SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
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A MONOGRAPH OF THE AMERICAN SHIPWORMS

BY

PAUL BARTSCH

Curator, Division of Mollusks, United States National Museum

WASHINGTON
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The scientific publications of the United States National Museum consist of two series, the *Proceedings* and the *Bulletins*.

The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original and usually brief, papers based on the collections of the National Museum, presenting newly acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper, in pamphlet form, is distributed to specialists and others interested in the different subjects as soon as printed. The date of publication is recorded in the table of contents of the volume.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, and catalogues of type-specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 122 of the *Bulletin series*.

WILLIAM DEC. RAVENEL,
Administrative Assistant to the Secretary,
In charge of the United States National Museum.

WASHINGTON, D. C., *June 6, 1922.*

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A MONOGRAPH OF THE AMERICAN SHIPWORMS.

By Paul Bartsch,

Curator, Division of Mollusks, United States National Museum.

INTRODUCTION.

Shipworms, on account of their destructiveness, have been objects of inquiry ever since the days of Theophrastus, Pliny, and Ovid. When one follows the history of our knowledge of these mollusks, one soon finds that the major output of literature dealing with this topic is usually coincident with or immediately follows a destructive infestation of these creatures. Literature produced at such times usually deals with the more or less garbled rehash of past efforts, tinged with enough local color to satisfy the popular needs of the moment. The abatement of the disastrous plague is usually followed by a cessation of scientific inquiry, and thus the world at large returns to placid contentment and offers a prayer of thanksgiving for the lifting of the scourge, hoping that the lightning will not strike on the same spot a second time. We are altogether too prone to accept complacently the constantly continued moderate (?) loss claimed by a persistent, silent enemy.

The perusal of the past literature has forced one question strongly before me, and that is, why have not the various enlightened countries depending more or less upon the sea, put forth a concerted inquiry into the nature and life history of these pests, for these to-day are scarcely known. Yes, I can say that the complete life history of not a single species is known to-day.

Most of the early authors seem to have contented themselves with merely discussing the *Teredo*. Now, what do they mean by this? I confess in most instances it is impossible to tell. Some of the brilliant work of the more recent cytologists and embryologists will be properly referable only when future investigations of the same species, carefully identified, will give a clue to the organism studied by them. The statement that an earlier observer was in error when he described such and such a structure, met in almost every treatise, expresses plainly the fact that the two observers were not dealing with the same species, and the error observed by number two in number one's treatise reflects rather upon number two's limited knowledge than upon number one's observation.

The history of systematic zoology and botany, too, for that matter, is replete with examples showing that the men of science have ever tried to keep down the number of specific names by stretching the definition of some previously described form to embrace the organism they had in hand. This superconservatism has caused more mischief in the proper understanding of many groups of organisms than any other single factor.

The layman who wishes to attempt an understanding of this mass of misconcepts will find himself in an interminable maze of synonyms and homonyms in which most signposts will be Greek to him, and, confused and confounded, he will turn the matter over to the specialist.

Now, unfortunately, the specialists, even to-day, have not the adequate material to definitely decide many points, but each succeeding year has seen an accumulation in our larger museums, even fragmentary as it usually is, of material gathered in many places, and by this means we are able to slowly forge our way from the hazy mists of the past into the clearer viewpoint of to-day.

Accumulated material, then, makes it possible for us to say that the shipworms are no law unto themselves, but are subject to the same limiting influences that govern the geographic distribution of other bivalve mollusks, and it is safe to state that the shipworms are as particular about their habitat as the other members of the phylum.

In spite of the fact that the shipping of the past in wooden bottoms offered an exceptional opportunity for the universal distribution of these pests, little of the kind seems to have been accomplished. Most of the exotic material thus obtained consists of dead pallets and shells entombed in the wood which they had affected. Such records can scarcely be accepted as genuine residents of the geographic place from which they were obtained. Thus it would be wrong to list as European, species encased in mahogany logs or coconut husks, and carried by the Gulf Stream's drift to Norway, Sweden, or the British Isles, where an unsuitable environment prevents them from propagating or establishing their kind. Were shipworm colonization merely a matter of transportation, then we should find the shores touched by the great ocean currents peopled by the same species, and this is not the case. The sea, like the land, has its environmental barriers, and the zoogeographic areas separated by them contain faunas just as peculiar to them as zoogeographic areas on land contain land animals peculiar to these. On land we have the elements of suitable habitat temperature, moisture, altitude, length of day, food, and other environmental factors. In the sea we have suitable habitat temperature, salinity, depth, light,

turbidity, food, etc., as the determining environmental factors which shift their relative proportions in the sea as on the land, and thus afford the differences that go to make up the environment of the different zoogeographic areas.

Mollusks when transplanted from one area to another may persist through the natural life of the individual, but may find it impossible to reproduce, the environmental adjustment in larval bivalves being particularly sensitive, as emphasized by the oyster.

I have dealt with greater detail upon this topic because some naturalists have conceived a wider distribution to species of shipworms than we usually accord to species of other groups, though I am sure that had they possessed adequate material for study, they would have voiced another opinion.

The finest piece of life history work on shipworms so far done is that by Prof. Charles P. Sigerfoos, in his Natural History, Organization, and Late Development of the Teredinidae, or Ship Worms.[1] It is particularly noteworthy that Sigerfoos carefully established the identity of the material used in his studies, removing the last question of doubt by placing a representative series of specimens in the United States National Museum, where they will typify his researches, regardless of nomenclatorial vicissitudes that may befall the names he used. His studies were based upon material collected at the United States Bureau of Fisheries Station at Beaufort, North Carolina. The species whose life history he almost completely worked out is "*Xylotrya gouldi*," now *Bankia* (*Bankiella*) *gouldi* Bartsch, which he traced from the egg through the early lamellibranch veliger larval stage, and later from the time of its settling stage to the adult worm. The only gap left in the life history of *Bankia* (*Bankiella*) *gouldi* is that which transpires between the veliger and the newly attached larva. He also traced the early embryologic history of "*Teredo dilatata*," which I have renamed *Teredo* (*Psiloteredo*) *sigerfoosi* in the present treatise.

A few points of general interest may be added to this introduction before undertaking the systematic treatment, the main object of the present study.

Why and how does the shipworm make the burrow that renders him obnoxious to man? As to why we may say that he needs it for the protection of his long, soft body. Most bivalve mollusks have a shell into which they may withdraw for protection in case of danger. Shipworms and the mollusks of several other families, however, have a much reduced shell that covers only a part of the body in the adult state (pl. 1, fig. 1, and pl. 2). In shipworms, in fact, the primary

[1] Bull. U. S. Bur. Fish., vol. 27, pp. 191–231, pls. 7 to 21.

function of protection is almost completely lost. Many interesting hints of how this change of structure has come about present themselves when one follows the embryologic history of these animals, for in their infancy they are provided with a typical bivalve shell, which soon becomes modified for its main mission, an organ for excavating the protective burrow necessary for the existence of the adult animal. Other links in the evolutionary chain through which shipworms may have passed are suggested by the nearly related family Pholadidae, whose members are also borers, but mostly mud or rock excavators, though some also affect wood.

Much speculation and considerable controversy has been printed regarding the methods employed by borers in excavating their burrows. In this investigation I have carefully examined under the microscope most pieces of wood that have come to hand, to see if I could find traces of the chisel marks of the shell. Practically all of these examinations have proved disappointing, but a piece of palmetto timber forming the home of *Teredo* (*Teredops*) *floridana* showed beautifully the chipping accomplished by the tiny chisels of the shell, and I am led to believe that most of the exogen wood affected, on account of its hardness requires so many raspings that the completed burrow becomes quite polished by the repeated tooling to which it is subjected, and thus fails to present the teeth marks shown in the easily cut softwood of the endogen palm. There is also a specimen of *Parapholas californica* Conrad in the collection of the United States National Museum (Cat. No. 151216), which shows satisfactorily the teeth marks of the shell in the burrow, which is in volcanic tuff.

There seems to be an additional popular concept for the existence of the burrow, and that is that the shipworm makes this just incidentally while he is feeding upon the wood. That the shipworm actually ingests the sawdust made by the teeth of the shell has been conclusively demonstrated by a number of observers. That he passes all of the wood through the alimentary canal is open to question, for many mollusks are known to be able to regurgitate undesirable material through the incurrent siphon by spasmodic contraction of the mantle. Even where sawdust has been swallowed, it is questionable whether the secretions of the digestive glands are capable of changing lignose—that is, wood, into a crystalloid carbohydrate, which can be absorbed. It is possible that the shipworm may simply indulge in a partial meal of this kind to have the comfortable feeling of a copious repast. The main food of shipworms, as that of all other bivalves and many other mollusks, consists of the countless minute free swimming plants and animals, collectively called plankton. These creatures are beaten down by the cilia of the gills as the water

brought in through the incurrent siphon is strained through these organs and by cilia carried forward to the mouth, where they are ingested.

Shipworms, after they have excavated a comfortable home (see the cutting tools figured on pl. 1, figs. 4–10) and lined this to a varying degree, depending upon the species in question, with a smooth shelly deposit, eventually stop burrowing, but continue to live and feast and reproduce, no one really knows for how long a period. We are told that some reach sexual maturity and may be full size within three months after settling down upon a piece of wood, and we are also told that some may produce as many as half a million to three million eggs, but these are all matters that need to be carefully studied, for as stated at the outset, little, yes, very little, is definitely known about these creatures.

Another structure of interest in the shipworms are the pallets. These are developed at the tail end of the animal; that is, the outer end (see pl. 3, a figure copied from Sigerfoos, which gives in a diagrammatic way the function of these structures). When the shipworm is actively engaged in feeding, the pallets are withdrawn, as shown in the top figure. The siphons are then extended, the lower one whose distal end is guarded by a series of tentacles that may keep undesirable material from entering this tube, carries the food and oxygen-containing water to the animal. The upper one carries the water away and into this are also discharged the fecal material and the sexual products. If any disturbing factor on the outside of the infested wood presents itself, or when the shipworm so desires, he can withdraw the siphons, push forward the pallets and thus effectively close the door to undesirable visitors, or probably even fluids, until the demand for oxygen compels the mollusk to take in a new supply of water.

The larval shipworm is free-swimming and attaches itself to wooden structures which it needs for its further development. This further development has been beautifully treated by Sigerfoos for *Bankia* (*Bankiella*) *gouldi* Bartsch, to which anyone is referred who desires to follow this phase of the life history of the animal.

Some of the problems that suggest themselves to the biologist in connection with shipworms are:

A. The systematic study which should form the foundation for all other inquiries. This is here attempted.

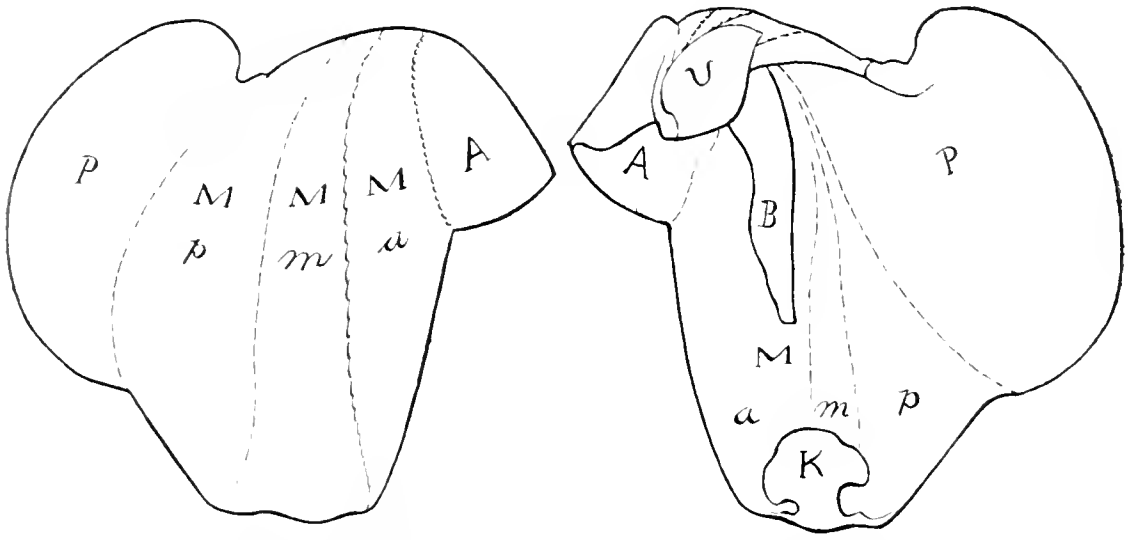
B. A study of the range in distribution of the various species, and their relative abundance.

