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THE NAUTILUS

THE PILSBRY QUARTERLY
DEVOTED TO THE INTERESTS OF CONCHOLOGISTS

EDITORS AND PUBLISHERS

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THE NAUTILUS

Vol. 80 July, 1966 No. 1

MESODESMA ARCTATUM: FOSSIL AND LIVING SPECIMENS ON NANTUCKET

By JOHN D. DAVIS
Department of Zoology, Smith College

Nantucket Island is one of the few places on the Atlantic Coast where fossil specimens of *Mesodesma arctatum* (Conrad) 1831 can be found near living populations of the clam. In fact, the proximity of these two sources of valves has probably led to mixing of fossil and present day specimens in museum and personal collections. Some references in the literature list Sankaty Head as a collecting site for either living or fossil specimens of *M. arctatum*. In August 1964, I spent a week collecting on Nantucket hoping to determine the present distribution of *M. arctatum* on the Island and to find out, if possible, whether the Sankaty Head area did yield both fossil and living specimens of this bivalve mollusk.

Sankaty Head fossil deposits were first described by Desor (1849). Later discussions included Shaler (1889), Curtis and Woodworth (1899), Wilson (1905, 1906), and Cushman (1906). The deposits were determined to be Post-Tertiary and more specifically described as Pleistocene and Post-glacial. Some disagreement developed on the manner in which the deposits were formed. Curtis and Woodworth (1899), particularly, argued that the material had been moved to the present location from another by ice action. This hypothesis is supported to some extent by the fragmented nature of much of the material.

In August 1964 the following intertidal areas were examined: (1) South Beach at Madaket, from Long Pond west to the new cut on Smith's Point, then one-fourth mile north toward Jackson's Point; (2) One and one-half miles of South Beach eastward from the end of Hummock Pond; (3) South Beach, one-quarter miles each side of bathhouse at Surfside; (4) South Beach, one-half mile east from Tom Nevers Head; (5) Siasconset Beach, from public parking area north nearly two miles; (6) Eastern Beach, five miles from Great Point to Wauwinet; (7) Wauwinet, one-quarter mile of harbor beach; (8) Beach at Pocomo Head; (9) Public beach area at The Jetties; (10) One-half mile of beach at Dionis. A few shells of *M. arctatum,* obviously recently vacated, were found on Great Point north of the narrow neck known as The Gauls. Similar shells were found more abundantly on South Beach east of Tom Nevers Head, at Surfside, near Cisco and Mioxes Pond and near the end of Hummock Pond Road. In addition, one live specimen, 31 mm. long, was found in the surf at Surfside. Careful collecting did not yield any beach shells of *M. arctatum* at Sankaty Head.

The Sankaty Head fossil desposits were examined on two occasions. Apparently recent beach erosion had sufficiently undermined the banks to cause the surface layers to slide down to the beach, thus exposing again portions of the fossil deposits. The bank in front of the present Sankaty Head Lighthouse was examined up to 30 ft. above the beach. Many shell fragments were found, but few whole valves were unearthed. Only one valve of *M. arctatum* was identified, and I could not detect any stratification of the bank described in earlier accounts.

M. arctatum does not appear to live in the area adjacent to Sankaty Head today. Instead, it is probably most abundant in shoal areas immediately offshore at Great Point, Tom Nevers Head, and between Surfside and Hummock Pond. Each of these areas is the site of a "rip" or shoal extending outward nearly at right angle to the beach line. The rips at Great Point and Surfside [Hummock Pond] are prominent enough to have earned names; the former is known on charts as Point Rip, the latter as Miacomet Rip. These areas can be located at low water by a line of white water and surf curving away from shore.

The possibility of confusing beach shells and fossil material is well illustrated by this situation on Nantucket and points up the desirability of basing distributional records on living material whenever possible.

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LIFE HISTORY AND POPULATION STUDIES OF ACHATINA FULICA

By WILLARD KEKAUOHA[1]

The purpose of this paper is to present certain findings regarding the Hawaiian form of *Achatina fulica* Bowdich: (1) period of egg production; (2) reproductive potential; (3) frequency of ovulation, period, capacity and viability; (4) viability of aborted eggs; (5) growth, aestivation and self-fertilization; and (6) census of two local populations.

Determining the Period of Egg Production.

Egg production was determined by fracturing the snails with a hammer following the "smash" technique suggested by Dr. Yoshio Kondo, Malacologist, Bernice P. Bishop Museum. A total of 5945 specimens between 50 and 125 mm. in length were examined to determine the number of egg-bearing snails from the three neighboring locations: Kahuku, Laie and Hauula on Oahu for the 1964 and 1965 seasons (Table I). No attempt was made to count the number of eggs in each individual snail during the June 1964 to July 1965 test. However, the number of eggs ranged from 50 to over 100 per specimen. In the 1965 season the eggs in snails killed ranged from 79 to 269 per specimen.

Data collected over a period of 18 months (Table I) show that the 1964 egg-laying season for *Achatina* was from June to December while the egg-laying season for 1965 was from May to November.

The data on egg production (Graph A and Table I) disclose the following significant points: (a) egg-laying commenced on June 30, 1964 (2% of snails killed had eggs); there was a small increase on August 24 (6%) followed by a drop on October 5 (5%); (b) there was a steep rise to November 14 (14.1%) and

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[1] Science Teacher, Kahuku High School. This research was supported by a grant (G.E.-7606) from the National Science Foundation as part of the Research Participation for High School Teachers Program conducted by the University of Hawaii.

TABLE I

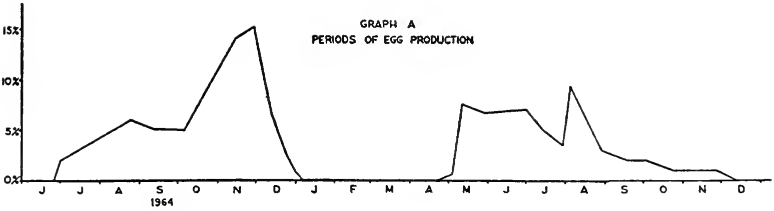
SUMMARY OF SMASH TECHNIQUE

Date	No. of snails killed	No. of snails with eggs	Per Cent snails with eggs
1964			
Jun 23	229	0	0
Jun 25	337	0	0
Jun 30	241	5	2
Jul 1	200*	7	3.5
Jul 2	250*	3	1.2
Aug 24	133	8	6.0
Sep 10	155	8	5.1
Oct 5	140	7	5.0
Nov 14	106	15	14.1
Nov 28	112	17	15.2
Dec 12	105	7	6.6
Dec 23	121	3	2.4
Dec 30	112	1	0.8
1965			
Jan 6	209**	0	0
Jan 14	238**	0	0
Jan 30	242**	0	0
Feb 20	230**	0	0
Mar 26	214**	0	0
Apr 21	270**	0	0
May 3	329**	2	0.6
May 11	119	9	7.6
May 29	108	7	6.7
Jun 30	153	11	7.1
Jul 13	137	7	5.1
Jul 29	141	5	3.5
Aug 4	128	12	9.3
Aug 28	131	4	3.0
Sep 18	102	2	2.0
Oct 2	102	2	2.0
Oct 23	102	1	1.0
Nov 13	102	1	1.0
Nov 27	102	1	1.0
Dec 11	230**	0	0
Dec 18	215**	0	0

* Data taken to verify start of egg-laying season June 30, 1964; not included on Graph A.

**Samples increased January 6 to May 3, 1965 to make sure of the ending of one egg-laying season and the beginning of the next.

November 28 (15.2%); (c) and a sudden drop thereafter on December 28 (6.6%), arriving at point zero on January 6, 1965. (General picture is a gradual increase from June to October, a peak in November, and a quick drop in egg production in De-



cember. There was no egg production from January 1965 to April 1965.

The 1965 egg-laying season began on May 3 (0.6%); it increased on May 11 (to 7.6%), dropped on July 29 (3.5%) and suddenly increased on August 4 (9.3%), followed by a drop on August 28 (3%) and September (2%); it slowly decreased during October (1%) and November (1%) to a point of no egg production on December 11. (General picture is a sudden increase from April to May with peak production in August, followed by a sudden drop in September and a gradual decrease in December.) The 1965 season seems to follow the same pattern as 1964.

Reproductive potential. The reproductive potential of *Achatina fulica* based on the hundreds of eggs per clutch has been thought to be enormous. This may be so, but the actual producers per population per season appear to be between 15 and 35% only: (a) a coarse fecundity test conducted by the "smash" technique tends to show that at peak of season, only 14 to 15% of the population is pregnant with eggs; (b) in an undirected experiment in which the goal was merely to obtain eggs for study from 54 wild snails detected in copulation, these 54 were kept separated from each other in captivity for 38 days between June 16 and July 23, 1964. Of the 54 only 5 laid eggs; 5 were pregnant, detected by the "smash" technique; 3 died within those 38 days; 41 had no eggs at any stage of development. Percentage of pregnancy in this instance is between 19 and 20%, which is close enough to the above quoted 14-15% to be significant; (c) in a second undirected experiment, 20 infant snails were kept in 2 batches of 10 each for scattergram plotting of growth rates between July 12, 1964 and January 28, 1965, a period of 6 months 16 days. One laid 271 eggs; 6 were pregnant when killed and 13 had no eggs. The percentage of pregnancy is 35% for this batch.

Frequency of ovulation, period, capacity and viability. Material

TABLE II

TABLE OF MULTIPLE OVULATION

Spm. No.	Size (mm)	Date	Days between clutches	Hatching time (days)	Number of eggs laid	Number of eggs hatched	Per Cent viable per clutch	Per Cent viable per snail
3	66.7	5 Jul 64	0(20)*	6	65	63	96.9	
	70.4	5 Sep 64	62	7	131	128	97.7	
	72.3	9 Oct 64	34	7	137	124	90.5	
	75.7	2 Nov 64	24	8	141	136	96.4	
	78.4	27 Nov 64	25	9	186	171	91.9	
	78.5	11 Jan 64	45	0	17	0	0.0	
			190		677	622		91.2
4	68.5	7 Jul 64	0(22)*	5	85	85	100.0	
	76.7	6 Oct 64	91	8	123	108	87.8	
	81.3	15 Nov 64	40	7	206	188	91.4	
	81.3	11 Dec 64	26	9	197	183	92.8	
	83.5	9 Jan 65	29	8	165	152	92.1	
			186		776	716		92.2
AQ	103.9	10 Jul 64	0(25)*	5	400	377	94.2	
	105.1	27 Aug 64	48	8	321	284	88.4	
	106.8	10 Nov 64	75	9	388	364	93.8	
	106.8	5 Dec 64	25	7	196	181	92.3	
	106.8	26 Dec 64	21	8	327	302	92.3	
	106.8	22 Jan 65	27	7	185	177	95.6	
			196		1817	1685		92.7
BB	108.2	24 Jul 64	0(39)*	10	207	183	88.4	
	108.4	9 Sep 64	47	8	316	301	95.2	
	109.2	8 Oct 64	29	8	323	320	99.0	
	111.4	3 Nov 64	26	7	442	431	97.5	
	111.5	30 Nov 64	27	7	198	172	86.8	
	111.5	12 Jan 65	43	8	138	128	92.7	
			172		1624	1535		94.5
TOTAL					4894	4558		
AVERAGE			34	7	213			93.1

* Refers to days between isolation and the ovulation of the first clutch.
** Grayish eggs, infertile; apparently aborted before maturity; not considered a normal clutch but included necessarily in the data.

for this study was obtained by selecting copulating pairs of *Achatina* and keeping each snail in isolation (Table II).

On July 5, 1964, the 20th day after isolation, snail #3 (smallest snail, 66.7 mm.) laid 63 eggs; two days later, it laid two more eggs, making a total of 65 eggs. Snail #3 laid six separate clutches of eggs, with egg clutches ranging from 17 to 186 eggs, making a total of 677 eggs laid over a period of 190 days. A total of 622 eggs hatched for a viability of 91.2%. (Last clutch of 17 eggs not considered normal because of low count and infertility. However, such clutches may be a normal occurrence in this species, according to Mead and Kondo through personal communication).

On July 7, 1964, 22 days after isolation, snail #4 laid its first clutch of 85 eggs. Snail #4 laid five separate clutches ranging from 85 eggs to 205 eggs over a period of 186 days. A total of 776 eggs were laid with 716 eggs hatching for a viability of 92.2%.

On July 10, 1964, the 25th day after isolation, snail AQ laid its first clutch of 400 eggs over a period of 2 days. Snail AQ laid six separate clutches ranging from 185 to 400 eggs per clutch. A total of 1817 eggs were laid over a period of 196 days, with 1685 eggs hatching for a viability of 92.8%.

On July 24, 1964, the 39th day after isolation, snail BB (the largest snail of this study, 108.2 mm.) began laying a clutch of 207 eggs and continued to lay 6 separate clutches of eggs for a total of 1624 eggs during a period of 172 days. Egg clutches ranged from 138 to 442 eggs, with a total of 1535 eggs hatching for a viability of 94.5%.

To summarize, data collected and tabulated (Table II) show that the snails laid five (snail #4) to 6 clutches of eggs (#3, AQ, BB) during their 1964 egg-laying season (July 5, 1964 to January 22, 1965). The average interval between ovulation is 34 days, with intervals ranging from 20 days (snail #3) to 91 days (snail #4). Egg clutches varied from 17 (snail #3) to 442 (snail BB) with an average of 213 eggs per clutch. The interval between the first and last clutch varied from 172 days (snail BB) to 196 days (snail AQ) with an average of 186 days. Hatching time varied from 5 to 10 days with an average hatching time of 7 days. The viability of egg clutches varied from 0% (snail #3, clutch #6 only) to 100% (snail #4). A total of 4894 eggs were laid with 4558 eggs hatching for an average viability of 93.1%.

While this paper was in preparation, snail #4 laid a clutch of two dark yellow eggs on July 29, 1965, 201 days after the last clutch was laid on January 9, 1965, or 410 days after isolation. This clutch represents the beginning of the second (1965) egg-laying season and is not included in the present study (Table II). Snail #4 also laid 32 eggs on September 10, 1965, 43 days after the two infertile eggs were laid with a viability of 27 eggs. On October 5, 1965 (487 days after isolation) 31 more eggs were laid with 24 eggs hatching. Snails #3, AQ, and BB have not produced any eggs in the 1965 season.

SUMMARY OF OVULATION STUDIES

Comparative findings. Number per brood, average per brood, and size of eggs are close to those quoted by Ghose, Lange, Mead and Mohr (Kondo, 1964).

Frequency per season is 5 to 6 clutches per season, differing from Ghose's one brood per year.

No. of eggs per clutch	17-442
Average number of eggs per clutch	213
Size of eggs	5 x 4 mm.
Frequency of ovulation per season	5-6
Interval between first and last clutch	186 days
Average interval between clutches	34 days
Total eggs laid per season	677-1817
Average fertility of eggs	93.1%
Incubation period	1-17 days
1964 egg-laying season	July to January
Growth rate	Same as Kondo's (1964)
Longevity	Observations continuing
Self-fertility	Observations continuing
Aestivation	None to date (18 months)

The interval between the first and last clutch varied slightly from 172 to 196 days, with an average of 186 days.

Total eggs per season was between 677 and 1817 for the isolated individuals.

Fertility averaged 93.1%; greater than Mohr's 80%.

Incubation period of 1-17 days compares well with those of the other observers.

The 1964 and 1965 egg-laying seasons seem to vary slightly. The 1964 season for the isolated individuals (#3, 4, AQ, BB) began in July and ended in January, 1965. The 1965 season began with #4 laying 2 eggs on July 29, 32 eggs on September 18 and 31 eggs on October 5. This appears to be the extent of the 1965 season. It should have paralleled the 1965 season as determined by the "smash" technique (began in May) but so far it has not commenced except for the 3 separate clutches of #4. Dr. Kondo tells me that the supply of sperm in #3, AQ and BB of the July 15, 1964 copulation seems depleted and these 3 may not lay any more eggs while isolated. Snail #4 seems to have retained a very small supply of the 1964 sperm which apparently has been carried over to 1965. Observations are being continued on all 4 specimens.

Self-fertilization appears negative. Certain evidences seem to indicate that copulation is necessary to produce fertile eggs: (1) 10 specimens raised together for scattergram, 35% of which became pregnant; (2) 6 isolated individuals raised from eggs to maturity, still virgins; and (3) two non-virgins (mixed-up accidentally) now producing fertile eggs.

TABLE III

ABORTED EGGS

Specimen No.	1	2	3	4	5	6	7
No. of eggs in vial	20	20	15	6	10	12	10
Color of eggs	MY	LY	G	G	G	LY	MY
Air (Open)	0	0	0	0	0	0	0
Moisture	0	0	0	0	0	0	0
Moist Cotton	0	70%	0	0	0	0	0
Moist Soil	55%	65%	0	0	0	58%	60%

TABLE IV

ABORTED EGGS

Specimen No.	A	A'	B	C
No. of eggs in vial	10	10	10	10
Color of eggs	DY	MY	MY	LV
Air (Open)	0	0	0	0
Airtight	0	0	0	0
Moisture	0	0	0	0
Moist Cotton	0	0	0	0
Moist Soil	70%	50%	50%	60%

Legend:	LY	Light Yellow
	MY	Medium Yellow
	DY	Dark Yellow
	G	Grayish

Contrary to Kondo's findings, none of the 4 specimens (#3, 4, AQ, BB) or the 8 snails raised in isolation from infancy (snails A to H) have aestivated during the 18 months of captivity.

Viability of aborted eggs. During the test for fecundity by the "smash" technique, seven egg samples from seven fractured specimens (Table III) were set up to test for viability under four separate conditions: (a) open vial, no soil, no moisture; (b) capped vial, no soil, 2 drops of water; (c) capped vial, no soil, with moist cotton underlying the eggs; and (d) capped vial, moist soil underlying the eggs but not covering them. Unbroken eggs were dissected from the uterus and placed in a petri dish, then transferred to the four separate vials without regard as to where the eggs were found in the uterus of the snail.

This test showed that yellow eggs hatched but the grayish eggs did not, indicating that the yellow eggs were mature while the grayish eggs were immature. (The 70% viability for eggs in moist cotton was possibly due to the fertile eggs being placed in the vials close to hatching time.)

A second test (Table IV) was designed to include only yellow eggs (from three individuals, A, B, C) because the yellow eggs showed 55 to 70% viability (Table III). One sample (A) was subdivided into two groups, A and A′. Group A included the dark yellow eggs from the lower uterus while Group A′ were a lighter yellow from the middle or upper uterus of the same individual. The same conditions were used for this test with the addition of an airtight vial, no soil or moisture.

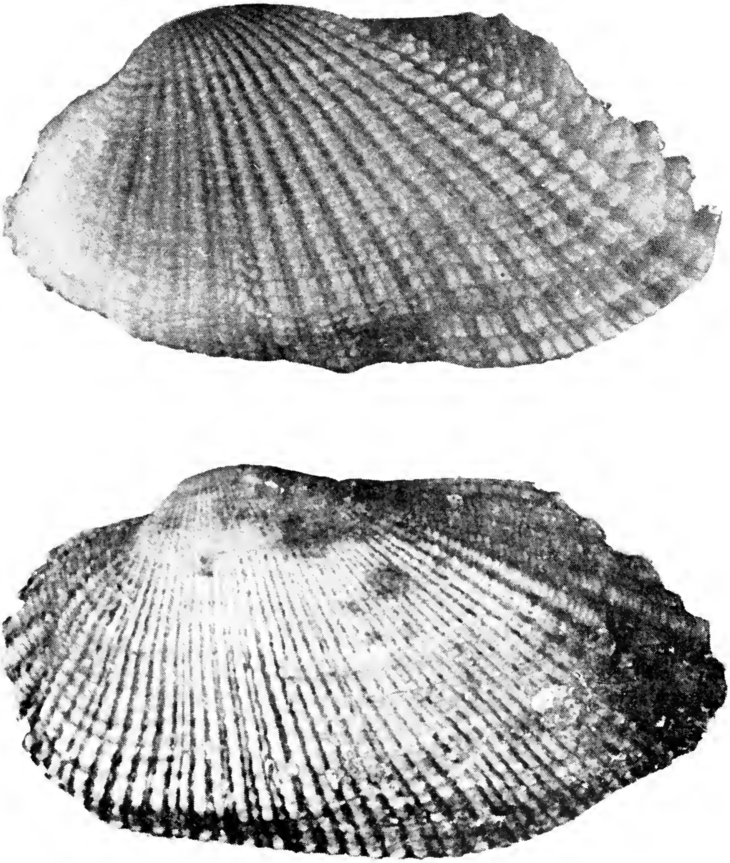
Results show that eggs with any shade of yellow were 50 to 70% viable on moist soil only. In comparing the viability of eggs aborted from a single snail, the eggs with the dark yellow color had a higher viability than the eggs that were light or medium yellow (Table IV).

[To be continued.]

WHAT IS ARCA CAELATA REEVE?

By MORRIS K. JACOBSON and GORDON USTICKE

Reeve described and figured *Arca caelata* (1844, pl. 16, fig. 110) from an unknown habitat. Subsequently von Martens (1890, p. 320) doubtfully listed this taxon from Mauritius on the basis of material collected there by Möbius. In the same work on the same page he also cited *Arca revelata* Deshayes 1863 from Bourbon and Mauritius. In 1907 Lamy (p. 92) placed *revelata* in the synonymy of *caelata* and accordingly gave Mauritius, Bourbon, and Réunion (the last being the type locality of Deshayes's species) as the "true"



Top figure: *Barbatia caelata* (Reeve), St. Croix, Virgin Islands, [= *B. candida* (Helbling)]. Lower figure: *B. revelata* (Deshayes), Mauritius, [= *B. decussata* (Sowerby)]. Both about 2x.

locality of *caelata.* In this he was followed later by Dautzenberg (1929, p. 368; 1932, p. 96) and Fischer-Piette (1958, p. 120) who reported *caelata* Reeve from Madagascar.

We became interested in this species when the junior author collected 5 valves of an unusual arcid among material pumped up by a commercial dredge from about 6 fathoms of water. This material forms an artificial island lying about 1 mile offshore from Krause's Lagoon on the south shore of St. Croix, Virgin Islands.

Later we found 2 valves of a very similar arcid in the collection of the American Museum of Natural History (no. 89531) from Grand Cayman Island, collector W. A. Swanker. A specimen was collected in Aruba, Netherlands Antilles, by Mrs. Elizabeth Johnson in 1965.

The junior author was able to visit the British Museum (Natural History) where he found, upon comparison, that the shells from St. Croix matched very closely the type specimen of *Arca caelata* Reeve. Hence we concluded that Reeve's shell lives in the West Indies and that the name should not be used for the shell from the Indian Ocean.

Subsequent comparisons of the presumed *A. caelata* with the large collections in the Academy of Natural Sciences of Philadelphia, the Museum of Comparative Zoology, as well as the American Museum, compelled us to accept the point of view that Reeve's species is in all likelihood a striking variation of the common *Barbatia candida* (Helbling). The Reeve name was given to a clean, uncluttered specimen, which, because of differing ecological conditions, was able to develop strongly frilled, radiating ribs.

The collection in the American Museum also contains a complete, well-matured specimen of *Barbatia revelata* (Deshayes) from Mauritius (no. 28647) that was originally in the Steward Collection. This specimen could easily be considered a clean, well-sculptured example of the widely distributed *B. decussata* (Sowerby). It bears a superficial resemblance to *A. caelata* Reeve but it can easily be separated as follows: *caelata* (Reeve) (= *candida* Helbling) has a heavier, more inflated shell with fewer and much stronger radial ribs, strongly decussated by rows of concentric cords, that, toward the ventral area, are raised into scale-like structures where they cross the radial ribs. The six heavy ribs on the posterior slope are higher and far more strongly decussated than the corresponding ribs in *revelata* Deshayes (= *decussata* Sowerby). The differences noted here are also apparent in the figures of Reeve and Deshayes, copied by Kobelt (1891, pl. 14, fig. 3-5, pl. 47, fig. 14). The specimen of *B. caelata* figured herein is probably worn and hence does not show the raised decussations quite as clearly as in Reeve's figure.

The authors wish to express their gratitude to the Trustees of the British Museum who generously permitted Mr. Peter Dance to compare the present specimens with the type of *Arca caelata* Reeve,

and to Mr. William Old, Jr., who provided pertinent material from the collection of the American Museum of Natural History. Dr. R. Tucker Abbott and Dr. William J. Clench gave valuable advice and readily made accessible the collections in their respective institutions for comparative purposes. Dr. William K. Emerson kindly read the manuscript and provided many helpful suggestions.

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MYA ON THE ALASKA PENINSULA

BY JAMES X. CORGAN
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This is an adjunct to a monograph of *Mya* by MacNeil (1965) . Geographic ranges of *Mya elegans* (Eichwald) and *M. japonica* Jay are extended. A possible gap in the distribution of *M. truncata* Linné is suggested.

Six species of *Mya* are currently recognized in the living fauna and all occur in Alaska. One, *M. arenaria* Linné, seems to owe its presence in southeastern Alaska to human introduction. The five remaining species have, or appear to have, naturally restricted distributions within Alaska.

In other parts of the world, contrasts between ancient and modern distributions of species of *Mya* have proven useful in establishing local glacial and human chronologies. This is not true is Alaska and the genus is a yet unexploited Alaskan economic resource. Thus, a recording of new Alaskan *Mya* localities seemed worthwhile.

Distribution. Most species of *Mya* range widely outside of Alaska. Only Alaskan distribution is here considered. For each species, MacNeil (1965) provides a specific characterization, a detailed synonymy, and a list of occurrences. In much abbreviated form, MacNeil's data are here given as the established range and the synonymy.

Data. New occurrences, here reported, are based on a suite of 44 beach shell samples obtained from the Alaskan Peninsula and adjacent regions by Allan P. Bennison, of the Sinclair Oil & Gas Company, and me during the summer of 1965. Collections cover both coasts from Pavlof Bay to Wide Bay. All areas mentioned in discussions of the distribution of species are located in Figure 1.

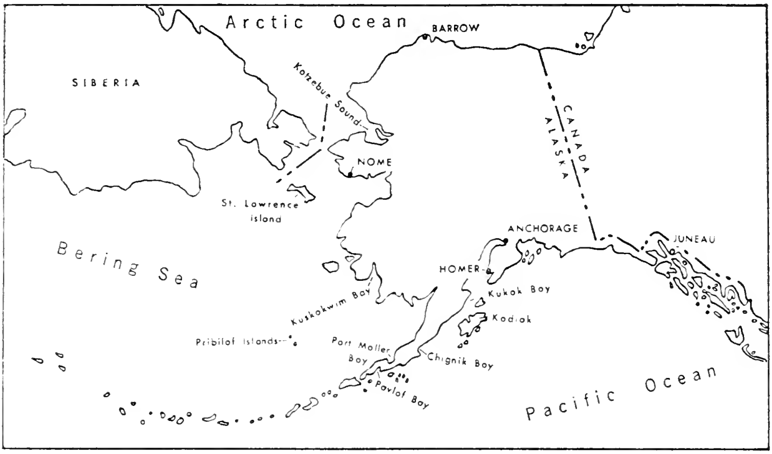

Figure 1. Index map. Named areas are cited in distribution records.

Literature on *Mya* in Alaska has been adequately summarized by MacNeil (1965). Since specific synonymies are intricate and modern concepts of species differ significantly from those long held, MacNeil excluded, or questioned, many published, but unillustrated, occurrences. In part, this mass of dubious literature forms a secondary control and permits a tenuous filling in of patterns of occurrence.

Mya (?*Arenomya*) *elegans* (Eichwald)

Synonymy: M. crassa Grewingk; *M. intermedia* Dall; *M. profundior* Grand and Gale; and, in part, *M. arenaria* and *M. japonica* of authors.

Distribution: Pribilof Islands; Kuskokwim Bay; Bristol Bay; Chignik Bay; Kukak Bay.

New Occurrences: Living: Port Moller Bay; Pavlof Bay; subfossil: in a Port Moller Bay midden.

Remarks: The name *M. elegans* was first applied in Alaska by MacNeil (1965). Interpretation of earlier reports is difficult though MacNeil noted questioned records on the southern Alaska Peninsula and in the Aleutians.

New occurrences, here recorded, significantly extend the definitely known range in Alaska. They also lend support to MacNeil's interpretation of the unillustrated record.

It should be noted that new records, here established, are also unillustrated; however, MacNeil's well illustrated monograph greatly increases the possible reliability of identifications.

Mya (Arenomya) japonica Jay

Synonymy: M. oonogai Makiyama and, in part, *M. arenaria* of authors.

Distribution: Recent: Nome and Kotzebue Sound; Pleistocene: Nome to Willapa Bay, Washington.

New Occurrences: Port Moller Bay and 8 miles north of Port Moller along the Bering Coast. All collections contain shells with fragments of the ligament attached but the species was not observed alive. Subfossil *M. japonica* occur in a midden on Port Moller Bay.

Remarks: Lack of *M. japonica* in collections from other areas, its prominence in modern and subfossil faunas of the Port Moller area, and the marked difference between known Pleistocene and Recent distributions suggest that the Port Moller population may be an isolated relict of the more widely distributed Pleistocene population rather than part of the northern Alaska population.

Mya (Mya) priapus Tilesius

Synonymy: In part, *M. arenaria; M. truncata;* and *M. japonica,* of authors.

Distribution: Northern Bering Sea to the Aleutians to Homer Spit.

New Occurrences: The most common *Mya* of the region, present in all major bays on each coast.

Remarks: The name *M. priapus* was not in common use prior to MacNeil (1965).

Other *Mya*

Mya (Mya) pseudoarenaria Schlesch is recorded by MacNeil

(1965) from Point Barrow and the Arctic Coast. It does not occur in peninsular collections. *Mya (Arenomya) arenaria* Linné does not range as far north as the Alaska Peninsula.

The only other Recent species of *Mya* is *Mya (Mya) truncata* Linné which MacNeil (1965) illustrates from Kodiak Island and from St. Lawrence Island. The species thus occurs both north and south of the Alaska Peninsula; however, it is absent from the 44 collections at hand.

Soot-Ryan (MacNeil, 1965, p. 40) states that *M. truncata,* which is essentially circumboreal, is absent from the East Siberian Sea. Possibly it is also absent from the Alaska Peninsula.

In the Anchorage region, at the beginning of the Alaska Peninsula, *M. truncata* is locally the dominant mollusk on modern beaches. Occurrences seem limited to areas where the Bootlegger Cove Clay, of Pleistocene age, forms the shoreline. In these areas, *M. truncata* is also the most common species in the fossiliferous Pleistocene clay. All Anchorage specimens which I have seen appear to be reworked fossils and the species may not occur in the modern fauna of the Anchorage area. It should be noted that MacNeil (*In* Schmidt, 1963; *In* Miller and Dobrovolny, 1959) had previously listed *M. truncata* from the Bootlegger Cove Clay.

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CORBICULA MANILENSIS IN THE MESILLA VALLEY OF TEXAS AND NEW MEXICO

BY ARTIE L. METCALF
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This report concerns the clam known colloquially as the "Asiatic clam" and referred by Sinclair and Isom (1963: 33) to *Corbicula (Corbiculina) manilensis* (Philippi). The clam has become established in "West Drain" of Mesilla Valley, which is a broadened part of the Rio Grande Valley extending from El Paso, El Paso County, Texas to Radium Springs, Dona Ana County, New Mexico. The generally north-south trending West Drain crosses the New Mexico-Texas border in several places; clams were observed in both states. The term "West Drain" is a locally-used name referring to a drainage ditch — one of a system of such ditches that form the chief permanent-water habitat of the Mesilla Valley. Drains are distinct from irrigation ditches, which carry water to fields of the valley and which are dry during the winter months. The drains were constructed mainly between 1917 and 1930 to alleviate the adverse effects to agriculture of a rising water table (Clark and Mauger, 1932: 14-16; Conover, 1954: 53-58). The channels of the drains are generally 6-10 feet deep and 8-20 feet wide at the bottom. The amount of discharge seems variable. Thus, during the years 1962-65 there was permanently flowing water in the lower parts of the major drains (including West Drain), but the upper reaches were periodically dry. Water in the drains is usually clear. A narrow fringe of phreatophytic shrubs and small trees borders the drains in most places; cottonwoods occur rarely. Along the bottoms of the drains grasses, rushes, cattails and other plants are common. Watercress, duckweeds and algae are the chief aquatic plants. The bottom sediments are mixed silt and sand, with gravels up to six inches in diameter occurring in some places.

Regarding characters of the shell, specimens from West Drain are subtrigonal to ovate, possess low umbones, a fine sculpture and an intensely purple nacreous layer. Of the American specimens illustrated by Sinclair and Isom (1963), the clams from West Drain seem most nearly to resemble figures 31-36, of clams from Phoenix, Arizona.

C. manilensis seems to have become recently established in West Drain, although the species has inhabited the drain long enough for individuals taken in November, 1964 (when the clam was first observed) to have reached 25 mm. in length and for specimens taken in November, 1965, to have reached 34 mm. in length. Sinclair and Isom (1963: 4) estimated that a specimen of 28 mm. from Tennessee was four years old. The population of Asiatic clams in West Drain is probably not of long standing, as bank sediments contain many shells of other species of aquatic mollusks but none of *C. manilensis*. The drains are periodically cleaned by power-shovel, and the sediments, containing shells taken from the bottoms of the drains, are heaped alongside the drains; eventually much of this shell-bearing sediment falls back down along the walls of the drains. None of several persons contacted in federal and state agencies connected with irrigation and agriculture was aware of the presence of the clams in the Rio Grande Valley, which also suggests recent establishment. To my knowledge, *C. manilensis* has not previously been reported from Texas or New Mexico, the nearest record being that of Dundee and Dundee (1958) from Phoenix, Arizona.

Sinclair and Isom (1963: 12) found that *C. manilensis* occupied a wide variety of habitats in the Ohio River System of Tennessee and that its dispersal within a stream system was rapid. It is, then, of interest that *C. manilensis* has been found in only one drain, of many inspected, in the Rio Grande Valley between El Paso, Texas, and Hatch, New Mexico. Possibly the Rio Grande acts as a barrier to dispersal between the drains tributary to it, either because it is an inhospitable habitat for larvae or because it may be completely dry in some sections when crops are not being irrigated. These recurrent periods of desiccation of parts of the river (the longest usually lasting from October to March) preclude establishment of permanent populations in the main channel of the Rio Grande in this area, except, possibly, immediately below the mouths of major drains. Alternately, the absence of *C. manilensis* in other drains may be attributable to some difference in environmental conditions. This seems especially plausible, because *C. manilensis* does not seem to have established populations in the tributaries of West Drain, — Nemexas Drain and Montoya Drain. Between October, 1964, and January, 1965, chemical analyses were made of water taken from West Drain and from Nemexas Drain at places a short distance above their confluence. The chief differences observed were in degree of hardness, with West Drain yielding higher values. Samples from West Drain gave readings for total hardness ranging from 365 to 410 ppm and for calcium hardness of 280-320 ppm. Water from Nemexas Drain yielded values for total hardness of 250-290 ppm and for calcium hardness of 180-215 ppm. Leggat, Lowry, and Hood (1962: Fig. 20) obtained values similar to those noted above for water analyzed from West Drain (they did not report on Nemexas Drain). These writers noted (p. 48) "In general, the drain water increases in dissolved-solids content from the upper to the lower end of the West Drain . . . The increase is due principally to the accretion of ground water in which mineralization increases toward the lower end of the valley, and also to the concentration of the dissolved salts in the drain water by evapotranspiration." The snail *Physa anatina* Lea was more abundant in Nemexas Drain than in West Drain and there seemed to be some differences between the aquatic floras of the two drains. Possibly these floral and faunal differences are related to volume or velocity of flow, or to chemical composition of the waters.

The negative economic implications of *C. manilensis* have been discussed at length by Sinclair and Isom (1963). In the Ohio River System it has obstructed pipes carrying water from rivers (the larvae entering the pipes, attaching to the inner surfaces of the pipes and then growing to adulthood), and has become a problem in the gravel industry (burrowing upward in newly-poured concrete made with *Corbicula*-containing gravels). Ingram, Keup and Henderson (1964: 121-122) reported that the high degree of infestation of Asiatic clams in concrete-lined irrigation canals near Parker, Arizona, necessitated their removal. These authors further noted (p. 124) " . . . this clam creates nuisance conditions in canals, ditches, pumps, and cooling systems." Sediments from the drains in Mesilla Valley are not used in concrete making and, to my knowledge, water is not piped from the drains for industrial or other purposes. However, a concrete flume carries the combined waters of West and Nemexas drains under and across the Rio Grande *ca.* one-half mile below the confluence of the drains.

Positive economic aspects of the genus *Corbicula* have been discussed by Villadolid and Del Rosario (1930: 355, 370) and Sinclair and Isom (1963: 27-28), and include use as human food, as food for domestic animals, and as fish bait. A party of young fishermen was once observed industriously collecting *C. manilensis* for fish bait from West Drain.

I am grateful to Dr. Ralph Sinclair, Tennessee Department of Public Health, for information and advice, and to the following persons, who kindly offered suggestions concerning the manuscript: Mrs. Eleanor Duke and Dr. Robert G. Webb, Texas Western College, and Dr. L. O. Sorensen, Pan American College, Edinburg, Texas.

