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A NEW CLASSIFICATION OF THE SHIPWORMS AND
DESCRIPTIONS OF SOME NEW WOOD
BORING MOLLUSKS.

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In the preparation of a monograph on the American shipworms a lot of interesting facts have come to light, among which are points pertaining to classification. These are deemed of sufficient importance to merit this preliminary paper, which furnishes a simple key to the generic and subgeneric groups of the shipworms. I have also added descriptions of a number of new forms, the latter having attracted considerable attention of late on account of the economic problems associated therewith. All these forms will be fully illustrated in the monograph which is almost ready for the press. It has been deemed unnecessary to cite the rather extensive, involved synonymy in the synopsis. This also will be done in the monograph.

A Key to the Genera and Subgenera of the Family Teredidae.

- Pallettes consisting of a series of cone-in-cone structures *Bankia*.
 Cone-in-cone elements entirely free at their distal end.
 Distal ends of the cones terminating in a thin membrane.
 Membrane of the cones fimbriated distally.
 Lateral fimbriations developed into long awnlike projections
Bankia.
 Lateral fimbriations not developed into long awnlike projections.
 Membrane of the cones not fimbriated distally.
 Membrane of the cones denticulated distally **Neobankia**.
 Membrane of the cones not denticulated distally.
 Membrane of the cones entire distally **Bankiella**.
 Cone-in-cone elements not entirely free at their distal end.
 Cones almost fused on the outside where they are covered by a thick
 periostracum *Nausitora*.

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- Pallettes not consisting of a series of cone-in-cone structures . . . *Teredo*.
- Pallettes paddle-shaped.
 - Terminal portion of the blade cupped.
 - Cup single *Teredo*.
 - Cup not single.
 - Cup rendered double by a median septum . . . **Teredothyra**.
 - Terminal portion of the blade not cupped.
 - Terminal portion of the blade ending in a forked tip . . . *Lyrodus*.
 - Terminal portion of the blade not ending in a forked tip.
 - Terminal portion ending in a calcified knob **Teredops**.
- Pallettes not paddle-shaped.
 - Pallettes spoon shaped.
 - Terminal portion of the blade cupped *Neoteredo*.
 - Terminal portion of the blade not cupped **Teredora**.

Bankia was proposed by Gray in 1840,¹ and *Teredo bipalmulata* Lamarek was designated as type by him in 1847.²

Neobankia new subgenus, type *Bankia* (*Neobankia*) *zeteki* new species.

Bankiella new subgenus, type *Bankia* (*Bankiella*) *mexicana* new species.

Nausitora was proposed by Wright in 1864³ type *Nausitora dunlopei* Wright.

Teredo was proposed by Linnæus in 1758,⁴ type *Teredo navalis* Linnæus.

Teredothyra new subgenus, type *Teredo* (*Teredothyra*) *dominicensis* new species.

Lyrodus was proposed by Gould in 1870,⁵ type *Lyrodus chlorotica* Gould.

Teredops new subgenus, type *Teredo diegensis* Bartsch.

Neoteredo Bartsch, 1920,⁶ type *Teredo* (*Neoteredo*) *reynei* Bartsch.

Teredora new subgenus, type *Teredo malleolus* Turton.

***Bankia* (*Neobankia*) *zeteki*, new species.**

Shell subglobular, white, the extreme anterior portion with the usual sinus and reflected smooth callus at its external border, the main portion bearing the dental ridges, which radiate from the anterior margin, where they are closely crowded, backward to the junction with the posterior median portion. Here they are separated by spaces about twice as wide as the ridges. These ridges are finely denticulated at their free margin. Seventy of these ridges are apparent, but at least twenty more appear to have been eroded at the umbonal end. The anterior median area is rather broad, and bears the closely crowded, strongly denticulated ridges, which are separated by mere lines. These ridges terminate in a straight line posteriorly. The middle portion of the median part is marked by the usual groove that extends from the umbones to the basal margin, and this groove