C. An examination of the physical oceanographic conditions that determine this distribution.

D. A study of the life history of the various forms.

With the information furnished by the above outlined inquiry, it should be easy to determine to what extent any form may become a menace, for past efforts to overcome other obnoxious organisms have repeatedly shown that when the full life history of the creature in question was made known, ways and means were easily devised to hold it in check, and shipworms should prove no exception to this rule.

SYSTEMATIC TREATMENT OF THE GROUP.



Exterior and interior of shell to show the terminology used in the descriptions.

A. Anterior part.	a. Anterior portion of median part.	U. Umbones.
M. Median part.	m. Middle portion of median part.	B. Blade.
P. Posterior part.	p. Posterior portion of median part.	K. Knob.

A KEY TO THE GENERA AND SUBGENERA OF THE FAMILY TEREDIDAE.

Pallets 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.....*Bankia.*
      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.*
Pallets not consisting of a series of cone-in-cone structures.
  Pallets stilt-shaped.....[2] BACTRONOPHORUS.
  Pallets not stilt-shaped.
    Pallets paddle- or spoon shaped.
      Pallets paddle-shaped.....TEREDO.
        Terminal portion of the blade cupped.
          Cup single.....*Teredo.*
          Cup not single.
            Cup rendered double by a median septum.....*Teredothyra.*

[2] As yet not reported in American waters. See plate 35.

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.*
Pallets not paddle-shaped.
Pallets spoon-shaped.
Terminal portion of the blade cupped--------*Neoteredo.*
Terminal portion of the blade not cupped.
Auricle projecting as a shelf over the posterior median portion of the inside----------*Teredora.*
Auricle not projecting as a shelf over the posterior median portion of the inside.
Auricle fused with the posterior median portion on the inside----------*Psiloteredo.*

Genus BANKIA Gray.

1840. *Bankia* GRAY, Synop. British Mus., p. 76.

The genus is characterized by having the pallets consisting of a series of cone-in-cone structures, which give to them the appearance of an ear of wheat.

Type.—Teredo bipalmulata Lamarck.

Subgenus BANKIA Gray.

1840. *Bankia* GRAY, Synop. British Mus., p. 76.

In this subgenus the distal end of the cones terminates in a thin membrane, which is fimbriated at the free margin. The lateral fimbriations form long awnlike projections.

Type.—Teredo bipalmulata Lamarck.

BANKIA (BANKIA) SETACEA Tryon.

NORTHWEST SHIPWORM.

Plates 4, 5, and 30, fig. 3.

1863. *Xylotrya setacea* TRYON, Proc. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pp. 144, 145, pl. 1, figs. 2, 3.

Shell very large, subglobose, white, excepting the anterior median portion, which has a rosy flush, a faint suffusion of which also extends over the anterior part. The anterior part has a strong sinus at the extreme anterior margin, which is covered with a thick callus that is reflected partly over the exterior, where it forms a pronounced crest. The anterior part is marked by strong riblike dental ridges, which expand slightly fan shaped from the anterior margin to the posterior termination. Forty-three of these ridges occur on the specimen figured. These ridges are more distantly spaced on the early parts of the shell; that is, the part nearest the umbone, than on the later, becoming successively closer spaced as the shell advances in age. In the early portion they are about twice as wide as the ridges, while in

the later part they are scarcely as wide as the ridges. The spaces between the ridges are marked by fine striations which coincide with the ridges. These markings are best shown on the younger portions of the shell. The ridges have their free margin minutely denticulated. In cross section they would appear triangular, with the dorsal side about one-third as long as the ventral. The anterior median part is marked by rather broad, strongly denticulated ridges which join those of the anterior part in a little more than a right angle. The junction of the anterior dental ridges and those of the posterior median part form a well-impressed line which extends from the ventral margin to the umbones. The spaces separating the dental ridges on the anterior median portion are mere impressed lines. The anterior half of the median portion is convex, while the posterior half is depressed, forming a groove. Both parts are crossed by rough, cordlike incremental lines, which follow a more or less sinuous course. The posterior portion of the median part is about as wide as the anterior and the median portion taken together, and is crossed by oblique, somewhat wrinkled lines of growth. The posterior part forms a strong auricle, which is thin, decidedly expanded and slightly reflected at the margin, and emarginate at the umbonal terminus. The interior is bluish white. The umbone marks a strong knob from the underside of which the broad blade projects for a little more than half the length of the shell. The ventral portion of the median part bears the usual strong knob. The anterior and the median part show a strong tumid area at their junction, while the median portion of the middle part is concaved. The posterior part projects over the posterior median part as a strong shelf. This part in cross section would show a decidedly sinuous outline. The emargination of the dorsal portion of the auricle shows best when seen from within. The pallets form long, plumelike elements composed of a series of cup-in-cup structures, which project at the lateral margin in the form of strong awns. Each cup is covered by a thin periostracum which is faintly fimbriated at the distal end, and marked by longitudinal striations. The stalk is about one-fourth the length of the entire pallet.

The specimen figured, Cat. No. 102762, U.S.N.M., comes from San Francisco Bay. It measures: Height, 11 mm.; length, 12.5 mm.; diameter, 11 mm. The pallet measures: Entire length, 32.5 mm.; length of stalk, 7.5 mm.; diameter, 3.7 mm. The specimen is a medium-sized individual. The animal, however, is probably the longest of all the American shipworms and is said to attain a length of 4 feet.

We have seen this species from various stations from Unalaska to San Francisco Bay.

Subgenus NEOBANKIA Bartsch.

1921 *Neobankia* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, p. 26.

In *Neobankia* the pallets consist of cone-in-cone elements, covered by a thin membrane, which is denticulate at the free margin.

Type.—Bankia (*Neobankia*) *zeteki* Bartsch.

BANKIA (NEOBANKIA) ZETEKI Bartsch.

ZETEK SHIPWORM.

Plates 6, 7, and 30, fig. 1.

1921. *Bankia* (*Neobankia*) *zeteki* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, pp. 26–27.

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 20 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 is crossed by strong lines of growth, which extend over the posterior median part. The posterior 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 umbone, 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 pallets 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. 341128, 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.; height, 9.5 mm. The pallets 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 pallets, 3.4 mm.

Subgenus BANKIELLA Bartsch.

1921. *Bankiella* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, p. 26.

Pallets consisting of a series of cone-in-cone elements covered by a thin membrane which is neither fimbriated nor denticulated at the free margin, but entire.

Type.—Bankia (Bankiella) mexicana Bartsch.

KEY TO THE AMERICAN SPECIES OF BANKIELLA.

Pallets:

Outer distal edge of segments strongly concavely curved_____*gouldi*
Outer distal edge of segments slightly concavely curved_____*mexicana.*

Shell:

Middle portion of median part narrow_____*gouldi*
Middle portion of median part very broad_____*mexicana.*

BANKIA (BANKIELLA) MEXICANA Bartsch.

MEXICO SHIPWORM.

Plate 8, fig. 1; plate 30, fig. 2.

1921. *Bankia (Bankiella) mexicana* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, pp. 27, 28.

Shell subglobular. Anterior portion, excepting the extreme smooth calloused 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 slighly 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 pallets are of the cone-in-cone type, the distal margin of the cones being entire.

The type, Cat. No. 194176*a*, 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.; height, 6.5 mm. The pallets are all fragmentary, and hence it is impossible to give their measurement.

BANKIA (BANKIELLA) GOULDI Bartsch.

GOULD SHIPWORM.

Plates 2, 3, and 8, fig. 3; plates 9–16; plate 30, fig. 4.

1908. *Xylotrya gouldi* Bartsch, Proc. Biol. Soc. Washington, vol. 21, pp. 211, 212.

Shell subglobular, milk-white. The extreme anterior part with an incised sinus which is covered with a smooth callus that is reflected over part of the anterior portion, terminating in a rather thickened ridge. The anterior portion is marked by a series of dental ridges which are separated by spaces about one and a half times as wide as the dental ridges. These ridges slope slightly more abruptly on the umbonal side than on the ventral side, and are finely denticulated at their free margin. There are 52 in the type. The junction of the anterior part with the anterior median portion forms a strong impressed line, which extends from the ventral margin to the umbones. The anterior median portion is marked by a series of dental ridges which meet those of the anterior part at almost right angles. These are provided with strong denticles. The center of the middle portion of the median part bears a strongly impressed groove, which extends from the ventral margin to the umbones. The entire median portion is covered with enfeebled nondenticulated upturned extensions of the dental ridges of the anterior median portion, which lends this part of the shell a rather rough appearance. The posterior median portion is about as wide as the anterior and median parts, and is marked by obliquely curved lines of growth. The posterior part forms a strong auricle, well constricted at the junction with the

median part, and this is marked by feeble lines of growth and a few rather strongly impressed wrinkles. In the interior there is a strong cord over the junction of the anterior and median portion, while the posterior part projects over the median part as a heavy callus, having a free margin. The umbones form a strong knob from the inner side of which the strong, obliquely curved sickle-like blade projects through about half of the length of the shell. The ventral median portions bears a strong knob. Pallets plumose, with the junction of the blade and the stalk well marked. The blade itself is lanceolate and is formed by a series of depressed cone-in-cone structures. The entire blade appears to be covered by a thin, horny film, which bridges over the gap between the free ends of one cone to the body of the next. The outer surface is well rounded; the free edge of the cone forms a decidedly curved outline. The inner surface of the blade is almost flattened, and the elements are less deeply curved than on the outside. There are 17 joints to the blade of the type.

The type, Cat. No. 27415, U.S.N.M., was collected in Norfolk Harbor, Virginia, and measures: Height, 8.6 mm.; length, 8.5 mm.; diameter, 9.2 mm.; length of the blade of pallet, 9.7 mm.; greatest diameter of blade, 2 mm.; length of stalk, 7.7 mm.

We have seen this species from various stations on the Atlantic coast from the Virginia Capes to the coast of Texas.

Subgenus NAUSITORA Wright.

1865. *Nausitora* WRIGHT, Trans. Linn. Soc., vol. 24, p. 451, pl. 46.

Pallets consisting of a series of cone-in-cone elements which are not entirely free at their distal ends, but fused on the exterior surface, where some shelly material and a thick periostracum cover the entire pallet.

Type.—Bankia (Nausitora) dunlopei Wright.

KEY TO THE AMERICAN SPECIES OF NAUSITORA.

Pallets:
- Length more than 40 mm ..... *dryas.*
- Length less than 10 mm.
  - Blade of pallets elongate-ovate.
    - Stalk very stout ..... *fusticula.*
    - Stalk slender ..... *excolpa.*
  - Blade of pallets not elongate-ovate.
    - Blade of pallets ovate ..... *braziliensis.*

Shell:
- Height more than 18 mm ..... *dryas.*
- Height less than 9 mm.
  - Anterior portion of median part very broad ..... *braziliensis.*
  - Anterior portion of median part not very broad.
    - Auricle large ..... *fusticula.*
    - Auricle small ..... *excolpa.*

BANKIA (NAUSITORA) EXCOLPA, new species.

GULF SHIPWORM.

Plate 8, fig. 2; plate 31, fig. 4.

