en français et en espagnol qui seront acceptés par le conseil de rédaction. Prière d'adresser toute correspondance au Rédacteur.

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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.

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HISTORICAL NOTES ON THE AMERICAN JOURNAL OF CONCHOLOGY

R. TUCKER ABBOTT

Curator, Department of Mollusks, Academy of Natural Science, Philadelphia

In connection with his very useful index of papers published in the American Journal of Conchology (Philadelphia, 1865-1872), Aurèle La Rocque raised some questions (STERKIANA, Columbus, Ohio, no. 5, p. 43-51) which prompted us to search through the Department of Mollusks' files for the answers.

Although the Civil War had just ended, George W. Tryon was impatient to organize the Conchological Section at the Academy of Natural Sciences. Financially independent, the young 27-year old conchologist had already written several papers, including a bibliography of the conchological works of his 73-year old mentor, Isaac Lea. He was surrounded by an enthusiastic group of other naturalists who were vitally interested in mollusks and were willing to give time, money and specimens. The Journal was the rallying venture, as is attested in the "By-Laws established for the government of the Conchological Section (1867)." The charter members included Isaac Lea (age 73), Dr. Joseph Leidy (age 42), Dr. W. S. W. Ruschenberger (age 58, navy surgeon, author of a popular book on conchology), John Ford, (age 38 and of Olividae fame), S. Raymond Roberts (age 20 and, later, author of the Cypraeidae in the Manual of Conchology), T. A. Conrad (age 62 and never very sympathetic towards Tryon), and others.

The Journal came at an interesting time. The Academy was 53 years old, Thomas Say had been dead 30 years, the Smithsonian was awakening conchologically under William Stimpson, Edward S. Morse was raking the ashes of the Portland Museum and getting ready to join Putnam and Hyatt at the Essex Institute. Pilsbry was three years old, and Charles W. Johnson was being born. Within carriage drive of the Academy, and attendants of the Conchological Section meetings were S. S. Haldeman, Charles M. Wheatley, W. D. Hartman, W. G. Binney and others.

A prospectus was written by Tryon, passed on by the above gentlemen, and sent out in late 1864. The first number was published on February 25, 1865. Tryon financed the Journal. It evidently was too much of a drain on his resources, and he stopped the publication after the May 15, 1872 issue (vol. 7, no. 4). Simultaneously Tryon was Chairman of a fund raising committee to raise money for the new (and present) building for the Academy on Logan Circle.

The Publication Committee (C. F. Parker, shell collector, librarian for the section, and owner (?) of Godey's Lady's Book Office at 6th and Chestnut, and Tryon) in 1868 reported that 250 copies of each number had been printed,

As of 1867, they had only 52 paid subscribers and 17 gift or exchange subscribers. The 1872 books show a total 109, but there must have been other sales, as indicated by receipts from such book dealers as A. E. Foote (Philadelphia), Trübner and Co. (London), Asher and Co. (Berlin) and Baillière Bros. (Paris). Each dealer took about 12 sets on consignment. Baillière went bankrupt in 1869. Among the exchanges were Crosse and Fischer (for the Journal de Conchyliologie), A. Morelet (France), Showalter (Alabama), Troschel (Prussia) F. Poey (Havana), P. P. Carpenter (Montreal), O. A. Mörch (Copenhagen) and the Smithsonian.

The list of purchasers is very instructive. Isaac Lea paid for Hugh Nevill (India) and Dr. James Lewis (Mohawk, N. Y.) in exchange for shells. Morse was in arrears at a time when the Smithsonian owed him money for drawings. The address changes are interesting: Gabb's was San Francisco, then Santo Domingo; R. E. C. Stearns' was Petaluma, Calif., then 11 Auburn St., Boston (visiting Gould or Anthony?), then California again; Robert Swift's was 1616 Locust St., Philadelphia, then c/o Thos. Bland, New York; Newcomb was Oakland, Calif., then Ithaca, New York. Among the other subscribers were well-known conchologists such as A. O. Currier, W. H. Pease (Sandwich Is.), Semper, J. G. Cooper, Dall, Meek, and Andrew Garrett (c/o Capt. W. H. Kelly, Papeeti, Tahiti).

The Journal was printed by Merrihew and Son, Philadelphia, who charged $175.91 for printing vol. 3, no. 1. Lithographing for vol. 3 was $370.00. Postage for a complete mailing of one number was evidently under $3.00! Cost of hand coloring plate 17 (1869) was $12.00; plate 1 (1870) was also $12.00. On Oct. 14, 1870, the expressage on Dall's reprints was 35 cents. The subscription price was $10.00 per volume. Tryon permitted a 25 percent discount to dealers. By 1868 the Journal was $650.00 in debt (to Tryon) and the committee on publication stated "that the circulation of the Journal has declined to the extent of 18 subscribers during the present year, and considerably more than half of the subscriptions yet remain unpaid."

I do not know, as yet, why the Journal ceased publication. It is probable that Tryon and others believed they could never reach a subscription list of over 150. Other matters were beginning to interest Tryon. Between 1873 and 1875 he published the first sumptuous, popular book on American sea shells, entitled "American Marine Conchology." There were 44 lithographic plates. According to a clipping from the "Naturalist's Leisure Hour" (by A. E. Foote?), only about 75 (or possibly 100) copies were published (50 hand colored at $30.00; 25 plain india tint at $18.00; and several (?) with both types of plates at $42.00). From this costly venture, Tryon went on to his more successful "Structural and Systematic Conchology" and finally the great "Manual of Conchology." Just before his death (age 50 in 1888), he printed up a prospectus for the third series of the Manual which was to be (with Benjamin Sharp's help) on the Bivalvia.

Tryon was also heavily burdened at this period with the curatorial problems of a fast-growing collection. By 1868, the Academy had the largest and most complete collection in the Americas, and was second only to that of the British Museum. Thousands of species were pouring in from Hugh Cuming, Sowerby, Pease, Garrett, Lea, Conrad, Gabb, Mörch, Haldeman, Bland, Newcomb, Brot, Redfield, Cox, and Philippi, to mention only a few who were members of the Conchological Section at that interesting time.

To judge from the present-day list of 51 institutions in the United States and Canada which possess part or all of the Journal, I would hazard the guess that there are about 100 sets in the Americas and 100 elsewhere in the world. Of the 51 American holders, only 11 were subscribers during Tryon's day. The majority were probably given to colleges and public libraries by the survivors of the original subscribers. Others, especially the Texas and California

institutions, probably purchased copies from secondhand book dealers. I would judge that about 20 copies are in small, town libraries.

Complete sets of the Journal were still available as late as 1930. At present, individual volumes are available by writing to the Department of Mollusks, Academy of Natural Sciences, 19th and the Parkway, Philadelphia 3, Pa. Parts of volumes 2, 3 and 4 are available only to institutions. Below is the present inventory for anyone wishing to purchase copies (all in original wrappers; originally $10.00 each in 1872). A complete set is probably worth, today, about $150.00.

Volume	No. of copies	Sales Price
5	18	$20.00
6	25	17.00
7	38	15.00

Parenthetically, it should be noted that E. R. Sykes published not only a list of the papers, arranged alphabetically by author, but also broke the subjects down faunistically and taxonomically (1901, Digesta Malacologica, no. 1, 46 pp., London).

The prospectus prepared by Tryon to announce the American Journal of Conchology is reproduced below.

(PAGE 1)

PROSPECTUS
OF THE
AMERICAN
JOURNAL OF CONCHOLOGY.

THE undersigned proposes to issue, early in next year, the first number of a quarterly publication bearing the above title.

Believing that the status of Conchology in the United States is such as to justify and demand a special exponent, and relying on the enthusiastic love of the Science which distinguishes its votaries for a generous and liberal support, he willingly assumes the responsibility of publisher, together with the certainty of present pecuniary loss, which must necessarily attend an undertaking of this nature.

It is surely not expecting too much, to depend upon the unanimous and hearty support, and unremitting effort of those interested in Conchology, to increase our Subscription List as rapidly as possible; -- and perhaps on our part, it may be deemed almost superfluous to say, that after paying the expenses of the publication of the Journal as now projected, any surplus funds remaining, with be expended entirely either on its enlargement, or in providing more abundant illustration.

The American Journal of Conchology will be published quarterly in numbers of about 100 pp. each, printed on fine heavy paper, making a volume of 400 pp. per annum.

Each number will contain at least two carefully executed Lithographic Plates, colored by hand, and also the Portrait and Autograph of a distinguished American Conchologist.

(PAGE 2)

The Literary contents of the Journal will consist of

Descriptions of New Genera and Species.
Articles on Geographical, Bathymetrical and Geological Distribution.
Anatomical Papers.
Synonymy and Classification.
Elaborate Reviews of New Books.
Editor's Table: -

Including Notices of all Works published, and of all Conchological Papers in American and foreign periodicals, and Transactions of Learned Societies, with interesting extracts from them and synopses of their contents - Announcements of new works in preparation - Notices of the various public and private Museums --- of Collections for sale or exchange - Answers to Inquiries of Correspondents - Obituary.

Conchologists are earnestly requested to contribute papers immediately, as the first

number of the Journal will be published as soon as a sufficient quantity and variety of MSS. is at our disposal.

GEORGE W. TRYON, Jr.,
625 Market Street,
Philadelphia.

November 30, 1864

(PAGE 3)

TERMS

Subscriptions in advance, Ten Dollars per annum.

The work will be sent throughout the United States post paid.

Single Numbers for sale at Three Dollars each.

In Europe all the principal booksellers and shell dealers will receive subscriptions and supply the Journal.

(P. O. address) 186

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Enter my name on the Subscription List for copies of the

AMERICAN JOURNAL OF CONCHOLOGY,

For the year 1865, and thereafter, until I order it to be discontinued.

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Subscriptions payable on delivery of the first number of the Journal.

MOLLUSCAN FAUNAS OF THE GUNNISON RESERVOIR DEPOSIT, SANPETE COUNTY, UTAH

EDWARD C. ROY

INTRODUCTION

PURPOSE OF INVESTIGATION. This study is an attempt to determine the paleoecology of the Gunnison Reservoir deposit and its possible age through quantitative study of the molluscan faunas which reveal successive changes in the environment. The method of investigation is the same as that used for similar deposits in Ohio.

LOCATION OF DEPOSIT. The Gunnison Reservoir deposit (Fig. 1) is located in Sanpete County, Utah, in the SE 1/4, SE 1/4 of Section 12, Range 1 East, Township 18 South. It is exposed in a west-facing cut, 50 feet east of the Denver and Rio Grande Western Railroad tracks and 1.75 miles N. 7° W. of Sterling, Utah. The deposit is in Sanpete Valley and is between 5400 and 5450 feet above sea level. It is 200 feet east of the southeast edge of the Gunnison Reservoir and some 50 feet above the water level of the reservoir. The deposit described in this paper (A on map, Fig. 2) is labeled Q1, and is the only deposit of lacustrine beds in the area of the map.

ACKNOWLEDGEMENTS. I am very grateful to Dr. Aurèle La Rocque, whose guidance and advice made this investigation possible. Thanks are due to Miss.C. J. Kochis who helped in preparation of the specimens for study.*

STRATIGRAPHIC RELATIONS

The Gunnison Reservoir deposit is associated with other beds of Quaternary age. Overlying the deposit is a thin layer of stream-rounded gravels (Fig. 2, Qtg-1) about one foot thick. These gravels have a nearly flat topography and appear to have been terraced. The materials that make up the gravels are limestone and chert, most likely from nearby exposures of Tertiary Flagstaff and Green River formations.

The base of the deposit is not exposed. It is covered by gravels (Fig. 2, Qtg-2) similar in character and composition to those that overlie the deposit. These gravels, because of their lower position, are assumed to be younger than those above the deposit. Beds underlying the Gunnison Reservoir deposit are not known, but judging by the normal stratigraphic sequence of the area, they are probably those of the Jurassic Arapien shale.

The extent of the Gunnison Reservoir deposit is not known. It is exposed on a west-facing cliff, from 200 feet north of the measured section to 300 feet south of the section. Elsewhere, it is covered by gravel.

Measured Section

The section was measured 200 feet south of

* The cost of printing the illustrations accompanying this paper was borne by the Department of Geology, Ohio State University. The grant of funds is gratefully acknowledged.

the north end of the deposit, which was exposed on the west-facing side of a cut 50 feet east of the Denver and Rio Grande Western Railroad tracks and 1.75 miles N. 7° W. of the town of Sterling, Utah.

The top is overlain by a thin layer of stream-rounded terraced gravels.

Unit		Inches
1	Clay, tan to light gray, weathers gray, thin-bedded, argillaceous	21
2	Sand, grayish brown, fine- to medium-grained, grains composed of subrounded limestone grains, angular clear quartz, and rose quartz crystals, some of which are doubly terminated, fossiliferous.	24
3	Gravel, medium sized, pebbles 1/4 to 1 inch, composed of angular siliceous ostracodal limestone, chert, and well-rounded pebbles of sandstone; color varies from light gray to yellow-brown and black.	3
4	Marl, light gray, breaks into angular chunks less than one inch across, chalky to the touch.	18
5	Clay, greenish brown, thin-bedded, breaks into angular chunks less than one-quarter inch across, fossiliferous.	2
6	Marl, light gray, like unit 4.	11
7	Clay, gray to yellowish brown, thin-bedded, breaks into angular chunks one-quarter inch across, fossiliferous.	8
8	Marl, medium gray, blocky, breaks into angular chunks one inch across.	10
9	Clay, greenish brown to yellowish brown, thin-bedded, breaks into angular chunks one-quarter inch across.	28
10	Clay, grayish green to yellowish brown, argillaceous, very loosely compacted, fossiliferous.	12
11	Clay, green to gray-green, weathers gray, thin-bedded, fossiliferous.	9
12	Sand, tan to brown, like unit 2, unfossiliferous.	7
13	Clay, tan to gray-brown, weathers yellow-brown, thin-bedded.	12
	Total deposit exposed	154

The base is covered by stream-rounded gravels.

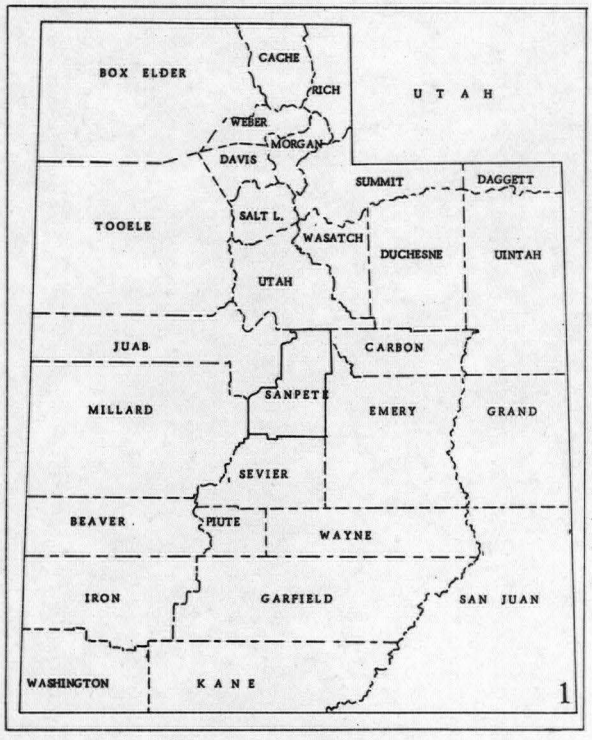
EXPLANATION OF FIGURES, OPPOSITE PAGE

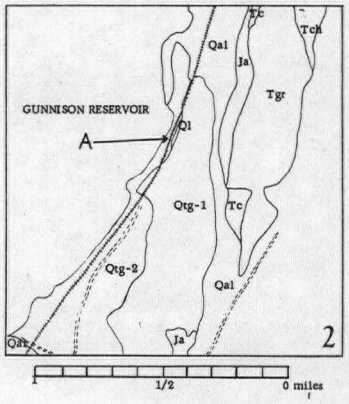
Fig. 1. Index map of Utah, showing the location of the Gunnison Reservoir deposit.

Fig. 2. Geologic map of the Gunnison Reservoir area.

Fig. 3. Cross-section of the Gunnison Reservoir deposit.

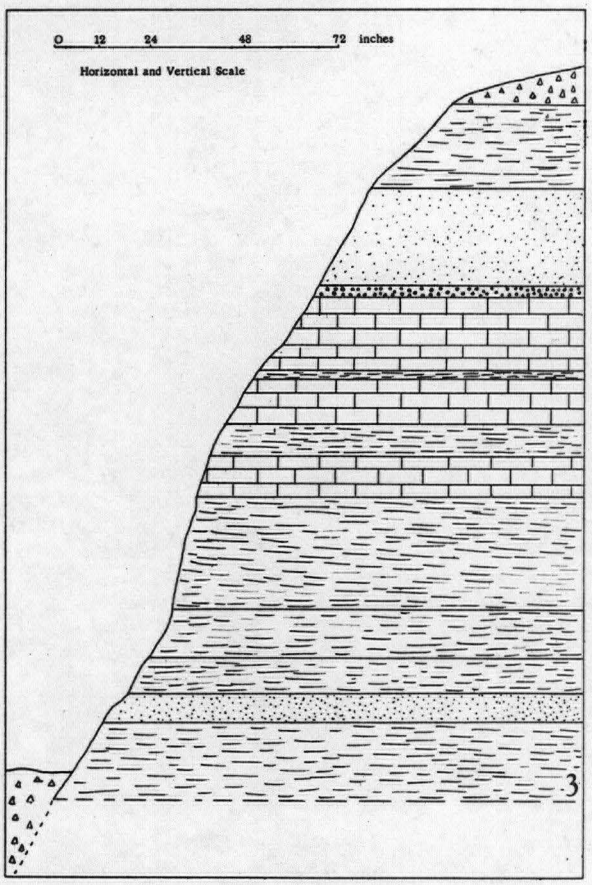
Fig. 4. Quantitative distribution of *Pisidium nitidum pauperculum* Sterki in the Gunnison Reservoir deposit.





LEGEND

Qtg-2	Lower Terrace Gravels	Tch	Crazy Hollow formation
Qtg-1	Upper Terrace Gravels	Tc	Colton formation
Qal	Quaternary Alluvium	Tgr	Green River formation
Ql	Quaternary lacustrine beds	Ja	Arapien formation



COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS (1 2 3 4 5)
15	1/2	0.7	
14	1/2	0.3	
13	8/2	4.2	
12	1/2	0.5	
11	3/2	0.7	
10	3/2	0.6	
9	0	0.0	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	0	0.0	
4	0	0.0	
3	0	0.0	
2	0	0.0	
1	0	0.0	

4

COMPOSITION OF FAUNA

The Mollusca of the Gunnison Reservoir deposit occur at irregular intervals and in unequal distribution throughout the deposit. There is a definite relationship between the lithology and the distribution of Mollusca. The shells occur in the clay units in the lower two-thirds of the deposit and in a sand unit in the upper third (Fig. 3). No shells are found in any of the marl units.

TABLE 1. SPECIES OF MOLLUSCA OCCURRING IN THE GUNNISON RESERVOIR DEPOSIT, SANPETE COUNTY, UTAH.

Pelecypoda

Pisidium nitidum pauperculum Sterki
Sphaerium sp.

Freshwater Gill-breathing Gastropod

Valvata humeralis californica Pilsbry

Freshwater Lung-breathing Gastropods

Gyraulus parvus (Say)
Armiger crista (L.)
Fossaria parva (Lea)
Physa gyrina Say
Promenetus exacuous (Say)
Stagnicola palustris (Müller)
Ferrissia parallela (Haldeman)
Helisoma trivolvis (Say)

Terrestrial Gastropods

Succinea avara Say
Oxyloma retusa (Lea)
Vertigo ovata Say
Discus cronkhitei (Pilsbry)
Retinella binneyana occidentalis H. B. Baker
Vallonia albula Sterki

Of these 17 species identified (Table 1), two are sphaeriid pelecypods, one a gill-breathing freshwater gastropod, eight are lung-breathing freshwater gastropods, and six are terrestrial gastropods. Three species occur in all the fossiliferous units, and one species occurs in all but one of the fossiliferous units. Valvata humeralis californica and Gyraulus parvus are by far the most abundant species in all but one of the fossiliferous units. Fossaria parva occurs in all the units but is significantly abundant in only two units. Armiger crista is more abundant in the lower units than in the upper.