¹Synop. Brit. Mus., p. 76.
²Proc. Zool. Soc. London, p. 188.
³Trans. Linn. Soc., vol. 24, pp. 451-4.
⁴Syst. Nat., 10th ed., p. 651.
⁵Inv. Mass., p. 34.
⁶Proc. Biol. Soc. Washington, vol. 33, pp. 69-70.

is crossed by strong lines of growth, which extend over the posterior median part. The anterior part forms a strong auricle, which is conspicuously separated from the posterior median portion, the shell here bending strongly inward. The auricle is marked by more or less curved lines of growth, which give one the false impression of raised cords. The interior of the shell is bluish white. The umbone projects inward as a strong knob, and the blade springs from deep within the umbones, and makes a decided curve, the early portion having the broad side of the blade parallel to the inner surface of the shell, that is within the umbones, while within the median portion of the shell the blade becomes twisted, so that it assumes an oblique position to the inner surface of the shell. The suture of the anterior and the median portion is marked by a slightly tumid area. The middle median portion is decidedly roughened and bears the usual knob at the ventral margin. The auricle extends over the median portion on the inside as a strong shelf. The inside of the auricle shows the same translucent cordlike lines apparent on the exterior. The pallettes are of the cone-in-cone shape variety, the individual cones being semicircular in cross section, the inner free border being straight, while the outer is curved. The cone elements are rather distantly spaced. The free margin of the membrane of these cone-in-cone elements is finely denticulated.

The type, Cat. No. 341,128, U. S. N. M., was taken from greenheart timber of the canal locks at Balboa, Canal Zone, by Mr. James Zetek, and measures: length, 10.2 mm.; altitude, 9.5 mm. The pallettes measure: length, 12 mm., but they are probably longer because the basal stalk seems slightly broken. 8 mm. of this length go to the blade. Diameter of pallettes, 3.4 mm.

Bankia (Bankiella) mexicana, new species.

Shell subglobular. Anterior portion, excepting the extreme smooth caloused area, brown; the rest of the shell white. The extreme anterior portion forms a sinus from which a thin callus is reflected over the anterior dental ridge bearing portion. The dental ridges radiate from this anterior smooth area backward, spreading out more or less fan-shaped, the spaces between the ridges becoming wider toward their distal end, where they are about twice as wide as the dental ridges. These dental ridges are rather coarsely denticulated at their free margin. Fifty-one of these ridges can be counted, though it is possible that some of the earlier ones have been lost through the erosion of the umbones. The denticles on these dental ridges are not nearly as strong as those on the anterior median portion. The dental ridges on this part are closely crowded and separated by mere impressed lines. They terminate posteriorly in a straight line that extends from the umbones to the ventral margin. The middle median portion is a slightly concaved area extending from the umbone to the ventral margin, and this part is crossed by curved rough wrinkles which evanesce on the posterior median portion. The median groove bears a strongly rounded knob at the ventral margin. The posterior portion forms a strong auricle which is separated from the median by a sudden depression in the curve of the shell. The interior of the shell is bluish white. A strong knob marks the umbones,

from the inside of which the slender blade curves downward into the cavity of the shell. This blade has its broad side obliquely placed to the inner curvature of the shell. The anterior portion is separated from the median by a thickened cord, and a roughened area marks the middle median portion of the shell. The posterior area projects over the posterior median portion as a shelf. The pallettes are of the cone-in-cone type, the distal margin of the cones being entire.

The type, Cat. No. 194, 176a, and a lot of additional specimens, were collected by Mr. C. R. Orcutt on dead mangroves at Sinaloa, Mexico. The type measures: length, 7 mm.; altitude, 6.5 mm. The pallettes are all fragmentary, and hence it is impossible to give their measurement.

