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CONTENTS

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IN FUTURE, PLEASE ADDRESS ALL MAIL FOR STERKIANA TO THE ABOVE ADDRESS AND NOT TO THE ONE BELOW.

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A PHOTOGRAPHIC RECORD OF SNAIL ACTIVITY

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Peninsula Nature Museum, Newport News, Va. 23601

Freshwater snails in their natural habitat move slowly over the vegetation and substrate, exhausting the patience of an observer trying to record their activity. At infrequent intervals they exhibit, for mollusks, rapid motion, travelling a distance of several yards in a few minutes. Occasionally they drop from the underside of the surface film or ascend rapidly. The approach of another individual of the same species can result in short periods of investigative behavior, that sometimes leads to mating. A snail moves with slow dispatch.

To measure the time occupied by activity or rest and to observe what occurred during these periods, marked gastropods were filmed in the laboratory.

Three adult and two juvenile *Goniobasis virginica* and a single *Pseudosuccinea columella* were used in this experiment. They had been collected, along with five other species of fresh water mollusks, from the Tar River at Rocky Mount, North Carolina, on September 30, 1968.

The river bed was completely exposed in places largely due to diversion of its waters by local industry in combination with a dry summer. Low water had isolated the mollusks so they could be easily hand-picked from pools, among the rocks of the cataracts at the base of a small dam. These animals and succeeding generations were reared in the laboratory during the winter of 1968-1969 and used in studies, one of which, based on a film of their activity follows.

In this report, the *Goniobasis* will be identified as G-1, G-2, G-3, adult animals; G-4 and G-5, juveniles; and the *Pseudosuccinea* as P.

At the time of their capture the spires of the *Goniobasis* were eroded at the tips and included only 6 to 8 of the most recent whorls. Similarly, the spires of the juvenile *Goniobasis* were eroded and showed only 5 to 6 whorls. No appreciable growth had occurred up to the date of the filming nor to the time of their death the following summer. Heights and greatest diameters are as follows:

Animal	*Height in mm.*	*Diameter in mm.*
G-1	26.8	8.3
G-2	26.6	9.2
G-3	28.8	11.2
G-4	12.9	5.6
G-5	15.7	6.1
P	12.0	6.5

For the film sequence the mollusks were introduced into a shallow pyrex dish, 8½ by 4½ by 3½ inches, positioned over a centimeter square grid to facilitate measurement. In order that the snails could be seen at all times only minute portions of leaf lettuce, algae and an alder leaf were added to the dish and replenished as consumed. Only tap water which had stood for 48 hours and was at room temperature was used. The water was kept at a depth of 2 inches during the filming.

Filming was begun on 12 December 1968 at 2:30 pm, 2 hours after the animals had been introduced and ended at 2:20 am, 15 December. A Bolex-Rex 16 mm movie camera was used. The camera setting was *f*-11 with a *f*-1.6 lens approximately 2 feet from the subject. Exposure time was 1/30 of a second, using Kodachrome II (photoflood) ASA with one light 3200° Kelvin. Frames were exposed at the rate of one per minute.

Positions of the mollusks at minute in-

tervals were marked on charts, from which the distances were measured and plotted on graphs. When the snails were first introduced into the photographic situation, they expended considerable energy in rapid exploration of the dish. To eliminate the introductory explorations and to have equal units of time for comparison, the decision was made to study activity patterns from 12:00 am 13 December to midnight of 14 December 1968.

Table 1 summarizes the amount of time each snail was either active or resting during the hours of dark and light. Sunrise occurred at 7:15 am and sunset at 4:40 pm EST on 13 and 14 December. In this report daylight was measured as the ten hours between 7:00 am and 5:00 pm.

TABLE 1. Number of hours snails were active or resting in a 24-hour period.

Animal	Date	NIGHT Active	NIGHT Rest	DAY Active	DAY Rest	TOTALS Active	TOTALS Rest
G-1	Dec. 13	9h 24m	4h 36m	4h 48m	5h 12m	14h 12m	9h 48m
	14	5h 30m	8h 30m	4h 48m	5h 12m	14h 18m	13h 42m
G-2	Dec. 13	6h 30m	7h 30m	2h 00m	8h 30m	8h 30m	15h 30m
	14	5h 00m	9h 00m	1h 30m	8h 30m	6h 30m	17h 30m
G-3	Dec. 13	5h 54m	8h 06m	6h 18m	3h 42m	12h 12m	11h 48m
	14	5h 12m	8h 48m	5h 00m	5h 00m	10h 12m	13h 48m
G-4	Dec. 13	4h 18m	9h 42m	6h 36m	3h 24m	10h 54m	13h 06m
	14	8h 06m	5h 54m	2h 24m	7h 36m	10h 30m	13h 30m
G-5	Dec. 13	6h 12m	7h 36m	4h 48m	5h 12m	11h 12m	12h 48m
	14	12h 18m	1h 42m	9h 48m	0h 12m	22h 06m	1h 54m
P	Dec. 13	8h 32m	5h 18m	8h 42m	1h 28m	17h 14m	6h 46m
	14	8h 00m	6h 00m	10h 00m	0h 00m	18h 00m	6h 00m

No consistent sequence of activity is evident from Table 1. Increased activity either in the dark or light did not occur and varied from day to day, even for the same individual.

G-2 was the least active mollusk and the total number of hours spent in resting was equally divided between day and night. The adults, G-1 and G-3 were active approximately twelve of each twenty-four hours, as were the juveniles, G-4 and G-5, except that on 14 December G-5 was almost continuously in motion. *Pseudosuccinea* was the most active animal. In the laboratory this genus was always more active than *Goniobasis*.

Figure 1 shows the patterns of activity obtained from 48 hours of filming. Activity peaked for the three adult *Goniobasis* between 10:00 pm and 5:00 am. During these hours two of the three snails were always in motion and between 12:00 am and 1:00 am all three were active. Between 7:00 am and 9:00 am and 1:00 pm and 6:00 pm activity again showed an upswing.

G-1 entered a long rest lasting from predawn until noon on both days. From noon to midnight on the 13th it remained active with only brief stops (snailnaps) of six to thirty minutes duration. After sunset on the 14th it had another long rest. Even the G-2 totaled equal amounts of rest in the dark and daylight, it had its longest rest during daylight hours. G-3 rested 5 hours before dawn of the 13th but delayed its major rest on the 14th until late afternoon.

The two juveniles, G-4 and G-5, were most active between 5:00 am and 7:00 am, 10:00 am and 1:00 pm and 8:00 pm to 10:00 pm. The trace of G-5 on 14 December shows no major rest at all. It ceased motion

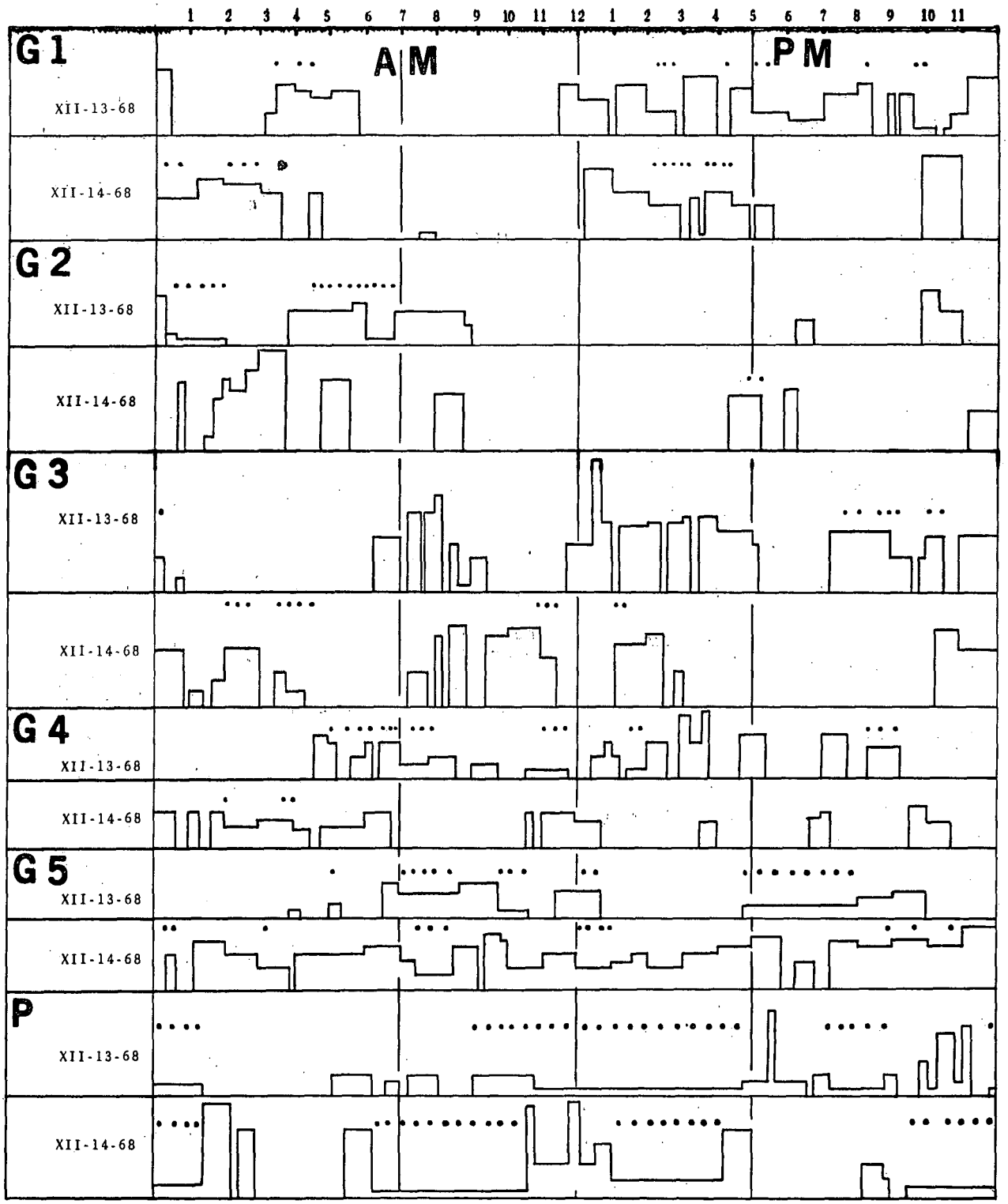

FIG. 1 ACTIVITY PATTERNS ••• FEEDING

seven times during the twenty-four hours, halting only six to thirty minutes each time. It is difficult to envision how it was able to sustain such a level of activity.

Although the number of hours during which *Pseudosuccinea* was active was about equally divided between day and night, its most sustained activity occurred during the day. It moved and fed ten and eleven hours without rest on both days. Out of each twenty-four hours, it fed approximately twelve hours, glided six hours and rested six hours. Its major rests were shorter than those of *Goniobasis*.

Biological rhythms have been described in the literature for various animals. These may be circadian, polycyclic or related to special activities such as sex or migration. When Figure 1 was examined in this light, it appeared from the alternation of activity and rest that any possible rhythmicity was polycyclic rather than circadian.

That the cycles did not coincide with dark or light, that they varied between individuals and even from day to day for a single individual possibly results from the nearly constant temperature in which they had been raised. Cycles do not appear to persist for long periods under constant conditions and these animals had been kept in the laboratory for two and one half months before being filmed.

GENERAL BEHAVIOR PATTERNS

Various types of behavior were identifiable on the film. These are designated as gliding, sweeping, feeding, contact and rest. The following descriptions and information apply to *Goniobasis* except as *Pseudosuccinea* is specifically identified.

In gliding, *Goniobasis* holds the rostrum and tentacles partially or fully extended and probing in advance of the route. The shell is carried above and nearly parallel with the body. It is advanced intermittently and abruptly as though sucked forward on the body.

The greatest distance covered per unit of time was during gliding; 5 to 15 mm was the basic distance advanced per minute, but during peak spurts both the *Goniobasis* and the *Pseudosuccinea* travelled 40 to 60 mm per minute. *Pseudosuccinea* covered the greatest distance in one minute - 64 mm.

An animal would glide an average of 5 to 15 minutes, halt one minute, and resume travel. It would continue this pattern at least one to two hours before resting. The longest continuous glide period, performed by a juvenile *Goniobasis*, lasted five hours.

A clean pyrex dish was used during the filming to ensure visibility of the grid system and the paucity of food in it may have contributed to the long periods of travel without rest.

The mollusks glided either in a straight line or along a circular path. No preference for counterclockwise as opposed to clockwise motion was found.

Tracings of their paths indicated phobotaxis. The snails frequently paralleled previous courses of their own or of other individuals or crossed them, but they did not retrace the old paths.

During the forty-eight hour period, G-3 retraced parts of its previous paths only 8 times for a total of 45 minutes. It never followed a path long. Retracing lasted from 2 to 7 minutes. The only exception occurred when it followed a former trail 17 minutes after an elapsed time of 2 hours 12 minutes. The shortest interval between retracing of a tract was 55 minutes; the longest 34 hours 2 minutes. Twice G-3 duplicated part of a G-1 track for 3 and 7 minutes respectively.

Arriving at the corner of the dish or a side wall, an animal would make sweeping motions of the rostrum before orienting in a new direction. The paths of all animals converged in the corners, but they continued on in various directions after crossing each other's trails.

A second motion frequently employed was sweeping. The snail ceased forward motion and, with shell stationary, alternately extended the rostrum and tentacles in an arc to left and right. After all the area within its reach was covered, the body and shell were hunched into a slightly advanced position and the sweeping continued. This motion was an exaggeration of the probing seen during gliding. Duration of sweeping was 5 to 45 minutes. Most periods lasted 15 to 20 minutes.

The pattern resulting from sweeping appears to be efficient in its thorough coverage of an area. Raup (1969) has discussed foraging behavior of minute fossil sediment feeders and has recreated their

meander patterns by digital computer. Uniform distribution of food in the sediments favors compact grazing patterns which provide maximum coverage of an area and minimum crossing of existing tracks. The pattern produced by a snail sweeping bears a similarity to the movements of these ancient animals in their meanderings. As *Goniobasis* is largely phytophagous, utilizing minute forms encrusting rocks and leaves, the distribution of its food could encourage such a pattern.

As the snail travelled, it appeared to search continuously for food. Viewed through the side of the aquarium, its jaws and radula could be seen working rhythmically, rasping everything in their path. Only if the snail encountered a concentration of food, such as algae, would it halt for a well defined feeding period. The animals frequently grazed on each other's shells which were covered with algae.

Dead leaves and algal encrusted pebbles from a local creek were placed in the aquaria as food and replenished monthly. Dazo (1965) has reported red and green algae, diatoms and desmids as the preferred food of *Goniobasis*. These would be ingested as the snails grazed the leaves and pebbles. In addition his laboratory animals accepted leaf lettuce. Although the juveniles consumed small amounts, the adults of this report did not readily utilize lettuce.

Unlike the *Goniobasis*, the *Pseudosuccinea* fed voraciously on leaf lettuce and alone consumed almost all supplied during the filming. It could be seen rasping on the leaf; the animal and its shell swinging from side to side with its exertions as it pulled the lettuce to it and turned it around in the water.

Pseudosuccinea was the most persistent feeder. Nevertheless, it abstained once from feeding for 9 hours. On 12 December between 2:40 p.m. and 11:36 p.m. it deposited an egg capsule and subsequently completed 2 glide and 2 rest periods of equal duration before feeding.

Table 2 lists the total time an animal remained in an area feeding during each 24 hour period.

See Fig. 1 for times in which feeding occurred. No consistent pattern of feeding is evident. An animal fed upon awakening, before resting, and might be active both before and after feeding.

TABLE 2. FEEDING PERIODS

	Dec. 13	Dec. 14
G-1	4h 48m	2h 55m
G-2	3h 36m	1h 12m
G-3	1h 46m	2h 18m
G-4	3h 54m	-- 27m
G-5	5h 40m	3h 43m
P	10h 42m	11h 42m

Contact between two active individuals was frequent. On contact with another snail, *Goniobasis* partially retracted its tentacles and halted. An exploratory phase employing the tentacles followed for one to a few minutes. The animals would separate and change course or rest side by side with bodies withdrawn into the shells, or one might crawl over the other or graze on its shell. In the laboratory juvenile animals used the larger ones as carriers and resting places. Small snails frequently were found riding aboard others, apparently not disturbing the carrier. Motion was neither slowed nor halted by this activity. There was little discernible reaction to being crawled over or having the shell grazed. Rarely was rapid twitching of the shell used to dislodge an animal of equal size that had carried.

The *Goniobasis* and *Pseudosuccinea* in general avoided each other. Upon contact they separated immediately. One exception occurred when *Pseudosuccinea* crawled upon the shell of the largest *Goniobasis*, a female (G-3), and remained there 2 hours 7 minutes from 3:08 p.m. to 5:15 p.m., 12 December, depositing an egg capsule. The capsule, 12 mm. long, contained 28 eggs. All but one hatched 20 to 22 days later. In the following week *Pseudosuccinea* deposited 8 other capsules and one half size capsule and died on 29 December.

The *Goniobasis* studied and 21 others remained alive until June and July, 1969, nearly 10 months after capture. No attempts to mate were observed nor were eggs found. They were kept in translucent white plastic containers and while the eggs are easily overlooked, it is expected they would have been found had they occurred. Dazo ascribes to Winsor (1933) the observation that *G. virginica* eggs are covered with 'foreign matter.' The lack of debris and sand grains may have contributed to the circumstances under which no eggs were found.

A rest period, as differentiated from brief pauses in contact or change of direction, was selected as lasting at least 30 minutes.

Major rests were commenced after an animal had been active at least an hour. Most resting periods occurred following 2 to 7 hours of activity.

The motion of the animal became fitful. It frequently travelled shorter distances per minute and stopped once or twice for several minutes before coming to rest. The length of a rest varied between 30 minutes and 9 hours 18 minutes. Of 42 rests totaled by all the snails more than half (24) were of 2 to 6 hours duration.

Goniobasis attached itself either to the side of the container or on the bottom. On the side of the container it rested with the head up, the apex of the shell pointed toward the bottom. On the bottom the shell was held parallel to the floor in a straight line with the head. It almost always withdrew completely into the shell, altho in a few instances the rostrum and tentacles were partially extended. All the animals except G-2 and G-4 assumed a resting position on the bottom more frequently than on the wall, in a ratio of 2:1. Of 42 rest periods 27 occurred on the floor, 15 on the walls of the container.

Pseudosuccinea was once active for 11 hours 36 minutes before resting. On 14 December G-5 went almost entirely without rest. It moved 16 hours 48 minutes with only 3 rests of 6 minutes duration during that period, rested 18 minutes, moved 30 minutes, rested another 30 minutes and then commenced a 4 hour 40 minute session of rapid glide.

If a snail had recently entered a rest period, it remained quiet in spite of being bumped, shoved to another location or grazed by an active animal. A few times a resting snail moved several mm. in one minute to another position and continued sleeping.

Contact by an active animal often terminated the rest period of a snail which had been quiet for an hour or more. 24 major rest periods were terminated when an active animal contacted a resting one. A minute or two after being bumped, the sleeper would resume gliding.

In 18 instances of 42 the resting animal resumed activity of its own accord. *Pseudosuccinea*, which was almost completely avoided by the *Goniobasis*, awoke from all its major rests without physical contact of another snail. G-5 contacted it 3 times to end short pauses of 24 minutes or less. G-2 ended one of its short pauses, but there was no other contact between *Pseudosuccinea* and the *Goniobasis* other than the deposition of the egg capsule. While the animals would be expected to awaken in the wild without physical contact between animals, the crowding in the photographic situation made it inevitable that they should frequently disturb each other.

CONCLUSIONS AND SUMMARY

Goniobasis exhibited a polycyclic rather than a circadian rhythm. There was no well defined preference to concentrate activity in either the dark or light. The animals were active approximately half of each 24 hours, alternating several hours of motion with several of rest. G-2 was the least active of the *Goniobasis*. It spent only a third of the time in motion and most of this occurred during the night.

Pseudosuccinea was a more active animal than the *Goniobasis*. It was engaged in various locomotor activities 18 of each 24 hours. Its activity pattern was also polycyclic, although the most sustained activity occurred during daylight hours. Rest periods were short, 3 to 4 hours at the most.

Several distinctive types of locomotor activity were clearly indicated in a film made of *Goniobasis* and *Pseudosuccinea*. These are described as gliding, sweeping, feeding, contact, and rest.

The maximum distance in a forward direction covered per unit time was in gliding. No preference for straight line, clockwise or counterclockwise motion was indicated. Sweeping motions with the shell held stationary and the rostrum and tentacles moved alternately to right and left in a series of arcs, enabled the animal to search an area thoroughly. Feeding periods adhered to no particular pattern and were not concentrated either in the hours of dark or light. Feeding was preceded or followed both by activity or rest. No clearcut pattern emerged.