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ANONYMOUS CATALOG OF OHIO RIVER UNIONES

BY NORA F. McMILLAN AND MARJORIE FOGAN

An apparently unknown conchological publication listing the Unionacea of the Ohio River was recently acquired by one of us (M. F.) and has prompted the present note.

The work is a 20 page pamphlet in small 8vo. and the title-page runs: "Catalogue / of the / unios, / alasmodontas, and anodontas / of the / Ohio River and its northern tributaries, / Adopted by the Western Academy of Natural Sciences, / of Cincinnati, January, 1849, / Cincinnati; / printed by J.A. & U.P. James." Alternate pages are blank and unnumbered; on the numbered pages 67 species are listed and in most cases some synonyms are given. None of the species appears to be new.

There is no indication of the author's identity but an unsigned slip pasted on the back of the title-page states "Mr. Wheatley seems to have given up the shells I could not procure a copy of his catalogue here but beg you will accept of my only copy." The handwriting is old and unfamiliar; it is not that of Lea. The title-page bears the autograph "Dr. Sorrain" in a quite different ink and hand-writing.

Charles Moore Wheatley was born in 1822 and died in 1882. An engineer by profession, he was not a prolific writer and Johnson (1959) only mentions two conchological papers by Wheatley, a privately-printed "Catalogue of the shells of the United States, with their localities" (1842; a second edition was issued in 1845) and "Revision of M. Petit's catalogue of the genus *Monocondylaea* D'Orb." (Am. Journ. Conch. *1:* 65-67. 1865). He also published a few papers on geological subjects. Lea named a number of species after "my friend C. M. Wheatley who has done so much for this branch of natural history," and in the case of *Diplodon wheatleyanus* (Lea) stated "was sent to me some time since by Mr. C. M. Wheatley who procured it from the Rio Negro, at the distance of 1200 miles from the mouth of the Amazon. . . . ". Wheatley is described by Dall (1888, p. 118) as "of Phoenixville, Pennsylvania"; an account of the present location of his collections is given by Johnson (1959).

Perhaps it is not quite correct to refer to the subject of this note as being an unknown work for in Lea's 1870 *Synopsis* it is referred to on p. 171, without, however, ascription to any author.

Photostats of the Catalogue are now in the possession of Mr. A. Blok (Rottingdean, England), Dr. Haas (Chicago), and Mr. F. R. Woodward (Paisley, Scotland).

Neither Dr. Clench nor Dr. Haas knew of the existence of this Wheatley catalogue and we are grateful to them for their interest in the matter and to Dr. Clench for a copy of Johnson's paper on the Wheatley collections.

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ALASMIDONTA MARGINATA AND PTYCHOBRANCHUS FASCIOLARIS IN KANSAS

BY BRANLEY A. BRANSON

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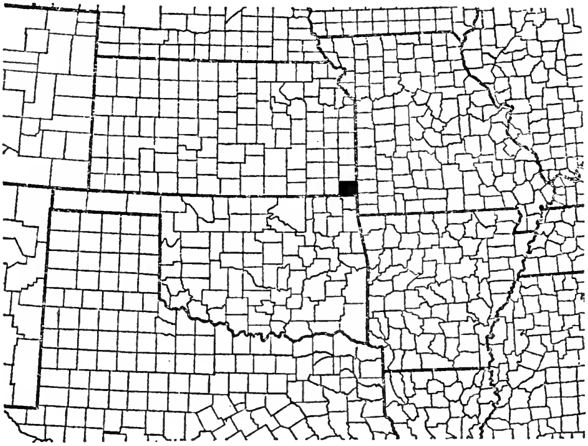
In their survey of the unionid mussels of Kansas, Murray and Leonard (1962) indicated that clear-water streams were absent in Kansas, the combined results of unwise farming practices and stripmining by-products. In general, this is unfortunately true. However, in the extreme southeastern corner of Cherokee County (Map 1) the Carolinian Biotic Province barely dips into the state, and in that area Shoal Creek flows for 5 miles to its confluence with Spring River. Shoal Creek is quite clear, being fed by numerous springs, and as such is one of the most important ecological elements in the state. For example, 62 per cent of the fish species known from Kansas also occur in Shoal Creek and/or adjacent Spring River, and 14 species, or 11 per cent of the total fauna, are known only from that stream (unpublished data). There are also several mollusks known only from that area.



Map 1. Position of the Spring River Drainage in Kansas, the only Ozarkian system in the state.

During the preceding 4 years, the author has been conducting an extensive biological survey of the Spring River Drainage in Missouri, Oklahoma and Kansas. As a matter of course, a collecting station was selected on Spring River proper at the point where the river crosses Kansas State Highway 96, R 25 N, T 33 S, Cherokee County. This site is characterized by a series of braided channels, gravel-bottomed riffles of 2½ feet to 3 feet in depth, and great quantities of *Dianthera americana*. It lies near the mouth of Cow Creek, a small muddy and badly polluted stream of approximately 30 miles in length, and about two miles above the mouth of Shoal Creek. The water is relatively clear. On 14 March 1964 a collecting party visited this station and secured extensive samples of fishes and moderate ones of pelecypod mollusks. In the mussel samples were discovered 3 specimens of *Alasmidonta marginata* Say and one of *Ptychobranchus fasciolaris* (Rafinesque).

Alasmidonta marginata has not heretofore been known from Kansas, although we have numerous records for the species in Oklahoma and Missouri. The largest specimen measured 97.0 mm. in length, and 47.0 mm. in greatest depth.

Since no specimens of *P. fasciolaris* have been collected in Kansas since 1890 (Murray and Leonard, 1962), and since there seems to have been considerable confusion as regards which species of *Ptychobranchus* was actually present in the original collections (Simpson, 1914; Scammon, 1906), our specimen is of considerable interest. The shell is 98.2 mm. in length and 55.8 mm. in greatest depth. It is strongly compressed and quite heavy, the nacre being pearly white. The umbones are very low and compressed, slightly eroded. The epidermis is greenish-horn posteriorly, grading to darker horn anteriorly. There are approximately 16 green, wavy, thin lines radiating from the umbonal region on the posterior slope. Internally, the pseudocardinals are rather small and moderately serrate. The laterals are characteristically short, decurved and heavy. The long, broad interdentum is smooth, and the beaks are nearly flush with its sides. The muscle scars are characteristic for the species: retracter small, deeply placed beneath the lateral tooth; adductor deep, directed posteriad. Anterior scars also deep, in front of pseudocardinals. The pallial line is distinct and impressed for its entire length.

The two species discussed briefly above were found associated with the following mussels. The number in parentheses indicates the number of specimens secured in this random sample. *Lasmigona costata* Rafinesque (2), *Plethobasis cypha* (Rafinesque) (1), *Strophitus rugosus* (Swainson) (17), *Tritogonia verrucosa* (Rafinesque) (12), *Actinonais carinata* (Barnes) (15), *Anodonta grandis* Say (1), *Quadrula quadrula* Rafinesque (11), *Quadrula pustulosa* (Lea) (17 pustulate, 10 non-pustulate), *Quadrula nodulata* Rafinesque (1), *Lampsilis anodontoides* (Lea) (1), *Lampsilis luteolus* Simpson (= *L. siliquoidea* Barnes) (9), *Lampsilis ovata* (Say) (28), *Amblema costata* Rafinesque (6), *Elliptio dilatatus* (Rafinesque) (27), *Ligumia recta* (Lamarck) (3), *Ligumia subrostata*

(Say) (7), *Fusconais flava* (Rafinesque) (12), *Pleurobema cordatum* Rafinesque (5).

This is a fairly respectable fauna, and it doubtless reflects the ameliorating influence of the unpolluted waters of nearby Shoal Creek.

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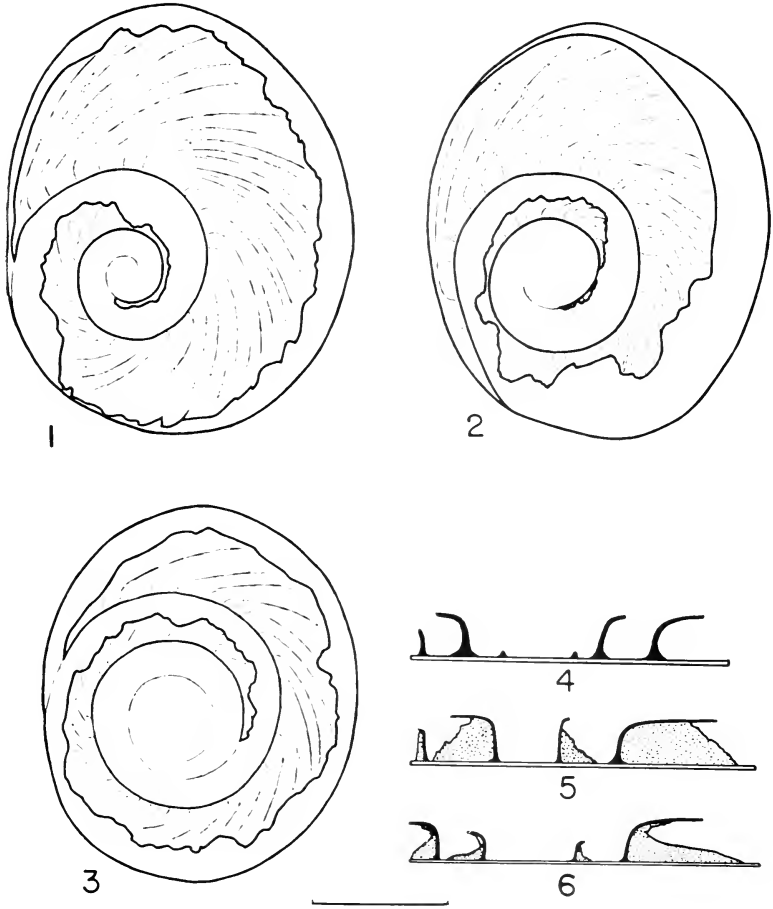
A NEW POMATIASID FROM CHIAPAS, MEXICO

BY FRED G. THOMPSON
Florida State Museum, University of Florida

Recent collections from Mexico have produced an interesting new land snail of the family Pomatiasidae. Characteristics of its operculum and radula place it in the genus *Choanopoma,* subgenus *Choanopomops* as defined by Baker (1928: 47-49). Because of its smooth, costulate sculpture it is named:

CHOANOPOMA TERECOSTATUM, new species. Figs. 1, 5, 7

Shell (figs. 7) conical, 0.53-0.60 times as wide as long. Shiny; light orange in color with vague alternating light and dark zones; slightly darker on upper whorls. Peristome and aperture same color as rest of shell. Shell with 4 faint, narrow, broken rose-colored bands which may be indistinct in old specimens; upper 2 bands located near periphery of whorls and visible through length of shell; lower 2 bands evident only on base of last whorl. Decollate, 4.2-4.7 whorls remaining. About 2.0-2.5 juvenile whorls lost in adult shells. Apical plug purplish, sloping, about ¼ whorl long. Suture deeply impressed. Whorls strongly inflated; supraperipheral area moderately curved, sloping, not shouldered; peripheral and subperipheral area more strongly rounded. Umbilicus about 1/5-1/6 diameter of shell. Aperture adnate to preceding whorl; broadly ovate, 1.07-1.16 times as high as wide; 0.34-0.36 times length of decollate shell. Inner peristome not extended; demarcated only as a strong annulation on lip. Outer peristome strongly expanded;



Opercula of Mexican *Choanopoma.* Fig. 1, *C. terecostatum* Thompson, frontal view. 2, *C. martensianum* (Pilsbry), frontal view. 3, *C. sumichrasti chiapense* Crosse and Fischer, frontal view. 4, *C. sumichrasti chiapense* Crosse and Fischer, tranverse section. 5, *C. terecostatum* Thompson, transverse section. 6, *C. martensianum* (Pilsbry), transverse section. Scale equals 1 mm.

about 0.5-0.8 mm. wide or about 1/5-1/7 width of aperture; widest at upper corner, which is vertical and not deflected. Outer peristome constricted in parietal region and only slightly flexed forward. Sculpture of adult shell consisting of smooth, uniformly spaced axial ribs that are slightly oblique and weakly recurved. Five-six ribs per mm. on body whorl; slightly more crowded on early whorls.

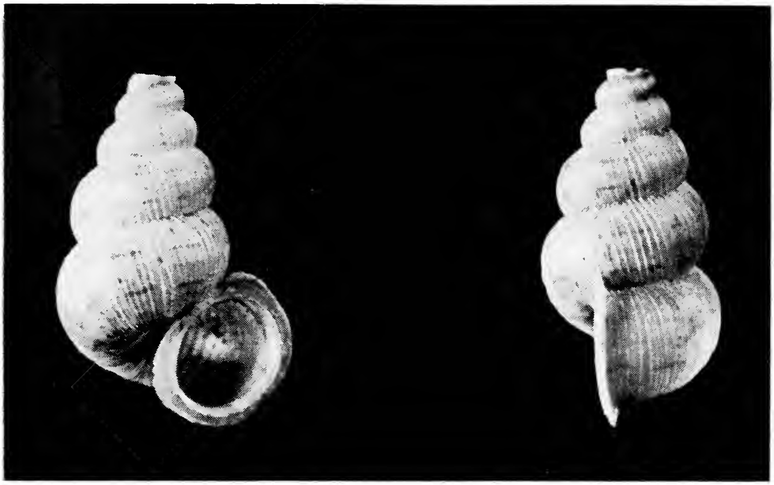


Fig. 7. *Choanopoma terecostatum* Thompson, Type (UMMZ. 216554).

Ribs of uniform intensity from suture to umbilicus, where they become reduced to sharp threads. Spiral sculpture absent. Two embryonic whorls (lost from adult shells) smooth.

Operculum flat, consisting of about 3.5 rapidly expanding whorls. Nucleus acentric. Calcareous lamella broadly reflected over basal chondroid plate and nearly covering latter (fig. 1). Reflected lamella parallel to chondroid plate and supported by numerous narrow calcareous buttresses and ribs that parallel growth striations (fig. 5). Lamellae of adjacent whorls separated.

Measurements of type: length, 12.4 mm.; minor diameter, 7.1 mm.; aperture length, 4.4 mm.; aperture width, 4.1 mm.; lip, 0.8 mm. wide; 4.4 whorls remaining.

Measurements of paratypes: length, 12.0-13.1 mm.; minor diameter, 6.5-7.3 mm.; aperture length, 4.2-4.4 mm.; aperture width, 3.8-4.1 mm.

Type locality: Limestone hillside 15.8 miles northwest of Ocozocoautla, Chiapas; 2700 ft. alt. TYPE: UMMZ. 216554; collected July 21, 1965 by Fred G. Thompson. *Paratypes:* UMMZ. 216555 (6), USNM, 669201 (1), ANSP. 305061 (1), MCZ. 260881 (1), Museo Nacional de Mexico (1); same data as the type. UMMZ. 216556 (1); 13.4 mi. n.w. of Ocozocoautla.

C. terecostatum is distinguished from all other mainland species of the genus *Choanopoma* (as defined by Solem, 1961: 194-195) by its smooth, costulate sculpture, its lack of spiral sculpture, and its operculum, which bears a broadly reflected calcareous lamella reinforced by numerous thin calcareous buttresses and ribs.

Relationships with other mainland forms are indicated by the structure of the operculum. On the basis of opercular similarities *C. terecostatum* is closely related to the group of species that contains *C. martensianum* (Pilsbry) (figs. 2, 6), *C. gaigei* Bequaert and Clench, *C. largillierti* (Pfeiffer) and *C. radiosum* (Morelet), although no particular relationship is indicated with any of these species. It is distinguished from all by its lack of spiral sculpture and by its smooth axial ribs. *C. martensianum* is geographically the closest related form to *C. terecostatum,* being found in adjacent regions of Tabasco. *C. martensianum* differs from *C. terecostatum* in being more slender (0.40-0.50 times as wide as long), in having rugose sculpture due to the occurrence of nodes on the axial ribs where they cross spiral threads, in having the upper corner of the outer peristome recurved posteriorly, and in being light brown in color with four or more broken peripheral bands.

Superficially, *C. terecostatum* resembles *C. sumichrasti* Crosse and Fischer because of similarities of their axial sculpture and their lack of spiral sculpture, but these similarities are secondary, for *C. sumichrasti* has a simple reflected opercular lamella that lacks reinforcing calcareous buttresses or deposits (figs. 3, 4).

The shell of *Choanopoma terecostatum* is nearly identical to that of *Chondropoma rubicundum* (Morelet), but the latter species is immediately recognized by its simple, chitinous operculum.

Specimens Examined. Material examined during this study significantly adds to the distributions of several species reported by Solem (1961: 191-213).

Choanopoma martensianum (Pilsbry)

Tabasco: 2.6 mi. e. Teapa; 1.5 mi. e.n.e. Teapa; 4.0 mi. w. of Teapa; hill 9.2 mi. s. Tacotalpa.

Choanopoma radiosum (Morelet)

Guatemala (Dept. *Izabel*): Puerto Matias de Galvez; 4 km. n. of Morales.

Choanopoma sumichrasti var. *chiapense* Crosse and Fischer

Chiapas: 8.6 mi. e. Chiapa de Corzo, 3100′; 14.9 mi. e. of Chiapa de Corzo, 4400′; 8.0 mi. n. Tuxtla Gutierrez, 3800′.

Choanopoma sumichrasti var.

Chiapas: 4.5 mi. n. Bochil, 4600′.

Choanopoma sumichrasti var.

Chiapas: 1.4 mi. s. La Trinitaria.

Choanopoma sumichrasti (?) var.

Chiapas: 8.2 mi. s. Solusuchiapa, 1600′.

Choanopoma gaigei Bequaert and Clench

Campeche: Eight localities (to be reported later). *Quintana Roo:* 4.0 mi. e. Xpujil (Campeche); 7.1 mi. n.n.w. Polyuc; 2.3 mi. s.s.e. Polyuc.

Yucatan: 0.8 mi. n.e. Becanchen.

Choanopoma largillierti (Pfeiffer)

Campeche: Seventeen localities (to be reported later). *Quintana Roo:* 4.0 mi. e. Xpujil (Campeche); 7.1 mi. n.n.w. Polyuc; 2.3 mi. s.s.e. Polyuc. *Yucatan:* 7.0 mi. s.s.e. Uman; 19.1 mi. s.s.e. Uman; 0.8 mi. n.e. Bechanchen; 10.0 mi. n.e. Bechanchen; 3.2 mi. s. Progreso; 1.0 mi. s.s.e. Puerto Telchac; Uxmal.

Choanopoma sp.

Ten localities in Campeche, Yucatan and Quintana Roo. (To be reported later.)

Material upon which this study is based was collected with the support of the National Institutes of Health research grant number 5 R01. GM. 12300-02. All material, unless otherwise stated, has been deposited in the Florida State Museum.

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NOTES AND NEWS

DATES OF THE NAUTILUS. — Vol. 79, no. 1, pp. 1-36, iii, pls. 1-3, was mailed July 9, 1965. No. 2, pp. 37-72, iii, pl. 4, Oct. 15, 1965. No. 3, pp. 77-108, iii, Jan. 25, 1966. No. 4, pp. 109-144, iii, and Index, pp. iii-vii, April 25, 1966. — H. B. B.

AMERICAN MALACOLOGICAL UNION. — The 32nd annual meeting will be held Aug. 22-27, 1966, at the University of North Carolina, Chapel Hill, N. C. Reservations will be made by James E. Wadsworth, Wilson Court, Chapel Hill, N. C. 27514.

CORRECTION. — The submission of a reversed photograph, fig. 1 on p. 130 of the April issue, was an oversight by the author and he wishes to apologize for this misrepresentation. — J. SHERMAN BLEAKNEY.

HAROLD HANNIBAL 1889-1965. — Word has just been received at the California Academy of Sciences of the death of Harold Hannibal on December 17, 1965, after a prolonged illness. Conchologists will remember Mr. Hannibal for his work on fresh-water mollusks of the West Coast, especially for his chapter on them in the 1910 edition of Keep's "West Coast Shells" and his "Synopsis of the Recent and Tertiary Mollusca of the Californian Province" published in 1912 in the Proceedings of the Malacological Society of London. He was a graduate of Stanford University with a major in paleontology and was also the author of several important papers in this field. — ALLYN G. SMITH.

LAND SNAIL RESISTANCE TO COLD. — A paper bag of aestivating snails was placed in my car January 2, 1949, and accidentally left there overnight at below freezing temperatures. It was then placed in a warm room for two weeks. All the snails were alive when placed in the bag. The dead specimens are in parentheses. *Ashmunella rhyssa edentata* 7 (2); *Allogona profunda* 1 (1); *Bradybaena similaris* 0 (3); *Cepaea nemoralis* 0 (5); *Helminthoglypta traski fieldi* 0 (5); *Mesodon kiowaensis* 0 (7); *Monadenia fidelis* 3 (5); *Theba pisiana* 1 (1); *Oreohelix strigosa* (from near Salt Lake, Utah) 1 (2). — GLENN R. WEBB.

BIRTH FREQUENCY IN LACTEOLUNA SELENINA (Gould) — Three surviving adults of material collected at Coral Gables, Florida, in the spring of 1950 were isolated into tin-can cages A. B. and C. Each can was nearly completely filled with earth and covered with a square of glass. The specimens were caged March 18, 1951. When young were found in the cages, the adults were placed in a new can-cage. This prevented unseen young from accumulating in the cage and confusing the results. Cage A yielded one young March 30; another young April 8. Cage B had 4 young of two sizes March

30; one young April 1; one young April 8. Cage C contained two young March 23; two more young March 30; and one young April 8, 1951. Apparently the species gives birth to one or two young at nearly weekly intervals. Probably the process is seasonal.

A combined courtship and birth occurred on April 15, 1951. On this occasion the 3 adults had been placed in one cage for observations on possible matings. Soon a pair were seen head-on with foreparts detached from the cage cover-glass. They then pressed their foreparts or 'necks' together laterally. One then turned away and pivoted counterclockwise (as viewed through the glass) and rejoined its mate head-on. The pair remained passively head-on for about an hour, became active again, but then separated. Later a pair were seen in courtship. Again the necks are pressed together on the non-genital-pore side. Both pivot, rejoin head-on. Repeat the "necking" act as before. During the act the lips or lower part of pedal disk is projected forward as an angularity. One begins to pivot; the other suddenly gives birth to a young snail. This egresses easily from the atrial pore and is not enclosed in egg or other membranes. The parent crawls forward and meets the partner which fails to respond. The parent continues crawling and encounters the third adult and makes head-on advances. The latter does not respond; the ex-mother commences to gnaw on its aperture edge. It turns and the third snail and it engage in the "necking" act. The sides in contact are the non-genital-pore sides. The third snail climbs onto the ex-mother's shell and the latter crawls off twitching the shell. The snail descends from the shell; the ex-mother crawls on and comes within tentacle sensing distance of the new-born. The parent turns from it, and it turns from the parent. No baby-eating here.

Under the dissecting scope the new-born is seen to have the dorsal surface of the spire marked with fine spiral lines, but hairs or papillae are lacking. The young shell is not subcarinated. The new-born was observed to crawl a few minutes after being born. None of the adults mated. — GLENN R. WEBB.

COPULATIONS BETWEEN XOLOTREMA (WILCOXORBIS) FOSTERI AND TRIODOPSIS TRIDENTATA FRISONI. — On May 29, 1952 a *frisoni* and a *fosteri* were found copulating. I tried gently pulling them apart but found they were united by the sex-organs. Reciprocality was not evident.

A second such mating was noted June 5, 1952. The long penis of the *fosteri* extended across the front of the foot and into the orifice of the female-organ of the *frisoni*. As I began to invert the cage cover-glass to examine the details of the union, they disengaged and I saw the penis-tip of the *fosteri* withdrawn across the foot of the other, which had the orifice of the female-organ filled with whitish material, possibly received semen. The *frisoni* had not everted its penis. Two days later this snail was noted with its foreparts in the soil; I then dug up and removed 4 eggs from the spot. The specimens of *X. fosteri* (F. C. Baker) derive from specimens collected about April 5, 1947 from the Mississippi River floodplain near Tiptonville, Tennessee by William Robertson. The *T. t. frisoni* F. C. Baker derive from specimens collected April 20, 1947 by Tom Hanning and Quintin Pickering near Shetlerville, Hardin County, Illinois. — GLENN R. WEBB, Kutztown State College, Kutztown, Pa.

FURTHER NOTE ON DISTRIBUTION OF CYMATIIDAE IN WESTERN ATLANTIC. — Range extensions for juveniles of two species of Cymatiidae found on navigation buoys off South Carolina were reported by Merrill (1961, Nautilus *75* (3) : 94-95). He postulated that the specimens were adventitious, that in their larval stage they had been carried northward of their normal range by the Gulf Stream, and therefore probably were unable to overwinter and reproduce at the higher latitude. This supposition was strengthened by the fact that no Cymatiidae had been reported from bottom habitats north of southern Florida in the latest monograph (Clench and Turner, 1957, Johnsonia 3 (30) : 189-244).

The occurrence of larval cymatiids in the Gulf Stream north of their reported range can now be documented. Dr. Rudolph Scheltema of the Woods Hole Oceanographic Institution has been collecting plankton extensively in the open waters of the Atlantic Ocean. He informs us (personal communication) that larval Cymatiidae are widely distributed in his collections over the North Atlantic. One species, probably *Cymatium parthenopeum,* was taken from a sample east of the Grand Banks at Latitude 47°30′, much farther north than adults are recorded.

Mr. Richard Petit of Ocean Drive Beach, South Carolina brought to the attention of the senior author the fact that a shrimp trawler had dredged a live specimen of *Cymatium parthenopeum,* 93 mm. long, 40 miles offshore of McClellanville, South Carolina, in 40 fathoms, June 1962. This find stimulated extensive dredging by Merrill and Petit in the offshore waters of South Carolina. The work produced many new range extensions, most of which were several hundred miles northward from southern Florida. The first report of these extensions has been published (Merrill and Petit, Nautilus *79* (2) : 58-66). In all, 5 species of *Cymatium* now have been reported from South Carolina.

Two species of *Cymatium* were later taken from the catch made by a trawler in January 1963, southeast of Cape Lookout, North Carolina, in 18-20 fathoms. Two specimens of *Cymatium parthenopeum* (Von Salis) 1793 measured 95 and 195 mm. (I.F.R., U.N.C. Moll. Coll. #1107.1 and 1107.2) and two specimens of *Cymatium poulsenii* (Mörch) measured 65 and 72 mm. (I.F.R., U.N.C. Moll. Coll. #1106.2 and 1106.1). The collections at Cape Lookout extended the known range of both species, which have been reported previously from South Carolina by Merrill and Petit (*op. cit.*).

In January 1965, during a surf clam cruise off Chincoteague Inlet, Virginia (Lat. N. 37°40′; Long. W. 75°15′), two shells of adult *Cymatium poulsenii,* both measuring about 75 mm., were dredged up from 12 fathoms. The shells were inhabited by hermit crabs; although worn they still possess color and texture and do not appear to be fossils. If adult specimens are found alive at this latitude it will represent a significant advance northward from Cape Hatteras. — ARTHUR S. MERRILL, Bureau of Commercial Fisheries, Biological Laboratory, Oxford, Maryland and HUGH S. PORTER, Institute of Fishery Research, University of North Carolina, Morehead City.

CORBICULA MANILENSIS (Philippi) in the Alabama River System. — *Corbicula* was first found in the Alabama River System in the Mobile River, 1 mile north of Bucks, Mobile Co., Alabama, in the spring of 1962 (Nautilus 77: 31). Adults were very abundant at this locality. They were found in lesser numbers several miles up the river at Chastang Bluff. During the fall of 1964 two young specimens were collected in the Alabama River at Claibone (Nautilus 78: 106). In the fall of 1964, adults were found abundant in the Tombigbee River, at Ezells Fish Camp, east of Lavaca, Choctaw Co., Alabama.

During the fall of 1965, numerous localities in the lower Alabama River system were visited to determine the extent of the distribution of *Corbicula*. In the Alabama River adults were found abundant at Choctaw Bluff, Clarke Co. One mile below Claiborne, Monroe Co., dead adults were abundant where they had been caught by lowering of the water level, but living immature specimens were common. In the Cahaba River a single dead shell was found on a sand bar 1.5 miles southwest of Sprott, Perry Co.

In the Tombigbee River adults were found abundant at McCartys Ferry, southeast of Ararat; young were very abundant at Tuscahoma Landing, eastsoutheast of Butler, Choctaw Co. Numerous immature specimens were found at Lock no. 3, southeast of Whitfield; adults were abundant below the Demopolis Dam, 2 miles east of McDowell, Sumter Co. Several young specimens were found 1.5 miles northeast of Cochrane, Pickens Co. Twelve young specimens were collected in Sucarnochee Creek, east of Bellamy, Butler Co.

At Tuscahoma Landing only two adults were found but the bottom was literally paved with young, which indicates an extremely high rate of reproduction. Judging by the size modes it must require 4 or 5 years for them to reach maximum size. — LESLIE HUBRICHT.

HABITAT OF EUPERA SINGLEYI Pilsbry. — *Eupera singleyi* is known from rather scattered records from streams in the Gulf Coastal Plain. The paucity of records is due in part to the absence of collecting within its range, and also to a lack of understanding as to its habitat. *Eupera singleyi* rarely is found by sifting mud and sand, a procedure usually used for collecting other Sphaeriidae. It is usually found attached by byssi to the undersides of stones and water-lodged wood, but sometimes to the roots of trees and to aquatic plants.

In the aquarium they move about on top of the sand without leaving a furrow. They can readily crawl up the glass and suspend themselves from the surface to find a suitable place for attachment among floating plants. — LESLIE HUBRICHT.

A PORTABLE SHELL COLLECTION. — When I started collecting shells, I followed the usual practice of placing them in trays in the shallow drawers of a cabinet. This worked fine until I had to move. Packing them required a full week. Since my work would require moving occasionally, it became necessary to find a means of storing the collection where the specimens would be readily available for study, but where they could be moved without laborious packing.

My solution of this problem consisted of using army plywood foot lockers for cabinets. The tops of these were fastened down and the fronts were opened and hinged so that the lockers could be stacked. All of the shells were put into vials or plastic boxes. To hold these, cartons were made of corrugated pasteboard 7 by 14 inches in size; the height varied with the size of the vials or plastic boxes they were to contain. This size carton would fit in four stacks in the foot lockers. Separators of card were made for the cartons to hold the vials in place and prevent breakage. These lockers when full were light enough so that they could be lifted and carried by one man without strain. The collection has been moved several times without any damage to the specimens.

The one disadvantage of this system is that all lots of a species cannot be kept together, because the different sizes of vials are in different cartons. A single specimen of a species would fit into one size vial and a large series would require another size, so that a species of which there were many lots could be in several sizes of vials or plastic boxes. In order to find a certain lot of a species, it was necessary to have a catalog. This consisted, under each species, of the collection number, county and state where collected, and the size of vial in which it was contained. With this any lot could be readily found. — LESLIE HUBRICHT.

RECORDS FOR PARABORNIA SQUILLINA. — Moore (1961. Gulf Research Reports, *1*(1), 58 pp.) noted a small bivalve which was tentatively referred to the genus "Lepton" on the stomatopod crustacean, *Lysiosquilla scabricauda* (Lamarck), in Mississippi. Boss (1965. Amer. Mus. Novitates, no. 2215, 11 pp., 3 figs.) described *Parabornia squillina* as a commensal erycinid attached to the ventral surface of the abdomen and thorax of *L. scabricauda* from the Caribbean coast of Panama. Boss ([*in press*]. Malacologia. Symbiotic Erycinacean Bivalves) indicated that Moore's "Lepton" is *P. squillina.* The present note is to record additional specimens and measurements of *P. squillina* and to document its range. Four specimens of this bivalve were taken by W. Demoran from *L. scabricauda* collected at Horn Island, Mississippi, and another six individuals were recovered in the same area from *L. scabricauda* collected at Dog Keys Pass, Mississippi. Two of the specimens are larger than any in the type series and are 7.48 mm. × 4.90 mm. × 2.28 mm. and 7.32 mm. × 4.88 mm. × 2.28 mm. respectively. — D. R. Moore, Institute of Marine Science, University of Miami, Miami, Florida, and K. J. Boss, Ichthyological Laboratory, Bureau of Commercial Fisheries, Washington, D. C. Contribution No. 673 from the Marine Laboratory, Institute of Marine Science, University of Miami.

RANGE AND BATHYMETRIC EXTENSIONS FOR OLIVELLA INCONSPICUA AND NASSARIUS LIMACINUS. — *Olivella (Minioliva) inconspicua* (C. B. Adams, 1852), apparently has never been collected outside of Panama. Lowe reported what he considered to be this species from La Paz, Baja California, but his specimens are *Olivella alba* (Marrat, 1871). Adam's specimens were taken from beach drift, which Olsson states, came from near the city wall.

While aboard the Mexican shrimp trawler, "Jose Antonio," during July, 1963, I collected 11 specimens of *Olivella inconspicua* trawled from a depth of 60-70 meters about 20 miles off Bara del Suchiate, Chiapas, West Mexico. (Latitude 14° 24′ North; Longitude 92° 32′ West.)

All the specimens were extricated from the stomach of a single "sand" starfish. The soft parts of the shells were present in each specimen.

Several days later, while trawling off the Oaxaca coast near Bahia de Rosario, additional specimens of *Olivella inconspicua* were obtained which came up with mud and decaying vegetation. These were, however, quite worn.

Nassarius limacinus (Dall, 1917), described from the "Gulf of California in shallow water" has been reported by Coan as far south as Mazatlan. Two specimens were taken from the stomach contents of the same starfish mentioned above, thus extending the range south to the Mexico-Guatemala border.

Those who dredge or trawl for shells frequently have to dispose of starfish, and these are usually tossed overboard. I have found them to be a very important source for fresh, well preserved specimens of many rare species of mollusks.

The rays are mostly devoid of shells and can easily be broken off or removed with a knife. The remainder is placed in alcohol for later examination. If allowed to air dry, the contracting starfish tissue will sometimes crush fragile pelecypods they have engulfed. — Donald R. Shasky, Research Associate, Los Angeles County Museum.

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Panopea bitruncata (Conrad). — A very large example of this species (a single, right valve) was presented to the Museum of Comparative Zoology by Mr. Riley Black of Fort Myers, Florida. This valve was brought up in a shrimp net from 10 fathoms, east of South Pass, Mississippi River, Louisiana, in June, 1965. This valve was but recently dead and measured 225 mm. in length and 147 mm. in height. — W. J. Clench.

Burch Collection. — The shells and the library remain in our possession with the thought that we may now have time to work on it. We wish to take this opportunity to give our sincere thanks to the host of customers and friends who have supported us over the years.

We have sold our entire stock and specimen shell business, but will continue dealing in books only. Our successor is: Mr. Richard E. Petit, P. O. Box 133, Ocean Drive Beach, South Carolina 29582, who will continue our mail order business in specimen shells.

Mr. Petit will at this time honor the prices in our list 551, only until he publishes his own first list. We are referring all orders to him. It may take a few weeks for him to get the stock arranged and orders filled.

The new owner will also publish the 1966 Directory of Concholo-

THE NAUTILUS

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REINSTATEMENT OF MELARHAPHE MENKE, 1828

By JOSEPH ROSEWATER
U. S. National Museum, Washington, D. C.

The vicissitudes of the International Code of Zoological Nomenclature will require taxonomists for some time to come, to give constant attention to keeping current the names even of our well known mollusks. While preparing a catalogue of Littorinidae, prior to reviewing the classification of Indo-Pacific species, I was reminded of the effect on this group of the recent change in I.C.Z.N' Article 11 (d) (2nd edition, 1964).

Following the rules then in effect, McMichael (1959) pointed out that *Melarhaphe* Menke, 1828, was introduced in synonymy, was therefore invalid, and should be replaced by *Melarapha* Cristofori and Jan, 1832. Rehder (1962) indicated that *Melarapha* Cristofori and Jan, 1832, and its use by Jan. 1830, are essentially nomina nuda, since no valid species names were included, nor were descriptions given. As a result, Rehder suggested the use of *Melarapha* A. and J. B. Villa, 1841, who cited several recognizable species. However, the latest edition of the code circumvents the need for this action. The new article 11 (d) (loc. cit.) stipulates that a name originally published as a synonym is not available unless before 1961 it was treated as an available name under its original date and authorship, and either used as the name of a taxon or as a senior homonym. Presumably this new interpretation will serve the best interests of stability of nomenclature. Nevertheless, it will create initial confusion where workers have acted to correct what previously appeared to be flaws in usage.

In conformance with this article, as revised, *Melarhaphe* Menke, 1828, is valid and was used by Dall (1909), Iredale (1912), Winckworth (1922), Abbott (1954), and by others before 1961. The type species of *Melarhaphe* has been quoted as: *Melarhaphe glabrata* Mühlfeld = *Paludina glabrata* Ziegler = *Littorina neritoides* (Linnaeus, 1758). The first two are manuscript species names as is another name included by Menke (1828), *T. rupestris* Chabrier, although the name attributed to Ziegler was described by Pfeiffer

(1828). In fact, the only valid name included with the original citation of *Melarhaphe* is *Turbo coerulescens* Lamarck [*caerulescens*], which must be considered the type species by monotypy. This does not alter the concept of *Melarhaphe* because *T. caerulescens* is a synonym of *L. neritoides,* the well known European species.