The relationship between the stratigraphic units and the collections is as follows. Collections 15 through 10 were taken from unit 2., collection 9 was taken from unit 5, collections 8 and 7 from unit 7, collections 6 to 4 from unit 10, and collections 3 to 1 were taken from unit 11.

Pelecypods of the species Pisidium nitidum pauperculum and Sphaerium sp. occur only in very small percentages in unit 2. This unit being the only fossiliferous sand in the deposit is considered by the writer to be the only lithologically favorable unit for these species.

Valvata humeralis californica in general shows a gradual increase in the total percentage from collection 1 through 8 (Fig. 6). In collection 9 there is a drastic decline in this species from 52.7 to 1.5 percent, but in the next higher fossiliferous unit, collection 10 shows a recurrence of this species to its greatest total percentage in the deposit, 73.7 (Fig. 6). This species remains fairly constant from collections 10 through 15. Gyraulus parvus varies in total percentage between 28 and 41 in collections 1 through 8. Its decline is not as drastic as that of V. humeralis californica in collection 9 nor is its increase in collection 10 (Fig. 7). Armiger crista is thought by the writer to be the species most significantly controlled by lithologic change. It occurs most abundantly in the clay units varying from 16.3 to 5.6 percent (Fig. 8). It does not occur in collection 9 and it occurs sparingly in collections 10 through 15 where it is probably an intruder in the sand. Fossaria parva occurs in greater abundance in unit 11,

collections 1, 2, and 3, and then declines in collections 4 through 8. It reaches its highest percentage in collection 9 after which it declines again in collections 10 through 15 (Fig. 9).

The remaining species of freshwater gastropods, Ferrissia parallela, Stagnicola palustris, Physa gyrina, Helisoma trivolvis, and Promenetus exacuous are scattered throughout the collections in percentages that rarely exceed 1.5. One exception is P. exacuous which is in collection 1 at 3.5 percent. These species for the most part were probably not indigenous to this habitat and were washed in by streams.

Oxyloma retusa, Succinea avara, Retinella binneyana occidentalis, Vallonia albula, Vertigo ovata, and Discus cronkhitei are the six species of terrestrial gastropods. Land snails are in general very scarce in every collection except collection 9. In collection 9, the land gastropods make up 46 percent of the total. V. ovata constitutes 38 percent of that collection. The rapid rise in percentage of land snails in collection 9 seems to indicate an arid year in which the lake was drying up and the land gastropods migrated toward the remaining moisture. Of the land gastropods, O. retusa and S. avara are the most widespread throughout the deposit; one or the other, or both, occur in all collections except 12, 13, and 15. Only one specimen of V. albula occurred and that in collection 6. R. binneyana occidentalis occurs in collections 1, 2, and 3 and in 9 where it reaches 5.2 percent of the total (Fig. 19).

The terrestrial gastropods are obviously intruders in the lake and were probably washed in from land areas along its shore.

PALEOECOLOGY

The Gunnison Reservoir deposit contains a typical freshwater assemblage. Six species of land gastropods occur in small numbers in all fossiliferous units, but this presence is to be expected because of the moist environment.

The ecology for each species has been summarized and condensed from the following authors: Baker, 1928; Clark, 1961; Henderson, 1936; La Rocque, 1952; Leonard, 1950; Mowery, 1961; Reynolds, 1959; and Zimmerman, 1960.

EXPLANATION OF FIGURES, OPPOSITE PAGE

Fig. 5. Quantitative distribution of Sphaerium sp. in the Gunnison Reservoir deposit.

Fig. 6. Quantitative distribution of Valvata humeralis californica Pilsbry in the Gunnison Reservoir deposit.

Fig. 7. Quantitative distribution of Gyraulus parvus (Say) in the Gunnison Reservoir deposit.

Fig. 8. Quantitative distribution of Armiger crista (L.) in the Gunnison Reservoir deposit.

Fig. 9. Quantitative distribution of Fossaria parva (Lea) in the Gunnison Reservoir deposit.

Fig. 10. Quantitative distribution of Physa gyrina Say in the Gunnison Reservoir deposit.

Fig. 11. Quantitative distribution of Promenetus exacuous (Say) in the Gunnison Reservoir deposit.

Fig. 12. Quantitative distribution of Stagnicola palustris (Müller) in the Gunnison Reservoir deposit.

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	1/2	0.3	
13	0	0.0	
12	0	0.0	
11	1/2	0.2	
10	0	0.0	
9	0	0.0	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	0	0.0	
4	0	0.0	
3	0	0.0	
2	0	0.0	
1	0	0.0	

5

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 10 20 30 40 50
15	85	60.7	
14	105	67.7	
13	115	60.7	
12	130	64.2	
11	270	70.8	
10	350	73.7	
9	4	1.5	
8	527	52.7	
7	520	52.0	
6	501	50.1	
5	483	48.3	
4	520	52.0	
3	147	41.7	
2	77	26.6	
1	247	38.6	

6

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 10 20 30 40 50
15	47	33.5	
14	43	27.7	
13	55	28.9	
12	65	32.0	
11	102	26.5	
10	110	23.1	
9	44	16.4	
8	347	34.7	
7	305	30.5	
6	410	41.0	
5	367	36.7	
4	350	35.0	
3	133	37.7	
2	87	30.1	
1	240	28.0	

7

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	4	2.9	
14	3	1.9	
13	5	2.6	
12	3	1.4	
11	2	0.5	
10	7	1.4	
9	0	0.0	
8	81	8.1	
7	134	13.4	
6	57	5.7	
5	120	12.0	
4	100	10.0	
3	20	5.6	
2	22	7.6	
1	140	16.3	

8

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	1	0.7	
14	1	0.6	
13	5	2.6	
12	2	0.9	
11	4	1.0	
10	4	0.8	
9	90	33.5	
8	30	3.0	
7	28	2.8	
6	26	2.6	
5	14	1.4	
4	24	2.4	
3	37	10.5	
2	91	31.8	
1	90	10.5	

9

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	1	0.5	
11	0	0.0	
10	0	0.0	
9	4	1.5	
8	3	0.3	
7	3	0.3	
6	2	0.2	
5	6	0.6	
4	1	0.1	
3	1	0.3	
2	0	0.0	
1	2	0.2	

10

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	1	0.2	
10	0	0.0	
9	0	0.0	
8	4	0.4	
7	1	0.1	
6	0	0.0	
5	0	0.0	
4	1	0.1	
3	1	0.3	
2	0	0.0	
1	30	3.5	

11

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	3	1.1	
8	4	0.4	
7	3	0.3	
6	2	0.2	
5	0	0.0	
4	0	0.0	
3	0	0.0	
2	3	1.0	
1	2	0.2	

12

Pelecypods

Pisidium nitidum pauperculum Sterki. This species lives in ponds, small and large lakes, in generally shallow water from 1 to 6 m. deep on sand, mud, or clay bottoms, in water with a pH of 7.0 to 8.0 and fixed carbon dioxide of 9.3 to 24.73 ppm.

Sphaerium sp. The one valve of a Sphaerium that occurred in the collection cannot as yet be identified to species. Sphaeriids live in all kinds of habitats. They occur in all depths of water; and in a great variety of bottom conditions. A firm bottom in which to burrow, such as sand, mud, or clay, is preferred.

Fresh-water Gastropods

Valvata humeralis californica Pilsbry. Very little ecological information on this species was found in the literature. Henderson (1929, p. 120) reports finding fossil V. humeralis californica high above water, at what now are small saline lakes, in the Grand Coulee district of Washington. Living members of the species occur in surrounding freshwater lakes. He considers the lacustrine deposits Pleistocene. Other occurrences are reported as lakes, ponds, and streams. The ecology of this species is inferred from that of V. tricarinata. This species lives in weedy places on either sand or muddy bottoms. None of the Valvatidae are found at a pH lower than 7.1 nor in water softer than that containing 8 ppm of fixed carbon dioxide.

Gyraulus paruvs (Say) usually occurs in quiet bodies of water often of small size, in depths between 0.5 and 2.2 m., with various bottoms supporting plant growth. It exhibits a partiality to vegetation, for it is rarely found in other situations. It is also found on debris near the top of the water. It lives in water of pH 7.0 to 8.16; and a fixed carbon dioxide of 8.16 to 30.56 ppm.

Armiger crista (L.). Very few ecological data are recorded for this species. It has been found in Barren Brook, Maine in three or four inches of water under logs and bark, and in a marl pond in Barren Brook, with some vegetation. It has also been reported to occur sparingly on dead leaves in stagnant water in small lakes in the company of G. deflectus obliquus but in much smaller amounts than that species. The only other reported occurrence of this species in Utah is by Eardley and Gvosdetsky (1960, p. 1337). It was located, by a core taken in Great Salt Lake, at a depth of 271 feet. Associated with A. crista were Valvata humeralis, Stagnicola caperata, Gyraulus sp., and Promenetus cf. P. exacuous.

No pH or fixed carbon dioxide data are available.

Fossaria parva (Lea) inhabits wet marshy places, generally out of water, on sticks, stones, or muddy flats. The animal is more prone to leave the water than any species of the family. The pH for the variety F. obrussa decampi is 7.42 to 7.7 and the fixed carbon dioxide 10.6 to 18.8 ppm.

Physa gyrina Say can exist in a variety of habitats, but it appears to be characteristic of slow-moving, and stagnant bodies of water, usually a mud bottom in small ponds. It flourishes best in newly isolated ponds. Its pH is 7.1 to 8.37 and fixed carbon dioxide 9.5 to 25.75 ppm.

Promenetus exacuous (Say) lives generally in quiet places that are more or less marshy; and on mud flats on the edge of small mountain streams of cold, clear water. It is generally found on the underside of lily-pads, sticks, or stones. The most important factors in its habitat seem to be its preference for cold water and the presence of vegetation. Its pH is 7.0 to 7.64 and fixed carbon dioxide 9.3 to 22.5 ppm.

Stagnicola palustris (Müller) occurs plentifully in bodies of water of all sizes,

on floating sticks and submerged vegetation, on stones and on muddy bottoms. It inhabits both clear and stagnant water, but prefers a habitat in which the water is not in motion. The pH of the variety S. palustris elodes is 7.4 and fixed carbon dioxide 21.0 ppm.

Ferrissia parallela (Haldeman) is an inhabitant of quiet water, on plants and on the shells of Naiades, in shallow water, from 0.3 to 2 m. deep. It is commonly found near the water's edge. The presence of vegetation seems to be an important factor in the distribution. F. parallela seems to be a lake or pond species, at least in Wisconsin. Its pH is 6.05 to 8.37 and fixed carbon dioxide 2.75 to 25.7 ppm.

Helisoma trivolvis (Say) is always an inhabitant of quiet, more or less stagnant water. It occurs along swampy shores, in marshes, or in stagnant pools, with mud or with fine sandy-silt bottoms, up to 2 m. in depth although generally in water less than 0.6 m. Its pH is 6.6 to 8.37 and fixed carbon dioxide from 7.5 to 30.56 ppm.

Terrestrial Gastropods

Succinea avara Say has a wide range of habitat preferences. It lives in low, swampy areas crawling on the muddy banks of ditches. This species has been observed climbing to a height of three feet on tall fronds in the water.

Oxyloma retusa (Lea) occurs in marshes and other wet places. It can be found upon partly submerged sticks and on rotting water weeds. It commonly occurs on mud flats above the high water level along swampy shores caused by the raising of water in a lake or pond.

Vertigo ovata Say prefers a moist environment afforded 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. The limiting factor for this species is a relatively high moisture requirement.

Discus cronkhitei (Pilsbry) in the east, lives in humid forests, under dead wood, and among rotting leaves and grass in rather wet situations. In northern Nebraska it occurs

EXPLANATION OF FIGURES, OPPOSITE PAGE

Fig. 13. Quantitative distribution of Ferrissia parallela (Haldeman) in the Gunnison Reservoir deposit.

Fig. 14. Quantitative distribution of Helisoma trivolvis (Say) in the Gunnison Reservoir deposit.

Fig. 15. Quantitative distribution of Succinea avara Say in the Gunnison Reservoir deposit.

Fig. 16. Quantitative distribution of Oxyloma retusa (Lea) in the Gunnison Reservoir deposit.

Fig. 17. Quantitative distribution of Vertigo ovata in the Gunnison Reservoir deposit.

Fig. 18. Quantitative distribution of Discus cronkhitei (Pilsbry) in the Gunnison Reservoir deposit.

Fig. 19. Quantitative distribution of Retinella binneyana occidentalis H. B. Baker in the Gunnison Reservoir deposit.

Fig. 20. Quantitative distribution of Vallonia albula Sterki in the Gunnison Reservoir deposit.

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	1	0.6	
13	2	1.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	0	0.0	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	1	0.1	
4	0	0.0	
3	0	0.0	
2	0	0.0	
1	0	0.0	

13

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	0	0.0	
8	3	0.3	
7	0	0.0	
6	0	0.0	
5	1	0.1	
4	0	0.0	
3	0	0.0	
2	0	0.0	
1	0	0.0	

14

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.00	
14	1	0.65	
13	0	0.00	
12	0	0.00	
11	3	0.40	
10	2	0.45	
9	0	0.00	
8	1	0.10	
7	5	0.50	
6	0	0.00	
5	8	0.80	
4	0	0.00	
3	0	0.00	
2	1	0.30	
1	4	0.46	

15

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	6	2.2	
8	1	0.1	
7	0	0.0	
6	1	0.1	
5	0	0.0	
4	4	0.4	
3	5	1.5	
2	3	1.0	
1	2	0.2	

16

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	1	0.5	
11	0	0.0	
10	0	0.0	
9	102	38.6	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	0	0.0	
4	0	0.0	
3	0	0.0	
2	1	0.3	
1	0	0.0	

17

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	2	1.5	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	0	0.0	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	0	0.0	
4	0	0.0	
3	2	0.6	
2	0	0.0	
1	0	0.0	

18

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	14	5.2	
8	0	0.0	
7	0	0.0	
6	0	0.0	
5	0	0.0	
4	0	0.0	
3	5	1.5	
2	4	1.3	
1	1	0.1	

19

COLLECTION NUMBER	NUMBER OF INDIVIDUALS	PERCENT OF TOTAL INDIVIDUALS	GRAPHIC REPRESENTATION OF PERCENTAGE OF TOTAL INDIVIDUALS 1 2 3 4 5
15	0	0.0	
14	0	0.0	
13	0	0.0	
12	0	0.0	
11	0	0.0	
10	0	0.0	
9	0	0.0	
8	0	0.0	
7	0	0.0	
6	1	0.1	
5	0	0.0	
4	0	0.0	
3	0	0.0	
2	0	0.0	
1	0	0.0	

20

under sticks and logs on moist leaf mold, always close to running water.

Retinella binneyana occidentalis H. B. Baker is found mostly in forests under forest debris, at the base of stumps, under logs, and under loose bark of fallen trees. This species is also found on lowlands which border lakes.

Vallonia albula Sterki. These small snails live in moss and among dead leaves, under decaying wood and stones and are very sensitive to light. During rains they may be washed along streams.

ENVIRONMENTAL HISTORY

The Gunnison Reservoir deposit reveals an unusual distribution of Mollusca. In similar lacustrine deposits, particularly in Ohio, mollusks are found in the marl units; in this deposit there was no evidence of any shells in the marl units.

The measured section (page 6) and the cross-section (Fig. 3) of the deposit show the order of deposition and lithologic variation from which the sequence of events can be established.

The lowest exposed unit of the deposit is an unfossiliferous clay. Above this unit is a sand unit, unit 12, which is also unfossiliferous. The first fossiliferous unit is unit 11, which consists of clay. Four significant species occur in this unit, Valvata humeralis californica, Gyraulus parvus, Fossaria parva, and Armiger crista. The occurrence of F. parva and A. crista indicates that this was probably a near-shore environment, in which the depth of water was not over 3 feet. G. parvus seems to substantiate this conclusion and its presence with A. crista indicates abundant vegetation, Valvata humeralis californica is not out of place here for it has a variable depth range.

Unit 10, the next higher unit, is also a clay and is also fossiliferous. It contains the same species as the lower units. A change in the percentages of F. parva, which decreases, seems to indicate that the depth of water increased at this point. G. parvus and A. crista remain unchanged, indicating the presence of vegetation.

Unit 9 is unfossiliferous clay. The disappearance of the gastropods from this unit may be explained by a rapid increase in water level under very muddy conditions which led to the destruction of the fauna. Unit 8 is marl and is unfossiliferous. A possible explanation for the lack of fossils is that the marl was deposited at a depth greater than the living conditions of the lake inhabitants.

Unit 7 is a highly fossiliferous clay. The significant species are the same as those in units 10 and 11 and this indicates a return to the former depth of 3 to 4 feet and fairly close to shore with abundant vegetation. The conditions must have been highly favorable for the gastropods because their abundance here far exceeds that in any other unit.

Unit 6 is an unfossiliferous marl, probably indicating an increase in depth at this point, similar to unit 8.

Unit 5 shows the greatest change in species in the entire deposit. The fresh-water species decline and the land gastropods increase. The great abundance of Vertigo ovata, a species that requires a certain amount of moisture, seems to indicate that the lake was drying up at this point. Fossaria parva attains its greatest total percentage here which can be considered normal because of the ability of this species to live on mud flats. Significant decrease in the percentage of G. parvus and V. humeralis californica and the complete absence of A. crista indicates an environment unsuitable for these species. The greater percentage of land snails permits us to

assume that the lake was drying up in an arid period and that the land snails were migrating toward the last remaining moisture.

Unit 4 is the uppermost marl unit and is also unfossiliferous. This unit probably indicates a return to the deeper water conditions similar to units 6 and 8.

Unit 3 is a 3-inch layer of coarse stream gravels. This unit indicates a new source of sediments carried at higher energy than any before. Its position here may be due to the shifting of a stream channel during an unusually wet period, carrying coarse sediments into the lake.

Unit 2 is a sand unit and is the uppermost fossiliferous unit in the deposit. The species V. humeralis californica and G. parvus make up approximately 90 percent of the shells. This shows that the change in lithology has greatly affected the occurrence of other species, namely A. crista and F. parva, which should probably be called intruders in this environment. Pisidium nitidum pauperculum and Sphaerium sp. occur in small percentages here. The water was probably between 4 and 6 feet deep with some vegetation.

Unit 1 is an unfossiliferous clay unit which probably indicates increased depth at this point.

AGE AND CORRELATION

Lack of data on Pleistocene molluscan assemblages in Utah makes it difficult to determine the age of the Gunnison Reservoir deposit. Taylor (1960, pp. 22-42) describes 9 Pliocene and Pleistocene faunas from the High Plains but none is similar to this assemblage. The two most abundant species in this deposit are recorded for the Pliocene. Taylor (1960, p. 58) reports the occurrence of Gyraulus parvus in the Pliocene. Chamberlin and Berry (1933, p. 29) report the occurrence of Valvata humeralis californica for the Pliocene. La Rocque (manuscript records) shows both of these species still living in Utah, as well as the other species that occur in the deposit with the exception of Armiger crista. Due to the fact that all the species except one are still living in Utah, the writer assumes that the deposit is of Wisconsin age and probably of latest Wisconsin age.

In a core taken in Great Salt Lake a number of layers containing fresh-water mollusks were located (Eardley and Gvosdetsky, 1960, pp. 1336-1338). The species Armiger crista occurred only at a depth of 271 feet along with other species that also occur in this assemblage. Eardley and Gvosdetsky (1960, p. 1340) estimate a rate of sedimentation of 1 foot in 825 years down to a depth of 330 feet. Assuming this rate of sedimentation, the age of the sediments at the 271 foot level would be 223,575 years. Because of the similarity of the Gunnison Reservoir assemblage to that collected at a depth of 271 feet in the Great Salt Lake core, it may be possible to consider these two assemblages as of the same age.

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ECOLOGICAL DATA -- 3. MOQUIN-TANDON'S OBSERVATIONS ON ANCYLUS FLUVIATILIS MÜLL.

Tucked away on the last two pages of a paper on "anatomico-physiological" investigations on A. fluviatilis (Jour. Conchyl. 3: 7-21, 1852) are some observations on this fresh-water limpet which may be useful to some of our readers. They are given here verbatim.

2° Fonctions. Les Ancyles sont herbivores; elles se nourrissent de fibrilles radicales, d'algues d'eau douce, surtout de conferves, de matière verte et de substances végétales en décomposition.