Contact between active animals usually resulted in a retraction of the tentacles and rostrum and a change in direction of motion after a moment's halt. On the other hand, no reaction was apparent if the shell was grazed upon, pushed aside or crawled

over. Phobotaxis was exhibited in the pronounced avoidance of previous slime trails, either its own or those of others.

A single instance of egg deposition by *Pseudosuccinea* was filmed. The egg capsule was laid on the shell of the largest *Goniobasis* and was carried 20 to 22 days to the successful hatch of all but one of the eggs.

More than half the major rest periods lasted between 2 and 6 hours. For at least an hour after entering a sleep period a passive individual was not aroused by contact from others. Beyond that initial period being pushed or grazed could disturb it sufficiently to resume activity.

The author wishes to thank Paul Chanley through whose good offices the facilities of the Virginia Institute of Marine Science were made available to photograph the snails, Fred Biggs, Associate Information Officer, arranged the photography. A film viewer loaned by William Radcliffe of the Mariners Museum was used to analyze the film. I am deeply indebted to these gentlemen for their assistance with this project and to Ronald Mollick of Christopher Newport College who read the manuscript.

REFERENCES

BAKER, F. C. (1928) Freshwater Mollusca of Wisconsin. I. Gastropoda. -- Wis. Geol. & Nat. Hist. Survey, Bull. 70: 170-187.

DAZO, B. C. (1965) The morphology and natural history of *Pleurocera acuta* and *Goniobasis livescens* (Gastropoda: Cerithiacea: Pleuroceridae). -- Malacologia 3(1): 1-80.

HARMON, W. N. (1968) Replacement of Pleurocerids by *Bithynia* in polluted waters of central New York. -- Naut. 81)3): 77-83.

KLOPPER, P. H. and HAILMAN, J. P. (1967) An introduction to animal behavior. -- Prentice-Hall, Inc., Englewood Cliffs, N. J., 297 p.

MORRISON, J. P. E. (1954) The relationships of old and new world melanians. -- Proc. U. S. Nat. Mus., 103(3325): 357-394.

RAUP, D. M. (1969) Fossil foraging behavior: computer simulation. -- Science 166 (3908): 994-995.

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THIRTY-SIXTH ANNUAL MEETING OF THE AMERICAN MALACOLOGICAL UNION, KEY WEST, FLORIDA, JULY 16-20, 1970

The local committee for this meeting, Ann Young, chairman, John Root, and Margaret Teskey, did a fine job according to all accounts.

The majority of the meetings were held in the Convention Hall, under the chairmanship of President Alan Solem. Ann Young welcomed members in attendance on behalf of the local committee and Roy C. Anderson and Mayor Dr. Delio Cobo on behalf of the Key West Convention Bureau and the City respectively on the first day, July 16.

A list of the papers presented is given below after an account of the distinctive social and field collecting events of the meeting.

A CONCH TRAIN TOUR of Key West was a feature of the first evening. The group picture was taken in front of Convention Hall on July 17, after a morning devoted entirely to a symposium on Commercial marine mollusks of the United States convened by Arthur S. Merrill. This symposium continued throughout the afternoon.

The evening presentation was SHELL CLUB NIGHT, organized by John Root. Executive Council met at the same time.

SATURDAY JULY 18. The morning was devoted to presentation of papers. In the afternoon, one group went on a field trip to Sand Key for marine collecting and another for non-marine collecting in the vicinity of Key West.

In the evening, the organizational meeting for the AMU CONSERVATION COMMITTEE was held in Convention, co-chairmen D. S. Dundee and Anne Speers presiding.

SUNDAY July 19th, papers on 'Mollusks introduced or thought to be introduced into North America' were presented in the morning and 'Contributed Papers' in the afternoon.

In the evening, an identification seminar, moderated by William Old, was held.

MONDAY, JULY 20th, a symposium convened by Robert Robertson on 'Biological Systematics of marine bivalves and gastropods' was presented, followed in the afternoon by another group of contributed papers.

The business meeting was held at 3:00 p.m., a cocktail party at 7:00 and the annual banquet at 8:00. The after-dinner program included an address on 'Living Cephalopods' by Edward T. LaRoe, University of Miami, Miami, Florida, the customary acknowledgements, greetings from Past Presidents and the induction of new officers.

PAPERS PRESENTED

(in order of their presentation)

WILLIAM J. CLENCH. History of Florida Malacology.

CATHERINE H. ROBINS. (Institute of Marine Science, Miami, Florida). The introduced freshwater snail, *Marisa*.

MARTIN F. GOMON (Institute of Marine Science, Miami, Florida). Florida undersea parks.

THOMAS R. WALLER (Smithsonian Institution, Washington, D. C.). The glass scallop, *Propeamussium*, a living relict of the past.

JOSEPH P. E. MORRISON (Smithsonian Institution, Washington, D.C.) Hydrobiidae.

MORRIS K. JACOBSON (Museum of Comparative Zoology, Harvard University). Evolution of a sheller - amateur to publishing pro

JAY D. ANDREWS (Virginia Institute of Marine Science, Gloucester Point, Va.) Oysters.

CARL N. SHUSTER, Jr. (U. S. Navy, CBC, Davisville, R. I.) Hard clams and soft clams.

ROBERT HANKS and ARTHUR S. MERRILL (Biological Laboratory, Bureau of Commercial Fisheries, Oxford, Md.) Bay scallops, razor clams and potential species.

JUGA, OXYTREMA AND *MUDALIA,* AND A CORRECTION

BRANLEY A. BRANSON

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Scarcely had my brief note (Branson, 1969) on some western and southwestern snails appeared in print before I received a cordial note from Allyn G. Smith (California Academy of Science) asking about the basis for my utilization of the combination *Mudalia* (Goniobasis) *silicula* (Gould). With a red face, I could only plead a *lapsus calami,* for in some manner or another I had used *Mudalia* where I had intended *Oxytrema*.

In the same letter, Dr. Smith indicated that he had been using *Juga* for western U.S. river snails, following the rationale of Taylor (1966). Prior to the latter work, Baker (1963, and more lately, 1967) selected *Melania silicula* Gould as the type of the Adams brothers' *Juga*. Taylor (loc. cit.) recognized *Juga* as a valid genus, and included in it all Recent and Tertiary Pleuroceridae of Western North America that have shells like *Elimia* (which is open to at least suspicion since *Semisulcospira cancellata* (Benson), 1833 has been found in Miocene rocks of Western Siberia (Zhadin, 1952). On the other hand, in the choice of *Oxytrema* as the generic designation for western river snails I agree with Morrison (1954): 'This genus includes numerous North American species whose range extends from the Atlantic to the Pacific coasts and from southern Canada to Florida and Texas.' In the genus, according to Morrison, the eggs are laid in close, flat clusters of 3 to 10 egg capsules -- a fact I have verified by numerous field observations.

Moreover, I am progressively more uncertain regarding the relationships of *Juga (fide* Taylor) and the Oriental pleurocerid genus *Semisulcospira*. Although the last named genus is ovoviviparous (Davis, 1969; others), the question has been raised whether its species were not more closely related to western American 'melanians' than the western forms were to those of the eastern U. S. (Dall, 1910). Personally, I suspect that *Semisulcospira* and similar forms are secondary derivatives of pleurocerid stocks in the center of dispersal, and that the American fauna is the more primitive of the two, particularly species complexes of the southeastern United States (where considerable radiation has occurred). *'Pachycheilus'* of Mexico, and *'Goniobasis'* of Texas are relict faunas. The species of the west coast of America are presumed to have been isolated there since at least late Pliocene times. The species of the Olympic Peninsula, and of the Puget Sound area in general, probably reinvaded the area following glacial abatement. There is ample evidence that many of the valleys were filled with ice during the Pleistocene, and field observations during the summer of 1969 demonstrated that *Oxytrema* is not now very abundant in glacier-fed streams, especially very far inland from the coast (or Hood Canal).

The author is now conducting a survey of the freshwater and terrestrial mollusks of the Olympic Peninsula[1], and he hopes to continue this work into the Cascade and Sierra Nevada ranges - funds permitting.

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1 Supported in part by Sigma Xi-RESA and Eastern Kentucky University Faculty grants in aid of research.

LITERATURE CITED

BAKER, H.B. (1963) The genera of Recent Mollusca. -- Nautilus, 77:35.

----- (1967) *Juga* and *Melasma*. -- Nautilus, 81: 36.

BRANSON, B.A. (1969) Distribution notes on western and southwestern snails. -- Sterkiana, 36: 21.

DALL, W. H. (1910) Land and freshwater mollusks.--Harriman Alaska Exped., 13: i-xii; 1-250.

DAVIS, G.M. (1969) A taxonomic study of some species of *Semisulcospira* in Japan (Mesogastropoda: Pleuroceridae). -- Malacologia 7: 211-294.

MORRISON, J. P. E.(1954) The relationships of Old and New World melanians. -- Proc. U.S. Nat. Mus., 103: 357-394.

TAYLOR, D.W. (1966) Summary of North American Blancan nonmarine mollusks. -- Malacologia, 4: 1-172.

ZHADIN, V. I. (1952) Mollusks of fresh and brackish waters of the U.S.S.R. -- Acad. Sci. U.S.S.R., 46: 1-368.

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THE LAND SNAILS OF NORTH CAROLINA

LESLIE HUBRICHT

North Carolina is one of the states for which the land snail fauna is very poorly known. There has been considerable collecting in the mountains in the western part of the state, and some of the Coastal Plain, but the Piedmont Region has been virtually unknown.

This paper lists all of the records for the state in the collection of the author. As in previous papers in this series, only the counties are given as this is usually sufficient for plotting distributions.

Helicella caperata Montagu. Carteret.

Polygyra postelliana (Bland). Beaufort, Carteret, Columbus, Hyde, New Hanover, Onslow, Pamlico.

Polygyra pustuloides (Bland). Graham, Guilford, Johnston, Macon, Rowan, Rutherford, Stanly.

Stenotrema altispira (Pilsbry). Alleghany, Avery, Buncombe, Haywood, McDowell, Mitchell, Swain, Watauga, Yancey.

Stenotrema depilatum (Pilsbry). Graham, Swain.

Stenotrema barbatum (Clapp). Alamance, Anson, Bladen, Caswell, Chowan, Edgecombe, Harnett, Johnston, Nash, New Hanover, Pamlico, Wake, Warren.

Stenotrema stenotrema stenotrema (Pfeiffer). Ashe, Burke, Caldwell, Forsyth, Gaston, Graham, Henderson, Macon, McDowell, Mecklenburg, Rowan, Rutherford, Stanly, Swain, Watauga, Wilkes.

Stenotrema stenotrema voluminosum (Clench & Banks). Swain.

Stenotrema magnifumosum (Pilsbry). Clay, Graham, Haywood, Henderson, Jackson, Macon.

Stenotrema pilula (Pilsbry). Haywood, Henderson, Madison, McDowell, Swain.

Stenotrema hirsutum (Say). Cabarrus, Caswell, Davidson, Guilford, Montgomery, Person, Randolph, Rockingham, Stanly, Stokes.

Stenotrema leai aliciae (Pilsbry). Rockingham.

Stenotrema fraternum montanum Archer. Swain.

Stenotrema fasciatum Pilsbry. Jackson.

Mesodon thyroidus (Say). Alamance, Beaufort, Bertie, Bladen, Brunswick, Buncombe, Cabarrus, Caldwell, Camden, Carteret, Cherokee, Chowan, Cleveland, Columbus, Craven, Cumberland, Currituck, Dare, Davidson, Duplin, Edgecombe, Forsyth, Franklin, Gaston, Gates, Guilford, Halifax, Harnett, Hertford, Hyde, Johnston, Jones, Lenoir, Lincoln, Madison, Martin, McDowell, Montgomery, Nash, New Hanover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Randolph, Richmond, Robeson, Rockingham, Scotland, Stanly, Stokes, Surrey, Swain, Transylvania, Tyrrell, Wake, Warren, Washington, Wayne, Wilkes, Wilson, Yancey.

Mesodon clausus clausus (Say). Cherokee, Macon.

Mesodon andrewsae W. G. Binney. Avery, Buncombe, Haywood, Mitchell, Swain, Transylvania, Yancey.

Mesodon normalis (Pilsbry). Clay, Graham, Haywood, Macon, McDowell, Swain, Transylvania, Yancey.

Mesodon zaletus (Binney). Haywood, Swain.

Mesodon clarki clarki (Lea). Clay, Graham, Haywood, Jackson, Macon.

Mesodon clarki nantahala (Clench & Banks). Swain.

Mesodon christyi (Bland). Cleveland, Gaston, Graham, Jackson, Lincoln, McDowell, Orange, Person, Rutherford, Surrey, Swain.

Mesodon wheatleyi (Bland). Avery, Graham, Haywood, Jackson, Macon, Mitchell, Swain, Transylvania, Yancey.

Mesodon ferrissi (Pilsbry). Haywood, Swain.

Mesodon laevior Hubricht. Carteret, Caswell, Pamlico, Sampson.

Mesodon appressus sculptior (Chadwick). Alexander, Caswell, Rowan, Stokes, Wilkes.

Mesodon perigraptus (Pilsbry). Cabarrus, Cherokee, Grahamn Haywood, Henderson, Macon, Mecklenburg, Swain.

Mesodon jonesianus (Archer). Haywood, Swain.

Mesodon subpalliatus (Pilsbry). Avery, Mitchell.

Mesodon sayanus (Pilsbry). Ashe, Watauga.

Mesodon rugeli (Shuttleworth). Buncombe, Cherokee, Graham, Haywood, Lincoln, Macon, Madison, McDowell, Mitchell, Rutherford, Swain, Yancey.

Mesodon inflectus (Say). Avery, Burke, Cabarrus, Caldwell, Cherokee, Hartnett, Henderson, Iredell, Mecklenburg, Randolph, Rowan, Rutherford, Stanly, Surrey, Yadkin, Yancey.

Mesodon verus Hubricht. Haywood.

Triodopsis fuleiden Hubricht. Burke, Catawba, Cleveland, Lincoln.

Triodopsis tridentata (Say). Ashe, Avery, Burke, Catawba, Forsyth, Gaston, Graham, Haywood, Henderson, Iredell, Jackson, Lincoln, Macon, McDowell, Rockingham, Rutherford, Stanly, Stokes, Swain, Watauga, Wilkes, Yadkin, Yancey.

Triodopsis tennesseensis (Walker). Madison.

Triodopsis burchi Hubricht. Davidson, Guilford, Mecklenburg, Montgomery, Randolph, Rockingham.

Triodopsis vulgata Pilsbry. Clay, Graham, Madison, Watauga.

Triodopsis juxtidens (Pilsbry). Alamance, Bladen, Cabarrus, Caswell, Chatham, Columbus, Cumberland, Davidson, Durham, Edgecombe, Forsyth, Franklin, Guilford, Halifax, Hertford, Johnston, Mecklenburg, Nash, Pamlico, Person, Rockingham, Rowan, Stanly, Wake, Warren.

Triodopsis pendula Hubricht. Alexander, Alleghany, Burke, Cabarrus, Caldwell, Davie, Forsyth, Guilford, Iredell, Lincoln, Rowan, Stokes, Surrey, Wilkes, Yadkin.

Triodopsis fallax fallax (Say). Catawba, Chatham, Cleveland, Forsyth, Franklin, Gaston, Gates, Guilford, Harnett, Iredell, Johnston, Lee, Montgomery, Person, Randolph, Richmond, Rockingham, Stanly, Stokes, Surrey, Wake, Warren.

Triodopsis fallax affinis Hubricht. Alexander, Cabarrus, Caldwell, Cleveland, Gaston, Guilford, Lincoln, McDowell, Polk, Rockingham, Rutherford, Stokes, Surrey, Wwke, Wilkes.

Triodopsis messana Hubricht. Bertie, Bladen, Brunswick, Columbus, Craven, Cumberland, Duplin, Gates, Halifax, Hoke, Johnston, Montgomery, Nash, Northampton, Pender, Pitt, Robeson, Sampson, Scotland, Wilson.

Triodopsis hopetonensis (Shuttleworth). Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Columbus, Currituck, Duplin, Hertford, Jones, Lenoir, Martin, New Hanover, Onslow, Pasquotank, Pender, Perquimans, Pitt, Scotland, Wayne.

Triodopsis obsoleta (Pilsbry). Beaufort, Bertie, Brunswick, Carteret, Chowan, Craven, Dare, Hertford, Hyde, Jones, Martin, Onslow, Pamlico, Perquimans, Sampson, Tyrrell, Washington.

Triodopsis messana X *T. obsoleta*. Sampson.

Triodopsis soelneri (J. B. Henderson). Bladen, Brunswick, Columbus, Jones.

Triodopsis denotata (Férussac). Bladen.

Triodopsis albolabris (Say). Alexander, Beaufort, Bladen, Brunswick, Burke, Cabarrus, Caldwell, Carteret, Catawba, Columbus, Craven, Dare, Davidson, Davie, Duplin, Durham, Edgecombe, Forsyth, Gaston, Gates, Guilford, Halifax, Hoke, Johnston, Jones, Lenoir, Martin, McDowell, Mecklenburg, Nash, New Hanover, Northampton, Onslow, Orange, Pamlico, Pender, Perquimans, Pitt, Randolph, Robeson, Rockingham, Rutherford, Stokes, Surrey, Swain, Tyrrell, Wilkes, Yancey.

Triodopsis major (Binney). Bladen, Brunswick, Cherokee, Columbus, Graham, Montgomery, Pender, Robeson, Rutherford, Sampson, Scotland.

Rumina decollata (Linné). Brunswick, New Hanover.

Opeas pyrgula Schmacker & Boettger. Wayne.

Haplotrema concavum (Say). Anson, Ashe, Avery, Beaufort, Bladen, Brunswick, Burke, Cabarrus, Caswell, Chatham, Chowan, Columbus, Craven, Currituck, Davidson, Davie, Edgecombe, Forsyth, Graham, Guilford, Halifax, Haywood, Henderson, Jackson, Johnston, Lenoir, Lincoln, Macon, McDowell, Mitchell, Nash, New Hanover, Onslow, Orange, Pamlico, Pasquotank, Person, Rockingham, Stanly, Stokes, Surrey, Swain, Transylvania, Wake, Watauga, Wilkes, Yadkin, Yancey.

Haplotrema kendeighi Webb. Swain.

Euconulus chersinus chersinus (Say). Avery, Beaufort, Bertie, Bladen, Brunswick, Chowan, Halifax, Johnston, Macon, Nash, Northampton, Onslow, Pasquotank, Pitt, Transylvania, Tyrrell, Wake, Yancey.

Euconulus dentatus (Sterki). Caswell.

Guppya sterkii (Dall). Avery, Macon.

Glyphyalinia burringtoni (Pilsbry). Avery, Haywood, Mitchell, Transylvania.

Glyphyalinia cumberlandiana (Clapp). Graham, Jackson, Macon.

Glyphyalinia roanensis (H. B. Baker). Avery, Graham, Macon, Mitchell, Yancey.

Glyphyalinia wheatleyi (Bland). Caswell, Franklin.

Glyphyalinia vanattai (Pilsbry & Walker). Yancey.

Glyphyalinia clingmani (Dall). Yancey.

Glyphyalinia pentadelphia (Pilsbry). Graham, Macon.

Glyphyalinia rhoadsi (Pilsbry). Caswell, Davidson, Edgecombe, Harnett, Johnston, Lincoln, Mecklenburg, Person, Rutherford, Stanly, Stokes, Surrey, Wake, Wilkes, Yadkin.

Glyphyalinia indentata (Say). Avery, Beaufort, Bertie, Bladen, Brunswick, Burke, Cabarrus, Camden, Chatham, Chowan, Clay, Cleveland, Columbus, Craven, Edgecombe, Franklin, Graham, Guilford, Halifax, Haywood, Jackson, Johnston, Macon, Martin, McDowell, Mecklenburg, New Hanover, Northhampton, Onslow, Rockingham, Rutherford, Stokes, Surrey, Swain, Tyrrell, Wake, Washington, Wilkes, Wilson.

Glyphyalinia carolinensis (Cockerell). Ashe, Avery, Jackson, Macon, Madison, Mitchell, Rutherford, Sampson, Yadkin.

Glyphyalinia junaluskana (Clench & Banks). Cherokee, Graham.

Glyphyalinia praecox (H. B. Baker). Graham, Macon, Swain.

Glyphyalinia lutticola Hubricht. Pasquotank.

Glyphyalinia sculptilis (Bland). Ashe, Graham.

Mesomphix andrewsae (Pilsbry). Graham, Haywood, Jackson, Macon, Rutherford, Swain, Transylvania.

Mesomphix subplanus subplanus (Binney). Buncombe, Graham, Haywood, Henderson, Jackson, Macon, Madison, Rutherford, Swain, Yancey.

Mesomphix subplanus planus Banks. Yancey.