Shell subglobular, small. Umbones and the center of the middle part tinged with rusty red. The anterior part with the usual sinus and the reflected callus at the extreme anterior edge, the latter free at its posterior termination on the outside. The anterior portion is marked by a series of dental ridges which take a sudden bend toward the callus near the anterior termination, and spread somewhat fanlike posteriorly. These ridges are about half as wide as the spaces that separate them. In the type, which shows scarcely any erosion at the umbone, 72 of these ridges are apparent. They are triangular in cross section, sloping a little more abruptly on the umbonal side than the ventral, and are finely denticulated at the free margin. The anterior portion of the median part is rather broad, and is marked with the dental ridges which are separated by mere lines and join those of the anterior part in a little more than a right angle. These dental ridges are provided with fine denticles. The median portion is depressed into a shallow groove, the anterior part of which is marked by the feeble nondenticulated upward flexed continuations of the dental ridges which here become decidedly reduced in strength. The posterior portion of the median part is about as broad as the middle and anterior portion combined and is marked by rather strongly impressed irregularly disposed grooves. The posterior part forms a narrow auricle which joins the posterior median portion in an even concave curve. It is marked on the outside by very regularly spaced incremental lines. The umbone is rather pronounced on the inside and the blade, springing from the inner side of it, is moderately broad, sickle-shaped, curved, and slightly flexed. The junction of the anterior and median portion is denoted by a tumid area, while the posterior part passes over a considerable portion of the median part with which it is fused, being free only at the inner border. The central median portion is marked by a groove. The extreme ventral point of the median part is provided with the usual strong knob. The pallets have very strong stalks and are covered on the outside by a strong shelly deposit which in turn is covered with a periostracum. Wherever this is broken it shows the lamellations beneath, in the blade. On the inside, the blade beyond the smooth basal third shows a series of transverse laminae, each alternating with a dark cord of periostracum.

The type and a lot of other specimens, Cat. No. 98763, U.S.N.M., come from a piece of Spanish cedar and were collected by A. W. Crawford in the Gulf of California.

The type measures: Height, 4 mm.; length, 3.8 mm.; diameter, 4.5 mm. The pallets measure: Length, 7.2 mm., of which 4.5 mm. belong to the stalk; diameter, 1.6 mm.

This species is smaller and has finer sculpture even than *Bankia (Nausitora) braziliensis.*

BANKIA (NAUSITORA) DRYAS Dall.

DALL SHIPWORM.

Plates 17–19, and plate 31, fig. 3.

1909. *Xylotrya dryas* Dall, Proc. U. S. Nat. Mus., vol. 37, No. 1704, pp. 162–174, pl. 25, figs. 2, 3, 5, 6, 7.

Shell gigantic, subglobular. Color of the anterior part and the anterior median part pale rose; the rest of the median part flesh colored and the posterior auricle white. The anterior part with the usual sinus and reflected callus, but the callus is separated from the dental bearing portion by an impressed sinus. The latter is marked by the dental ridges, which turn upward suddenly at the anterior extremity and then expand fanlike backward. These ridges are as wide or a little wider than the spaces that separate them. The umbonal members have been eroded, but there remain 93 in the type. These ridges are finely denticulated at their free margin. The individual denticles are marked by slender grooves on both sides of the dental ridges. The anterior median part joins the anterior part in a somewhat sinuous line, and this part is covered by dental ridges which join those of the anterior part at a little more than a right angle. These ridges, which are separated by mere lines only, bear very large, broad denticles. The median portion forms a concave groove at its posterior extremity. The anterior portion of the median part is slightly convex and covered by a series of irregularly disposed wrinkles. The posterior portion of the median part is not quite as wide as the anterior portion of the median part and is marked by lines of growth only. The posterior part forms a narrow auricle and is separated from the posterior median portion by a concavely impressed groove. Interior white. Umbone with a strong knob, from the basal portion of which the broad, irregular blade extends almost to the basal knob. The anterior portion has a number of irregular ridges and the suture between the anterior and median portion is slightly roughened. The middle of the median part is grooved and bears at its base at the ventral margin the usual strong knob. The posterior part is reflected over the median, and fused for its greater part, but the anterior margin of it projects over and into the cavity of the shell as a shelf, leaving a broad space behind it. Pallet fan-shaped. Stalk very long, cylindric. Blade expanded, featherlike, the outside covered with a thick calcareous deposit, over which a dark periostracum is placed. Where the periostracum and

the calcareous deposit are broken away a series of laminae within laminae or condensed cone-in-cone-shaped elements appear. The inside has a solid expanded portion at the base, and beyond this a series of laminae, separated by spaces about as broad as the laminae or a little wider.

The type, Cat. No. 207695, U.S.N.M., was collected by Dr. Robert E. Coker in the Estero del Palo Santo, Tumbes, Peru, in a green mangrove root.

It measures: Height, 20 mm.; length, 20 mm.; diameter, 18 mm. The pallet measures: Length, 41.5 mm., of which 21 mm. belong to the stalk; the greatest diameter is 5.2 mm.

This is the largest shipworm in American waters, and it is not only remarkable for its size, but for its infesting living mangrove wood, supposed to be immune to the attack of shipworms.

BANKIA (NAUSITORA) BRAZILIENSIS, new species.

BRAZIL SHIPWORM.

Plate 20, fig. 3; plate 31, fig. 1.

Shell subglobular, of moderate size, flesh colored. The anterior part marked by the usual sinus, with a smooth, thin callus slightly reflected over the exterior surface. From this the dental ridges radiate backward in a fan-shaped manner. They are separated by spaces about one and a half times as wide as the ridges. The ridges slope a little more abruptly on the umbonal side than the ventral side, and are finely denticulated on their free margin. The umbones of the type are partially eroded, but there are 49 ridges present in the type. The line of junction between the anterior and the anterior median portion is well marked and slightly sinuous. The anterior median portion is rather broad and marked by strongly denticulated ridges which are separated by very narrow lines and which join the dental ridges of the anterior part at a little more than a right angle. The anterior half of the middle median portion is slightly convex, and rendered rough by the feeble nondenticulated subobsolete continuation of the dental ridges while the posterior portion is slightly concave. The posterior median portion is about as wide as the anterior and the middle portion of the median part, and is marked by a series of strong lines of growth, which give it a more or less roughened aspect. The posterior part forms a narrow auricle which joins the posterior part of the middle portion in an even concaved line. The interior is bluish white. The junction of the anterior and the median portion is marked by a tumid ridge while the posterior part overlaps the median part as a callus, which extends over the median part, at the umbonal half, as a slender shelf. The posterior auricle is thin and marked by a series of opaque and translucent areas when

viewed by transmitted light. The pallet has a long stalk. The base of the pallet is solid. The distal half consists of cone-in-cone elements which are covered by a thin calcareous deposit over which a strong periostracum is stretched on the outside. The inside of the solid portion is slightly concave, the distal portion on the inside being marked by a series of cross lines marking the condensed cone-in-cone elements and periostracum.

The type, Cat. No. 110435, U.S.N.M., was collected by Dr. H. von Ihering at Santos, Brazil.

It measures: Height, 6 mm.; length, 5.8 mm.; diameter, 5.5 mm. The pallet measures: Length, 8 mm.; length of stalk, 5.7 mm.; diameter, 2.3 mm.

This species resembles *Bankia* (*Nausitora*) *fusticula* Jeffreys, but differs from this in having the dental ridges of both the anterior and the anterior median portion much more closely spaced and much finer and more numerous than in *Bankia* (*Nausitora*) *fusticula* Jeffreys.

BANKIA (NAUSITORA) FUSTICULA Jeffreys.

JEFFREYS SHIPWORM.

Plate 20, fig. 2; plate 31, fig. 2.

1860. *Teredo fusticulus* Jeffreys, Ann. Mag. Nat. Hist., ser. 3, vol. 6, p. 125.

Shell small, subglobular. The anterior part and the posterior median portion pale brown, the rest 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 the anterior smooth area backward, spreading out more or less fan shaped, the spaces between the ridges becoming wider toward their distal ends, where they are about two and a half or three times as wide as the dental ridges. The dental ridges are very finely denticulated at their free margin. Thirty-six of these ridges can be counted in the specimen figured, but as usual some of the earlier ones have been eroded at the umbone. The dental ridges on the anterior median portion correspond with those on the anterior portion and meet these in a straight line, which extends from the ventral margin to the umbones. These ridges are closely crowded, being separated by mere impressed lines only, and are marked by strong denticles which are also separated by very narrow lines. The middle median region is a narrow, slightly depressed area crossed by the obliquely curving enfeebled dental ridges, which here become evanescent. The posterior median portion is a little wider than the anterior and middle median portion. It is moderately curved and marked by rather strong incremental lines. The posterior part forms an auricle which is slightly upturned at the outer margin

and extends at its anterior margin over about half of the posterior edge of the median portion. It is about as broad as the posterior portion of the median part, and is crossed by coarse concentric more or less irregularly developed threads. The posterior auricle on the inside laps over the posterior median portion but does not form a conspicuous shelf. The middle portion of the median area bears a very strong knob at its ventral termination on the inside. A moderately strong knob also marks the umbone, from the inner side of which a narrow curved sickle-shaped blade extends downward over three-fourths of the distance between the umbone toward the ventral knob. The anterior portion is separated from the anterior median portion by a straight line. Pallets with a stalk a little more than twice as long as the blade. The stalk is rounded and gently sinuously curved. The blade is oval, half of its length solid, the distal half marked by a series of grooves which denote segments on the inside. The outside is covered by a thick, solid periostracum.

The above description is based on one of Jeffreys's types, Cat. No. 194267, U.S.N.M., which he states came from drift West Indian cedar (*Cedrella odorata*), taken at Leith, Scotland.

The shell measures: Height, 5.1 mm.; length, 5.1 mm.: diameter, 6 mm. The pallet measures: Length, 6.7 mm., length of stalk, 4.4 mm.; width of blade, 1.7 mm.

This species resembles closely *Bankia braziliensis*, from which it differs in having the dental ridges of both the anterior part and the anterior median portion much more widely spaced, much stronger and decidedly less numerous than in *braziliensis*. It is quite possible that this may belong to the West Indian region, but the mere occurrence in West Indian drift cedar on the coast of Leith of course does not establish this.

Genus TEREDO Linnaeus.

1758. *Teredo* Linnaeus, Syst. Nat., ed. 10, p. 651.

In this genus the pallets are either paddle or spoon shaped. They may be distally cupped or not, or they may even bear a calcareous knob at the terminal portion.

Type.—*Teredo navalis* Linnaeus.

Subgenus Teredo Linnaeus.

1758. *Teredo* Linnaeus, Syst. Nat., ed. 10, p. 651.

Teredo has the pallets paddle-shaped, with a decidedly cup-shaped depression at the distal end. The distal portion is covered with a dark periostracum, which terminates in the shape of two lateral horns.

Type.—*Teredo navalis* Linnaeus.

KEY TO THE AMERICAN SPECIES OF TEREDO.

Pallets:
- Blade with the lateral margin concavely contracted at base ---- *norangliae.*
- Blade with the lateral margin not concavely contracted at base.
  - Lateral margin of contracted base forming almost a straight line.
    - Blade very narrow ---- *beaufortana.*
    - Blade rather broad ---- *beachi.*

Shell:
- Auricle with a deep dorsal sinus ---- *norangliae.*
- Auricle with scarcely any sinus ---- *beachi.*

The shell of *beaufortana* is unknown.

TEREDO (TEREDO) BEACHI Bartsch.

BEACH SHIPWORM.

Plate 20, fig. 1; plate 32, fig. 4.

1921. *Teredo (Teredo) beachi* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, pp. 29, 30.

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 fan-shaped backward over the rest of the anterior area. There are about 35 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 anterior median portion at almost right angles. The dental ridges of the anterior 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 pallets 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 pallets, 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 pallets and extends down over the rest of the animal for a length equal to the exposed part of the siphons.

The type, Cat. No. 341155, U.S.N.M., was collected in San Pablo Bay, California. It measures: Height, 5.5 mm.; length, 6 mm.; diameter, 7 mm. The pallets measure: Length, 5.5 mm., of which 2 mm. go to the stalk; width, 2 mm.

TEREDO (TEREDO) NOVANGLIAE, new species.

NEW ENGLAND SHIPWORM.

Plate 21, fig. 3; plate 32, fig. 3.