The question of the value of some generic groups in Littorinidae remains to be settled. At present such taxons as *Melarhaphe* are differentiated largely on morphology of egg capsules and of the verge and on minute differences in shell anatomy. But one may argue that these characters are as much a matter of species differences as they are of generic significance. Both Winckworth and McMichael (loc. cit.) suggested that subgeneric versus generic allocations of these taxons still remains a matter of opinion. Further study may provide more evidence by which these distinctions may be interpreted. The purpose of the preceding note is to call attention to the correct name for one of these taxons commonly recognized today.

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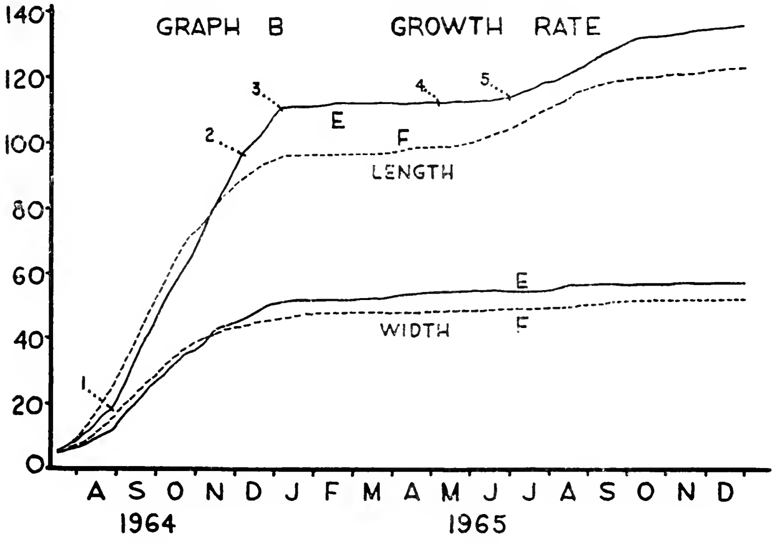
LIFE HISTORY AND POPULATION STUDIES OF ACHATINA FULICA

By WILLARD KEKAUOHA

[Continued from July number]

Growth, aestivation, self-fertilization. On July 12, 1964, 24 infants of 377 hatched eggs laid by snail AQ were isolated individually for the following purposes: (a) growth rate studies and (b) observations on self-fertilzation. Three months later the 24 were reduced to 8 (snails A to H) to reduce the work load.



The results to date (December 29, 1965, Graph B) are as follows: 1. *Growth.* Periods in the rate of growth were found to parallel Kondo's study (1964) in most respects. Snail E grew in length from 5.5 mm. to 132.5 mm. in 1 year 170 days (535 days), a total of 127.0 mm. (a) Infant growth (to point 1) was confirmed. Kondo, 9 mm. in 35 days; Kekauoha, 16.5 mm. in 41 days. (b) Adolescence (to point 2). Kondo, 74 mm. in 94 days; Kekauoha, 73.8 mm. in 95 days. (c) Young adult (point 2 to point 4). Kondo did not define exactly the period called young adult. He said in personal conversation that no arbitrary span can be obtained by the growth curve but a period between the end of adolescence (4 months) and the eighth month should suffice for our purposes.

According to the plotted graphs, specimen E grew from 81 mm. to 111 during that period (December 5 to February 10, 17 mm. in 120 days). In specimen E (point 3) there was a sudden stoppage in growth in 175 days which was expressed also in specimen F. (d) Maturity (point 4 to point 5). Growth levels off then, curiously, takes a gradual upswing from point 5 to end of curve. (e) Width, same as Kondo's.

Aestivation. None of the 8 specimens (snails A to H) went into aestivation in the 18 months period, in contrast to Ghose's and Kondo's reports of aestivation in their laboratory snails. Similarly, none of the original four (#3, 4, AQ, BB) obtained in the wild condition (in order to procure studies in ovulation and infants for growth and other studies) aestivated during their 18 months of captivity.

Self-fertilization. Three hundred and fourteen days after isolation (May 27, 1965) snails C (94.2 mm.) and D (102.7 mm.) were accidentally placed together by a neighbor's child. They copulated on May 28th; were separated and isolated on May 29th. Snail C laid 3 clutches of eggs while snail D laid 4 clutches, with viability ranging from 92.8 to 97.8%. Mortality rates will be studied from the progenies of snails C and D and one clutch is being kept together until egg-laying begins. The other 6 isolated virgin snails (snails A, B, E, F, G, H) are still under observation. None have laid eggs after 17½ months.

Two significant points must be cited here, namely, (a) the accidental mix-up of snails C and D provided a control for observations on virgins A, B, E, F, G, H and (b) isolation of individuals from infancy seems to provide evidence that copulation is necessary for production of fertile eggs. However, it is premature to conclude from this evidence alone that self-fertilization does not occur in *A. fulica.* This experiment must be continued 2 or 3 years longer.

Population study. A population study was first suggested by Dr. Yoshio Kondo in March 1963. Twenty separate meter-square plots were selected at random in May and June, 1963 in an area between Laie and Kahuku, Oahu. All individuals within these plots were grouped into 5 categories of size and data tabulated (Table V).

By random sampling, an *Achatina* population was approximated at 537,600 snails for the whole 67,200 square meter area, or approximately 8 snails per square meter plot. A follow-up census made in June 1964, using the same procedures, showed a total population of approximately 403,200 snails for the same area, or approximately 6 snails per square meter plot, a decrease of approximately one-fourth.

TABLE V

POPULATION STUDY

	1963	1964
Eggs (0-5 mm)	0	0
Infants (5-25 mm)	28	22
One-half Grown (25-40 mm)	1	23
Sub-adult (40-60 mm)	33	31
Adult (60^+ mm)	93	53
TOTAL FOR 20 SQUARE METER PLOTS	155	129
AVERAGE PER SQUARE METER PLOT	7.75	6.45
ESTIMATED TOTAL FOR 67,200 SQUARE METER AREA	537,600	403,200

Material and method

1. *Ovulation studies.* For the study of ovulation, copulating pairs of *Achatina* were found in the evening of July 15, 1961 and marked. The next morning, 10 pairs of the snails still in copula were gathered, separated and isolated. Twenty additional snails in copula were gathered the following night and put into isolated compartments. On July 17, 1964, 14 more snails in copula were gathered and isolated. All 54 snails were measured, numbered and fed constantly with measurements of length taken every 10 days. Fifty of the 54 were killed and only 4 were kept (#3, 4, AQ, BB).

Preceding ovulation, a snail would burrow 1 to 3 inches into the soil and then deposit its eggs. Egg-laying took 1 to 4 days. After

TABLE VI

	TEMPERATURE		RAINFALL
1964	LOW	HIGH	AVERAGE
January	68.52	78.68	5.32
February	67.62	78.52	1.24
March	66.55	78.52	3.83
April	68.20	79.13	2.81
May	68.93	78.86	1.01
June	69.93	82.70	0.70
July	71.23	82.87	2.98
August	70.97	83.16	1.33
September	71.20	84.10	3.16
October	69.13	81.26	4.29
November	66.73	80.90	3.58
December	67.29	90.23	11.44
1965			
January	61.42	78.94	5.20
February	60.85	75.29	6.93
March	60.84	78.00	2.48
April	62.73	78.83	6.46
May	66.03	80.81	14.65
June	68.81	82.07	0.84
July	70.84	82.87	3.17
August	72.87	83.81	1.88
September	70.60	85.20	2.48
October	70.25	84.32	14.07
November	64.25	82.17	17.68
December	62.08	79.31	6.75

completion of egg-laying, a snail would rest from 3 hours to 3 days before normal activity was resumed. On a few occasions, snails would lay their clutch of eggs 1/4 to 1/2 inch into the soil with the main body of the eggs exposed and out of the soil. All eggs laid were removed, counted and separated for viability studies. When the infants emerged from their eggs, they were removed and housed in a separate container.

Normal eggs are approximately 5 x 4 mm. in size. However, on all occasions during the 1964 laying, one to six infertile pearl-like eggs 2 x 2 to 4 x 4 mm. in size were found with each clutch (with the exception of snail #4, first clutch). In the 1965 egg-laying of snail #4, large eggs, 6.5 x 5.5 mm. were found.

2. *Food.* Food consisted mainly of lettuce with an occasional diet of papaya, apple, cabbage and broccoli. Fresh food was placed with the snail every 3 to 4 days and decayed vegetable matter removed.

3. *Temperature.* The temperature varied from a low of 66.55° to a high of 90.23° for 1964 while the temperature for 1965 varied from 60.84° to 85.20° F.

4. *Rainfall.* Rainfall varied from an average monthly low of 0.70 inches in June 1964 to a high of 17.68 inches in November 1965. There seems to be no correlation between rainfall and egg production.

5. *Moisture.* All compartments were sprinkled with water every 3 to 4 days to keep them wet and moist.

6. *Measurements.* During infancy, a cardboard caliper was used to prevent injury to the shell. When the snails were approximately 30 mm. in length, a metal caliper was used. When specimens grew too large for these calipers (approximately 115 mm.) a cranial caliper was used for the measurement of length only.

SUMMARY

1. *Egg-laying season determined by the smash technique.* The egg-laying season for 1964 was from June to December while the 1965 season was from May to November.

2. *Multiple ovulation.* Snails kept in captivity laid five to six clutches of eggs during their 1964 season fom July 5, 1964 to Januay 22, 1965.

3. *Period between ovulation.* The period between ovulation varied from 20 days to 91 days with an average of 34 days.

4. *Number of eggs per clutch.* Egg clutches varied from 17 to 442 eggs per clutch with an average of 213 eggs per clutch.

5. *Capacity of eggs per individual.* The capacity of eggs were 677, 776, 1624 and 1817 eggs per individual per season.

6. *Viability of eggs.* Viability of egg clutches varied from 0% to

100% with an overall viability of 93.1%.

7. *Aborted eggs.* Results from the study of viability of aborted eggs show that eggs with any shade of yellow were 50 to 70% viable; and that eggs aborted from a single individual varied in color with dark yellow eggs having a higher viability than light yellow eggs.

8. *Growth.* Snail E grew in length from 5.5 mm. to 132.5 mm in 535 days, a total of 127.0 mm. and from 4.5 to 55.7 mm. in width, which parallels Kondo's (1964) findings in most respects.

9. *Aestivation.* None of the 8 specimens raised from infancy, or the 4 original snails obtained from the natural environment aestivated during their 18 months of isolation and captivity.

10. *Self-fertilization.* An accidental mix-up of 2 specimens provided a control producing fertile eggs while 6 others still in isolation since infancy have not produced any eggs (17 months).

11. *Population studies.* Random sampling in 1963 showed a total population of approximately 537,600 snails, or approximately 8 snails per square meter plot. A 1964 census showed approximately 403,200 snails, or approximately 6 snails per square meter plot, a decrease of approximately one-fourth.

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THREE NEW SONORELLA FROM SOUTHWEST ARIZONA

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In early 1918, James H. Ferriss explored for mollusks in the area west of Tucson, Arizona, as far as Ajo. He stated that the large Growler Range west of Ajo city looked promising from a distance, but the Mexican bandits were active at that time along the western boundary. This was apparently sufficient deterrence, even for an ardent collector like Ferriss. The most western locality for *Sonorella* on that trip turned out to be "3 miles west of Comovo Church" (now Kom Vo) in the Papago Indian Reservation.

In recent years, explorations for mollusks have been resumed in this general area. Snails have been brought to the University of Arizona from the Organ Pipe National Monument, the Cabeza Prieta Game Range, and the Picacho Mts. They are described below.

SONORELLA BABOQUIVARIENSIS COSSI **new subspecies.** Plate 1, figs. A-C.

Description: Shell depressed-globose, heliciform, thin, glossy, light brown, with a chestnut-brown spiral band on the well rounded shoulder; narrowly and half-covered umbilicate, the umbilicus contained about 13 times in the diameter. Embryonic shell of about 1¼ whorls, with apical sculpture like *S. hachitana.* First half whorl irregularly radially wrinkled only, the remainder of the embryonic shell with forwardly descending spiral threads superimposed on the radial sculpture. First 2½ whorls, including embryonic whorls, show scars of worn off, hair-like periostracal projections. Remaining whorls with faint, raised growth striae, with a silky luster. Body whorl descending only slightly to the narrowly expanded peristome. The columellar margin of the peristome is broadly expanded and reflexed to cover nearly half of the umbilicus. Aperture oblique, large, broadly ovate, its width more than half the diameter of the shell; with a thin parietal callus.

Holotype measurements: Height 11.7 mm.; max. diam. 19.2 mm.; umbilicus 1.5 mm.; whorls 4½.

Genitalia of holotype (Plate 2, fig. A): The penis contains a relatively small cylindric verge with a blunt, rounded end. The epiphallus is only slightly longer than the penis and bears a long (for the genus), well detached, epiphallic caecum. The penial retractor inserts on the epiphallus a short distance above the penis. Penial sheath relatively long, about half the length of the penis. The vagina is about as long as the penis and about twice as long as the free oviduct.

Measurements of genitalia, in mm.	Holotype	Paratype A	Paratype C
Penis	8.0	7.0	6.0
Verge	2.5	2.5	2.5
Penial sheath	3.5	4.5	4.5
Epiphallus	9.0	8.0	8.5
Epiphallic caecum	1.0	1.0	1.5
Vagina	8.0	9.0	7.5
Free oviduct	4.0	4.0	4.0

Type locality: Ajo Range, Organ Pipe Cactus National Monument, Pima Co., Arizona, in rockslide along left bank of Arch canyon, at base of north facing cliffs about ½ mile upstream from the Arch; elevation ca. 2900 ft. (J. Bequaert and W. B. Miller, 25 Jan. 1965). Holotype ANSP. (308955). Paratypes in collections of ANSP. (308956), Dept. of Zoology, University of Arizona (879), and the author (4745).

Other localities: Upper Arch canyon, Ajo Range, elev. ca. 3500 ft. to 4000 ft. (Harold T. Coss, 12 April 1965). Cave in saddle about ¼ mile south of the Arch in Arch canyon (Harold T. Coss and Jim Taylor, 6 Feb. 1966).

In shell characteristics, this subspecies is not distinguishable from small forms of *S. baboquivariensis* s.s. The smallest paratype measures: height 11.2 mm.; max. diam. 17.2 mm.; umbilicus 1.3 mm.; whorls 4½. The largest paratype measures: height 12.3 mm.; max. diam. 19.5 mm.; umbilicus 1.6 mm.; whorls 4½. Specimens of *cossi* from upper Arch canyon ran even smaller, with max. diam. as low as 15.0 mm. In embryonic sculpture, *cossi* displays the protractive spiral threads consistently in all specimens examined, where the apical sculpture was not completely worn off. Some fresh young shells also show ascending spiral threads on the embryonic whorls.

In the genitalia, *cossi* differs significantly and consistently from *baboquivariensis* s.s. The verge is smaller, ca. ⅓ the length of the penis, and does not have a swollen, glandiform tip. The vagina is as long as or longer than the penis, and the epiphallic caecum is particularly long and detached (for the genus).

Since the shell characteristics are so similar to those of *baboquivariensis* s.s., only a subspecific distinction seems indicated. Hybridization experiments between the nominate species and *cossi* are planned; if they reveal evidence that potential interbreeding between them no longer exists, this subspecies would have to be raised to specific rank.

The subspecies is named after Mr. Harold T. Coss of the National Park Service who was stationed at the Organ Pipe National Monument in 1965 and brought in the first specimens of this snail to the University of Arizona. For some time, this was the westernmost known population of *Sonorella* in southwestern Arizona, until further explorations reevaled other populations farther west (*vide infra*).

SONORELLA SIMMONSI new species. Plate 1, figs D-F.

Description: Shell depressed, heliciform, thin to solid, glossy, light brown, with chestnut brown spiral band on the well rounded shoulder; umbilicate, the umbilicus contained 8 to 9 times in the diameter. Embryonic shell of about 1 and ⅓ whorls, with sculpture like *S. hachitana;* its apex smooth; the remainder with weak, irregular radial wrinkles and fine, spirally arranged, hyphen-like papillae which anastomose over the last third of the embryonic shell into thin, forwardly descending threads. Later whorls have light growth lines with occasional papillae at first, the papillae disappearing on the body whorl. Body whorl smooth, with a silky luster. Aperture oblique, rounded, slightly wider than high. Peristome expanded, the margins converging; parietal callus thin.

Holotype measurements: Height 12.0 mm.; max. diam. 20.6 mm.; umbilicus 2.6 mm.; whorls 5.

Genitalia of holotype (Plate 2, fig. C): Penis large and thick, equally thick throughout. A short, thick penial sheath envelops its base. The verge is nearly as long as the penis, moderately thick, its largest diameter at about ⅓ of its length from the epiphallus, then slowly tapering toward the abruptly truncate tip, indistinctly annulate. The slender epiphallus is as long as the penis and bears the retractor muscle near its distal end; near its proximal end, it is invested by connective tissue from the upper end of the penial sheath. Epiphallic caecum small, only slightly detached from the epiphallus. Vagina ⅔ to ¾ the length of the penis, about 3 times as long as the free oviduct.

Measurements of gentalia, in mm.	Holotype	Paratype A	Paratype B
Penis	15.0	13.0	13.0
Verge	11.0	10.5	11.0
Penial sheath	2.5	2.5	2.5
Epiphallus	18.5	18.0	20.0
Epiphallic caecum	1.0	0.5	1.0
Vagina	11.5	9.5	7.0
Free oviduct	3.0	4.0	3.0

Type locality: Picacho Mts., Pima Co., Arizona, in north facing rock piles on west side of canyon which runs southeasterly from Newman Peak, R 9 E, T 8 S, Sec. 26, SE ¼; elevation ca. 2500 ft. (J. Bequaert, M. L. Walton, W. N. Miller, and W. B. Miller, 27 Dec. 1965). Holotype ANSP. (308953). Paratypes in collections of ANSP. (308954), Dept. of Zoology, University of Arizona (1628), M. L. Walton (9245), and the author (4842).

The embryonic spiral threads vary in intensity, but are present at least to some degree on all specimens examined. Shell color varies from light brown to nearly white. One fresh specimen had no band at all and was completely white. There is a large variation in maximum diameter. The smallest paratype measured as follows: height 11.2 mm.; max. diam. 17.8 mm.; umbilicus 2.0 mm.; whorls 4¾. The largest paratype measured: height 12.7 mm.; max. diam. 22.1 mm.; umbilicus 2.6 mm.; whorls 5.

The shell of *S. simmonsi* has the general appearance of certain forms of *S. ambigua* from the Roskruge Mts., about 35 miles to the south, as well as some specimens of *S. sitiens* from the Ko Vaya hills (Cababi Mts.) about 55 miles to the southwest. It is readily distinguishable from these by the presence of spiral threads on the embryonic whorls. In the genitalia, it bears some resemblance to *S. ambigua* in the large, thick penis and verge. The shape of the verge differs, however, in that it slowly tapers for the last ⅔ of its length to an abruptly truncate tip, while *ambigua* has a club-shaped verge with maximum diameter at the short-conic tip. Other differences are in the penial sheath, which is ca. 1/6 the length of the penis in *simmonsi* and ca. ⅓ in *ambigua,* the epiphallus, which is ca. 1½ times the length of the penis in *simmonsi* and ca. ⅔ to ¾ in *ambigua,* and the vagina, which is ca. ⅔ to ¾ the length of the penis in *simmonsi,* while it is about as long as the penis in *ambigua.*

Dead shells were collected by Mr. Norman M. Simmons of the Fish and Wildlife Service, while hunting in the Picacho Mts. and brought to the University of Arizona for identification. Subsequently, on 27 Dec. 1965, the author, accompanied by Dr. Joseph Bequaert. Mr. Munroe Walton, and the author's son, W. Nixon Miller, collected large numbers of live speciments and dead shells at the type locality. The holotype was selected from among the live adults, and all other specimens collected on this expedition have been designated paratypes.

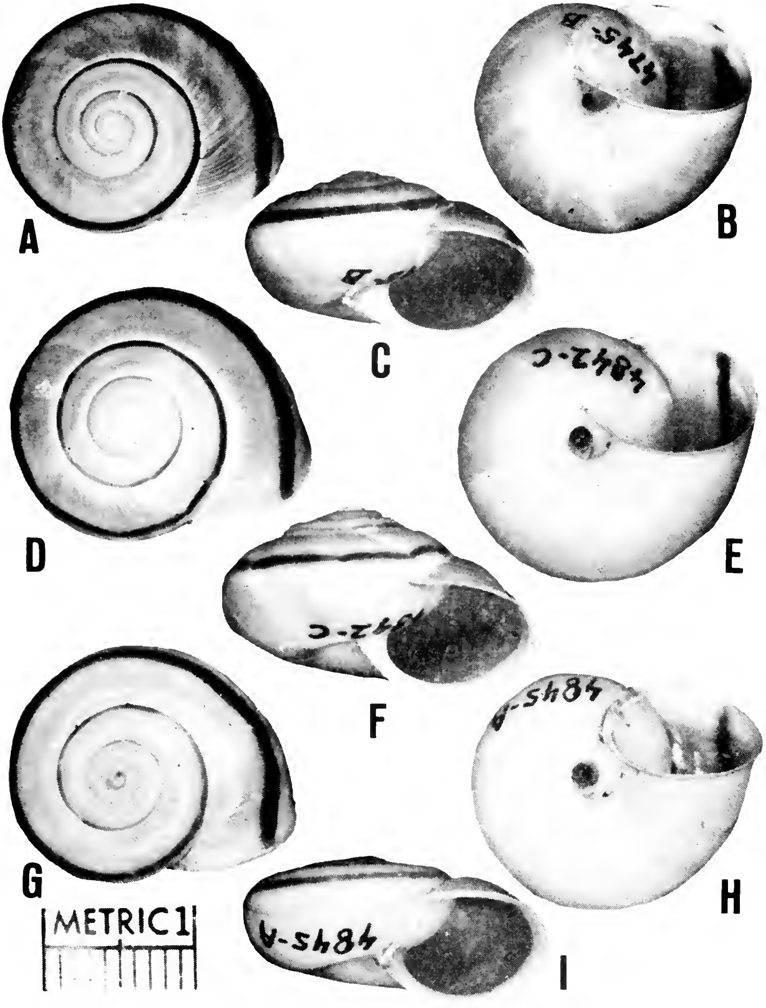
It is probable that this snail is widespread in the Picacho Mts. Mr. Simmons stated that he had found shells in several other canyons in these mountains. This species is named for Mr. Simmons, whose interest in all branches of natural history was responsible for bringing this new species to the author's attention.

SONORELLA MEADI new species. Plate 1, figs. G-I.

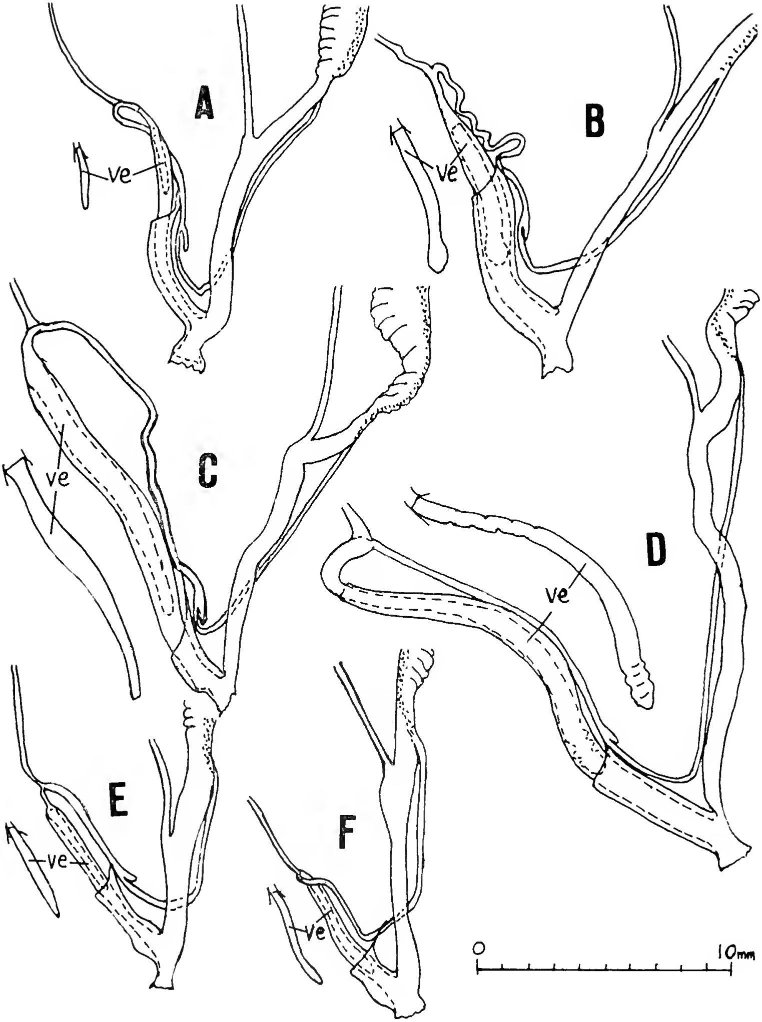
Description: Shell strongly depressed, heliciform, solid, glossy, light tan, fading to nearly white around the umbilicus, with a chestnut brown spiral band on the well rounded shoulder; widely umbilicate, the umbilicus contained 6 to 7 times in the diameter. Embryonic shell of about 1 and ⅓ whorls, with sculpture of the *hachitana type.* Apex smooth, followed by an area of weak, irregular radial wrinkles; after the first half whorl, hyphen-like papillae are superimposed over the radial wrinkles. Over the last third of the embryonic shell, the hyphen-like papillae are elongated and run together to form forwardly descending spiral threads. Postembryonic whorls with small papillae superimposed on weak radial wrinkles, the papillae numerous on the early whorls, gradually disappearing, and finally absent on the body whorl. Body whorl with faint spiral lines impressed on the shoulder between the chestnut-brown band and the suture. Body whorl descends shortly to the moderately expanded peristome. Aperture oblique, rounded-oval, slightly wider than high, with a moderately thick parietal callus.

Holotype measurements: Height 9.7 mm.; max. diam. 20.2 mm.; umbilicus 3.0 mm.; whorls 4½.

Genitalia of holotype (Plate 2, fig. E): The penis contains a



Holotypes. A-C. *Sonorella baboquivariensis cossi* W. B. Miller D-F. *S. simmonsi* W. B. Miller. G-I. *S. meadi* W. B. Miller.



Lower genitalia. A. *S. baboquivariensis cossi* W. B. Miller. B. *S. baboquivariensis* Pilsbry & Ferriss, Saucito ridge, Baboquivari Mts. C. *S. simmonsi* W. B. Miller, D. *S. ambigua* Pilsbry & Ferriss, Coyote Mts. E. *S. meadi* W. B. Miller. F. *S. eremita* Pilsbry & Ferriss, "San Xavier Hill" (type loc.) . ve: verge. All drawings to same scale, drawn from stained whole mounts.

long thin verge with a narrow, pointed tip. The epiphallus is slightly shorter than the penis and bears a short, only slightly detached caecum. The penial retractor is inserted on the epiphallus a short distance above the penis. The penial sheath is about half the length of the penis. The vagina is about half the length of the penis and about equal to the length of the free oviduct.

Measurements of genitalia, in mm.:	Holotype	Paratype B	Paratype C
Penis	7.0	7.5	8.0
Verge	5.0	4.0	5.0
Penial sheath	3.5	3.5	4.0
Epiphallus	6.0	6.5	6.5
Epiphallic caecum	0.3	0.5	0.5
Vagina	4.0	3.5	3.0
Free oviduct	3.0	4.0	3.0

Type locality: Agua Dulce Mts., Pima Co., Arizona, in rock piles in canyons both south and north of Agua Dulce Pass, east of Quitovaguita Peak; elevation ca. 1600 ft. (W. N. Miller and W. B. Miller, 29 Jan. 1966). Holotype ANSP. (308951). Paratypes in collections of ANSP. (308952), Dept. of Zoology, University of Arizona (2301), and the author (4845).

The spiral lines impressed on the body whorl vary in intensity from prominent to absent; on the holotype, they are present but faint. Two paratypes are completely bandless and white, although fresh and lustrous. The smallest of the paratypes measures: height 9.4 mm.; max. diam. 18.1 mm.; umbilicus 2.3 mm.; whorls 4¼. The largest of the paratypes measures: height 10.4 mm.; max. diam. 21.9 mm.; umbilicus 3.7 mm.; whorls 4½.

In shell characteristics as well as genitalia, this species appears to be most closely related to *S. eremita* P. & F. from the Mineral Hills about 120 miles to the east. In general *meadi* is more depressed than *eremita* and the embryonic sculpture of spiral threads is not so well developed. In the genitalia, *meadi* does not have the basal swelling of the penis which is present in *eremita;* the long verge is narrowly pointed instead of rounded; and the vagina is much shorter than the penis, instead of longer as in *eremita. S. meadi* is not closely related to the neighboring populations of *S. baboquivariensis cossi* W. B. Miller of the Ajo Mts., nor to *S. ambigua* P. & F. of the hills just west of Kom Vo.

A dead shell which appears referable to this species was collected by Mr. Harold T. Coss, of the National Park Service, in the Bates

Mts. in the Organ Pipe National Monument on 23 Jan. 1966. Live material will be necessary before a firm diagnosis of this population can be made. Supposedly this species extends to the north and east into the Bates Mts., the Growler Mts., the Little Ajo Mts., and possibly the Sauceda Mts. The Sierra Pinta to the west and the Sierra del Pozo to the southeast are the abodes of races of *Micrarionta (Eremarionta) rowelli.*

The Agua Dulce Mts. have been erroneously marked on certain topographic maps as located within the Organ Pipe National Monument. The 1964, 15 minute series Agua Dulce quadrangle shows them correctly located just west of the Monument.

This locality represents the westernmost locality for *Sonorella* in southern Arizona. It also represents one of the lowest habitats for the genus. The vegetation is indicative of the Lower Sonoran life zone, consisting primarily of saguaro, organ pipe cactus, small-leaved palo verde, chuparosa, and desert lavender.

This species is named after Dr. Albert R. Mead, an eminent malacologist, who enabled the author to devote full time to the study of zoology in general and *Sonorella* in particular.

A NEW SPECIES OF KALENDYMA FROM MALAITA, SOLOMON ISLANDS

By WILLIAM J. CLENCH

The species described below is the second known species in the genus *Kalendyma.* This genus was introduced by Gude for *Helix compluviatus* Cox, a rather remarkable land mollusk now placed in the Ariophantidae. The distinguishing character is a deep spiral groove which is developed a little above the whorl periphery. It is initiated just beyond the protoconch. Its function is unknown as the soft anatomy has never been studied.

The specific locality for *H. compluviatus* was unknown to Cox who had given only the "Solomon Islands" as its type locality. We have specimens collected in 1949 by J. R. Hood from "head of the Tenaru River, Guadalcanal Id., Solomon Islands at 1000 feet," so this island can be accpeted as the type locality.

ARIOPHANTIDAE

KALENDYMA Gude

Kalendyma Gude, 1911, Proc. Malac. Soc. London *9*:273 (type species, *Helix compluviatus* Cox).

KALENDYMA COMPLUVIATA (Cox)

Helix compluviatus Cox, 1871 [1872], Proc. Zool. Soc. London, p. 646, pl. 52, fig. 10 (Solomon Islands).

KALENDYMA VANDERRIETI, new species. Plate 3, figs. 1-2.

Holotype. Mus. Comp. Zool. 260885, from Ataa, Malaita Island, Solomon Islands. Rev. J. Vander Riet collector, 1965.

Paratype. Mus Comp. Zool. 260886, from the same locality as the holotype.

Description. Shell depressed, minutely umbilicate, nearly smooth, shining and reaching about 12 mm. in greater diameter. Color a uniform brown. Whorls 5½, convex, a little less so above the spiral groove. Spire depressed, dome-shaped and forming an angle of about 140°. Aperture auricular in outline. Outer lip simple with a slight reflection at the base near the columella. Umbilicus very small and partially concealed by the reflection of the columella. Suture deeply indented. Sculpture consisting of numerous, flattened, axial ridges above the spiral groove, and exceedingly fine growth lines below the groove. A little above the whorl periphery there is developed a spiral groove, deeply indentd on the outside and forming a ridge inside.

Measurements

Height mm.	Gt. Diameter mm.	Less. Diameter mm.	
7.5	12.5	12	Holotype
7.3	12.2	10.5	Paratype

Remarks. This new species differs mainly in size from that of *K. compluviata.* This latter species has 5 whorls and is 30 mm. in greater diameter, while *vanderrieti* has 5½ whorls and is only 12.5 mm. in greater diameter. All other charatcers are similar.

FOUR NEW LAND SNAILS

BY LESLIE HUBRICHT

MESODON CLAUSUS TROSSULUS, new subspecies. Plate 3, fig. A-C.

The shell differs from that of *Mesodon clausus clausus* (Say) in having a broad reddish-brown revolving band just above the periphery. This band was present in all specimens collected and in all dead and immature shells seen.

Ht. 10.0 mm., Diam. 14.1 mm., Ap. Ht. 6.9 mm., Ap. Diam. 8.2 mm. Holotype.

Type locality. Alabama: Clarke Co.: base of bluff of Baileys

Creek, 2.5 miles east of Gainestown, holotype, Field Museum of Natural History 152202, paratype 152203; other paratypes 34561, collection of the author.

GLYPHYALINIA LUTICOLA, **new species.** Plate 3, fig.D-F.

Shell small, strongly depressed, coppery (when fresh), glossy, thin and transparent, spire very low conoid. Whorls 4 to 4.5, well rounded, gradually and uniformly increasing, sutures moderately impressed. Sculpture of rather widely spaced radial furrows (20 on the last whorl of the holotype) and fine spiral striae. Aperture lunate; lip thin, sinuous. Umbilicus rimate.

Height 2.6 mm., diameter 5.7 mm., aperture height 2.3 mm., aperture width 3.1 mm., 4.5 whorls. Holotype.

Animal slate colored. Penis rather short, claviform; retractor short and stout, attached to the side of the apical chamber so that there is a broad, rounded lobe above it. Epiphallus about 1.5 times as long as the penis, of uniform diameter except for a short taper at the ends, a little greater in diameter than the penis, attached near the center of the penis. Vagina very short. Free oviduct about 1.5 times as long as the penis. Spermatheca large, ovoid; duct about as long as the free oviduct, stout.

Egg with white calcareous shell, length 1.2 mm., diameter 0.9 mm.

Distribution. Alabama: Greene Co.: near Black Warrior River, north of Demopolis. Dallas Co.: near Cahaba River, east of Harrell. Sumter Co.: Black Bluff, 3 miles east of Whitfield. Choctow Co.: near Tuckabun Creek, 2.7 miles south of Pennington. Baldwin Co.: swamp, Lillian, holotype 147043 and paratypes 147044 F.M.N.H., other paratypes 33431, collection of the author. *Mississippi:* Clarke Co.: Basic City; wet woods, 1.5 miles southwest of Langsdale. Wayne Co.: near Turkey Creek, 8 miles east of Waynesboro. Lamar Co.: edge of swamp, 2 miles southeast of Lumberton. *Louisiana:* Tangipahoa Ph.: magnolia woods 1.3 miles west of Amite. Pointe Coupee Ph.: low woods, 3 miles southeast of Batchelor; low woods, 1.6 miles west of Torbert; low woods, 3 miles northwest of Lettsworth; low woods, 1.9 miles west of New Roads. East Baton Rouge Ph.: roadside, 4800 Laurel St., Baton Rouge; low woods, Duncan Point, south of Baton Rouge; low woods, 6 miles south of Baton Rouge. West Baton Rouge Ph.: low woods, 1 mile west of Carey; low woods, 1 mile west of Port Allen. Evangeline Ph.: low woods, 6.4 miles east of Basile. Allan Ph.: along RR., Reeves; low woods, 2 miles east of Le Blanc; waste ground, 0.4 mile west of Le Blanc.

Glyphyalinia luticola may be readily distinguished from *G. indentata* by its coppery color. The umbilicus is smaller than is usually found in *G. indentata* within its range, and it is usually found in wetter habitats. It is a species of swamps, where it is frequently associated with *Vertigo* and *Catinella.*

GLYPHYALINIA PECKI, new species. Plate 3, fig. G-I.

Shell small, strongly depressed, nearly transparent with a whitish wash, glossy, spire very low conoid. Whorls 4.5 to 5, well rounded, gradually and uniformly increasing, sutures moderately impressed. Sculpture of radial furrows which are followed by radial ridges, the furrows continue onto the base but not the ridges (about 60 furrows on the last whorl of holotype), and distinct spiral striae. Aperture lunate; lip thin, sinuous. Umbilicus very small, about 3.5% of the diameter of the shell.

Height 2.5 mm., diameter 5 .7 mm., aperture height 2.1 mm., aperture width 2.7 mm., umbilicus diameter 0.2 mm., 4.5 whorls. Holotype.

Height 2.9 mm., diameter 5.9 mm., aperture height 2.3 mm., aperture width 2.9 mm., umbilicus diameter 0.2 mm., 5 whorls. Paratype.

Animal white and apparently blind. Penis rather short, claviform; retractor short and stout, attached teriminally. Epiphallus about 1.5 times as long as the penis, of uniform diameter, distal end rounded, about twice the diameter of the penis, attached about three-fourths up on the penis. Vagina very short. Free oviduct about twice as long as the penis. Spermatheca fusiform, about as long as the penis; duct as long as the free oviduct, stout.