Dans la mastication, la membrane linguale, mise en mouvement par la plaque cartilagineuse qui se trouve au-dessous de son extrémité antérieure, presse la matière alimentaire contre la mâchoire supérieure; puis les mâchoires latérales se portent horizontalement l'une contre l'autre, s'écartent bientôt, et la langue recommence son mouvement de bas en haut.

Les papilles linguales, dirigées d'avant en arrière, doivent contribuer puissamment à la déglutition.

Les Ancyles avalent, avec leurs aliments, une certaine quantité de parcelles minérales, dures, sans doute pour faciliter la digestion. Plusieurs fois j'ai trouvé leur estomac rempli de graviers extrêmement fins (37); c'étaient de petits fragments de quartz et de calcaire, mêlés à une matière roussâtre ou verdâtre de nature végétale.

Un individu qui avait vécu trois jours dans une solution de cochenille, m'a présenté l'estomac et la cavité buccale colorés en rougeâtre. Les matières contenues dans la poche digestive étaient d'un rouge assez intense.

La digestion paraît lente. Des Ancyles, conservées pendant huit jours dans de l'eau très pure, offraient encore une partie de l'intestin remplie de matières fécales.

Les excréments de l'Ancyle sont filiformes, un peu contournés et de couleur brunâtre.

L'animal peut vivre assez longtemps sans manger.

(37) Gray a remarqué aussi des fragments de matière inorganique.

REPRINTS OF RARE PAPERS ON MOLLUSCA: 1. J. W. DAWSON on: NEWER PLIOCENE FOSSILS OF THE ST. LAWRENCE VALLEY, a report of a paper presented at the Montreal meetings of the American Association for the Advancement of Science. From the CANADIAN NATURALIST AND GEOLOGIST, vol. 2, pages 279-280, Montreal, 1857.

(Page 279)

NEWER PLIOCENE FOSSILS OF THE ST. LAWRENCE VALLEY,

by Professor Dawson. The object of this paper was in the first place to notice several fossil shells recently found by the author and others in these deposits, and which did not appear to have been previously observed. The species mentioned were: -

Natica Heros, Say,	Beauport.
Natica Groenlandica, Beck,	do.
Fusus tornatus Gould,	Montreal.
Fusus harpularius, Couthouy,	
Rissoa minuta,	Montreal.
Turritella, (like erosa,)	Beauport.
Bulla oryza, Tott,	Montreal.
Spirorbis sinistrorsu, Montagu,	do.
Univalve, (perhaps Menestho albula)	

Most of these shells are now living on the Atlantic coast of America, north of Cape Cod, and some of them ranging very far north. The paper then referred to the distribution of the various kinds of drift in the vicinity of Montreal, and to the conditions of the sea areas, in which the shells and other marine animals of the Newer Pliocene period existed in the St. Lawrence Valley. 'Good evidence exists of a sea beach on Montreal Mountain, at an elevation of 470 feet above the sea. The sea area corresponding to this beach must have extended to the Laurentide hills and the escarpment of Niagara, and communicated freely with the ocean on the east. On the other hand there are lower shores of the same period only 100 feet above the St. Lawrence. These must have belonged to a

(Page 280)

very narrow prolongation of the present gulf of St. Lawrence.

The conditions of climate, ice, drift, &c., corresponding to these different shores must have been very diverse.'

Again, in the stratified drift, it is possible to recognise, within a few inches of each other, a bed containing deep-sea shells, and another containing species that are littoral; these sea bottoms corresponding to different levels of the land. It is evident that any conclusions with reference to the climate indicated by the marine fauna of these successive beds of marine detritus, must take into account these fluctuations of the sea level, and the changes in animal life consequent on them. Taking these into account, positive and reliable results may be attained; and the study of such districts as the St. Lawrence valley may be made to contribute toward the elucidation of the conditions of life in older formations.'

Retyped without change of pagination, October, 1971

RECORDS OF GASTROPODS COLLECTED IN WESTERN OHIO

CLARENCE F. CLARK

ALLEN COUNTY

BATH TWP., Sec. 14. Aug. 18, 1947

Anguispira alternata (Say)	4
Euconulus fulvus (Müller)	1
Haplotrema concavum (Say)	2
Ventridens ligera (Say)	2
Gastrocopta corticaria (Say)	1
Gastrocopta contracta (Say)	6
Discus patulus (Deshayes)	5
Lymnaea humilis modicella (Say)	1
Stenotrema fraternum (Say)	13
Stenotrema hirsutum (Say)	3
Triodopsis tridentata (Say)	2
Mesodon zaletus (Binney)	5
Retinella indentata (Say)	1
Strobilops aenea Pilsbry	5
Succinea avara Say	2
Succinea ovalis Say	1
Zonitoides arboreus (Say)	1

SUGAR CREEK TWP., Sec. 14, Aug. 12, 1944

Gyraulus deflectus (Say)	1
Helisoma anceps (Menke)	1
Physa gyrina Say	6

AUGLAIZE COUNTY

CLAY TWP., Sec. 16, July 11, 1945.

Anguispira alternata (Say)	3
Anguispira kochi (Pfeiffer)	1
Discus patulus (Deshayes)	7
Stenotrema fraternum (Say)	5
Mesodon thyroidus (Say)	2
Mesodon zaletus (Binney)	3
Retinella electrina (Gould)	1
Zonitoides arboreus (Say)	1
Ventridens intertextus (Binney)	4

CLAY TWP., Sec. 18, April 16, 1945.

Anguispira alternata (Say)	7
Discus patulus (Deshayes)	6
Euconulus fulvus (Müller)	1
Helicodiscus parallelus (Say)	2
Haplotrema concavum (Say)	1
Stenotrema fraternum (Say)	3
Stenotrema hirsutum (Say)	11
Mesodon inflectus (Say)	3
Mesodon thyroidus (Say)	3
Mesodon zaletus (Binney)	1
Retinella indentata (Say)	4
Strobilops labyrinthica (Say)	3

CLAY TWP., Sec. 24 (2 collections), July 1, 1945.

Anguispira alternata (Say)	2
Deroceras laeve (Müller)	2
Discus patulus (Deshayes)	4
Haplotrema concavum (Say)	2
Helisoma trivolvis (Say)	6
Pallifera dorsalis (Binney)	1
Philomycus carolinianus (Bosc)	1
Planorbula armigera (Say)	4
Mesodon appressus (Say)	8
Allogona profunda (Say)	7
Mesodon thyroidus (Say)	5
Zonitoides arboreus (Say)	4

DUCHOUQUET TWP., Sec. 28 (2 collections) May 27, 1945.

Anguispira alternata (Say)	9
Carychium exile canadense Clapp	6
Deroceras laeve (Müller)	1
Gastrocopta contracta (Say)	8
Haplotrema concavum (Say)	8
Hawaiia minuscula (Binney)	11
Pallifera dorsalis (Binney)	1
Stenotrema hirsutum (Say)	4
Triodopsis tridentata (Say)	3
Mesodon zaletus (Binney)	10

GERMAN TWP., Sec. 3, Aug. 2, 1944.

Anguispira alternata (Say)	5
Discus patulus (Deshayes)	15
Pisidium casertanum (Poli)	5
Mesodon thyroidus (Say)	5
Mesodon zaletus (Binney)	1
Zonitoides arboreus (Say)	10

GERMAN TWP., Sec. 4, April 1, 1945.

Anguispira alternata (Say)	6
Discus patulus (Deshayes)	7
Helicodiscus parallelus (Say)	2
Haplotrema concavum (Say)	2
Mesodon inflectus (Say)	3
Mesodon zaletus (Binney)	1
Retinella indentata (Say)	14
Succinea ovalis Say	1

GERMAN TWP., Sec. 5.

Anguispira alternata (Say)	3
Discus patulus (Deshayes)	1
Mesodon inflectus (Say)	1
Retinella indentata (Say)	1
Stenotrema hirsutum (Say)	1
Stenotrema fraternum (Say)	2
Succinea avara Say	2
Succinea ovalis Say	2
Triodopsis fraudulenta (Pilsbry)	1
Zonitoides arboreus (Say)	1
Triodopsis albolabris (Say)	2

JACKSON TWP., Sec. 6, April 28, 1945.

Anguispira alternata (Say)	8
Discus patulus (Deshayes)	4
Haplotrema concavum (Say)	1
Hawaiia minuscula (Binney)	1
Triodopsis albolabris (Say)	1
Mesodon inflectus (Say)	2
Mesodon thyroidus (Say)	4
Mesodon zaletus (Binney)	8
Retinella indentata (Say)	3
Strobilops labyrinthica (Say)	3

LOGAN TWP., Sec. 22, May 13, 1945.

Anguispira alternata (Say)	6
Anguispira kochi (Pfeiffer)	2
Discus patulus (Deshayes)	10
Haplotrema concavum (Say)	3
Stenotrema fraternum (Say)	4
Mesodon inflectus (Say)	1
Allogona profunda (Say)	1
Mesodon thyroidus (Say)	1
Pupoides albilabris (C. B. Adams)	1
Retinella electrina (Gould)	1
Strobilops labyrinthica (Say)	1
Zonitoides arboreus (Say)	6
Philomycus carolinianus (Bosc)	1
Pallifera dorsalis (Binney)	1

LOGAN TWP., Sec. 23.

Lymnaea caperata Say	1
Mesodon thyroidus (Say)	1
Triodopsis fraudulenta (Pilsbry)	1

LOGAN TWP., Sec. 32, April 22, 1945.

Anguispira alternata (Say)	5
Haplotrema concavum (Say)	3
Helicodiscus parallelus (Say)	1
Discus patulus (Deshayes)	7
Triodopsis fraudulenta (Pilsbry)	9
Stenotrema hirsutum (Say)	2
Triodopsis denotata (Férussac)	2
Mesodon thyroidus (Say)	3
Mesodon zaletus (Binney)	4
Zonitoides arboreus (Say)	2

MOULTON TWP., Sec. 24, April 22, 1945 and May 13, 1945.

Anguispira alternata (Say)	16
Discus patulus (Deshayes)	7
Gastrocopta contracta (Say)	3

Haplotrema concavum (Say)	8
Helicodiscus parallelus (Say)	3
Mesomphix cupreus (Rafinesque)	3
Stenotrema fraternum (Say)	2
Triodopsis fraudulenta (Pilsbry)	16
Stenotrema hirsutum (Say)	7
Mesodon inflectus (Say)	3
Mesodon thyroidus (Say)	4
Mesodon zaletus (Binney)	6
Retinella indentata (Gould)	3
Strobilops labyrinthica (Say)	1
Zonitoides arboreus (Say)	4

MOULTON TWP., Sec. 36.

Helisoma trivolvis (Say)	
Gyraulus parvus (Say)	
Lymnaea palustris (Müller)	
Planorbula armigera (Say)	
Succinea avara Say	
Mesodon thyroidus (Say)	1

MOULTON TWP., Sec. 36, Mar. 4, 1945.

Anguispira alternata (Say)	1
Discus patulus (Deshayes)	7
Haplotrema concavum (Say)	1
Helicodiscus parallelus (Say)	2
Mesodon inflectus (Say)	1
Mesodon thyroidus (Say)	3
Mesodon zaletus (Binney)	2
Retinella indentata (Gould)	5

NOBLE TWP., Sec. 17, May 27, 1945.

Anguispira alternata (Say)	20
Deroceras laeve (Müller)	2
Gastrocopta contracta (Say)	24
Stenotrema fraternum (Say)	4
Stenotrema hirsutum (Say)	2
Triodopsis tridentata (Say)	6
Punctum minutissimum (Lea)	4
Retinella indentata (Say)	4
Vertigo milium (Gould)	2
Zonitoides arboreus (Say)	10

NOBLE TWP., Sec. 3.

Mesodon thyroidus (Say)	

SALEM TWP., Sec. 1, April 3, 1946

Anguispira alternata (Say)	5
Aplexa hypnorum (Linnaeus)	10
Carychium exile H. C. Lea	10
Cionella lubrica (Müller)	2
Gastrocopta contracta (Say)	10
Discus patulus (Deshayes)	9
Hawaiia minuscula (Binney)	1
Triodopsis albolabris (Say)	1
Triodopsis multilineata (Say)	5
Triodopsis denotata (Férussac)	1
Triodopsis tridentata (Say)	5
Mesodon zaletus (Binney)	3
Punctum minutissimum (Lea)	2
Retinella indentata (Say)	3
Striatura milium (Morse)	4
Strobilops aenea Pilsbry	5
Vertigo milium (Gould)	2
Zonitoides nitidus (Müller)	1

SALEM TWP., Sec. 22, April 22, 1945.

Anguispira alternata (Say)	6
Discus patulus (Deshayes)	3
Haplotrema concavum (Say)	4
Triodopsis albolabris (Say)	2
Stenotrema fraternum (Say)	1
Triodopsis fraudulenta (Pilsbry)	8
Mesodon thyroidus (Say)	1
Mesodon zaletus (Binney)	1
Retinella indentata (Say)	5

PUSHETA TWP., Sec. 21, May 6, 1945.

Anguispira alternata (Say)	6
Discus patulus (Deshayes)	8
Mesomphix cupreus (Rafinesque)	1
Stenotrema fraternum (Say)	4
Triodopsis fraudulenta (Pilsbry)	14
Mesodon zaletus (Binney)	5
Retinella indentata (Say)	2

ST. MARYS TWP., Sec. 2.

Discus cronkhitei anthonyi (Pilsbry)	1
Stenotrema leaii (Binney)	6
Oxyloma retusa (Lea)	6
Triodopsis multilineata (Say)	4

ST. MARYS TWP., Sec. 8, July 23, 1943

Deroceras laeve (Müller)	6
Anguispira alternata (Say)	1
Discus cronkhitei anthonyi (Pilsbry)	1
Planorbula armigera (Say)	1
Retinella indentata (Say)	1
Stenotrema leaii (Binney)	5
Oxyloma retusa (Lea)	3
Zonitoides arboreus (Say)	1
Lymnaea palustris (Müller)	5
Helisoma trivolvis (Say)	18
Gyraulus parvus (Say)	2
Lymnaea obrussa Say	8
Oxyloma retusa (Lea)	1

ST. MARYS TWP., sec. 25, Mar. 11, 1945

Anguispira alternata (Say)	4
Discus patulus (Deshayes)	4
Gastrocopta contracta (Say)	3
Hawaiia minuscula (Binney)	1
Lymnaea palustris (Müller)	1
Planorbula armigera (Say)	2
Retinella indentata (Say)	9
Vertigo milium (Gould)	1

ST. MARYS TWP., sec. 26, April 16, 1945

Anguispira alternata (Say)	2
Discus patulus (Deshayes)	2
Haplotrema concavum (Say)	3
Triodopsis fraudulenta (Pilsbry)	9
Stenotrema hirsutum (Say)	2
Mesodon inflectus (Say)	4
Triodopsis denotata (Férussac)	2
Mesodon thyroidus (Say)	1
Mesodon zaletus (Binney)	3

ST. MARYS TWP., Sec. 30, April 29, 1945

Anguispira alternata (Say)	7
Discus patulus (Deshayes)	5
Gastrocopta contracta (Say)	4
Hawaiia minuscula (Binney)	1
Haplotrema concavum (Say)	6
Stenotrema fraternum (Say)	3
Triodopsis fraudulenta (Pilsbry)	1
Mesodon inflectus (Say)	1
Mesodon thyroidus (Say)	4
Mesodon zaletus (Binney)	7
Strobilops labyrinthica (Say)	1
Succinea ovalis (Say)	3
Zonitoides arboreus (Say)	3

UNION TWP., Sec. 15, March 11, 1945.

Anguispira alternata (Say)	3
Discus patulus (Deshayes)	12
Haplotrema concavum (Say)	1
Helicodiscus parallelus (Say)	2
Mesomphix cupreus (Rafinesque)	1
Planorbula armigera (Say)	1
Lymnaea caperata Say	1
Stenotrema fraternum (Say)	1
Triodopsis fraudulenta (Pilsbry)	2
Mesodon inflectus (Say)	2
Retinella indentata (Say)	8

WASHINGTON TWP., Sec. 14, May 13, 1945.

Anguispira alternata (Say)	5
Discus patulus (Deshayes)	7
Helicodiscus parallelus (Say)	1
Helisoma trivolvis (Say)	4
Mesomphix cupreus (Rafinesque)	1
Mesodon inflectus (Say)	6
Triodopsis fraudulenta (Pilsbry)	16
Mesodon thyroidus (Say)	3
Mesodon zaletus (Binney)	3
Retinella indentata (Say)	2
Strobilops labyrinthica (Say)	1
Succinea avara Say	3
Zonitoides arboreus (Say)	2

WASHINGTON TWP., Sec. 21, Apr. 29, 1945.

Anguispira alternata (Say)	7
Discus patulus (Deshayes)	2
Haplotrema concavum (Say)	1
Helicodiscus parallelus (Say)	1
Triodopsis fraudulenta (Pilsbry)	1
Mesodon zaletus (Binney)	5

WAYNE TWP., Sec. 4, May 13, 1945.

Stenotrema fraternum (Say)	1
Stenotrema hirsutum (Say)	1
Mesodon inflectus (Say)	6
Retinella indentata (Say)	1

WAYNE TWP., Sec. 13, May 13, 1945.

Anguispira alternata (Say)	7
Gastrocopta contracta (Say)	1
Haplotrema concavum (Say)	1
Helicodiscus parallelus (Say)	1
Stenotrema fraternum (Say)	3
Triodopsis fraudulenta (Pilsbry)	3
Mesodon inflectus (Say)	1
Stenotrema monodon aliciae (Pilsbry)	1
Triodopsis denotata (Férussac)	1
Allogona profunda (Say)	2
Mesodon zaletus (Binney)	2
Retinella indentata (Say)	2
Zonitoides arboreus (Say)	1

BROWN COUNTY

FAYETTEVILLE, Aug. 21, 1945.

Goniobasis livescens (Menke)	2
Campeloma integrum (Say)	4

ERIE COUNTY

MARGARETTA TWP., May 22, 1945.

Anguispira alternata (Say)	5
Ventridens ligera (Say)	1
Gyraulus parvus (Say)	10
Lymnaea palustris (Müller)	9
Physa gyrina Say	4
Stenotrema hirsutum (Say)	12
Allogona profunda (Say)	1
Mesodon thyroidus (Say)	2
Succinea cf. S. ovalis Say	3
Vallonia costata (Müller)	5
Zonitoides arboreus (Say)	1
Deroceras laeve (Müller)	2

FULTON COUNTY

GERMAN TWP., Sec. 23, 2 collections, May 26, 1945

Anguispira alternata (Say)	7
Anguispira kochi (Pfeiffer)	8
Discus patulus (Deshayes)	3
Stenotrema fraternum (Say)	1
Triodopsis fraudulenta (Pilsbry)	9
Triodopsis multilineata (Say)	1
Mesodon thyroidus (Say)	1
Triodopsis tridentata (Say)	3
Mesodon zaletus (Binney)	1

GERMAN TWP., Sec. 23, July 13, 1947.

Anguispira alternata (Say)	8
Anguispira kochi (Pfeiffer)	1
Aplexa hypnorum (Linnaeus)	5
Euconulus fulvus (Müller)	1
Gastrocopta contracta (Say)	4
Gastrocopta tappaniana (C. B. Adams)	1
Discus cronkhitei anthonyi (Pilsbry)	2
Planorbula armigera (Say)	1
Triodopsis albolabris (Say)	2
Stenotrema fraternum (Say)	2
Triodopsis multilineata (Say)	3
Mesodon thyroidus (Say)	3
Triodopsis tridentata (Say)	1
Mesodon zaletus (Binney)	6
Punctum minutissimum (Lea)	1
Retinella indentata (Say)	2
Strobilops labyrinthica (Say)	8
Succinea avara Say	2
Succinea ovalis Say	1
Zonitoides arboreus (Say)	2

GERMAN TWP., July 8, 1947.

Oxyloma retusa (Lea)	2
Helisoma trivolvis (Say)	2
Physa gyrina Say	12

GERMAN TWP., Sec. 20, July 8, 1947.

Helisoma trivolvis (Say)	30
Lymnaea caperata Say	1
Physa gyrina Say	5
Oxyloma retusa (Lea)	1

GERMAN TWP., Sec. 12, Bates Run, July 8, 1947.