Shell subglobular, of medium size. Anterior half flesh colored, the rest white. The extreme anterior portion of the anterior part is marked by the usual sinus, which is covered by a smooth callus that is reflected and appressed to the anterior portion of the anterior part, its limit being a rather well marked line. From this callus the dental ridges slope abruptly downward and then backward in an even curve, spreading out fanshaped. At the posterior extremity they are about as wide as the spaces that separate them. These dental ridges slope abruptly on the dorsal side and very gently on the ventral, the latter being about three times as long as the former. Of these ridges, which are not eroded at the umbones in the type, 27 are present. The free angle is extremely finely denticulated. The anterior median portion is narrow and marked by dental ridges which join those of the anterior part at a little more than a right angle. These dental ridges are provided with very strong denticles. The junction of the anterior and the anterior median part forms a slightly sinuous line. The middle median portion forms a depressed groove in the center, both the anterior and the posterior portion being concave. The entire portion is marked by rough irregularly spaced threads. The posterior median portion is about as wide as the anterior and middle combined, and is some-

what wavy in appearance, the waves corresponding in their longitudinal disposition with the basal margin of the shell. The posterior median margin joins the posterior part or auricle of the shell in a depressed groove. The auricle is very broad, and extends high up toward the umbone. It has a low, corrugated appearance, the corrugations being concentrically disposed and corresponding with the waves of the posterior median portion. The edge of the auricle is thin and slightly reflected. Interior bluish white. The junction of the anterior with the median portion is marked by a tumid ridge, while the auricle is reflected over the posterior median portion as a thin shelf. The umbone forms a strong knob, from the basal portion of which the rather broad, irregular, flattened blade extends two-thirds across the inside of the shell. The ventral margin of the median part bears the usual heavy knob. The pallets have a slender, somewhat sinuous cylindric stalk. The basal portion is rather expanded. It is rounded on the outside and flattened on the inner. The anterior portion narrows somewhat and is deeply cupped. It is covered by a brownish periostracum, and terminates in two horns.

The type, Cat. No. 74499, U.S.N.M., and a lot of additional specimens, were taken from piles at the guano works at Woods Hole, Massachusetts.

The type measures: Height, 5.2 mm.; length, 5.7 mm.; diameter, 6 mm. The pallet measures: Total length, 5 mm., of which 1.7 mm. belongs to the stalk; diameter, 1.7 mm.

In comparing this American shipworm with the specimen of *Teredo navalis* figured by Jeffreys in his British Conchology, Cat. No. 194285, U.S.N.M., the following differential characters become apparent. In the American species the auricle is gigantic compared with the European, which is of only moderate size. The middle portion of the median area is very rough, while in the European it is much less so. The wavy sculpture described for the auricle on the posterior median portion is much stronger in the American species than in the European. The pallets of the American species expand suddenly beyond the stalk, forming a decidedly concave outline, while in the European species they expand only gradually, forming an almost straight line.

We have specimens of this species in the collection of the United States National Museum ranging from Prince Edward Island south to New York.

TEREDO (TEREDO) MORSEI, new species.[3]

MORSE SHIPWORM.

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. Forty-seven of these ridges are present in the type. At their posterior extremity they are separated on the early turns by spaces that are about five times as wide as the ridges, while in the last third they are separated by spaces no wider than the ridges. These ridges slope a little more abruptly on the dorsal side than on the ventral, and are finely denticulated at the free border. The anterior median portion is rather broad and marked with rather closely spaced, strongly denticulated ridges, of which there are 27 in the type opposite the ventral border of the anterior portion. The middle median portion is slightly concaved, marked by rather rough curved lines of growth. The posterior median portion is about as broad as the anterior and median portion combined, marked by distantly spaced rough lines of growth, between which finer lines are apparent. The posterior auricle is large, strongly curved and slightly upturned at the posterior border. It extends strongly up toward the umbone. On the inside the umbones are strongly marked and from the lower edge a conspicuous blade extends for a little more than half the length of the shell. A moderately curved, decidedly broad and slightly twisted blade extends for a little more than half the length of the shell from the under side of the umbone. The junction of the anterior and middle portion is marked by a raised thread, while the auricle is reflected over the posterior median portion as a thick callus, and is free as a slender shelf at its anterior extremity. The pallets are rather broad at the anterior termination of the calcareous portion. The corneous portion is rather short and deeply cut. The sides of the calcareous portion slope gently toward the somewhat curved and twisted stalk.

The type, Cat. No. 346333, U.S.N.M., measures: Height, 5.7 mm.; length, 6.3 mm.; diameter, 5.5 mm. The pallets measure: Length, 5.1 mm., of which 1.7 mm. go to the stalk; diameter, 1.7 mm.

The type and a number of additional specimens were obtained by Mr. T. G. Townsend at Manhattan Beach, Long Island, New York.

This species closely resembles *Teredo* (*Teredo*) *navalis*, but differs from it in having the ridges of the anterior area more numerous and much more closely spaced. The specimen of *Teredo navalis*

[3] This species was discovered after the manuscript of this paper was in galley form and therefore does not appear in the key.

figured by Jeffreys has 30 ridges on the anterior area, while in the type of *Teredo* (*Teredo*) *morsei* we have 47. The denticulated median area is also much broader in the Morse shipworm than in true *navalis*. In *navalis*, in the specimen figured by Jeffreys, there are 15 ridges, while in the Morse shipworm there are 27. They are also relatively broader in *Teredo navalis* than in this species.

I take pleasure in naming this species for Prof. Edward S. Morse, of Salem, Massachusetts.

TEREDO (TEREDO) BEAUFORTANA, new species.

BEAUFORT SHIPWORM.

Plate 32, fig. 1.

1908. *Teredo navalis* SIGERFOOS, Bull. Bur. Fish., vol. 28, p. 94.

The *Teredo navalis* referred to by Sigerfoos is not *Teredo navalis*, notwithstanding the fact that I myself so identified it.

In the light of accumulated material I am now willing to say, although I have only the pallets at hand, that these, while they resemble *Teredo navalis* more closely than do those of *Teredo novangliae*, are nevertheless much narrower and more elongate than any that we have seen of true *Teredo navalis*. They agree with those of *Teredo navalis* in having the sides of the base almost straight instead of concave, as in *Teredo novangliae*.

They measure: Length, 5.2 mm., of which 2 mm. go to the stalk; diameter, 1.3 mm.

I am sorry not to have the shells that belong to this mollusk, but trust that they will be found by some one at the U. S. Bureau of Fisheries Station at Beaufort.

These specimens were taken at Rivers Island, Beaufort, North Carolina, on November 16, 1909. They are registered as Cat. No. 345346, U.S.N.M.

TEREDO (TEREDO), species?

The Jeffreys collection in the United States National Museum contains a lot of young specimens, Cat. No. 194283*a*, sent by Prof. C. B. Adams to Jeffreys from Jamaica. They were given the provisional name *Teredo spatha* by Jeffreys, but under the microscope they easily reveal the fact that they do not belong to this species.

I do not wish to bestow a specific name upon this form until adequate material will have been received, and we therefore merely list it at the present time.

Subgenus TEREDOTHYRA Bartsch.

1921. *Teredothyra* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, p. 26.

In this subgenus the pallets are doubly cupped at the terminal portion.

Type.—*Teredo* (*Teredothyra*) *dominicensis* Bartsch.

TEREDO (TEREDOTHYRA) DOMINICENSIS Bartsch.

DOMINICA SHIPWORM.

Plate 21, fig. 2; plate 33, fig. 1.

Teredo (Teredothyra) dominicensis BARTSCH, Proc. Biol. Soc. Washington, vol. 34, pp. 30, 31.

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; 34 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 and 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 umbones project into the interior of the shell as a strong boss, from the underside 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 pallets are short stalked, the stalk being more or less irregularly curved. The ex-

panded 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. 341129, U.S.N.M., come from a small piece of wood collected by the United States 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 pallet measures: Length, 2.5 mm., of which 1.2 mm. belong to the stalk. Width of pallet, 1.1 mm.

Subgenus LYRODUS Gould.

1870. *Lyrodus* GOULD, Invert. Mass., p. 34.

In this subgenus the terminal portion is not cupped, but ends in two lateral forks, covered with a periostracum.

Type.—Teredo (Lyrodus) chlorotica Gould.

KEY TO THE AMERICAN SPECIES OF LYRODUS.

Pallets:

Blade broadly ovate ..... *bipartita.*

Blade elongate ovate ..... *townsendi.*

Shell:

Anterior portion of median part very broad ..... *bipartita.*

Anterior portion of median part very narrow ..... *townsendi.*

TEREDO (LYRODUS) CHLOROTICA Gould.

1870. *Teredo chlorotica* GOULD, Invert. Mass., pp. 33–34.

I have not seen specimens of this species and quote Dr. A. A. Gould's statement:

"Shell minute, subglobose, greenish, the anterior area of the claw very large; pallets with the blades lyre-shaped, posterior portion encrusted.

"Shell quite small, solid, subglobose, valves rhomboidal, greenish, beaks enveloped in the callus of the triangular area, which is large, ascendant, obtuse at point, with about 40 diverging square ribs, the interspaces finely barred; marginal area of the claw very broad, the ridges as broad as those of the anterior wing and coarsely barred, but the interspaces very narrow; at the junction of the two series is a deep diagonal groove toward which they slope; a sharp angle limits the anterior area, followed by a barred groove ray, then a very narrow posterior area with a lunate auricular projection, occupying about the middle third of the posterior margin, not reflected, its inner face concave and broadly shelving over the deep cavity of the beaks; no callosity to beaks; denticle slender, blade attached close to the denticle, linear, somewhat granulate. Pallets paddle-shaped, the stalk flexuous and very delicate, the blade half as long as the stalk, lyre-shaped, the extreme two thirds covered with a dark crust which has a projecting horn at each angle; when the crust is de-

tached there is left a bony, acorn-shaped nucleus. Diameter about 3 millimeters.

"From timbers of ships that have cruised in the Pacific.

"This species is remarkable for its minute size and globular form, its large sculptured claw area, and its peculiar pallets, to which there is nothing similar among the species of true *Teredo*, and which have no cups or transverse segments as in *Xylotrya*. The burrows do not run in the course of the grain of the plank, but transversely, and stand thickly side by side so as to resemble honeycomb, or the organ coral, *Tubipora musica;* the tubes are lined by a thin gummy or horny coat, and terminate in a concave calcareous disk with a sort of transverse scar on its outer or convex face. I have not been able to detect any transverse partitions. If on these accounts it should be considered as entitled to generic distinction, it may be denominated *Lyrodus*."

TEREDO (LYRODUS) BIPARTITA Jeffreys.

TWO-PARTED SHIPWORM.

Plate 21, fig. 1; plate 33, fig. 4.

1860. *Teredo bipartita* JEFFREYS, Ann. Mag. Nat. Hist., ser. 3, vol. 6, p. 123.

Shell subglobular, the anterior part having a sinus at the extreme anterior edge, which is covered by a callus that is slightly reflected outwardly over the shell. The rest of the anterior portion is covered by a series of dental ridges which expand fan shaped from the anterior portion backward. At the posterior margin the spaces that separate them are about as wide as the ridges. These ridges are marked by exceedingly fine denticulations at their free border. There are 53 of them in the specimen figured. The posterior edge of the anterior portion is joined to the anterior portion of the median part in a straight line that extends from the ventral edge to the umbones. The posterior median portion is marked by slender ridges which join the dental ridges of the anterior part at almost right angles. These ridges are separated by narrow grooves, and are strongly denticulated on their free margin. The middle median portion is marked by a depressed groove, across which the upturned enfeebled and subobsolete terminal portions of the dental ribs extend. The posterior portion of the median part is a little wider than the anterior, and is marked by strong oblique lines of growth. The posterior part forms a slender, small auricle, which is marked by feeble incremental lines. The interior of the shell shows that the auricle projects slightly over the posterior median part. The posterior median part shows a strong median groove that extends from the umbones to the ventral portion of the shell. The latter part is armed with a strong knob. The blade is very slender, sickle shaped, extending three-fourths of the way across the inside of the shell.