Distribution. Alabama: Jefferson Co.: in McClunney (Alabama Crystal) Cave, 2 miles west of Clay (Stewart B. Peck, coll.), holotype 147045 F.M.N.H., other paratypes 34487, collection of the author; in cave, ¾ mile northeast of McClunney Cave (Peck, coll.).

Glyphyalinia pecki differs from *Glyphyalinia indentata* (Say) to which it seems most closely related by the distinct ridge which follows the radial grooves. In this character it seems unique in the genus. It is known only from two caves in Jefferson County, Alabama.

HELICODISCUS HEXODON, new species. Plate 3, fig. J-L.

Shell discoidal, spire flat or nearly so; whorls 5 to 5.5, yellowish, translucent when young, becoming opaque with age. Umbilicus wide and shallow, showing all the whorls, occupying from 50 to 57% of the diameter of the shell. Whorls well rounded below, distinctly flattened above the periphery, slowly increasing, the last slowly descending; sutures well impressed; sculptured with numerous, fine, fimbriated lirae. Aperture lunate, the peristome simple, somewhat thickened within. Within the last quarter whorl there are usually 3 pairs of teeth on the outer and basal walls. These teeth are transversely elongate; the outer teeth are somewhat oblique, the upper end forward; the basal teeth are a little in front of their respective outer teeth, and have triangular bases, broadest near the parietal wall.

Height 1.9 mm., diameter 4.9 mm., umbilicus diameter 2.8 mm., aperture height 1.4 mm., 5.5 whorls. Holotype.

Type locality Tennessee: Bledsoe Co.: base of Walden Ridge, 2.5 miles southeast of Pikeville, holotype 147046, paratypes 147047, F.M.N.H., other paratypes 30918, collection of the author.

Helicodiscus hexodon is most closely related to *H. fimbriatus* Wetherby, differing in the uniformity of its lirae and fringes. In *H. fimbriatus* there are at least 3 lirae which are more prominent than the rest and the fringes are longer. It differs from *H. notius notius* Hubricht, with which it was found, in having higher whorls and in the flattened upper part of the body whorl, as well as in the form of the teeth.

TWO NEW SUBSPECIES OF POTAMOLITHUS

By J. J. PARODIZ
Carnegie Museum, Pittsburgh, Pa.

In 1961 I collected typical *Potamolithus peristomatus* (Orb.) at Paso de la Patria, Paraná River near San Cosme, only 30 km. W. of the type locality (Itaty), province of Corrientes, Argentina. Although the species was often mentioned in the bibliography of the group, apparently it had not been collected since d'Orbigny; Pilsbry has not seen this species but he referred it in his key of 1896 (Nautilus, *10:*87), which may give the impression of belonging to the materials collected by Dr. Rush in Uruguay. Corsi in 1900 (Anales Museo Nacional Montevideo, *2:*335) also mentioned *peristomatus* from the Queguay River in Uruguay, but during our extensive collecting in that area not a single specimen was found.

However, a lot collected by myself on the Uruguay River, at San Javier, Misiones, Argentina, represents an allopatric form, here considered as a new subspecies:

POTAMOLITHUS PERISTOMATUS MISIONUM **new subspecies.** Figs. 1-4. Plate 4.

Larger and longer than typical *peristomatus* (the smaller specimen 6.5 x 5 mm., and the larger 9 x 7 mm.). The spire is still very conic and acute as in *peristomatus peristomatus,* but the last whorl shows a greatly developed hump protruding on the left side (in front view), which corresponds to a broader and higher expansion in that area. The color is much darker, almost black.

Holotype (Carnegie Museum) 7 mm. long, 6.5 wide, from San Javier on the Uruguay River, Misiones.

The hump on the side and back of the shell gives to it a more distorted configuration than that often found in *P. rushi* (Pils.) which also differs in shape, color and other characteristics.

The allopatric populations of *peristomatus peristomatus* and *peristomatus misionum,* are from basins at present well isolated, due to drainage changes during the late Pliocene and Pleistocene, a case which is repeated in *Neocorbicula* and other fresh-water mollusks of that area.

Another very rare species is *Potamolithus felipponei* Ihering, the only specimen known is the type collected by Dr. Felippone at Montevideo. On the Argentine shore of the Uruguay River, 260 miles NW. of the type locality, I collected several specimens showing remarkable differences, here described as new subspecies:

POTAMOLITHUS FELIPPONEI CONCORDIANUS **new subspecies.** Fig. 6

Trochiform, conic-pyramidal, the spire forming an angle of 45° with the base, but shorter than in *felipponei felipponei* (fig. 5) and with flatter walls. Surface smooth, dark-olive with brown spiral band stronger marked than in *felipponei felipponei* (compared with Ihering' and Pilsbry's descriptions), which starts at the middle of the last whorl and becomes suprasutural in position in the upper whorls; another, but less conspicuous band, runs subsuturally; 4½ to 5 whorls, the last with a strong and oblique central keel running up to the suture and vanishing before reaching the penultimate whorl; on the periphery, at left, this keel marks the vertex of a right angle which divides the upper from the lower portion of the shell. Umbilical area depressed, with a second keel surrounding it. Columellar area strongly bi-folded, with a large tooth-like prominence on the inner side, which is thick and chamfered; inner area of columella forming a groove or pit separating conspicuously the inner and outer sections. The aperture is very oblique, semicircular, angulate at the top and, in minor degree, at the base. Peristome thick, simple, without a notch below the suture and very little expanded. Suture well marked, especially at front by effect of the carina, but not deep.

Holotype: (Carnegie Museum) 3 mm. long, 2.5 mm. wide, apert. 1.7 x 1.3 mm. from Arroyo Yuquerí Grande at Concordia, province of Entre Rios, Argentina, coll. Parodiz 1961.

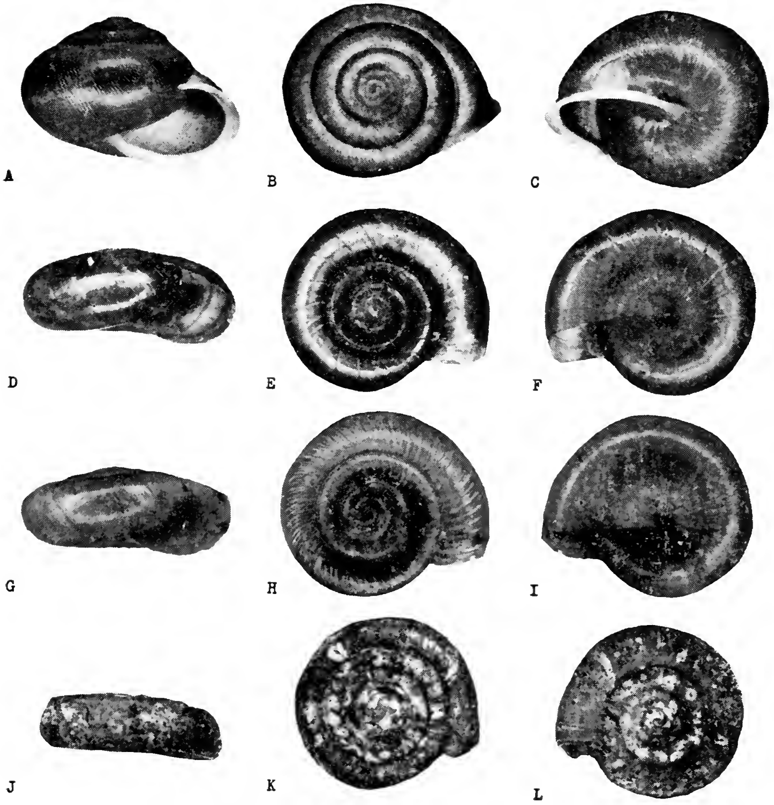
The spire (counting from its sutural base at the penultimate whorl) shortly less than 1/5 of total length. Basal area extraordinarily large in relation to the size of the shell.

The small size of the shells, the thinness of the lip and, judging from similar characteristics offered by other species in their neanic stages, the specimens observed suggest some immature condition. However, they have such striking characteristics that unlikely would disappear in full adults: the lack of a strong marginated notch at the upper portion of the lip, as well as strong sinuses, and its wide, folded columella with a tooth-like process and sunken middle area (vaguely resembling *intracallosus* but stronger). Its general shape may be compared with that of *buschi* (according to what Pilsbry figured in 1911, (pl. 61b, fig. 2), but it differs entirely in colors, columella and convexity of the whorls.

Compared with *P. conicus, P.f. concordianus* is shorter, more pyramidal and differ in color and columellar area. Pilsbry (1911, Non Marine Mollusca of Patagonia, Princeton Exped., pl. 38, fig. 4) figured some young *P. rushi* which resembles *concordianus* in shape but lacking its most prominent features: folds in columella, spiral bands, carina stronger and cordiform.

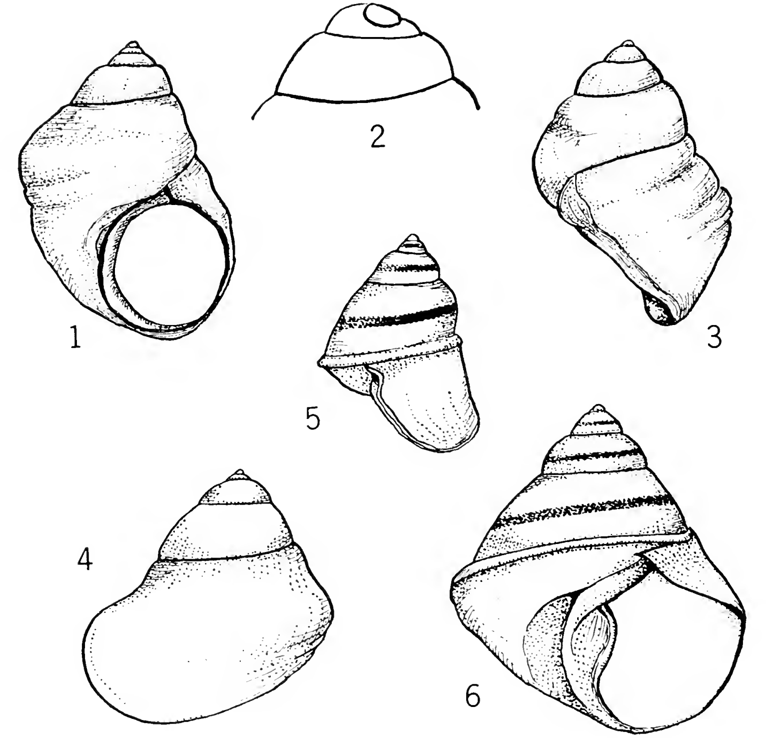
P. felipponei concordianus bears with typical *felipponei* the same relation of geographical variation found between *P. petitianus* and *P. petitianus sykesi.* Although the differences between the Montevideo type and the Concordia specimens are remarkable, they do not justify a new species name, but properly subordinate allopatrically as subspecies.

The two new subspecies are from a revisional study of the genus, published in 1965, Sterkiana no. 20: 26 & 36 (Research supported by grant NSF-15032).



Holotypes. A-C. *Mesodon clausus trossulus* Hubricht. D-F. *Glyphyalinia luticola* Hubricht. G-I. *Glyphyalinia pecki* Hubricht. J-L. *Helicodiscus hexodon* Hubricht. Photographs by Field Museum of Natural History.

Kalendyma vanderrieti Clench. Fig 1, Holotype; Fig. 2, Paratype, both from Ataa, Malaita Id., Solomon Islands (both 3×).



Figs. 1-4. *Potamolithus peristomatus misionum* Parodiz (x 8), San Javier, Uruguay River, Misiones, Argentina. 5. *P. felipponei Ihering* (Montevideo; Cf. Pilsbry, op. cit.). *P. felipponei concordianus* Parodiz (x 17.5), Arroyo Yuqueri Grande, Entre Rios, Argentine.

ANATOMY OF THE SUCCINEID GASTROPOD OXYLOMA SALLEANA (PFEIFFER)

By DOROTHEA S. FRANZEN
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Oxyloma salleana (Pfeiffer), family Succineidae, is a snail of the lower Mississippi River valley of the United States. Its known geographic distribution extends from New Orleans, Louisiana, as far north as Hardin, Jersey Co., Illinois, between 91° and 89° longitude, along either the Mississippi or the Illinois rivers. The localities from which this species has been taken include New Orleans, Louisiana; near Memphis, Shelby Co., and Samburg, Obion Co., Tennessee; Crève Coeur Lake, St. Louis Co., Missouri; Pittsburg Lake near East St. Louis, St. Clair Co., and Hill Lake near Columbia, Monroe Co., Illinois (Pilsbry, 1948, p. 792). I have found large populations of this species living on the banks of the Illinois river at Pere Marquette State Park, Jersey Co., and at Hardin, Jersey Co., Illinois, and along the Mississippi River in Southport, near New Orleans, Louisiana. Perhaps further collecting will reveal a wider geographic distribution of this species.

In Southport, Louisiana, the habitat of *Oxyloma salleana* is on the mudflats between the Mississippi River and the levees. I found the snails creeping on the ground, especially on willow leaves, and on moist decaying logs. At Pere Marquette State Park, Illinois, I took the snails from the shaded muddy banks of the Illinois River and from the leaves of *Sagittaria* sp. growing in the water. At Hardin, Illinois, I found most of the snails creeping on the very wet, muddy shore of the Illinois River where they were exposed to the direct sunlight; whereas some were near the shore in an area shaded chiefly by willow trees. The localities at Pere Marquette State Park and Hardin are flooded whenever the Illinois River reaches flood stage. I have found large populations of *O. salleana* in the summertime following a flooding of the area in the spring. This indicates that this species survives such flooding and becomes reestablished within the same season.

The Shell. The thin, glossy, amber-colored, elongate-ovate shell consists of 2¾-3½ convex, sharply incised whorls. From the broadly arcuate base the shell becomes gradually inflated towards the upper third of the ultimate whorl from where it narrows to form a short, bluntly tapered spire. The large, elongate-ovate aperture, broadly

TABLE I

Measurements of Shells of Oxyloma salleana (Pfeiffer)

STATION	No. of Whorls	Height	Width	Width/ Height	Height of Aperture	Width of Aperture	H. Ap./ H. Shell	W. Ap./ W. Shell	W. Ap./ H. Ap.
Hardin, Illinois Illinois River June 11, 1964	3-1/2	19.0 mm.	12.4 mm.	.653	14.5 mm.	8.4 mm.	.763	.677	.579
	3-1/2	18.0	12.5	.695	14.6	8.2	.811	.656	.561
	3-1/4	17.6	12.2	.693	14.2	8.3	.806	.680	.585
	3-1/4	17.4	11.6	.667	13.3	8.2	.765	.707	.616
	3-1/2	17.3	11.4	.659	13.8	7.8	.798	.684	.565
	3-1/4	17.2	11.5	.668	14.0	8.2	.814	.713	.585
	3-1/4	17.1	10.8	.632	13.0	7.7	.760	.713	.592
	3-1/2	17.1	10.4	.608	13.0	7.4	.760	.712	.569
June 18, 1965	3-1/8	16.4	8.2	.500	12.5	7.1	.762	.865	.568
	3-1/4	16.0	8.0	.500	11.7	6.8	.731	.850	.581
	3-1/4	15.4	8.3	.532	12.6	6.8	.818	.819	.539
July 6, 1965	2-3/4	18.4	9.8	.532	15.0	8.0	.815	.816	.533
	3	18.2	9.3	.510	14.4	8.0	.791	.860	.555
	3-1/4	18.0	10.0	.555	14.0	7.5	.777	.750	.535
	3	18.0	10.0	.555	14.5	7.9	.805	.790	.544
	3-1/4	17.8	9.2	.516	13.5	7.6	.758	.826	.562
	3-1/4	17.5	10.0	.571	13.7	7.7	.782	.770	.562
	3-1/4	17.5	9.6	.548	13.4	7.6	.765	.790	.567
	3	17.3	9.0	.520	12.6	7.2	.728	.800	.571
	3	16.8	9.7	.577	13.6	7.7	.809	.793	.566
Pere Marquette State Park, Ill. Illinois River June 15, 1954	3-1/4	18.2	10.3	.565	14.5	8.5	.796	.825	.586
	3-1/4	18.1	10.2	.563	15.6	8.7	.861	.852	.557
	3-1/4	15.1	8.8	.582	13.2	7.3	.874	.829	.553
	2-3/4	15.0	9.2	.613	12.2	7.5	.813	.815	.614
Sep't. 15, 1958	3-1/4	16.4	9.5	.579	12.6	7.4	.768	.779	.587
	3-1/4	15.9	10.7	.673	12.1	7.3	.761	.682	.603
	2-7/8	14.6	9.7	.664	11.8	7.0	.808	.722	.593
	3-1/4	14.5	9.3	.641	11.5	6.7	.793	.720	.582
	2-7/8	13.4	8.5	.634	10.6	6.7	.791	.788	.632
	3	12.2	7.9	.648	9.0	5.7	.738	.722	.633
Sep't. 29, 1963	3-1/4	16.1	9.0	.559	11.7	6.7	.726	.744	.572
	3-1/4	15.5	8.2	.529	11.2	6.6	.722	.804	.589
	3-1/4	14.7	8.5	.578	11.5	6.5	.782	.764	.565
	3-1/8	14.7	8.2	.557	10.9	6.5	.741	.792	.596
June 11, 1964	3	15.1	8.0	.529	11.8	6.6	.781	.825	.559
	2-3/4	15.0	8.0	.533	11.4	6.4	.760	.800	.561
	2-7/8	14.2	8.7	.612	11.2	6.8	.788	.781	.607
Southport, New Orleans, La. July 22, 1964	3	15.7	8.6	.547	12.5	7.5	.796	.872	.600
	2-3/4	15.3	8.3	.542	12.1	7.2	.790	.867	.595
	3	15.0	7.5	.500	11.8	6.8	.786	.906	.576
	2-3/4	14.5	7.5	.517	11.4	6.4	.786	.853	.561
	2-1/2	13.6	7.0	.514	11.1	6.7	.816	.957	.603
	2-3/4	13.0	7.3	.561	9.8	6.0	.753	.821	.612

Table I. The measurements of the largest shells of each of the 3 stations obtained in the season and year as noted. In the 4th column of measurements are listed the ratios of the width of the shell over its height. In the last 3 columns are listed the ratios of the height of the aperture over the height of the shell; width of aperture over width of shell; width of aperture over height of aperture.

arcuate at its base, becomes sharply attenuated toward the spire; its height ranges from 73% to 81.8% of the total height of the shell as is shown in Table I. The sharp peristome becomes roundly infolded along the inner border of the ultimate whorl and is continuous with the columella. In some shells the columella emerges below the apex of the aperture and continues along the ultimate whorl in the form of a thin, white, spiral plait such as that occurring also in *Oxyloma retusa* (Lea) (Franzen, 1963, p. 86) and in *Oxyloma haydeni* (W. G. Binney) (Franzen, 1964, p. 75). Frequently a thin callous forms on the portion of the ultimate whorl bordering the aperture.

The nuclear whorl is finely punctate and marked with fine, evenly-spaced striae on its lower half. The penultimate whorl is marked with fine, closely-spaced ridges and furrows. The striae become coarser, the irregularly spaced ridges heavier and the furrows deeper and wider, producing a rough surface on the ultimate whorl.

The range in height and width of the shell, ratios of these two dimensions, the size of the aperture, and ratios of the height to the width of the aperture, as well as ratios of the dimensions of the aperture to corresponding shell dimensions, are to be noted in Table I. The measurements of the shells are those of the largest taken from the 3 stations and during the time of seasons as noted. Because *O. salleana* is essentially southern in its geographic range, one might assume that the largest shells would be found in the southern-most localities. Pilsbry (1948, p. 792) reports shells taken from New Orleans measuring up to 19.3 mm. in height. However, he does not indicate the date of collection. The shells which I obtained from Southport, near New Orleans, were collected in the latter part of the month of July. As is noted in Table I, these shells are shorter than the measurements reported by Pilsbry as well as those which I obtained from the two localities in Illinois. The dates of collection of the largest shells from the Illinois stations were in the months of June and July. This may mean that in the southern localities the older snails surviving from the previous summer die earlier in the following summer than is true of snails in more northern localities, and that the shells I obtained from Southport, Louisiana, did not represent maximum size attained.

The significant characteristics which distinguish the shell of *Oxyloma salleana* from that of *O. retusa* are those of certain dimensions. This becomes obvious when the shells of the two species are observed simultaneously and which, also, is illustrated in figure 1. The shell of *O. salleana* is not so streamlined as that of *O. retusa*. The median of the ratios of the width to the height of the shell of *O. salleana,* of those whose measurements are included in Table I, is .563, whereas of *O. retusa* the median of the series of the shells measured is .520 (Franzen, 1963, Table I). The difference in ratios of the height of the aperture to the height of the shell is also to be noted. Of *O. salleana* the median of such a ratio is .786 and of *O. retusa* .744. The ultimate whorl of *O. salleana* is more inflated and the spire shorter than in *O. retusa*.

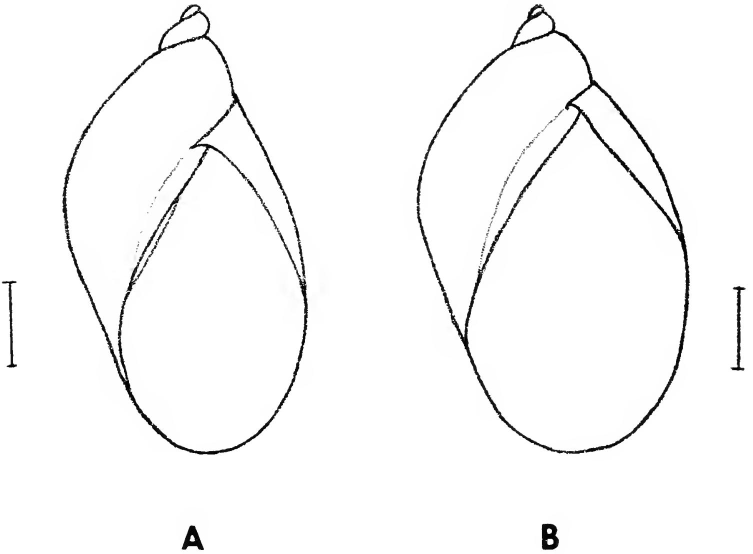

Figure 1. A. Shell of *Oxyloma retusa* (Lea) from White Cloud, Kansas. Scale line represents 17.3 mm., actual height of shell. B. Shell of *Oxyloma salleana* (Pfeiffer) from Hardin, Illinois. Scale line represents 17.5 mm., actual height of shell.

Pfeiffer describes the shell as being composed of 2½ whorls (Pfeiffer, 1849, p. 133). Pilsbry (1948, p. 792) considers that the smaller number of whorls (2½) distinguishes this species from *O. retusa* (Lea). However, I did not find that to be true as noted when comparing the figures of *O. salleana* given in Table I with those of *O. retusa* (Lea) (Franzen, 1963, Table I).

Description of the Body Wall and Mantle. The body wall is cream colored, finely and irregularly tuberculated. The pigmentation of the dorsal, anterior portion of the head consists of black flecks arranged in four pairs of longitudinal bands, of which three pairs terminate at the base of the posterior tentacles. The fourth band of either side courses lateral to the tentacles uninterrupted to the level of the mantle collar. The two median bands converge at the level of the posterior tentacles to form a single band occupying the area between the posterior tentacles and continuing caudad to the level of the mantle collar; this band may bifurcate as it progresses caudad. Posterior to the tentacles this median band is flanked on either side by a band extending from the tentacles to

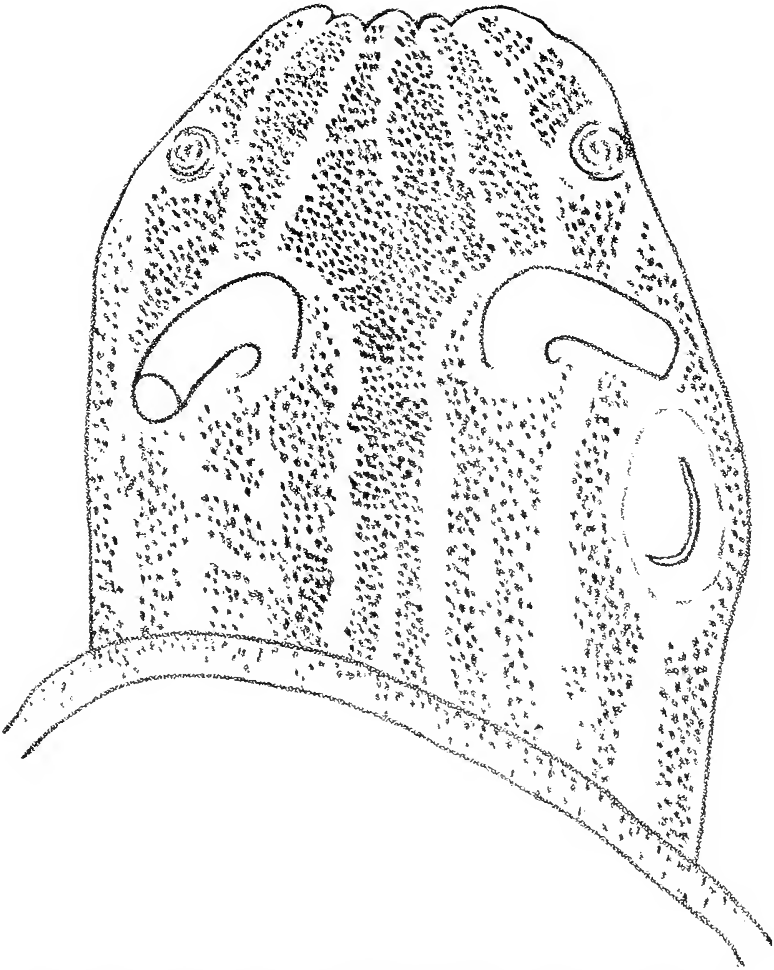

Figure 2. Drawing of head of *Oxyloma salleana* (Pfeiffer) showing pattern of pigmentation.

the mantle collar. The lateral body wall is covered with a broad band of blotches of pigment, figure 2. The degree of the intensity of this pigmentation as well as the distinctiveness of the bands is an individual variant. Of the bands on the anterior head region, the third band, which crosses over the anterior tentacles, may be quite distinct or it may be fused with the fourth band. Likewise, the fourth band may be fused with the broad band of the lateral body wall.

The mantle collar may be lightly or heavily pigmented. The pigmentation of the mantle is, likewise, variable. The entire surface may be darkly and uniformly, or it may be lightly, pigmented. The anterior portion may be heavily pigmented or the pigmentation may be in the form of irregular bands, while the posterior portion of the mantle is covered with blotches of pigment. Or the pigmentation may take the form of blotches over the entire mantle surface. through the mantle the kidney is to be seen, unless obscured by heavy pigmentation of the mantle, as a yellow band following the contour of the body. The distinct dark pigment band characteristically outlining the posterior margin of the kidney in *O. retusa* and *O. haydeni* is lacking in *O. salleana*. Or if such a band is present, it is not so pronounced.

A pedal groove, continuous from the labial palp on one side of the animal to the palp of the other side, separate the foot from the lateral body wall. A less pronounced suprapedal groove parallels the pedal groove dorsally. Shallow, vertical grooves incise the pedal and suprapedal grooves and the broad band of pigment. These vertical grooves produce a series of shallow scallops along the ventral margin, especially when the animal is in a partially contracted state. The sole of the foot may be unpigmented or it may be flecked.

The genital aperture, located on the right-hand side of the body wall, surrounded by a white tumid lip, may appear as an irregularly elongate or a crescent-shaped slit, 0.5 mm. to 0.8 mm. in length, depending upon its state of contraction. The shape and size of the genital aperture, as well as that of the lip, is comparable to that of other species of *Oxyloma* studied by the author, namely *O. retusa* (Lea) (Franzen, 1963) and *O. haydeni* (W. G. Binney) (Franzen, 1964).

The Radula. The structure of the radula of *Oxyloma salleana* bears the general generic characteristics. In the radulae studied, the total number of rows of teeth range from 80 to 100. The number of teeth in a row, as well as the number of laterals and marginals, varies. In the rows, excepting those of the most anterior portion of the radula, the ratio of the marginals to laterals approaches 1:3 or 1:4 as can be noted in table II. This is similar to what has been reported of *O. retusa* (Franzen, 1963, Table II) and of *O. haydeni* (Franzen, 1964, table II). The form of the teeth is also characteristic of the genus. The basal plate is longer and more tapering than

TABLE II

Station	No. of Rows of Teeth	No. of Teeth in a Row	Tooth Formula
Southport, New Orleans, La.	(a) 94	52	13 - 11 - C - 9 - 18
		91	37 - 8 - C - 9 - 36
	(b) 126	93	34 - 12 - C - 12 - 34
		94	34 - 12 - C - 12 - 35
Hardin, Ill.	(a) 91	91	23 - 10 - C - 16 - 31
	(b) 98	102	42 - 10 - C - 12 - 37
		102	42 - 10 - C - 12 - 37
		90	43 - 9 - C - 11 - 26
	(c) 100	108	42 - 11 - C - 12 - 42

Counts made of representative radulae to show variations in the number of rows of teeth in a radula and variations of the number of teeth in a row.

that of *Succinea* and *Catinella* (Quick, 1933, p. 296, figs. 1-4; Franzen, 1959, fig. 3).

The central tooth has the structural characteristics of the succineids, namely, a large mesocone flanked on either side by a smaller ectocone. The laterals have a large mesocone and a smaller ectocone. Occasionally laterals located near the marginals have also an endocone. The marginals have an endocone, a mesocone, and an ectocone. The ectocone of the most medial marginals is divided into two cusps of which the lateral one is characteristically longer and heavier than the other. The remaining marginals have an ectocone which is divided into three cusps. The lateral cusp is longer and usually heavier than the other two. Infrequently the cusps of the ectocone are of equal size.

The Jaw. The amber-colored jaw resembles that of *Oxyloma retusa*. It has a large median fold which projects anteriorly. In several jaws which I have studied, a lateral fold flanks the median fold as is also characteristic of *O. retusa* (Franzen, 1963, Fig 2). Likewise, the jaw lacks the series of small lateral folds characteristic of the jaw of *Succinea ovalis* Say (Franzen, 1959, Fig. 2). No distinctive specific features of the jaw were noted.

The Reproductive System. The penis and the vagina are located in the right anterior region of the animal. The penis is located to the left of the vagina. The elongate penis is encased in a sheath which is slightly pigmented with black flecks over the distal ⅔ of its surface.

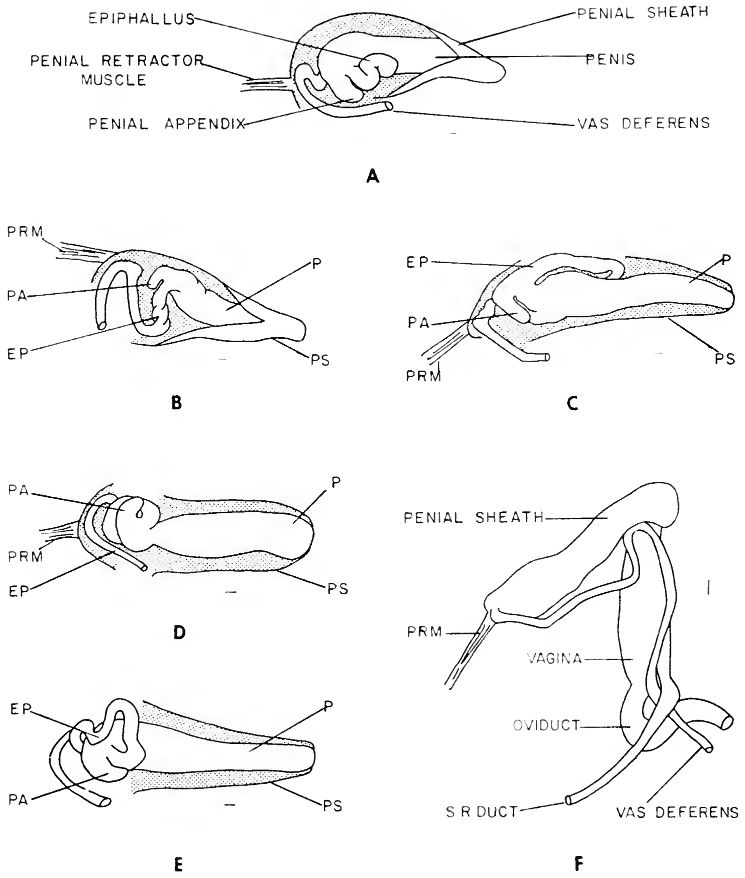

Figure 3. A - E: Penis shown inside of penial sheat cut open. All figures are from snails taken from the station at Hardin, Illinois. The scale lines represent the following measurements from epiphallus to end of penis: A. 3.6 mm.; B. 3.2 mm.; C. 4.8 mm.; D. 4.2 mm.; E. 4.8 mm. F. Drawing showing relative position and lengths of penial sheath and vagina. Scale line of entire length of drawing, 60 mm.

The epiphallus (the vas deferens after its entry into the sheath) is coiled and recurved around the penis in no regular fashion. It enters the penis subterminally as shown in A - E of figure 3. Pilsbry (1948, p. 793) describes the epiphallus as being nearly straight. This is not true of the individuals of *O. salleana* which I have dissected including those from New Orleans as well as those from the two localities in Illinois. The penial appendix is inflated, its diameter tends to be uniform in its entire length, and its end is bluntly rounded. I have not found any penial appendix to be digitiform as is characteristic of *O. retusa* and of *O. haydeni* nor to have its terminus in the form of a blunt hook as is found in *O. haydeni* (Franzen, 1964, Fig. 1). The length of the vagina approximates that of the penial sheath. The oviduct and the duct from the seminal receptacle enter the vagina terminally as shown in Figure III, F.

The length of the prostate gland generally equals that of the albumin gland. In *O. retusa* and in *O. haydeni* I have found the prostate gland to be consistently shorter than the albumin gland. The acini of the prostate gland are about twice the size of those of the albumin gland. The seminal vesicle is a bilobed structure; the two lobes are equal to subequal in length. The amount of pigmentation of the lobes is variable, which is true also of the hermaphroditic duct. Both of these glandular organs are enclosed in a thin transparent sheath on which may be scattered flecks of black pigment.

Chromosomes. The search for reliable criteria in the identification of species of succineids has led to the investigation of the possibility of the employment of the specific numbers of chromosomes along with anatomical characteristics. For such purposes sperm cells in segments of ovotestis fixed in Newcomer's fixative, stained with acetic-orcein and squashed between a glass slide and a cover slip, have been studied.

Examinations which have been made of *Oxyloma salleana, O. retusa* and *O. haydeni* reveal that the haploid number of chromosomes of these species is nineteen. The snails used for such studies were obtained from several geographically separated localities. My studies were of snails of *O. salleana* from the Hardin, Illinois, station, of *O. retusa* from White Cloud, Doniphan Co., Kansas, and from Meade County State Park, Kansas, and of *O. haydeni* from a station twenty-one miles south of Valentine, Nebraska. The study of *O. salleana* obtained from Southport, Jefferson Parish, Louisiana, has been reported (Natarajan, Hubricht, Burch. In press). J. B. Burch (personal communication) examined tissues of *O. retusa* obtained from White Cloud, Doniphan Co., Kansas.

Chromosome numbers do not always distinguish one species from another. Continued studies may reveal that certain groups of species share common numbers which may prove to be of some taxonomic value.

SUMMARY

Shells of succineids generally lack sharply defined specific features. However, certain characters such as the ratios of the height of the aperture to the height of the shell and the width of the shell to its height are useful in distinguishing *Oxyloma salleana* from *O. retusa.*

Anatomical features which distinguish *O. salleana* from *O. retusa:* 1. Penial appendix. The penial appendix of *O. retusa* is generally a distinctly digitiform structure although variable in length. The penial appendix of *O. salleana* is inflated; its diameter tends to be uniform in its entire length and its end is bluntly rounded. I have not found variations comparable to those occurring in *O. retusa* (Franzen, 1963). 2. Relative size of the albumin gland to the prostate gland. In *O. retusa* I have found the prostate gland to be consistently smaller than the albumin gland (Franzen, 1963). The dissections I have made of the snails from the three stations noted reveal that in *O. salleana* the length of the prostate gland tends to equal that of the albumin gland. 3. Pigmentation of the body. The pattern of pigmentation of the head region of *Oxyloma salleana* is more consistently in the form of bands (as shown in Figure II) than is characteristic of either *O. retusa* or of *O. haydeni.* The pigmentation along the lateral body wall assumes the form of a broad band as it does in *O. retusa* but which is not characteristic of *O. haydeni.* If the darkly pigmented band on the mantle outlining the posterior margin of the kidney is present, it is not as distinct as in *O. retusa.*

Geographic distribution and habitats. *Oxyloma salleana* is a species of the lower Mississippi River valley whereas *O. retusa* is found in the upper Mississippi River valley. Both species live on muddy to wet ground and on vegetation growing in water. *O. retusa* favors cattails (*Typha* sp.) and reeds, whereas I have found *O. salleana* to favor *Sagittaria* sp.