Ferrissia rivularis (Say)	4
Pomatiopsis cincinnatiensis (Lea)	2
Vallonia costata (Müller)	1

GORHAM TWP., Galls Woods, Sept. 18, 1947.

Anguispira alternata (Say)	3
Anguispira kochi (Pfeiffer)	3
Carychium exile H. C. Lea	12
Ventridens ligera (Say)	1
Discus patulus (Deshayes)	4
Mesomphix cupreus (Rafinesque)	1
Stenotrema fraternum (Say)	2

Triodopsis fraudulenta (Pilsbry)	5
Mesodon inflectus (Say)	1
Mesodon thyroidus (Say)	1
Triodopsis tridentata (Say)	2
Mesodon zaletus (Binney)	7
Retinella hammonis Ström	1
Strobilops aenea Pilsbry	9
Succinea ovalis Say	2
Vertigo milium (Gould)	2
Vertigo ovata Say	4
Zonitoides arboreus (Say)	1
Zonitoides nitidus (Müller)	1

GORHAM TWP., Sec. 5.

Anguispira alternata (Say)	4
Gastrocopta armifera (Say)	1
Haplotrema concavum (Say)	2
Mesodon thyroidus (Say)	1
Stenotrema fraternum (Say)	2
Succinea avara Say	5
Oxyloma retusa (Lea)	2
Triodopsis fraudulenta (Pilsbry)	3
Triodopsis multilineata (Say)	1
Zonitoides nitidus (Müller)	10

HANCOCK COUNTY

MARION TWP., August 10, 1947.

Anguispira alternata (Say)	1
Aplexa hypnorum (Linnaeus)	5
Ventridens ligera (Say)	2
Discus patulus (Deshayes)	1
Helicodiscus parallelus (Say)	1
Helisoma trivolvis (Say)	1
Lymnaea humilis modicella (Say)	4
Planorbula armigera (Say)	3
Stenotrema fraternum (Say)	1
Mesodon inflectus (Say)	2
Strobilops aenea Pilsbry	2
Zonitoides arboreus (Say)	3

LOGAN COUNTY

STOKES TWP., Sec. 11, Sept. 27, 1947.

Aplexa hypnorum (Linnaeus)	4
Anguispira alternata (Say)	1
Carychium exile H. C. Lea	3
Euconulus fulvus (Müller)	3
Gastrocopta contracta (Say)	4
Planorbula crassilabris (Walker)	1
Stenotrema hirsutum (Say)	1
Mesodon thyroidus (Say)	2
Retinella indentata (Say)	1
Strobilops aenea Pilsbry	1
Vertigo milium (Gould)	4

LUCAS COUNTY

GRAND RAPIDS.

Viviparus malleatus Reeve	2

MERCER COUNTY

BUTLER TWP., Sec. 2, Sept. 26, 1947.

Anguispira alternata (Say)	2
Cionella lubrica (Müller)	3
Euconulus fulvus (Müller)	2
Gastrocopta contracta (Say)	3
Gastrocopta tappaniana (C. B. Adams)	1
Discus patulus (Deshayes)	2
Haplotrema concavum (Say)	4
Mesodon thyroidus (Say)	5
Stenotrema fraternum (Say)	5
Triodopsis fraudulenta (Pilsbry)	1
Retinella hammonis (Ström)	1
Striatura milium (Morse)	1
Vertigo ovata Say	1

BUTLER TWP., Sec. 24, March 18, 1945.

Anguispira alternata (Say)	5
Discus patulus (Deshayes)	4
Haplotrema concavum (Say)	1
Mesodon inflectus (Say)	2
Mesodon zaletus (Binney)	1
Retinella indentata (Say)	2

HOPEWELL TWP., Sec. 33, Sept. 1, 1944.

Anguispira alternata (Say)	5
Triodopsis albolabris (Say)	1
Mesodon inflectus (Say)	8
Mesodon thyroidus (Say)	1
Zonitoides arboreus (Say)	2

JEFFERSON TWP., Sec. 5, Apr. 29, 1945.

Anguispira alternata (Say)	4
Discus patulus (Deshayes)	5
Gastrocopta contracta (Say)	1
Haplotrema concavum (Say)	2

Stenotrema fraternum (Say)	3
Triodopsis fraudulenta (Pilsbry)	3
Mesodon inflectus (Say)	5
Mesodon thyroidus (Say)	3
Retinella indentata (Say)	1

JEFFERSON TWP., Sec. 33, May 26, 1945.

Anguispira alternata (Say)	5
Helicodiscus parallelus (Say)	1
Planorbula armigera (Say)	4
Physa gyrina (Say)	3
Stenotrema fraternum (Say)	4
Triodopsis fraudulenta (Pilsbry)	5
Mesodon inflectus (Say)	3
Mesodon thyroidus (Say)	4
Mesodon zaletus (Binney)	2

JEFFERSON TWP., Sec. 33, July 8, 1945.

Anguispira alternata (Say)	6
Helicodiscus parallelus (Say)	1
Physa gyrina Say	8
Planorbula armigera (Say)	8
Stenotrema fraternum (Say)	6
Triodopsis fraudulenta (Pilsbry)	5
Mesodon inflectus (Say)	3
Mesodon thyroidus (Say)	8
Mesodon zaletus (Binney)	2
Retinella electrina (Gould)	2
Zonitoides arboreus (Say)	1
Strobilops labyrinthica (Say)	17

MIAMI COUNTY

PAULDING TWP., Sec. 20, June 24, 1945.

Anguispira alternata (Say)	6
Discus patulus (Deshayes)	3
Gastrocopta contracta (Say)	1
Haplotrema concavum (Say)	1
Hawaiia minuscula (Binney)	1
Helicodiscus singleyanus inermis (HBB)	1
Philomycus carolinianus (Bosc)	1
Stenotrema hirsutum (Say)	2
Allogona profunda (Say)	6
Mesodon thyroidus (Say)	8
Triodopsis tridentata (Say)	1
Retinella electrina (Gould)	1
Succinea ovalis Say	8

SHELBY COUNTY

GREEN ISLAND, Lake Loramie.

Aplexa hypnorum (Linnaeus)	1
Anguispira alternata (Say)	10
Mesodon thyroidus (Say)	1
Physa gyrina Say	1
Triodopsis albolabris (Say)	1
Zonitoides arboreus (Say)	8

WILLIAMS COUNTY

BRADY TWP., Sec. 36.

Triodopsis multilineata (Say).

NORTHWEST TWP., Sec. 13, July 18, 1947.

Anguispira alternata (Say)	4
Anguispira kochi (Pfeiffer)	1
Carychium exile H. C. Lea	4
Cionella lubrica (Müller)	11
Gastrocopta tappaniana (C. B. Adams)	2
Gastrocopta contracta (Say)	2
Hawaiia minuscula (Binney)	3
Helicodiscus parallelus (Say)	1
Triodopsis multilineata (Say)	17
Mesodon thyroidus (Say)	4
Mesodon zaletus (Binney)	6
Retinella indentata (Say)	1
Strobilops labyrinthica (Say)	2
Vallonia pulchella (Müller)	6
Zonitoides nitidus (Müller)	3

NORTHWEST TWP., Sec. 14, June 19, 1947.

Gyraulus parvus (Say)	1
Helisoma trivolvis (Say)	4
Campeloma decisum (Say)	8

NORTHWEST TWP., Sec. 16, June 17, 1947.

Helisoma trivolvis (Say)	8
Physa gyrina Say	50

NORTHWEST TWP., Sec. 17, Apr. 22, 1948.

Gyraulus parvus (Say)	3
Planorbula armigera (Say)	1

NORTHWEST TWP., Sec. 23, Aug. 2, 1947.

Anguispira alternata (Say)	1
Euconulus fulvus (Müller)	5

Gastrocopta contracta (Say)	1
Gastrocopta corticaria (Say)	1
Mesomphix cupreus Rafinesque	1
Stenotrema fraternum (Say)	7
Mesodon inflectus (Say)	2
Mesodon zaletus (Binney)	2
Retinella indentata (Say)	1
Strobilops labyrinthica (Say)	4
Zonitoides nitidus (Müller)	1

ST. JOSEPH TWP., Sec. 20, June 10, 1945.

Campeloma decisum (Say)	4
Discus cronkhitei anthonyi (Pilsbry)	1
Gastrocopta contracta (Say)	2
Hawaiia minuscula (Binney)	1
Helicodiscus parallelus (Say)	1
Pomatiopsis cincinnatiensis (Lea)	5
Retinella indentata (Say)	1
Zonitoides nitidus (Müller)	1
Goniobasis livescens (Menke)	12

SCIOTO TRAILS FOREST

Philomycus carolinianus (Bosc)
Triodopsis albolabris (Say)

KEY REFERENCES TO THE NON-MARINE MOLLUSCA OF ALASKA

The basic reference for the state of Alaska is Dall's account, No. 1, below. The nomenclature is somewhat out of date but the work remains usable. Other references published after Dall's work are given. The record of fossil freshwater Mollusca of the state remains to be assembled. One rare, though rather old work (Mayer, 1869) is listed.

Additions to this list will be welcome. This is the first of the state and provincial lists of non-marine Mollusca which it is planned to print in STERKIANA from time to time.

1. DALL, William H. (1905) Land and Fresh Water Mollusks of Alaska and adjoining regions. -- Harriman-Alaska Exped., vol. 13, pp. 1-171, 2 pls., 118 text figs.

2. BERRY, S. Stillman (1937) Land Snails of Kadiak. -- Nautilus 50: 87-88.

3. EYERDAM, Walter J. (1933) A Biological collecting excursion to the Aleutian Islands. -- Nautilus 46: 124-128.

4. EYERDAM, Walter J. (1939) Land Snails collected at Uganik Bay, Kodiak Island. -- Nautilus 53: 61-64.

5. EYERDAM, Walter J. (1940) Further notes on land shells from Kodiak and nearby Islands. -- Nautilus 53: 131-133.

6. HANNA, G. Dallas (1925) Some land shells from the Aleutian Islands, Alaska. -- Nautilus 38: 122-125.

7. HANNA, G. Dallas (1956) Land and Freshwater Mollusks of the Arctic Slope, Alaska. -- Nautilus 70: 4-10, pl. 1.

8. MAYER, Charles (1869) [Mollusca of the Plant Beds.] IN Heer, Flora Fossilis Alaskana. -- Kong. Svensk. Vetensk.-Akad. Handl., n. s., 8: 40-41, pl. 10, figs. 7-13.

9. ODHNER, Nils Hj. (1939) Sphaeriids from the Aleutian Islands. -- Nautilus 52: 79-84, 1 text fig. and pl. 6.

10. STERKI, Victor (1918) A new Mollusk of the genus Pisidium from Alaska, with field notes by G. Dallas Hanna. -- Proc. U. S. Nat. Mus. 51: 475-477.

A. La Rocque

CONTRIBUTIONS TO THE HISTORY OF CANADIAN MALACOLOGY

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INTRODUCTION

Some years ago I finished the manuscript of a Catalogue of Canadian Mollusca which was published (La Rocque, 1953) by the National Museum of Canada. The introduction to this work included an outline of the history of malacological work in Canada but the manuscript proved so lengthy that I was asked to excise the history from it in order to produce a catalogue of manageable size. This was done and in the intervening years I have added to the history as materials became available. The revised and somewhat expanded paper is presented here in the hope that it may prove useful to those who have come into the field in recent years and that it may bring back pleasant memories to those who knew some of the scientists mentioned in these pages who have died in the last few years.

It would be somewhat presumptuous to call these notes a history since much work remains to be done before a complete account of malacological work in and about Canada emerges. Using the title "Contributions" has the further advantage of inviting others to add to them and to put on paper information available to a few or buried in correspondence files or archives where they may eventually be lost. The gaps in the subject will be all too evident to those who read this account; calling attention to the gaps may induce others to fill them. Such is my hope in presenting this incomplete account in the following pages.

There is a tendency in Canada to deplore the country's proximity to a large and more powerful neighbor. In science, at least, that proximity has had and still has advantages for the smaller country, advantages which are demonstrated in a small way by the development of malacology in Canada. Many workers south of the border have helped in many ways ranging from collecting expeditions to valuable assistance in identifying specimens. In general, I think it would be fair to say that in this field, at least, the United States has both helped and stimulated development. Particularly in systematics and in ecological and anatomical work, anything done on the Mollusca of the northern states has a bearing on Canadian species. In addition, the doors of American Universities and scientific institutions have always been open wide to qualified Canadians many of whom have taken advantage of the opportunities offered and returned to Canada with improved skills and knowledge.

In preparing this account, I have adhered to my original policy of confining myself largely

to personalities no longer living. The thinning of the ranks since the first draft of this paper was prepared for presentation at the A.M.U. meetings in Toronto in 1939 has made it imperative to include the work of distinguished Canadians such as Frank R. Latchford and that of their American friends, such as Bryant Walker, Calvin Goodrich, Imogene C. S. Robertson, Clifford Blakeslee, Henry A. Pilsbry, Victor Sterki, and many others. I trust that those still living who had a hand in shaping the course of malacology in Canada will forgive me for omitting them.

The course of events of importance to malacology and a few dates indirectly influential on the development of our field are enumerated in the Chronological Table which follows. In the remainder of the paper I have discussed trends, accomplishments, reminiscences, personal and otherwise, which may be of interest.

References cited have been reduced to a minimum here; a full list will be found in my Catalogue (La Rocque, 1953) except for a few, omitted there since they relate particularly to history, which are given under References Cited.

CHRONOLOGICAL TABLE

1534 Jacques Cartier discovers Canada.
1578 Parkhurst writes on shells from Newfoundland.
1608 Champlain founds Quebec.
1612 Lescarbot's "Histoire de la Nouvelle France" published.
1613 Champlain's "Voyages" published.
1636 Harvard College founded.
1663 Laval University founded.
1672 Nicholas Denys' "Description géographique et historique ... histoire naturelle de l'Amérique septentrionale."
1693 College of William and Mary founded.
1701 Yale founded.
1740 University of Pennsylvania founded.
1746 Princeton founded.
1754 Columbia University founded.
1763 Canada ceded to Great Britain.
1804 Maton and Rackett's history of conchology published
1816 Thomas Say's article in Nicholson's Encyclopedia.
1817 University of Michigan founded.
1821 McGill University founded.
1822 Rackett's description of Canadian shells.
1824 Say's description of shells of Long's Expedition.
J. E. Gray's shells of Parry's Voyage.
1827 University of Toronto founded.
1830 Mrs. Sheppard on the shells of Quebec.
1834 R. Owen, shells of Ross Arctic Expedition.
1835 R. Owen on shells of the Northwest Passage Expedition.
1836 Sowerby's Mollusca in Richardson's Fauna Boreali-Americana.
1839 Gray on shells of Beechey's Arctic Voyage.
1840-1845 Haldeman's Monograph of the Limniades.
1841 Queen's University founded.
Gould's Invertebrates of Massachusetts.
1842 Foundation of the Geological Survey of Canada.
1843 DeKay's Zoology of New York, Mollusca.
1846 Albany Hancock on shells from Davis Straits.
1848 Ottawa University founded.
1850 Gould, Mollusca in Agassiz' Lake Superior.
Forbes on Mollusca of the "Herald" and "Pandora."
1855 Lovell Reeve on shells of the "Assistance" Voyage.
1857 First volume of the Canadian Naturalist and Geologist, Elkanah Billings, Editor.
Willis on Shells of Nova Scotia.
1858 Robert Bell on shells collected for the Geological Survey of Canada.
- Elkanah Billings on freshwater shells.
- J. W. Dawson on Mollusca of Gaspé Bay.
1859 Robert Bell on natural history of the Gulf of St. Lawrence.
- P. P. Carpenter on Labrador shells.
- D'Urban on Argenteuil and Ottawa counties.
1859-60 D'Urban on shells of the Rouge River.
1861 Robert Bell on post-Tertiary shells and Lake Superior shells.

1861 W. G. Binney: Northwest Territories collections by Ross, Kennicott and Drexler.
- Chapman, two papers on "drift."
- A. E. Williamson on shells of Toronto.

1862 Stimpson on Hudson Bay and Pleistocene of James Bay.
- Willis on marine shells of Nova Scotia.
- Whiteaves on land and freshwater shells of Lower Canada.

1863 Whiteaves' second paper on land and freshwater shells of Lower Canada.
- Baird on British Columbia shells.
- Packard on Labrador shells.
- Willis on Nova Scotia shells.

1864 Baird and Lord on Dentaliidae especially of British Columbia.
- P. P. Carpenter, four papers.

1865 P. P. Carpenter on Vancouver Island.
Tryon begins publishing the American Journal of Conchology.
- Stimpson on Buccinum in Canadian Nat. & Geol.

1866 Lord's book on British Columbia.

1867 Confederation.
- Packard on shells of Labrador and Maine.
- Willis on Littorina littorea in Nova Scotia.

1869 Whiteaves on marine Mollusca of Eastern Canada.

1870 Binney's Gould published.
- Whiteaves' second paper on marine Mollusca of Eastern Canada.

1871 Smith and Verrill on Lake Superior shells.
- Whiteaves' third paper on marine Mollusca of Eastern Canada.

1872 H. Alleyne Nicholson on shells dredged in Lake Ontario.

1873 Carpenter's Mollusca of Western North America.

1874 Kent on Newfoundland giant squids.
- Whiteaves' fourth paper on marine Mollusca of Eastern Canada.
- Verrill's two papers on giant squids.

1875 Verrill on giant squids again.
- G. M. Dawson on Mollusca of the 49th parallel.

1876 Jeffreys' Mollusca of the "Valorous."

1877 Jeffreys' on the "Valorous" again.
- Verrill on giant squids,
- Jones on Nova Scotia shells.

1878 Whiteaves on West Coast marine shells.

1879 Jeffreys' "Lightning" and "Porcupine" Mollusca.

1880 Robert Bell on Manitoba shells.
- Boettger on Hudson Bay shells.
- Whiteaves on West Coast marine shells.
- Whiteaves on shells of Manitoba and the Nelson River.
- Heron on shells of Ottawa.

1881 Whiteaves on shells of Hudson Bay.

1882 Latchford on Ottawa Unionidae.
- Verrill on Newfoundland giant squids.
- A. F. Gray on Unio borealis near Ottawa.

1883 Katherine J. Bush on Labrador Mollusca and Echinodermata.

1884 Ami's list of fossils from Ottawa region.
- Latchford on Anticosti shells.
- Matthew on shells of the Bocabec site, New Brunswick.

1885 F. Bain on shells of Prince Edward Id.
- Christie on Manitoba shells.
- Ganong's 2 papers on New Brunswick shells.
- Latchford on Manitoba shells.
- J. W. Taylor on the same subject.
- Westerlund's "Vega" Expedition Mollusca.
- Verkrüzen on Newfoundland shells.

1886 Conchologist's Exchange begins publication.
- Dall on shells from Ungava Bay.

1887 Ganong on New Brunswick Mollusca.
- Tyrrell on shells from Alberta and Saskatchewan.
- Whiteaves on British Columbia shells.

1888 Binney's reprinting of Say's works.
- Winkley on New Brunswick shells.

1889 The Nautilus succeeds the Conchologist's Exchange.
- Ganong on Mollusca of Acadia.
- G. W. Taylor on Vancouver Island shells.

1890 Ganong on John Robert Willis' life and work.
- Hanham on Hamilton, Ontario, Mollusca.
- Provancher on Quebec Mollusca.
- Taylor and Latchford's Ottawa list.

1891 Cockerell on British Columbia slugs.
- Leslie on Hamilton, Ontario, Mollusca.
- G. W. Taylor on Vancouver Id. land snails.

1892 Farrer on "Planorbis multivolvis in Newfoundland.
- C. C. Nutting's Saskatchewan R. paper.

1892 G. W. Taylor's checklist of Canadian non-marine Mollusca.
- Bryant Walker on Michigan Mollusca.

1893 Hanham on Gaspé shells
- C. F. Newcombe on marine shells of British Columbia.

1894 Frank Smith on Lake St. Clair fauna.

1895 G. W. Taylor's Catalogue of West Coast marine Mollusca.
- A. P. Coleman's two papers on the Don beds at Toronto.

1896 Lemon on Ontario shells.

1897 Ami on Post-Pliocene Mollusca of the Ottawa Valley.
- Dall on British Columbia marines.
- Hanham on Quebec City Mollusca.