In the specimen before us it extends only about one-third of the way across the shell. The pallets have a long, somewhat enfeebled cylindric stalk which is about twice as long as the blade. The blade consists of a calcareous club-shaped portion surmounted by a double-pointed horny portion at the summit.

Jeffreys's material, one of the cotypes of which we have here described and figured, Cat. No. 194268, U.S.N.M., was obtained from West Indian cedar (*Cedrella odorata*) thrown ashore, perhaps by the Gulf Stream's drift at Guernsey.

The largest of Jeffreys's specimens measures: Height, 5.5 mm.; length, 4.3 mm.; diameter, 5.5 mm. The pallets measure: Length, 3.1 mm., of which 1.6 mm. belong to the stalk; diameter, 0.7 mm.

It is the only *Lyrodus* so far reported from the east American waters, excepting the type of the genus, which is probably Pacific.

TEREDO (LYRODUS) TOWNSENDI, new species.

TOWNSEND SHIPWORM.

Plate 22, fig. 2; plate 33, fig. 2.

1921. *Teredo digensis* Kofoid not Bartsch, Rept. on the San Francisco Bay Marine Piling Survey, pp. 33–36, pl. 19.

Shell small, subglobular, white. The extreme anterior part with a strong sinus covered by a heavy callus, which is reflected over part of the outer portion as a thin callus, through which the dental ridges may be seen. These bend suddenly downward at the anterior margin, and then spread fan-shaped backward, being separated by spaces about three times as wide as the ridges. These ridges slope abruptly on the dorsal side and much more gently on the ventral, the ventral side being about twice as long as the dorsal. Of these ridges, which are finely denticulated at their free margin, 22 are present in the type. The anterior median area is quite narrow and marked by dental ridges bearing rather prominent tubercles. These dental ridges join those of the anterior part at almost a right angle. The middle median portion forms a depressed groove which is crossed by rough U-shaped curved wrinkles. The posterior portion is a little wider than the anterior and median portion combined, and is marked by a series of wavelike markings, between which finer lines of growth are present. The posterior part forms a conspicuous triangular auricle, which is rather large and not strongly separated, though somewhat constricted at its junction with the posterior median portion. The interior is bluish white. The junction of the anterior and median portions is marked by a raised thread. The median portion is a roughened groove at the basal termination of which the ventral knob is placed. The posterior part projects over the posterior median portion as a conspicuous shelf. The free auricular portion is marked by concentric lines of growth. The umbone

has a strong knob, from the basal portion of which a narrow blade extends down through about half the length of the shell. Pallets paddle-shaped, rounded at the distal end, which is surmounted by two strong periostracal prongs, which form a forked tip. The distal half of the outside, which is rounded, is covered by a periostracum. The inside is slightly concave, the distal half also having a thin brown periostracum.

The type, Cat. No. 344665, U.S.N.M., was collected by Mr. T. G. Townsend at the Shaw-Batcher Shipyard, South San Francisco, California, October 5, 1920, at water line at low tide. It measures: Height, 4.1 mm.; length, 4.1 mm.; diameter, 4.1 mm. The pallets measure: Total length, 2.8 mm., of which 0.5 mm. go to the stalk and 0.7 mm. to the prongs; diameter, 0.7 mm.

The present form is the only member of the subgenus *Lyrodus* known from the West Coast at the present time. It agrees with *Teredo* (*Teredo*) *beachi* in having the pallets with forked prongs at the tip, but in the subgenus *Lyrodus*, to which the present species belongs, the pallets are not cupped at the apex. It differs from *Teredo* (*Teredops*) *diegensis* in having the pallets tipped with two prongs instead of provided with a calcareous knob. The shell also differs from *Teredo* (*Teredops*) *diegensis* in having the auricle much larger and the anterior median portion much narrower and the dental ridges of the anterior part much more distantly spaced and fewer than in *Teredo* (*Teredops*) *diegensis*.

I identified this species for Dr. A. L. Barrows, as stated by Doctor Kofoid on page 33 of the above cited report, believing at the time from the scanty material at hand that it was a young stage of *Teredo* (*Teredops*) *diegensis*. Additional material sent to me by Mr. T. G. Townsend leaves no doubt that this is a distinct species belonging to the subgenus *Lyrodus*, and I therefore take great pleasure in naming it for Mr. Townsend, who has been very helpful to me in securing this material, as well as material from other sources, and for illustrations.

Subgenus TEREDOPS Bartsch.

1921. *Teredops* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, p. 26.

In the subgenus *Teredops* the terminal portion of the pallets ends in a calcified knob.

Type.—*Teredo* (*Teredops*) *diegensis* Bartsch.

KEY TO THE AMERICAN SPECIES OF TEREDOPS.

Pallets:
- Stalk stout ..... *floridana.*
- Stalk slender ..... *diegensis.*

Shell:
- Anterior portion of median part very broad ..... *floridana.*
- Anterior portion of median part only moderately broad ..... *diegensis.*

TEREDO (TEREDOPS) FLORIDANA, new species.

FLORIDA SHIPWORM.

Plate 22, fig. 1; plate 34, fig. 1.

Shell small, subglobular, white. The extreme anterior area of the anterior part with a shallow sinus, which is heavily calloused. Callus reflected outward, but not forming a distinct ridge. The anterior part is marked by a series of slender dental ridges, which have a strong downward trend, rather more distantly from the edge than in any other American species, and then spread fanlike backward. At the posterior border they are as wide as the spaces that separate them. Of these ridges there are 84 in the type. They slope abruptly on the upper side, and a little less so on the ventral, and are fringed at the free edge by exceedingly fine denticles. The posterior median area is very broad, almost equaling the anterior area in width, and crossed by dental ridges which are separated by mere lines only, and provided with numerous rather fine denticles. The middle median portion is marked by very rough wrinkles, while the posterior portion is feebly wrinkled. The latter is about as wide as the anterior median portion. The posterior part is joined to the posterior median portion by a thickened tumid area and forms a very small, inconspicuous auricle which is marked by lines of growth only. Interior bluish white, the junction of the anterior and median portion is marked by a tumid cord, while the slender auricle projects slightly over the posterior median area as a thin shelf. The umbones bear a thick knob, from the inside of which a very broad, short blade extends obliquely downward. This blade has a constricted neck by which it attaches to the umbone. The ventral margin of the median portion bears the usual knob. The pallets are spatulate, with the stalk cylindric, the outer portion rounded, while the inner surface is flat. The distal portion consists of a strong cone-shaped mass of periostracum, with a certain amount of calcium at its free termination.

The type and a lot of additional specimens, Cat. No. 193031, U.S.N.M., come from a palmetto pile, which was said to have been driven 12 years, at Tampa, Florida.

The type measures: Height, 4.5 mm.; length, 4.7 mm.; diameter, 5 mm. The pallet measures: Length, 4.3 mm., of which 2.3 mm. belong to the stalk; diameter, 1.1 mm.

Another specimen, Cat. No. 36047, U.S.N.M., was obtained by Henry Hemphill at Cedar Keys, Florida.

This is the only *Teredops* so far reported from East American waters.

TEREDO (TEREDOPS) DIEGENSIS Bartsch.

SAN DIEGO SHIPWORM.

Plate 22, fig. 3; plate 34, fig. 3.

1916. *Teredo diegensis* Bartsch, Nautilus, vol. 30, No. 4, pp. 47, 48.

Shell small, subglobular, white. The anterior area rather heavy, with the usual sinus which is edged with a strong callus slightly reflected over the back of the shell, from which it is not strongly differentiated. The rest of the anterior area is marked by dental ridges which have a strong downward flexure a little distance from the anterior edge, and then bend in an even curve backward, expanding slightly fan-shaped. These ridges are almost as wide as the spaces that separate them. There are 53 present in the type. They seem to slope almost as abruptly on the ventral side as on the dorsal, and are very finely denticulated on the free margin. The anterior median portion of the middle part is crossed by strong dental ridges which are separated by mere impressed lines and very strongly denticulated at the free edge. They join those of the anterior part at right angles. The junction between the anterior and median part is a slightly sinuous line. The middle portion of the median part forms a slightly depressed groove which is crossed by rough wrinkles. The posterior portion of the median part is about as wide as the anterior and is marked by strong lines of growth. The posterior part forms a minute auricle which is marked by a series of obsolete corrugations which parallel the ventral margin. Interior bluish white. The junction of the anterior and the posterior portion is marked by a tumid cord. The auricle extends over the posterior median portion as a narrow shelf. The umbone has a strong knob from which a broad, curved, and somewhat flexed blade extends for a little more than half the width of the shell. The ventral margin of the median portion bears the usual knob. The pallet has a sinuous, cylindric stalk. The blade is subcordate in shape. The distal portion is drawn out. The distal two-thirds are covered by a strong periostracum, the outer portion of which bears a strong calcareous knob at the tip.

The type, Cat. No. 74219, U.S.N.M., was collected by Henry Hemphill at San Diego, California, and measures: Height: 4.7 mm.; length, 4.4 mm.; diameter, 4.6 mm. The pallet measures: Length, 5.7 mm., of which 3 mm. go to the stalk; diameter 1.2 mm.

There are four additional lots of this species in the United States National Museum, all from San Diego.

The peculiar pallets, the broad anterior median area, and the small auricle will distinguish this at a glance from any of the West American forms. It is distinguished from *Teredo* (*Teredops*) *floridana* by

having the dental ridges of the anterior portion much heavier and fewer in number, and by having the middle median portion much more smooth. The blade of the pallet, too, is heart shaped, while in the Florida form it is more paddle shaped.

Subgenus NEOTEREDO Bartsch.

1920. *Neoteredo* BARTSCH, Proc. Biol. Soc. Washington, vol. 33, p. 69.

The characters which differentiate this subgenus from typical *Teredo* are that the pallets are spoon-shaped instead of paddle-shaped, but cupped at the distal end. The small posterior auricle bends inward very strongly and thus forms a deep cavity which extends from the umbones downward behind the shelf thus produced.

Type.—*Teredo* (*Neoteredo*) *reynei* Bartsch.

KEY TO THE AMERICAN SPECIES OF NEOTEREDO.

Pallets of *miraflora* unknown.
Shell:
Auricle very small ..... *reynei.*
Auricle moderately large ..... *miraflora.*

TEREDO (NEOTEREDO) REYNEI Bartsch.

REYNE SHIPWORM.

Plate 23; plate 33, fig. 3.

1920. *Teredo* (*Neoteredo*) *reynei* BARTSCH, Proc. Biol. Soc. Washington, vol. 33, pp. 69, 70.

Shell subglobular; exterior cream-yellow excepting the central portion of the median part, which is dark brown gradually shading to light brown posteriorly; interior bluish white. The anterior portion consists of an outer roughly grooved area at the extreme anterior edge, followed by the main anterior portion which bears dental ridges and is about two and a half times as broad as the part just mentioned. The dental ridges are of quite regular width and spacing; they curve downward at their anterior limit, then extend in an even curve across the shell to meet the anterior end of the dental ridges of the median portion. In the type 125 of these dental ridges are present. These ridges are about as wide as the grooves that separate them. They are triangular with the dorsal slope a little more abrupt than the ventral, the edge being finely serrated. The depressions between the denticles pass down on both sides of the dental ridge as fine incised lines. There are about six denticles present on the ridge in a distance equal to that separating ridge from ridge. The dental ridges of the anterior and median part meet almost at right angles. The denticles on the median part are slightly stronger than those on the anterior ridges. The dental ridges of the median portion terminate rather abruptly without

change of curve at the junction of the anterior median with the posterior median portion. The posterior median portion is marked by coarse transverse wrinkles on its anterior third, from which lesser lines of growth take a sudden upward curve and extend partly over the rest of the shell. The posterior median portion is suddenly deflected inward, giving this portion of the shell a truncated appearance at the posterior margin. This part is finely granulose above the median portion of the posterior auricular part, while ventrally it is faintly longitudinally grooved. The posterior portion of the shell is produced into a short auricle, which is marked by the continuation of the feeble grooves extending over it from the posterior portion of the median part. The umbonal knob has a strong, narrow, blade-like tooth extending obliquely into the cavity. A strong oblique shelf for muscular attachment extends from the umbonal tooth to the ventral termination of the posterior auricle, overarching the umbonal cavity. The blade for muscular attachment is thin, short, and decidedly flattened. It is inserted under the umbonal tooth, extending obliquely backward, the tip pointing to a position midway on the ventral edge of the posterior part. In *Teredo* in the restricted sense the blade usually has its flat surface parallel to the ventral curvature of the interior of the shell, while here the reverse is almost true, for the narrow edge almost parallels the interior. The extreme ventral portion of the median part is provided with a strong rounded knob, while the middle of the median portion is decidedly roughened within. The pallets are paddle-shaped, cupped at the distal extremity, with a long, rounded stalk and short ovate blade.