***Teredo (Teredo) parksi*, new species.**

Shell subglobular, milk white; interior bluish white. The anterior portion is edged by a thick, decidedly curved callus-like smoothish area, from which the dental ridges curve at first downward and then gradually and steadily outward, forming almost straight lines for the major portion of their length. These dental ridges are a little narrower than the spaces that separate them, and are of triangular shape, sloping a little more gently ventrally than dorsally. The extreme edge is exceedingly, finely denticulated. The posterior edge of the anterior portion joins the anterior edge of the median portion in such a way that the dental ridges of the two form almost right angles. About ninety-five of these dental ridges can be counted on the anterior part. The anterior median portion is crossed by slender dental ridges, which are separated by very narrow grooves and bear rather prominent denticles. The erosion of the umbone makes it impossible to see exactly how many of these dental ridges occur, but there must be at least as many as we found on the anterior part. The middle median portion is a narrow roughened zone extending from the umbones to the ventral margin, which is not concave, as is usually the case. The posterior part of the median portion is marked by rather strong irregular upward curved lines of growth. The posterior portion forms a short auricle, which is crossed by rather regular lirations, which are really intensified lines of growth that coincide with the outer margin in disposition. In the interior a somewhat thickened ridge marks the junction of the anterior and median portions. The middle median portion is marked by a strong, irregular roughened area, while the posterior portion overlaps the posterior median portion in such a way as to form a slight shelf having a decided cavity behind it. A strong, flattened, broad, rough, irregular blade extends two-thirds of the distance from behind the knoblike umbones toward the ventral edge of the shell. The outer border of this blade keeps almost at an even distance from the shell. The basal portion of the median part has a strong knob which extends as a thickening for some little distance into the interior of the shell. The pallettes are spatulate, having a very long, very slightly curved flexuous stalk, the spatulate portion being decidedly excavated at the tip, and covered with a brown epidermis. The siphons in this species are almost equal and project in the alcoholic material about half the length

of the pallettes beyond these. The base of the siphons and the base of the pallettes are surrounded by a membrane that forms a cuplike structure. The siphons extend about the length of the pallettes beyond the termination of the pallettes and are separated throughout the distance that extends beyond the pallettes.

The type, Cat. No. 341,132, U. S. N. M., was taken by the author from pilings in Pearl Harbor, Oahu, Hawaiian Is. It measures: height, 9 mm., length, 8.5 mm.; thickness, 9 mm. The pallettes measure: length, 6 mm., of which 2.5 mm. go to the blade, which has a diameter of 2 mm.

I take great pleasure in naming this shipworm for Admiral C. W. Parks, Chief of the Bureau of Yards and Docks, to whom I am indebted for much help in connection with shipworm problems.

***Teredo (Teredo) beachi*, new species.**

Shell subglobular, with a strong posterior auricle. Exterior milk white, excepting the umbones and a streak in the median middle portion, which are rose colored; interior bluish white. The anterior portion forms a deep sinus which is bordered by a narrow smooth edge, the external margin of which is reflected over the anterior portion as a smooth callus, which is translucent and permits the dental ridges covered by it to be seen through it. The dental ridges radiate from this anterior smooth portion fanshaped backward over the rest of the anterior area. There are about thirty-five of these in the type, although some of the earlier ones may have been lost through the erosion of the umbones. The dental ridges, which are finely denticulated at their free margin, are about one-third as wide as the flattened spaces that separate them at the junction of the anterior with the median portion. The flattened interspaces are finely striated, the striations coinciding with the dental ridges. The dental ridges of the anterior portion meet those of the posterior median portion at almost right angles. The dental ridges of the posterior median portion are closely crowded, being separated by a mere line only. They are very strongly denticulated. The middle median portion is a somewhat depressed area, which extends from the umbone to the ventral margin. There is a strongly impressed line marking the center of this area, which is crossed by rather rough, curved incremental lines which extend equally rough over the posterior median portion. The posterior portion forms a strong auricle, which is marked by rough lines of growth. The interior has the umbones strongly curved inward, forming a prominent knob, from the inside of which a strong, broad, thin blade extends, which maintains almost an equidistance from the inside of the shell throughout its entire length, the broad side of the blade being placed obliquely to this. The junction of the anterior and median portion is marked by a slightly thickened ridge on the inside. The center of the median portion is marked by a roughened area which extends from the umbones to the ventral margin, where the usual strong knob is present. The auricle extends over the posterior median portion and forms a narrow, thin, free shelf, with very little of a cavity behind it. The auricle is marked by strong, curved lines of growth. The pallettes are spatulate, very short stalked and very broad,