1898 Ganong on Mollusca of the Bay Chaleur.
- Lemon on interglacial fauna at Toronto.

1899 Randolph on shells from the Yukon.
- Hanham on Manitoba shells.

1899-1900 Grant on Hamilton Mollusca.

1900 Bryant Walker's Additions to the Canadian list.

1901 Ami's lists of Ottawa District fossils.
- Whiteaves' Catalogue of Marine Invertebrates of Eastern Canada.

1902 Brodie on animal remains from Indian village sites.

1903? G. W. Bailey's New Brunswick list.

1904 Whiteaves on Newfoundland Mollusca.
- Bryant Walker on Canadian shells.
- Schmitt's monograph of Anticosti.

1905 Dall's Harriman-Alaska report.
- Five papers by Whiteaves.

1906 A. R. Campbell's Pictou County list.
- Chadwick on Prince Edward Island.
- Vanatta on British Columbia shells.

1907 Clapp on shells of Magdalen Islands.
- E. B. Williamson on shells north of Sault Ste Marie, Ont.
- Bryant Walker on Cobalt marl shells.
- Ives on Prince Edward Island shells.

1908 Wintemberg on use of shells by Ontario Indians.

1909 Lermond's Maine list published.

1910 Victoria Memorial Museum completed and occupied.
- Dall and Bartsch on B.C. marines.
- Ganong on the early voyages to Canada.

1911 Allen records Lymnaea auricularia from Canada.
- F. C. Baker's Lymnaeidae published.

1912 Ardley on Ostrea in the Pleistocene of Montreal.

1913 Stafford on the Canadian Oyster.
- Dall and Bartsch on new marine species from both coasts of Canada.
- Hanham on B. C. marines.
- Robertson's Toronto list.

1914 World War I begins.
- Simpson's Catalogue of the Naiades published by Bryant Walker.
- Nylander on shells of the St. John River.
- C. F. Newcombe on Pleistocene raised beaches in British Columbia.

1915 A. D. Robertson on Georgian Bay, Ont.
- C. W. Johnson's New England Mollusca.

1916 Sterki's Catalogue of Sphaeriidae.
- Kindle's paper on Bay of Fundy Mollusca.

1917 E. M. Walker on land snails near Lake Simcoe, Ontario.
- Lillian Thompson on Nova Scotia shells.
- Kindle on Nova Scotia marines.

1918 World War I ends.
- Grier's paper on Lake Erie Naiades.
- Whittaker on McKay Lake fauna.
- Bryant Walker's Synopsis published.
- Kindle and Whittaker's Bathymetric checklist published.

1919 Dall on Mollusca of the Canadian Arctic Expedition (followed by several others).
- Andrew Halkett on the scallop.
- Wintemberg on Helix hortensis in Nova Scotia.

1920 Two more papers by Grier on Lake Erie.

1921 Dall's West Coast list.
- Whittaker on marl shells in Ontario.
- O'Donoghue on West Coast nudibranchs.

1922 S. S. Berry on land snails from the Canadian Rockies.
- Coleman on Pleistocene lakes.
- O'Donoghue, 3 papers on nudibranchs.
- Whittaker on McKay Lake.
- Bryant Walker's Goderich list.
- Ortmann and Walker's paper on nomenclature of the Naiades.
- Latchford's account of Canadian Sphaeriidae completed.

1923 Adamstone's two papers on L. Nipigon.
- Mant on Vancouver Island shells.

1924 Adamstone on bottom fauna of Lake Nipigon.
- Whittaker on shells of Mackenzie River basin.
- Macoun on Vancouver Id. marines.
- Johansen on shells from Anticosti.
- Ida S. Oldroyd's West Coast Pelecypoda published.

1925 Crickmay on Pleistocene of British Columbia.
- Dall on British Columbia marines.
- Dall on Canadian Arctic Expedition Pteropoda.
- Vanatta on Newfoundland shells.
- Mozley's first of a long series of papers on western and northern Canada.
- Kindle on Lake Ontario dredgings.

1926 Dall on St. Lawrence collections made by Johansen.
- O'Donoghue on nudibranchs.
- Winslow's Michigan checklist.
- Johnson on Labrador, Newfoundland, and Nova Scotia shells.
- Johansen on shells of the "Arctic."

1927 Museum Branch of the Department of Mines officially designated "National Museum of Canada."
- O'Donoghue on nudibranchs.
- Frierson's checklist of Naiades published.
- Tolmachoff on Pleistocene of Lake St. John.
- Oldroyd's Gastropods published.

1928 F. C. Baker's Fresh Water Mollusca of Wisconsin published.
- Rawson on Lake Simcoe.

1929 Crickmay on Pleistocene of B. C.
- Henderson's Mollusca of Oregon and Washington.
- Hayes on Nova Scotia Littorina.

1930 Ahlstrom on Lake Erie Mollusca.
- Rawson on Lake Simcoe Mollusca.
- Vanatta on Newfoundland shells.

1931 Two papers by F. C. Baker.
- Baker and Cahn on Central Ontario.
- Foundation of "Conchological Society of America" with one Canadian charter member.

1932 F. C. Baker, two more papers.
- Cronk on Shakespeare Island Lake, Ont.
- Goodrich and van der Schalie on Naiades of the Great Lakes.
- Goodrich's Mollusca of Michigan.

1933 F. C. Baker on Canadian Lymnaeidae.
- Goodrich on Mollusca of Moose Factory.

1934 Three papers by F. C. Baker.
- George E. Fairbairn on McKay Lake shells.
- Johnson's Checklist of marine Mollusca, Labrador to Texas.

1935 C. L. Newcombe on Nova Scotia Mya arenaria.
- Mattox's first paper on Campeloma.
- Henderson's Fossil non-marine Mollusca of North America.

1936 Two papers by F. C. Baker.
- Brooks on Newfoundland non-marines.
- Nichols on Arctic raised beaches.

1937 F. C. Baker's Mollusca of Prince Albert National Park, Saskatchewan.
- G. E. Fairbairn on Ottawa Mollusca.
- Goodrich on Canadian Goniobasis.

1938 Brown, Clark, and Gleissner on Lake Erie Naiades.
- Fairbairn on "Helix rufescens" at Ottawa.
- M. W. Smith on Lake Jesse, Nova Scotia.

1939 World War II begins.
- F. C. Baker on Western Ontario shells.
- Goodrich on Pleuroceridae of the St. Lawrence drainage.

1940 Brooks and Brooks on Newfoundland non-marine Mollusca.
- Medcof on Campeloma.
- Kerswill on Eastern Canadian Pteropoda.
- Mattox on Campeloma.

1941 Nylander on marl shells from Quebec.

1942 Goodrich on Pleuroceridae of the Pacific drainage.

1943 Nylander on marl shells from Quebec.
- Nylander on Lymnaeidae of eastern Canada.

1944 Herrington's first paper on Sphaeriidae.

1945 World War II ends.
- F. C. Baker's Planorbidae.
- Palmer on the Carpenter Collection.

1948 Robertson and Blakeslee's Niagara Frontier Mollusca.

1958 Palmer's memoir on Carpenter's types.

PRE-LINNEAN WRITERS

Mollusca are mentioned incidentally by many explorers and discoverers. One of the earliest is a letter to Richard Hakluyt "conteining a report of the true state and commodities of Newfoundland" by "M. Anthonie Parkhurst Gentleman, 1578" given by Hakluyt, vol. 3, pp. 170-174: "As thouching the kindes of Fish ... there are ... Oisters, and Muskles, in which I haue found pearles aboue 40 in one Muskle, and generally all haue some, great or small. I heard of a Portugall that found one woorth 300 duckets. There are also other kinds of shell-fish, as limpets, cockles, wilkes, lobsters, and crabs."

Another writer in Hakluyt (same vol., p. 194) describing Sir Humphrey Gilbert's voyage to Newfoundland in 1583, says that oysters occur there; "Oysters hauing pearle but not orient in colour: I tooke it by reason they were not gathered in season." Ganong thinks that "he must confound some other mollusc with the Oyster." A little farther on, the same writer says: "Lakes or pooles of fresh water, both on the tops of mountaines and in the vallies. In which are sayd to be muskles not unlike to haue pearle." This may be the earliest record of freshwater Mollusca in Newfoundland.

Jacques Cartier, although he gives copious remarks on the animals and plants of Canada, does not mention any invertebrates.

Champlain, in his Voyages (1603 or 1613) records the presence at what is now Weymouth Harbour, St. Mary's Bay, Nova Scotia, of "many Shell-fish, such as Mussels, Cockles and Sea-snails" which he observed in his exploration of 1604. At St. Croix, now Dochet, Island in the St. Croix River, he found Cockles, Mussels, and Sea-snails. His otherreference to Mollusca is in his description of Bras d'Or Lake, Cape Breton, in which he says, "there are many islands, filled with a great deal of game, and shell-fish of several kinds, among others of Oysters which are not of good flavor."

Lescarbot (Histoire de la Nouvelle France, 1609) speaks of the occurrence of Mussels at St. Croix Island, and referring to the natural productions of the country, he says: "I would be forced to make an entire book if I should discourse on all the fishes ... but I will restrain myself to two or three, after having said that at Port Royal there are great beds of Mussels, with which we filled our boats when sometimes we went to those places. There are also there, Scallops, Palourdes twice as large as Oysters in size; also Cockles, which have never failed us."

Nicholas Denys ("Description géographique et historique des Costes de l'Amérique Septentrionale" and "Histoire Naturelle ... de l'Amérique Septentrionale") gives several observations of interest. He knew of the occurrence of the Oyster at several points in Nova Scotia, and mentions the abundance of shell-fish at several places, notably at Cape Sable, La Have Harbour, George's Bay, near the mouth of Bras d'Or Lakes, Tatamagouche, Miramichi, Bathurst, Port Daniel. He noticed Razor-clams (Coutellières) near Cape Sable and Scallops (Conniffles), at La Have. He also gave interesting descriptions of the Squid and the oyster fishery.

We must not expect too much from these early travel reports since they were not written in the same spirit as later scientific reports. They are permeated with a sense of wonder at the strange new country and its unfamiliar fauna and flora, not always conducive to exact description. The investigations themselves were slanted towards economic considerations, hence the obsession with pearls and edibility whenever Mollusca are mentioned. All of them may be suspected of at least slight exaggeration as to quantities available because of the constant preoccupation with bringing out the wealth of resources of the new regions visited. Their descriptions of Canada may be compared with the glowing accounts published two centuries later to entice settlers to various parts of the world, including Canada.

TRANSITION PERIOD

Early Linnean writers from Europe visited North America in the eighteenth century. Most of them collected all sorts of natural history objects which found a resting place in the museums of Europe but few of the Mollusca thus collected were described in separate papers dealing with Canada. Once natural history establishments of various kinds appeared in North America, papers on Mollusca began to appear in their Proceedings and Journals, for example in the publications of the Academy of Natural Sciences of Philadelphia and Silliman's Journal, later the American Journal of Science. During this period two names stand out, those of Thomas Rackett and Thomas Say, one in England, the other in the United States.

Thomas Rackett (1757-1841) was a country clergyman somewhat after the style of Gilbert White of Selborne. He established himself early as an antiquarian of ability and published many papers on antiquities. He became a Fellow of the Royal Society, of the Society of Antiquaries, and of the Linnean Society. In his eighties he took up conchology with enthusiasm but did not publish as voluminously on the subject as he had on antiquities. He is known to us chiefly for his "Description of some shells found in Canada" (1822). His Helix monodon is the land snail now called Stenotrema leaii (Binney) and his Helix angulata falls in the synonymy of Helisoma anceps (Menke). His shells were collected on the shores of Lake Huron in 1816, by one Edmund Sheppard of the Royal Artillery who could well have been a relative of Mrs. Sheppard mentioned later in this paper.

Rackett's paper on Canadian shells was a short one of only two pages, but he published another with W. G. Maton (Maton and Rackett, 1804) on "An Historical Account of Testaceological Writers" which lists writers from Aristotle to the end of the eighteenth century, one of the earliest histories of malacology.

Thomas Say (1787-1834) is the outstanding figure in American malacology in the first half of the nineteenth century. In accuracy of description and thoroughness he is the acknowledged leader of his time. His complete works were reprinted by Binney and several accounts of his life have been published.

He described the shells collected by Long's Expedition in the region of Lake Superior including such typically Canadian species as Helisoma corpulentum, Bulimnea megasoma, and Cotyrenetes harpa which still bear the names he gave them.

QUEBEC GROUP

The first of Canada's scientific societies to produce a conchologist was the Literary and Historical Society of Quebec. Founded in 1824 under vice-regal patronage it was thriving in 1830 and had attracted the intelligentsia of the city. In that year it published a paper "On the recent shells which characterize Quebec and its environs," by Mrs. Sheppard. I have elsewhere (La Rocque, 1935d) given all the facts available to me about this lady. She was the wife of William Sheppard who, with his brother Peter, was a founder-member of the Literary and Historical Society. In the list of founders he is merely William Sheppard, Esquire, but later his articles are by "Honorable Wm. Sheppard, of Woodfield." He was three or four times president of the Society and the centenary volume (1924) mentions that his portrait is in the possession of the Society. In 1841 we find him listed with the corresponding members. It is probable, therefore, that the Sheppards lived in Canada some sixteen years, then returned to England. Wallace (Encyclopedia of Canada, vol. 5, p. 388) states that Sheppard was a member of the Executive Council of Lower Canada from 1837 to 1841 and that he died in 1867. Beyond this and the facts given above, we know nothing of the Sheppards.

In later years, the Literary and Historical Society confined itself almost exclusively to the subjects indicated by its name.

The next group of papers on the Mollusca

of Quebec appeared in the "Canadian Naturalist and Geologist" of Montreal, founded by Elkanah Billings who was its first editor, and in the reports of the Geological Survey of Canada. The availability of a new natural history periodical stimulated publication of data on Canadian Mollusca. Moreover, the Geological Survey was then located in Montreal and it attracted to its staff geologists and paleontologists who were also interested in natural history; the arrival of J. W. Dawson on the scene and his lectures on natural history at McGill University led to a flowering of interest in that field, including conchology and Pleistocene fossils. The newly founded Montreal Natural History Society appointed a curator in the person of Joseph Frederick Whiteaves, fresh from Oxford, who immediately began studies on the Mollusca of Canada, a subject which occupied him until his death in Ottawa in 1909.

The first volume of the Canadian Naturalist and Geologist appeared in 1857. It contains an unsigned paper on the freshwater gastropods of Canada (Anon. 1857) which I have credited doubtfully, and perhaps erroneously, to J. W. Dawson; it may have been written by Elkanah Billings. The latter is undoubtedly the author of "Notes on the Natural History of Montreal" which contains some data on shells. In the second volume (1859) Robert Bell of the Geological Survey lists some species from the Gulf of St. Lawrence. The Rev. Philip P. Carpenter has an article on Labrador shells and W. S. M. D'Urban the first half of his paper on shells of Argenteuil and Ottawa counties, Quebec. The remainder of this paper was published in the next volume of the Naturalist. D'Urban also published a list of shells for the same counties in the annual report of the Geological Survey for 1858 (published in 1859). Papers on Canadian Mollusca continued to appear in the Canadian Naturalist and Geologist and its successor the Canadian Record of Science until at least 1895.

Elkanah Billings (1820-1876) was born in the township of Gloucester, not far from the Rideau River, inside the present limits of the city of Ottawa. Trained for the law, he practiced briefly in Ottawa, edited the "Bytown Gazette" for a time and in 1856 accepted an appointment as paleontologist to the Geological Survey of Canada. His new post required his removal to Montreal where the Survey was located and this brought him in contact with the group of naturalists just mentioned. His previous newspaper experience probably led him to initiate the Canadian Naturalist and Geologist as a side line to his duties with the Survey. A biographic sketch by Ami (1901) includes a list of Billings' publications.

Robert Bell (1841-1917) was born near Toronto, of Scottish parents. Both his father and his grandfather were Presbyterian ministers. His father had an interest in nature which he communicated to his son. Bell was attached to a party of the Geological Survey of Canada at the age of fifteen. Later he attended Mc Gill University from which he graduated first in engineering and later in medicine. During his work with the Survey he visited many parts of Quebec and Ontario, collecting fossils, plants, and shells as part of his duties. He served for a time as "Interim Professor of Chemistry and Natural History" at Queens University but resigned from that position to return to field work with the Survey. In 1872 and 1873 he accompanied A. R. C. Selwyn on geological work from Lake Superior to Fort Garry; in later years he worked in northern Ontario, Manitoba, and the Athabasca-Mackenzie region. He did geological work in Hudson Bay, traveling on the "Neptune" and "Alert." In 1899 he worked in the area of Great Slave Lake. He was acting director of the Geological Survey from 1900 to 1906. His conchological work was incidental to his formal duties in the field but it was done in regions then so inaccessible that we owe to his industry the first records of many parts of Canada. After retiring from the Geological Survey in 1906 he went to live in Manitoba, where he died in 1917. A biographical sketch by Ami (1927) includes a list of his publications.

We know very little about W. S. M. D'Urban. Benjamin D'Urban, after whom Durban in South Africa was named, died in Montreal

in 1849. W. S. M. D'Urban may have been a son or other relative of his. His first paper, on Canadian birds, appeared in 1856 and some 12 other papers on natural history of Canada are listed by the Royal Society Catalogue of Scientific Literature. In 1863 he was writing on Ferns of South Africa and in 1865 on naturalized weeds of British Kaffraria. He is said to have published in the Zoologist (London) as late as 1909.

Philip Pearsall Carpenter (1819-1877) was in Montreal from 1865 to his death in 1877. Mrs. Palmer (1958, pp. 7-14) has given an account of the life and scientific works of this remarkable clergyman which need not be repeated here. Suffice it to say that his presence in Montreal infected with his enthusiasm all those who came in contact with him. His extensive knowledge of the Mollusca of the world and his high reputation had great effect in stimulating the study of conchology in Montreal.

Joseph Frederick Whiteaves (1835-1909) arrived in Montreal in his middle twenties, already a Fellow of the Ashmolean Society, with several publications already in print, and an appointment as Curator of the Montreal Natural History Society. He was later to succeed Billings as paleontologist to the Geological Survey of Canada. He moved to Ottawa with the Survey in 1880 and died there in 1909. His main work was on the fossils collected by the field men of the Geological Survey and on monographic syntheses on Paleozoic and Mesozoic fossils but he maintained his interest in living Mollusca to the end and published on the subject as late as 1907. His collection of shells, which included species from all over the world, was acquired for the National Museum. How well I remember the characteristic pill-boxes filled with light blue or pink cottonwool and with glass tops in which his smaller shells were stored. Part of my work as a museum assistant with the Survey was to remove the dust of some twenty years which had already accumulated on them.

No really adequate biography of Whiteaves has yet appeared. The obituaries are sketchy both on his life and on his scientific work. Information still exists in his letter books which are still in the care of the Geological Survey and some personal documents may still be in the possession of his grandchildren, some of whom still live in Ottawa and elsewhere in Canada.

Léon Provancher (1820-1892) came from an entirely different environment. He was born at Bécancour, Quebec, and at the age of fourteen entered the Seminary at Nicolet. Here his taste for natural history was first aroused by a short chapter on Botany in a book of general science.

In 1844, having completed his studies he was ordained to the priesthood and was assigned to his native parish of Bécancour as curate (vicaire), which post he occupied until 1847. In that year typhus was raging on Grosse-Isle among the Irish immigrants quarantined there in thousands and the Archbishop of Quebec no sooner sent a priest to minister to their religious needs than his legate contracted the dread disease. Provancher was one of forty-two young priests sent to this station; of these fully half contracted typhus and four died. Fortunately, Provancher was not one of them. In 1848 he was appointed curate of St-Gervais, then successively parish priest (curé) of St-Victor, Isle Verte, St-Joachim, and finally, in 1852, of Portneuf.

In 1858 he published his "Traité élémentaire de Botanique" the first of its kind in Quebec. Many publications followed, among them his "Flore canadienne" and some publications of a religious character.

In 1868 he began publishing the "Naturaliste Canadien" and for twenty years issued it regularly, writing most of the articles himself. In 1869 he retired from active work in the church, due to failing health, and made his home first at Quebec and then at Cap-Rouge, a few miles away. In 1890 he published a list of Quebec Mollusca and his "Mollusques de la Province de Québec." Of the latter he managed to issue the Cephalopods and Gastropods

before funds ran out; the Pelecypods were never published, to my knowledge. The work is well organized and compares favorably with regional accounts of the day.