Mesomphix rugeli rugeli (W. G. Binney). Mitchell, Transylvania.

Mesomphix rugeli oxycoccus (Vanatta). Ashe, Avery, Watauga.

Mesomphix perlaevis (Pilsbry). Burke, Caswell, Davidson, Forsyth, Graham, Haywood, Macon, Madison, McDowell, Rockingham, Rutherford, Stanly, Swain, Yadkin.

Mesomphix latior Pilsbry. Mitchell, Swain.

Mesomphix cupreus (Rafinesque). Guilford, Madison, McDowell, Wilkes.

Mesomphix pilsbryi (Clapp). Anson, Stanly.

Vitrinizonites latissimus (Lewis). Avery, Graham, Haywood, Macon, McDowell, Mitchell, Swain, Transylvania, Watauga.

Paravitrea multidentata (Binney). Ashe, Avery, Mitchell, Yancey.

Paravitrea lamellidens (Pilsbry). Cherokee, Graham, Haywood, Macon, Swain.

Paravitrea andrewsae (W. G. Binney). Avery, Madison, Mitchell, Yancey.

Paravitrea placentula (Shuttleworth). Swain.

Paravitrea capsella (Gould). Graham.

Hawaiia minuscula minuscula (Binney). Beaufort, Bertie, Brunswick, Carteret, Columbus, Craven, Currituck, Harnett, Hyde, Johnston, New Hanover, Onslow, Pamlico, Pasquotank, Perquimans, Pitt, Rockingham, Tyrrell, Wake.

Gastrodonta interna (Say). Burke, Catawba, Cherokee, Cleveland, Graham, Haywood, Henderson, Iredell, Jackson, McDowell, Rutherford, Yancey.

Ventridens pilsbryi Hubricht. Burke, Cherokee, Clay, Graham, Macon, Yancey.

Ventridens decussatus (Walker & Pilsbry). Avery, Cleveland, Graham, Haywood, Mitchell, Transylvania.

Ventridens decussatus (Walker & Pilsbry). Avery, Cleveland, Graham, Haywood, Mitchell, Transylvania.

Ventridens theloides (Walker & Pilsbry). Alleghany, Burke, Catawba, Graham, Macon, McDowell, Rutherford, Wilkes, Yadkin.

Ventridens lawae (W. G. Binney). Henderson, Madison, Transylvania.

Ventridens coelaxis (Pilsbry). Alleghany, Watauga.

Ventridens gularis (Say). Cleveland, Gaston, Guilford, Johnston, Randolph, Rockingham, Rowan, Stanly, Transylvania.

Ventridens cerinoideus (Anthony). Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chatham, Chowan, Columbus, Craven, Currituck, Dare, Franklin, Halifax, Harnett, Hoke, Johnston, Jones, Lenoir, Montgomery, Nash, New Hanover, Northampton, Pasquotank, Pender, Pitt, Robeson, Scotland, Tyrrell, Wake, Washington, Wilson.

Ventridens suppressus (Say). Stokes.

Ventridens acerrus (Lewis). Ashe, Graham, Haywood, Jackson, Macon, Madison, Swain, Watauga, Yancey.

Ventridens ligerus (Say). Caswell, Johnston, Nash, New Hanover, Rockingham, Wake, Warren.

Ventridens intertextus (Binney). Brunswick, Catawba, Cherokee, Cleveland, Columbus, Davidson, Franklin, Gaston, Graham, Granville, Guilford, Iredell, Johnston,

Lincoln, Macon, Mecklenburg, Polk, Randolph, Rockingham, Rowan, Rutherford, Stanly, Stokes, Wake, Wilkes, Yadkin.

Ventridens elliotti (Redfield). Buncombe, Burke, Cherokee, Cleveland, Graham, Haywood, Iredell, Jackson, Macon, McDowell, Polk, Rowan, Swain, Transylvania.

Zonitoides arboreus (Say). Beaufort, Bertie, Bladen, Brunswick, Cabarrus, Carteret, Chatham, Cherokee, Cleveland, Columbus, Craven, Duplin, Franklin, Graham, Guilford, Halifax, Harnett, Haywood, Hyde, Johnston, Lenoir, Lincoln, Mitchell, Northhampton, Onslow, Pasquotank, Rockingham, Transylvania, Tyrrell, Wake, Warren, Wayne, Wilkes.

Zonitoides patuloides (Pilsbry). Macon.

Striatura meridionalis (Pilsbry & Ferriss). Beaufort, Caswell, Columbus, Craven, Franklin, Graham, Halifax, Harnett, Johnston, Macon, McDowell, Swain, Transylvania, Yancey.

Striatura ferrea Morse. Haywood, McDowell, Mitchell, Yancey.

Anguispira alternata (Say). Caswell, Swain.

Anguispira strongylodes (Pfeiffer). Burke, McDowell, Rutherford.

Anguispira fergusoni (Bland). Beaufort, Bertie, Camden, Caswell, Carteret, Columbus, Craven, Cumberland, Franklin, Gates, Halifax, Lenoir, Martin, New Hanover, Onslow, Pamlico, Pasquotank, Perquimans, Pitt, Sampson, Tyrrell, Wake, Warren, Washington, Wayne.

Anguispira jessica Kutchka. Graham, Haywood, Mitchell, Swain, Watauga, Yancey.

Discus cronkhitei (Newcomb). Guilford.

Discus patulus patulus (Deshayes). Avery, Burke, Cabarrus, Davidson, Graham, Haywood, Macon, Mecklenburg, Mitchell, Stanly, Swain, Watauga, Yadkin.

Discus nigrimontanus (Pilsbry). Ashe, Watauga.

Discus bryanti (Harper). Avery, Madison, Mitchell.

Helicodiscus fimbriatus (Wetherby). Graham.

Helicodiscus notius notius Hubricht. Catawba, Guilford, Mecklenburg, Mitchell.

Helicodiscus parallelus (Say). Alexander, Bladen, Brunswick, Caswell, Chatham, Cleveland, Columbus, Davidson, Duplin, Franklin, Gates, Graham, Guilford, Halifax, Harnett, Johnston, Lenoir, Lincoln, Macon, Nash, Northampton, Onslow, Pasquotank, Person, Polk, Rutherford, Stanly, Tyrrell, Wake, Washington, Watauga, Wayne.

Punctum minutissimum (Lea). Avery.

Punctum blandianum Pilsbry. Avery, Graham, Johnston, Swain, Yancey.

Punctum smithi (Morrison). Caswell

Deroceras laeve (Müller). Widely distributed in North Carolina but no collections were made.

Arion fasciatus (Nilsson). Buncombe, Swain.

Limax maximus (Linné). Widely distributed on the Piedmont and Coastal Plain but no collections were made.

Philomycus carolinianus (Bosc). Anson, Ashe, Beaufort, Bertie, Bladen, Brunswick, Burke, Carteret, Caswell, Columbus, Craven, Dare, Duplin, Edgecombe, Franklin, Gates, Halifax, Johnston, Jones, Lenoir, Lincoln, Martin, Montgomery, Nash, Northhampton, Onslow, Pamlico, Pender, Perquimans, Pitt, Polk, Robeson, Sampson, Stanly, Stokes, Swain, Wake, Warren, Washington, Wilkes.

Philomycus virginicus Hubricht. Henderson.

Philomycus venustus Hubricht. Avery, Haywood, Macon, Mitchell, Swain, Watauga.

Pallifera mutabilis Hubricht. Bertie, Bladen, Brunswick, Cleveland, Edgecombe, Gates, Greene, Iredell, Lenoir, Lincoln, Martin, Rockingham, Rowan, Stanly, Swain, Tyrrell, Wake.

Pallifera dorsalis (Binney). Johnston, Rockingham, Wake.

Pallifera hemphilli (W. G. Binney). Avery, Buncombe, Mitchell, Swain, Yancey.

Pallifera secreta (Cockerell). Ashe, Burke, Caswell, Clay, Graham, Haywood, Macon, Mitchell, Stokes, Swain, Watauga, Yadkin.

Pallifera megaphallica Grimm. Anson, Beaufort, Burke, Graham, Guilford, Hyde, Iredell, Lincoln, Macon, Person, Rockingham, Stanly, Swain, Tyrrell, Wake.

Oxyloma effusa effusa (Pfeiffer). Chowan.

Succinea ovalis (Say). Swain, Yancey.

Succinea pronophobus Pilsbry. Beaufort, Bertie, Brunswick, Chowan, Craven, Dare, Hyde, New Hanover, Onslow, Pamlico.

Succinea concordialis Gould. Chowan, Perquimans.

Succinea indiana Pilsbry. Craven.

Succinea wilsoni Lea. Beaufort.

Succinea campestris Say. Brunswick, Carteret, Martin, New Hanover, Onslow, Pender.

Succinea witteri Shimek. Beaufort.

Catinella vermeta (Say). Beaufort, Bertie, Bladen, Brunswick, Chowan, Columbus,

Craven, Gates, Johnston, Jones, Martin, Nash, Onslow, Perquimans, Tyrrell, Washington.

Catinella oklahomarum (Webb). Brunswick, Carteret, Johnston, Onslow, Pitt, Swain, Wilson.

Catinella hubrichti Grimm. Beaufort.

Catinella pugilator Hubricht. Currituck.

Strobilops labyrinthica labyrinthica (Say). Catawba, Franklin, Guilford, Lincoln, Mecklenburg, Onslow, Wake.

Strobilops labyrinthica parietalis Pilsbry. Beaufort, Carteret, Tyrrell, Washington.

Strobilops aenea Pilsbry. Beaufort, Brunswick, Cabarrus, Chowan, Cleveland, Craven, Duplin, Franklin, Gates, Halifax, Johnston, Lincoln, Northampton, Pasquotank, Tyrrell.

Gastrocopta contracta (Say). Beaufort, Brunswick, Chatham, Cleveland, Halifax, Harnett, Lincoln, Onslow, Pasquotank, Rockingham, Washington, Wayne.

Gastrocopta pentodon (Say). Halifax, Johnston, Pasquotank.

Gastrocopta tappaniana (C. B. Adams). Beaufort, Chowan, Craven, Currituck, Duplin, Onslow.

Gastrocopta rupicola (Say). Brunswick, Carteret, Craven.

Gastrocopta procera procera (Gould). New Hanover.

Pupoides albilabris (C.B. Adams). Beaufort, Brunswick, Carteret, Columbus, Craven, Hertford, New Hanover, Pamlico, Pasquotank, Wake.

Vertico milium Gould. Beaufort, Brunswick.

Vertigo ovalis Sterki. Beaufort, Chowan.

Vertigo ovata ovata (Say). Beaufort, Bertie, Brunswick, Camden, Chowan, Craven, Currituck, Gates, Pamlico, Pasquotank, Tyrrell, Washington.

Vertigo teskeyae Hubricht. Beaufort, Camden, Chowan, Columbus, Craven, Gates.

Columella edentata (Draparnaud). Caswell, McDowell.

Vallonia pulchella (Müller). Northampton.

Cionella morseana Doherty. Ashe, Avery, Burke, Caswell, Jackson, Macon, Swain, Transylvania.

Carychium exile H. C. Lea. Caswell, Chatham, Franklin, Halifax, Harnett, Johnston, Nash, Pitt, Wilkes, Yadkin.

Carychium clappi Hubricht. Avery, Graham, Haywood, Jackson, Macon, Madison, Mitchell, Rutherford, Swain, Transylvania, Yancey.

Carychium exiguum (Say). Beaufort, Brunswick, Chowan, Craven, Duplin, Franklin, Johnston.

Carychium nannodes Clapp. Avery, Graham, Jackson, Rutherford, Swain, Transylvania, Yadkin.

Pomatiopsis lapidaria (Say). Beaufort, Brunswick, Chowan, Craven.

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ALBERT K. SPARKS (Biological Laboratory, Galveston, Texas) West Coast mollusk fisheries.

HERBERT HIDU (Chesapeake Biological Laboratory, Solomons, Md.) World aspects of molluscan culture.

JOHN W. ROPES (Biological Laboratory, Oxford, Md.) Surf clams and ocean quahogs.

JULIUS A. POSGAY (Biological Laboratory, Woods Hole, Mass.) The North Atlantic Sea Scallop.

HAROLD HUDSON (Tropical Atlantic Biological Laboratory, Miami, Fla.) The Calico scallop.

EDWIN A. JOYCE, Jr. (Marine Research Laboratory, St. Petersburg, Fla.) The Sunray Venus, a new Florida fishery.

MALCOLM MERCER (Fisheries Research Board of Canada, St. Johns, Nfld.) Cephalopod fisheries in the Northwest Atlantic. Presented by Kenneth Boss.

KENNETH J. BOSS (Museum of Comparative Zoology, Cambridge, Mass.) Conch fisheries.

CARL J. SINDERMANN (Tropical Atlantic Biological Laboratory, Miami, Fla.) Predators and diseases of commercial mollusks.

DONALD A. LEAR (Federal Water Quality Agency, Annapolis, Md.) Pollution problems in commercial mollusks.

KENNETH J. BOSS (Museum of Comparative Zoology, Cambridge, Mass.) How many species of mollusks are there?

PAT TORRANCE (St. Petersburg, Fla.) Observations on a Florida *Gastropteron*.

CHARLES E. JENNER (University of North Carolina, Chapel Hill, N. C. and ANNE B. McCRARY, (University of North Carolina at Wilmington, N.C.) *Montacuta floridana* Dall and *Aligena elevata* (Stimpson) as closely related species.

CARL W. GUGLER (University of Nebraska, Lincoln, Nebraska) Fertilization in *Discus*.

KENNETH R. BAZATA (University of Nebraska, Lincoln, Neb.) The renopericardial aperture in *Discus*.

MARC J. IMLAY (National Water Quality Laboratory, Duluth, Minn.) Methods for growing freshwater sponges, mussels and clams in the laboratory.

WILLARD N. HARMAN. (Department of Biology, New York State University College, Oneonta, N. Y.) A local case of clinal intra-population variation in *Lymnaea emarginata* (Say).

HAROLD J. WALTER (103 East Elmwood Avenue, Dayton, Ohio) *Amphigyra*, miniplanorbs and microsculpture in planorbid systematics.

RITA STURGEON (6273 Miller Road, South Miami, Fla.) *Achatina fulica* infestation in North Miami, Florida.

ARTHUR H. CLARKE (National Museums of Canada, Ottawa, Canada) *Littorina littorea*, native or introduced?—a review.

RALPH M. SINCLAIR (FWPCA Training, 4676 Columbus Parkway, Cincinnati, Ohio 45226) *Corbicula* and *Dreissena* parallels.

DOLORES S. DUNDEE (Dept. of Biological Sciences, Louisiana State University in New Orleans, New Orleans, La.) Introduced Gulf Coast Mollusks.

ALBERT R. MEAD (Dept. of Zoology, University of Arizona, Tucson, Ariz.) Helicid land mollusks introduced into North America.

HAROLD D. MURRAY (Biology Department, Trinity University, San Antonio, Texas) Introduction and spread of Thiarids in the United States.

LOWELL L. GETZ, Department of Zoology, University of Illinois, Urbana, Illinois) Introduced terrestrial slugs.

ALBERT R. MEAD (University of Arizona) Status of *Achatina* and *Rumina* in the United States.

MARTIN L. H. THOMAS (Fisheries Research Board of Canada, Dartmouth, N.S., Canada) Mollusca of Prince Edward Island, their distribution, composition and origin.

JEAN-JACQUES VAN MOL (Service de Zoologie systématique, Université Libre de Bruxelles, 1050 Bruxelles, Belgium) Anatomical studies in the families Urocyclidae and Helicarionidae.

W. LLOYD PRATT, Jr. (Fort Worth Museum of Science and History, Fort Worth, Tex.)

MUSSELS IN THE HURON RIVER ABOVE ANN ARBOR IN 1969

HENRY VAN DER SCHALIE

Museum of Zoology, Ann Arbor, Michigan

In mid-December, 1969, repairs were made to the Argo Dam at Ann Arbor, Michigan. Consequently, the water in the Huron River between the Barton and Argo dams was unusually low. Although the weather was bitter cold, it was an ideal occasion for making some observations on the mussels in an area below Barton Dam where conditions although somewhat impounded, were still shoal-like and where the original fauna was likely to be retained. The opportunity to examine the shoals directly during such a low water stage with the dams open (depth was not more than six inches over extended reaches) was of special interest, since a survey of the mussels was made in this same portion of the river more than thirty years ago (van der Schalie, 1938). Then mussels virtually paved the bottom on such shoals as usually serve as mussel beds. The study of the mussels in the whole Huron River drainage indicated that the several species form characteristic ecological assemblages, so that the kinds of lakes (river-lakes, land-locked, etc.), the creeks, small-, medium- and large-river zones each had its own typical assemblage of mussels. The need for information on *original* conditions is evident, when this information is taken in its broader context to trace former stream confluences (van der Schalie, 1945).

Some of the changes brought about in the river because of human activities were already evident a decade ago (van der Schalie, 1958) when the ruinous effects of the war economy brought about serious depletion among the 25 species of mussels that occupied long stretches of this river. It is generally conceded that mussels are sensitive to pollution and are considered good for monitoring degrees of depredation in streams and lakes. Since many live confined to a very restricted portion of a shoal, they have been used to measure fall-out (Nelson, 1934) and pesticides (Bedford, *et al.*, 1968).

Although in the early thirties the dams (Barton and Argo) had already had an adverse influence on the mussels in that region of the river, the list given here shows that at least thirteen species were found at that time. In the intervening years both pollution and especially fluctuating water levels brought about by water level regulation tended to deplete the fauna. While conditions were uncomfortable when the collections were made during the low water stage last December, it was of interest to find the few mussels that still managed to survive there. Six species were taken alive; another 4 were recorded as empty shells. Only two, *Cyclonaias tuberculata* and *Anodonta grandis*, were found in appreciable numbers. The lack of young specimens found recently also clearly indicated that this shoal no longer is healthy in appearance. This local survey was undertaken by three collectors, Curt Schneider, Daune Crankshaw and the author.

It is just this vital need for infor-

MUSSELS FOUND BELOW BARTON DAM, ANN ARBOR: 1938 vs 1969

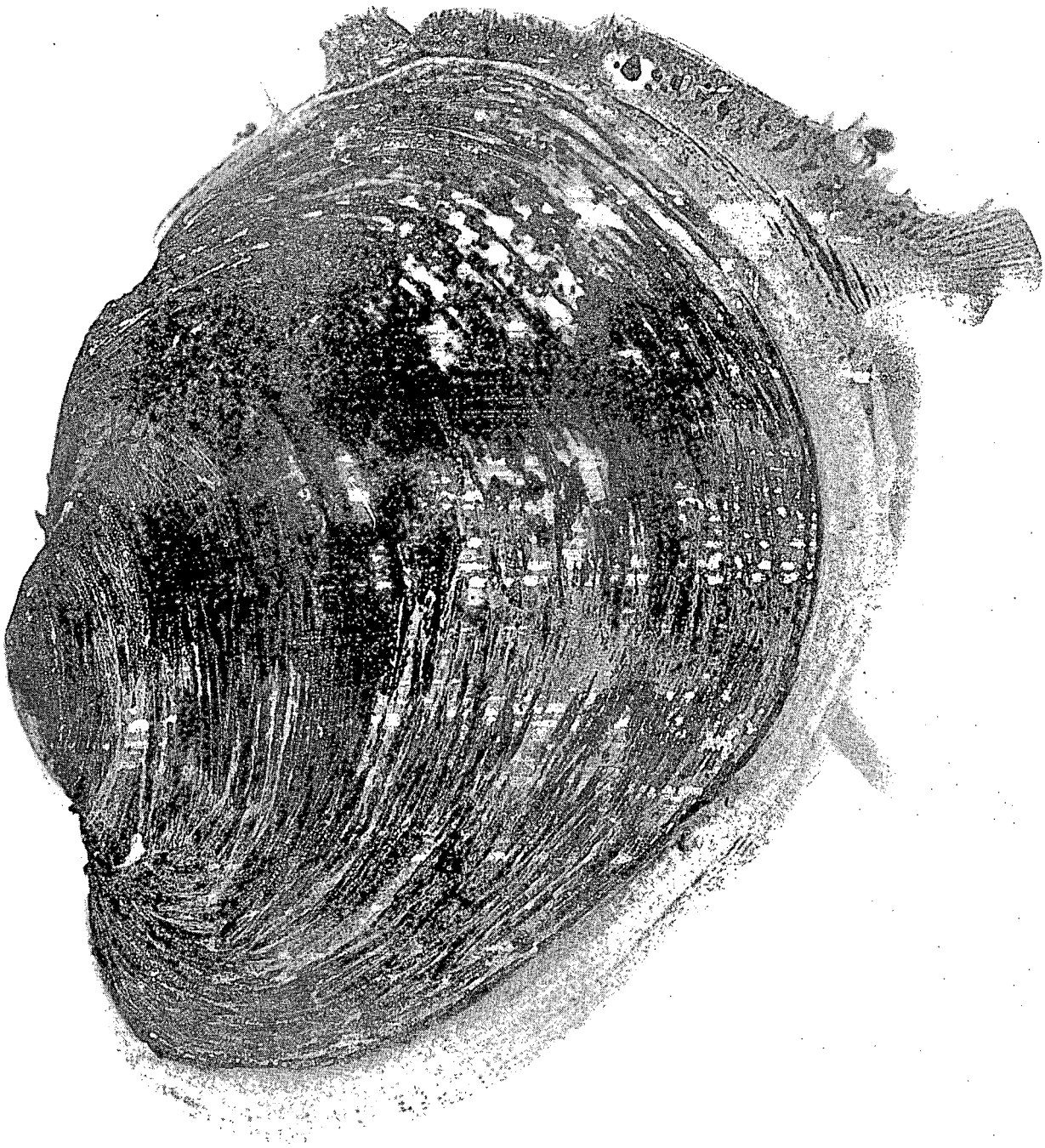
1938 13 species	1969 December 14 and 15, 1969 10 species (6 alive)	Alive	Dead
Cyclonaias tuberculata	*Cyclonaias tuberculata*	19	8
Elliptio dilatatus	*Elliptio dilatatus*	4	4
Strophitus rugosus			
Anodonta grandis	*Anodonta grandis*	15	7
	Anodonta imbecillis		1
Lasmigona costata			
Alasmidonta calceolus	*Alasmidonta calceolus*		1
Ptychobranchus fasciolaris			
Villosa (Micromya) iris	*Villosa (Micromya) iris*	1	1
Lampsilis fasciola	*Lampsilis fasciola*		5
Lampsilis siliquoidea	*Lampsilis siliquoidea*	1	
Lampsilis ventricosa	*Lampsilis ventricosa*	3	3
		43	*30*

mation on the *original* fauna in drainage systems that makes the detrimental changes brought about by the many destructive agents so unfortunate. Those responsible for alterations in the environment such as are brought about by power dams, sewage, industrial wastes, etc. usually are quick with a reminder that they will clean up their mess. Yet, few who are instrumental in making the changes have the foggiest notion of the fact that the losses in the biota are *irreversible* and the alterations witnessed will leave gaps in inter-relationships of fields like parasitology, public health, physiography, zoogeography, Pleistocene geology, etc. which can never again be bridged! It would, however, seem worthwhile to have those same agencies try to contribute something, if only in funds, to assist those who will at some later time try to bring back a semblance of the natural conditions where such assets were destroyed.