the distal dark portion being decidedly hollowed out, almost suggesting a basal joint of *Bankia*. Of the animal we may say that the siphons are of unequal thickness but almost of equal length. They are tipped with numerous rose colored spots. They extend about half the length of the spatulate portion of the pallettes, and are split to the base of the spatulate portion. A broad collar in the shape of a membrane surrounds the stalked portion of the pallettes and extends down over the rest of the animal for a length equal to the exposed part of the siphons.

The type, Cat. No. 341,155, U. S. N. M., was collected in San Pablo Bay, California. It measures: height, 5.5 mm.; length, 6 mm.; thickness, 7 mm. The pallettes measure: length, 5.5 mm., of which 2 mm. go to the stalk; width, 2 mm.

Thanks to the help of Captain Edward L. Beach, the Commandant of the Mare Island Naval Station, who placed at my disposal the necessary equipment for extracting and examining infested pilings, I was able to make a large collection of this species, which has been causing the extensive ravages in San Pablo Bay and the adjacent region in recent years. I therefore take great pleasure in naming this species in honor of the Captain.

***Teredo (Teredothyra) dominicensis*, new species.**

Shell subglobular, compressed, cream yellow, the extreme anterior portion bearing a notch whose external border is reflected as a smooth fold over the outer portion of the shell, but not appressed to it. Immediately back of this are the dental ridges, which appear to radiate more or less fanlike from the anterior margin. They are closely crowded at the anterior margin, but become regularly more distantly spaced as they pass from the anterior to the posterior termination. At the latter place they are about two and a half times the width of the ridges. These ridges are exceedingly finely denticulated at their free margin; thirty-four of these are visible, but this is not all, for the earliest are partly covered by the anterior reflection, and some have probably been lost by the erosion of the umbones. These ridges join the dental ridges of the anterior median portion in a little more than a right angle. The latter are very closely crowded, the spaces between them being mere impressed lines. The dental ridges of the anterior median portion are a little more strongly denticulated than the dental ridges on the anterior portion. In about the middle of their length they separate from their closely packed condition, taking a decidedly backward slant on the early portion of the shell, and a lesser angle on the last portion. The middle of the median portion is but a roughened groove, which extends from the umbone to the ventral margin. The posterior portion is about twice as wide as the anterior median, and is marked by rather strong lines of growth. In fact, it would almost seem as if the attenuated dental ridges, after bending over the median groove, continued as smooth raised threads over the posterior median portion. The median portion, compared with *Teredo* in general, is rather narrow. The posterior portion forms a moderately large auricle which on the external surface is marked by lines of growth and a few roughened ridges. The interior of the shell is bluish white. The um-

bones project into the interior of the shell as a strong boss, from the under side of which the slender blade curves downward basally. The narrow portion of the blade is parallel with the inside of the shell. The median portion is smooth, although it shows the groove that corresponds with the external depression, and bears the usual knob at the ventral margin. The posterior auricle does not project into the cavity of the interior to form a shelf, but fuses smoothly with the median portion. The auricle shows lines of growth markings on the inside. The pallettes are short stalked, the stalk being more or less irregularly curved. The expanded blade is hollow throughout its length, the cavity being divided into two chambers by a median septum.