Provancher was one of those rare men who had an unquenchable thirst for knowledge and a burning desire to transmit it to others. Only by careful husbanding of every spare moment was he able to accumulate his extensive knowledge of entomology, botany, and malacology. His chosen work was that of popularizer of biology in Quebec and this he accomplished in spite of the lack of publications, money, and public support. He wrote many text-books and monographs on the natural history of Quebec, his interests ranging from plants to mammals, birds, fishes, reptiles, and Mollusca.

He died in 1892 and was buried in the parish church of Cap-Rouge but for twenty-five years his grave remained unmarked. Rev. Canon Huard, his biographer and successor as editor of the "Naturaliste," started a subscription to erect a tablet marking his grave and was finally able to place a handsome marble slab over the last resting place of one who may well be termed the "Linnaeus of Canada."

Provancher's herbarium, correspondence, and library are preserved at Laval University, Quebec, where the "Naturaliste Canadien" is still published. So far, I have been unable to find out what became of his shell collection although it is probably also at Laval.

Finally, the names of workers better known in other fields must be mentioned here. They collected shells for Dawson, Whiteaves, and Billings and their contributions to the progress of malacology must not be neglected. Some of them, for example A. H. Foord, Sir William Logan, J. A. Dresser, were prominent geologists; others, such as R. J. Fowler, William Couper, and M. de Villeneuve, had sufficient interest in natural history to collect shells but they did not, so far as I know, publish anything on Quebec Mollusca. A. W. Hanham, Frank R. Latchford, Rev. G. W. Taylor, Pascal Poirier, George E. Fairbairn, and Olof O. Nylander are mentioned elsewhere in this account although all of them either collected or published on Quebec Mollusca.

ONTARIO GROUP

Conchology has flourished at different times in three centers of Ontario, Hamilton, Toronto, and Ottawa, with a few isolated workers in other localities.

In Hamilton, the Hamilton Association had a conchological division, at least from 1889 to 1891, which consisted mostly of two enthusiastic workers, Hanham and Leslie. I have been unable to obtain any details about Leslie, but Hanham is fairly well known.

Mr. Hanham was for many years a bank manager stationed in several cities all over Canada. In the late 1880's he lived in Hamilton and actively collected shells. In 1890 he published a list for that district. In 1893 he moved to Quebec and while there collected in the Gaspé region and the vicinity of Quebec City itself. We find him at Winnipeg in 1899, publishing a list of Manitoba shells. By 1911 he had moved to British Columbia and was still active in conchology; from that date until 1926 he published a series of papers on British Columbia shells. He retired from the bank and lived at Duncan, B. C. until his death, some time before April, 1944.

W. R. McColl, of Owen Sound, collected Mollusca over a long period of years but so far as I know did not publish anything. Among other things, he discovered *Cepaea nemoralis* at Owen Sound and the variety of *Valvata lewisi* which bears his name. He corresponded with Dr. Robert Bell and died a few years ago.

The earliest list of Toronto Mollusca appears to be that of A. E. Williamson (1861); in 1872, H. A. Nicholson published a few records in his Fauna Canadensis. For many years Dr. William Brodie and Chief Justice Latchford collected in the region and in 1913 their records

were assembled by A. D. Robertson, together with a few others, and published as Chapter 21 of the Natural History of the Toronto region. Since then a few additions to the list have been made by subsequent workers.

With my good friend Jack Oughton, I have elsewhere published an obituary (La Rocque and Oughton, 1940) of Francis Robert Latchford. Both of us well remember the huge Toronto house which was his home and the comfortable study in which he graciously received two budding malacologists and talked shop over a roaring fire with them while showing them his fine collections. He was born at Aylmer, Quebec, near Ottawa, on April 30, 1856, of Irish parents. He graduated from the University of Ottawa in 1882, was admitted to the bar in 1886, and made a Queen's Counsel in 1899. From that date until 1905 he sat as member for South Renfrew in the Provincial Parliament, serving successively as Commissioner of Public Works and Attorney-General. In 1908 he was appointed a judge of the High Court of Ontario and henceforth resided in Toronto during the winter and Ottawa during the summer. In the course of a busy life he found time to collect Mollusca, first in the Ottawa region, then wherever his duties as a judge took him. He wrote over 35 papers on Mollusca. He will be mentioned again in connection with conchology in Ottawa.

Until World War II or thereabouts, Toronto was a center of activity in malacology. Toronto University, the Royal Ontario Museum of Zoology, and the Ontario Fisheries Research Laboratory sponsored work in Mollusca and many fine papers resulted, for example those of E. M. Walker on De Grassi Point, of Adamstone on Lake Nipigon, and of Rawson on Lake Simcoe, to mention only a few.

The village of Bytown, at one end of the Rideau Canal, assumed the name of Ottawa in 1855. Soon afterwards it was designated as the Capital of Canada by Queen Victoria. Naturalists appear surprisingly early in its history.

One of the earliest was Elkanah Billings, already mentioned, who published many early records of mollusks from the Ottawa region. Natural History societies were in existence in Ottawa as early as 1859 but it was not until 1880 that the first list devoted exclusively to the Ottawa region made its appearance. It was published in the Transactions of the newly founded Ottawa Field-Naturalists' Club and was by Gilbert Clifford Heron, son of an Ottawa pioneer. Heron removed soon afterwards to Kansas but not without leaving an able successor in Latchford.

The main facts about Francis Robert Latchford's life have already been given; it remains now to outline his conchological beginnings in the Ottawa area. For many years he was the leader of the Conchological Section of the Ottawa Field-Naturalists' Club. His many papers in the Transactions and the Ottawa Naturalist testify to his zeal and his considerable accomplishments both in collecting almost every species known for the area and in infecting others with his enthusiasm for conchology. Of these, Pascal Poirier, then a struggling young lawyer, later became a Senator of Canada, philologist and historian. H. Beaumont Small, who was the last of the founding members of the Ottawa Field-Naturalists' Club to survive, joined in the collecting excursions and helped publish reports on the finds of the section. James Fletcher, Botanist and Entomologist to the Dominion Experimental Farms, still found time to collect shells in his spare moments. Finally, the Rev. G. W. Taylor, who had long been in correspondence with the Ottawa group, visited the city in the late eighties. This resulted in the publication, jointly with Latchford, of the 1890 list of Ottawa Mollusca.

As mentioned earlier, it was my privilege to know Judge Latchford personally. Shortly after I published my first paper on Mollusca, I had a surprise visit from him one summer day in the thirties. In spite of his rather formal dress and his walking stick, he was very informal in manner and we were soon talking shop.

It was not long before we had arranged a field trip to White Lake for the following Sunday. The trip was a roaring success. Judge Latchford fished for Sphaeriidae with his Walker dredge and got quite a few; all together, we bagged an impressive lot of freshwater snails and clams. I saw him again a few times in Ottawa and Toronto and we carried on a correspondence almost until the time of his death.

Among Ottawa workers, Edward J. Whittaker, a geologist with the Geological Survey, developed an interest in Pleistocene and living Mollusca. His papers on marl shells of McKay Lake and other lakes in the Ottawa region gave promise of lengthier papers but his career was unfortunately cut short by an accident after he published his first papers.

For a few years after Whittaker's death conchology in the Ottawa district stagnated but interest revived briefly in the thirties. During that time I had the privilege of being associated with George E. Fairbairn who assembled a large collection, now in Ann Arbor, with Charles H. Young, "collector-preparator-specialist" in the National Museum of Canada, who had worked with Dr. J. Macoun and William Spreadborough in British Columbia and who was always ready for a foray after microlepidoptera or snails; with Claude E. Johnson, artist-naturalist with the Museum, who was also interested in collecting shells, and others, still living, who collected snails and clams for the National Museum. Their collections are a monument to their interest in conchology and are still carefully preserved in the National Museum of Canada at Ottawa.

MARITIMES GROUP

Our knowledge of the Mollusca of the Maritime provinces rests on the work of some eight men. First in importance is John Robert Willis (1825-1876) who published a list of Nova Scotia shells as early as 1857 but unfortunately in a rare periodical, the Halifax Church Record, almost unobtainable today. His second paper, a catalogue of the marine shells of Nova Scotia, appeared in the Proceedings of the Boston Society of Natural History for 1861. He published three more papers.

Willis was born in Philadelphia. His father, a native of Ireland, moved to Canada, first to Kingston, Ontario, and later to Halifax. In 1854 he exhibited a collection of Nova Scotia shells at the Nova Scotia Industrial Exhibition at Halifax, for which he was awarded a prize. He also obtained another for a collection of insects. In 1855 he opened a correspondence with Spencer F. Baird of the Smithsonian Institution which continued over many years. He also corresponded and exchanged with Gould, Stimpson, Carpenter, and Cope, among others. He presented collections of Nova Scotia shells to King's College (Windsor), Acadia College, Wolfville, the Smithsonian Institution, and the British Museum, the Boston Society of Natural History, and the Academy of Natural Sciences in Philadelphia.

He was successively appointed superintendent of the Industrial School in Halifax and secretary of the Board of School Commissioners of that city. In 1875 he retired from the latter position and found himself without an appointment and in poor circumstances. He was forced to sell his collection and this almost broke his heart. He died in 1876 and was buried in Camp Hill cemetery. Further details of his life are given by Piers (1890) in Ganong (1890) together with a detailed bibliography of his published papers.

T. A. Verkrüzen who, according to Hatton and Harvey (1883, p. 204) introduced the Leonberg dog to Newfoundland, "spent a portion of two summers in dredging and collecting Mollusca around the shores of the Island. He also visited the banks in a fishing vessel for the same purpose. The result was a collection of the Mollusca of Newfoundland of great value to science, by an able and accomplished naturalist, who is a master of Conchology. He very kindly presented to the Geological Museum of St. Johns a collection embracing specimens of ninety-two different species which he had collected and identified. He

also printed a small pamphlet containing a complete list of his discoveries." As a matter of fact there were two pamphlets, one (Zur Fauna von Neu Schotland und Neufundland) in the Jahrbucher der Deutschen Malakozoölogischen Gesellschaft and the other (Die Mollusken Neufundlands und der Neufundland-Bänke) in various numbers of Der Sammler for 1885 and 1886.

Next to appear was J. Matthew Jones, whose "Mollusca of Nova Scotia" was published in 1877. His main interest, however, seems to have been the shells of Bermuda on which he published two papers (1864, 1888).

George F. Matthew (1884), although mainly interested in anthropology, mentioned a few species of shells found in an ancient Indian village site at Bocabec, New Brunswick.

At about the same time W. F. Ganong was preparing two papers on marine invertebrates of New Brunswick waters which appeared in 1885. Ganong's works added many new species and new records for New Brunswick. In addition, his paper on John R. Willis (1890) has brought attention to an interesting personality. The Library of the Geological Survey of Canada was chosen by Professor Ganong as the repository for a copy of Willis' privately printed list of Nova Scotia shells and a number of Willis manuscripts.

The Reverend Henry W. Winkley (1858-1918) was a native of Boston. For some years he was rector of a church in St. Stephens, New Brunswick, and while there he collected shells actively. His only paper on New Brunswick shells, so far as I know, was published in 1888. All his other papers deal with New England. He died in Boston and his collections went to the Museum of Comparative Zoology, Harvard. Charles W. Johnson published an obituary in the Nautilus.

George Whitman Bailey published "The Land Snails of New Brunswick" (1903); I have been unable to obtain any further information about him but suspect that he was related (perhaps a son?) to Jacob Whitman Bailey (1811-1857) and Loring Woart Bailey (1839-1925), the latter professor of geology at the University of New Brunswick.

No account of Maritime conchology would be complete without mention of the work of Charles Ives. So far as I know, his only published paper (1907) appeared in the Prince Edward Agriculturist. Fortunately he corresponded with W. J. Wintemberg, then of Washington, Ontario, later of Ottawa, who gave me a collection of eleven of his letters which provide a few details about Charles Ives. The letters were written in the period from June 9, 1904 to March 10, 1913; three of them are undated, except for the day and month. They tell us that Ives had a large collection of shells including Prince Edward Island, New Brunswick, India, Ceylon, Africa, and Florida forms. He was a man between 40 and 50 since he had a son in the Northwest who had promised to send him specimens. In one letter he says that the weather is too stormy for outdoor work and in another he mentions that he can wield a pitchfork or a rifle more easily than a pen. He was a farmer, but his careful notes on shells and their habitat show him to have been a very unusual and intelligent observer. He corresponded with other conchologists of his time, notably Winkley, Whiteaves, and Professor Chadwick of Rochester, New York, who published a list of shells received from him in the Nautilus.

Ives was willing to place his collection of some 150 species in a museum but he regrets in one of his letters that no such institution existed in Prince Edward Island and that therefore he would probably have to keep it during his lifetime and added "God knows what will become of them after I am dead." One of his important finds was Zoögenetes harpa collected at Miscouche, the first record for Prince Edward Island, and a very unexpected one.

Olof O. Nylander (1864-1943) of Maine, collected on the tributaries of the St. John River in that state, in Quebec and New Brunswick, making known data on the Mollusca of a region of considerable interest. There is an anonymous obituary of Nylander in the Nautilus (57: 66, 1943).

GEOLOGICAL SURVEY GROUP

The Geological Survey of Canada was founded in 1842. At first the only field work was done by Sir William Logan, its director, and Alexander Murray, his assistant. Within the next two decades its staff grew until five or more parties were in the field every year. Sir William Logan, himself a naturalist of great ability, realized that survey parties were offered an opportunity to advance other sciences by collecting specimens in remote parts of Canada. From the very first, they brought in all kinds of botanical and zoölogical materials, including many shells. Among those who did much of this incidental collecting were Robert Bell, already mentioned, who collected from Lake Superior to the Gaspé Peninsula; George Mercer Dawson whose special field was the western provinces and the Yukon; Elkanah Billings, who contributed many Ottawa and Renfrew County specimens; Robert Chalmers and E. R. Faribault who collected in Nova Scotia and New Brunswick; N. J. Giroux in Quebec, Joseph Keele in the Yukon, Quebec, and the Maritimes; E. M. Kindle in northern Ontario and the Mackenzie River area; R. G. McConnell in Alberta and the Northwest Territories; William McInnes in Quebec, Ontario, and Saskatchewan; the two Macouns in almost every province of Canada; J. J. O'Neill, Owen O'Sullivan, James Richardson, A. R. C. Selwyn, J. B. Tyrrell, A. W. G. Wilson, and many more. Biographic details on these and other Canadian geologists are fully indexed in the "Bibliography of North American Geology" issued by the U. S. Geological Survey. Portraits of Sir William E. Logan, Elkanah Billings, John Macoun, and many others have been published by Collins (1928).

In 1907 the Geological Survey organized an ambitious program of dredging for marine invertebrates, first on the coast of British Columbia and then on the coast of Nova Scotia. This work was done under the direction of Professor Macoún by two industrious collectors, Charles H. Young and William Spreadborough, who accumulated vast quantities of material which was to be worked up by Dr. Whiteaves. On the latter's death in 1909, the work was undertaken by Drs. W. H. Dall and Paul Bartsch of the U. S. National Museum.

After 1909 work on invertebrates lagged until 1917 when Edward J. Whittaker, already mentioned, began to take an interest in them. Whittaker was just beginning to grasp his subject thoroughly when he died in 1924, not without having published a few papers.

The outstanding member of this group is Joseph Frederick Whiteaves (1835-1909) previously mentioned in this paper. Appointed in 1875 as Paleontologist of the Survey, succeeding Billings, he later became also Zoölogist and Assistant-Director. His most important work from our standpoint is undoubtedly his "Marine Invertebrates of Eastern Canada" which appeared in 1900, but he also wrote over 30 papers on Mollusca of Canada brought in by other officers of the Geological Survey or collected by himself. He also did much dredging in the Gulf of St. Lawrence and Gaspé Bay.

BRITISH COLUMBIA GROUP

Until the middle of the nineteenth century references to British Columbia Mollusca were few and casual. In 1866 John Keast Lord published his "Naturalist in Vancouver Island and British Columbia," the product of his observations and collections as naturalist to the British North American Boundary Commission. The Mollusca, described by Baird, are listed in the appendix of this work (p. 356) and the list contains nearly 80 species with annotations on life history and distribution. Baird had previously published much the same information in 1863.

The Reverend Mr. George W. Taylor (d. 1912) was born in Derby, England. The information on his life and work given here is from two obituaries by E. E. Prince (Ottawa Naturalist 26: 74-76, 1912; Proc. Royal Soc. Canada, 3d ser., 7: xv-xix, portrait, 1913) and one by A. W. Hanham (Nautilus 26: 83-84, 1912). He came to Canada in 1882 and soon assumed a place as an authority in entomology and

conchology. A clergyman of the Church of England, he was stationed in Ottawa, Ontario, Victoria, Nanaimo, and Wellington, B. C. Wherever he went he collected actively; for some years he gave up church work and took up residence on Gabriola Island, on the coast of British Columbia, in order to investigate the marine zoology of the nearby waters, and in the hope that a biological station would be established there by the Dominion Government. This hope was realized in 1909 when the station was founded with Mr. Taylor as its first curator, a post which he held until his death. He accumulated a vast collection of marine fishes and invertebrates by dint of much shore collecting and constant dredging expeditions. The late Dr. E. E. Prince, who went on one of these trips with him wrote: "... at every point where hauls of the dredge were made myriads of strange creatures were brought up from the depths below. From morning to night Mr. Taylor sorted out and named the specimens, usually working on deck till long after dark, aided by the light of a ship's lantern. He had such an unusual knowledge of marine zoology that he could name without difficulty a vast proportion of the hosts of molluscs, echinoderms, zoophytes, etc. and very fine collections resulted."

His conchological papers number at least eighteen, covering a period from 1889 to 1900 and their scope is very wide. The first was on the land shells of Vancouver Island; his "Canadian Land and Freshwater Mollusca" lists the sources from which a list of Canadian Mollusca could be compiled; in 1895 he published his "Preliminary Catalogue of the marine Mollusca of the Pacific Coast of Canada;" his last paper, so far as I know, was one on the discovery of *Hemphillia glandulosa* in Canada; it appeared in the Ottawa Naturalist for 1900.

Dr. Charles F. Newcombe, who died in 1924, is better known as a botanist and ethnologist but in his earlier years he was an enthusiastic collector of marine life and accumulated a large collection of Mollusca. His most important publication on the subject is his "Preliminary Check List of Marine shells of British Columbia" published by the Provincial Museum in 1893.

Around 1910 that much traveled conchologist A. W. Hanham was transferred to British Columbia by his bank; he retired after a few years and died at Duncan, B. C. some time after 1937. I had the pleasure of corresponding with him and the last letter I had from him is dated April 9, 1937. It states that he had given up all work on shells. His British Columbia work is contained in three papers, published from 1911 to 1926.

The life and work of William Healey Dall (1845-1927) are too well known to need review here. He worked up much of the material collected in British Columbia and Nova Scotia waters previously mentioned. His associate and successor at the U. S. National Museum, Paul Bartsch (1871-1960) also did much work on Canadian Mollusca. An account of his life by Harald A. Rehder appears in the American Malacological Union Annual Reports for 1960, pp. 5-6, with a portrait. We owe Dall and Bartsch descriptions and identifications of many West Coast species represented by material in the National Museum of Canada.

Mrs. Ida Shepard Oldroyd (1856-1940) of Stanford University, California, was doubly connected with Mollusca in British Columbia, first as a collector of no mean ability and second as the compiler of a work on West Coast marine Mollusca (1924, 1927) which is still invaluable to workers in that field. I had the privilege of meeting her first in Florida in 1935 and a little later when she visited Ottawa briefly on her way home from New York City.

Professor Charles H. O'Donoghue is a native of England. In 1918 he came to Winnipeg as Professor of Zoology at the University of Manitoba. For a number of years he spent his summers in British Columbia, collecting and studying the Nudibranchs of the Pacific Coast. His papers on this much neglected group added greatly to our knowledge of Pacific Coast Nudibranchs. About 1930 he returned to Scotland as Professor of Zoology at Edinburgh.

The Biological Station established by the Dominion Government in British Columbia has become a center for the study of Mollusca in that Province. It was here that Professor Macoun's party made their headquarters in 1909, here that O'Donoghue collected his Nudibranchs, and here also that Mrs. Oldroyd spent a few summers continuing the work of Taylor.