In the list of six species taken alive the relative abundance of the pink wartyback *(Cyclonaias tuberculata)* was interesting because somewhat farther upstream in the region of Delhi Mill (below Dexter) the shoals formerly produced thousands of specimens. This section of the stream is essentially the same ecological zone as the area below Barton Dam. As previously stated (van der Schalie, 1958), specimens of this species amounting to several tons were gathered and piled up on the bank of the river years ago when collectors tried to harvest pearls (produced by metacercariae of trematode parasites) commonly found in the mantle tissue between the interdental plate area of the hinge of this mussel. Since this species produces a nacre that is an off-color pink and not lustrous, their venture obviously was wasteful. All of the mussels at the site above the Barton Dam have now disappeared so that it is interesting to find some are still surviving below that dam. In view of the changes brought about in the river and the disappearance of all of the mussels below Dexter, it would seem reasonable to have these mussels used for almost any purpose rather than have them destroyed, as they too often have been, by pollution.

The next most common mussel was the paper-shell, *Anodonta grandis*, which while not formerly abundant probably became numerous by virtue of the slowing of the current as brought about by the impounding of water after the construction of the Argo Dam. All of the specimens collected were old and larger than usually found in the flow

FIG. 1. *Lampsilis ventricosa* (Barnes); a female with a well developed mantle flap showing its fish-like characteristics. (Picture by Daune Crankshaw).



system of a stream. The area evidently has become sufficiently lake-like to form the type of habitat in which *Anodonta* thrives. The general area also has assumed features that one associates with muskrat and mink habitats. Mussels are known to be the staple food of these fur bearers during the winter and, as a consequence, the survival and propagation of *Anodonta* (as well as the other species of mussels) can be viewed not only as important in the food chain, but also as a worthwhile feature for maintaining natural conditions in that portion of the Huron-Clinton park system.

Only four live lampsilid mussels were found, one *Lampsilis siliquoidea* (Barnes) and three *Lampsilis ventricosa* (Barnes). They are evidently less pollution tolerant than the more numerous species at this station. When the three Pocketbooks *(Lampsilis ventricosa)* were placed in a tray with water, the two females extended their mantle-flaps producing the striking minnow-like structures often seen in females of the Lampsilid group (Figure 1). Isaac Lea, as early as 1836, described and figured the flap of *Unio radiatus* (now known as *Lampsilis radiata* (Gmelin). Ortmann (1911) was among the first to observe the behavior of the flaps which are developed only in the females. He indicated that there are two possible uses one may involve the need they serve to assist in aerating the protruding gills when they are heavily charged with developing glochidia; the other that the fish-like flaps serve as a lure for fish which may then serve as hosts for the glochidia. Louise R. Kraemer (1966) made an extensive study of the flaps of three lampsilid mussels but was careful to avoid any anthropocentric interpretations pending more critical studies designed to prove their function. Recently Welsh (1969) adduced plausible reasons to indicate that the flaps do serve to attract fish hosts.

Productive mussel-sustaining rivers are gradually disappearing. While formerly naiades were used extensively in the pearl button industry they now are eagerly sought by dealers for shipment to Japan for use in the pearl industry. Tons of mussels (Pig-toes, Wash-boards, Niggerheads, etc.) are shipped to the Orient. The Japanese craftsmen grind out seed-pearls, which are then placed in live marine mussels for the addition of a lustrous outer coat to make a marketable natural pearl. In the U.S.A. one center for harvesting the shell for the pearl industry was the Kentucky Reservoir in the lower Tennessee River. The impact of this large impoundment on the mussels of that region was discussed by Bates (1962). It is now recognized that the supply is disappearing. Data on the studies undertaken during a three-year survey in that impoundment will be presented later. Many of the animals taken there were measured, aged and sectioned. It is evident that the fauna in those deep waters created by the dam at Paducah are probably mussels remaining from the preimpoundment period. The gonads of many of the animals were studied histologically (van der Schalie, in press) and it is now known that even animals from shells showing 25 annuli have normal reproductive functions. Evidently the marked ecological changes from flowing river to impoundment no longer permit the normal processes in the life histories of the several species and young specimens clearly are not appearing in the deep water beds.

More recently intensive studies have been undertaken in the Muskingum River in Ohio. This stream is still highly productive and as much as 50 tons of mussels per year have been sent to Japan. In addition to the collaborative work in the Museum of Zoology, intensive studies have been undertaken by John Bates and his group at Eastern Michigan University. Since in the past, records on production of mussels on shoals in rivers have been poorly reported, these studies will enable not only a measure of what the river yields but also some estimates as to the amounts that can safely be harvested. Means will be sought to replenish mussels on shoals in rivers, like the Huron, to reestablish the original fauna as an aid in the process of purification in streams.

REFERENCES

BATES, John M. (1962) The impact of impoundment on the mussel fauna of Kentucky Reservoir, Tennessee River. --Amer. Midl. Nat., 68: 232-36.

BEDFORD, F.W., ROELOFS, E.W., & ZABIK, J. (1968) The freshwater mussel as a biological monitor of pesticide concentrations in a lotic environment. --Limnology and Oceanography, 13: 118-126.

KRAEMER, Louise R. (1966) The mantle flaps in three species of freshwater mussels. -- Thesis, University of Michigan, 192 pp.

LEA, Isaac (1836) Observations on the genus Unio, etc. Vol. 2: 53; Plate 15, figure 49. Philadelphia; printed for the author.

NELSON, D.J. (1964) Deposition of strontium in relation to morphology of clam (Unionidae) shells. -- Verh. Internat. Verein Limno., 15: 893-902.

ORTMANN, A. E. (1911) Monograph of the Najades of Pennsylvania. -- Mem. Carnegie Mus., 4: 279-347.

van der SCHALIE, Henry (1938) The Naiad fauna of the Huron River in southeastern Michigan. -- Univ. Mich., Mus. Zool., Misc. Papers, 40: 1-83, 12 pls.

----- (1958) The effects of thirty years of 'progress' on the Huron River in Michigan. -- The Biologist, 40: 7-10.

----- (1970) Hermaphroditism among North American fresh-water mussels. -- Malacologia (in press).

WELSH, John H. (1969) Mussels on the move. -- Natural History, May, 1969: 56-59.

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FIELD JOURNAL OF HENRY A. PILSBRY PERTAINING TO NEW MEXICO AND TRANS-PECOS TEXAS

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INTRODUCTION

On file in the Department of Mollusks, Academy of Natural Sciences of Philadelphia (ANSP), are a number of field journals kept by Henry A. Pilsbry during several expeditions to the southwestern United States and Mexico. The notes are in ink and pencil, faded in some places, and the notebooks are of rather poor quality paper. Herein, parts of these journals pertaining to New Mexico and Trans-Pecos Texas have been extracted. Four expeditions are involved: 1906, 1910, 1922, and 1935. I was unable to find any notes pertaining to another expedition, which Pilsbry made to the Black Range of New Mexico in 1915.

Three sections are comprised below: (1) Pilsbry's journal notes (with explanatory comments indented or in brackets; parentheses are Pilsbry's), (2) annotations referring to the notes, and (3) a list of station numbers that Pilsbry maintained for each expedition and the ANSP collection numbers that pertain to these stations.

I thank Dr. Robert Robertson and Dr. R. Tucker Abbott for making available the notebooks at the Academy of Natural Sciences of Philadelphia. The following persons provided information concerning localities: Dr. Clifford B. Casey, Alpine, Texas; Mrs. Walter Glover, Pine Springs, Texas; Dr. Arthur H. Harris, University of Texas at El Paso; Mr. John H. Kiger, San Andres National Wildlife Refuge, New Mexico; Mr. Philip F. Van Cleave, Carlsbad Caverns National Park; Dr. Barton Warnock, Sul Ross State College, Texas; and Mr. Roland Wauer, Big Bend National Park.

NOTES FROM NOTEBOOKS OF PILSBRY

In 1906, Pilsbry and James H. Ferriss crossed northern New Mexico on their way to Arizona, where they collected extensively (Pilsbry, 1906: 7). They left Joliet, Illinois, the home of Ferriss, on Oct. 8 and arrived in Albuquerque, N.M., on Oct. 10. On this expedition, only a few notes pertained to New Mexico.

Oct. 10. Trinidad to Albuquerque, where we arrived about 9 pm. Went morning to see Prof. Tight, at the Univ. of N M. Then crossed the Rio Grande, finding a very little drift, & went west to a terrace covered with volcanic blocks, ca. 5 miles from Albuquerque—or about 7 by road. Found one *B. procera* & 2 *Pupoides marginatus*. Also some large ground beetles. Left at about 8 pm.

Grants, NM. 12th Oct. Arr. at 12:30 The country is traversed by ridges capped with

'malpais' or basaltic rock, which over lays sandstone, forming a cliff of 10-50 ft. The valley to N.S. of RR sta is evidently an eroded anticline. Near head of valley or where it narrows northward, we found Pupillidae & Oreohel. neomex. in a coarse rock talus which slopes very steeply from the foot of the basaltic cliff, down perhaps a 100 yards. They were got by digging deep; to the earth; through the basaltic rock fragments.

On Oct. 30, the party returned to Albuquerque, made a short trip into the Sandia Mountains, and then proceeded southwest to Deming, Luna County, N. M. Here they made a trip into the Florida Mountains, southeast of Deming. Pilsbry (1915: 346 - 349) published a short account of the Mollusca collected on this trip.

Nov. 1 Deming. Drove out to Florida Mts. 18 miles stopped in about middle of W side. Priser has a cabin which his brother occupies here.

Nov. 2. Ascended range just behind cabin in Spring Canyon. Summit here is a great limestone cliff on E, W, & N sides, but slopes down on S. somewhat so rounded top can be gained. [1] Covered with grass, rock, cacti, Fouquieria & agave, with low shrubbery. No sagebrush. A few prickly pears & the round-branched kind. Plain around looks like the sea--with islands at intervals. In East Organs are visible. The mountain-islands rise abruptly, as if half submerged, from the plain. Around base of rock top of Mt. we found *Ash.* [*Ashmunella*] *walkeri* & *Sonorella* everywhere, the former in pockets. The rock below is granitic, but at top, limestone. 2 oaks, one holly-leafed, the other scrub, with white oak leaf, hackberry, sotol, no narrow-leafed yucca on the Mt., but there is some mescal & a stout-leaved yucca. [2]. Saw keg cactus at base of Mt. The round-branched cane-cactus (Cylindropuntia) grows all over Mt., from foot of slope to summit.

'Trails first made by the bear & deer, then followed by the Indian, & then by the White Man' [3]

Elevation of Deming according to S.P. sign, is 4333 ft. Mts. must be about 2500 or 3000 ft higher. Limestone in middle, granitic south & porphyritic N. The range runs nearly N & S., & is about 13 miles long. a low continuation sep by pass at N end is known as the little Floridas. Dry process farming being started around Deming.

The part of the 1910 expedition described below seems to have been made by Pilsbry and Lorenzo E. Daniels, only, although James Ferriss seemingly joined the party later in southern Arizona (Pilsbry, 1910: 84). However, one of the snails taken by Pilsbry and Daniels in the Big Hatchet Mountains was named *Oreohelix ferrissi* Pilsbry. The mollusks taken in the Big Hatchet Mountains were reported by Pilsbry (1915: 323-346).

Aug 17 1910. With L. E. Dwniels, enroute for El Paso. Stopped from 9:30 to 1:35 at Duran, N.M. Elevation 6272 ft., & explored a large butte about 1 mile S. of Station [48] It is white sandstone, lower slopes covered with stones, larger above. Found Bifidaria hordeacella (?) Pupilla like Blandi but very small, and a flat, delicate, ribbed Vallonia. Most abundant quite near top on N. side, under flat stones. The sides & flat top of butte are thickly covered with scrubby cedar, a little pinyon & very little scrub oak, knee high. There is a Cereus, an Echinocactus, 2 flat prickly pears & the cylindric cane cactus. Saw on top a young barrel cactus (?) & two ferns. The mesa has also scrubby juniper cedar, & a small yucca, near and on butte there is a small, filamentous agave. The buttes S. of Torrance (& also N.) form ranges, & there are also isolated, more or less barren, small buttes thus [sketched] in all stages of degradation. The mesa is evidently formed by their erosion & is quite sandy. The sandstone is fine, white, & in level strata. This sort of country is found from about Santa Rosa southwest.

[In margin] Butte nr. Duran is about 500 ft above town.

At Carrizozo there is a fine range eastward, the Capitans. Splendid & very high, beautifully wooded. About 8 miles distant & looks 2. [5] Best reached by a branch road from Carrizozo to Capitan, trains run Monday & Thursday at 6 a.m. Westward, more distant, are the Organ Mts. Capitan is a fine place to outfit. Upper slopes of Capitans are vivid green, the sides are deeply furrowed with canyons, & the mass culminates in the fine peak of El Capitan. I5I Farther south on the E P & SW [El Paso and Southwestern Railroad] it appears that the green range trends eastward. Southward the

mts. are arid. The mass is probably isolated. [5]

At Tularosa the peaches are the best ever Next best at Alamogordo, 4320 ft elevation. The Capitan, Sacramento & S [Sierra] Blanca form a system cut off from the Mts westward by a broad mesa, highest at & below Duran (6666 ft at Corona) but here the Mts are sandstone & very arid. Reached El Paso ca 8:30 p.m.

El Paso Aug 18/10. Explored Franklin Mt., going out Highland Park car to Altura [6], perhaps 3 miles & on the E side of Mt. The Mt. is monocline strata dipping steeply west. Going up the canyon at Altura it is red granite at first, then metamorphic & top half limestone bluish & hard, without fossils. On the ridge we started towards town, reaching a peak **** [word illegible] with heavy rock & little cliffs. Here found a few Holospira roemeri & Bul. pasoni, in fine grass among stones. The Mt. is extremely dry, with abundance of a small agave. Up above there is Fouquieria, a fine sawtooth agave, & a few large yuccas. Almost no soil. Descended side towards town, & went down to river, which is dry bed of sand & fine gray mud, with a little water in narrow pools in places.

Aug. 19/10. Left for Hachita at 7:50 a.m. Crossed into Mex. [7] where the hills are arid & sandy, with very little herbage. It becomes more grassy further on. There are several ranges including the Floridas in view. Arrived at Hachita at 11 a.m. & got in touch with Mr. John Pitts foreman of the Hachita ranch, managed & owned by Mr. Everhardt. Sorted our stuff & drove out to the ranch, 15 miles, found turtle in garden. [8]

Aug. 20. Drove into Sheridan canyon, where two men are at work drilling a well. Wells at ranch are ca. 150 ft deep. The Mts are very barren, more so than Floridas. This canyon is a big one about 7 miles long & much branched. Made camp in a shack put up by miners near the Sheridan mine & the well. After lunch struck out southward to a high peak surrounded with cliffs, about 3 miles distant--Teocalli Peak. Here at bases & benches of cliffs found Holospira & Oreohelix, the latter very rare. [°Sta. 1° in margin.] On way back found a draw with Holo. ca 1/3 way to camp on N. side of a hogback running to ridge on which peak stands. [°Sta. 2' in margin.] [9]

Aug. 21 Sunday. Went to Mt facing mouth of Sheridan. The cliffs are high, near summit very many Oreo. & Holo. [*Oreohelix* and *Holospira*] in talus at bases of cliffs & found living Oreo. under small & large stones & leaves, but not deep, on a bench of cliff half way up. [°Sta. 3' in margin.] Here they live on the face of an almost inaccessible cliff, where they can look out 50 miles into Old Mexico. On top there is sotol, candelabral mescal, Fouquieria & cacti. Below cliffs, dwarf oak, knee-high, wild roses, candle cacti & the small branching stick kind, & prickly pear, etc. Also ferns in rocks, & very rare cedar trees, low like an apple tree.

[Written out of sequence on another page is the following:] ['Hachitas have no water whatever, & no timber. Scrubby cedars & small but old pinyons are sparsely scattered near peaks. All limestone, hard & angular with very few fossils--some corals like Zaphrentis & crinoid stems with traces of a spiral snail & very rare brachiopods. Produce rattlesnakes, small pale brown scorpions, large centipedes & tarantulas. Heat intense from sunrise on Sky cloudless until noon when small white clouds appear in middle of p.m. perhaps covering 10%. Most days with very little breeze, often still'

Aug. 22 Monday. Went westward to a Mt. at head of Thompson Canyon. The way is up to Sheridan mine, then following the ridge which rises in a succession of steps or stages, culminating in the mountain (Thompson Mt). The N. branch of Sheridan almost connects with Thompson Canyon, but is separated by a rather low saddle. North side of summit of Daniels ['Thompson' crossed out and 'Daniels' written above it] Mt. descends in high cliffs, at base of which the steep slope supplies abundant good rock for snails. [°Sta. 5' in margin.] There are occasional pinyons all over this slope. Found large Holospira, Ash. mearnsi, & 2 Oreohelix here. There are slender Holospiras also all over the sunny side of same Mt. high up (Sta. 4). What we took were nearly as high as the base of cliffs.

Aug. 23/10. Stayed in camp. Collected plants in morning. rested. Ash. mearnsi lives in earth and stones like A. walkeri. South of Hachita group there is another group, very rugged and full of high cliffs. looks dry, & is not nearly so high as Hachita Grande. Away to the west there are very high Mts, apparently well wooded distant perhaps 25 or 30 miles, possibly more.

[10] Sheridan Cn. has been scooped out of middle of range, also Thomson [sic.] out of N. end.

Aug. 24. Started at 7 a.m. for Big Hatchet. followed along draw which heads up a low col betw Teocalli ridge & Thompson Mt. Here Antithompson Cn. [The word 'Sunset' has been inserted between 'Antithompson' and 'Cn.' I seems to have stolen the long (ca 2 miles) head of the Sheridan draw. Followed this up [Sta. 6 was seemingly on the southwest side of this canyon] & at its head ascended Mt on right & got Sonorella in some abundance near summit, [Sta. 7] on stones among pinyons, from here went around Big H. Mt. on right across gulley, Sta. 8. Ascending ridge to camp, which was on the warm side of a low rock wall. Gathered wood--small cedar & agave stalks--& spent the night, which was cold, in keeping up fire. In morning ascended to small peak 10, where Daniels got Sonorella & Oreohelix. I went up to the highest peak, 11 Found Oreo. bones all over & many living ones *on* & *under* stones, just below peak. Left name & date in can on cairn at peak. Saw 4 Mt. sheep from sta. 10. They spent over an hour on a ledge near Sta. 9. One ram & 3 ewes. Started for camp about 10 & reached there about 4, both of us about 'all in.'