The type and some additional specimens, Cat. No. 341,129, U. S. N. M., come from a small piece of wood collected by the U. S. Coast Survey Steamer Blake at Station 192, in 138 fathoms off Dominica, West Indies. The type measures: length, 2.3 mm.; altitude, 2.2 mm. The pallette measures: length, 2.5 mm., of which 1.2 mm. belong to the stalk. Width of pallette, 1.1 mm.

XYLOPHAGA.

An examination of the West American specimens belonging to the genus *Xylophaga* Turton in the collections of the United States National Museum shows that in addition to *Xylophaga mexicana* Dall we will have to recognize two new species. The three species have quite distinctive characters, and also occupy separate zoogeographic ranges.

The exterior surface of the shell *Xylophaga* is not unlike that of *Teredo* and *Bankia* but the posterior end does not gape and the posterior auricular portion is not differentiated from the median. A broad median sulcus extends over the exterior of the shell from the umbones to the ventral margin and a strong lamina a little anterior to the middle of the sulcus reinforces the shell on the inside. This lamina is marked at more or less regular intervals by slight constrictions which give to it an articulated appearance.

Xylophaga, like *Teredo* and *Bankia*, burrows in wood, but lacking the long siphonal portion characteristic of those genera, the burrows are correspondingly shallow. They are usually quite abundant and their burrows may completely honeycomb and riddle the piece of wood affected.

The following key will help to differentiate the species:

Ridges on the anterior portion strong and distantly spaced . . . *washingtona*

Ridges on the anterior portion not strong and distantly spaced.

Ridges on the anterior portion slender and closely spaced.

Anterior median area broad *mexicana*

Anterior median area narrow *californica*

***Xylophaga mexicana* Dall.**

In *Xylophaga mexicana* there are twenty denticulated ridges to the millimeter in the center of the posterior area and the denticulated ridge bearing posterior median portion is 1.7 mm. in width at the angle of the junction of the posterior with the median part.

The type (Cat. No. 172,947, U.S.N.M.) comes from the U. S. Bureau of Fisheries Albatross Station 3422, off Acapulco, Mexico, dredged in 141 fathoms on mud bottom. The type measures: length, 5.1 mm.; altitude, 4.5 mm.

***Xylophaga californica*, new species.**

In *Xylophaga californica* there are about fourteen denticulated ridges to a millimeter in the center of the posterior area, and the denticulated ridge bearing posterior median portion is .7 mm. in width at the angle of junction of the posterior with the median part.

The type, Cat No. 209,876, U. S. N. M., comes from the U. S. Bureau of Fisheries Albatross Station 4525, off Pt. Pinos Light, California, in 75-108 fathoms, on mud bottom. The type measures: length, 4.9 mm.; altitude, 4.7 mm.

***Xylophaga washingtona*, new species.**

In *Xylophaga washingtona* there are about ten denticulated ridges to a millimeter in the center of the posterior area and the denticulated ridge bearing posterior median portion is 1.2 mm. in width at the angle of junction of the posterior with the median part.

The type, Cat. No. 344,479, U. S. N. M., was collected by Dr. C. C. Engberg at San Juan Island, Washington. The type measures: length, 5.7 mm.; altitude, 5.5 mm. There are two additional specimens entered from the same station under the same catalogue number. Cat. No. 226,151, U. S. N. M., represents two specimens from the U. S. Bureau of Fisheries Albatross Station 2867, off the coast of Washington, taken from a piece of wood dredged in 37 fathoms. Cat. No. 331,683, U. S. N. M., contains 13 specimens dredged at U. S. Bureau of Fisheries Albatross Station 5432, off Oregon. Cat. No. 341,157, U. S. N. M., contains 95 specimens from U. S. Bureau of Fisheries Albatross Station 3456, off Washington, dredged in 136 fathoms on gray sand bottom, bottom temperature 42.2°. Cat. No. 341,158, U. S. N. M., contains 5 specimens collected by Mrs. Oldroyd in Departure Bay, British Columbia. These were taken from a dead twig. An additional lot from the same place is in Mrs. Oldroyd's collection.