The type, Cat. No. 338240, U.S.N.M., was taken by Mr. A. Reyne, of the Agricultural Experiment Station, at Paramaribo, Dutch Guiana, from greenheart wood (*Ocotandra rodiaei* Schomburgk), which was believed to be immune to shipworm attacks. Cat. No. 345347, U.S.N.M., contains specimens from Surinam.

The type measures: Height, 12.2 mm.; length, 12.3 mm.; thickness, 13.4 mm. The pallets measure: Length, 7.2 mm.; diameter, 2.5 mm.

TEREDO (NEOTEREDO) MIRAFLORA, new species.

MIRAFLORA SHIPWORM.

Plates 24, 25.

Shell large, subglobular, white. The anterior portion with a moderate sinus which in adult specimens is plugged up with a heavy callus. From the edge of this callus, which is reflected, the dental ridges bend slightly downward and then forward, spreading out in a fan-shaped manner, separated at the posterior extremity by spaces

not quite as wide as the ridges. In fact, the bases of the adjacent ridges touch each other. The sides of the dental ridges slope a little more abruptly dorsally than ventrally, the free edge being rather conspicuously denticulated. Of these ridges, 97 are present in the type. The anterior median portion is very broad and bears denticulated ridges which are separated by mere impressed lines. These ridges are a little more closely approximated than those of the anterior area, and a little narrower than those of the anterior area. They join these at almost right angles. The central median portion is slightly depressed. The anterior border is strongly marked off from the anterior portion by a conspicuous line. The posterior median portion is about as wide as the anterior, and is marked by rough, curved growth lines. The posterior part forms a rather conspicuous auricle, the junction of which with the posterior median portion forms a depressed groove. The interior is bluish white. The junction of the anterior and median portion is not conspicuous. The central median portion is a slightly roughened groove, which bears a prominent knob at its ventral extremity. The posterior portion projects over the median part to form a strong shelf. The blade, which is broad and grooved and extends to about half the length of the shell, is pendant from below this heavy umbone. We have been unable to obtain pallets of this species so far.

The type and a lot of other specimens, Cat. No. 344661, U.S.N.M., is Z 1402 from greenheart timber in fresh water in Mira Flores Lake at Pedro Miguel, Canal Zone, collected by Mr. C. J. Embree, office engineer, the Panama Canal. The type measures: Height, 11.3 mm.; length, 11.6 mm.; diameter, 12 mm.

This species is most nearly related to *Teredo* (*Neoteredo*) *reynei*, the only other known species of the subgenus, but differs from it in having the auricle much larger and in not having the posterior portion of the median part bend down suddenly.

This is the only *Teredo* so far reported from the fresh waters of America.

Subgenus TEREDORA Bartsch.

1921. *Teredora* BARTSCH, Proc. Biol. Soc. Washington, vol. 34, p. 26.

In this subgenus the auricle is so placed upon the posterior median portion that half of it projects as a shelf inwardly, and the other half outwardly. The pallets have a naillike depression, which may be marked by concentric lines of growth, or these may become even riblike, and it may have longitudinally radiating riblets, confined to the basal portion of the naillike part, or these also may be strong and riblike.

Type.—Teredo malleolus Turton.

KEY TO THE AMERICAN SPECIES OF TEREDORA.

Pallets:

Nail strongly ribbed ..... *panamensis.*

Nail obsoletely ribbed ..... *thomsoni.*

The pallets of *vincentensis* are unknown.

Shell:

Anterior portion of median part moderately broad ..... *thomsoni.*

Anterior portion of median part very narrow.

Height more than 10 mm ..... *vincentensis.*

Height less than 5 mm ..... *panamensis.*

TEREDO (TEREDORA) THOMSONI Tryon.

THOMSON SHIPWORM.

Plate 26; plate 34, fig. 4.

1863. *Teredo thomsonii* TRYON, Proc. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pp. 280, 281, pl. 2, figs. 3–5.

Shell large, white. The extreme anterior area with the usual sinus and heavy callus, which forms a strong projecting cord at the edge of the shell. From this sinus the dental ridges bend first downward and then pass backward in an even curve, spreading out slightly fan shaped. They are about half as wide as the spaces that separate them at the posterior termination in the later portion of the shell, but in the first fourth they are not more than one-fourth as wide. The anterior callus covers up the early ones, but 68 are present in the specimen figured. The anterior part is separated from the posterior median part by a straight line. These ridges slope abruptly on the dorsal side, and gently on the ventral which is about twice as broad. They are finely denticulated on their free margin. The anterior median part is crossed by dental ridges that join those of the anterior part at a little more than a right angle. These ridges are separated by rather broad lines, and bear numerous fine denticles at their free margin. The median portion of the middle part is concave and crossed by coarse lines of growth. The posterior portion is much wider than the anterior, and is marked by irregular lines of growth. The posterior part forms a small auricle which is very obliquely placed and strongly constricted at its junction with the posterior median portion. Interior bluish white. The anterior and median portions are joined by a somewhat thickened area, while the middle portion of the median part is a rough groove that extends apparently from the umbone to the strong knob at the base. The auricle is placed on the posterior median portion in such a way that it looks almost like a pallet attached in the middle to the posterior median part, about as much projecting inward as projects outward. From the under side of the knob at the umbone a strong blade, which is broad and becomes expanded basally, extends for half or more of the length of the shell downward. The pallets have a subcylindric

stalk. To this attaches a solid portion which has two strong wings passing up on the outside on either side. The median portion of the pallet is depressed and naillike, and resembles very much a finger nail in its nail bed, there being a slight pocket at the basal margin. The nail portion itself is marked by strong concentric rough lines. A similar type of sculpture also characterizes the edges of the lateral areas of the basal portion of the blade. The inside of the blade is smooth, and shows a rib running through its center very much as if the stalk portion extended toward the tip through the pallet.

Cat. No. 345349, U.S.N.M., contains three valves and two pallets of this species collected by Sanderson Smith in New England. The specimen figured measures: Height, 9.8 mm.; length, 9.7 mm.; diameter, 9.9 mm. The pallet measures: Length, 9.9 mm., of which 2.2 mm. go to the stalk; diameter of blade, 4.7 mm.

This is the American analogue of the European *Teredo* (*Teredora*) *malleolus* Turton, from which it is easily distinguished by its having the median portion much wider than that form, and the auricle comparatively much smaller and much less strongly sculptured.

TEREDO (TEREDORA) PANAMENSIS, new species.

PANAMA SHIPWORM.

Plate 27, fig. 3 and 4; plate 35, fig. 2.

Shell very short, with the median part extremely elongated; white, covered with a brown periostracum, except at the posterior border. The anterior portion has the usual sinus, but very shallow in this case. This is covered with a callus which is reflected over the outside, where it extends over the dark periostracum for some little distance. The dental ridges that radiate from under this callus bend downward first and then in a gentle, even curve backward. There are only nine of these present in the type. They are extremely distantly placed, and stand out as strong lamellae, finely denticulated at the free border, the margins of the denticulations extending down on the sides of the dental ridges. The spaces separating the dental ridges are marked by lines of growth, crossed at right angles by microscopic striations. The median area is very narrow and very long and bears at the anterior margin a small number of dental ridges, which join those of the anterior area in a little more than a right angle. These dental ridges are marked by strong tubercles. The middle median portion is slightly concave and marked by lines of growth only, while the posterior median portion is extremely narrow and marked by lines of growth only. The posterior area forms a very narrow auricle which really appears as a partly upturned portion of the posterior median area. This is marked by lines of growth only. The interior is bluish white. The junction of the anterior with the median portion

is marked by a tumid line, while the middle median portion shows as a groove that extends from the umbones to the knob at the ventral margin. The posterior area is shaped like a pallet, with a stalk pointing to the umbone and so attached to the posterior median part that as much of the shelf thus formed projects inward as there is auricle projecting outward. The blade is almost cylindric, slightly expanded at the basal margin, and curves through about half of the length of the shell. The pallets are paddle shaped, the free stalk being short, but it appears to extend through the center of the blade, the inside of which is smooth. The basal portion of the blade is solid and thick, while the distal portion is naillike, and is marked by a series of longitudinally radiating ribs which are connected and crossed by fine concentric riblets.

The type and some additional specimens, Cat. No. 212591, U.S.N.M., were collected by the United States Bureau of Fisheries steamer *Albatross* in Panama Bay at Station 2805, in 51½ fathoms.

It measures: Height, 4.6 mm.; length, 3.3 mm.; diameter, 5.5 mm. The pallet measures: Length, 4.8 mm., of which 1.3 mm. go to the stalk, and 2.3 mm. diameter.

The curious pallet and the extremely limited number of dental ridges distinguish this from all other American shipworms.

TEREDO (TEREDORA) VINCENTENSIS, new species.

ST. VINCENT SHIPWORM.

Plate 27, figs. 1 and 2.

Shell large, white. The extreme anterior portion with the usual sinus which shows a strongly reflected callus, free at its posterior margin. From this cavelike portion the dental ridges pass abruptly downward and then backward in an even curve. They are very distantly spaced at the posterior margin, where the spaces that separate them are probably seven or eight times as wide as the dental ridges. The dental ridges slope a little more abruptly on the umbonal side than on the ventral. Most of them show a slender secondary thread at the basal margin. Of these ridges, 26 are present in the type, and none are here covered by the callus. It is therefore a perfect specimen. The anterior median portion bearing the narrow dental ridges which are here separated by mere impressed lines is narrow. The dental ridges join those of the anterior portion at almost a right angle. The middle median portion forms a slightly depressed groove which is crossed by rough wrinkles. The posterior median portion is about twice as wide as the anterior and the middle median part combined, and is marked by a series of wavelike markings which are extensions of those marking the middle portion of the median part. The posterior part is exceedingly oblique and placed far on the dorsal margin. It is pallet-shaped and marked by a series of

concentric wavelike markings, and so placed upon the dorsal posterior median portion that about one-third projects inward and two-thirds outward. On the exterior there is a deep inflexion at the junction of the auricle with the posterior median part. The interior is bluish white. The junction of the anterior and median part is marked by a mere slightly raised thread, while the middle median portion is marked by a strongly impressed groove. The auricle extends inward as a shelf, as already indicated. The umbones are marked by a strong knob. The base of the ventral median part is broken in the type.

The type, Cat. No. 17622, U.S.N.M., comes from St. Vincent, West Indies.

It measures: Height (estimated), 11 mm.; length, 9.5 mm.; diameter, 9.5 mm.

This species differs from *Teredo* (*Teredora*) *thomsoni* Tryon in having the anterior median area much narrower than in that species. It can be differentiated from *Teredo* (*Teredora*) *panamensis* by its much broader, entire median portion. It comes nearest to the European *Teredo* (*Teredora*) *malleolus* Turton as far as shell characters are concerned, agreeing with this in the width of the denticulated anterior median portion, but differs from it in having the denticulated ridges of the anterior portion much more distantly spaced. It is also quite possible that when the pallets of it will be found, additional characters will be presented.

This is probably what Jeffreys referred to as *Teredo malleolus* Turton, sent to him by P. P. Carpenter from the West Indies. The specimen is marked as having been determined by Jeffreys.

Psiloteredo, new subgenus.

In this subgenus the auricle fuses with the posterior median portion on the inside in such a manner that no shelf projects. In fact, in some of the species it is difficult to note even a suture. The pallets are spoon-shaped, with the outer distal portion slightly excavated.

Type.—Teredo dilatata Stimpson.