Aug. 26/10. Cleaned up catch this morning At noon went up to cliffs opp. & S. of Teocalli & these cliffs, but it is not cut so low as the one southward. This morning took photo. of Teocalli, # 2 on film, ## 1 is view of peaks and head of Thomson /sic./ Cn. from camps. Men at well are Willard Merrill & McBride Howard

Inserted on back of page, out of sequence: 'There is a zone of big yuccas several miles from Hachitas. It is 2 or 3 miles wide. Inside this there is an agave zone. The Mts are very full of small agave with filaments along the sides 'lichigylla' (see about spelling), [parens. Pilsbry's -- presumably he referred to *Agave lecheguilla* Torr.] besides several other spp. On high peaks much of the compact broadleafed dark agave with black spines.'

Aug 27, Saturday. Mr. Pitts brought us down to ranch, arriving about 2 oclock. Very hot. Mr. Everhard there.

Aug. 28, Sunday About 7 a.m. started for town. Reached Hachita about 10 & left for west at 11:10 a.m., reaching Bisbee [Arizona] about 4 p.m.

The southwestern expedition of 1922 was outlined briefly by Pilsbry (1926: 5-6) in his commemorative account of James H. Ferriss who joined him on this trip. Seemingly Mrs. Ferriss (presumably the 'Mrs. F.' of the notes, below) and a Miss Jane Towne accompanied the party at least part of the time, although references to them in the notes are few. The trip was by automobile, perhaps one belonging to Ferriss, as Pilsbry (1926: 5) noted, in regard to the 1915 expedition to the Black Range 'This was the last of the trips by wagon and pack train. Ferriss bought a Ford.' Title of the notebook, all of which is given here, is '1922. Santa Fe to Great Bend.' 'Great Bend' refers to the Big Bend area of the Rio Grande in southwestern Texas.

Sept. 17. Sta. 201. Road from Santa Fe to Albuquerque Lavahada -- dry stream near adobe village southwest of the steep hill. [1]

Sunday Sept 18. Left Albuquerque about 9 am. for Sandia Mts. Went up Tijeras canyon & a left branch to San Lorenzo Falls. Camped ½ mile below falls. Hills covered with juniper. Some distance above falls some yellow pine--a sparce [sic] stand, & abundant scrub oak. Pine goes nearly to the top, but the last 800 ft scrub oak only--from 10 ft or more to ankle high near summit. Under summit are groves of aspen Rock on Albuquerque side is granitic the peaks & whole Mt. otherwise a hard limestone. In the canyons where there is water some maple groves.

Sta. 202. Canyon above falls in juniper zone mixed with pinyon pine.

Sta. 203 On top, in aspen groves.

Wednesday, 20th Sept. Camped last night ca. 10 miles south of Albuquerque. Before leaving camp collected ['Station 204' inserted here] in swampy strip along the railroad It is quite dry now, but with close growth of tules, cattails (2 species) &c. found Lymnaea, Physa, Planorbis, abundundant [sic]. Are continuing S. on the Camino real.

21st Sept. Camped in valley at windmill & tank, 24 miles N. of Socorro. Wash runs west, with vertical earth banks 6-10 ft high, gravel & boulder bed. In the banks found Succinea, Lymnaea & Zonitoides sparcely. [Sta. 205]

Sta. 205. Broke camp at noon, proceeding southward. The valley sides are sandstone. No shells to be found.

Sept. 22. Camped 15 mi. S. of Socorro & several miles off the road west at Nogales canyon [12] in the E. foothills of the San Mateo range, *Sta. 206* Found small stuff only. It is about 10 miles to the main range.

26th Camped at Elephant Butte Dam. Some small stuff in drift. *Sta 207a.* (At Socorro we went w. a couple of miles to Socorro Mt., rhyolite, no shells whatever).

Sta. 207 Dry wash 9½ miles N. W. of Hot Springs. [13]

28 Sept. Camped last night at the Jornado [sic] ranch 17 miles N. of Las Cruces. This morning rode out to the western slopes of the San Andres--about 9 miles. The Fouquieria society occurs on S. slopes, with pinyon and cedar on the northern. In the latter found Bulimulus & in same slopes, Holospira roemeri. ['Sta. 208' in margin] On top there is agave and bear grass. On the mesa a broad yucca belt. Got large series of plants. Also a Crotalus. The ranch buildings are in the lowest part of the plain. The rainfall here is usually about 8-9 inches, but this year only 3 or 4 so far. Water in one of the canyons, the others dry. Humming birds and black bumble bees abundant. Burke's Spring is the general loc. for Sta 208. [14] The head of the Jornado ranch is Dr. Enoch Nelson. Manager B.P. (?) Lister.

29 Sept. Left at 8 for Ropes Spring about 13 miles N. E. of the Jornado ranch buildings, [15] & probably 10 N. of Burke's spring. Found Sonorella and Ashmunella in a ravine S.E. of the Spring. Both live under stones rather deep, chiefly in the bottom of the ravine. ['Sta 209' in margin] Holospira found under flat stones on the sunny side of the ravine. [16] The western division of the San Andraes [sic] is wholly limestone--softer layers alternating with thinner hard strata--the whole dipping steeply to the west. The slopes of the Mts largely follow the dip of the strata & are very steep. The ravines are relatively small. The summit here is said to be about 8000 ft.

30 Left for Las Cruces & then for Dripping Springs.

Oct. 1 Sunday. Camped. Dripping Spring. [17] Found Sonorella at Sta. 210. South of the Spring about 100 ft., higher.

Oct. 2. Monday. Worked rock in bay east from hotel Sonorella. *Sta 211.*

Oct. 3 Tuesday. Went up N-E branch of the canyon. Very steep & rough. About 1000 - 800 ft below summit of ridge, are several long slides on right side of canyon. Ashmunella sparcely found dead, also Sonorella living, in large slide. Further up in a slide about 6 ft wide found Ashmunella living. ['Sta. 212' in margin] There are a few yellow pines, much scrub oak with white oak leaf, a scrub maple, few pinyons & cedar. One of the steepest climbs anywhere. [18]

Oct. 4. Packing to return to Las Cruces. Saw Mr. Frank Herran, owner of Dripping Springs. Left Mrs. F. & Jane at hotel & went up river 4 miles to Doñana [Doña Ana] where we camped.

Oct. 5. Crossed Rio Grande on bridge & searched the Cerro Magdalana. ['Sta 113' in margin--apparently he meant '213'] F. found Pennsylvanian fossils which he gave me. [19] Very hot. Afternoon returned to Las Cruces & interviewed W.A. McCalla (Hatch, N,M.) who has found fossil wood &c. on his ranch above Hatch. He gave me a fossil horse tooth for determination & report.

About 5 p.m. left for the east, on road to Organ City [now called simply 'Organ']. Camped about 3 or 4 miles out.

Oct. 6. continued journey to Organ City. On arrival we searched mountains south of pass, without success. [20] Got 2 horned toads. Camped east of the pass.

Oct. 7. Crossed desert to Alamogordo. Photographed white sands. Elev. about 4000 ft

Oct 8. Sunday. Went up to Alamo canyon [21] & camped about ½ miles from mouth Rested. Ferriss collected Bulimulus & Holospira ['Sta. 114. S side Alamo canyon above camp. : 214' appears in margin].

Oct. 9. Went up right (southern) branch of canyon to high cliffs near top. Just below cliffs found Ashmunella and Oreohelix bones, very dead. ['Sta. 215(115)' appears in margin] Nothing above cliffs but Gastrocopta & V. indentata. From summit of ridge one looks into another big canyon opening west.

Oct. 10. Ferriss & I went up Alamo Canyon 6-6 miles--to the mine. found practically nothing.

Oct. 11. Returned to Alamogordo.

Oct. 12. Went north on road to Carrizozo as far as Three Rivers. [22] Very hot. By this time were in a severe sandstorm. Heat! dust! Stopped in lee of store for an hour. Storm abated. Then took road past Sec'y Fall's house [23] to Stone House, ['elev 5800' appears under the words Stone House] on the Thoroughbred Ranch, at the mouth of Three Rivers Canyon. Camped in mouth of the canyon. Johnson, supt of ranch seemed unwilling to give any information. Camp is in Forest reserve. [24]

13th F. & I went up canyon at the dam we met NW Palmer. This is 6500 ft. Went along up trail ½ mile or more, where we found Ashmunella very abundant in rock piles along bottom of canyon [25] *Station 216*. The shells are under the edges of rocks in the mellow mould. A few on the rocks. This station is about 6700 ft. Also found very rich earth with small shells about here.

Station 217 is about 7000 ft up on the south side of canyon, half a mile further up. Ashmunella is somewhat larger. Also dirt. The Ash are often in leaves along edges of stones. This station is near a grove of aspens.

Oct. 14. Went along up 3-rivers cn. About 1 mile above Sta 217 found large Ashmunella--*Sta 218*.

Sta 219. About a mile further up, among a few aspens in floor of cn., a short distance below old corral ca. 8000 ft.

Sta. 220. Aspen grove on side of canyon ¼-½ mile above old corral about 8500 ft-mostly little stuff but Cochlicopa very rare--no Euconulus.

Oct. 15. F. & I went over to canyon southward, ca 4 miles. Got bones of same Ashmunella near mouth of cn. about a mile above the cultivated field & irrigation ditches. Heavy rain. [26] [Location of Sta. 22]

Oct. 16. Went up dry branch ***th [first part of word illegible but probably 'north'] of 3-rivers Cn. about 2 miles up found trickle of water & near there collected large Ashmunellas ['Sta 222' in margin] Ferriss collected some distance above also on right side of cn., ['*Sta.* 224' appears in margin] still larger ones. Cleaned all.

Oct. 17. Returned to 3-rivers and left for the northward. Camped several miles east of Oscuro. [27]

Oct. 18. Went east 2 or 3 miles & climbed foothills. Found Helicodiscus & Succinea but specimens lost. Camped 2 of X bar I ranch.

Oct. 19. Camped at Cottonwood Springs, several miles E of X bar I ranch. I went up canyon beyond spring & got small stuff & dirt. ['225' in margin]

Oct. 20. Jim & I went up next canyon south of that on which Cottonwood Spring is situated. It is a canyon with 2 main branches & many forks. Went up to aspens the only ones visible, about 9000 feet. Most of the ridges are densely covered with scrub oak. [28]

Sta. 226. Found Ashmunella above 2d fork and from there up to 229, in the aspens. They are abundant under stones in maple. The canyons here all contain a little water. Maple, oak, ash, yellow pine & spruce.

Oct. 21. F & I went north about 4 miles to Water Canyon, on the western flank of Nogal Peak. [29] A large canyon, with some walnut, ash & oak, higher up, maples. Water down nearly to mouth of the canyon. Found Ashmunella about half mile up, & from there to summit. F. collected at three stations, about ½ mile apart, 230, 231, 232. I went far above these & collected in the aspens, now leafless, under the peak [Nogal Peak] on W side, ['234' in margin] and at least 1000 ft lower on the west side of the southern branch of the head of Water Canyon (parallel to part of the Forestry Service trail [30] to the saddle south of the peak ['233' in margin]. Here Ashmunella was very abundant, hybernating [sic] under stones along the steep slopes of the narrow ravine. I got 104 from one stone about 18 X 12 inches. Ravine full of fallen maple leaves. Above this the mountain is long bunch grass & small scrub oak, very steep, with a few rather low & short cliffs. The rounded summit, about 50 ft long, has a rock monument. On its flanks are rock piles covered with large lichens, collected some of them. Scrub oak is the prevailing vegetation of these mountains in the upper 2000 ft or more. Found horned toad about 500 ft below summit. Now red brown & yellow.

Oct. 22, 23, 24 returned to Alamogordo & camped in public grounds.

Oct. 25. Shopped, & about 3:30 got off southward. Ran about 15-20 miles & made dry camp on desert. Sage brush. [sagebrush does not occur here; perhaps Pilsbry was referring to creosote bush, *Larrea divaricata*] lone house 'miner's shack.

Oct. 26 F went before breakfast to Sacranto [surely 'Sacramento' is meant here] Mts about 2 miles away 20 mi. S. of Alamogordo. ['Sta 235' in margin] Got Bulimulus & Holospira. [31]

Oct 26, 27, 28, 29. road to Orange. [32]

Oct. 30. Orange.

Oct. 31. Ran about 10 mi. N. of Orange but turned back on account of engine trouble. P.M., ran east to base of Mts. & camped at a tank & windmill ca. 2 miles from base of Mts. at base of PX Trail. [33]

Nov. 1. [34] Went up canyon which enters from west to highest peak. Found Bulimulus & Holospira all along. At head the canyon branches, N.S. & 2 East found Ashmunella on south branch. [Sta. 236]

Nov 2. Went up PX trail to meadow Found Ashmunella & Lysinoe on N. slope of cliffs of a deep canyon south of the summit of trail. ['237' in margin] Madrono common in heads of gulches. Around high peaks some yellow pine which straggles sparcely down about 800 ft in places. Trees not full size. Below this pinyon & arid, stony hills with yucca, sotol, scrub oak &c. The prevalent shrub is a small leaved one Some preserved.

Below, steep ****[illegible word] mesa with yucca & cacti. Below it a zone of creosote bush, then grass or mostly bare earth. Gypsum beds further out. The strata slope steeply (ca 30°) on W. side. Slopes often steeper.

Nov. 3, 4, 5. Laid out. & explored following stations

238. Stony ridge on E side of park just at the left of where PX trail crosses ridge. Bulimulus among yuccas and sumac(?) --a fine leaved, currant-like kind.

239. Stony hills on E side of park and southward.

240. Upper side of terraced butte on dry canyon, not far above bed in steep rock slide and around base of cliff.

Nov. 7. At Orange. Cleaned up catch.

Nov. 8. Went around southern foothill and up Guadalupe canyon (immediately east of high cliff peaks (Guadalupe Peak), to ranch of Walter Glover, Pine Spring Cn. & camped about half a mile w. of ranch house, nearly same distance below large spring, just outside the mouth of Pine Canyon. [35]

Nov. 9. Went up Cn. as far as the Gateway. [36] Found Holo roemeri & n. sp. [Holospira montivaga breviara] & Ashmunella.

Nov. 10. F. and I went up to just above the box above the gateway. I got one living Lysinoe ['Humboldtiana ultima' has seemingly been written in later] They were hybernating in stony slopes, under leaves only, in oak and maple groves. There is a good deal of a chestnut leaved oak a small maple (gorgously [sic] red), manzanita with ripe berries, & throughout the canyon rather sparce yellow pine. The best place is about half a mile above box. From here up the sides are mainly cliffs, little talus anywhere. Half a mile further up the canyon forks. [37] This part has many fine spruce. Extremely windy--cold. Mts. are all limestone, strata slope east, but not so steeply as they slope west on the other side. Top cliffs soft yellow limestone not noticeably stratified -- a different 'formation.' [All the collections of Nov. 9-11 were included in 'Sta. 241']

Nov. 12. Left for Orange about noon. Camped in a cabin on W. side of foothills. Worst camp of the trip. Wind very high and cold.

Nov. 13. Reached Orange about n. Left for Sierra Blanca Hudspeth Co., Texas at 2:30 and arrived about 7.

Nov. 14. F. and 8 tried hills south of town. Found a few minutiae and Succinea. [Sta. 242] Left for Van Horn--camping about 8 miles out from latter. Snowed a little.

Nov. 15. Drove into Van Horn. Very windy and dusty. One thing worse than a hot dust storm is a cold one. In p.m. went out to Mts. about 6 miles north. [Sta. 243, probably located in the Beach Mts.] Found Holo roemeri. Rocky hills are limestone,

covered with Selaginella & ferns- extremely dry. Wind high, *dust*. Camped in campground--Rain--snow in the night.

Nov. 16. Wind subsided. Cloudy. In pm Jim and I walked out south of town on the desert, which is rather thickly covered with a fine leaved mesquite, creosote bush, crucifixion tree, &c. few cacti found Succinea in soil around bushes and in shallow washes. Sta. 244. Photo of *tank*.

Nov. 17. Started early for Marfa. Had 4 punctures, & finally camped about 10 miles out.

Nov. 18. Went into Marfa, where we stayed all day. Miss Jane Towne left for East. We left town about 6 & ran out some 10-12 miles where we camped near Toronto Sta.

Nov. 19. The rock here is volcanic, country very hilly and craggy, with live oaks on the hills and in groves in the valleys. Grass good. Very beautiful country. Drove into Alpine, where we got a few things and left at 11 for Chisos Mts. The same volcanic, hilly country continues south of Alpine. We go through a succession of valleys, separated by rather steep hills, one about a mile long. These valleys and hills are sometimes grassy, often sparcely covered with live oaks. Photo teamsters, 8 mule team

Monday, 20th Nov. limestone 4 punctures, made about 20 miles & camped 15 m. N. of Terlingua. Found Succinea in bank of Terlingua Ck, which has a small stream (2671 ft USGS elev. bench mark) [38]

21st Nov. Arrived Terlingua about noon & left soon after. Route was to Mine, then up creek bed for 5 or 6 miles, then eastward across mesa [39] to Oak Canyon and house of Mr. Naill (Nov. 22) [40] There is abundant water in a fine grove of oak with some willows and a few walnuts. Garden. The canyon runs about half a mile or more and terminates in a box with vertical walls of 200 ft height. Above it the canyon is walled in steeply for half a mile or more, then opens into a large basin with several branches, leading toward cliffs around the margin on all sides. The bed of canyon is forested, chiefly oaks, also buckeye, a large madrone also the small one we had in the Guadalupes. Slopes everywhere with many big agaves, beargrass with very sharp edges, large yuccas, a few pinyons & cedars (or junipers with stringy bark). On the N. side, high up, are small grove of stunted aspens. All the slopes below cliffs have numerous long slides of coarse or fine rock, very steep. Found Lysinoe & Polygyra in long slides N.E. of Oak Canyon, Sta. 245, outside. Also about 2 miles further N.E., Sta. 246, in narrow wooded ravines in the upper cliff wall. Also a small slaty Philomycus here, all in rock among leaves. Sta. 247 inside canyon.

Nov. 23 and 24. Collected. Left at noon Nov. 25. Arr. Terlingua about 5 and pulled out northward, where we camped on bank of Terlingua Ck. a mile or two below the ford. [41]

Nov. 26, Sunday. Took photo of 2 cottonwoods at the ford. Collected some drift with Pupae &c. along road near the little white school house with a red roof--just north of the rough ridge where I had photo a red dome & serrate rocks on the way down. [42] Also a few Bulimulus among low mesquites. Also found Bulimulus some 5 miles further north. [Stations 248 and 249]

In 1934 and 1935, Pilsbry made extensive collections in Mexico on the 'Penrose-Philosophical Society Expedition.' In 1935, he and Cyril Harvey also made some collections in parts of southern New Mexico and western Texas. In the notebooks pertaining to this expedition, Pilsbry kept a separate log of stations. This log is placed at the end of this section.

June 16. Cyril Harvey & I left Phila. at 1:05 p.m.

June 17. Arr. Chicago 7 a.m.

June 19. Wed. arr. El Paso 8:30. Went to Hotel Paso del Norte. Then to Baily *** [illegible word] Co. I saw Mr. Brown. Held up pending arr. of immigration permits. Got out car & had it tuned up &c. Called up by a Mr. Conklin who was a friend of Howard.

June 20. Thursday. Called on Brown. No message yet from Phila. Had name put on car. Very hot. 90° inside. In p.m. drove out to Hueco tanks [now a Texas State Park] about 36 miles from El Paso & 8 miles N. of Carlsbad road. The tanks are in an andesitic hill. Rock very massive--no small stone. There are 2 tanks, the one used being largely formed by a short dam. Water extremely low.

170. contained Physa only Below the

171. Dam a small shallow pool contained thousands of Apus. They swim inverted. A large pool still lower had no snails or Apus.

Hill 1 m. south of Tanks was gone over to the cliff at top. No trace of shells. There is an adobe house at the tanks--not inhabited just now. About 25 cattle stood around. Very bony, as it is extremely dry & practically no feed. On the hill south of tanks found 1 spirifer & crinoid stems. 172 Got back about 7.

June 23. Sunday. At Columbus, N.M. Left El Paso about 11, came via Las Cruces & Deming, dirt road 31 miles to Columbus. Passed Floridas & Tres Hermanas Mts. At S. peak of latter turned in road of T. H. Mining Co. which runs to base of Mt. where one of the owners of the prospect has a shack--2 m. from main road. Around the mine found bones of Oreohelix [43] (Elev. about 4700 ft. estimated) & 3 Thys. hornii [sic] a couple of hundred ft higher. The Mts are a sort of granite-porphyry, with limestone outcrops. Above, mostly massive granite(?) with no small slide rock. A few old cedars & fewer scrub oaks, Fouquieria, cacti, &c. Arr. Columbus about 6. Town largely deserted. Lives on memory of Villa's raid, when 67 persons were killed.