Acknowledgments. This study has been made possible through the financial assistance of a National Science Foundation Grant-in-Aid. Henry van der Schalie kindly made available to me facilities of the Div. of Mollusca, Mus. of Zoology, Univ. of Michigan, for the study of chromosomes of succineids, and also offered helpful

suggestions. I am grateful to J. B. Burch and R. Natarajan for assistance and suggestions offered in my study of chromosomes.

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NOTES AND NEWS

EDWIN PERRIN BAKER: Oct. 15, 1891 - April 24, 1966. — We have suffered a loss in the passing of a dear friend, a native Californian, born in Poway, San Diego County. He entered high school at Pasadena, but soon thereafter registered in the Training School for Christian Workers, an interdenominational school run by Quakers. There he finished high school and more than two years of Bible study. In 1913 he registered at Nazarene University, Pasadena with sufficient Bible credits to enable him to graduate with one year's additional work. He earned the degree of Bachelor of Theology. He wished to continue in art work; however, his mother wished him to enter the ministry. As there was no opening in ministerial work at the time, he became employed in a sign shop doing lettering and illustrating.

He married Irene Donaldson in 1937. Through their interest in the work of the American Friends Service Committee they travelled extensively among the Indians of the southwest. They visited various reservations of California, Arizona, and New Mexico. Shells always travelled with them and were distributed among the Indians.

Mr. and Mrs. Baker became avid shell collectors. Mr. Baker served as president of the Conchological Club of Southern California. He was also president of the Long Beach Shell Club, and later chairman of the American Malacological Union Pacific Division. The Baker natural history collection and library is left to the family.

Mr. Baker is survived by his widow, Irene Baker, two daughters, Mrs. Edith Repogle and Miss Edna Perrin Baker, five grandchildren, several great-grandchildren, and a host of friends. —Mrs. John Q. Burch, 4206 Halldale Ave., Los Angeles, California 90062.

EXTENSION IN RANGE FOR DOSINIA DISCUS. — On a recent trip to Sanibel-Captiva Islands I found 3 specimens of *D. discus* (Reeve) near the northern end of Captiva Island. At the time this genus was monographed in *Johnsonia* (1942, no. 3, pp. 1-5) we had seen no specimens south of Tampa Bay.

In the second edition of "Marine Shells of the Western Coast of Florida" (1955), Perry and Schwengel state that "*Dosinia discus* (Reeve) is occasionally found north of Tampa and may be distinguished from *D. elegans* by its finer and closer concentric striation and its more compressed form."

The west coast of Florida from Cedar Keys to Naples is perhaps the most thoroughly collected area of the Atlantic coast of the United States. It seems reasonable to assume that *D. discus* would have been found in our large museum collections from the area south of Tampa Bay had it occurred there prior to 1955. *Dosinia discus* and *D. elegans* are sympatric species since they occur together in many sections of their ranges from Cape Hatteras to Northern Yucatan. Competition on any large scale between the two species is apparently of no great importance and any minor temperature change could hardly be effective, as this area is in the approximate center of their ranges. Just what has occasioned this range extension is at present unknown. It will be of considerable interest to see if *D. discus* is found elsewhere south of the Tampa Bay area. — W. J. CLENCH.

CYPRAEA (PROPUSTULARIA) SURINAMENSIS Perry from Brazil. — Mr. Henry R. Matthews of Fortaleza, Ceará, Brazil, kindly has informed us (*in lit.*) that he has found in recent months 12, well-preserved specimens of this rare cowrie. They were taken from the digestive tracts of a bottom-dwelling toadfish, *Amphichthys crypto-*

centrus, caught off Fortaleza in depths of approximately 15 fathoms. Inasmuch as "Surinam" (Dutch Guiana) was the most southern locality previously reported, the Brazilian specimens extend the range southward below the equator to about 4° S. latitude.

According to Mr. Matthews, measurements of nine of the shells range in length from 28 to 35 mm., with an average of 31.08 mm. and a median of 31 mm.; width ranges from 18 to 22 mm., with an average of 20.33 mm. and a median of 20 mm.; height ranges from 13 to 19 mm., with an average of 15.66 mm. and a median of 16 mm. All but two of the twelve specimens have the "inflated form" as described in our recent paper (Nautilus, 1965, *79*(1):27, pl. 3, fig. 2). — WILLIAM K. EMERSON and WILLIAM E. OLD, JR., The American Museum of Natural History, New York City.

ON AMPULLINA GUPPY. — In a paper in the Proc. Victoria Inst. Trinidad (1895, pp. 72-77) referred to by H. B. Baker (1927, Nautilus *41*:22), Guppy cited *Ampullina* in the subgenus *Helicina* (p. 74) and listed 3 species under this taxon: *H. moquiniana* Pf., Fiji; *H. amoena* Pf., Guatemala; and *H. concentrica* Pf., Venezuela.

The name *Ampullina* DeBlainville, 1824, Dictionnaire Sciences Naturelles *32*:235 (type species, *Ampullina striata* DeBlainville, monotypic); 1825, Manuel de Malacologie, p. 441 [as *Ampulline*] is now in the synonymy of *Viana* H. & A. Adams because of an earlier use by Bowditch (1822, Elements of Conchology (Paris), p. 31, pl. 9, fig. 2) for a naticid.

In order to prevent *Ampullina* Guppy (*non* Bowditch 1822; DeBlainville 1824; Fischer 1885) from being confused with the synonyms of *Viana,* we hereby designate as type species *Helicina amoena* Pfeiffer (1848, Proc. Zoo. Soc. London, p. 119) and thus make *Ampullina* Guppy a synonym of *Oxyrhombus* Crosse & Fischer, 1893, same type by subsequent designation of H. B. Baker (1922, Proc. Acad. Nat. Sci. Philadelphia *74*:48). — W. J. CLENCH and M. K. JACOBSON.

LEHMANNIA IN MASSACHUSETTS. — In May and June, 1966, a considerable number of specimens of *Lehmannia poirieri* (Mabille) were collected in the Boston area. This appears to be the first record of the slug in New England. In the greenhouses of the Mt. Auburn Cemetery, Watertown, Middlesex County, over 50 slugs were found in a few minutes, including one melanic specimen. Three individuals were collected in the greenhouse of the Pine Grove Cemetery in Lynn, Essex County. The slug seems to be restricted to greenhouses at the present, but probably in time will spread into neighboring gardens and other areas. — LANDON T. ROSS, Dept. of Geology, Harvard University, Cambridge, Mass.

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ON THE TAXONOMY AND BIOLOGY OF THE DORID NUDIBRANCH DORIDELLA OBSCURA

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In 1963, the writer discovered a large population of *Doridella obscura* Verrill in lower Delaware Bay, a population also noted by Lowden (1965). These animals occur both in deep water (20-25 ft., oyster beds) and in the intertidal zone, wherever substrate and food conditions permit survival. In reviewing the available literature, it soon became apparent that little information exists on the biology of this animal. Moreover, the taxonomic status of *Doridella* has been in doubt for many years, principally because the original description (Verrill, 1870) was inadequate and subsequent authors have failed to search for and compare Verrill's type material. In this report, I have reviewed briefly the taxonomy of *Doridella* and added a few observations on its biology in Delaware Bay.

Doridella obscura was described by Verrill on the basis of a single specimen collected at Savin Rock, Connecticut. In later years (Verrill, 1880) collections were made from Block Island Sound, Vineyard Sound and Great Egg Harbor, N. J., and Verrill noted (1873) that it occurred both along the rocky shores of bays and sounds and in oyster beds in brackish water.

Doridella has been placed in the family Corambidae of Bergh, 1869, (family Hypobranchiaeidae of authors: Fischer, 1887; MacFarland and O'Donoghue, 1929; Harry, 1953). The status of Hypobranchiaeidae has been discussed by Marcus (1960). The type genus of Corambidae is *Corambe* Bergh, 1869, with *Corambe sargassicola* Bergh (1872) as its type species. The genus is characterized by the presence of a notch in the posterior margin of the notum on the midline. This notch is not present in *Doridella* according to Verrill (1870). In 1899, Balch erected the genus *Corambella* with the type species *C. depressa* Balch from Cold Spring Harbor, Long Island. As noted by Marcus (1955), *Corambella* differs from *Corambe* only by the absence of a posterior notch in the notum. Apparently, Balch felt justified in ignoring Verrill's genus *Doridella* on the grounds that Verrill's later descriptions (1873, pp. 401, 664) are contradictory regarding the location of the branchiae. In 1953, a second species of *Corambella* was described, *C. baratariae* Harry from Louisiana.

The proper generic allocation of all described species of "unnotched" corambids requires a re-analysis of the systematic position of *Doridella* Verrill, 1870.

I have examined the holotype of *D. obscura* (Yale Peabody Mus. No. 13273). Unfortunately, this specimen is completely dessicated and useless for determination of external morphology. However, two lots of two specimens each, collected and identified by Verrill from Outer Island and Thimble Island, Branford, Conn. (YPM No. 13179, 10/21/1893) and Savin Rock (YPM No. 13180, 11/5/1874), were examined. In addition, a lot of 3 specimens collected by W. R. Coe from New Haven was examined (YPM No. 13178). The length and width measurements of Verrill's collections from Branford were 1.98x1.73 and 1.54x1.09 mm. respectively. The animals from Savin Rock measured 1.92x1.47 and 1.60x1.44 mm. The 3 specimens from New Haven were 3.80x3.13, 1.99x1.80 and 3.13x2.75 mm respectively.

Evidently, the type material of *Corambella depressa* Balch is lost. However, I have examined paratypes of *C. baratariae* Harry (USNM No. 597689, F-766 - slide) along with preserved material from North Carolina and Virginia and both living and preserved material from New Jersey. *Doridella* does not have a posterior notch in its notum and corresponds in its external appearance in all respects to the paratypes of *Corambella baratariae*. Therefore, *C. baratariae* Harry (1953) must be considered a synonym of *Doridella obscura* Verrill (1870). The specific differences between *C. depressa* and *C. baratariae* as listed by Harry (p. 4) are, in my opinion, insignificant. The position of the genital complex on the left side as reported by Balch for *C. depressa* is almost certainly an error in observation. No known nudibranchs exhibit this phenomenon. The reticulate pattern of the notum in *C. depressa* disappears in preserved material and the pattern of pigment spots is extremely variable. Moreover, Balch himself, due to the preservation of the animals, expresses some doubt concerning his original description of the rhinophores and sheaths and also concerning the presence of armature in the penis. The grooves on the ventral surface of the head described by Harry for *C. barataríae* are invisable in many preserved animals without staining. The buccal armature noted in *C. baratariae* is not generally evident in unsectioned material. The radula, as figured by Balch, does not appear to be significantly different from *C. baratariae* if cognizance is taken of the variability in appearance of radulate depending on the way in which they have been mounted. Thus, the available evidence strongly suggests that *C. depressa* Balch and *C. baratariae* Harry are conspecific. In this case, as noted above, both are synonyms of *Doridella obscura.*

D. obscura was recorded by Verrill (1880) from locations ranging from Vineyard Sound, Mass., south to Great Egg Harbor, N. J. The type locality of *C. depressa,* as with *D. obscura,* is in Long Island Sound. Nudibranchs identified as *C. baratariae* have been collected from Raritan Bay, N. J. (Dean, D., 1957, unpubl.) south to Virginia, North Carolina (Marcus, 1961) and on the Gulf Coast from Mississippi (Moore, D., 1961), Louisiana and Texas (Marcus, 1960). This distribution, which encompasses almost the entire eastern seaboard of the U. S., indirectly supports the contention that we are dealing with a single, widely distributed species.

The present status of *Doridella* and its contained species may be summarized as follows:

Genus *Doridella* Verrill

Doridella Verrill, 1870, Amer. Journ. Sci. and Arts, L (CL): Art. XLVI, p. 405.

Corambella Balch, 1899, Proc. Bost. Soc. Nat. Hist. *27* (7): 151.

DORIDELLA OBSCURA Verrill

Doridella obscura Verrill 1870

Corambella depressa Balch 1899

Corambe obscura Sumner et al., 1913, Bull. U. S. Bur. Fish. 31 (Pt. 2): 705.

Corambella baratariae Harry 1953. Occas. Papers Mar. Lab., La. State Univ., Baton Rouge. No. 8, p. 1.

DORIDELLA CARAMBOLA (Marcus)

Corambella carambola Marcus 1955, Zoologia 20, Bol. No. 207, p. 89.

DORIDELLA STEINBERGAE (Lance)

Corambella steinbergae Lance 1962, The Veliger *5* (1): 33.

Size and External Appearance of N. J. Doridella: The largest living specimen collected was 7.50x3.41 mm. but in general, they range from 2 - 4 mm. in length. A representative series of 20 preserved specimens ranged in size as follows:

Length	1.11 - 4.07 mm. with a mean of 2.99 ± .17 mm.
Width	1.19 - 3.73 mm. with a mean of 2.69 ± .14 mm.
Head Width	0.34 - 1.33 mm. with a mean of 0.87 ± .06 mm.
Foot Length	0.66 - 2.66 mm. with a mean of 2.02 ± .14 mm.
Foot Width	0.58 - 2.90 mm. with a mean of 0.58 ± .12 mm.

The dorsal coloration and pattern in this species is the result of a combination of two types of dendritic pigment cells in addition to a reticulated color network within the notum. Most animals have a variable number of black dendritic pigment cells which are located deep within the notum at or close to its ventral surface. In many specimens, especially some of those collected late in the season or collected from the laboratory sea water system, the black pigment cells are very small and few in number and, because of their depth in the notum, their effect on the overall coloration of the animal is minimal. Other animals have extremely large black pigment cells. In these, the pigment masses seem to fill up more of the space in the notum and in very dark animals, the black cells are extremely large, moving out into the normally unpigmented marginal area of the notum.

A second type of pigment cell is present in most animals. These are brown, located superficially in the notum, and rarely attain the size of the largest black cells. Following fixation, the brown cells may become very faint or disappear altogether. Very few animals have been observed which totally lack pigment cells of either type.

The reticulate pattern which can be seen in virtually all living animals appears yellow with reflected light but black in transmitted light. This would suggest that it is due to the presence of some opaque material, perhaps leucocytes, located either in blood spaces or some other network within the notum. A similar notal network has been reported in all corambids which have been observed alive and is particularly well illustrated in Lance's photographic figure of *D. steinbergae* (Lance, 1962).

Water Circulation: Although the animal can hold the margin of its notum tightly against the substrate, this structure is nor-

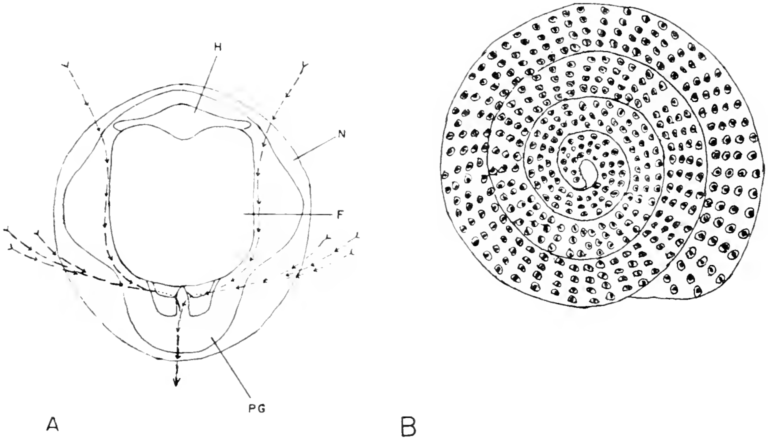

Figure 1. *Doridella obscura* Verrill. A. Ventral view showing path of ciliary respiratory currents. (x28) . B. Egg mass (x34) .

mally held in such a position that gaps occur between the substrate and the edge of the notum. A posterior gap, just behind the branchiae (Fig. 1a) , is the functional analog of the notch in *Corambe*. However, the skirt of the notum can be manipulated so that a gap can occur anywhere along the margin. Water currents created by cilia on the dorsal surface of the foot and on the branchiae are drawn through gaps between the notum and substrate in front and on each side of the animal. This current is carried along the channel formed between the dorsal side of the foot and the ventral surface of the notum. The current is drawn over the surface of the branchiae and expelled as a single stream through the posterior gap. The various pathways followed by the respiratory currents are indicated in Fig. 1a. Carmine particles drawn under the notum are subjected to considerable mucous secretion and are generally heavily clumped when expelled through the posterior gap.

Feeding: In Delaware Bay, *Doridella* is always found in association with and feeding on incrusting Bryozoa. During most of the 1965 season, these nudibranchs were very common in the intertidal zone on shells incrusted with *Membranipora crustulenta* (Pallas) . This species appeared to die out by October and during the autumn, the nudibranchs were observed to occur on *Alcyonidium verrilli* Osburn. In October, two specimens were found in deep water on a bottle covered with *Acanthodesia tenuis* (Desor).

Oviposition: The egg mass, or at least part of one, was described by Verrill (1870). In New Jersey, egg production begins no later than June and continues until cold weather. The eggs are oval and are embedded in a transparent gelatinous matrix deposited on a flat surface in the form of a low, flat spiral (Fig. 1b). Very fine silt particles usually adhere to its surface making it virtually invisible. In a mass 2.66x2.37 mm., there are approximately 375 eggs, each averaging 0.11 mm. in length. Gravid nudibranchs have been observed to produce eggs at 5° C. and animals brought into the laboratory in November, 1965 produced egg masses at 10° C. The writer has kept unfed specimens over the winter in the laboratory at 10°.

I gladly acknowledge the aid of Dr. Joseph Rosewater who provided me with the paratypes of *C. baratariae* from the USNM and of Dr. Willard Hartman of the Peabody Museum at Yale University for his kindness in allowing me to examine Verrill's collections of *Doridella obscura.* I am also indebted to Dr. Ruth Turner of the MCZ who searched for the type of *C. depressa* and to C. J. Risso-Dominguez of Buenos Aires who provided many valuable suggestions. Finally, I appreciate the efforts of Dr. Robertson of the ANSP who critically reviewed this paper.

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SOME OBSERVATIONS ON THE ECOLOGY OF CALLOCARDIA TEXASIANA

By PAUL S. BOYER

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Dead shells of the venerid clam *Callocardia texasiana* (Dall) occur uncommonly on Gulf Coast beaches from northwest Florida to Texas and Mexico. A few paired valves of recently deceased specimens have been found on Texas beaches, and one live adult individual has been taken from an unknown locality in the Gulf of Campeche by a commercial shrimp fisherman. Dr. T. E. Pulley (personal conversation) reports that William C. Guest collected live specimens in Matagorda Bay in 1956; this was following a period of drought which caused bay salinities to be abnormally high (Gunter, personal communication to Harry S. Ladd; cited in Ladd, 1951, p. 134). Abbott (1954, p. 416) has stated that the biology and habits of *Callocardia texasiana* are unknown.

While engaged in the study of the distribution of larger invertebrates with respect to various environmental parameters, the author recently made two trips by shrimpboat along the Louisiana Coast. On both trips, numbers of live *Callocardia texasiana* were collected by means of a small biological dredge. The following stations yielded living specimens:

LIP 10/12-10	8½ nautical miles south of Big Constance Bayou.
LIP 6/6-2	10 nautical miles south of Tigre Point.
LIP 6/6-3	9 nautical miles south of Tigre Point.
LPP 10/8-9	7 nautical miles south of Grand Bayou Pass.
LPP 6/9-5	7 nautical miles north of West Jetty, Southwest Pass.

At all locations where live material was found, the substrate consisted of a superficial layer (about 1 cm.) of flocculate clay material on 3 to 5 cm. of silty sand, overlying a stiff, gray mud. When collected, the live clams were coated with mud, in which they apparently had been living. Since the dredge could not have excavated deeper than about 8 cm. into the sediment, I estimated that the specimens collected must have been living about 4 to 8 cm. beneath the sediment surface.

Live clams were found at depths of from 24 feet (near the Mississippi Delta) to 80 feet (south-southeast of Marsh Island). Bottom salinities ranged from 28 (near the Delta) to 34 0/00 farther west; clearly, this species favors euhaline condtions.

According to data kindly supplied by the Bureau of Commercial Fisheries in Galveston, and supplemented by our own measurements, the bottom temperature ranges at the *Callocardia texasiana* stations are: for the winter, 63 to 67 F.; and for the summer, 79 to 86 F.

Although our Winkler measurements of bottom-water dissolved oxygen varied greatly along the Louisiana Coast, in 4 of the 5 stations at which live *Callocardia* were collected, the dissolved oxygen fell in a range of 5.7 to 6.0 ml/liter. The exception was the point nearest the Delta (LPP 6/9-5), which showed a dissolved oxygen content of about 2.8 ml/liter. The low oxygen content of bottom water at this station is a result of strong salinity-density stratification brought about by the influx of Mississippi River water, and of the high content of suspended organic material in the areas close to the Delta.

The shells of several specimens of *Callocardia texasiana* had been attacked by a worm similar to the *Polydora* which often infests commercial oysters (Hofstetter, 1965, p. 19). The pallial sinus of one valve was completely riddled by this shell inhabitant.

Dead valves of *Callocardia texasiana* which have been drilled by a predatory gastropod are occasionally found. The geometry of such drill holes may be used to identify the predator; this method has even been applied to fossil shells (Siler, 1965). The smooth, hemispherical drill holes found in our *Callocardia* shells are the work of a naticid gastropod, most likely the common *Polinices duplicatus.*

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A NEW ANCILLA FROM BRAZIL

BY JOHN Q. AND ROSE L. BURCH

Among specimens received from Fortaleza, Ceara, Brazil, there are some specimens of *Ancilla* that seem to us to be a new species. The shells were taken from the digestive tract of the toad fish *Amphichthys cryptocentrus* (Valenciennes 1837) in the family Batrachoididae. The fish was taken in about fifteen fathoms. They are bottom feeders.

ANCILLA MATTHEWSI, new species. Figure 1

Shell fusiform, greatest width at middle of body whorl; spire high, smooth, pointed; callus expanding on body whorl, but not covering the preceding suture; 3 or 4 plaits on base of columella; columella excavately arched then slightly twisted; minute vertical striations on body whorl; two spiral basal grooves, the lower groove starting at the notch and ending at columella with a small plait on interior, the upper groove pitted with rib-like nodes; outer lip with minute tooth before turn at base; shell orange, but some paratypes apricot or white. Dimensions of the holotype are, length 18.8 mm., length of aperture 12.4 mm., width 9.1 mm.

The dimensions of the paratypes vary from length 20.1 mm., length of aperture 11.9 mm., width 8.7 mm. to length 11.9 mm., length of aperture 5.0 mm., width 5.0 mm.

This species may be compared with *Ancilla cinnamonea* Lamarck 1801, in form alone, but the latter lacks the basal grooves.

The holotype is to be deposited in the Academy of Natural Sciences of Philadelphia, no. 308959. Two paratypes are in the collection of Mr. H. R. Matthews, two paratypes, no. 308960, in the collection of the Academy of Natural Sciences of Philadelphia, two in the Burch collection, and others will be distributed to various institutions.

It is our pleasure to name this species in honor of Mr. H. R. Matthews, British Vice-Consul in Fortaleza. His enthusiasm in research has contributed much to those interested in the malacology of this region.

We wish to thank Dr. Bruce Campbell for preparing the figures.

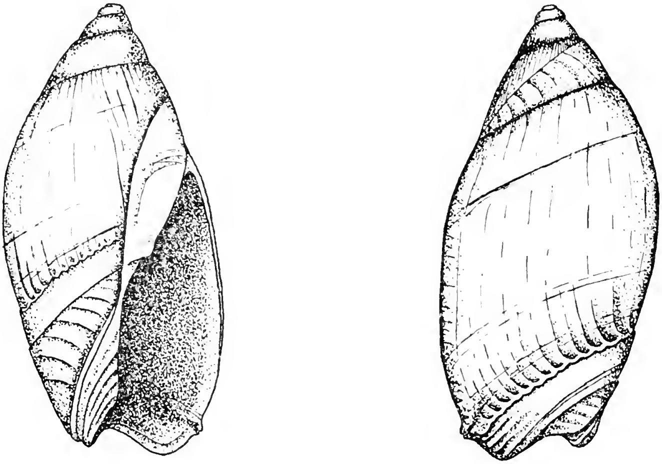

Figure 1. *Ancilla matthewsi* Burch and Burch. Two views of holotype.

A NEW SPECIES OF LYRIA (VOLUTIDAE) FROM HISPANIOLA

By W. J. CLENCH and R. D. TURNER

Through the kindness of Dr. L. E. Vega of Santo Domingo, República Dominicana, we have been privileged to describe this new *Lyria* from Hispaniola.

Various species in the genus *Lyria* appear to be very rare in the western Atlantic. Probably no more than 5 or 6 specimens of *Lyria beauii* (F. & B.) are known to exist.

Lyria (Lyria) vegai, new species. Page 84, fig. 1

Description: Shell relatively small for this family, though large for the genus; nearly smooth, imperforate and reaching 60 mm. (about 2½ inches) in length. Whorls 8 and convex. Color ivory with numerous and irregular spiral bands of brownish spots and lines which are also in axial arrangement. Spire extended and produced at an angle of 48°. Aperture subelliptical. Outer lip slightly reflected. Parietal wall thinly glazed. Columella with two well developed plicae and one small one near the base and with several exceedingly fine, thread-like plicae above which extend over the parietal wall. Suture well indented. Sculpture consisting of very fine axial costae on the early whorls which are absent on the later whorls which have only very fine growth lines. Protoconch broken. Operculum unknown.

Measurements of holotype: Height 60 mm., width 26 mm.

Type: Holotype, Museum of Comparative Zoology, no. 256494, from a fishtrap, Cabo Rojo, Prov. Pedernales, República Dominicana, Hispaniola. Collected by Bernardo Vega in December 1961.

Remarks: This species is related to *Lyria beauii* (Fischer and Bernardi) from Marie-Galante, Lesser Antilles, though it differs in several of its morphological characters from that species. *Lyria vegai* is smooth except for the first two whorls, and not axially ribbed throughout as in *beauii;* also the outer lip is more rounded. In addition, *L. vegai* has only the columellar plicae and 3 or 4 very small plicae at the upper parietal area, while *beauii* has a continuous series of small plicae which extend from the columellar area to nearly the uppermost portion of the parietal area.

Named for Dr. L. E. Vega of Ciudad Santo Domingo.

Lyria (Lyria) beauii (Fischer and Bernardi) Figs. 2-3

Voluta beauii Fischer and Bernardi 1857, Jour. de Conchyliol-

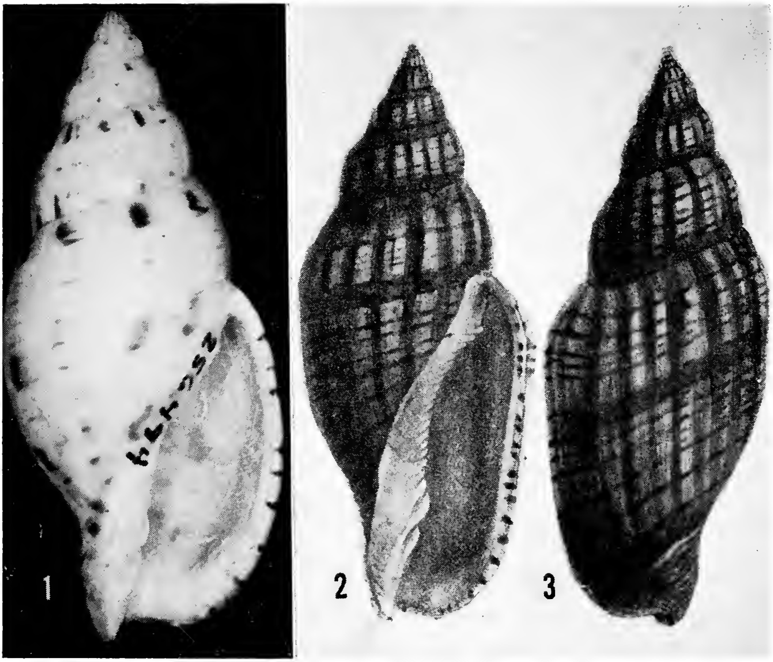

Figure 1. *Lyria (Lyria) vegai* Clench and Turner (1.4X). Figures 2-3. *Lyria (Lyria) beauii* (Fischer and Bernardi) (about natural size) [after Fischer and Bernardi].

ogie *5:* 296, pl. 9, figs. 8-9 (Marie-Galante [Lesser Antilles] West Indies).

Lyria beauii (Fischer and Bernardi). Tryon 1882, Man. of Conch. (1) *4:* 101, pl. 2, fig. 7 (radula); pl. 31, fig. 137.

THRACIA CONRADI IN MALPEQUE BAY, PRINCE EDWARD ISLAND

By M.L.H. THOMAS
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Thracia conradi Couthouy, a bivalve mollusk of the family Thraciidae, order Anomalodesmacea, has seldom been collected alive because of its deep burrowing habit and its delicate shell. Consequently its geographical range is not completely known and its biological characteristics are known even less. Johnson (1934) gave the range as Labrador to North Carolina in 3-16 fm. Most later general accounts merely repeat this information (Smith, 1937, Miner, 1950 and LaRocque, 1953) but Abbott (1954) gives the range as Nova Scotia to Long Island Sound, N. Y. in water down to 150 fm. Canadian records, mostly from Whiteaves (1901, were summarized by LaRocque (1953) but unfortunately several significant records by Stafford (1910a, 1910b) were not included. These records show a distribution extending from U.S.A. waters as far north as Caribou Island, Labrador and up the St. Lawrence to Gaspe Bay, P.Q. There are several records for the mainland side of Northumberland Strait but none for P.E.I. waters. Most of these records are based on shells only.

A few observations on habitat and general biology of *T. conradi* are included in the records discussed above but the only papers giving any details of this aspect are those of Gould (1870) and Morse (1913, 1919) who did observe living specimens.

During recent faunal surveys of Malpeque Bay, P.E.I. it has been established that *T. conradi* is common in the area. It has a wide distribution in the bay proper and occurs to at least the lower parts of tributary estuarine waters. It has not been found where salinity ever would be greatly reduced, although specimens retained in the laboratory have withstood temporary fresh-water conditions lasting several hours.

Bottoms in which populations have been found have all been of muddy sand, with the proportion of mud varying considerably. However, in all locations the sediment was similar in that it was firm with little tendency to shift. Eel grass *Zostera marina* L. was abundant at some stations and absent at others.

One abundant population was examined using skin diving (SCUBA) methods. This location was typical for populations in the area and comprised a bottom of slightly muddy sand in about 4 meters of water. The bottom at this station was covered with numerous paired holes which proved to be *T. conradi* burrows. The main associated molluscan fauna comprised *Pitar morrhuana, Tellina agilis, Ensis directus, Lacuna vincta* and *Nassarius trivittatus.*

Numerous specimens were carefully dug by hand and with a hand operated suction dredge (Brett, 1964). Where possible, individuals were marked in situ, their position recorded and the burrow depth measured. Specimens were measured and weighed entire while still alive.

Specimens collected measured up to 91 mm. long and weighed up to 162 grams. Each individual had two burrows to the surface, emerging up to about 80 mm. apart. Both burrows were round in cross section; that for the incurrent (ventral) siphon characteristically being surrounded by a mound of excavated sand, whereas the excurrent siphon hole lay in a depression. Both burrows descended almost vertically to a few centimeters above the clam, then converged to form a common chamber at the posterior end of the shell. Burrow depths to the uppermost part of the shell were measured for many specimens over 53 mm. long. I observed that the burrow depth was not proportional to size but varied randomly from 140 to 260 mm., a mean of about 175 mm. Several specimens smaller than 53 mm. in length have been collected by the suction dredge but none were observed in their burrows. All specimens examined *in situ* were lying on their sides with the larger right valve up.

Several specimens from 55 to 89 mm. long have been held alive in the laboratory in containers of muddy sand. One has been observed for several months with its burrows against the glass wall of a container. In the laboratory all specimens fed freely on a culture of marine diatom *Phaeodactylum tricornutum* Bohlin.

Specimens observed in the laboratory made no attempt to burrow or even move. However, those placed in a typical attitude and depth in sand quickly constructed siphon holes to the surface and fed when food was provided. In the laboratory siphon holes have rarely been retained unaltered for more than a day, being re-dug frequently and changed in position. During this re-working process a considerable volume of sediment was transferred from the excurrent to the incurrent siphon burrow where it built up at the surface. Specimens periodically allowed both burrows to collapse and fill and remained quiescent for periods of up to a week. Such action also resulted when fresh water replaced the sea water flow. There is evidence, however, that some water was still drawn in through the sand when the holes were blocked, since addition of food culture or return of full salinity resulted in prompt reburrowing to the surface.

The field and laboratory observations of living specimens, both buried and free, and the diminutive size of the foot, suggest that adult specimens do not move once established in a burrow.

I must conclude that *T. conradi* has a much more general distribution and is probably much more abundant throughout its range than references indicate. Studies on its mode of life, behavior and general biology suggest a fascinating life history. Further studies would no doubt be rewarding.

I am grateful to Dr. A. H. Clarke of the National Museum of Canada for his help and advice and for checking the identity of specimens.

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NOTES ON COASTAL LAND SNAILS

By ROBERT R. TALMADGE
Willow Creek, California

A recent paper by Bleakney, Nautilus *79* (4), April, 1966, on the availability of calcium carbonate for *Cepaea nemoralis* on an offshore island off Nova Scotia, supplied the incentive for this rather brief discussion on similar coastal situations, but along the coasts of northern California and southern Oregon. There are numerous headlands, offshore islets and sea stacks along the coasts mentioned above, many of which have a vegetation cover. Some of them also have local populations of slugs and snails in the genera *Ariolimax, Haplotrema, Vespericola,* and *Monadenia,* the latter having been the subject of several taxonomic papers covering insular, headland, or beach populations.

The vegetation cover mentioned may consist of grass only, grass and low brush, grass brush and trees, or any combination of such, dependent upon the size, soil, and exposure to the prevailing winds of any stack, islet, or headland. At least in my field records, there does not appear to be any definite trend of snail populations dependent upon any special type of vegetation or size of headland or islet. Apparently the availability of free lime, plus cover from the strong prevailing winds were the two prime factors of abundance and distribution.

Bleakney refers to the use of lime from the drift or bird taken marine shells that the snails found on the island. This appears to be duplicated on the South and Middle Sisters Rocks, south of Port Orford, Oregon. At the present time, one may easily reach the headland on the mainland and the South or innermost Sister Rock, and the Middle Sister at low-low tide. North Sister, a nearly vertical sea stack cannot be reached except by boat, and then the possibility of climbing the sides is questionable. The only noticeable lime about the two inshore rocks and the mainland headland appears to be either drift shells or shells that gulls have left amid certain rocky areas rather low down on the tall stacks. There is a population of a rather small *Monadenia,* as well as small *Vespericola* and some *Haplotrema* also low down on these rocks, living in the grasses rather than in the available low brush. The population is not noted as being very heavy.

The reef, sea stack, insular, and headland complex near Trinidad, and at Crescent City in northern California is quite different. Some of the localities that appear the least suitable for land snails have a much heavier population than sites one would consider more suitable. I did note that in the areas of the greatest number of land snails, there were deposits of sandy soil, filled with subfossil marine shells, and that the snails appeared to be concentrated in the heavy rank grass at or adjacent to such lime areas. Guano also appeared to be a factor in furnishing lime. Prehistoric sand dunes filled with old marine shells are also a possible source of lime, and such seem to support a much larger population of land snails. Such sites are the mouth and lower reaches of the Pistol River in Oregon, the Smith and Mad Rivers in California. In such areas snails are to be found well into the dunes, even in what many might consider to be poor vegetation cover.

Shell mounds, or Indian middens, with the loose soil, filled with bits of broken clam shell, also furnish free lime to the snails. Personal observations indicate that the snail populations around such sites are more dense than in similar vegetation cover nearby.

The majority of the reef, sea stack, insular, headland complexes, appear to be remnants of more massive headlands that were separated, broken apart, or worn into more or less their present condition by the rise and fall of the sea level during the glacial and interglacial periods of the Pleistocene. Most paleontologists consider that our present genera of land snails were present and had a similar distribution during that geological time. There are areas that have altered since the glacial periods to such an extent that land snails may no longer inhabit the region, or else other species have moved in, replacing the original forms. At the present time, apparently the insular and headland races of *Monadenia, Vespericola,* and *Haplotrema* on the Pacific Coast, were present prior to this breaking up of the larger headlands, and survived in suitable locations that furnished them with cover, food, and lime.

SNAILS ON MIGRATORY BIRDS

By DEE S. DUNDEE, Louisiana State University in New Orleans,
PAUL H. PHILLIPS and JOHN D. NEWSOM, Louisiana State
University, Baton Rouge

During nocturnal woodcock-banding operations by the Louisiana Cooperative Wildlife Research Unit in the winters of 1964-65 and 1965-66, snails (*Succinea unicolor* Tryon) were found among the feathers of some of these migratory birds. The banding was done in the Atchafalaya River Basin area in Louisiana.

Various birds were caught during these operations but snails were found on only 3 species: woodcock *(Philohola minor),* common snipe *(Cappella gallinago),* and whippoorwill *(Caprimulgus vociferous).* Since the banding was primarily aimed at woodcock, only the snails found on them were given special attention.