PRAIRIE PROVINCE GROUP

The first mention of Prairie Province shells is probably that of Say in the Report of Long's Expedition (1824); some of Say's specimens were from what is now southeastern Manitoba. The earliest list known to us is that of George Mercer Dawson (1875) which covered the entire boundary region from Lake of the Woods to British Columbia. Robert Miller Christie (1885) published his list of Manitoba land and freshwater Mollusca in the Leeds Journal of Conchology.

The Rev. G. W. Taylor also published two papers (1893, 1895) on the area and Hanham (1899) gave us a new list of Manitoba Mollusca. Dall's Alaska report (1905) summarized all known records for the western provinces of Canada to that date. C. C. Nutting (1858-1927) has given us a list of shells collected by him and his associates of the University of Iowa Expedition on the Lower Saskatchewan River in 1891.

Alan Mozley's work in the Prairie Provinces from 1925 to about 1932 greatly extended our knowledge of that area. F. C. Baker (1937) published a list of shells collected by T. D. A. Cockerell in Prince Albert National Park, Saskatchewan.

ARCTIC EXPLORERS

Little work has been done on the Arctic Islands of Canada, its mainland above the Arctic circle and on the marine fauna of Canadian waters north of Hudson Bay. Most of our knowledge of these areas is drawn from the work of the Arctic explorers, starting in the late eighteenth century and continuing to the present day.

First, we owe much to the Greenland group (Fabricius, 1780; Möller, 1842; Mörch, 1868; Posselt, 1898) and the Alaska group (Lehnert, 1884; von Martens, 1872; Dall, 1905) and the monumental work of von Middendorff (1861) on Siberia. James de Carle Sowerby gave us valuable records in his chapter of Richardson's "Fauna Boreali-Americana;" Oscar Boettger (1880) published a list of snails from Hudson Bay; W. G. Binney (1861) identified the shells collected by Ross, Kennicott, and Drexler in northern Canada; Isaac Lea described two species of Anodonta from Great Slave Lake; P. B. Randolph (1899) published a list of shells from the Klondike region, and Whiteaves (1881-1905) a number of lists from Ungava, James, and Hudson bays and the Yukon.

The land and freshwater fauna was summarized by W.H. Dall in his Harriman-Alaska report. Since then notable contributions have been made by the Canadian Arctic Expedition of 1913-1918. Whittaker (1924) published a list of Mackenzie River Mollusca; Goodrich (1933) gave us a list of Moose Factory Mollusca, and Mozley (1937, 1938) has published the results of his work on Arctic and sub-Arctic Mollusca.

CONTRIBUTIONS OF THE SYSTEMATISTS

Throughout its history Canadian malacology has profited from the assistance of systematists, mainly in the United States. Every one of our conchologists was in correspondence with specialists in Philadelphia, Washington, Ann Arbor, or California. The courtesy and generosity of these authorities south of the border persist to this day. In the past, Binney, Walker, Tryon, Conrad, Lea, Simpson, Dall, Goodrich, F. C. Baker, Paul Bartsch, Victor Sterki, H. A. Pilsbry, E. G. Vanatta, and many others have given of their time and knowledge to the study of our fauna. A list of the ablest living American conchologists would be

identical with that of Canada's malacological friends who continue the tradition of friendship and helpfulness initiated by their predecessors. One need only follow the current literature of malacology to appreciate their contributions to Canadian science.

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KEY REFERENCES TO THE MOLLUSCA OF ARKANSAS

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This is the second of a series of state lists of key references. The first appears in this number of STERKIANA. Additions and corrections will be welcome.

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A. La Rocque

REPRINTS OF RARE ARTICLES ON MOLLUSCA. -- D. W. Barnes "ON THE GENERA UNIO AND ALASMODONTA; WITH INTRODUCTORY REMARKS." -- American Journal of Science, vol. 6, No. 1, pp. 107-127.** (Reprinted with permission of the Editor of the American Journal of Science, Dr. John Rodgers).

(Page 107)

CONCHOLOGY

ART. VI. — On the Genera Unio and Alasmodonta; with Introductory Remarks: by D. W. BARNES, M.A. Member of the New-York Lyceum of Natural History.

[Read before the Lyceum.]

INTRODUCTORY REMARKS

The family of the Naiades, according to M. Lamarck, contains four genera of fresh water Bivales, viz. Unio, Hyria, Anodonta and Iridina. To this family belong the Dipsas of Dr. Leach, and the Alasmodonta of Mr. Say. Several undescribed species of the Genera Unio and Alasmodonta, were brought to our knowledge by the expedition sent by our government in the summer of 1820, under Gov. Cass, to explore the North Western Territory; and others have since been obtained from various sources.

Little has been hitherto been done by our countrymen in describing these interesting productions of our lakes and rivers. The only American work, of the kind, at present known, is that of Mr. Thomas Say, who published at Philadelphia in the year 1819, "A description of the land and fresh-water shells of the United States." This treatise had been previously published in Nicholson's Encyclopedia. It deserves the thanks, and ought to be in the possession of every American lover of Natural Science. It has been quoted by M. Lamarck, and adopted by M. de Ferrusac, and has thus taken its place in the scientific world.

But Mr. Say's tract, though a very commendable performance, was necessarily imperfect. The author himself has described thirty new species of univalves since the publication of his book, and a great part of the splendid collection, brought from the N. W. Territory, was unknown to him. For our first view of them we were indebted to the zeal and

(page 108)

liberality of Mr. H. R. Schoolcraft, Mineralogist to the expedition, who collected them at the expesne of much voluntary fatigue, transported them a thousand miles, and generously distributed them among the lovers of Natural Science, in New-York and Philadelphia.

A second parcel was soon after received from Capt. D. B. Douglass, Professor in the Military Academy at West-Point, and topographical engineer to the expedition, whose avowed object, in sending his collection, was that it might be arranged and described for the American Journal of Science and Arts. To this gentleman we feel ourselves much indebted, for his valuable and detailed account of the localities of his specimens. What adds to the value of these collections, is, that independent of the numerous species and varieties before unknown, the specimens of the previously ascertained species are in many instances, remarkably large and beautiful.

M. Lamarck, in the sixth Volume of his "Animaux sans Vertebres," has described twenty-six* species of North American Unionos. He was moreover in doubt of the localities of several others, which will probably be found to be American. Whether he

** Published 1823.

* For eight of these, he quotes Mr. Say's book, which contains nine.

has, as we strongly suspect, described some of our species under four or five different names, cannot be certainly determined, as his book contains no figures, and the descriptions are short and equivocal. The Unio purpureus of Mr. Say, purpurascens of M. Lamarck, is common in all our eastern waters, and has a different appearance from every locality. In the Hudson it is small and short; in the Housatonick, long and slender; in the Saratoga Lake, of middling size; in the Kayaderosseras, thick and heavy; in the Lakes of New-Jersey, large and ponderous. If these are to be made different species, we may as well make four or five different species of the common clam, Venus mercenaria, Linn. from as many different localities around New-York. They are really unlike. Not only is the appearance of the shells different to the eye of the naturalist, but also the taste of the included animals, to the palate of the epicure. Who does not know that the Indian corn Zea Mays, assumes a different appearance in every latitude from Quebec to Florida? Yet whoever thought of

(Page 109)

making these varieties, different species? We have examined shells from the localities mentioned by M. Lamarck, and compared them with his descriptions, and, if we do not mistake, he has fallen into the error of making distinctions without a specific difference. But, even if this is admitted, we shall not be disposed very severely to censure, so long as anatomical dissections have not been, and in many cases cannot be called in to decide the question; for it is, after all, upon the knife that we must depend for perfect accuracy in this and similar cases. In the mean time, it has been agreed upon by naturalists, to arrange these animals by their shells; presuming always that a different form and figure of covering belonged to an animal of a different organization. It is impossible to decide whether they are "the common children of common parents," or otherwise. This is a case precisely similar to that which occurred between Linnaeus and Lamarck concerning the Olives. "The former expressed a doubt whether there is more than one species of the Olive, and the latter has described fifty-nine."*

In most cases wherever M. Lamarck can find a difference, though by his own account, "nothing remarkable,"+ he makes a different species. Too many as well as too few distinctions undoubtedly defeat the object of the Naturalist, which is to make his readers acquainted with the productions he describes. In the present state of our knowledge we cannot perhaps do better than to take a mean course, and where the discriminations are sufficiently obvious, in important parts and essential particulars, to apply a different specific designation. This course has been attempted in the following notice of undescribed species. We have had the opportunity of examining and comparing a great number of specimens, and very rarely have we given a new specific name to a solitary individual. In cases where the contrary has, from necessity, been done, the specimens were by no means of a dubious character; but healthy, well-grown and perfect individuals, so strongly marked and distinctly characterized, as to leave no doubt.

* Dillwyn, page 514.
+ See U. Georgina and Glabrata of Lamarck.

(Page 110)

M. Lamarck has confessed the great difficulty of determining the species of the genus Unio on account of their "shading and melting into each other in the course of their variations." This difficulty is surely not obviated by short and equivocal descriptions. Short definitions may have an appearance of scientific neatness, but their brevity is an insuperable obstacle to a learner, especially when, as it commonly happens, the same terms are applied to different species. M. Lamarck applies the term ovate, either by itself or compounded with another word, to the description of thirty-two, our of his forty-eight species. Now it will be apparent to every one that, as this is made a leading feature in his descriptions, it must be the cause of endless perplexity to the unlearned, and of constant uncertainty even to the experienced. For the purpose of

discrimination it is useless, and might almost as well have been omitted, unless it had been placed at the head of a section.

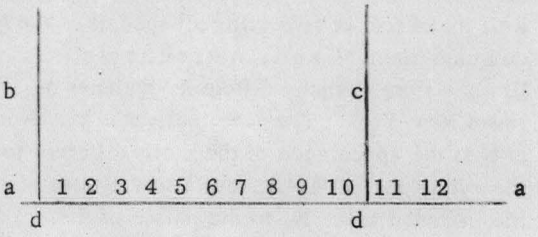
M. Lamarck dwells most on the external form, and with a great latitude of compound epithets, he has not succeeded in making his descriptions intelligible, without danger of mistake to those who have not seen his specimens. Ten or twelve latin words cannot so describe a Unio as to identify it, and distinguish it from all others. We have therefore adopted full descriptions, the obvious utility of which needs no comment. If short definitions are insufficient, full descriptions become absolutely necessary. M. Lamarck, generally mentions the breadth of shells in Millimetres, which we have reduced to inches and lines, or what is the same thing, to inches and decimals. The multiplier .039371, which multiplied by any number of Millimetres gives the corresponding English expression, as, Unio Crassidens 105 Millim. 105 X .039371 = 4.133955 or four inches and 1 line. Dividing the English inches by the multiplier, will reduce Mr. Say's measures to M. Lamarck's by which means they may be more readily compared. For ordinary purposes 12.5 Millim. to half an inch, and 4 inches to 100 Millimetres, will be sufficiently exact.

But the breadth, or as Lamarck often says the "apparent length" of the shell is useless without the length; for two shells may be of the same breadth, and yet differ totally in their other dimensions. For instance, the U. Crassus and U. Nasutus may each be 26 lines broad; but the Cras-

(Page 111)

sus may be as long as it is broad, while the Nasutus is only 1 inch, or 10 lines long. The former may weigh more than half a pound, the latter less than half an ounce. The former may be half an inch thick, the latter, as thin as paper. And to say that one is broad and the other narrow, does not obviate the difficulty; for these terms are altogether comparative, and, without something for a standard, convey no definite ideas.

We have therefore adopted an improvement which we hope to see become general in the description of Bivalves, that is, to give the length from the summit to the opposite margin; the breadth between the lateral extremities, and the diameter through the disks, at right angles to both the length and the breadth; that is, the thickness through the most prominent part of the body of the animal. We prefer the term diameter to thickness, because the latter is often applied to the substance of the shell; the former never. In determining these dimensions with ease and accuracy, we have constructed a convenient instrument of the following description;



a, a, is a box-wood ruler, one foot long, graduated on its upper side, in inches and lines, b, c, cross bars, made to stand at right angles, and drop down by hinge joints, d, d, upon the ruler, for the convenience of packing. The bar, c, d, slides upon the ruler by means of a clasp. The shells, to be measured, are placed between the bars, and the length is read off from below. The instrument measures any irregular body or figure, from one line to one foot in diameter. When used for measuring shells, it may be called a Conchometer.

One advantage of thus measuring shells, is, that those of the same species, or the same variety, will be found to have very nearly the same proportions which will hold good as it regards all the varieties of age. These proportions may be

(Page 112)

called the law of the species, and every Unio which has the same proportions, may be presumed to belong to the same species.

Another obvious advantage of this method will appear in the following remark. The Unio which we have designated praelongus, is perhaps the Unio purpurata of M. La-

marck, all the terms of his description may be applied, and probably with truth, to our shell. But then, he "believes that his shell came from the great Rivers of Africa." This caused a doubt. Had he stated the very remarkable proportions of our shell, the identity would have been instantly determined. Had he stated the proportions at all, there could have been no doubt. We have put it into his power to settle the question with certainty.

Writers on Conchology differ very much concerning the right and left, and the base of Bivalves. M. Lamarck and the authors of the New Edinburgh Encyclopedia consider the beaks as the base, and the opposite parts, the upper margin: and they give the following direction for right and left. If the shell is placed upon its base or hinge, with the ligament behind, then the right and left sides of the shell will correspond with those of the observer. Burrow on the contrary considers the opposite part to be the base, and the beaks, the summit, and says, "If the shell be placed on its base, with the area in front, and the valves be then divided, the right valve will be opposite the left hand of the examiner, and the left valve opposite the right." By placing a Bivalve in the manner directed, it will be perceived that the two are directly opposite, the right of one is the left of the other. The view which we have hitherto had of these parts, and with which Mr. Say agrees, is expressed in the following directions: Place the shell upon its base with the beaks upward, and the ligament before, (that is from the observer,) the right and left valves of the shell will correspond with the hands of the observer. With due deference to the high authority of M. Lamarck, there seems to be a propriety in calling the base of a Bivalve, that part which is downward, and from which the foot projects when the animal is in motion. But when the Unio does not, as some authors seem to suppose, move on its beaks. The beaks are upwards, and should therefore be called the back rather than the base. This makes a simplicity, in the language of Con-

(Page 113)

chology, which is very desirable in every science, that the same terms should have a uniform meaning. Having learned in univalves what is the mouth and what is the base of a shell, we apply the same terms to bivalves; but to call the thin, sharp, unconnected edges of a shell, the dorsum or back would sound very strangely. M. Lamarck has not ventured on so strange an expression; but says commonly the upper margin, the same that Mr. Say calls the "basal edge." According to this view of the subject we should agree with M. Lamarck and the Encyclopedia as to right and left, but not as to base; and with Burrow as to base, but not as to right and left. We call the connected part of a bivalve the back and the opposite the base.

If this is determined, there will remain another point to be settled. Authors have very generally agreed in calling that side of the beaks in which the ligament is situated, the anterior, and the opposite, the posterior. "But rigidly speaking," says Mr. Say, "we seem to be all wrong in our adaptation of these relative terms, because the latter is used to indicate that part of the shell which covers the mouth of the included animal, and which is foremost in its progressive movements. In order to be correct in descriptions where the animal is referred to, these terms must be reversed, and if in descriptions which have reference to the animal, certainly the principle applies to all other bivalves, in which the mouth is similarly situated. The mouth ought always to be considered as in the anterior. For this reason, Cuvier reverses the term right and left, applying the former to that valve of the Unionès which has but a single lamelliform tooth, and which is our left valve.* He of course, reverses the anterior and posterior as now applied."+ It would surely be deemed safe to follow an author so pre-eminent as M. Cuvier, and this mode of viewing the shell is doubtless most conformable to nature; but as all other authors have a different view, we have resolved, for the present, to adopt the established usage of the term anterior and posterior, and to follow M.

*This agrees with Burrow. + Mr. Say's MSS.

Lamarck as to right and left.

If we rightly understand the celebrated French Naturalist, he is under a mistake in saying that the Uniones "keep

(Page 114)

themselves buried in the mud, having their beaks turned downward."* If he means by this that they are usually concealed, or that they lie on their beaks; we remark that, as it regards those of our country, such is not the fact. In winter they may bury themselves, but in summer we have found them, generally, when at rest, standing with the posterior side inserted obliquely, and the hinge margin the anterior slope, and a small portion of the basal edge exserted. Even when they sink below the surface the place of their retreat is conspicuous. In streams which have a rough bottom, and rapid current, they choose the narrow crevices between the stones or under the edges of rocks, and thus defend themselves from injury. We have never found a live Unio on its back, or on what M. Lamarck and his followers would call the base.

While standing in the position above described, they have the anterior side slightly gaping, but on being touched they instantly close. They are usually found in company, rarely solitary; and the sand of the bottom is often marked with little furrows made by their passing from place to place. They advance with the posterior end foremost, and the decorticated beaks, seen through the water, bear a strong resemblance to the eyes of a large animal. Deterville says "they have been observed to live for several months of the summer in clay too hard to be cut by the hoe, and with but momentary showers to refresh them." This, if it be a fact, must rest, for the present, on his authority; as we know of no one who has confirmed it by observation.

We know but little concerning the generation and propagation of the species of Molluscous animals that inhabit these shells. They are generally supposed to be hermaphrodite per se. If they are really and absolutely so, the number of species must be exceedingly great. M. Lamarck supposes that they are propagated by means of a fecundating fluid emitted into the water. If so, they must be male and female. What reason he has for this supposition, we are not informed, but if it be admitted, it will readily account for the numerous varieties of these animals, and it will show also that they are merely varieties, and not different species, that is, they will prove to be the "common

(Page 115)

children of common parents, and as much like them as they are like each other." If the fecundating fluid, emitted by the male, be received by the female, a variety intermediate between them, will be produced. By a second propagation, by one of the parents and the intermediate, a new variety, less different from the former one, than that was from its parents, will be again produced, and so on, in an endless succession of innumerable varieties. The admission of M. Lamarck's supposition would confirm the thought which has frequently and very forcibly struck us, that, properly speaking, there is but one species of the whole genus; and perhaps of the whole family. There is yet wanting a series of minute and well-directed observations on the habits and manners of this interesting tribe of molluscous Bivalves. In the mean time we must follow our guides at the hazard of being sometimes misled.

Brugière established the genus Unio, but his original observation on this subject we have not been able to find. The word signifies a pearl, because "many of them produce very fine pearls,"* and nearly all of them have a pearly inside called naker or mother-of-pearl. Pliny in his Natural Hist. Lib. IX, Cap. 35, entitled Quomodo et ubi inveniuntur, margaritae, uses the word, gives the reason for its derivation, and makes it constantly masculine. In this he is followed by our countryman Mr. Say who makes it always of the masculine gender except in that species for which he gives credit to M. Le Sueur. Why the celebrated and accurate M. Lamarck, has chosen to make it feminine, we cannot even conjecture. Order of description. No certain order has hitherto been adopted by Naturalists in

* Ils se tiennent enfoncés dans la vase, ayant leurs crochets tournés en bas." -- Lam. An. S. Vertebres, Vol. VI. page 70.

their description of Bivalves. The descriptions both of M. Lamarck and Mr. Say are without a definite method. Though they generally begin with the outline of the shell, yet they throw together promiscuously the other parts, both internal and external. I propose to reduce this subject to order in the following manner. In examining a bivalve, the first thing that strikes the eye of the observer is the outside, the second is the inside. Hence the description will be divided naturally into two parts, the External and the Internal. As it is by the interior that we determine the genera of the Naiades, as

*M. Lamarck.

(Page 116)

well as of many Oceanic Bivalves, it might seem most proper to commence with that part in describing. But as the generick characters, standing at the head of the genus are supposed to be known, and are therefore not enumerated in the description, and as the method of commencing with the exterior has been generally adopted, we have not deemed it necessary to depart from the established usage. The parts are two, viz.

(A.) EXTERNAL (B.) INTERNAL.

Each of these comprehends three divisions, viz. I, Form, II, Color, III, Surface. With sub-divisions as follows, viz.

A. EXTERNAL

I. FORM AND SUBSTANCE includes

1. General outline or circumference.
2. Substance of the shell.
3. Disks, right and left.
4. Sides, anterior and posterior.
5. Umbones or bosses
6. Beaks.
7. Ligament.
8. Lunules, anterior and posterior.
9. Eight margins, viz.
   a. Hinge, or dorsal.
   b. Basal.
   c. Anterior.
   d. Posterior.
   e. f. Anterior, dorsal and basal.
   g. h. Posterior, dorsal, and basal.