June 26. Left Deming June 25 pm. & stayed at Columbus overnight Met Mr. Reed & family. Morning of 26th crossed line.

Pilsbry and Harvey remained in Chihuahua, Mexico, until July 8.

July 8. Monday. Arr. Deming about 4 pm.

July 8 Tuesday. To Diamond A (Victoria Cattle Co.) via Lordsburg. Arr. about 4. Entertained at ranch house. [44]

July 10, Wednesday. Left for Black Bill Spring above tank about 7 am [45] Drove to tank spring about ½ mile further up. Some distance above spring found tiger rattler, and at 6500 ft. Sonorella. They were under andesite ? mostly not sealed on. Though one big stone had 8 sealed on & many rings. *Photo*. Went up to 7000 ft. & found only Sonorella. Pines begin there. No other snails.

July 11. Thurs. Drove 50 m. over to Hacheta [sic] around south end Animas range. Went in to Robeson's ranch & took road to the Mt. Sheep Corrall [sic]. There ascended canyon & up to peak on far rim, 6000 ft. Got only Holospira. Exhausting hot & steep. 146I

July 12. Friday. Drove to Douglas, Ariz. [A brief visit was made to Rucker Canyon in the Chiricahua Mts.]

July 13. Drove to Deming.

July 14. Drove to El Paso.

July 15. Drove to Carlsbad.

July 16. Tuesday. Went through Cavern. No shells found. Drove to filling station just east of Guadalupe Mts. Tx. [47]

July 18. Went up southern flank of Sentinal [in the ANSP catalog, 'Sentinal' has been corrected to 'Signal'] Peak to 6500 ft. Found Bulimulus & Holospira roemeri, & a couple of zonitids in ledges of cliffs, among scrub oak &c. None alive. Drove to Ft. Davis. [Date should, perhaps be July 17]

July 19. Thursday. Tried cliffs back of town & a canyon, little Aguja Cn., also known as Nation, about 4 m. NW of Observatory 148I where we were guided by Mr. Roach Got plants but no bones. About 5500 to 6000 ft. spotted frog. [Date, July 18?]

July 19. Friday. Drove about 10 miles west (road to Valentine) & then north to ranch in valley at west end of Blue Mt. [49] Then up very steep stony road to 5900 ft., where we left the car & walked about 2 miles to Mt. over a broad foothill butress [sic]. Ascent very steep & stony, but everywhere are goat trails, & the whole mountain is covered with their droppings. At summit there is a rocky bluff west & a slightly higher, rounded top a few hundred yards eastward. On the N. side of the westward summit in coarse, angular igneous rock found Humboldtiana &c. Two live ones only, & most of the bones very dead (eaten by rats or chipmunks). Harvey moved several tons of rock.

July 20. Left Ft. Davis about 7 am. Stopped at Phantom Lake. 150I Collected a few small gastropods but no Sphaerium or Pisidium Lake issues from a cleft in limestone, is quite small. The stream running and is about 10-12 ft. across & 3 or 4 deep. Very clear water. Many kinds of fish--saw some up to a foot long. Caught a few small minnows, No. 196

Arrived in El Paso about 4

July 21. Sunday. El Paso. went to bullfight.

July 22. Met Pennell [Dr. Francis W. Pennell, botanist, ANSP] about 9 a.m.

July 23. Started west about noon. Stopped at Deming. Dust storm.

July 24. To Nogales [Arizona] via Bisbee & Tombstone. [The party then proceeded into Mexico.]

The following stations in New Mexico and west Texas were visited during the expedition of 1935.

170. Hueco Tanks. El Paso Co., Texas. June 20, '35. Pilsbry & Harvey.
171. Shallow pond below Hueco Tanks, El Paso Co., Tx. [June 20]
172. Hill about 1 mile S of Hueco Tanks, El Paso Co., Tx. [June 20]
173. Southern Peak of Tres Hermanas Mts., at about 4700 ft. Luna Co., N.M. June 23, '35.
189. Animas range above Black Bill Spring 6500 ft. to 7000 ft. Hidalgo Co., N.M. [July 10]
190. Peak at head of mountain-sheep corral canyon. West side of Big Hatchet Mts., 6000 ft. Hidalgo Co., N. M. [July 11]
193. Signal Peak, Guadalupe Mts., Culbertson Co., Tx. Small slender snake 6500 ft. Horned toad about 5500 ft. Shells about 6500 ft. [July 17 or 18]
194. Nation Canyon, NW of Observatory, Davis Mts., Texas. 5500-6000 ft. [July 18 or 19]
195. Northern side of summit of Blue Mt., Davis Mts., Texas at 7300 ft. July 19, 1935.
196. Stream out of Phantom Lake, Jeff Davis Co., Texas. Picked from floating plants. 9 fish. [July 20]

ANNOTATIONS

The following annotations referring to Pilsbry's notes, above, are indicated by numbers in brackets in the notes.

A number of U.S. Geological Survey topographic map quadrangles are referred to by the following designations:

Q-1. Gym Peak, N,M,, 7.5', 1964 ed.
Q-2. Deming, N.M., 15', 1915 ed.
Q-3. South Peak, N.M., 7.5', 1965 ed.
Q-4. El Paso, Tex., 7.5', 1955 ed.
Q-5. Big Hatchet Peak, N.M., 15', 1937 ed.
Q-6. Bear Peak, N.M., 15', 1948 ed.
Q-7. Organ Peak, N.M., 7.5', 1955 ed.
Q-8, Three Rivers, N.M., 7.5', 1950 ed.
Q-9. Sierra Blanca Peak, N.M., 15', 1950 ed.
Q-10. Carrizozo, N.M., 15', 1950 ed.
Q-11. Guadalupe Peak, Tex., 15', 1933 ed.
Q-12. Terlingua, Tex., 30', 1904 ed.
Q-13. Chisos Mts., Tex., 30', 1905 ed.
Q-14. Terlingua-Chisos Mts., Tex., 1: 130,000, eds. of 1904-1905, revised in 1969 by Big Bend Nat. Hist. Assn.
Q-15. Columbus, N.M., 15', 1917 ed.

1. Pilsbry seems almost certainly to be referring to Baldy Peak near the center of Sec. 36, T. 25 S, R. 8 W (Q-1). In his published account (1915: 347) he suggested, from memory, that he had collected in the vicinity of Arco del Diablo 2½ miles farther north. However, there are no limestone cliffs near Arco del Diablo (Q-2) like those described, whereas Baldy Peak seems perfectly to fit the description given. Below the cliff on the north side of Baldy Peak, I collected on Jan. 25, 1970, most of the species taken by Pilsbry and Ferriss (1915: 346 - 349), including *Ashmunella walkeri* Ferriss, *Oreohelix metcalfei florida* Pilsbry, and *Sonorella hachitana flora* Pilsbry. Easy access to the west side of Baldy Peak is gained by the road leading into 'The Park' (Q-2) or 'Mahoney Park' (Q-3). Ruins of old cabins remain in Mahoney Park.

2. Pilsbry's observations concerning the flora still appertain. *Quercus gambelii* Nutt. his 'scrub, with white oak leaf' still occurs high up below Baldy Peak.

3. The author of this quotation is not known to me.

4. Duran is a village in southeastern Torrance Co. Duran Mesa (T. 3 N, R. 14 E) begins one mile SW of Duran and attains a height of *ca.* 600 ft.

5. Probably Pilsbry was referring to Carrizo Peak, an isolated peak seven miles NE of Carrizozo rather than to the Capitan Mts., which begin *ca.* 18 miles to the east and are not visible from Carrizozo.

6. Probably Altura Blvd, terminating westward against Comanche Peak at the south end of the Franklin Mountains (Q-4). Presumably Pilsbry and Daniels ascended Comanche Peak from the east and then descended its nose southward towards the city, after which they went to inspect the Rio Grande. *Holospira roemeri* and *Bulimulus pasonis* Pilsbry still occur in the southern Franklin Mountains.

7. Seemingly 'New Mexico' is meant instead of 'Mexico.' In 1910, the El Paso and Southwestern Railroad, now defunct and its tracks disassembled, extended from El Paso to the village of Hachita in southeasternmost Grant County.

8. Probably the Dallas Hatchet Ranch (Q-5), *ca.* 15 miles south of Hachita.

9. Pilsbry (1915: Fig. 1) published a map of the localities visited in the Big Hatchet Mountains and mentioned some of them in text. Four rough, preliminary sketches are found in his notes showing various parts of the range. One sketch seems to have served as the basis for his published map. On it is written 'General view of Hachita Grande sketched from summit of highest Peak.' Below I have attempted to correlate notes, rough sketches, and published map with the Big Hatchet Peak 15' Quadrangle, Edition of 1937 (Q-5). All sections are located in T. 31 S, R. 15 W.

Station 1. 'Teocalli Ridge,' of the notes and sketches, seems to refer to the entire mountain at the head of the southwestern tributaries of Sheridan Canyon in SE¼, Sec. 21; SW¼, Sec. 22; E½, Sec. 28; and W½, Sec. 27. 'Teocalli Peak' or 'Teocalli Butte,' around which Sta. 1 was located, seemingly referred to the highest peak on the ridge, the 6413 ft. peak centered around the center of eastern section boundary of Sec. 28. Hoff (1961) concurs in locating 'Teocalli Butte' here.

Station 2. Pilsbry and Dwniels camped near the Sheridan Mine, probably the mine indicated (Q-5) in Sheridan Canyon (NE¼, Sec. 22). If Sta. 2 was one-third the distance between Teocalli Peak and the mine, it was probably in the NW¼, Sec. 27 or extreme southwestern corner of Sec. 22 or one of the eastern hogbacks of Teocalli Ridge.

Station 3. Probably located in the vicinity of the 6328 ft. ridge and associated cliffs in NW¼, Sec. 30.

Stations 4, 5. 'Daniels Mountain' seems to be the elongate 6829 ft. mountain in N½, Sec. 16, between tributaries of Sheridan and Thompson canyons. Sta. 4 seems to have been on its southeastern and Sta. 5 on its north or northeastern slopes. In his notes, Pilsbry originally called this peak 'Thompson Mountain.'

Stations 6-11. In ascending Big Hatchet Peak on Aug. 24 and 25, Pilsbry and Daniels seemingly first ascended the branch of Sheridan Canyon that cuts diagonally across NE¼, Sec. 21, and SW¼, Sec. 16, proceeded over the 'col' and then entered the head of a westeard-draining canyon, termed 'Western cañon' in Pilsbry's published map, but indicated as 'Antithompson Canyon' on his sketches and in his notes. This tributary extends diagonally, SE to NW across Sec. 17, and does give the appearance, as suggested by Pilsbry, of having captured the upper part of the tributary of Sheridan Canyon that they had ascended.

According to the published map and the sketches, Sta. 6 was located in the southeastern part of the mountain bordering the head of 'Western Cañon' on its southwest side. Probably, then, the station was somewhere near the center of Sec. 17. Pilsbry and Daniels then seem to have ascended the peak to the northeast of the head of Western Cañon in SW¼, Sec. 8, around the summit of which was located Sta. 7. They probably proceeded across the narrow col directly north of this peak and onto the eastern slope of Big Hatchet Peak. Sta. 8 was probably in the NW¼, Sec. 8. The sketch map indicates that it was on a prominent ridge between two canyons tributary to Sheridan Canyon; probably this is the ridge near the '7' in '7500.' Probably the overnight camping site was in the shelter of the ridge beginning in SW¼, Sec. 5 and extending diagonally across NE¼, Sec. 8. Sta. 9 was probably at the campsite, as the notation '9. Camp' appears on the sketch map. The sketch map indicates that Sta. 10 was on a peak between Big Hatchet Peak and one labelled 'Probably next to highest peak,' to the northeast. Probably this latter peak was the 7822 ft. peak (second highest in the range) near the center of Sec. 5 and Sta. 10 was probably on the 7700 ft. peak .4 mi. to the southwest in SW¼, Sec. 5.

Station 12. The mountains 'opp. and S. of Teocalli' are probably the two peaks in the SE¼, Sec. 27 and SW¼, Sec. 26. The published map suggests that the collection was made on the eastern peak in Sec. 26, but the sketch map shows '12' on the higher, western peak in Sec. 27.

10. To the south, are the arid Alamo Hueco Mountains; to the west the higher, better-watered and forested Animas Mountains.

11. The name 'La Bajada,' seemingly meant here, was applied to a mesa, the descent from the mesa, and a nearby village, all *ca.* 19 miles southwest of Santa Fe on the road to Albuquerque (Pearce, 1965: 80).

12. Six miles west of San Antonio, Socorro Co., in the Chupadera Mountains.

13. Now Truth or Consequences, Sierra County.

14. Probably the Jornada Ranch headquarters were at the present-day headquarters (Sec. 33, T. 19 S, R. 2 E, see Q-6) of the Jornada Experimental Range of the U.S. Department of Agriculture. A road leads southeast from these headquarters to Burke Spring (Sec. 17, T. 20 S, R. 4 E), a distance of 12 miles.

15. Another road leads northeast and east from the Jornada Range headquarters to Ropes Spring, named for the Ropes family, whose ranchhouse was located just below the spring and is still standing.

16. *Sonorella hachitana* Dall, *Ashmunella kochi* Clapp, *Holospira roemeri* (Pfeiffer), and *Bulimulus dealbatus neomexicanus* Pilsbry were taken in two ravines ¾ and 7/8 mile east-southeast of Ropes Spring (NW¼, Sec. 9, T. 19 S, R. 4 E) on June 23, 1970.

17. Center of Sec. 7, T. 23 S, R. 4 E (Q-7).

18. Probably Pilsbry and Ferriss collected in the extreme northwest corner of Sec. 8 or the extreme northeast corner of Sec. 7, T. 23 S, R. 4 E (Q-7).

19. The 'Cerro Magdelana' must be the Robledo Mountains, opposite the village of Doña Ana, Doña Ana Co., on the west side of the Rio Grande. Fossiliferous Pennsylvanian and Permian strata are found in these mountains.

20. The northern part of the Organ Mountains (Baylor Peak area) south of San Augustin Pass.

21. A large canyon of the eastern part of the Sacramento Mountains, debouching 3 miles southeast of Alamogordo.

22. Village located on U.S. Hwy. 54, 17 miles north of Tularosa.

23. Ranch developed by Albert B. Fall, Secretary of the Interior, 1921-1923, during the Harding administration; E½ Sec. 25, T. 11 S, R. 9 E (Q-8).

24. At present, the national forest boundary passes between sections 34 and 35, T. 10 S, R. 10 E (Q-9).

25. *Ashmunella rhyssa trifluviorum* Pilsbry is still abundant in such habitat here at its type locality.

26. The next two major canyons south of Three Rivers Canyon are those along Indian Creek (2½ mi. south) and Golondrina Draw (4½ mi. south). However, a drive of at least seven miles would have been required to reach the mouth of Golondrina Canyon. It seems more likely that Pilsbry refers to Indian Creek Canyon, on the Mescalero Apache Indian Reservation. A cluster of houses *ca.* one mile WNW of the mouth of this canyon is indicated on map Q-9.

27. Spelled 'Oscura' on U.S. Geological Survey topographic maps and in Pearce (1965: 114) but 'Oscuro' on commercial road maps. Located 17 miles south of Carrizozo on U.S. Hwy. 54.

28. It is not clear whether the party camped along Cottonwood Creek at the mouth of Elder Canyon on Oct. 19 and then ascended a branch of Spring Canyon on Oct. 20 or whether they camped on Spring Canyon and ascended a branch of Tanner Canyon (canyons in T. 9 and 5. 10 S, R. 10 E, see Q-9).

29. Probably the party drove over the primitive road just east of the Hogback in Sec. 26, T. 9 S, R. 10 E, from Cottonwood Creek around to the mouth of Water Canyon, which debouches in Sec. 19. T. 9 S, R. 11 E (Q-9 and Q-10).

30. Probably the trail shown in Secs. 28 and 32, T. 9 S, R. 11 E (Q-9).

31. *Bulimulus pasonis* Pilsbry and *Holospira roemeri* (Pfeiffer) are common in the deep canyons in the southwestern part of the Sacramento Mts.

32. The party seemingly followed primitive roads around the southern end of the Sacramento Mts. and southeastward to Orange, Otero Co., N.M., described as follows by Pearce (1965: 114): 'Former trading point in SE part of county, 5 mi SW of Cienaga and 3 mi N of Texas border. Post office, 1904-25.' Hoff (1961) erred in supposing that Pilsbry had collected in this area before 1899.

33. Possibly this campsite was at or near the 'Old PX Ranch' indicated on Map Q-11.

34. A rough sketch included in the notes leads me to the following interpretation of Stations 236-240. Landmarks noted are on Map Q-11. The 'Park' of the sketch and 'Meadow' of the notes seem to be PX Flat at the head of the Old PX Trail. The sketch map suggests that Sta. 239 was on

the west, rather than the east (as stated in the notes) side of PX Flat. Sta. 239, however, must have been in the hills bounding PX Flat on the east. No. 237 was probably in the deep canyon that bounds PX Flat on the south (heading near the word 'Ridge' in 'Blue Ridge' on Q-11). If, on Nov. 1, the party went up a canyon towards the 'Highest Peak' in the area, this was probably Bush Mountain, which, at 8676 ft., is the highest peak north of Guadalupe Peak. Map Q-11 indicates four branches at the head of the canyon draining the western slope of Bush Mountain which accords with Pilsbry's description. Sta. 236 was presumably on the southeasternmost of these branches. The 'terraced butte' of Sta. 240 is possibly between two northeastern arms of this canyon complex west of Bush Mountain. As pointed out by Hoff (1961), all these localities were in Texas rather than in New Mexico as supposed by Pilsbry.

35. Guadalupe Canyon appears on Map Q-11 and is followed by the present U. S. Hwy. 62/180. The tiny village of Pine Springs still exists and Mr. and Mrs. Walter Glover operate a service station there. They have resided in Pine Springs since 1914. Mrs. Glover, contacted on June 10, 1970, was vague concerning any memory of Pilsbry's visit. Pine Spring Canyon is part of the newly created Guadalupe Mountains National Park. The spring mentioned no longer flows.

36. Approximately one mile above its mouth and directly south of the letter 'g' in 'Spring' on Map Q-11, Pine Spring Canyon makes a right-angled turn to the north. The 'Gateway' described (and photographed) by Pilsbry is located *ca.* ¼ mile beyond this turn, to the north, and consists of salient rock ramparts that extend medially from both walls of the canyon, allowing only a narrow defile for passage of the arroyo at base of the canyon.

37. The 'Box' seems to be the feature designated 'Devil's Hall' on Map Q-11. Above it, the canyon forks into northern and southern arms embracing Shumard Peak.

38. This bench mark is located (Q-12) on the 'old' road from Terlingua to Adobe Walls (west of the present Texas Hwy. 118) and *ca.* 3¾ mi N of the present junction of this road with Texas Ranch Rd. 170, which passes through Terlingua.

39. Dr. Clifford Casey (Pers. Comm.) suggested that the road taken was probably along Rough Run and then up Cottonwood Creek. Map Q-13 indicates such a road following these two arroyos, in part. It seems probable that by 'Mesa' Pilsbry was not referring to high, rough Burro Mesa west of Cottonwood Creek but rather to the flat area between Cottonwood and Oak creeks.

40. Pilsbry seems to have erred here. According to Dr. Barton Warnock and Dr. Clifford Casey (Pers. Comm.) the ranch at Oak Springs (Q-13, Q-14) never belonged to a member of the Nail (rather than Naill, as spelled by Pilsbry) family. Dr. Casey suggested that the ranch probably was occupied by Mr. Charlie Burnham (a relative of Mrs. Sam Nail) in 1922. A part of one building at the Oak Spring Ranch is still standing. The Sam Nail Ranch was at the foot of Burro Mesa, two miles due west of Oak Spring at the site now designated 'Old Ranch' by the National Park Service (Q-14). Warnock (1970: Fig. 21) mentions the Sam Nail Ranch and illustrates a part of the site.

The 'Box' above Oak Spring noted by Pilsbry surely refers to the box canyon and cliffs of Oak Creek Canyon as it plunges through the Window (Maxwell, 1968: 79, Fig. 74) of the Chisos Mts. It is unclear whether Pilsbry and Ferriss actually climbed up through the Window and into Chisos Basin (Maxwell, 1968: 72). Although Pilsbry describes the topography of the area surrounding the Chisos Basin, his information could have been gained from what could be seen from outside the Window and from accounts by local residents. Of the three collections made, two (245 and 246) seem definitely to have been from the northwest-facing slopes of Vernon Bailey Peak and Pulliam Bluff (Q-14). It is not clear which of these is the type locality of *Polygyra chisosensis* Pilsbry and *Humboldtiana chisosensis* Pilsbry. The talus slide of Loc. 245 is probably one of those seen in Warnock (1970: Fig. 21) in the extreme left part of the photograph. Locality 247, where only *Polygyra chisosensis* seemingly was collected, is described as being 'inside canyon.' Whether this refers to a collection made in Oak Canyon below or above the Window is not clear but the former seems more likely. The observation of aspens occurring 'On the N. side, high up' is also confusing. According to Dr. Warnock and Mr. Roland Wauer (Pers. Comms.). aspens occur only on Emory Peak to the south of Oak Creek and Chisos Basin.