KEY TO THE AMERICAN SPECIES OF PSILOTEREDO.

Pallets:
- Blade elongate ovate ..... *stimpsoni.*
- Blade not elongate ovate.
  - Blade ovate ..... *jamaicensis.*
  - Blade not ovate.
    - Blade broadly ovate.
      - Lateral margin of base of blade convexly rounded.
        - Strong concentric markings restricted to nail ..... *tryoni.*
        - Strong concentric markings not restricted to nail ..... *knoxi.*
      - Lateral margin of base of blade not convexly rounded.
        - Lateral margin of base of blade almost straight ..... *sigerfoosi.*
        - Lateral margin of base of blade slightly concave ..... *dilatata.*

Shell:
- Auricle very large ..... *dilatata.*
- Auricle not large.
  - Anterior portion of median part very narrow ..... *sigerfoosi.*
  - Anterior portion of median part not very narrow.
    - Auricle moderately large ..... *jamaicensis.*
    - Auricle small.
      - Height more than 7 mm.
        - Incremental lines of middle and posterior median part coarse ..... *stimpsoni.*
        - Incremental lines of middle and posterior median part fine ..... *tryoni.*
      - Height less than 6 mm ..... *knoxi.*

TEREDO (PSILOTEREDO) DILATATA Stimpson.

BIG-EARED SHIPWORM.

Plate 28, fig. 1; plate 36, fig. 2.

1851. *Teredo dilatata* Stimpson, Proc. Bost. Soc. Nat. Hist., vol. 4, p. 113.

Shell of medium size, white. The extreme anterior portion with the usual sinus and reflected callus. The latter covers a considerable portion. The ventral anterior portion projects forward as a decided point from which the dental ridges radiate downward and backward. These are separated by spaces about twice as wide as the dental ridges at the posterior margin. Twenty-three are visible in the specimen figured. These dental ridges slope abruptly on the dorsal margin and gently toward the ventral, the ventral side being fully three times the width of the dorsal. They are finely denticulated at the free edge. The anterior median part is quite narrow and marked by strongly denticulated ridges, which are separated by mere impressed lines. The middle median part is not strongly depressed, but crossed by strong cords, which are the nondenticulated continuation of the dental ridges of the anterior median part and between these are finer threads, which coincide with the heavier in disposition. The posterior median portion is about one and a half times as wide as the anterior and middle median portion and appears wavy, the crest of the waves corresponding with the stronger ridges described for the middle median portion. The posterior part forms a huge auricle which is almost as wide as the middle part. It is thin at the free margin and slightly reflected outward. It extends prominently upward and has a strong incised margin near the umbones. It is marked by a series of concentric feeble wave-like elements. The interior is bluish white, the suture of the anterior and median part being a mere raised thread, while the middle part is marked by a groove, the extreme ventral portion bearing the prominent knob. The auricle fuses with the posterior median part and does not in any way project over it, but it seems rather as if the median part covered the auricle slightly with a thin callus. The

umbonal knob is strong, from the inner surface of which a slender blade projects, which is about half the length of the shell. The pallets are spoon-shaped, short stalked, and broadly expanded, and show a slightly gouged out area, marked with concentric lines on the outside. The inside shows the extension of the stalk up through the mass of the pallet.

Stimpson's type came from a pine buoy used to indicate the position of the lobster pots of fishermen at Lynn and Marblehead, Massachusetts.

The specimen described and figured is one of a lot, Cat. No. 33630, U.S.N.M., taken from United States Bureau of Fisheries Station 995 off Marthas Vineyard in 1881.

Ie measures: Height, 8 mm.; length, 8 mm.; diameter, 8 mm. The pallets measure: Length, 5.3 mm., of which 1.2 mm. go to the stalk; diameter, 2.7 mm.

This is the big-eared shipworm of the Northeast coast, which has undoubtedly been listed by many authors as *Teredo megotara* Hanley, which is European, from which it differs by its smaller size, proportionately larger auricles, and by the differently shaped pallets. In *Teredo megotara* Hanley they are much more slender and elongate. We have it from many stations ranging from Georges Bank and Casco Bay south to Rhode Island.

TEREDO (PSILOTEREDO) STIMPSONI, new species.

STIMPSON SHIPWORM.

Plate 28, fig. 3; plate 35, fig. 3.

Shell large, yellowish white, subglobular, the anterior area with a deeply incised narrow sinus, which is marked by a reflected callus that is differentiated from the rest of the shell by an impressed groove. From this callus the dental ridges radiate, taking first a sudden downward course, then spreading out in a somewhat fan-shaped, even-curved course. The dental ridges are separated at their posterior termination by a space a trifle wider than the width of the ridges. They slope a little more abruptly anteriorly than posteriorly and are denticulated on their free margin. Sixty-four of them occur in the type. The anterior median portion is very broad and is marked by strong dental ridges, which are separated by well-impressed grooves. These dental ridges join the anterior part at almost a right angle. The middle median part forms a slightly depressed groove, crossed by rather prominent cords and between these finer threads. The posterior median area is about as wide as the anterior and median combined, and is marked by the continuations of the coarser threads that cross the median area, and also by fine lines. The posterior area forms a very narrow inconspicuous

auricle, joining the posterior median portion in an even curve. The interior is bluish white. The junction of the anterior and median parts are marked by a raised thread. The middle median part has a depressed groove terminating at the ventral margin in a heavy knob. The auricle joins the posterior median part without a definite suture. From the prominent umbone the wide, obliquely curved blade is pendant, the flat surface of which runs parallel with the surface of the shell. It extends for about half the length of the shell. The pallets are very large, elongate spoon-shaped. The stalk is short and the blade rather long, terminating at the anterior part. The blade shows a tendency to flake on the outside, the distal portion being marked by a series of concentric lines on the outside. The inside shows the continuation of the stalk through the center of the blade. It is smooth except at the distal portion, where it is marked by a series of concentric lines, and is covered by a rather thick periostracum.

The type, Cat. No. 27461, U.S.N.M., comes from Charleston, South Carolina, and measures: Height, 9 mm.; length, 9 mm.; diameter, 9 mm. The pallets measure: Length, 14 mm., of which 3.5 go to the stalk; diameter, 5 mm.

We have seen this species in collections under the name of *Teredo dilatata* Stimpson, from which it is, however, at once distinguished by its minute auricle and much larger pallets. We have it ranging from Charleston to Florida.

TEREDO (PSILOTEREDO) SIGERFOOSI, new species.

SIGERFOOS SHIPWORM.

Plate 28, fig. 2; plate 36, fig. 1.

1908. *Teredo dilatata* SIGERFOOS not Stimpson, Bull. U. S. Bur. Fisheries, vol. 27, 1907.

Shell subglobular, white. The extreme anterior portion with the usual sinus, covered by a narrow callus from the edge of which the denticulated ridges bend downward and then evenly curve backward in a fan-shaped manner. At the posterior extremity these ridges are about one-fourth as wide as the spaces that separate them. There are 47 of these, for it has been possible to count them from the very beginning through the thin umbonal callus. These ridges slope more abruptly dorsally than ventrally, the ventral side being about twice as wide as the dorsal. They are finely denticulated at the free margin. The anterior median portion is rather narrow. The strongly denticulated ridges here are separated by mere impressed lines, and they join those of the anterior area at a little more than a right angle. The middle median portion forms a slightly concave groove, which is crossed by the much enfeebled

continuations of the dental ridges of the anterior portion, which make a U-shaped bend here, becoming lost at the posterior margin. Between these stronger ridges finer rough lines which coincide with the other are present. The posterior median portion is a little wider than the anterior, and the middle portion and is marked by rough wavelike markings. The posterior part forms a small auricle, which joins the posterior median portion without specific differentiation. The interior is bluish white, the anterior and median portion being joined by a cordlike callus. The middle median portion bears a groove, at the ventral margin of which the usual knob is present. The auricle joins the posterior median portion without any sutural marking. The umbonal knob is strong, and from the inside of it a broad, curved blade extends two-thirds of the way across the inside of the shell. The pallets are spoon-shaped. The stalk is irregular and twisted, short, and can be seen extending through the blade on the inside. The blade is broadly ovate, solid and smooth when viewed from the inside, except at the distal end, which is marked by a number of concentric lines. The outside is inclined to scale, the distal margin being marked by a series of concentric growth lines.

The type, Cat. No. 345357, U.S.N.M., was collected by Sigerfoos at Beaufort, North Carolina, December 7, 1911. It measures: Height, 5 mm.; length, 5 mm.; diameter, 5 mm. The pallet measures: Length, 5.3 mm., of which 1.7 mm. go to the stalk; diameter, 2.7 mm.

This is the specimen which I identified for Prof. Charles P. Sigerfoos as *Teredo dilatata*. I take great pleasure in naming it for Professor Sigerfoos, who has contributed more to the life history of American shipworms than any other man.

This species is easily distinguished from *Teredo dilatata* by its small auricle and broad blade.

TEREDO (PSILOTEREDO) TRYONI, new species.

TRYON SHIPWORM.

Plate 29, fig. 3; plate 35, fig. 4.

Shell subglobular, white. The anterior area with the usual sinus and callus. The extreme anterior basal portion projects as a triangular point. A callus is reflected over the anterior area, but closely appressed to it and not strongly differentiated from it. The dental ridges curve suddenly downward and then spread out evenly in a fanlike manner. They are separated at their posterior termination by spaces a little wider than the dental ridges. These ridges are strongly denticulated at the free margin and slope a little more abruptly dorsally than ventrally. The type, which has the umbone quite strongly eroded, shows 58 of these ridges. The an-

terior median portion is very broad and crossed by the dental ridges which are strongly denticulated and separated by mere lines of growth. These join those of the anterior area at almost a right angle. The middle median area is scarcely concave and crossed by rough lines of growth. The posterior median area is a little narrower than the anterior and middle median area combined, and crossed by rather rough lines of growth, which are of irregular strength. The posterior area forms a very narrow auricle, which is distinguished from the posterior median area by an impressed groove, and is marked by the continuations of the rough lines crossing the posterior median area. The interior is bluish white, the anterior and the posterior areas being joined by a slightly raised cord. The middle median area forms a broad groove, in the ventral margin of which the strong knob is situated. The auricle is very narrow and not differentiated from the posterior median area. It shows the lines of growth by transmitted light. On the under side of the umbonal knob the broad, somewhat twisted blade descends through half the length of the shell. The pallets are spoon-shaped. The stalk is short, slender, and somewhat twisted. The exterior is roughly scaly, marked with concentric lines at its terminal portion. The inside is smooth and shows the stalk passing through the center of the blade. The distal portion is marked by a heavy periostracum showing lines of growth.

The type, Cat. No. 36046a, U.S.N.M., was collected by Mr. Hemphill at Cedar Keys, Florida. It measures: Height, 7.5 mm.; length, 7.5 mm.; diameter, 7.5 mm. The pallet measures: Length, 5.5 mm., of which 1.7 mm. go to the stalk; diameter, 2.5 mm.

The present species recalls *Teredo* (*Psiloteredo*) *sigerfoosi* but can be at once differentiated from it by the very wide anterior median area. We have seen additional specimens from San Andrews, Florida, collected by Mr. C. S. Smith on October 5, 1896, and also several odd valves taken by Prof. Sigerfoos at Rivers Island, Beaufort, North Carolina, on November 16, 1909.

TEREDO (PSILOTEREDO) KNOXI Bartsch.

KNOX SHIPWORM.

Plate 29, fig. 2; plate 34, fig. 2.

1917. *Teredo knoxi* Bartsch, Bull. No. 28, Public Works of the Navy, p. 47, 7 figs.