II. COLOR of Epidermis.

III. SURFACE

B. INTERNAL.

I. FORM of

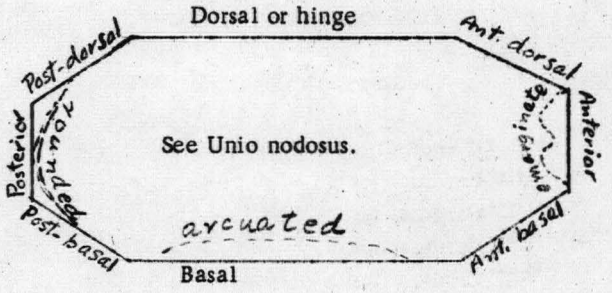
1. Cardinal teeth.
2. Lateral teeth.
3. Muscular impressions, or Cicatrices.
4. Cavity of the beaks.

(Page 117)

II. Color of Naker.

III. SURFACE.

The eight margins explained. Every Bivalve shell may be supposed to be circumscribed by an octagon, which will be more or less irregular, according to the shape of the shell. The eight sides of the octagon will represent the eight margins, as will be seen by the following figure.



This distribution of the circumference of the shell, tends very much to precision in the language of description, for if it be said that any particular margin is rounded, arcuated or emarginate, the part intended cannot be mistaken. To go into an explanation in general, of terms used in description, would carry us too far from our present purpose. We refer to Burrow.

We come now to the description of species of the Unio, which we propose to distribute into five* sections, by the form of the Cardinal teeth.

UNIO.

Generick character from M. Lamarck.

Shell transverse,[1] equivalve, inequilateral, free, beaks decorticated,[2] somewhat carious, (presque rongés) Posterior

*M. Lamarck makes two sections, the principal distinction of which is, non en crête and en crête, applied to the Cardinal tooth.

(Page 118)

muscular impression compound, hinge with two[3] teeth in each valve; the Cardinal one, short, irregular, simple or divided into two, substriated; the other elongated, compressed lateral, extending beneath the corselet. Ligament exterior.

1 & 2, Generally, but not always when young.

3, Others consider the divisions as separate teeth.

Divisions.

A. Cardinal teeth direct.

B. Cardinal Teeth, Oblique

Sections.

A { * Cardinal teeth, very thick.
** Cardinal teeth, moderately thick.
*** Cardinal teeth, small.

B { **** Cardinal teeth, broad, compressed.
***** Cardinal teeth, narrow, compressed.

*Cardinal teeth, very thick, direct.

Species.

1. Unio Crassus. Fig. 1 { a. inside. b. outside.

Shell very thick, tumid; Cardinal teeth, lobed, angulated; Posterior cicatrix, deep, rough.

Unio Crassus. Mr. Say.
Unio Crassidens. M. Lamarck.
Mya ponderosa? Mr. Dillwyn p. 51.
Mr. Say's Amer. Conch. pl. 1, fig. 8.

Habitat. The Ohio, Mississippi, and the Lakes. Diameter 2.4 Length 3.2 Breadth 4.8 inches.

My Collection.

Shell oval, ponderous, rounded behind, angulated before; Epidermis blackish brown; surface waved. Cardinal tooth deeply sulcated; anterior cicatrix wrinkled and striated; Naker pearly white and iridescent.

Remarks.-- The varieties of this shell are numerous, and they differ considerably in form and surface. In some, the beaks are large, prominent, re-curved, projecting backwards

(Page 119)

with a deep cavity beneath. In others, the beaks are flat, slightly elevated, having only a small cavity within.

Varieties.

(a.) Oval. Mr. Say's book, pl. 1. fig. 8.
(b.) Ovate. Mr. S.B. Collins' collection, hab. Ohio.
(c.) Triangular, do. do. do.
(d.) Quadrangular. My collection.
(e.) Orbicular. Mr. Collins's collection.
(f.) Undulate. do. do.
(g.) Rugose. do. do.
(h.) Radiate. Mr. Say's collection Philadelphia, Ouisconsin.
(i.) Unio, giganteus. Mississippi. Dr. Mitchill's collection.
(k.) Deeply folded. Maj. Delafield's collection.
(l.) With the cardinal tooth oblique. Mr. Collins's collection.

Variety (c.) has the beaks projecting and recurved : cicatrices deep ; primary tooth deeply sulcate ; lateral tooth long, high, and crenulate. It approaches our Unio Undatus.

The variety (i.) deserves particular notice. A single valve sent by Professor Douglass to Dr. Mitchill, weighs fifteen ounces. It is in every respect, a gigantic shell. The distance between the points of the two lobes of the cardinal tooth, is one inch; the length of the lateral tooth, three inches ; diameter of the posterior cicatrix, one inch, and its depth one fourth of an inch. This shell of which four specimens were obtained by the N. W. Expedition, might perhaps constitute a separate species under the designation of Unio giganteus. It is three times the size of the largest Unio Crassus, mentioned by Mr.

Say and M. Lamarck. Three specimens.
Diam. 2.9 Length, 4.8 Breadth 7.2 inches.
3.0 4.6 7.0
3.1 4.7 7.1 are
preserved in Dr. Mitchill's cabinet. Another specimen

Diam. 2.9 Length 4.9 Breadth 7.0 and weighing fourteen ounces, is preserved in Gov. Gass's collection, Detroit. Hab. The Mississippi near Prairie du Chien. Prof. Douglass.

Variety (k.) has the Epidermis dark brownish red, and the shell is deeply folded like U. Plicatus. Hab. Lake Erie.

(Page 120)

Maj. Delafield's collection.

Diam. 1.7 Length, 2.3 Breadth 3.1

Remark. -- This shell is thinner than specimens of the same size usually are.

2. Unio Undulatus. Fig. 2 {a. inside. b. outside.

Shell rhombick ovate, with numerous waving folds radiating from the beaks.

Unio Peruviana ? M. Lamarck.

Taken by Mr. Collins in the Ohio and preserved in his collection.

Diam. 1.9 Length, 3.4 Breadth, 4.6

Shell thick, very short and obtusely rounded behind; beaks slightly elevated; hinge-margin sub-alated, compressed, carinated, distinct with a furrow on each side; anterior dorsal margin sub-truncate; Epidermis blackish brown; surface finely wrinkled transversely; wrinkles becoming lamellar on the anterior side; oblique folds deeply indenting the anterior margin; waves largest and deepest below, not extending to the anterior dorsal margin, fine, numerous, curved upwards, and extending to the ligament above; longitudinal furrows extending from the beaks to the anterior dorsal margin; decussating the oblique waves; the lowest furrow deepest, the other somewhat obsolete; disks tuberculated below the beaks. Cardinal teeth sulcated; posterior cicatrix very rough and deep; Naker pearly white, irregularly spotted with brownish green.

Remark. -- A large and very beautiful shell.

3. Unio Plicatus. Fig. 3. {a. inside. b. outside.

Shell sub-quadrangular, tumid, sinuous before with distant oblique folds; hinge-margin elevated, compressed, carinated.

Unio plicata. Le Sueur. Mr. Say.
Unio Rariplicata. M. Lamarck.
Hab. Ohio, Mississippi, and Ouisconsin.

(Page 121)

My collection. Cabinets of Lyceum and Dr. Mitchill. Mr. Say's cabinet, Philadelphia.

Diam. .75 Length, 1.0 Breadth, 1.3 inches.
1.35 1.9 2.4
1.9 2.3 3.2

Shell thick; posterior side very short, obtusely rounded; anterior side compressed, wedge-shaped; beaks very prominent, large rounded and projecting backwards nearly as far as the posterior side; ligament passing under the beaks, anterior lunule distinct and marked with longitudinal furrows; hinge margin alated, compressed, carinated; epidermis green, becoming blackish as the shell advances in age; surface glabrous, deeply folded; folds indenting the anterior basal edge. Cardinal teeth crenate, sulcate; posterior cicatrix rough; cavity of the beaks deep and directed backwards. Naker very white, tinged on the anterior side with rose colour; surface polished and on the fore part iridescent.

Remarks. -- In young specimens the folds are visible on the inside, but in older ones the edge is not even indented. This shell very much resembles the variety (d.) of the Unio Crassus. Both shells will stand erect when placed on the posterior side, being supported by the projecting beaks. M. Lamarck observes that his Rariplicata is nearly allied to his Peruviana, but if we have not mistaken his short definitions, they are much more unlike than the two above mentioned. Our undulatus will not stand on the posterior side, as the beaks project very little.

4. Unio Undatus. Fig. 4. { a. inside. b. outside.

Shell, sub-triangular, sub-longitudinal, very tumid, waved; lateral teeth, two in each valve.

Unio Obliqua? M. Lamarck.

Hab. Ouisconsin and Fox Rivers. Mr. Schoolcraft.

Dr. Mitchill's cabinet. My collection. Mr. Say's collection.

Diam. 1.5 Length, 2.1 Breadth, 2.2

Shell thick, disks swelled behind; depressed before; anterior side slightly produced, rapidly narrowed, angulated; beaks projecting backward nearly as far as the posterior

(Page 122)

side, elevated, and recurved, with the ligament passing between them; anterior lunule long-heart-shaped, and separated by a slightly elevated heel; hinge margin depressed, between the beaks; basal margin waved and rounded behind, compressed in the middle, angulated before; epidermis horn-color, exhibiting a light yellowish green where the surface is worn or rubbed, wrinkled and finely striated transversely; surface glabrous. Cardinal teeth deeply sulcated and crenated; lateral teeth two in each valve: internal or lower one of the left valve small, but distinct and elevated, and both marked with fine dotted striae. Muscular impressions deep, posterior one rough. Naker pearly white.

Remarks. -- This shell, as will be seen by its dimensions, has a more globose form than perhaps any other Unio. It will stand erect on the posterior side, and in this position has something of a pyramidal appearance.

Variety (a.) Shell less, very slightly compressed, anterior lunule much flattened, and the separating heel more elevated. No posterior lunule; transverse wrinkles deeper; hinge bent to nearly a right angle. Teeth somewhat compressed. Naker, pink or flesh colored; surface polished and iridescent.

Diam. 1.0 Length, 1.4 Breadth, 1.6

Dr. Mitchill's Cabinet.

Remarks. -- This shell differs in so many particulars from the former that we might have given it a different specific designation, had we not been averse to doing that in the case of solitary specimens. The double lateral tooth of the left valve is distinct.

5. Unio Cornutus. Fig. 5. { a. inside b. outside. c. Posterior slope.

Shell sub-orbicular, divided longitudinally by a regular row of large, distant tubercles.

Hab. Fox River. Schoolcraft.

My Collection.

Diam. 1.0* Length, 1.7 Breadth, 1.8

*Exclusive of the horns.

(Page 123)

Mr. Collins' collection contains a specimen from the Ohio of the following dimensions.

Diam. 1.0 Length, 1.5 Breadth, 1.8

Shell thick, rounded behind, sub-biangulate before. Beaks somewhat elevated and nearly central, with the ligament passing between them; anterior lunule long-heart-shaped, compressed, distinct by a roundish elevated ridge which ends in a projection on the anterior margin, and marked by small transverse, sub-nodulous wrinkles, and obsolete longitudinal furrows; surface waved and on the fore part compressed; a regular row of large, distant, elevated and transversely compressed tubercles, extends from the beaks to the basal edge, dividing the shell into two nearly equal parts. Cardinal teeth, sulcated. Naker, pearly white, and iridescent.

Remarks. -- This shell resembles the last in its color, outline, and glabrous surface. The teeth very much resemble those of the last, and there is also in the left valve, the rudiment of a second internal lateral tooth. The principal difference is in the smaller size of the present shell, and the remarkable row of horns, which furnish the specific designation. These horns are not opposite each other, but alternate, and the highest one is in the right valve, nearly as high as the summit. In both the above mentioned specimens, the number of horns is three on each valve, and the rudiment of a fourth on the extremity of the basal edge. We rarely find shells from different and distant localities so much alike. Almost the only difference is in the elevation of the beaks of the former being greater than that of the latter. Exclusive of the beaks, the length, breadth and diameter of the shells, is precisely the same.

6. Unio Verrucosus. Fig. 6 { a. inside b. outside

Shell sub-longitudinal, sub-truncate before, irregularly tuberculated; tubercles transversely compressed; inside brownish red.

Hab. Ouisconsin River. Mr. Schoolcraft
Lake Erie. Major Delafield.
The collections before mentioned.

Diam. .9-1.6 Length, 1.7-3.05 Breadth, 1.95 - 3.15

Shell sub-quadrangular, thick, rounded behind, biangulate and sub-truncate before; beaks elevated and recurved

(Page 124)

ligament deeply inserted between the valves; hinge-margin nearly straight, compressed alated, heel-shaped, and making an obtuse angle with the anterior margin; basal margin rounded; epidermis light green, tinged with reddish brown; surface of the anterior part studded with irregular transversely compressed tubercles. Cardinal teeth crenated or sulcated; cavity of the beaks very deep, compressed angular and directed backwards under the cardinal tooth; Naker brownish red with a tinge of blue, or light chocolate colored, slightly iridescent on the anterior part; the other dull and not highly polished; posterior muscular impression deep and rough.

Variety (a.) has the epidermis of an uncommonly light green without the brown tinge.

Hab. Lake Erie. Major Delafield's collection.

Diam. .8 Length, 1.65 Breadth, 1.9

Variety (b.) is a slender and rather thin shell; epidermis very pale green; Naker pearly white, polished and iridescent.

Diam. .9 Length, 1.6 Breadth, 1.9

Locality and authority as before.

Remark. -- If a straight line is drawn from the beak to the base, through the cardinal tooth, it will divide the tuberculated from the smooth part of the shell, in all except the variety (b.) in which the tubercles extend a little farther back.

7. Unio Nodosus. Fig. 7 { a. inside. b. outside.

Shell, sub-quadrangular, sub-longitudinal, emarginate before, knotted, ridged, corrugated; lateral tooth terminating abruptly.

Hab. Ouisconsin. Mr. Schoolcraft.
Collections of Lyceum and Dr. Mitchill. My Collection.

Diam. 1.8 Length, 2.5 Breadth, 3.0

Shell, thick and ponderous, short and very obtusely rounded behind; beaks distant, elevated, eroded, chalky or greenish white, with the ligament passing between them. Anterior lunule, compressed, wedge-shaped, separated by a deep groove, ending in the emargination in front. Hinge-mar-

(Page 125)

gin, straight with the beaks projecting above it; anterior dorsal margin rounded; anterior margin emarginate; anterior basal margin; compressed and a little shortened, basal and posterior margins rounded. Epidermis horn color, surface irregularly corrugated and tuberculated all over, except a small portion of the posterior side. Tubercles largest near the centre of the disks, and often eroded; a strong, elevated and nodulous ridge extending from the beaks to the anterior margin and projecting in front. Cardinal teeth sulcated and crenulated. Lateral teeth short, thick, rough, crenated and terminating abruptly at both ends. Cavity deep and angular admitting the end of the fore finger.

Remarks. -- The breadth from the emargination to the posterior side is equal to the length of the shell. Two specimens in the Lyceum's cabinet are wrinkled regularly and beautifully across the transverse striae on the anterior lunule, giving to that part, a feather-shaped appearance. Other specimens have the lunule wrinkled and granulated. This shell will stand on the posterior side though not quite erect, but leaning towards the hinge.

8. Unio Tuberculatus. Fig. 8. {

Shell, long-ovate, surface corrugated, waved tuberculated, ribbed. Disks compressed, base falcated.

Hab. Ouisconsin, Prof. Douglass.
Cabinets of Lyceum and Dr. Mitchill.

Diam. .7	Length, 1.3	Breadth, 2.4
1.3	2.3	4.2
1.3	2.4	4.5

Shell thick and rugged; anterior side compressed, narrowed thin; posterior side rounded, short, obtuse, and broader than the interiour. Beaks flat, placed about two ninths from the posterior end; ligament higher than the beaks; hinge-margin nearly straight, elevated, compressed and carinate before; basal margin compressed, falcated; anterior dorsal emarginate, anterior basal, projecting; anterior margin narrow and rounded. Epidermis dark brown or horn color. Surface thickly and irregularly tuberculated, tubercles elongated longitudinally; those near the base larger; an elevated ridge extending from the beaks and

(Page 126)

projecting on the anterior basal edge; irregular profound, nodulous undulations radiating from the elevated ridge to the hinge and anterior margin. Cardinal teeth crenated; lateral teeth long and striated; posterior muscular impression deep, and the anterior half of it rough. Cavity, angular compressed, directed backward under the cardinal tooth, admitting the end of the finger. Naker pearly white, with irregular spots of greenish, iridescent on the fore part.

9. Unio Rugosus. Fig. 9.

Shell broad ovate; surface wrinkled tuberculated, ribbed, waved; disks swelled; base falcated.

Hab. Ohio. Mr. Collins.

Mr. Collins's Collection.

Length, 2.3 Breadth, 2.9 Diam. 1.5

Shell narrowed, compressed and thin before; short, obtuse, rounded and wider behind; beaks slightly elevated; ligament more elevated than the beaks; hinge-margin compressed, carinate; basal margin falcate, emarginate, and compressed; anterior margin subangulate; anterior dorsal margin sub-truncate, nearly straight; anterior, basal margin projecting. Epidermis dark brown, under the epidermis pearly white. Surface rough and scaly, wrinkled transversely and waved longitudinally, having distant irregular transversely compressed tubercles; a broad nodulous elevated somewhat double ridge extending from the beaks to the anterior basal edge, and projecting on that part; a broad furrow or wave behind the ridge ending in the emarginate basal edge; and a furrow before separating the anterior lunule; small oblique waves radiating from the ridge to the hinge and anterior dorsal margin. Cardinal teeth sulcated; lateral tooth striated rough and in the left valve somewhat double: Posterior muscular impression deep and partly rough. Cavity of the beaks angular, compressed and directed backward under the cardinal tooth. Naker pearly white, and on the fore part iridescent.

Remarks. -- This shell agrees in some parts of its description with the U. Tuberculatus. It is, however, while of the same length, of only a little more than half the breadth, and yet of longer diameter. The tubercles, also are very different. In the U. Tuberculatus they are compressed lon-

(Page 127)

gitudinally, in this transversely, in that they are crowded and small: in this they are distant and rather large. The elevated ridge in that is higher and narrower; in this it is broader and more depressed; in that it continues of nearly the same breadth to the base; in this it diverges at the base, to about four times its breadth at the beaks. The shell above described has the appearance of age. The tubercles, as well as the beaks are much corroded, and the epidermis is cracked and broken in many places.

Remarks on the first section, viz.

*Cardinal teeth, very thick.

To this section belong the U. Peruviana, ligamentina and obliqua of M. Lamarck, and the U. Cylindricus? of Mr. Say. The shells in this section bear in many respects, a resemblance to each other. They are all thick, and have a very strong hinge, with, in most cases, deeply sulcated cardinal teeth, and a cavity under the beaks, more or less angular and compressed, extending under the cardinal tooth. They are nearly all waved, wrinkled, or tuberculated on the outside. From the last two characters, however, some varieties of the U. Crassus are ex-

excepted, which have little or no cavity under the beak, and a small external surface.

It may perhaps be thought that we have made too many distinctions in this section, and that several of the foregoing ought to belong to the U. Crassus, but they are much more unlike than many which are admitted to be distinct species, and therefore they require a separate description. And when it is observed that we have not yet enumerated all that have been supposed to belong to the numerous family of the Crassus — that the ascertained varieties of that species have already been described to the number of eleven from (a) to (l) inclusive; and that among these varieties are several which M. Lamarck has described as different species — and that the foregoing are all very distinct from each other, so as to be instantly recognized by even an inexperienced observer — we shall perhaps be justified in discriminating the above, and several others also, which belong to the next section.

(To be continued.)

EDITOR'S NOTE. The second part of Barnes' paper will be reprinted in a future issue of STERKIANA, together with the places illustrating both parts.

A. L.

ERRATA

Page 3, right hand column, para. 2, line 9, for "with" read "will"
Page 9, left hand column, para. 4, line 1, for "paruvs" read "parvus"
Page 35, right hand column, para. 2, line 5, after "Edward" add "Island"
Page 51, Editor's note, line 2, for "places" read "plates"