41. According to Map Q-12, the only crossing of Terlingua Creek on the Terlingua-Adobe Walls road was near 'Reed Ranch' and 'Rock Corral,' six miles north of the junction of that road with Ranch Rd. 170.

42. This locality was not identified: no schoolhouse is shown on maps consulted. Dr. Clifford Casey (Pers. Comm.) suggested that the schoolhouse was near a ranch formerly owned by the Fulcher family, located *ca.* six miles north of Terlingua near the 'Rock Corral' (Q-12).

43. These specimens are probably from sediments of probable Pleistocene age, found along the eastern flank of the mountains near an abandoned mine in SE¼, SW¼, Sec. 31, T. 27, S, R. 8 W (Q-15). The shells are much heavier than fresh shells and seem to have undergone some permineralization. I have taken similar shells of *Sonorella* from the deposits noted.

44. In southwestern part of T. 16 S, R. 17 W.

45. Hoff (1961) suggested that Black Bill Spring might have been located in Black Bill Canyon on the west slope of Animas Peak, Hidalgo Co.

46. The localities mentioned here have not been identified. Possibly 'Robeson's ranch' is actually the 'Robertsons Ranch' (Sec. 34, T. 31 S, R. 16 W) of Map Q-5. From this ranch a trail is indicated (Q-5) as leading eastward to the Big Hatchet Mts.

47. Presumably this filling station was the one in Pine Springs, Texas, probably the one still being operated by Mr. and Mrs. Walter Glover (see annotation 35, above.)

48. McDonald Observatory.

49. Blue Mountain is *ca.* 8 mi. WSW of Fort Davis and attains an elevation of 7331 ft.

50. Phantom Lake is *ca.* 13.5 mi. southwest of Toyahvale, Reeves Co., in the foothills of the Davis Mts. (Texas State Highway Comm., 1940: 642).

ANSP CATALOGUE NUMBERS OF SPECIMENS FROM LOCALITIES DESCRIBED

EXPEDITION OF 1906

Florida Mts. Loc. (Probably below Baldy Peak): 97338, 97393, 97452, 97455, 97456, 97527, 97530.)03243 (type of *Oreohelix metcalfei florida* Pilsbry), 112087(type of *Sonorella hachitana flora* Pilsbry & Ferriss), 112088, 112289.

EXPEDITION OF 1910

Duran Butte, N.M. Loc.: 112023 to 112027, 104005 (type of *Pupilla muscorum xerobia* Pilsbry.)

Mt. Franklin at El Paso, Tex. Loc.: 111994, 111995.

Localities in the Big Hatchet Mts.:
Sta. 1. 112265 (type of *Holospira bilamellata heliophila* Pilsbry), 112278.
Sta. 2. 112266.
Sta. 3. 111980, 111986, 111992, 112078, 112268 (type of *Holospira bilamellata media* Pilsbry), 112275, 112276 (type of *Oreohelix ferrissi* Pilsbry), 112279.
Sta. 4. 112269 (type of *Holospira lamellata longa* Pilsbry).
Sta. 5. 111979, 111987, 111991, 112086, 112270, 112277 (type of *Oreohelix ferrissi morticina* Pilsbry), 112283 (type of *Oreohelix hachetana cadaver* Pilsbry), 112284.
Sta. 6. 112272 (type of *Holospira bilamellata insolata* Pilsbry), 112281.
Sta. 7. 112085, 112285.
Sta. 8. 111978, 111983 111984, 111988, 111989, 111993, 112084, 112271, 112286.
Sta. 9. No entries located.
Sta. 10. 112280, 112287.
Sta. 11. 111981, 111982, 111985, 111990, 112012 (type of *Vallonia sonorana* Pilsbry), 112075, 112077, 112083, 112273, 112274, 112282 (type of *Oreohelix hachetana* Pilsbry), 112288.
Sta. 12. 112267.

EXPEDITION OF 1922

Sta. 201. 158105 to 158107.
Sta. 202. 157899 to 157908.
Sta. 203. 158018, 158019 158024 to 158032 158108.
Sta. 204. 157696, 158020 to 158023, 158080 to 158084 158151.
Sta. 205. 157996 to 158003.
Sta. 207. 158004 to 158008.
Sta. 207a. 158111, 158112.
Sta. 208. 175853, 175910, 175911, 175913. (type of *Bulimulus dealbatus neomexicanus* Pilsbry), 176115.
Sta. 209. 158110, 164668, 165934, 175909, 176118.
Sta. 210. 165931 (type of *Sonorella hachitana orientis* Pilsbry), 165936.
Sta. 211. 165932, 165933.
Sta. 212. 158009 to 158017, 165909 (type of *Ashmunella organensis* Pilsbry) 165910, 165935.
Sta. 213. Paleozoic fossils.
Sta. 214. 158109, 175845, 176122.
Sta. 215. 158065 to 158068, 165912, 167507.
Sta. 216. 157909 to 157927.

Sta. 217. 157976 to 157995, 158142 to 158143 165914.
Sta. 218. 165911 (type of *Ashmunella rhyssa trifluviorum* Pilsbry).
Sta. 219. 165915.
Sta. 220. 158070 158071. 158131 to 158141 165916 166948.
Sta. 221. 165917.
Sta. 222. 165918.
Sta. 223. No entries located.
Sta. 224. 165919.
Sta. 225. 158122, 158124 to 158130.
Sta. 226. 165927 165937.
Sta. 227. 165926. 165941.
Sta. 228. 165928 166262.
Sta. 229. 157928 to 157940, 158121 165929. 166901.
Sta. 230. 158101 to 158104, 165920, (type of *Oreohelix strigosa nogalensis* Pilsbry), 166064 Itype of *Ashmunella townsendi nogalensis* Pilsbry -- the ANSP catalogue does not list a station number for this type; however, Pilsbry (1940: 933) indicated that it was taken half a mile above the mouth of Water Canyon, presumably at the lowermost of the three stations at which Ferriss collected on Oct. 21.I
Sta. 231. 165924.
Sta. 232. 165925, 165942.
Sta. 233. 158072 to 158073. 158085 to 158091. 165921. 165939.
Sta. 234. 158074, 158079, 165922. 166923, 165938.
Sta. 235. 158159 166936. 176114.
Sta. 236. 164666. 175844. 175849.
Sta. 237. 164663, 164665, 164667 175912, 176117.
Sta. 238. 158154, 158160(?) 158162.
Sta. 239. 158153, 158158, 158161. 176113.
Sta. 240. 158113 to 158120, 164662, 164664(?). 254988 (type of *Holospira montivaga* Pilsbry).
Sta. 241. Seemingly all collections from Pine Spring Canyon were combined under this single number, although the notes indicate that they were made at several different places. 142330 (type of *Humboldtiana ultima* Pilsbry), 157896 157897 (type of *Holospira montivaga breviara* Pilsbry), 158092 to 158100. 158152 164659 (type of *Ashmunella kochi amblya* (Pilsbry), 164660. 164661 176121.
Sta. 243. 176121.
Sta. 244 Notes indicate this station as south of Van Horn. The only catalogue entry found (166902) is, however, from 15 mi. N of Terlingua.
Sta. 245 and Sta. 246. The catalogue does not indicate station numbers for collections from the Chisos Mts. 132385 (type of *Humboldtiana chisosensis* Pilsbry), 166097 (type of *Polygyra chisosensis* Pilsbry. Pilsbry, 1940:621, incorrectly listed this specimen as ANSP 166077), 166098 to 166100, 166944 to 166947.
Sta. 247. 166101.
Sta. 248 and Sta. 249. A number of catalogued specimens seem to have come from the vicinity of these two stations. 157892 to 157895, 158155 to 158157, 166954 to 166956.

EXPEDITION OF 1935

Sta. 170. 166258.
Sta. 173. 166172 166173.
Sta. 189. 166153 (type of *Sonorella animasensis* Pilsbry).
Sta. 190. 166334, 166335.
Sta. 193. 166345 to 166349.
Sta. 195. 166353 to 166356 168049.
Sta. 196. 165982, 165983.

LITERATURE CITED

HOFF, C. C. (1961) Place names used by Pilsbry in his monograph of the Land Mollusca of North America. -- Bull. New Mexico Acad. Sci., 2: 50-57.
MAXWELL, R. A. (1968) The Big Bend of the Rio Grande. -- Bur. Econ. Geol. Univ. Texas at Austin, Guidebook 7: 1-138.
PEARCE, T. M. (1965) New Mexico place names, a geographical dictionary. -- Univ. of New Mexico Press, Albuquerque, xvi + 187.
PILSBRY, H. A. (1906) (No title). -- Nautilus, 20: 84.
----- (1910) (No title). -- Nautilus, 24: 84.
---- (1915) Mollusca of the southwestern states, VI: The Hacheta Grande, Florida, and Peloncillo Mountains, New Mexico. -- Proc. Acad. Nat. Sci. Philadelphia, 1915: 323-350.
---- (1926) James H. Ferriss, November 18 1849 - March 17, 1926. -- Nautilus, 40: 1-6.
---- (1940) Land Mollusca of North America (North of Mexico). -- Acad. Nat. Sci. Philadelphia, Monogr. III, 1(2): viii + 575-994.
TEXAS STATE HIGHWAY COMMISSION (1940) Texas, a guide to the Lone Star State. -- Hastings House, New York, xxxiii + 718.
WARNOCK, B.H. (1970) Wildflowers of the Big Bend Country, Texas. -- Sul Ross State University, Alpine, Texas, xix + 157.

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JEAN-JACQUES VAN MOL (Service de Zoologie systématique, Université Libre de Bruxelles, 1050 Bruxelles, Belgium) Anatomical studies in the families Urocyclidae and Helicarionidae.

W. LLOYD PRATT, Jr. (Fort Worth Museum of Science and History, Fort Worth, Tex.) Land snails of the Greer Islands Nature Center, Fort Worth, Texas.

C. J. BAYNE (Museum of Zoology, University of Michigan, Ann Arbor, Mich.) The movements of spermatozoa in basommatophoran snails.

GALE SPHON (Los Angeles County Museum of Natural History, Los Angeles, Calif.) Nudibranchs and their allies - a 45 minute color movie.

THOMAS BORKOWSKI (School for Marine and Atmospheric Sciences, University of Miami, Miami, Fla.) Reproductive biology of some South Florida Littorinids.

IDENTIFICATION SEMINAR

(Moderator, William Old)

(The following four papers were presented at this seminar).

HARALD A. REHDER (Division of Mollusks, U.S. National Museum, Washington, D. C.) The species of *Harpa*.

R. TUCKER ABBOTT (Delaware Museum of Natural History, Greenville, Del.) Helmet shells of the World.

WILLIAM E. OLD, Jr. & JOHN HOLEMAN, American Museum of Natural History, New York, N.Y.) Fossil shells under ultra-violet light.

WILLIAM E. OLD, Jr. Confusing species groups of *Conus*.

SYMPOSIUM ON BIOLOGICAL SYSTEMATICS OF MARINE BIVALVES AND GASTROPODS

Convener: Robert Robertson

(The following nine papers were to be presented at this symposium).

DOROTHY RAEIHLE (5346 82ND St., Elmhurst, N.Y.) Maintaining Florida marine mollusks in a New York City Apartment.

RUTH D. TURNER & J. L. CULLINEY (Museum of Comparative Zoology, Cambridge, Mass.) Some anatomical and life history studies related to bivalve systematics.

LARRY G. HARRIS (Department of Zoology, University of New Hampshire, Durham, N.H.) Comparative biology of two coral-eating nudibranchs of the genus *Phestilla* Bergh, 1874.

DAVID R. FRANZ (Department of Biological Sciences, University of Connecticut, Storrs, Conn.) Possible variability in larval development between populations of the cephalaspid opisthobranch *Acteocina canaliculata* (Say).

VIRGINIA O. MAES (Academy of Natural Sciences, Philadelphia, Pa.) Evolution of the toxoglossate radula and methods of envenomation.

BRUCE A. MILLER (45 Monroe St., Hyde Park, Reading, Pa.) Feeding mechanisms in the family Terebridae.

LANGLEY WOOD (Zoology Department, University of New Hampshire, Durham, N. H.) An integrated study of selected populations of *Urosalpinx cinerea*.

JEANNETTE W. STRUHSAKER (c/o Hawaii Institute of Marine Biology, Box 1067, Kaneohe, Hawaii) Population ecology of *Littorina*.

ROBERT ROBERTSON (Academy of Natural Sciences, Philadelphia, Pa.) Sexually dimorphic Archaeogastropods.

CONTRIBUTED PAPERS

DONALD R. MOORE (Institute of Marine Sciences, University of Miami, Miami, Fla.) *Cochliolepis parasitica*, a non-parasitic marine gastropod.

DAVID H. STANSBERY (Ohio State Museum, Columbus, Ohio) Growth of the naiad *Amblema plicata* (Say, 1817) in Lake Erie as related to habitat.

ANNUAL BUSINESS MEETING

The annual business meeting of the Union was held at the conclusion of the presentation of papers. In the evening of July 20, a cocktail party was followed by the annual banquet. The after dinner program included an address: 'Living Cephalopods' by Edward T. LaRoe, University of Miami, Miami, Florida.

Your editor regrets that he was unavoidably prevented from attending this meeting of the AMU, hence the paucity of detail concerning the various features of the meeting. No doubt this will be corrected in the annual report of the Union later this year.

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The account of this (thirty-sixth) annual meeting of the American Malacological Union begins on page 8 of this issue of Sterkiana, is continued on page 16, and concluded on this page.

A.L.

PLANORBIS LENTUS Say.

Fischer and Crosse (38, p. 65) restrict this species to the New Orleans form described by Say and do not consider that the figures given by Gould, Haldeman, Dunker and others represent the species. Dall (32, p. 86) refers it to *glabratus*.

PLANORBIS LIEBMANNI Dunker.

Is referred to *orbiculus* by Fischer and Crosse (38, p. 71), but is stated by Pilsbry (91, p. 322) to be distinct. It is the type of section *Tropicorbis* Brown and Pilsbry.

PLANORBIS MAGNIFICUS Pilsbry.

Planorbis magnificus Pilsbry, Naut., 1903, XVII, p. 75; Bartsch, Pr. U. S. Nat. Mus., XXXIII, 1908, p. 697, pl. 57, figs. 7-9.
Type locality: Cape Fear River, Wilmington, N. C.

PANORBIS MULTIVOLVIS Case.

Is a valid species and has been rediscovered at Howe Lake, Marquette Co., Mich. See Walker, 149, p. 61. Earlier citations of this species from Michigan, except the original one, and Newfoundland refer to *P. campanulatus rudentis*.

PLANORBIS NATHORSTI Westerlund.

Planorbis nathorsti Westerlund, Vega Exp., IV, 1887, p. 168.
Type locality: Aulatsivik, West Greenland.

PLANORBIS OCCIDENTALIS Cooper.

Planorbis occidentalis Cooper, Pr. Cal. Acad. Sci., IV, 1870, p. 99.
Type locality: Not given. Range: Washington Terr. to San José, Cal.
See *trivolvis*. Is the mature form of *tumens* according to Cooper (26, p. 89).

PLANORBIS OPERCULARIS Gould.

Planorbis lenticularis Sowerby, Con. Icon., Planorbis, 1876, Sp. 110, pl. 13, fig. 110.
Includes *planulatus* Cooper, *centervillensis* Tryon and *multilineatus* Van. (*oregonensis* Van.) as varieties according to Dall (32, p. 92), with *callioglyptus* Van. as a synonym of *planulatus*.

PLANORBIS OPERCULARIS MULTILINEATUS Vanatta.

Planorbis opercularis oregonensis Vanatta, Naut., IX, 1895, p. 54; *non* Tryon, 1865.
Planorbis opercularis multilineatus Vanatta, Naut., XIII, 1899, p. 48.
Type locality: Salem and Portland, Oregon.

PLANORBIS ORBICULUS Morelet.

Planorbis orbiculus Morelet, Test. Noviss., 1849, I, p. 17.
Includes *haldemani* Dunker (1850) *non haldemani* C. B. Adams (1849). Fischer and Crosse also include *liebmanni*, but Pilsbry (l. c.) considers it to be distinct.

PLANORBIS OREGONENSIS Tryon.

Planorbis oregonensis Tryon, Am. J. of Con., I, 1865, p. 231, pl. 22, fig. 17.
Type locality: Pueblo Valley, Oregon. See *trivolvis*.

PLANORBIS PARVUS Say.

Includes *billingsii* Lea according to Vanatta (136, p. 54) and Dall (32, p. 95) and *circumstriatus* Tryon according to Vanatta (l. c.).

PLANORBIS PARVUS WALKERI Vanatta.

Planorbis parvus walkeri Vanatta, Naut., XVI, 1902, p. 58.
Type locality: Hartland, Vt. Also Michigan.

PLANORBIS PERFORATUS "Gould?" Sowerby.

Planorbis perforatus Sowerby, Con. Icon., Planorbis, 1876, Sp. 105, pl. 13, fig. 105.
Type locality: United States.
Gould never described a *Planorbis* under this name. Clessin (20, p. 227) suggests that the species is perhaps from East Asia.

PLANORBIS PLANULATUS Cooper.

Is doubtfully referred to *P. opercularis* Gld. as a variety by Cooper (25, p. 100).

PLANORBIS PLEXATA Ingersoll.

Planorbis plexata Ingersoll, U. S. Geol. & Geog. Surv. Terr., 1874, p. 402, text-fig.
Type locality: St. Mary's Lake, Antelope Co., Col.
Is a var. of *trivolvis* according to Stearns (121, p. 105) and Cooper (26, p. 85).

PLANORBIS RUBELLUS Sterki.

Planorbis harni Pilsbry, Naut., IV, 1891, p. 137, *sine desc.*
Planorbis exacutus rubellus Sterki, I. and F. W. Moll., New Phila., 1894, p. 7.
Planorbis rubellus, Pilsbry, Naut., XIII, 1899, p. 51.
Type locality: Stone Creek Valley, Odbert's Station, O.

PLANORBIS SAMPSONI Ancey.

Planorbis sampsoni Ancey in Sampson, Bull. Sedalia N. H. Soc., No. 1, 1885, p. 10, text-fig.

Type locality: Flat Creek, Sedalia, Mo.

PLANORBIS SCALARIS (Jay).

Paludina scalaris Jay, Cat., 3rd ed., 1839, p. 112, pl. 1, figs. 8-9.

Physa scalaris Haldeman, Mon., 1842, p. 34, pl. IV, fig. 9; W. G. Binney, L. and F. W. Shells, Pt. II, 1865, p. 96, fig. 164.

Ameria scalaris Tryon, Mon., 1870, p. 168; Dall, Ann. N. Y. Lyc. N. H., IX, 1870, p. 356; Naut., III, 1889, p. 8.

Planorbis scalaris Pilsbry, Con. Ex., II, 1888, p. 113.

Physa (Thomsonia) carinifera Ancey, Le Nat., 1886, p. 358.

Type locality: Everglades of Florida.

Pilsbry (86, p. 287) states that this species is a *Planorbis*.

PLANORBIS SINUOSUS Bonnet.

Planorbis sinuosus Bonnet, Rev. & Mag. Zool., 1864, p. 280, pl. XXII, fig. 3.

Type locality: New Mexico.

Is referred to *glabratus* Say by Tryon (129, p. 183). Fischer and Crosse (38, p. 67) question this approximation, but as their opinion is based on Binney's figure (11, fig. 179), which does not represent Say's species, it is not of much value. However as *glabratus* is not known to occur outside of Florida, Tryon's suggestion is wrong anyway. Dr. Pilsbry informs me that it is *P. tumidus* Pfr.

PLANORBIS SUBCRENATUS DISJECTUS Cooper.

Planorbis subcrenatus disjectus Cooper, Pr. Cal. Acad. Sci., (2) III, 1890, p. 84, pl. 1, fig. 30.

Type locality: Tuolumne Meadows, Cal.

PLANORBIS TENUIS Phil.

Listed from the drift of the Santa Cruz River, Tucson, Ariz., by Pilsbry and Ferriss (109, p. 400).

PLANORBIS TRASKII Lea.

Planorbis traskii Lea, Jour. A. N. S. P., VI, 1866, p. 157, pl. XXIII, fig. 70; Obs., XI, 1866, p. 113, pl. XXIII, fig. 70.