During the 1964-65 winter, 2754 woodcock were banded and in 1965-66 the number was 1103. The first season the number of snails per bird ranged from 1 to 14 and during the second year it dropped to from 1 to 8. The drop was most likely due to a long drought which was not broken until mid-December. During 1965-66 banding program every 10th woodcock was weighed, sexed, aged, and checked for snails. Of the 96 woodcock checked, 11.4% had snails present. Of those, the average number of snails per bird was 3. There seems to be no correlation as to age of bird, sex, size and the age of the snail. Snails involved in these associations ranged in size from 1.5—9.0 mm. It seems to be purely a matter of chance as to whether any particular bird has on it any particular snail.

The snails were found at different positions on the birds. Some were at the base of the feathers on the upper breast, mid-breast, and low breast; others were at feather bases under the anterior feathers of the mid-abdomen between the legs; some were on the outside of the tibio-fibula, on the outside of flank feathers at the base of the tail, on the underside of feathers outside of the tibio-tarsus, and at the base of the undertail coverts. In no case were the snails on the dorsal surface of the birds.

Why are these Succineids on the woodcocks? At this point there is no answer; only hypotheses. Since the woodcock is a nocturnal feeder whose diet is composed almost exclusively of earthworms, it needs damp or even wet soil to facilititate probing for the worms. Thus, perhaps it is mere chance that the snails happen to crawl onto the bird while it is sitting in their locality. Perhaps the warmth of the bird attracts the snails. Since the snails, in most cases, were taken from the *base* of the feathers, perhaps the snails are feeding on some material at that point. The reason remains to be determined.

In any case, these are not the only records of the occurrence of snails on migratory birds. Rees (1965), in summarizing the work of others, points out that *Physa* sp. has been found on the upland plover *(Bartramia longicauda)* and *Succinea riisei* (Pfeiffer) on the bobolink *(Dolichonyx oxyzivorous)* and on the western vesper sparrow *(Pooecetes gramineus)*. All these birds are migrants also.

Recaptures of the banded woodcock have occurred in many places in their migratory range: Ontario, Michigan, Massachusetts, etc. Here, again, is evidence of one of the means of distribution of our molluscan fauna. We have no records of snails on these recaptures since there is no program of examination for snails after recapture. Such would be ideal.

We owe thanks to Mr. Don J. Bethancourt of the Louisiana State University School of Forestry and Wildlife Management for his aid with this paper.

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NEW AND OLDEST RECORDS OF PELECYPOD MYA FROM WEST NORTH AMERICA, SOUTH OF ALASKA

By OLUWAFEYISOLA S. ADEGOKE
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During a detailed biostratigraphic study of the Neogene Formations of the Coalinga region, California, the writer collected two specimens of the pelecypod *Mya* (figs. 1-3) from the middle of the Middle Miocene Temblor Formation. The significance of these occurrences, constituting the oldest known records of the genus from the northeastern Pacific, south of Alaska, and their bearing on the evolutionary history and the biogeography of the genus are discussed briefly below.

The earliest recorded occurrences of *Mya* in America are from the upper part of the *Acila shumardi* zone (Middle Oligocene) of Popof Island, south of the Alaskan Peninsula, and from the lowermost part of the Poul Creek Formation of the Yakataga district, Alaska (MacNeil, 1965, p. G14). This oldest American species was identified as *Mya kusiroensis* Nagao and Inoue 1941, by MacNeil, who regarded the species as a trans-Arctic migrant from the western Pacific (MacNeil, *op. cit.*, p. G2). The same species occurs in Middle Oligocene strata of Hokkaido, Japan (Fujie, 1957; 1962), and is believed to have evolved directly from *Mya ezoensis* Nagao and Inoue, a species known from the Late Eocene or Early Oligocene Wakkanabe Formation of Hokkaido, Japan (MacNeil, 1955, pp. G13-14). In addition, MacNeil *(op. cit.)* has recognized *Mya salmonensis* Clark and a doubtful occurrence of *M. grewingki* Makiyama from the middle and upper parts of the

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Poul Creek Formation (Late Oligocene and Early Miocene) of Alaska. These species are abundant in chronologically equivalent strata in Hokkaido and Sakhalin, and the latter persisted until Middle Miocene times in Hokkaido. However, none of these species had ever been recorded from other parts of western North America, outside of Alaska.

To date, the oldest indisputable western North American record of species of *Mya* from outcropping strata south of Alaska[2] is *Mya fujiei* MacNeil, 1965 (see MacNeil, *op. cit.,* p. G30).

The holotype of this species came from the Takinoue Formation (early Middle Miocene) of Hokkaido (see Fujie, 1957; 1962; MacNeil, 1965, p. G14). The single Californian specimen doubtfully referred to the species by MacNeil was collected from the Briones Sandstone (Late Miocene) of the San Pablo Bay area (Univ. Calif. Mus. Paleo. locality 197). This specimen had earlier been designated as one of the paratypes of *Mya dickersoni* by Clark (1915, p. 478, pl. 63, fig. 4).

The Middle Miocene specimens collected by the writer from the Temblor Formation of the Coalinga area are shown in figures 1-3. They have relatively elongate anterior and posterior dorsal margins, and broadly rounded anterior and posterior extremities. They are tentatively identified as *Mya (Arenomya) fujiei* MacNeil, though they appear to be morphologically intermediate between the latter and *M. kusiroensis* Nagao and Inoue. They are slightly less bulky and more slender than *M. kusiroensis,* but not quite so elongate or acutely tapering posteriorly as *M. fujiei.* Inasmuch as the spoons of these Temblor specimens could not be prepared without doing considerable damage to the valves, the affinities of the species could not be more accurately determined here.

The following fossil taxons occur at the two localities in association with *M. fujiei:*

Locality B-7085. Temblor Formation, Joaquin Rocks Quadrangle, T.19S., R.15E., Section 21. N.W. ¼ of S.W. ¼ of Sec. 21. From *Vaquerosella*-bearing resistant ledges outcropping near the

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[2] Specimens earlier reported as *Mya n.* sp.? by Loel and Corey (1932, p. 233, pl. 45, fig. 2) from theVaqueros Formation, Plano Trabudo, Santa Ana Mountains, Orange County, California (Univ. Calif. Mus. Paleo. loc. 6128) were apparently misidentified. The figured hypotype (UCMP no. 31844) was examined by the writer. The specimen was poorly preserved and badly crushed. Despite this, characters such as the subquadrate outline, nature of the hinge, and the thin, flat valves show that it is certainly not a *Mya* but a Tellinid.

hill top on the east side and just south of the junction of a north-south dirt road with an east-west dirt road from Oil Canyon.

Asteroidea

Astropecten sp. indet.?

Pelecypoda

Aequipecten andersoni (Arnold)
Amiantis diabloensis (Anderson)
Anadara (Scapharca) obispoana (Conrad)
Anadara (Anadara) osmonti (Dall)
Psammotreta biangulata (Carpenter)
Chione temblorensis Anderson
Clementia (Egesta) pertenuis (Gabb)
Dosinia margaritana Wiedey
Lucinoma acutilineata (Conrad)
Macoma piercei Arnold
Mactra sectoris Anderson and Martin
Miltha sanctaecrucis (Arnold)
Mytilus mathewsonii expansus Arnold
Ostrea ashleyi Hertlein
Ostrea sp. indet.
Pseudocardium panzanum (Loel and Corey)
Zirfaea dentata Gabb

Gastropoda

Calliostoma pacificum Anderson and Martin
Calyptraea filosa (Gabb)
Calyptraea inornata (Gabb)
Cancellaria dalliana Anderson
Neverita reclusiana Deshayes
Sinum sp. indet.
Tritonalia topangensis (Arnold)
Forreria gabbianum cancellarioides (Arnold)
Turritella ocoyana Conrad

Brachiopoda

Discinisca loeli Hertlein and Grant

Porifera

Cliona sp. indet.

Annelida

Serpula sp. indet.

Locality D-1059. Temblor Formation, Reef Ridge Quadrangle, T.23S., R. 16E., Section 3: 1,085 feet north, 1,390 feet west. From lowest two of the four prominent *Turritella* beds that crop out on the north bank of Garza Creek, a few feet above the creek bed.

Pelecypoda

Aequipecten andersoni (Arnold)
Anadara (Anadara) osmonti (Dall)
Psammotreta biangulata (Carpenter)

Diplodonta orbella Gould
Macoma nasuta Conrad
Pseudocardium densatum minor (Arnold)
Semele morani Anderson and Martin
Solen gravidus Clark
Spisula albaria Conrad
Tellina ocoyana Conrad
Trachycardium vaquerosense (Arnold)
Transennella joaquinensis Anderson and Martin
Zirfaea dentata Gabb

Gastropoda

Bruclarkia barkerianum santacruzanum (Arnold)
Crepidula rostralis (Conrad)
Tritonalia topangensis (Arnold)
Forreria gabbianum cancellarioides (Arnold)
Turritella bosei Hertlein and Jordan
Turritella ocoyana Conrad
Turritella wittichi Hertlein and Jordan

Discussion and inferences. The fauna associated with *Mya fujiei* MacNeil at both localities (see above) are interesting and significant in that a number of the genera represented are commonly regarded as indicators of a warm (tropical-subtropical) climate (see Smith, 1919; Durham, 1950, p. 1256). Such genera include *Anadara, Chione, Dosinia, Miltha, Clementia, Psammotreta, Semele,* and *Turritella.* The abundant occurrences of these genera in the Early Miocene faunas of this region was taken by Durham (1950, p. 1256) as inidcative of a minimum water surface temperature of 19° or 20° C. Living representatives of *Forreria* and *Miltha* live today in tropical waters with a minimum surface temperature of about 20° C. MacNeil (*op. cit.,* p. G30) similarly noted that Fujie's (1962, p. 404) assignment of the Japanese representatives of *M. fujiei* implied that the species was a warm-water form. This, and the present records of *Mya* in the Temblor Formation in association with taxa with apparently tropical affinities indicate that the latitudinal restriction to cold climates characteristic of the distribution of *Mya* today is not in harmony with the latitudinal distribution of the genus in the geologic past. Most of the older species (including all the California Late Miocene species mentioned below) appear to have been tolerant to a greater range of climatic variations than are the modern representatives of the genus.

Apart from *Mya fujiei,* MacNeil (*op. cit.*) recognized the following species from the Late Miocene San Pablo Group of California: *M. arrosis* MacNeil 1965 (Briones, Cierbo and Neroly Formations), *M. dickersoni* Clark 1915 (Neroly Formation), and *M. arenaria* Linnaeus 1758 (Late Miocene to Recent). According to MacNeil (*op. cit.*, p. G15), *M. arrosis* evolved from *M. fujiei,* and the former is directly ancestral to *M. japonica* Jay.

The present Middle Miocene record of *M. fujiei* MacNeil is significant in that it supplies another stage in the evolution of the California Late Miocene species from the Alaskan and Japanese Early Miocene form such as *M. kusiroensis* Nagao and Inoue. These records further indicate that southerly migrations of *Mya* from Alaska probably occurred in pre-Middle Miocene times. More careful search in Lower and Middle Miocene strata especially in Oregon and Washington may reveal the occurrences of still older species.

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MacNeil, F. S. 1965. Evolution and Distribution of the Genus *Mya,* and Tertiary Migrations of Mollusca: U. S. Geol. Survey Prof. Paper 483-G, 51 pp., 11 pls.

Smith, J. P. 1919. Climatic relations of the Tertiary and Quaternary Faunas of the Coalinga Region. Calif. Acad. Sci., Proc., ser. 4, *9:* 123-173, pl. 9.

MURICANTHUS MELANAMATHOS, A WEST AFRICAN MURICID

By ANTHONY D'ATTILIO
Associate, American Museum of Natural History

Through the generosity of Mr. Israel Bendersky, of the New York Shell Club, I received a muricid specimen which has proved to be of more than ordinary interest. Its identity was easily established as it agrees with numerous published figures of *Murex melanamathos* Gmelin. However, because of its apparent rarity, the true locality of this species has remained questionable until the discovery of the present specimen. This specimen, with a few other mollusks, was sent to Mr. Bendersky from Lobito, Angola on the west coast of Africa. The collector, a skin diver, stated that the specimen had been found by him in the vicinity of Lobito.

I should like to thank my colleague, Mr. William E. Old, Jr., for bibliographic assistance. Dr. R. Tucker Abbott kindly read the manuscript and provided helpful information.

Annotated Synonymy of *Murex melanamathos* Gmelin,
Pl. 5, Figs. 1, 2

1791, Gmelin, J. F. Systema naturae, ed. 13, *Murex*, p. 3527, sp. 9. For a figure Gmelin refers to Martini, Conchylien Cabinet, vol. 3, pl. 108, fig. 1015, locality "East Indies." This drawing, though poorly executed, is a recognizable illustration of this species.

1798, Röding, P. F. Museum Boltenianum, pt. 2, p. 141, no. 1776, as *Purpura tuberosa* Röding. Refers to Martini, vol. 3, pl. 108, fig. 1015.

1801, Bosc, L. A. G. Histoire naturelle des coq., vol. 4, p. 207. Refers to Martini, (vol. *3,* pl. 108, fig. 1015.

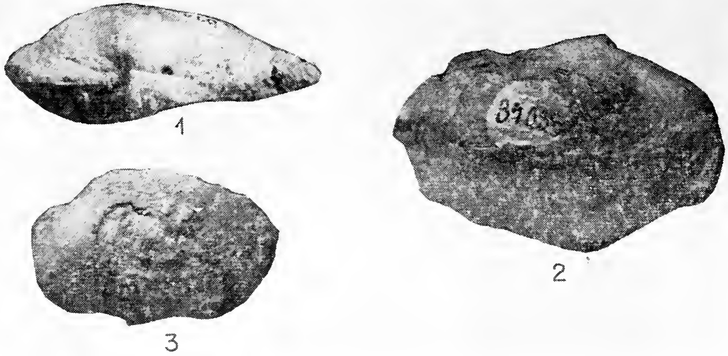
1807, von Waldheim, G. Fischer. Muséum Démidoff, Moscow, vol. *3,* p. 194. Refers to Martini, vol. *3,* pl. 108, fig. 1015; [*teste* R. T. Abbott].

1816, Lamarck, M. Encyclopédie et Méthodique, pl. 418, fig. 2b. A passable figure, as *M. melanomathos* (sic.).

1817, Dillwyn, L. W. Descriptive catalog of recent shells, vol. 2, p. 686, [*sp.*] 11, East Indian Seas, as *M. melanomathos (sic.).* Besides referring to Gmelin, Dillwyn cites, Schroeter, Einl., i, p. 548; Argenville, Zoom t. 11, fig. K; and D'Avila, t. 15, fig. H.

1818, Wood, W. Index testaceologicus or a catalogue of shells, p. 120, no. 11, East Indian Seas, as *M. melanomathos (sic.).* Refers to Martini, vol. *3,* pl. 108, fig. 1015.

1828, Wood, W. Index testaceologicus or a catalogue of shells, p. 120, pl. 25, fig. 11, East Indian Seas. This very small figure may be taken to illustrate the species.



Figures 1-3. *Mya (Arenomya) fujiei* MacNeil. Temblor Formation, Coalinga, California. 1, 2, hinge and side views of Univ. Calif. Mus. Paleo. no. 36779, locality B-7085, X 1. 3, side view of Univ. Calif. Mus. Paleo. no. 37680, locality D-1059, X 1.

1828, Sowerby, G. B. Jun. Genera of recent and fossil shells, vol. 2, pt. 30, *Murex*, fig. 6. This is an excellent figure of this species which was presented in this work as an example of the genus *Murex*.

1843, Kiener, L. C. Coquilles vivantes, *Murex*, pp. 62-63, pl. 29, fig. 2-2. The species is well figured in this work and Kiener notes that specimens were to be found in the collection of Lamarck, with the locality: Indian Ocean, as *M. melanomathos (sic.)*.

1845, Reeve, L. A. Conchologia iconica, vol. *3*, *Murex*, species 48. An excellent figure, but no locality is given, as *M. melanomathos (sic.)*.

1878, Küster, H. C. and Kobelt, W. Conchylien cabinet, *Murex*, pp. 12-13, pl. 4, fig. 5, pl. 4b, fig. 3, Indian Ocean, as *M. melanomathos (sic.)*.

1879, Sowerby, G. B. Thesaurus conchyliorum, *Murex*, p. 30, sp. 13, fig. 144, Habitat?

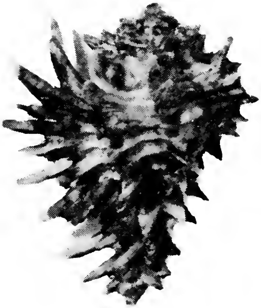
1880, Tryon, G. W. [in part]. Manual of conchology, Muricinae and Purpurinae, pl. 26, fig. 230. Tryon incorrectly synonymizes *Murex melanomathos (sic.)* with *Murex oxyacantha* Broderip, 1833, and cites the locality as Real Llejos, west Central America (now known as Corinto, Nicaragua).

Discussion. The specimen from Lobito agrees generally with Reeve's (1845) excellent figure of this taxon, but it has only 7 varices instead of 8 as shown by that author. The shell is white with black varices and spines. The spines are comparatively short and develop as the ends of 5 major spiral cords on the body whorl

NAUTILUS 80 (3) PLATE 5

1

2



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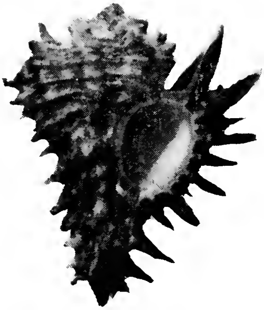

4

Figs. 1, 2. *Muricanthus melanamathos* (Gmelin), Lobito, Angola, Africa. Figs. 3, 4. *M. oxyacantha* (Broderip), San Juan del Sur, Nicaragua. Both ×1.

and one major cord on the canal. Between these major cords there are present secondary and lesser cords. Spiral cords and spines occur on the shoulder close to the suture.

Muricanthus oxyacantha (Broderip, 1833), on the other hand, has many more major spiral cords, the shell is mostly white with the spines commonly stained with a little brown. The cords and spines are wanting on the region above the shoulder to the suture, and there are only a few minor cords between the major ones (see pl. 5, figs. 3, 4). Keen (1958, p. 356) noted in her remarks to *M. oxyacantha* "the species has been identified as *Murex melanamathos* Gmelin, 1791 by some authors, but that form, which is apparently Indo-Pacific in distribution, has black spines on all eight varices, and the published figures show spines above the aperture that are lacking in *M. oxyacantha.*"

That a species from west Central America should find a counterpart in west Africa is not surprising considering the presence on the west African coast of a number of species that have twin species in the tropical west American and the eastern American regions. As for one example, in the Muricidae, *Purpurellus pinniger* (Broderip) of the Panamic province is very similar in conchological characters to *Purpurellus gambiensis* (Reeve) from west Africa.

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Broderip, W. J., 1833. Characters of new species of Mollusca and Conchifera. p. 176, Hab. in America Centrali (Real Lleijos). *Murex oxyacantha* was first illustrated in the following work: Sowerby, G. B. Jun., 1834. The conchological illustrations, *Murex,* A catalogue of recent species, sp. 80, pl. 59, fig. 11.

Keen, M., 1958. Sea shells of tropical west America, p. 356, sp. 345.

FRESHWATER MOLLUSCA FROM JAMES RIVER, VA. AND A NEW NAME FOR MUDALIA OF AUTHORS.

BY WILLIAM J. CLENCH AND KENNETH J. BOSS

While on our way to the American Malacological Union meetings in Chapel Hill (1966), the authors and Mr. Morris K. Jacobson of New York collected along the central reaches of the James River, Virginia. Four stations were made, three in the James and one in a tributary, the Rivanna River near Columbia. Good fortune was with us because the river was low and clear, two most important factors in fresh water collecting.

Twenty to forty miles west of Richmond, where we made most of our stations, the James River was over 300 feet wide but rather shallow, probably not more than 10-15 feet deep in the main channel of the stream and about 2 or 3 feet deep for much of its area. The substrate of the river is largely sand with extensive patches of smooth flattened boulders or rocks and with occasional areas of gravel; much of the bank was soft black mud.

We are indebted to Mr. R. I. Johnson for the determination of several species of the Unionidae.

Stations made in the James River System on August 21, 1966. (Museum of Comparative Zoology, Mollusk Department Field Numbers)

2288, James River, Powhattan County, across the river from Maidens, Goochland County, Virginia.
2289, James River, near Cartersville, Cumberland County, Virginia.
2290, James River, near Columbia, Fluvanna County, Virginia.
2291, Rivanna River, 2 miles west of Columbia, Fluvanna County, Virginia.

LIST OF THE SPECIES

Viviparidae

Lioplax subcarinata (Say, 1817), Stations 2288, 2289.
Campeloma lima (Anthony, 1860), Stations 2288, 2289, 2290.

Hydrobiidae

Gillia altilis (Lea, 1841), Stations 2288, 2289, 2290.

Pleuroceridae

Goniobasis virginica (Gmelin, 1791), Stations 2288, 2289, 2290.
Anculosa (Alleghenya) carinata (Bruguière, 1789), Stations 2288, 2289, 2291.

Planorbidae

Helisoma anceps (Menke, 1830), Station 2291.

Physidae

Physa inflata Lea, 1841, Stations 2289, 2290, 2291.

Sphaeriidae

Sphaerium striatinum (Lamarck, 1818), Station 2288.

Unionidae

Lexingtonia subplana (Conrad, 1837), Stations 2288, 2289, 2291.
Elliptio complanata (Solander, 1786), Stations 2288, 2289, 2290, 2291.
Elliptio lanceolata (Lea, 1828), Stations 2288, 2289, 2290, 2291.
Alasmidonta undulata (Say, 1817), Stations 2288, 2289, 2291.
Lasmigona subviridis (Conrad, 1835), Stations 2288, 2289, 2291.
Strophitus undulatus (Say, 1817), Stations 2288, 2289, 2290.
Alasmidonta collina (Conrad, 1837), Stations 2288, 2291.

Unio collinus Conrad 1837, Monography of the Family Unionidae of North America, Philadelphia, no. 8, p. 65, pl. 36, fig. 2

(type-locality, North River, a branch of James River, Virginia); Conrad 1840, *Ibid.*, no. 12, p. 109, pl. 60, fig. 3.

Alasmidonta collina (Conrad). Simpson 1900, Proc. U.S. National Museum, *22*:669; Simpson 1914, A Descriptive Catalogue of the Naiades, Detroit, Michigan, *1*:501.

Villosa constricta (Conrad, 1838), Stations 2288, 2289.

While writing up the list of mollusks collected in the James River System, we discovered that the *Mudalia* of Haldeman 1840 has been used in error for the species complex containing *Anculosa carinata* (Bruguière 1789) and *Anculosa dilatata* (Conrad 1834). Since the only available synonym of *Mudalia* of authors *non* Haldeman 1840 is *Nitocris* H. and A. Adams, which itself is preoccupied, we propose, in accordance with the International Code of Zoological Nomenclature, the **new name:**

ALLEGHENYA.

Mudalia of authors, *non* Haldeman 1840.

Nitocris H. and A. Adams 1854, The Genera of Recent Mollusca, *1*:308 (type-species, here designated, *Paludina dissimilis* Say 1819 [= *Bulimus carinatus* Bruguière 1789]. *non Nitrocris* Rafinesque 1815 (Hymenoptera), Thompson 1858 (Coleoptera), Kinberg 1866 (Vermes) and Guenée 1868 (Lepidoptera).

Bulimus carinatus Bruguière 1789 is here designated as the type-species of *Alleghenya.*

Mudalia Haldeman 1840: 1) never has been given a correct type-species designation and 2) embraces a species complex widely separated geographically from the east coast-middle-western complex represented by *carinata* and *dilatata.* Most authors have claimed consistently and incorrectly that *Bulimus carinatus* Bruguière was the type-species of *Mudalia* (Hannibal, H. 1912, Proc. Malac. Soc. London, *10*:168; Morrison, J. P. E. 1954, Proc. U. S. Nat. Mus., *103*:361; Wenz, W. 1939, Handbuch Paläozoologie, *6* (1):701). Bruguière's name was not even used or ever mentioned by Haldeman in connection with his name *Mudalia.*

In Ocober 1840, Haldeman introduced *Mudalia* as a subgeneric name under *Anculosa* in his Monograph of the Limniades, Supplement to No. 1, p. 1, and on p. 2 he described the species *A. (M.) turgida* without locality data; he mentioned that *A. (M.) turgida* resembled the *Paludina dissimilis* of Say. Later, he described another species of *Mudalia, A.* (*M.*) *affinis* Haldeman 1841, Monograph, inside of back cover of number 3. Goodrich (1932, Nautilus, *46:* 40) mistook the 1841 citation of *Mudalia* as the introduction of the generic name by Haldeman and considered *A. (M.) affinis* as the type-species of the genus and, further, made it a synonym of *Lithasia obovata* Say; he also suggested that the name *Nitocris* H. and A. Adams be usde for the group of *A. carinata* (Bruguière) (Goodrich, C. 1942, Occ. Papers Mus. Zool., Univ. Mich., no. 456, p. 2). Haldeman ([*in*] Chenu 1848, Illustrations Conchyliologiques, vol. 3, *Leptoxis,* p. 5, pl. 5, fig. 151) gave the locality of *L.* (*Mudalia*) *turgida* as Alabama. We here designate *Anculosa (Mudalia) turgida* as type-species of *Mudalia* Haldeman 1840 and restrict the type-locality to the Black Warrior River, Alabama.

LOCALITIES FOR NEW BRUNSWICK LAND MOLLUSKS

By N. J. REIGLE, JR.[1] and H. B. HERRINGTON[2]

There are very few published records of the land and fresh-water mollusk fauna of the Canadian province of New Brunswick. La Rocque (1961) provided a review of the literature and a summary checklist of the non-marine mollusks of the province. Since that work Dimelow (1962) working near the Nova Scotian border has provided some additions to the faunal record and a checklist of his collection.

The authors collected in New Brunswick from September 2 to September 10, 1961. The primary purpose of his trip was to collect fresh-water mollusks, particularly Sphaeriidae; however a secondary effort was made to procure as many specimens of land mollusks as time permitted. Land mollusk collections were made near Lincoln in Sunbury and York Counties and during brief stops at various localities along Number 2 Highway and the St. John River en route from the Quebec border to Lincoln. In all, collections were made at 9 localities in 5 counties. A total of 16 species of land snails and 3 species of slugs were collected. The material has been deposited in the Museum of Zoology of the University of Michigan and the National Museum of Canada. Since many of these records are county records and due to a general lack of information concerning the distribution of New Brunswick mollusks, all land mollusks collected during the trip will be listed here.

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[1] U.S. Bureau of Commercial Fisheries, Ann Arbor, Michigan.
[2] Westbrook, Ontario, Canada.

We would like to thank Dr. Henry van der Schalie of the Museum of Zoology, University of Michigan, for the use of facilities at his disposal and making the trip possible. Dr. Lowell L. Getz, University of Connecticut, kindly determined the species of *Deroceras*. Collecting expenses were defrayed in part by a research grant 2E-41, from the National Institute of Allergy and Infectious Diseases, U. S. Public Health Service.

List of species collected

Triodopsis albolabris (Say). Sunbury Co.; along Nevers Road 2.3 miles south of No. 2 Highway.

Stenotrema fraternum (Say). Sunbury Co.; along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Euconulus fulvus (Müller). Sunbury Co.; along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Zonitoides arboreus (Say). Madawaska Co.; along No. 2 Highway 4 miles south of Edmundston and along No. 2 Highway 4 miles south of Green River: Victoria Co; along St. John River at Andover: Carleton Co.; along No. 2 Highway 2 miles north of Route 5 near Woodstock: York Co.; western edge of Lincoln: Sunbury Co.; along Baker Brook 1½ miles each of Lincoln, along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Oxychilus cellarius (Müller). York Co.; along St. John River at the Princess Margaret Bridge in Frederickton.

Hygromia hispida (Linne). York Co.; along St. John River at the Princess Margaret Bridge in Frederickton.

Deroceras laeve (Müller). Carleton Co.; along No. 2 Highway 2 miles north of Route 5 near Woodstock: Sunbury Co.; along Camp Road 1½ miles south of No. 2 Highway.

Deroceras reticulatum (Müller). Victoria Co.; near St. John River at Andover: Carleton Co.; along No. 2 Highway 2 miles north of Route 5 near Woodstock: York Co.; along St. John River at Princess Margaret Bridge in Frederickton and near the western edge of Lincoln: Sunbury Co.; along Baker Brook 1½ miles east of Lincoln, along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Anguispira alternata (Say). Victoria Co.; near the St. John River at Andover: Carleton Co.; along No. 2 Highway 2 miles north of Route 5 near Woodstock.

Discus cronkhitei (Newcomb) var. *catskillensis* (Pilsbry). Madawaska Co.; along No. 2 Highway 4 miles south of Edmundston: Victoria Co.; near St. John River at Andover: Sunbury Co.; along Baker Brook 1½ miles east of Lincoln, along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Helicodiscus parallelus (Say). Victoria Co.; near St. John River at Andover: Sunbury Co.; along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Arion circumscriptus (Johnston). Victoria Co.; near St. John River at Andover: Carleton Co.; along No. 2 Highway 2 miles north of Route 5 near Woodstock: York Co.; along St. John River at Princess Margaret Bridge in Frederickton and near the western edge of Lincoln: Sunbury Co.; along Baker Brook 1½ miles east of Lincoln.

Oxyloma cf. *decampi gouldi* Pilsbry. Sunbury Co.; along Baker Brook 1½ miles east of Lincoln.

Succinea ovalis Say. Madawaska Co.; along No. 2 Highway 4 miles south of Green River: York Co.; western edge of Lincoln: Sunbury Co.; along Baker Brook 1½ miles east of Lincoln, along Nevers Road 2.3 miles south of No. 2 Highway and along Camp Road 2 miles south of No. 2 Highway.

Catinella avara (Say). York Co.; western edge of Lincoln: Sunbury Co.; along Baker Brook 1½ miles east of Lincoln.

Strobilops labyrinthica (Say). Sunbury Co.; along Camp Road 2 miles south of No. 2 Highway.

Vertigo gouldi (Binney). Sunbury Co.; along Camp Road 2 miles south of No. 2 Highway.

Vallonia pulchella (Müller). Victoria Co.; near St. John River at Andover.

Cionella lubrica (Müller). Madawaska Co.; along No. 2 Highway 4 miles south of Green River: Victoria Co.; near St. John River at Andover: York Co.; along St. John River at Princess Margaret Bridge in Frederickton; Sunbury Co.; along Baker Brook 1½ miles east of Lincoln.

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THIRTY-SECOND ANNUAL MEETING OF THE AMERICAN MALACOLOGICAL UNION

By MARGARET C. TESKEY, AMU. Secretary

On August 22nd to 26th, the American Malacological Union met at the University of North Carolina at Chapel Hill, North Carolina. It was the thirty-second such session and 151 members and their guests made it the best attended. The North Carolina Shell Club was co-host with the University and each hard working club member made every effort to ensure that the AMU. would never forget the 1966 annual meeting.

Dr. Ralph W. Dexter occupied the presidential chair, and during a four day period introduced the following papers:

Significance of larval development in bivalve taxonomy, Paul Chanley. An observation of captive *Murex celluosus* Conrad, Dorothy Raeihle. Care and feeding of incubated marine snails, Dorothy Raeihle. Snails on migratory birds, Dee Dundee. Small beginnings, Adlai B. Wheel. Evolutionary sequence in *Phyllodina,* Kenneth Jay Boss. Genetic and ecophenotypic relationships in northern *Andonta* populations, Arthur H. Clarke. Observations on the distribution of the naiad *Cumberlandia monodonta* (Say) 1829, David H. Stansbery. Lymnaeidae of western Montana - Taxonomy and distribution, Richard H. Russell. Commercial scalloping, anyone? Mrs. Kay Lawrence. Shell damage in the sea scallop, *Placopecten magellanicus,* Arthur S. Merrill. Oyster production and research in Tampa Bay, Lulu B. Siekman. Utilization of naides by prehistoric man in the Ohio Valley, David H. Stansbury. *Aeromonas* in the pathology of the giant African snail, Albert R. Mead (read by title). Zoogeography of Montana mollusks, Royal Bruce Brunson. Systematics and zoogeography of the Ctiloceratidae, Donald R. Moore. Zoogeography of the family Amblemidae, Joseph P. E. Morrison. Raising of *Segmentina hemisphaerula* (Benson) for the study of fasciolopsiasis, Chin-Tsong Lo. The Species Groups of African *Bulinus S. S.,* J. B. Burch and RaJah Natarajan. Some serological relationships in the African genus *Bulinus,* J. B. Burch and Gene K. Lindsay. Progress in surf clam research, 1965, Robert M. Yancey. Instant Oysters, Bill Shaw. Salinity tolerance and distribution of *Spisula solidissima, Mulinia lateralis* and *Rangia Cuneata* (Family Macteridae), Michael Castagna and Paul Chanley. What is the true *Spisula similus* (Say)?, Morris K. Jacobson (read by title). Land and freshwater mollusks from the outer banks of North Carolina, Dorothy E. Beetle. Population sexuality in *Anodonta* (Pelecypoda: Unionidae), William H. Heard. Preliminary report on a study of the Illinois River, William C. Starrett and Gerald Root. Some nudibranch names, Henry D. Russell.

There was a mid-week break for field trips, one group going to sea on Duke University's research vessel Eastwind, while another beach-combed and a third sought land and freshwater species in the vicinity of Durham and Raleigh. There wore two informal evening sessions and the annual banquet with Scotch bonnet motif was greatly enjoyed.

The following officers were elected to serve in 1967 at which time the thirty-third annual meeting will be held in August at the National Museum of Canada, Ottawa, Ontario, Canada:

President, Leo G. Hertlein. Vice-president, Arthur H. Clarke. 2nd Vice-president, Gale G. Sphon, Jr. Secretary, Margaret C. Teskey. Treasurer, Mrs. H. B. Baker. Publications Editor, Morris Karl Jacobson. Councillors-at-Large, J. Frances Allen, Emile A. Malek, William E. Old, Jr., Robert Robertson.

NOTES AND NEWS

UNIONID INTRODUCTION IN MASSACHUSETTS: Results. — In 1958 and 1959 an experiment was begun to determine if hybridization could be brought about between *Elliptio complanata* and *E. dilatata* and between *Anodonta grandis* and *A. cataracta,* and also to observe the effects of semi-controlled gene flow between *Lampsilis radiata radiata* and *L. r. siliquoidea* (see Nautilus 73 (1): 36-37, 1959).

Between September 5 and 8, 1958, I transferred 7 living specimens of *Elliptio dilatata,* 16 of *Anodonta grandis,* and 70 of *Lampsilis radiata siliquoidea* from Base Line Lake, Livingston Co., Michigan to a newly created reservoir-lake in the Putnamville section of Danvers, Massachusetts. On July 21, 1959, 9 living specimens of *Elliptio complanata* from Silver Lake, Wilmington, Mass., and 14 of *Anodonta grandis* and 24 of *Lampsilis radiata radiata,* both from Wakebee-Mashpee Pond, Mashpee, Mass., were also introduced at the Danvers locality. All specimens were measured and classed for morphological characters before introduction. As a control, on September 8, 1958, 66 living specimens of *L. r. siliquoidea* from lime-rich Base Line Lake were also placed in Silver Lake, Wilmington, Mass. This was done in the hope of providing criteria for recognizing any phenotypic modifications which might result from exposure to lime-poor northeastern Massachusetts water and for separating such modifications from those which might result from genetic interchange. Both the Danvers and Wilmington lakes are in the Ipswich River System.

High water in northeastern Massachusetts prevented inspection of the Danvers specimens in the fall of 1959. The Wilmington locality was more accessible, however, and brief examination of the area of introduction revealed 8 living specimens and 3 pairs of empty valves of *L. r. siliquoidea.* The living specimens were immediately replaced. They all appeared to be paler in color than when they were first introduced.

On July 1, 1964, the Danvers locality was revisited. Although water was low and visibility was good, during two hours of careful searching no living unionids were found. Only one corroded valve of *Elliptio complanata* was seen. On May 22, 1966, the Wilmington locality was also revisited and no *L. r. siliquoidea* was seen; only the native *E. complanata* and a few *A. cataracta* were found. *L. r. siliquoidea* appears now to be absent from Silver Lake.

Water samples were also taken from both localities on May 22 and tested for hardness. The Danvers water measured only 40 p.p.m. $CaCO_3$ and the Wilmington water only 35 p.p.m. Water from Base Line Lake, Livingston Co., Michigan, sampled on June 5, 1966, measured 260 p.p.m. $CaCO_3$, however.

Apparently the attempted introduction of the Michigan species *E. dilatata, A. grandis,* and *L. r. siliquoidea* into the Ipswich River System has failed and those species have not survived there. Both of the Massachusetts localities support abundant fish populations (*Perca fluviatilis flavescens, Esox americanus, Lepomis* spp., etc.) and seem to be physically suitable for unionids. Excessively soft water in these lakes appears to be the most probable cause of the failure although it does not explain why even native Massachusetts species apparently did not survive in the Danvers reservoir. Further experiments in hybridization would be of interest.

I wish to thank Mr. John Tottenham, Museum of Zoology, University of Michigan, for kindly collecting the water sample from Base Line Lake. — A. H. CLARKE, JR.