Type locality: Kern Lake, Cal.

Dall (32, p. 88) considers this specifically distinct from *P. ammon*.

PLANORBIS TRIVOLVIS Say.

Includes *subcrenatus* Cpr., with *oregonensis* Tryon, *occidentalis* Cooper, and *tumens* Cooper, *non* Cpr., as synonyms and probably *hornii* Tryon according to Dall (32, p. 89). Pilsbry also (95, p. 65) lists *hornii* as a variety.

PLANORBIS TRIVOLVUS BINNEYI Tryon.

Planorbis corpulentus Gould, U. S. Expl. Exp., 1852, p. 114, fig. 130; Haldeman, Mon., 1844, p. 19, pl. III, figs. 7-9; W. G. Binney, L. & F. W. Shells, pt. II, 1865, p. 114, figs. 191-2; Sowerby, Con. Icon., 1877, Sp. 4, pl. I, fig. 4; pl. X, fig. 4b.
Planorbis binneyi Tryon, Am. J. of Con., III, 1867, p. 197.
Type locality: West Coast.

PLANORBIS UMBILICATELLUS Cockerell.

Planorbis umbilicatus Taylor, J. of Con., IV, 1885, p. 351, text-fig. *non* Müller (1774).
Planorbis umbilicatellus Cockerell, Con. Ex., 1885, II, p. 68.
Type locality: Brandon and Birtle, Manitoba. Ranges from New York to South Dakota. See also Vanatta (137, p. 117).

PLANORBIS VERMICULARIS Gould.

Is referred to *parvus* by Vanatta (136, p. 55), but is considered distinct by Dall (32, p. 95).

Genus SEGMENTINA Fleming, 1817.

Subgenus PLANORBULA Haldeman, 1842.

SEGMENTINA ARMIGERA (Say).

Dr. Pilsbry informs me that he has seen the type of *Planorbis lautus* H. Ads. and that it is a young specimen of this species.

SEGMENTINA ARMIGERA CAMPESTRIS Dawson.

Segmentina armigera campestris Dawson, Rep. Brit. N. A. Boundary Com., 1875, p. 349.
Type locality: Red River Valley, Canada.

SEGMENTINA CHRISTYI Dall.

Segmentina christyi Dall, Rep. Harriman Exp. XIII, 1905, p. 99, pl. 11, figs. 10-11.
Type locality: High Bluff, Manitoba; Fort Smith, Mackenzie River. Reported from South Dakota by Walker (151, p. 11).

SEGMENTINA CRASSILABRIS Walker.

Segmentina crassilabris Walker, Naut., XX, 1907, p. 122, pl. 7, figs. 4-6.
Type locality: Hamtramck, Wayne Co., Mich.

SEGMENTINA DECLIVIS (Tate).

Planorbis declivis Tate, Am. J. of Con., V, 1869, p. 159.
Type locality: San Augustin, Acoyapa, Nicaragua.

Cited by Dall (32, p. 98) from Umpqua River, Oregon.

Hannibal (53, p. 158) states that it has not been found by any of the local collectors in that region and questions the authenticity of the locality of Dall's specimens.

SEGMENTINA OBSTRUCTA (Morelet).

Planorbis obstructus Morelet, Test. Noviss. I, 1849, p. 17.
Planorbis berendti Tryon, Am. J. of Con., II, 1866, p. 10, pl. 2, figs. 14-16.
Type locality: Carmen Island, Yucatan.

"Occurs abundantly in Texas as far north as Austin." (Pilsbry 91, p. 322. See also Pilsbry and Ferris, 106, p. 166.) In the absence of a figure of this species in any American publication, I have quoted that of *berendti* Tryon from Mexico, which is considered a synonym by Fischer and Crosse (38, p. 78) and von Martens (73, p. 398).

SEGMENTINA WHEATLEYI (Lea).

Planorbis wheatleyi Lea, Jour. A. N. S. P. VI, 1866, p. 158, pl. 23, fig. 71; Obs. XI, 1866, p. 113, pl. 23, fig. 71.
Segmentina wheatleyi Walker, Naut. XX, 1907, p. 123, pl. VII, figs. 7-9.

Dall (32, p. 97) has proposed a new section, *Haldemanina*, for this species, based on the "complex, dentiform and ridgelike" lamellæ, but these differ from those of the other species (*armigera* and *crassilabris*) only in degree. See Pilsbry and Ferriss (106, p. 166) and Walker (l. c.).

Subfamily POMPHOLIGINÆ Dall, 1866.

Genus POMPHOLYX Lea, 1856.

POMPHOLYX LEANA H. and A. Adams.

Pompholyx leana H. and A. Adams, Pr. Zool. Soc. London, 1863, p. 434.
Type locality: West Columbia.

POMPHOLYX SOLIDA Dall.

Pompholyx var. *solida* Dall, Ann. N. Y. Lyc. Nat. Hist., IX, 1870, p. 335, pl. II, fig. 7a.
Type locality: West Columbia.

Dall states that his species is clearly not *effusa* Lea, but that in the absence of typical specimens of *P. leana* H. and A. Adams described from W. Columbia it still remains doubtful whether it belongs to the latter

Genus CARINIFEX W. G. Binney, 1863.

Megastropha Lea, 1866

CARINIFEX NEWBERRYI MINOR Cooper.

Carnifex newberryi var. ? *minor* Cooper, Pr. Cal. Acad. Sci., IV, 1870, p. 98.
Type locality not stated.

CARINIFEX PONSONBYI E. A. Smith.

Carinifex ponsonbyi E. A. Smith, P. Z. S. Lond., 1875, p. 536, text-fig.
Planorbis ponsonbyi Sowerby, Con. Icon., Planorbis 1876, Sp. 80, pl. X, figs. 80a-b.
Type locality: California.

Call (16, p. 149) states that the figure in the P. Z. S. is interchanged with that of *Diala leithii* described at the same time.

Family PHYSIDÆ.

Genus PHYSA Draparnaud.

Dall (32, p. 100) has proposed the following arrangement:

Section PHYSA s. s.

Type *P. fontinalis* L.

Section COSTATELLA Dall.

Type *P. costata* Newcomb.

For an excellent revision of the Eastern American species, see Crandall, No. 27.

Von Martens (73, p. 368) has proposed the subgenus *Alampetis* for the North American and Mexican species with a dull, not glossy, surface and (often) thickened lip. He gives no type, but mentions *P. ancillaria* as an example.

PHYSA ALBOFILATA Ancey.

Physa albofilata Ancey, in Sampson, Rep. Geol. Surv. Ark., II, 1891, p. 194.
Type locality: West Leatherwood Creek, Eureka Springs, Carroll Co., Ark.
See *gyrina*.

PHYSA ALTONENSIS Lea.

Physa altonensis Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 164, pl. 24, fig. 82; Obs., XI, 1866, p. 125, pl. 24, fig. 82.
Type locality: Alton, Ills.

Is *elliptica* according to Tryon (132, p. 163) and an abnormal *gyrina* according to Crandall (27, p. 71).

PHYSA AMPULLACEA Gould.

Includes *P. lordi* Bd., *propinqua* Try. and *coniformis* Try. as varieties according to Cooper (25, p. 98).

According to Henderson and Daniels (56, p. 52) it is possible that Lea's *P. huttallii* may be this species. If so it would have priority.

PHYSA AMPULLACEA COLUMBIANA Hemphill.

Physa ampullacea columbiana Hemphill, Naut., IV, 1890, p. 27.
Type locality: Columbia River, Astoria, Oregon.

PHYSA AMYGDALUS Sowerby.

Physa amygdalus Sowerby, Con. Icon., Physa, 1873, Sp. 65, pl. 8, fig. 65.
Type locality: Texas.

PHYSA ANATINA Lea.

Physa anatina Lea, Pr. A. N. S. P., 1864, p. 115; Jour. A. N. S. P., VI, 1866, p. 171, pl. 24, fig. 94; Obs., XI, 1866, p. 127, pl. 24, fig. 94.
Type locality: Northern tributary of the Arkansas River, Kans.

PHYSA ANCILLARIA Say.

According to von Martens (73, p. 374) *Physa suberata* Mke. belongs to this species and not to *P. heterostropha* Say as supposed by Binney and is represented by fig. 1, pl. III of Haldeman's Monograph.

PHYSA ANCILLARIA CRASSA Walker.

Physa ancillaria crassa Walker, Naut., XIV, 1901, p. 98.
Type locality: Higgins Lake, Roscommon Co., Mich.
Types No. 1471 Coll. Walker.

PHYSA ANCILLARIA MAGNALACUSTRIS Walker.

Physa ancillaria magnalacustris Walker, Naut., XIV, 1901, p. 97.
Type locality: Frankfort, Benzie Co., Mich.
Types No. 9214 Coll. Walker.

PHYSA APLECTOIDES Sterki.

Physa aplectoides Sterki, Pr. O. St. Acad. Sci., IV, 1907, p. 381.
Type locality: Portage and Tuscawaras Co's., O. Also Isle Royale and Schoolcraft County, Michigan.

PHYSA AUREA Lea.

Is a synonym of *elliptica* and not of *heterostropha* according to Tryon (132, p. 163) and Crandall (27, p. 55).

PHYSA BILLINGSII Heron.

Physa billingsii Heron, Tr. Ott. F. Nat. Club, I, 1880, p. 62, pl. 2, fig. 5.
Type locality: Billings' Bridge, Ottawa, Ont.
Is a var. of *integra* according to Crandall (27, p. 15).

PHYSA BINNEYANA Ancey.

Physa diaphana Tryon, Am. J. of Con. I, 1865, p. 224, pl. 23, fig. 11, *non* Krauss (1848).
Physa binneyana Ancey, Le Nat., 1886, p. 358.
Type locality: Oakland, Cal.

PHYSA BLANDI Lea.

Physa blandi Lea, Pr. A. N. S. P., 1864, p. 116; Jour. A. N. S. P., VI, 1866, p. 168, pl. 24, fig. 88; Obs., XI, 1866, p. 124, pl. 24, fig. 88.
Type locality: California.
Includes *distinguenda* Try. and "?" is the same as *grosvernori* Lea and *nuttallii* Lea according to Cooper (25, p. 97). Both of the latter names have priority.

PHYSA BREVISPIRA Lea.

Physa brevispira Lea, Pr. A. N. S. P., 1864, p. 116; Jour. A. N. S. P., VI, 1866, p. 173, pl. 24, fig. 98; Obs., XI, 1866, p. 129, pl. 24, fig. 98.
Type locality: Ottawa River, Ont.

PHYSA CARLTONII Lea.

Physa carltonii Lea, Pr. A. N. S. P., 1869, p. 125; Jour. A. N. S. P., VIII, 1874, p. 63, pl. 21, fig. 19; Obs., XIII, 1874, p. 67, pl. 21, fig. 19.
Type locality: Mount Diablo, Cal.

PHYSA CONIFORMIS Tryon.

Physa coniformis Tryon, Am. J. of Con., II, 1866, p. 6, pl. II, fig. 5.
Type locality: Humboldt River, Oregon.

PHYSA COOPERI Tryon.

Physa cooperi Tryon, Am. J. of Con., I, 1865, p. 224, pl. 23, fig. 9.
Type locality: Crane Lake Valley, Cal.
Is a variety of *P. triticea* Lea according to Cooper (25, p. 97).

PHYSA CRANDALLI Baker.

Physa rhomboidea Crandall, Naut., XV, 1901, p. 44, pl. II, figs. 6-7, *non* Meek and Hayden (1856).
Physa crandalli Baker, Tr. Acad. St. Louis, XVI, 1906, p. 8.
Type locality: Cedar and Muddy Creeks, Sedalia, Mo. Also Dardenelles and Sulphur Springs, Ark., and Las Vegas, N. M.
Types No. 40775 Coll. Walker.
According to Springer (120, p. 513) is a synonym of *P. humerosa*.

PHYSA CROCATA Lea.

Physa crocata Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 169, pl. 24, fig. 90; Obs., XI, 1866, p. 125, pl. 24, fig. 90.
Type locality: Lafayette, Walker Co., Ga.
Is closely allied to *microstoma* Hald. according to Crandall (27, p. 70).

PHYSA CUPREONITENS Cockerell.

Physa cupreonitens Cockerell, J. of Con., VI, 1889, p. 63.
Type locality: Hot Spring, Wellsville, Colo.
Though described as a distinct species, in the text it is called a subspecies of *heterostropha*.

PHYSA CUBENSIS Pfeiffer.

Physa cubensis Pfeiffer, Wiegm. Archiv., I, 1839, p. 354.
Physa heterostropha peninsulæ Pilsbry, Naut., XIII, 1899, p. 48; ibid, XIII, 1899, p. 70.
Type locality: Cuba. Also Miami and elsewhere in Florida. See Rhoads (113, p. 48).

PHYSA DEFORMIS Currier.

Physa deformis Currier, Am. J. of Con., III, 1867, p. 112, pl. 6, fig. 1.
Type locality: Grand Rapids, Mich.
Is *elliptica* Lea according to Crandall (27, p. 54).

PHYSA DISTINGUENDA Tryon.

Physa distinguenda Tryon, Am. J. of Con., I, 1865, p. 225, pl. 23, fig. 6.
Type locality: Marysville and Stockton, Cal.

PHYSA DORBIGNYANA Lea.

Physa striata Lea, Pr. A. N. S. P. 1864, p. 115, *non* d'Orbigny (1853), *nec* Menke (1830).
Physa dorbignyana Lea, Jour. A. N. S. P., VI, 1866, p. 166, pl. 24, fig. 85; Obs., XI, 1866, p. 123, pl. 24, fig. 85.
Type locality: Monterey, Cal.
Is a synonym of *P. virgata* Gld. according to Pilsbry and Ferriss (108, p. 198).

PHYSA ELLIPTICA Lea.

Is a valid species according to Crandall (27, p. 54) and includes *troostiana* Lea and *minor* Crandall as varieties and *aurea, febigeri* and *nicklinii* Lea and *deformis* Currier as synonyms. Baker's figures (4, pl. 34, fig. 5), copied by Blatchley and Daniels (14, pl. I, fig. 118) do not represent the true *elliptica.*

PHYSA ELLIPTICA MINOR Crandall.

Phýsa elliptica minor Crandall, Naut., XV, 1901, p. 55.
Type locality: Grand Rapids, Mich.
Types No. 14469 Coll. Walker.

PHYSA FEBIGERI Lea.

Physa febigeri Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 174, pl. 24, fig. 99; Obs., XI, 1866, p. 130, pl. 24, fig. 99.
Type locality: Logan Co., O.
Is *elliptica* according to Tryon (132, p. 163) and Crandall (27, p. 55).

PHYSA FORSHEYI Lea.

Physa forsheyi Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 172, pl. 24, fig. 95; Obs., XI, 1866, p. 128, pl. 24, fig. 95.
Type locality: Rutersville, Texas.
Includes *whitei* Lea according to Crandall (27, p. 67).

PHYSA FRAGILIS Mighels.

Is a pathologic form of *ancillaria* according to Morse (75, p. 43).

PHYSA GROSVERNORI Lea.

Physa grosvernori Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 175, pl. 24, fig. 100; Obs., XI, 1866, p. 131, pl. 24, fig. 100.
According to Cooper (25, p. 97) includes *P. traskii* Lea, *occidentalis* Try., *dorbignyana* Lea and *sparsestriata* Try. as varieties.
Type locality: Santa Rita Valley.
Is a var. of *forsheyi* according to Crandall (27, p. 69).

PHYSA GYRINA Say.

Includes *cylindrica* Newc., *altonensis, hawnii* and *smithsoniana* Lea as synonyms and *albofilata* Ancey, *hildrethiana* Lea and *oleacea* Tryon as varieties according to Crandall (27, p. 45).

PHYSA HALEI Lea.

Physa halei Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 165, pl. 24, fig. 83; Obs., XI, 1866, p. 121, pl. 24, fig. 83.
Type locality: Alexandria, La.

PHYSA HAWNII Lea.

Physa hawnii Lea, Pr. A. N. S. P., 1864, p. 115; Jour. A. N. S. P., VI, 1866, p. 165, pl. 24, fig. 84; Obs., XI, 1866, p. 121, pl. 24, fig. 84.
Type locality: Verdigris River, Kans.
Is *gyrina* according to Tryon (132, p. 162) and Crandall (27, p. 84).

PHYSA HETEROSTROPHA Say.

Includes *lata* and *primeana* Tryon according to Crandall (27, p. 29).

PHYSA HETEROSTROPHA ALBA Crandall.

Physa heterostropha alba Crandall, Naut., XV, 1901, p. 29.
Type locality: Cedar Lake, Capachet, N. Y.
Types No. 40747 Coll. Walker.

PHYSA HUMEROSA Gould.

Includes *rhomboidea* Crandall (*crandalli* Baker), according to Springer (120, p. 513).

PHYSA INTEGRA Haldeman.

Includes *billingsii* as a var. according to Crandall (27, p. 56).

PHYSA LATA Tryon.

Physa lata Tryon, Am. J. of Con., I, 1865, p. 227, pl. 23, fig. 7.
Type locality: Juniata River, Hallidaysburg, Pa.
See *heterostropha*.

PHYSA LORDI Baird.

Physa parkeri Currier, Kent Sci. Inst., Misc. Pub., 1868, p. 7 (no desc.); DeCamp, Kent Sci. Inst., Misc. Pub., No. 5, 1881, p. 15, pl. 1, fig. 3.
Type locality (*parkeri*): Houghton Lake, Mich.
Types (*parkeri*) No. 11997 Coll. Walker.
Henderson and Daniels (56, p. 75) suggest that the Michigan and Canadian forms differ markedly from the typical western form.

PHYSA MALLEATA Tryon.

Physa malleata Tryon, Am. J. of Con., I, 1865, p. 225, pl. 23, fig. 14.
Type locality: Hell Gate River, Oregon.

PHYSA MARGARITA Lesson.

Physa margarita Lesson, Rev. Zool., 1840, p. 356.
Type locality: Newfoundland.

PHYSA MEXICANA CONOIDEA Fischer and Crosse.

Physa mexicana conoidea Fischer and Crosse, Moll. Mex., II, 1886, p. 101, pl. 39, figs. 8-8a.
Type locality: Mehedin, Mexico.
Also McLennan Co., Texas, see Strecker, 126, p. 64.

PHYSA NIAGARENSIS Lea.

Physa niagarensis Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 168, pl. 24, fig. 97; Obs., XI, 1866, p. 124, pl. 24, fig. 97.
Type locality: Niagara River, N. Y.
Is referred to *integra* by Tryon, (132, p. 167), but Crandall (27, p. 55) considers it distinct.

PHYSA NICKLINII Lea.

Physa nicklinii Lea, Pr. A. N. S. P., 1864, p. 114; Jour. A. N. S. P., VI, 1866, p. 175, pl. 24, fig. 101; Obs., XI, 1866, p. 131, pl. 24, fig. 101.
Type locality: Callaghan's, Alleghany Co., Va.
Is *elliptica* according to Tryon (132, p. 163) and Crandall (27, p. 55).

PHYSA NUTTALLII Lea.

Physa nuttallii Lea, Pr. A. N. S. P., 1864, p. 116; Jour. A. N. S. P., VI, 1866, p. 171, pl. 24, fig. 93; Obs., XI, 1866, p. 127, pl. 24, fig. 93.
Type locality: Lewis River, Oregon.
See *ampullacea*.

PHYSA OCCIDENTALIS Tryon.

Physa occidentalis Tryon, Am. J. of Con., I, 1865, p. 226, pl. 2, fig. 8.
Type locality: San Francisco and numerous other localities in California and Oregon.

PHYSA OLEACEA Tryon.

Physa oleacea Tryon, Am. J. of Con., II, 1866, p. 6, pl. II, fig. 6.
Type locality: Bridgeport, Ala., and Lake Superior.
Is *elliptica* according to Tryon (132, p. 163). Crandall states (27, p. 45) that Tryon himself admitted this obvious error and considers it to be a var. of *gyrina*. Baker (5, p. 492) considers it to be simply an immature stage of typical *gyrina*.

UNITAS MALACOLOGICA EUROPAEA

IV EUROPEAN MALACOLOGICAL CONGRESS

The Fourth European Malacological Congress will be held in Geneva, Switzerland, from September 7 to 11, 1971. It will follow a one-day meeting of museum curators in charge of Mollusca, devoted to the discussion of curatorial problems and collaboration. The meetings will take place in the new Museum of Natural History and eventually also in the University buildings. All malacologists are cordially invited.

Accommodation will be arranged by the Tourist office in hotels and the Student hostel.

Congress fee is S.Fr. 30.- (about $7.00) for members and corresponding members of U.M.E., S. Fr. 40.- (about $9.00) for non members, S. Fr. 15.- (about $3.50) for students and accompanying persons.

If you are interested and have not received the circulars, please contact the Organizing Committee for more detailed information.

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