NITOCRIS. — Rafinesque, 1815, Analyse de la Nature: 123 [Palermo] stated simply: "37. Nitocris R. Nomia Latr." Was this "substitution" in the sense of article 16 (a) (iii) of the code? According to (b) (ii) it apparently did not "constitute an indication," even though the usual order of synonymy was reversed. — H. B. B.

PEDRO DE MESA. — With much regret, we hear that this well known collector died Nov. 17, 1966, at the age of 86, in Manila, Philippines.

INTRODUCED SLUGS STILL SPREADING. — Through repeated collections in the same localities over a period of several years, it has been possible to observe the gradual distribution of various mollusks.

When our collecting began here in 1958, the only record of *Limax marginatus* Müller was in Shreveport, Louisiana by H. Harry in 1948. An attempt to collect more from that locality in 1949 failed. The following new records now exist: 1961: Pineville Cemetery, Pineville, Louisiana; 1962: Texas Cemetery, Shreveport, Louisiana; City Cemetery, Vicksburg, Mississippi; 1963: Vienna Cemetery, Vienna, Louisiana; vacant lot on river road near downtown Natchez, Mississippi; 1965: Delhi Cemetery, Delhi, Louisiana; Hattiesburg Cemetery, Hattiesburg, Mississippi.

Otherwise *Limax marginatus* Müller is known from: *Virginia:* Danville; Gretna; Richmond. *Arizona:* Tucson. *California:* 21 localities throughout the state. *Colorado:* Boulder. *Missouri:* greenhouse in St. Louis.

In addition, *Milax gagates* (Draparnaud) now occurs in City Cemetery in Vicksburg, *Mississippi*. Previously it was known from: *California:* 22 localities. *Virginia:* Danville. *Colorado:* Boulder greenhouse. *New Jersey:* Clifton.

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NEW BRUNSWICK SPHAERIIDAE

By H. B. HERRINGTON and N. J. REIGLE, JR.
Westbrook, Ontario, and U. S. Bureau of Commercial Fisheries,
Ann Arbor, Michigan

Little data has been published concerning the sphaeriid fauna of the Canadian province of New Brunswick. The first published record of this fauna was included in a paper by Nylander (1944) who listed *Sphaerium striatinum* in the St. John River. Athearn (1961) added *S. rhomboideum* from the St. John River and *S. sulcatum* (= *S. simile*) (see Herrington, 1965) from the Tantramar River. In his 1962 revision of the Sphaeriidae, Herrington added to the fauna 3 species of *Sphaerium: occidentale, partumeium* and *securis;* and 5 species of *Pisidium: adamsi, casertanum, ferrugineum, variabile* and *nitidum.*

This paper is based primarily on collections made by the authors in the St. John River drainage from September 2 to September 10, 1961 and by the senior author in northwestern New Brunswick from August 17 to August 23, 1960. In addition, locality data for New Brunswick Sphaeriidae in the Museum of Zoology of the University of Michigan are also included. The latter data are preceded by UMMZ. in the species list. This paper lists 15 species and one form of Spaeriidae from New Brunswick. Five of these constitute new records for the province. Species new to the fauna of New Brunswick are *Sphaerium lacustre, Pisidium aequilaterale, P. compressum, P. milium* and *P. nitidum* form *pauperculum.*

We would like to thank Dr. Henry van der Schalie of the Museum of Zoology, University of Michigan, for the use of facilities at his disposal and for making the 1961 trip possible. Collecting expenses were defrayed in part by a research grant 2E-41, from the National Institute of Allergy and Infectious Diseases, U. S. Public Health Service.

Sphaerium (Musculium) lacustre (Müller). St. John River at Princess Margaret Bridge, Frederickton, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County.

Sphaerium occidentale Prime. Baker Brook, 1½ miles East of

Lincoln, Sunbury County. UMMZ: vicinity of Bay of Fundy, collector—Huntsman, August 5, 1911.

Sphaerium (Musculium) partumeium (Say). Listed by Herrington (1962).

Sphaerium rhomboideum (Say). Small tributary of the Jemseg River, ¾ mile southwest of Jemseg, Cambridge Parish, Queens County.

Sphaerium (Musculium) securis Prime. Listed by Herrington (1962). UMMZ: vicinity of Bay of Fundy, collector—Huntsman, August 5, 1911.

Sphaerium striatinum (Lamarck). Oromocto River, 1½ miles East of the south end of Sunpoke Lake, Lincoln Parish, Sunbury County. Grand Lake at Waterboro, Queens County. UMMZ: vicinity of Bay of Fundy, collector-Huntsman, August 5, 1911. Petitcodiac River at River Glade, 19 miles WSW, of Moncton, collector—A. H. Clarke, June 22, 1960.

Sphaerium simile (Say). Listed by Athearn (1961).

Pisidium adamsi Prime. Baker Brook, 1½ miles East of Lincoln, Sunbury County. UMMZ: Crecy Lake, Charlotte County, collector—M. W. Smith, May-August, 1954.

Pisidium aequilaterale Prime. St. John River at McNally Ferry, Kingsclear Parish, York County. St. John River at McKinley Ferry, Kingsclear Parish, York County. St. John River at Princess Margaret Bridge, Frederickton, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County. Oromocto River, ¼ mile East of the south end of Sunpoke Lake, Lincoln Parish, Sunbury County. Small tributary of the Jemseg River, ¾ mile Southwest of Jemseg, Cambridge Parish, Queens County. UMMZ: Trout Creek, just East of Sussex, collector—A. H. Clarke, June 25, 1960.

Pisidium casertanum (Poli). Small pond on road to Beaconsfield, Andover Parish, Victoria County. St. John River at McKinley Ferry, Kingsclear Parish, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County. UMMZ: Gas well pool near Frederick, Albert County, August 25, 1940. Crecy Lake, Charlotte County, collector—M. W. Smith, 1954. Trout Creek just East of Sussex, collector—A. H. Clarke, June 25, 1960.

Pisidium compressum Prime. Aroostock River, ½ mile above mouth at No. 2 Highway, Andover Parish, Victoria County. Little Presquisle River below sawmill at Waterville, Wakefield Parish

Carleton County. St. John River at McKinley Ferry, Kingsclear Parish, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County. UMMZ: Trout Creek just East of Sussex, collector—A. H. Clarke, June 25, 1960.

Pisidium ferrugineum Prime. St. John River at McKinley Ferry, Kingsclear Parish, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County.

Pisidium milium Held. Little Presquisle River below sawmill at Waterville, Wakefield Parish, Carleton County. Pond on Lovelly Brook, 2½ miles South of Perth-Andover Bridge, Perth Parish, Victoria County.

Pisidium nitidum Jenyns. Little Presquisle River below sawmill at Waterville, Wakefield Parish, Carleton County.

Pisidium nitidum Jenyns, form *pauperculum* Sterki. Little Presquisle River below sawmill at Waterville, Wakefield Parish, Carleton County. St. John River at Princess Margaret Bridge, Fredericton, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County.

Pisidium variabile Prime. Pond on Lovelly Brook, 2½ miles South of Perth-Andover Bridge, Perth Parish, Victoria County. Lake Edward, Denmark Parish, Victoria County. Little Presquisle River below sawmill at Waterville, Wakefield Parish, Carleton County. St. John River at McKinley Ferry, Kingsclear Parish, York County. Baker Brook, 1½ miles East of Lincoln, Sunbury County, Small tributary of the Jemseg River, ¾ mile Southwest of Jemseg, Cambridge Parish, Queen's County.

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A NORTHERNMOST RECORD AND ECOLOGICAL DATA ON HYDROBIA SALSA IN MAINE

By JAMES F. GORE
Maine Cooperative Wildlife Research Unit[1]

This note reports ecological data and an apparent northernmost record for *Hydrobia salsa,* Pilsbry. Articles containing ecological data on American species of mollusks are for the most part lacking (Morrison, 1965a). Therefore, such information should be reported to help guide those studying salt marsh ecology. *H. salsa* was first described in 1905 and its type location was reported as Cohasset, Massachusetts (Pilsbry, 1905). He first called the species *Paludestrina salsa,* but *Paludestrina* has since been changed to *Hydrobia.*

The current salt marsh study was conducted under the supervision of Malcolm W. Coulter, Assistant Leader, Maine Cooperative Wildlife Research Unit, Orono, Maine, to whom I am most grateful. Special thanks are also extended to Dr. Joseph P. E. Morrison, Associate Curator of the Division of Mollusks, Smithsonian Institution, Washington, D. C., for his advice and identification of snail specimens.

The study was conducted on the Weskeag River salt marsh, located in South Thomaston, Knox County, Maine. The Weskeag River flows into West Penobscot Bay slightly southwest from the town of Rockland. The marsh is 4⅓ miles from the mouth of the river, and has a normal range of high tides from 8 to 11 feet.

This marsh was drained long ago to facilitate the harvesting of salt marsh hay. Many deep (2-5 feet), narrow (2-4 feet) ditches still remain. Samples of *H. salsa* were taken from bottom samples in 9 of these ditches.

Salinity, temperature and pH measurements of the water were taken once a week from June 10 through September, 1964. The results are presented in Table 1.

Morrison (1965b) believes that these collections of *H. salsa* represent a new northernmost record for this species. Stickney (1959) reported finding *H. salsa* in the Sheepscot River estuary

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[1] Maine Cooperative Wildlife Research Unit, Orono, Maine: University of Maine, Maine Department of Inland Fisheries and Game, Wildlife Management Institute, and U. S. Bureau of Sport Fisheries and Wildlife, cooperating.

Table 1. Water Analyses Data from Nine Drainage Ditches On the Weskeag River Salt Marsh

Month	Air Temp. °C		Water Temp. °C		Salinity °/oo		pH	
	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range
June [2]	19.8°C	16-22°C	17.5	14-21.5	22.5	14-30	7.3	6.7-8.2
July [3]	20.9	21-26	20.1	18-26	17.6	7.5-27.5	7.1	6.5-7.6
Aug. [4]	19.0	15.5-21	17.8	16.5-20	20.2	8-31	7.1	6.4-7.6
Sept. [4]	19.3	16.5-22	15.9	11.5-21	20.8	12-30	7.1	6.7-7.5
Total Summer	21.0	15.5-26	17.6	11.5-26	19.9	7.5-31	7.2	6.4-8.2

near Boothbay Harbor, Lincoln County, Maine. This estuary is approximately 31 air miles southwest from the Weskeag study area. He found *H. salsa* on intertidal sediments and in water ranging in salinity from 0 to 27 0/00 (parts per thousand).

Hartman (1960), studying estuarine ecology at Bucksport, Hancock County, Maine, did not find *H. salsa*. However, he did find *H. totteni*, Morrison, in marsh areas along the Penobscot Estuary, about 39 miles northeast from the site of the present collection of *H. salsa*. The annual salinity for his area ranged from 2 to 18 0/00, while salinity for the summer months ranged from 8 to 18 0/00.

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[2] 3 weeks. [3] 5 weeks. [4] 4 weeks.

TWO NEW SONORELLA FROM SONORA, MEXICO

By WALTER B. MILLER
Department of Zoology, University of Arizona

The dedicated efforts of Pilsbry and Ferriss, over a period of more than 20 years, in collecting and examining *Sonorella* in the Southwest, have provided science with a relatively excellent state of knowledge on the speciation and distribution of the genus in the U. S. By contrast, similar data for the contiguous regions of Mexico are extremely sketchy. Only 4 species are known from Chihuahua, namely *S. nelsoni* and *S. goldmani* Bartsch, and *S. pennelli* and *S. mormonum* Pilsbry; 2 more species are known from Sonora, *S. mearnsi* Bartsch and *S. magdalenensis* (Stearns).

For years, whenever an opportunity came to travel in northwest Mexico, the author gazed at the distant mountain ranges of eastern Sonora and wondered what molluscan treasures lay waiting to be discovered. On 29 Dec. 1964, a program of systematic exploration for *Sonorella* was finally begun in the region, with immediate rewards of new and interesting species. Well known U. S. species were also found established in many localities south of the border. Progress has necessarily been slow, for one cannot adequately describe new species unless one is thoroughly familiar with species already described; this, in turn, has required the collecting and dissecting of nearly every known species and subspecies, including those whose anatomy was previously unknown, such as *mearnsi, magdalenensis, ashmuni, superstitionis, neglecta,* etc. Progress is being made, nevertheless, and the following are two new species from eastern Sonora:

Sonorella greggi new species. Plate 6, figs. A-F.

Description: Shell depressed, globose, heliciform, thin, translucent, with a dull, silky sheen, more glossy at base, dilute brownish, with a chestnut spiral band on the well-rounded shoulder; umbilicate, the umbilicus contained about 8 times in the diameter. Embryonic shell of 1 and ⅓ whorls covered with radial ripples upon and between which are superimposed fine radial wrinkles and round papillae; there is no trace of spiral threads; in life, the papillae bear periostracal bristles. Post-embryonic whorls with larger growth striae; the superimposed radial wrinkles break up into lengthened granules, giving a densely granular-wrinkled appearance to the entire shell; numerous papillae present on all whorls, with periostracal bristles persisting on live, adult shells, creating a hirsute appearance. Last whorl descends markedly to the aperture. Aperture oblique, nearly circular, the peristome thin, only slightly expanded, its margins converging.

Holotype measurements: Height 10.0 mm.; max. diam. 16.9 mm.; umbilicus 2.1 mm.; whorls 4⅓.

Genitalia of holotype (Plate 7, figs. C, D): The large penis contain a stout, cylindric verge with an abruptly truncate tip. The verge is prominently spirally grooved, with 13 to 14 right-handed spirals; the seminal duct orifice is terminal on the verge and is raised slightly on a short conic papilla. The epiphallus is slightly longer than the penis and bears a very small, barely detached epiphallic caecum at its junction with the vas deferens. Penial sheath ⅓ to ⅖ the length of the penis. Vagina about ¾ the length of the penis and about 3 times the length of the free oviduct.

Measurements of genitalia, in mm.	Holotype	Paratype 4788A
Penis	13.5	11.5
Verge	7.0	7.0
Penial sheath	5.0	4.0
Epiphallus	14.5	14.0
Vagina	9.5	9.5
Free oviduct	3.5	3.0
Spermathecal duct	25.0	19.0

Type locality: Sierra Purica, Sonora, Mexico, in igneous rock outcroppings in northeast-facing ravine, on south bank of large canyon which runs easterly from saddle between the two highest peaks at the south end of the range. Lat. ca. 30° 31′ N, λ ca. 109° 45′ W. Elev. ca. 6300 ft. (W.N. Miller and W.B. Miller, 29 July, 1965 and 27 July, 1966). Holotype ANSP 310363. Paratypes in collections of ANSP. 310364, Dept. of Zoology, University of Arizona (2564), and the author (4788, 4904).

Maximum diameter of paratype varies from 15.3 mm. in the smallest specimen to 18.2 mm. in the largest. This snail combines features of many diverse groups of *Sonorella* and has unique characteristics of its own. By the lack of embryonic spiral threads, the granular surface of the shell, and the conformation of the verge, it clearly belongs in the group of *S. granulatissima* Pilsbry.

The spirally grooved verge has been seen heretofore only in the group of *S. tumamocensis* P. & F. The very pilose periostracum, persisting in live adult shells, is somewhat similar to that of *S. apache* P. & F.

Two other characteristics stand out as unique: (1) the mantle is strongly pigmented with large, dark-grey, polymorphic spots, from the mantle collar all the way to the apex of the hepatopancreatic gland, similar to the pigmentation seen in most species of *Helminthoglypta* but heretofore never described in *Sonorella;* (2) the mantle collar is permeated by a greenish-yellow mucus. This coloration of the mantle collar has been observed at all times, in freshly collected animals as well as in animals kept in the terrarium, regardless of feeding or aestivating conditions. In other species of *Sonorella,* the color of the mantle collar varies among various shades of brown, orange, and white, from the deep orange of *sabinoensis* to the milk-white of *tumanocensis.*

The Sierra Purica lies to the west of the Agua Prieta-Nacozari road, about 15 to 20 road miles north of Nacozari. The type locality lies in an ecotone between the Upper Sonoran and the Transition life zones, on the eastern slope of the range, near the southern end. The vegetation consists predominantly of *Quercus arizonica, Q. hypoleucoides, Rhus trilobata, Arbutus arizonica,* and *Pinus ponderosa.* In the same rocks, two live specimens each of a *Sonorella* of the *hachitana* group and *Pallifera pilsbryi* Miles and Mead were also taken.

This species is named after Dr. Wendell O. Gregg, an eminent malacologist and specialist on western land and fresh water mollusks, who painstakingly taught me his technique for making stained whole-mounts of snail genitalia, and with whom I have enjoyed innumerable collecting trips.

SONORELLA NIXONI new species. Plate 6, figs. G-I.

Description: Shell depressed-globose, heliciform, thin, glossy, light tan, with chestnut spiral band on the well-rounded shoulder; umbilicate, the umbilicus contained about 9 times in the diameter. Embryonic shell of about 1 whorl with sculpture of the *binneyi* type; its apex and first half whorl with weak, irregular radial wrinkles giving a malleated effect; the second half whorl with weakly raised striae arranged in ascending and descending spirals. Later whorls marked by light growth wrinkles and occasional scars of worn-off periostracal projections. The periostracum presents a silky, lustrous appearance. The last whorl descends sharply to the peristome. Aperture oblique, rounded, slightly wider than high. Peristome slightly expanded, the margins converging; parietal callus thin.

Holotype measurements: Height 10.6 mm.; max. diam. 17.0 mm.; umbilicus 1.8 mm.; whorls 4¼.

Genitalia of holotype (Plate 7, figs. A,B) ; The large penis contains a stout, cylindric verge with a bluntly rounded end from which protrudes a narrower, terminal papilla; the orifice of the seminal duct is not at the tip of the verge, but rather at the base of the terminal papilla. The epiphallus is about ¾ the length of the penis and bears a distinct, well detached epiphallic caecum. The penial retractor inserts on the epiphallus a short distance above the penis. Penial sheath about half the length of the penis.

The vagina is about ¾ the length of the penis; anteriorly, at the genital orifice, its diameter is about equal to that of the penis, ca. 1.0 mm., as is usual in *Sonorella;* posteriorly, however, the diameter increases to a maximum size of about 2.5 mm. near the junction of the spermathecal duct, giving it an overall club-shaped appearance; interiorly, the walls of the vagina have a pleated, accordion-like structure. The free oviduct is narrow and short (ca. 3.0 mm.), in the usual manner for *Sonorella.*

Measurements of genitalia, in mm.	Holotype	Paratype B	Paratype E
Penis	22.0	19.0	21.0
Verge	9.5	9.0	9.0
Penial sheath	8.5	8.5	7.5
Epiphallus	14.0	14.5	15.5
Vagina	17.0	15.5	14.5
Free oviduct	3.0	3.0	3.5
Spermathecal duct	16.0	21.0	20.0

Type locality: La Angostura, Sonora, Mexico, in rocks just south of the main road at the village, overlooking the west rim of La Angostura Dam on the Rio de Bavispe; elevation ca. 3100 ft. (W.N. Miller and W.B. Miller, 8 Aug., 1965). Holotype ANSP. 310361. Paratype in collections of ANSP. 310362, Dept. of Zoology, University of Arizona (2565), and the author (4796).

Other localities: In rockslide on mountain south of road from El Tajo (on Agua Prieta-Nacozari road) to La Angostura, at a point 8.4 road miles from El Tajo, elev. ca. 4800 ft. (W.N. Miller and W.B. Miller, 7 Aug., 1965) Pilares de Nacozari, about 1 mile east of Nacozari, at base of cliffs, in rockslides; elev. ca. 4200 ft. (W.N. Miller and W.B. Miller, 30 Dec., 1964, 31 July, 1965).

S. nixoni belongs to the group of *S. binneyi*. The mantle collar and the border of the foot are strongly pigmented with orange mucus, as in *binneyi* and *bowiensis*. Although the type and 5 paratypes were dissected at various times during the year, they all showed the unusual, club-shaped vagina. One specimen from Nacozari, however, did not show this characteristic; instead, it had a cylindrical vagina of relatively uniform diameter throughout. Large numbers of dissections from several populations would be required in order to determine whether the variation in vagina morphology might be of subspecific value. The shell of *nixoni* varies much in diameter. Specimens from the type locality are generally larger than those from Nacozari. The largest paratype measures 19.6 mm. and the smallest, 16.1 mm. The smallest shell in a lot from Nacozari measures 15.6 mm. The embryonic spiral threads vary in intensity, but are present, at least to some degree, on all specimens examined, as in *S. binneyi*.

S. nixoni most closely resembles *S. bowiensis* in shell characteristics; it has a slightly smaller umbilicus, however, and the embryonic spiral threads are generally less distinct. In the genitalia, *nixoni* differs from both *bowiensis* and *binneyi* by the large size and stout shape of the verge, the terminal papilla on the verge, and the relative length of penis to epiphallus.

In *bowiensis*, the verge, examined in three topotypes, is widely cylindrical all the way to the tip, with a subterminal seminal duct orifice, but without a smaller papilla at the tip (Plate 7, fig. F); the epiphallus is as long as or longer than the penis; the vagina is narrowly cylindrical throughout.

In *binneyi*, the verge, examined in two topotypes, has a large swollen, heart-shaped tip, with a subterminal seminal duct orifice which opens in a circular depression in the side of the verge; a small, pointed papilla lies in the middle of this depression, attached to the verge at the upper edge of the depression, *above* the duct orifice (Plate 7, figs. G,H); the vagina is narrowly cylindrical throughout.

S. nixoni inhabits the range of mountains between the Agua

Prieta-Nacozari road and the Rio de Bavispe. At the type locality, several specimens were found crawling over the rocks early in the morning, after a violent thunderstorm; there, it is associated with *Bulimulus nigromontanus* Dall, also crawling in the same rocks. Along the road from El Tajo to La Angostura, just south of Cerro Pinitos, it was found associated with *Sonorella walkeri* P. & F. In the Pilares de Nacozari, just east of town, dead shells of *S. nixoni, S. walkeri,* and *B. nigromontanus* were found in quantity, but only one live *nixoni* was collected, a moribund adult, and a clutch of eggs from which only one individual survived in a terrarium. This individual was raised to maturity in just one year. Dissection revealed genitalia similar to those of the population from La Angostura, with the exception of the uniform diameter of the vagina mentioned above.

This species is named for my son, W. Nixon Miller, who found the first specimen and whose help was invaluable in making possible several arduous collecting expeditions into the mountains of northeastern Sonora.

NEW SPECIES OF HELICODISCUS FROM VIRGINIA

By F. WAYNE GRIMM
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HELICODISCUS DIADEMA, new species. Page 123, figs. A to E.

Shell discoidal, spire flat or slightly depressed; dull greenish-brown, opaque, whorls 4¼ to 5; umbilicus wide and shallow, showing all whorls, occupying from 40 to 47% of the diameter of the shell; whorls rounded, slowly increasing, the last descending slightly; sculptured with coarse growth-wrinkles and 11 to 13 pinched spiral threads bearing prominent, curved hairs; sutures deep, impressed; aperture lunate, peristome simple, slightly thickened within; within the last quarter whorl are 2 to 3 pairs of large, radially elongate teeth, and alternating with them, 3 parietal teeth. The teeth on the outer and basal walls precede those on the parietal wall, are borne on a thick callous ridge, and separated by a deep, rounded sinus. The teeth on the outer wall are larger and more pointed than those on the basal wall. The cupped parietal teeth are twice as broad as high, the ends turned forward, and the upper end is longer than the lower. As the shell grows, the innermost set of teeth is absorbed and a new set appears near the aperture. In some examples, the innermost parietal tooth remains and only the innermost teeth on the outer and basal walls are absorbed.

Dimensionsin mm.

Height	Diameter	Diameter of Umbilicus	Whorls	
1.34	4.00	1.78	4⅞	holotype
1.09	3.26	1.30	4¼	paratype
1.48	4.13	1.96	5	paratype
1.22	3.70	1.61	4½	paratype

Distribution: Virginia: Rockbridge Co.: leaf litter at base of limey shale outcrop along U. S.-60, 9.2 mi. northwest of jct. U. S.-11 at Lexington. Allegheny Co.: base limey shale outcrop 4.9 mi. west of jct. U. S.-60 and U. S.-220 at Covington; thinly wooded *(Robinia)* limestone hillside near quarry on U. S.-220, 7.6 mi. northeast of Covington city limit and 1.8 mi. southwest of Bath Co. line, holotype U.S.N.M. 683586; paratypes U.S.N.M. 683587, A.M.N.H. 128744, A.N.S.P. 310365, M.C.Z. 256812, U.M.M.Z. 228931, collection of Leslie Hubricht (35749), and collection of the author (1640).

The apertural dentition of *Helicodiscus diadema* is almost identical to that of *H. multidens* Hubricht and *H. enneodon* Hubricht. *Helicodiscus diadema* differs from both species by having fewer, coarser fringes on the body whorl, and from all other previously described species by possessing large, curved hairs on the lirae. "*H. multidens* has between 25 and 30 fringes on the body whorl. They are so fine that it is hard to count them accurately." (Hubricht, in litt.) The hairs wear off with age, for the youngest examples are the most conspicuously hirsute, and the old adults bear only scattered traces of their previous adornment. In the field, these hairs, visible to the unaided eye and bearing tiny droplets of condensed moisture, gave the shells the appearance of being crowned with rings of gems.

At the type-locality, *Helicodiscus diadema* is abundant in the topmost layer of damp leaf litter on an exposed, locust-scrub clad, limestone hillside. Living specimens are quite rare in the deeper layers of leaves and soil, where *H. notius* Hubricht, *H. intermedius* Morrison, and *H. jacksoni* Hubricht were found.

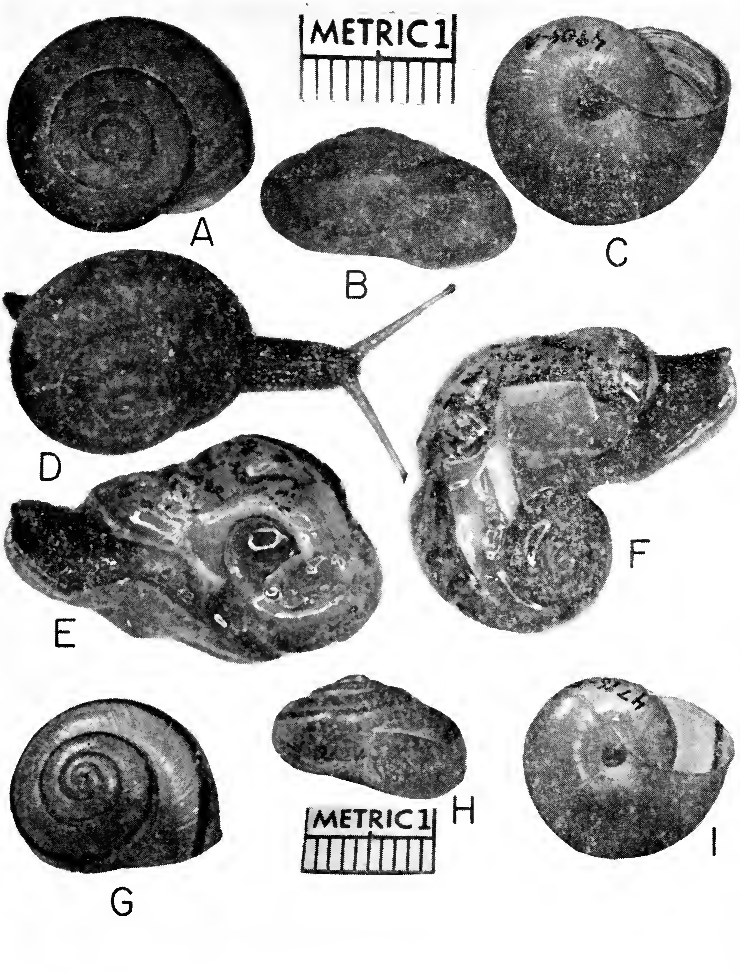


Plate 7. Lower genitalia. A. Holotype, S. *nixoni* W. B. Miller; B. Verge of paratype 4796-E. C. Holotype, S. *greggi* W. B. Miller; D. Verge of paratype 4788-A. E. Verge of S. *granulatissima* Pils. F. Verge of S. *bowiensis* Pils. G. Verge of S. *binneyi* P. & F., #4910-A, front view. H. Verge of S. *binneyi* P. & F., #4802-A, side view. ec, epiphallic caecum; ep, epiphallus; fo, free oviduct; pe, penis; pr, penial retractor; ps, penial sheath; sd, seminal duct; sp, spermathecal duct; va, vagina, vd, vas deferens ve, verge. All drawings to scale indicated, from stained whole mounts.

NAUTILUS 80 (4) PLATE 7

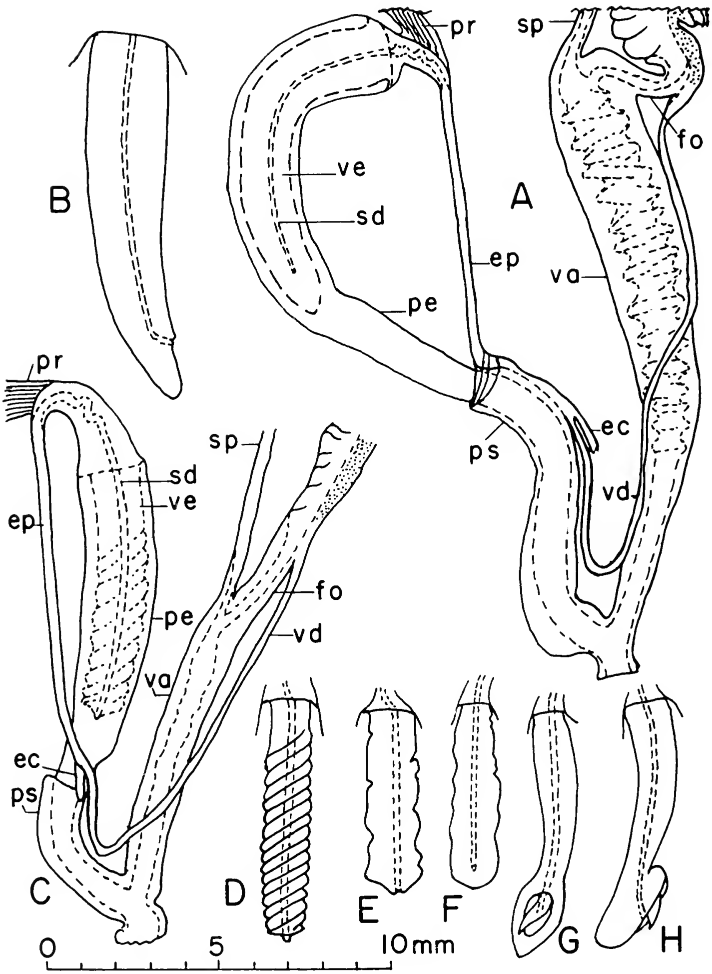
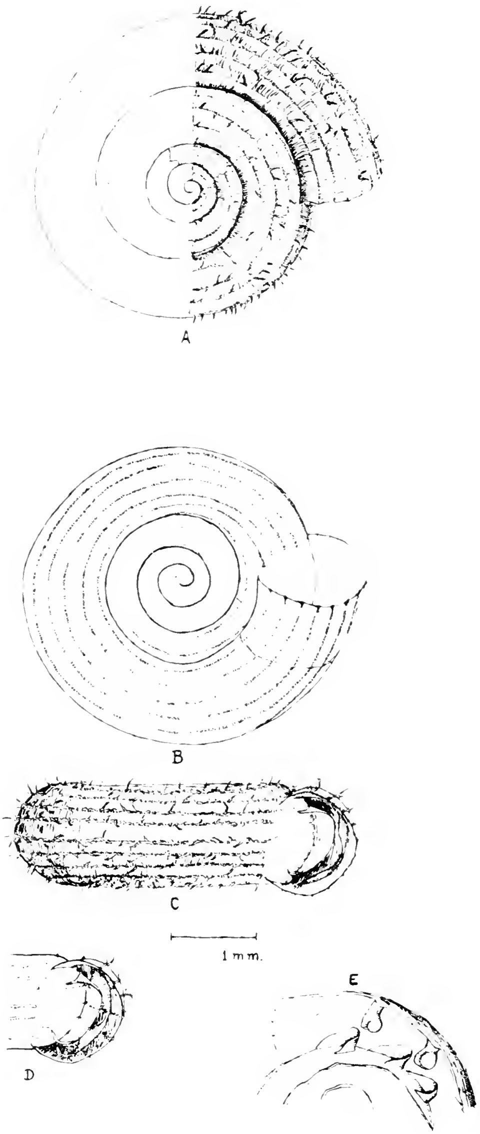


Plate 6. Holotypes. A-F. *Sonorella greggi* W. B. Miller. G-I. *S. nixoni* W. B. Miller. Upper scale for A-F; lower scale for G-I.

NAUTILUS 80 (4)

PLATE 8



Helicodiscus diadema Grimm. A - C, holotype. D, aperture of paratype showing mature dentition. E, paratype, with base removed to show teeth.

NAUTILUS 80 (4) PLATE 9

FIG. 1

FIG. 2

FIG. 5

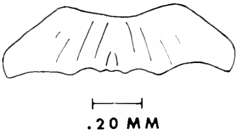


FIG. 4

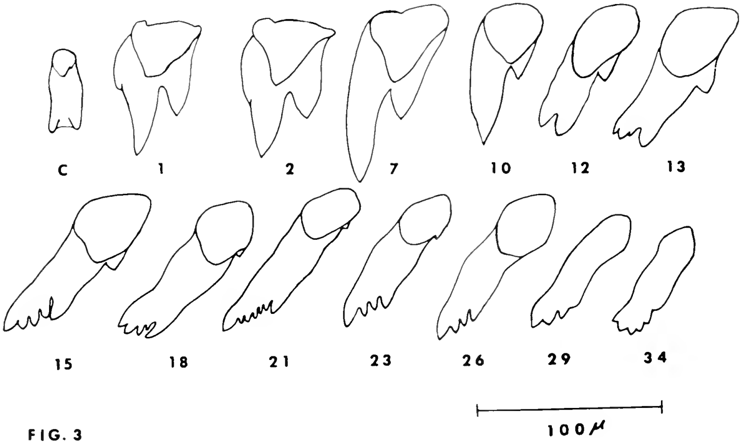


FIG. 3

Plate 9, figs. 1-5. *Lymnaea stagnalis brunsoni* Miller. 1, holotype shell. 2, paratype. 3, radular teeth. 4, upper jaw. 5, penial complex.

A NEW SUBSPECIES OF LYMNAEA STAGNALIS FROM MONTANA

By RICHARD H. RUSSELL
Department of Zoology, University of Montana

In recent years, extensive collecting of land and fresh-water mollusks in western Montana has resulted in many range extensions and several new varieties of recent Mollusca. The subspecies here described represents one of these new varieties.

Lymnaea stagnalis brunsoni new subspecies. Page 124, figs. 1-5

Shell (figs. 1, 2) medium in size, color light horn; surface with fine impressed growth lines. Whorls 5½, flat-sided; sutures indistinct; body whorl large, rounded. Spire acute, the nuclear whorl rounded. Aperture roundly ovate, elongate in immature shells. Inner lip folded over columella leaving a narrow umbilical chink. Columella with distinct plait.

Holotype: Height 28.5 mm.; width 16.0 mm.; aperture length 17.2 mm.; aperture width 11.9 mm. USNM 683584. Paratypes in the Invertebrate Museum, Department of Zoology, University of Montana, and the collection of the author.

Measurements of paratypes are as follows, in mm.:

Height	Width	Aperture Length	Aperture Width
27.3	14.8	17.0	11.1
27.7	14.8	15.6	10.8
25.4	14.8	15.5	10.6
25.3	14.5	14.9	10.5
24.9	13.8	13.9	9.7
24.4	13.6	15.3	10.3
23.7	13.5	13.7	9.7
23.2	13.8	13.9	10.0
23.2	13.2	13.8	9.5
22.5	12.2	12.8	8.6
21.9	11.8	12.8	8.7
21.2	12.5	12.8	9.0

Type locality: East shore of Flathead Lake, north of point of land at Yellow Bay; 18 miles north of Polson, Lake County, Montana. Township 24 N., Range 19 W., Section 4, Principle Meridian, Montana. Elevation 2983′. Collected during a period of extremely low water. Found 8-10 feet below usual lake level. March 26, 1966.

Animal: Mantle dark with white patches. Body grey, foot broad; tentacles broadly triangular. Other characterictics as in *L. stagnalis appressa.*

Radula and Jaw: Radula (fig. 3) with 11 laterals, first lateral tricuspid in some specimens. Mesocone of seventh lateral long and acute, becoming smaller in laterals eight through eleven. Entocone of intermediates with one to four cusps. Entocone of marginals one through 7 having from 3 to 6 cusps. Marginals 8 through 23 show a gradual reduction in the number of cusps. Formula: 23/4-6 + 3/3-4 + 11/2 + 1/1 + 11/2 + 3/3-4 + 23/4-6 (37-1-37). In some specimens the central tooth shows a small cusp on the right side of the main cusp. Superior jaw (fig. 4) well-arched, higher than in *L. stagnalis appresa.* Median cusp worn and indistinct.

Genitalia (fig. 5): Similar to *L. stagnalis appressa.* The penis sheath retractor is inserted in the posterior preputium retractor. The preputium retractors consist of two heavy muscles. Protractors two in number. Vas deferens about seven times the length of the penis sheath and preputium. Length of preputium in holotype 3.88 mm., penis sheath 1.15 mm., vas deferens 36 mm.

Remarks: This race resembles in shell characters the Great Lakes *L. stagnalis sanctaemariae* Walker and *L. s. occidentalis* Hemphill from Lake Whatcom, Washington. However, the characters of the genitalia and radula are closer to F. C. Baker's *L. stagnalis lillianae.*

The cosmopolitan occurrence of *Lymnaea stagnalis* is probably the result of a southward ingression from a circumboreal distribution. The northern populations of this species were adversely affected by glaciation during the Pleistocene as were many other animals and plants. Few of the organisms which did survive this period were able to compete with and remain distinct from those which later moved into these areas. *Lymnaea stagnalis brunsoni* lives in a restricted environment which has existed from preglacial times. Anatomical and shell characters are unique among North American Lymnaeas, and some features are closer to the European forms of *Lymnaea stagnalis. Lymnaea stagnalis brunsoni* represents a microgeographical race and can be considered as a Pleistocene relict, probably restricted to Flathead Lake.

This subspecies is named after Dr. Royal Bruce Brunson of the Department of Zoology, University of Montana.

CARUNCULINA PULLA (CONRAD), AN OVERLOOKED ATLANTIC DRAINAGE UNIONID

By RICHARD I. JOHNSON
Museum of Comparative Zoology

The present paper is a result of a study of the Unionidae of the south Atlantic states begun in 1961 and now largely completed. All the extant types of the various named forms mentioned here have been examined and photographed. Call (1896) illustrated his paper with line drawings of all the types of *Carunculina* known at that time. Reproduced here are only the type figure of *C. pulla* and photographs of some specimens, including two topotypes of *C. patrickae.*

I wish to thank Mr. John M. Bates for allowing me to examine his specimens of *Carunculina* in the Museum of Zoology, University of Michigan, prior to the appearance of his paper declaring them to represent a new species. Thanks are also extended to Drs. K. J. Boss, W. J. Clench, and R. D. Turner for reading the manuscript of this paper and for making several suggestions toward its improvement.

The following abbreviations have been used:

ANSP.	Academy of Natural Sciences of Philadelphia, Pennsylvania.
MCZ.	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
UMMZ.	Museum of Zoology, University of Michigan, Ann Arbor, Michigan.
USNM.	United States National Museum, Washington, D. C.

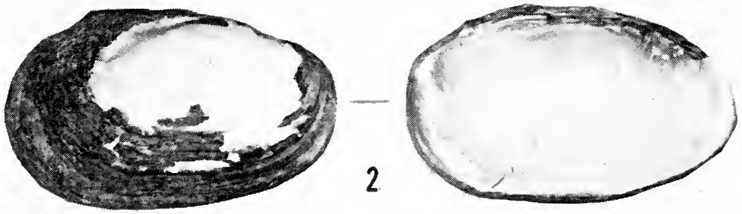
Bates (1966) in his original description of this species, *Carunculina patrickae,* (Savannah River at approximately mile point 134.5 [U. S. Army Corps of Engineers Map] on the South Carolina bank, holotype UMMZ. 85274) stated that, "The beak sculpture, prominent posterior ridge and heavy growth lines clearly distinguish this species from all others in the genus." Further he erroneously contended that, "None of the 3 species (*C. pulla* [Conrad, Wateree River, South Carolina, type lost]; *C. paula* [Lea, Chattahoochee River, Columbus, Muscogee Co., Georgia, holotype USNM. 85274]; *C. minor* [Lea, Lake George, Florida, holotype USNM. 85310]) from this general geographic area (Southeastern U. S., Atlantic drainage) appear to be closely related to this form."

The Atlantic drainage *Carunculina, C. pulla,* was first described by Conrad (1838, p. 100, pl. 55, fig. 2, Wateree River, South Carolina). The figured type (fig. 1) was collected by Dr. William Blanding and is presumed to have been in the Academy of Natural Sciences of Philadelphia, but it is lost. The specimen mentioned by Conrad from Warm Springs [=Hot Springs, Madison Co.] North Carolina was probably a *Villosa,* and the locality is in the Tennessee River system. Conrad's figured specimen was a male shell which shows the sharp, double, posterior ridge and the prominent growth lines. The posterior ridge is especially clear in colored copies of Conrad's plate.

Call (1896, p. 109) recognized that *C. paula* and *minor* were synonyms of *Carunculina parva* Barnes, 1823 (Fox River, Wisconsin, type lost) a variable species which ranges from western New York to Minnesota, to Texas, Arkansas and Florida. He unfortunately placed *C. pulla* in the synonym of *C. glans* Lea, 1830 (Ohio River, type not found in USNM) on the basis of their both having purple nacre. Call probably never saw a specimen of *pulla* and based his synonymy on Conrad's description. Bates first pointed out that the color of the nacre varies. "Nacre salmon colored and somewhat iridescent, becoming purplish at posterior extremity." Simpson (1914, 1:160) recognized Conrad's species, but was unaware of its distribution, since it was known from very few specimens until Bates found it, in some abundance, in the Savannah River, South Carolina.

Bates did not illustrate the beak sculpture of *patrickae,* but said the beaks were, "Sculptured with sharp ridges which, posteriorly, form small double-loop ridges curving acutely upward to the very prominent posterior ridge." He further claimed that, "The closest affinity of this species would be with *C. haleiana* [Lea, 1842] (group of *C. texasensis* [Lea, 1857]) which has raised beaks that often exhibit a rudimentary posterior loop." I have examined the holotype, which was the only specimen seen by Lea, of *C. haleiana* (Mississippi River, thirty miles above New Orleans [corrected on shell by Lea to: Alexandria, Louisiana] holotype USNM 85306). The holotype is more than twice the size of any *Carunculina,* and is a male shell of *Villosa lienosa* Conrad, 1834. The beak sculpture of topotypes of *C. patrickae* do not appear to be appreciably different from *parva* in the tendency to be somewhat double looped.

1



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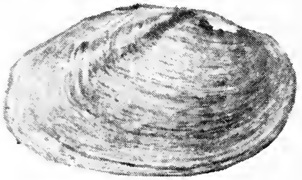

4

Figs. 1-4. *Carunculina pulla* (Conrad). 1, from Wateree River, South Carolina. Type lost. Length 33, height 19, width 13.5 mm. Male. Figures after Conrad. 2, from Savannah River, Johnsons Landing, 10 mi. W. Allendale, Allendale Co., South Carolina. MCZ. 255220. Length 32, height 19, width 15.5 mm. Female. A topotype of *C. patrickae* which lacks the sharp posterior ridge. (1.25 x). 3, from Savannah River, Johnsons Landing, 10 mi. W. Allendale, Allendale Co., South Carolina. MCZ. 25522. Length 22, height 13.5, width 10 mm. Male. A topotype of *C. patrickae* which closely resembles Bates' sketch of the allotype. 4, from University Lake, an empoundment on Morgan Creek, 1 mi. W. Chapel Hill, Orange Co., North Carolina. MCZ. 261347. Length 25, height 17, width 11 mm. Male. Specimen showing strong, double, posterior ridge.

The only characters which tend to distinguish *Carunculina* in the Atlantic drainage from typical *parva* are the sometimes heavy growth lines, and a generally present, sharp posterior ridge with a second less prominent ridge above it. Most probably the growth lines are caused by environmental conditions. The posterior ridge is not usually present in typical *parva,* and when it is, it is generally not as acute as in the Atlantic drainage form. Occasional specimens of *C. pulla* have an indistinct posterior ridge, as does one of the topotypes of *patrickae* figured here. Nevertheless, the sharp posterior ridge is so generally present, that the Atlantic drainage form of *Carunculina, C. pulla,* can be resognized as a species in the modern sense, with *C. patrickae* as a synonym of it. *C. pulla* is relatively isolated from *parva* in its distribution.

Distribution: Atlantic drainage: Altamaha River system, Georgia to the Neuse River system, North Carolina. *C. parva* is abundant in Black Creek, northern Florida, but no *Carunculina* have been reported from the two systems, the St. Mary's and Satilla, between Black Creek and the Altamaha River system. To the north no *Carunculina* have been found in the Atlantic drainage beyond the Neuse River. Presumably the ancestors of *C. pulla* entered the Atlantic drainage through a mingling of the headwaters of the Chattahoochee and Savannah River systems.

Specimens of *C. pulla* examined.

ALTAMAHA RIVER SYSTEM

Ocmulgee River drainage, Georgia: Ocmulgee River, below Lumber City, Telfair Co. (H. D. Athearn).

Altamaha River drainage, Georgia: [Altamaha River] Darien, McIntosh Co. (USNM.).

SAVANNAH RIVER SYSTEM

Savannah River drainage, South Carolina: Savannah River, approximately mile point 134.5 (U. S. Army Corps of Engineers Map) = Johnsons Landing, 10 mi. W. Allendale, Allendale Co. (UMMZ. and MCZ.; figs 2 & 3)

SANTEE RIVER SYSTEM

Wateree River drainage, North Carolina: [headwaters of] Catawba River; Pfeiffers Pond, Stewarts Pond, Bissels Pond, Beaver Creek, *all* Charlotte, Mecklenberg Co. (*all* ANSP.). South Carolina, Wateree River (Conrad).

CAPE FEAR RIVER SYSTEM

New Hope River drainage, North Carolina: University Lake, an empoundment on Morgan Creek, 1 mi. W. Chapel Hill, Orange Co. (MCZ., fig. 4)

NEUSE RIVER SYSTEM

Neuse River drainage, North Carolina: Neuse River, Raleigh, Wake Co. (Lea).

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NOTES ON CYCLOSTREMISCUS SCHRAMMII

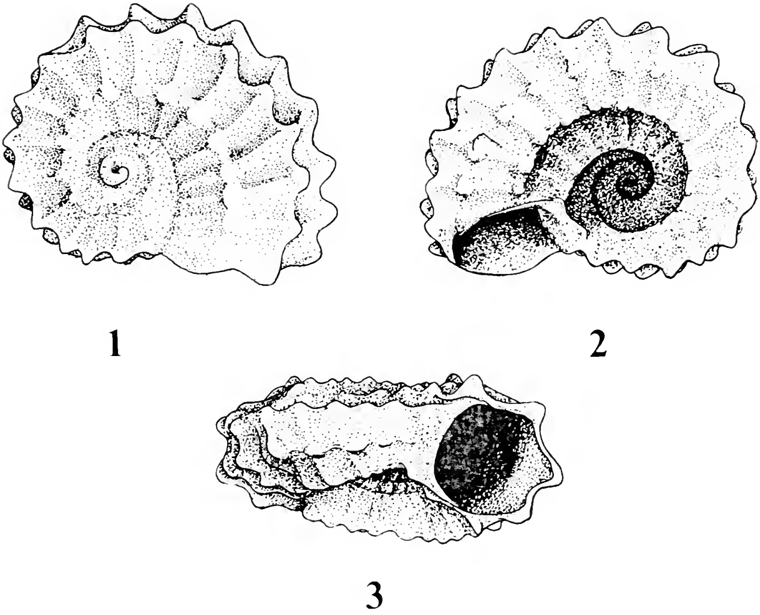
By JOSEPH HOUBRICK
Department of Biology, University of Miami

Cyclostremiscus schrammii (Fischer) has not been discussed or illustrated since it was first described and figured by Fischer in 1857. Olsson and McGinty (1958) merely included it in their check list of the marine mollusks of the Caribbean coast of Panama. Dr. Donald R. Moore, personal communication, informed the writer that he made a search for Fischer's types of Vitrinellidae while at the Laboratoire du Malacologie in Paris in 1963. *C. schrammii* (Fischer) was not found, and is either lost or misplaced.

Fischer placed this species in the genus *Cyclostrema,* but Olsson and McGinty (1958) included it under the genus *Cyclostremiscus.* Fischer's original description is confusing and his illustration is poor. Since nothing seems to have been recorded about this species since Fischer's publication, his original descrpition is given here along with an augmented description, new figures, and an additional locality record.

"*Cyclostrema schrammii.*" Figs. 1 to 3.

"Planorbid-like shell, compressed, orbicular, horn-white, widely umbilicate; adorned with strong, radiating ribs, a median crested keel with insertion of ribs, and with two keels, one situated above, one below, with worn nodes. Three turns, rounded aperture;



Figs. 1-3. *Cyclostremiscus schrammii* (Fischer). 1, upper, 2, lower, and 3, apertural views. Diameter 1 mm.

Fig. 4. *Physa anatina* (p. 144). Usual and scalariform shells.

pointed right margin. Dimensions: 8/10 mm. to 1.00 mm. Habitat — Guadeloupe."

Fischer further stated that *G. shrammii* resembles a small ammonite with 3 rows of spines and an elegant form.

The writer found 7 specimens in beach drift collected at Portete, Limon Province, Costa Rica, during the month of July, 1966. Judging from the amount of beach drift sorted and the paucity of specimens taken, this species of vitrinellid may be equally uncommon in its natural state.

The specimens are white, translucent and shining, show a convex spire little elevated except for the protoconch, and a moderately obtuse apex. There are about 2½ whorls, the last one being wide and elevated above the spire. Each whorl has five rows (keels) of nodes. Of these, there are two rows on the periphery of the whorl, one row on the upper surface, and two below, the second of these two being weaker and bordering the umbilicus.

Since the holotype is missing, the specimen illustrated (figs. 1-3) in this paper has been deposited in the Division of Mollusks, U. S. National Museum.

Acknowledgements — The writer wishes to thank Donald R. Moore of the Institute of Marine Science, University of Miami, for his help and direction in the preparation of this paper.

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EROTOLOGY OF THREE SPECIES OF PRATICOLELLA, AND OF POLYGYRA PUSTULA

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The present paper deals with the courtship, mating, and sex-organ functioning of *Praticolella mobiliana floridana* Vanatta, *Polygyra pustula* (Férussac), *Praticolella berlandieriana* (Moricand) and *P. griseola* (Pfeiffer). The data on the last two species is further supplemented by studies on development patterns of genitalia. This part of the work was done at the University of

Oklahoma in the Zoology laboratory; I am indebted to Drs. Harley P. Brown and John T. Self for permitting me to use a large portion of the available table-space for concrete snail-cages and otherwise aiding in the procurement of research supplies. I am also indebted to the Graduate College and Dr. Carl D. Riggs for a research assistantship on the Biological Survey staff which made my presence at the University possible. Since these data were not directly involved in an already somewhat lengthy thesis, they are presented here with additional data which has accumulated and seems to be adequate to justify publication at this time, particularly since the specific validity of some of the taxons are currently under evaluation (Hubricht, 1961, p. 29-30).

Because the configuration of the genitalia of *P. berlandieriana* just prior to maturity is seemingly nearly like that of *P. griseola* at maturity, a study of random samples of the genitalia of the two taxons may be misleading and inadequate in evaluating taxonomic status (compare figs. 18 and 24). For such a study, both the configuration of the developing genitalia and of the functioning sex-organs of topotypic material seem mandatory. My data do not qualify for such a study because topotypic material was not available; yet the data do indicate differences of genitalia in the two taxons, and imply that a sex-organ barrier to inter-mating could exist. Any study of typotypic material should test this possibility: Can these two cross-copulate and effectively cross-fertilize? Any hybrids secured, further, would have to demonstrate an ability to reproduce either among themselves or with the parental stocks.

For the above reasons, the present data are pertinent but not final on the question of inter-species distinctness of *berlandieriana* and *griseola*. The data illustrate the dangers of bland statements of taxonomic conclusion not supported by verifying evidence. To an increasing degree, the literature of modern malacology may not benefit from the publishing of bare opinions, despite the ubiquity of such procedures in the past decades.

Praticolella berlandieriana: The material was collected Dec. 21, 1953 on the bluff above Comal Creek, at New Braunfels, Comal Co., Texas. The specimens were active on dead vegetation, especially compositae, other forbs and grass following fog and light rain; none were noted near the creek. The mating-anatomies were from collected specimens; the genital development series was derived partly from laboratory-raised young.

On Jan. 5, 1954 a pair were noted head-on suspended from the cage cover-glass; the sex-organs quickly everted and almost immediately the two snails sexually disengaged and separated. Then another pair was noted head-on. Boiling water now being at hand, when the penes engaged a moment later, the pair was scraped off the cover-glass into the boiling water to fix the exserted organs in the extended condition. As observed, the engaged penes seemed not to entwist but to evert into reciprocal contact as in species of *Euchemotrema* (Webb, 1947, 1948). A fellow student at this time, Virgil Dowell, then placed a pair head-on and they exserted the penes into contact a few seconds later, and provided another pair of mating-anatomies.

On Jan. 6, 1954 another glimpse of courtship was secured when a pair of specimens were noted head-on, biting at each other. Biting had not happened in previously noted courtships. The pair soon separated, however, without mating.

Mating-anatomy data: Four mating-anatomies have been available for study; three are illustrated (figs. 22, 23, 30). In two mating-anatomies the main part of the penis, essentially the basal half of the retracted organ exclusive of the accessory gland, appears pendant on a stalk-like part. The stalked condition is probably due to the exserted organs having been withdrawn into the aperture of the shell as the bodies of the snails cooled. As shown in figure 23, the complete eversion of the atrium causes the nominal vagina to open as a pore high up on the side of the everted sex-organs near the atrium. The main bulk of the exserted sex-organs is made up of the basal penis. In non-mating anatomies, a circular, lobed pilaster (basal discoid body) occupies the basal part of the penis, and forms the body of the everted penis; it holds the orifice of the accessory gland, and from its mass everts the recurved, digitiform, apical penis which terminates in the ejaculatory pore. Inside the apical penis are the descended parts of the epiphallus-vas deferens complex. I interpret the basal discoid body to be homologous to the penis-clasping disk or organ in *Ashmunella* (Webb, 1954).

The orifice of the accessory gland of the penis would seem to receive the penis tip and ejected semen from the mate; how far into the accessory gland lumen [if at all] the penis tip enters must be determined by further observations.

The bulk of the accessory gland descends passively into the everted basal penis. In form the accessory gland may be nearly straight or recurved (figs. 30, 22, 23). The lumen of the gland is variably capacious, and its size in the mature, resting anatomy causes the penis tip to seem to insert laterally and to be ½ to ⅓ as large as the gland Pilsbry (1930) has shown; he did not describe the internal parts of the sex-organs.

Praticolella griseola: I am indebted to Jim Campbell for helping to collect part of the specimens. All were taken Dec. 24, 1953 from Harlingen, Cameron Co., Texas, or were offspring raised in the laboratory. The first courtship was seen Jan. 3, 1954, when two snails were noted head-on clinging to the cage cover-glass. The foreparts were detached from the glass. The pair lost each other while pivoting. On Jan. 4, another head-on pair were noted as before, and head arching and biting followed, the foreparts of each being detached from the glass and the jaws making biting actions at the other. This was a mutual behavior. They wandered apart after pivoting.

On Jan. 5th, again a pair were noted head on, biting at each other, with foreparts detached from the cage cover-glass. A few seconds later they were noted with the sexual organs exserted but were found to have become sexually disengaged a few seconds later, and on Jan. 8th a head-on pair also were noted to suddenly evert the sex organs which attained a marked volume relative to that of the snails. Two entwining processes spiralled horizontally free from the main mass of the united penes. The pair were plunged into boiling water and mating anatomies were secured (figs. 31, 32). The eversion of the organs had required only seconds.

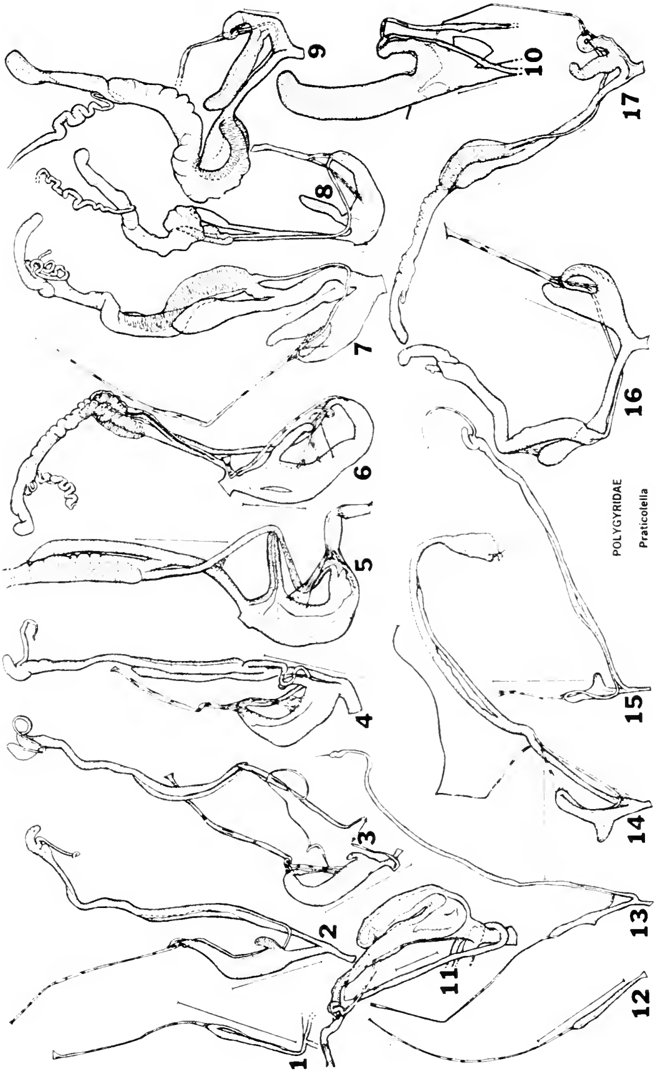
No more matings happened to be observed. On Jan. 23, 1954 large numbers of young, which were not hirsute, were seen appearing in the cage. Many dead and dying adults were noted in the cage on Feb. 17, 1954. Prolonged exposure to moisture, with temperatures in excess of 74° F., are seemingly fatal, and possibly so at even lesser temperatures. This seems also true of *P. berlandieriana*. In the culture of these two taxons, alternate wet-dry periods are indicated as being necessary.

Mating-anatomy data: Two mating anatomies were available (figs. 31, 32). The anatomy shown in fig. 32 is probably abnormally elongate below the atrium due to the extruding organs being drawn into the aperture of the shell as the body of the killed snail cooled. The mating anatomy of fig. 31 is believed not to exhibit this defect. The female-organs (vagina, free-oviduct, and basal spermathecal duct) are not everted, although the orifice of the vagina opens onto the side of the everted penis just below the atrium, and to this degree the nominal vagina has descended into the everted penis. The discoid body of the basal penis is seemingly ring-like (fig. 24, 25) and bears a more enlarged edge-lobe than in *berlandieriana*. This causes the edge of the main body of the penis, the basal part, to be calicular, with the narrowed orifice of the accessory gland opening on the rim of the cup. A mass of material occupies the orifice and adjacent duct in the anatomy of fig. 31, but less conspicuously so in fig. 32. The body of the entire accessory gland occupies the interior of the basal portion of the penis. The proportionately smaller accessory gland in *griseola* is about half the length of the everted penial tip, whereas in *berlandieriana* the tip is larger than the gland. The penis tip, as in *berlandieriana,* is everted from the basal penis, but is much larger and more elongate, being narrowly funnel-shaped. The tip seems not intrinsicly recurved as it is in *berlandieriana*. The epiphallus and vas-deferens which are merged indistinguishably, open to the exterior at the ejaculatory pore at the tip of the everted penis-tip. In both, semen is visible in these ducts.

No semen is present in the slightly enlarged part of the vas deferens at its point of seeming origin from the base of the prostrate. In most preparations the path of the sperm duct above the vas deferens is not evident in macroscopic, whole mounts of the entire genitalia. But in the two available mating-anatomies, conspicuous masses of semen are present in the sperm duct just above the point at which the vas deferens hangs and appears as a free tube parallel to the free oviduct and vagina. A restudy of the *berlandieriana* slides fails to reveal a comparable feature, due possibly to less perfect staining and tissue clearing, or to the semen having already been discharged. The semen mass above the vas deferens in *griseola* is about as wide as the prostate, but only about half as long. The material is more copious in one example than the other. In one a thin line of the material seems to reveal the path of the sperm duct up to about the region of the insertion of the hermaphroditic duct at the talon.

The mode of seminal transfer during mating is not clearly evident. The seeming entwisting of tubular bodies noted during one mating may have been the eversion and entwistment of the penial tips. The narrowed tip of the everted penis is about as large as the accessory gland pore, but its situation in the rim of the basal disk would seem to render it difficult for the everting, entwisting tip of the penis to engage the pore of the gland. Semen transfer seems mechanically different than in *berlandieriana*. Possibly the horizontally entwisting, tips merely eject semen into the cup-like basal penis; then accessory gland secretions cement the deposited semen to the cup to facilitate engulfment and withdrawal as the entire organ is retracted.

Heretofore, data on the genitalia of *P. griseola* seem not to have been published. The uterus, prostate, albumen gland and talon are as in *berlandieriana*. In some dissections, the spermatheca in *berlandieriana* is more inflated and egg-shaped; none of those available from *griseola* showed this feature. In comparing adult *griseola* with *berlandieriana,* one may characterize the anatomical differences thus: in *griseola* the penial tip is larger than the accessory gland which is lateral; the penis retractor trifurcates before its insertion on the epiphallus-penis junction and sends two strands (penis-retentor muscles) on each side of the vas deferens to the central part of the main body of the penis. At this point the two strands may radiate variously just before insertion on the penis side (figs. 20, 24, 25). I have never found such a pronounced trifurcation of the penis retractor in *berlandieriana;* the retractor continues as a main mass to an insertion on the epiphallus-penis junction with a minor strand, sometimes two strands, (penis-retentor muscles) reaching the basal penis. In the Polygyridae, the trifurcation of the penial retractor is exhibited in species of *Allogona, Vespericola, Cryptomastix, Trilobopsis,* immature *Euchemotrema,* and probably others. For this reason the trifurcate condition is probably a primitive one, but not the most primitive. The condition seems correlated with a massive basal disk, and a rather elongate, sometimes verge-bearing penial tip. The retentor strands probably aid the retraction and retain or prohibit too much eversion of the everting, penial disk; especially when the penis tip is further everted therefrom. Because the epiphallus and lower part of the vas deferens must descend into the penis to permit eversion of the penial tip the retentor strands in *P. griseola*



Figs. 1-6, 8, 11. *Practicolella griseola* (Pfr.). Harlingen, Cameron Co., Texas. 1-6, 8, development of genitalia. 11, adult genitalia. Figs. 12-17. *P. berlandieriana* (Moricand), New Braunfels, Comal Co., Texas. Maturation shown in figs. 7, 9 and 10.

may not insert diffusely but must insert to leave the epiphallus-vas deferens free to move; the insertion of the retractor muscle near the penis tip at the epiphallus-penis union prohibits excessive eversion, and probably aids the retraction of the penis tip. In *berlandieriana* the penis-retractor muscle system is thus believed to have lost the trifurcate configuration. The changed muscle structure may help cause the recurvature of the everted penial tip toward the orifice of the accessory-gland, and to prohibit twisting such as occurs in the everting tip in *griseola*. The changed condition in *berlandieriana* is indicated by the potentially trifurcate condition (fig. 7) at one stage of organ development; the final condition is probably adapted to the changed organ function which is evolving in *berlandieriana*.

(To be continued)

NOTES AND NEWS

RUTH E. COATS, 1911-1966 — Conchology suffered a severe loss in the passing of Miss Ruth E. Coats. Ruth was born on March 2, 1911, in Seattle, Washington, and passed away on Oct. 19, 1966, in Carlsbad, California. Surviving are her mother, Mrs. Emma Coats of Carlsbad, and two brothers.

Ruth received both a Bachelor of Science and a Master of Science degree from the University of Washington. She had a major in zoology and a minor in geology. She taught geology for a number of years at Palomar College.

Ruth Coats was the first elected chairman of the American Malacological Union, Pacific Division. Her first meeting, in 1949, was held in the Long Beach Municapal Auditorium, but Ruth was hospitalized and unable to attend. Later she served as Secretary-Treasurer of the A.M.U.P.D. for several years. In 1954, Miss Coats was President of the Conchological Club of Southern California. She conducted a shell study class at the Burch home.

The shell house at Carlsbad, California (some would call it a museum) reflected her originality. It was remarkable for its artistic beauty and contained an excellent library of many rare volumes. Around 1950, she bought the famous Raymond Collection. In 1954 she purchased the superb second Belle Whitmore collection. These were added to her large collection made over the years from personal collecting, purchase, and by exchange — *Rose L. Burch.*

JOYCE ALLAN (in private life, Mrs. H. W. Kirkpatrick) died on September 1, 1966, after a long illness, in Sydney, Australia. She was Curator of Mollusca at the Australian Museum from 1944 to 1956, and was author of "Australian Shells" and "Cowry Shells of World Seas."

N.S.F. GRANTS. — The following is a list of malacologists or those working in aspects of molluscan research who have received awards from the National Science Foundation. This information was extracted from the section on Biological and medical science research projects of the category of Basic research support from the recently published report "National Science Foundation, grants and awards for the fiscal year ended June 30, 1965."

Arnold, John M. Influences of the egg cortex on the development of the molluscan embryo (GB3202); 36 months; $35,900. Iowa State Univ. of Science and Technology.

Burch, John B. Biological studies of Thiaridae (GB3006); 12 mos.; $6,900. Univ. of Michigan.

Burch, John B. Cell and tissue culture methods for mollusks (GB3133); 24 mos.; $15,000.

Burch, John B. Cytotaxonomic studies of aquatic pulmonate snails (GB787 — Amend. No. 1; $14,000. Univ. of Michigan.

Costlow, John D. Environmental effects on larval development and shell formation in "Littorina picta" Philippi (GB3270); 24 mos. $26,300. Duke Univ.

Costlow, John D., Jr. Environmental effects on larval development and shell formation in "Littorina picta" Philippi (GB3270 — Amend. No. 1); $12,800. Duke Univ.

Franzen, Dorothea S. Recent Succineidae of central North America (GB2715); 36 mos.; $13,900. Illinois Wesleyan Univ.

Friedl, Frank E. Nitrogen catabolism in the snail "Lymnaea stagnalis jugularis" (GB3158); 24 mos.; $11,300. Univ. of South Florida.

Levins, Richard and Heatwole, Harold. A study of insular populations (GB2906); 36 mos.; $25,800. University of Puerto Rico.

Hanna, G. Dallas. Biological effects of the Alaska earthquake (GB3533); 6 mos.; $32,600. California Academy of Sciences.

Harry, Harold W. Systematic studies on selected taxa of fresh and brackish water mollusks (GB2753); 24 mos.; $19,200. Texas A and M Univ.

Hillman, Robert E. Comparative study of free amino acids among allopatric populations of "Crassostrea virginica" (GB2724); 24 mos.; $5,100. Univ. of Maryland.

McClary, Andrew. Cues involved in vertical movement and static orientation of Gastropods (GB3672); 24 mos.; $9,000. Michigan State Univ.

Mead, Albert R. Population decline and decimation in "Achatina fulica" (GB3768); 12 mos.; $20,100. Univ. of Arizona.

Mellon, DeForest, Jr. Reflex pathways in the surf clam (GB3623); 24 mos.; $14,800. Univ. of Virginia.

Moore, Donald R. Systematics and zoogeography of western North Atlantic Caecidae (GB3104); 12 mos.; $11,100. Univ. of Miami.

Olsson, Axel A. and Woodring, Wendell P. Comparative study of molluscan faunas of Tertiary stages (GB3892); 4 mos.; $6,800. Smithsonian Institution.

Solem, G. Alan. Classification and zoogeography of the Endodontidae (GB3384); 24 mos.; $20,500. Chicago Natural History Museum, Chicago. — KENNETH J. BOSS.

TURBONILLA SECURA. — Under different authorship, *Turbonilla (Strioturbonilla) secura* was twice proposed as a replacement name for *Turbonilla obeliscus* Gould. Though the species is South African, all critical references were published in the North American literature. A brief synonymy is as follows:

Turbonilla (Strioturbonilla) secura Dall and Bartsch, 1906.

1861. *Turbonilla obeliscus* Gould, Proc. Boston Soc. Nat. Hist., v. 7, p. 406. Not *Chemnitzia obeliscus* C. B. Adams, 1850, Contrib. Conch, p. 72. [*Turbonilla (Strioturbonilla) obeliscus* (C. B. Adams)].

1906. *Turbonilla (Strioturbonilla) secura* Dall and Bartsch, Proc. U. S. Nat. Mus., v. 30, p. 339. (Replacement name.)

1915. *Turbonilla (Strioturbonilla) secura* Bartsch, U. S. Nat. Mus. Bull. 91, p. 76, pl. 17, fig. 7. (Replacement name.)

1964. *Turbonella* (sic) *(Striothurbonilla)* (sic) *secura* "Bartsch" Johnson, Smithsonian Inst. Bull. 269, p. 147 —

JAMES X. CORGAN, Sinclair Oil and Gas Company, Tulsa, Oklahoma.

FURTHER COMMENTS ON BRACHYSTYLOMA CARIBBEANA — The genus *Brachystyloma* and the type species *B. caribbeana,* from the Abisinia Formation (Pleistocene) of northern Venezuela, were named, described, and illustrated by Weisbord (1962, Bulls. American Paleo., *42* (193): 18, 28, 335-337, 485, pl. 29, figs. 23-24). Three specimens were available for study, all badly worn and broken on the outer lip and spire. On all three specimens also, there is a deep and wide excavation under the columella, imparting to the aperture and anterior canal the outline of a broad inverted and reversed comma. Mainly on this character, the genus *Brachystyloma* was erected. After examining one specimen of *Brachystyloma,* the holotype, Robertson (Nautilus, 77 (1), p. 32) came to the conclusion that the character in question "is an erosional feature that would be found only in broken and abraded shells," that "*Brachystyloma* is a worn and badly broken columbellid probably the abundant and variable *Anachis (Costoanachis) hotessieriana* Orbigny or a closely related species in the same subgenus," and that "*Brachystyloma* Weisbord (1962) is a subjective junior synonym of *Anachis* H. & A. Adams (1853) and of *Costoanachis* Sacco (1890)."

Only recently, I happened to read Robertson's note or I would have commented on it earlier. I might state at the outset, that at the time I was working on the shells, I too was apprehensive that the peculiar shape of the aperture might be due to weathering rather than to its genetic structure; and, if the excavation under the columella is attributable wholly to erosion (or, as I once thought, to a burrowing organism), then the validity of the genus *Brachystyloma* is indeed questionable. However, after re-examining the two topotypes in our collection at Florida State University, I am again persuaded that the "excavation" is a true morphologic character and not a fortuitous one. It would be more than passing strange for all *three* specimens of *B. caribbeana* to be eroded or burrowed into in exactly the same complex pattern, and I must contend that the inverted comma effect is an inherent one. Secondly, breakage cannot be invoked to account for the excavation, since sharp, ragged edges are not present in the critical areas as one might expect along breaks, but are rounded and thickened instead. Thirdly, the smooth, slightly arcuate columella seems to me to be foreshortened naturally, and extends down into the aperture as a small projection considerably distant from the basal lip. The lower end of the columella is subtruncate and is thickened or emarginate, the emargination continuing along the edge of the lower and basal lips. Truly the spire of *Brachystyloma* resembles that of *Anachis (Costoanachis)* as stated by Robertson, and even the residual color pattern of our specimens is similar to that of *A. hotessieriana* (Orbigny). However, the aperture of the Venezuelan shells is completely different than that of *Anachis (Costoanachis)*, and is so unique (genetically, in my judgment) that the new genus *Brachystyloma* was proposed. — NORMAN E. WEISBORD, Florida State University.

COILING ABNORMALITY IN PHYSA ANATINA. — On October 15, 1965, the junior author, searching for tardigrades on some flat rocks (heavily laden with algae), inadvertently transported the eggs of *Physa anatina* Lea to his laboratory. The eggs hatched. Among the hundreds of normal individuals, a single "un-coiled" individual was observed (page 132, fig. 4). It measured 5.5 mm in greatest length. — BRANLEY A. BRANSON, Eastern Kentucky University and CLARK W. BEASLEY, University of Oklahoma.

MONTACUTA FLORIDANA COMMENSAL WITH ANNELID ONUPHIS MAGNA. — A number of bivalve mollusks of the eulamellibranch superfamily Erycinacea have been found in symbiotic association with annelids. Boss (1965, Malacologia, *3:* 183-195) has reviewed these occurrences. Along the Atlantic coast of North America, Stimpson (1855, Proc. Boston Soc. Nat. Hist., *5:* 110-117) first described *Lepton* [*Ceratobornia*] *longipes* as occurring in the "holes of marine worms and fossorial crustaceans." More recently Sanders *et al.* (1962, Limn. and Oceanogr., *7:* 63-79) found *Aligena elevata* (Stimpson) attached to the lower end of *Clymenella torquata* (Leidy) at Barnstable Harbor, Massachusetts. The present note documents the commensal relationship of *Montacuta floridana* Dall with the annelid *Onuphis magna* (Andrews). Specimens of these species in association were collected in a muddy sand bar about 200 yards south of the mouth of Hall's Creek (south of Matheson Hammock, Dade County, Florida). The burrows of *O. magna* at this locale were among *Thalassia* rhizomes. The substrate below the thin layer of detritus and mud was anaerobic.