Shell small, white. The anterior portion with the usual sinus, and the anterior ventral margin prolonged into a decided point. The sinus is covered by a strong reflected callus, from the dorsal margin of which the dental ridges bend suddenly downward and backward. Of these dental ridges, 50 are present in the type. They slope a little

more abruptly dorsally than ventrally. The spaces that separate these ridges are wider on the early part than on the later. They are about as wide as the ridges in the later portion. The anterior median portion is crossed by dental ridges which bear strong denticles, and are separated by narrow impressed lines. They join the ridges of the anterior portion in a little more than a right angle. The middle median portion is concave and crossed by rough incremental lines. The posterior median portion is not quite as wide as the anterior and middle portions combined, and is also crossed by curved, rough lines of growth. The posterior part forms a very small auricle, which is decidedly obliquely situated and scarcely differentiated from the posterior median part. It is marked by the same rough lines of growth characterizing the posterior median part. The interior is bluish white. The junction of the anterior and median portions is marked by a raised thread. The middle median portion has an irregular groove terminating in a basal knob. The very narrow oblique auricle fuses with the posterior median portion, without suture. A strong, broad, curved blade springs from the under side of the large umbone and extends for about two-thirds of the way across the inside of the shell. The pallets are spoon shaped. The stalk is short and irregularly curved. The junction of the blade and the stalk forms a number of rings. The inside of the blade is smooth, except at the edge where the periostracum is roughened. It shows the stalk passing through the interior of the blade. The outside of the pallet is very rough and scaly, marked by a series of concentric lines.

The type, Cat. No. 216919, U.S.N.M., and a lot of additional material was collected at the Naval Station at Guantanamo Bay, Cuba. It measures: Height, 5.8 mm.; length, 5.3 mm.; diameter, 6 mm. The pallets measure: Length, 6 mm., of which 1.3 mm. go to the stalk; diameter, 3 mm.

This species is readily distinguished from all the others by its extremely narrow oblique auricle.

TEREDO (PSILOTEREDO) JAMAICENSIS, new species.

JAMAICA SHIPWORM.

Plate 29, fig. 1; plate 35, fig. 1.

Shell subglobular, white. The anterior portion with the usual sinus. The extreme anterior ventral margin forming a strongly drawn out point. The callus is reflected over the shell and forms a rather broad ridge, from the edge of which the dental ridges of the anterior part radiate, although those more ventral bend first downward and then backward. Of these ridges 79 can be counted in the type. These ridges are about as wide, or a little wider, than the spaces that separate them at the posterior termination, and the dorsal side is about

half as long as the ventral. They are minutely denticulated at the free edge. The anterior median area is rather broad and marked by dental ridges which bear rather fine denticles. The ridges of this area join those of the anterior portion at a little more than a right angle. The middle median area forms a slightly depressed groove and is crossed by the enfeebled continuations of the dental ridges, which here lose their denticles and form U-shaped curves. There are finer incremental lines between the heavier. The posterior median portion is about as wide as the anterior, and is crossed by the continuation of the lines of growth and ridges just referred to. Auricle moderately prominent, not strongly differentiated from the posterior median portion, marked by growth lines. Interior bluish white. The anterior median portion is joined to the anterior part by a somewhat thickened line. The middle median portion has an irregular groove bearing a knob at the ventral termination. The auricle is rather prominent and joins the posterior median portion without differentiation. Blade unknown. The pallets are of very irregular shape. Stalk twisted and curved. The external portion of the pallets is scaly and marked by rough lines. The interior is smooth.

The type, Cat. No. 194283, U.S.N.M., was collected by Dr. C. B. Adams at Jamaica. It measures: Height, 6.2 mm.; length, 6.2 mm.; diameter, 6.2 mm. The pallet measures: Length, 6.2 mm., of which 1.3 mm. go to the stalk; diameter, 2.2 mm.

The present species is differentiated from *Teredo* (*Psiloteredo*) *knoxi* by its entirely differently shaped pallets and also by some differences in the width of the anterior median portion.

The type is a specimen of the Jeffreys collection submitted to Jeffreys by Prof. C. B. Adams, and bears the name of *Teredo spatha* Jeffreys, from which it differs by having a much larger auricle, less wide anterior median area, and entirely differently shaped pallets.

There are several additional lots of specimens in the collection of the U. S. National Museum, chiefly from the West Indies and South America, which indicate that additional species of these mollusks will have to be recognized when more material comes in. I refrain from giving a description of them or bestowing a name upon them until that time comes.

EXPLANATION OF PLATES.

PLATE 1.

Teredo navalis Linnaeus, after Meyer and Möbius.

FIG. 1. In its wood burrow.
2, 3. Siphons and pallets.
13. Exterior right valve.
7. Interior left valve.
6, 12. Dental ridges of the anterior part.
4, 5, 9, 10, 11. Views of the denticles of the anterior median portion.
8. Pallets.

PLATE 2.

Bankia (Bankiella) gouldi Bartsch.

(Copy of Sigerfoos's Plate 8.)

FIG. 5. Showing exterior of the animal.
6. With the mantle removed, showing internal organization.

KEY TO LETTERING.

aa, Anterior adductor muscle.
ap, Posterior adductor muscle.
apa, Adductor muscle of pallet.
bg, Branchial groove.
ch, Cephalic hood of mantle.
col, Collar.
epc, Epibranchial cavity.
es, Exhalent or anal siphon.
f, Foot.
g, Ctenidium or gill.
is, Inhalent or respiratory siphon.
lig, Shell ligament.
mc, Mantle cavity.
pa, Pallet.
pp, Protractor muscle of pallet.
rs, Attachments of the siphons.
sh, Shell.
vm, Visceral mass.

PLATE 3.

Detail of the siphon and pallet apparatus of *Bankia (Bankiella) gouldi* Bartsch. FIGS. 35 and 36 from Sigerfoos.

Lettering as in Plate 2 with the following additions: *ca*, calcareous lining of burrow; *rp*, retractor muscle of pallet.

PLATE 4.

Bankia (Bankia) setacea Tryon.

PLATE 5.

A number of animals of *Bankia (Bankia) setacea* Tryon.

(Used by permission of the San Francisco Bay Marine Piling Committee.)

PLATE 6.

Bankia (Neobankia) zeteki Bartsch.

PLATE 7.

Greenheart wood sill of Balboa Lock, Panama Canal, destroyed by *Bankia* (*Neobankia*) *zeteki* Bartsch.

PLATE 8.

FIG. 1. *Bankia* (*Bankiella*) *mexicana* Bartsch.
2. *Bankia* (*Nausitora*) *excolpa* Bartsch.
3. *Bankia* (*Bankiella*) *gouldi* Bartsch.

PLATE 9.

A number of animals of *Bankia* (*Bankiella*) *gouldi* Bartsch.
(By courtesy of the American Railway Engineering Association.)

PLATE 10.

Teredo navalis Linnaeus, after Meyer and Möbius.

Details of the posterior end of the animal.
(By courtesy of the American Railway Engineering Association.)

PLATE 11.

Charleston wharf attacked by *Bankia* (*Bankiella*) *gouldi* Bartsch.
(By courtesy of the American Railway Engineering Association.)

PLATE 12.

Four pieces of piling showing burrows of *Bankia* (*Bankiella*) *gouldi* Bartsch, from Charleston.
(By courtesy of the American Railway Engineering Association.)

PLATE 13.

Two pieces of timber riddled by *Bankia* (*Bankiella*) *gouldi* Bartsch at Miami.
(By courtesy of the American Railway Engineering Association.)

PLATE 14.

Pilings destroyed by *Bankia* (*Bankiella*) *gouldi* Bartsch at Port Tampa, Florida.
(By courtesy of the American Railway Engineering Association.)

PLATE 15.

Pilings destroyed by *Bankia* (*Bankiella*) *gouldi* Bartsch at Port Tampa, Florida.
(By courtesy of the American Railway Engineering Association.)

PLATE 16.

Pieces of wood rendered a mere sponge by *Bankia* (*Bankiella*) *gouldi* Bartsch at Port Tampa, Florida.
(By courtesy of the American Railway Engineering Association.)

PLATE 17.

Bankia (*Nausitora*) *dryas* Dall.

PLATE 18.

Bankia (*Nausitora*) *dryas* Dall.

PLATE 19.

Bankia (*Nausitora*) *dryas* Dall.
Upper figure, dental ridges of the anterior part.
Lower figure, dental ridges of the anterior median portion.

PLATE 20.

FIG. 1. *Teredo* (*Teredo*) *beachi* Bartsch.
2. *Bankia* (*Bankiella*) *fusticula* Jeffreys.
3. *Bankia* (*Nausitora*) *braziliensis* Bartsch.

PLATE 21.

FIG. 1. *Teredo* (*Lyrodus*) *bipartita* Jeffreys.
2. *Teredo* (*Teredothyra*) *dominicensis* Bartsch.
3. *Teredo* (*Teredo*) *norangliae* Bartsch.

PLATE 22.

FIG. 1. *Teredo* (*Teredops*) *floridana* Bartsch.
2. *Teredo* (*Lyrodus*) *townsendi* Bartsch.
3. *Teredo* (*Teredops*) *dicaensis* Bartsch.

PLATE 23.

Teredo (*Neoteredo*) *reynei Bartsch.*

PLATE 24.

Teredo (*Neoteredo*) *miraflora* Bartsch.

PLATE 25.

Greenheart wood destroyed by *Teredo* (*Neoteredo*) *miraflora* Bartsch.

PLATE 26.

Teredo (*Teredora*) *thomsoni* Tryon.

PLATE 27.

FIG. 1, 2. *Teredo* (*Teredora*) *vincentensis* Bartsch.
3, 4. *Teredo* (*Teredora*) *panamensis* Bartsch.

PLATE 28.

FIG. 1. *Teredo* (*Psiloteredo*) *dilatata* Stimpson.
2. *Teredo* (*Psiloteredo*) *sigerfoosi* Bartsch.
3. *Teredo* (*Psiloteredo*) *stimpsoni* Bartsch.

PLATE 29.

FIG. 1. *Teredo* (*Psiloteredo*) *jamaicensis* Bartsch.
2. *Teredo* (*Psiloteredo*) *knoxi* Bartsch.
3. *Teredo* (*Psiloteredo*) *tryoni* Bartsch.

PLATE 30.

FIG. 1. Pallets of *Bankia* (*Neobankia*) *zeteki* Bartsch.
2. Pallets of *Bankia* (*Bankiella*) *mexicana* Bartsch.
3. Pallets of *Bankia* (*Bankia*) *setacea* Tryon.
4. Pallets of *Bankia* (*Bankiella*) *gouldi* Bartsch.

PLATE 31.

FIG. 1. Pallets of *Bankia* (*Nausitora*) *braziliensis* Bartsch.
2. Pallets of *Bankia* (*Nausitora*) *fusticula* Jeffreys.
3. Pallets of *Bankia* (*Nausitora*) *dryas* Dall.
4. Pallets of *Bankia* (*Nausitora*) *excolpa* Bartsch.

PLATE 32.

FIG. 1. Pallets of *Teredo* (*Teredo*) *beaufortana* Bartsch.
2. Pallets of *Teredo* (*Teredo*) *navalis* Linnaeus.
3. Pallets of *Teredo* (*Teredo*) *norvangiae* Bartsch.
4. Pallets of *Teredo* (*Teredo*) *beachi* Bartsch.

PLATE 33.

FIG. 1. Pallets of *Teredo* (*Teredothyra*) *dominicensis* Bartsch.
2. Pallets of *Teredo* (*Lyrodus*) *townsendi* Bartsch.
3. Pallets of *Teredo* (*Neoteredo*) *reynei* Bartsch.
4. Pallets of *Teredo* (*Lyrodus*) *bipartita* Jeffreys.

PLATE 34.

FIG. 1. Pallets of *Teredo* (*Teredops*) *floridana* Bartsch.
2. Pallets of *Teredo* (*Psiloteredo*) *knoxi* Bartsch.
3. Pallets of *Teredo* (*Teredops*) *dicgensis* Bartsch.
4. Pallets of *Teredo* (*Teredora*) *thomsoni* Tryon.

PLATE 35.

FIG. 1. Pallets of *Teredo* (*Psiloteredo*) *jamaicensis* Bartsch.
2. Pallets of *Teredo* (*Teredora*) *panamensis* Bartsch.
3. Pallets of *Teredo* (*Psiloteredo*) *stimpsoni* Bartsch.
4. Pallets of *Teredo* (*Psiloteredo*) *tryoni* Bartsch.

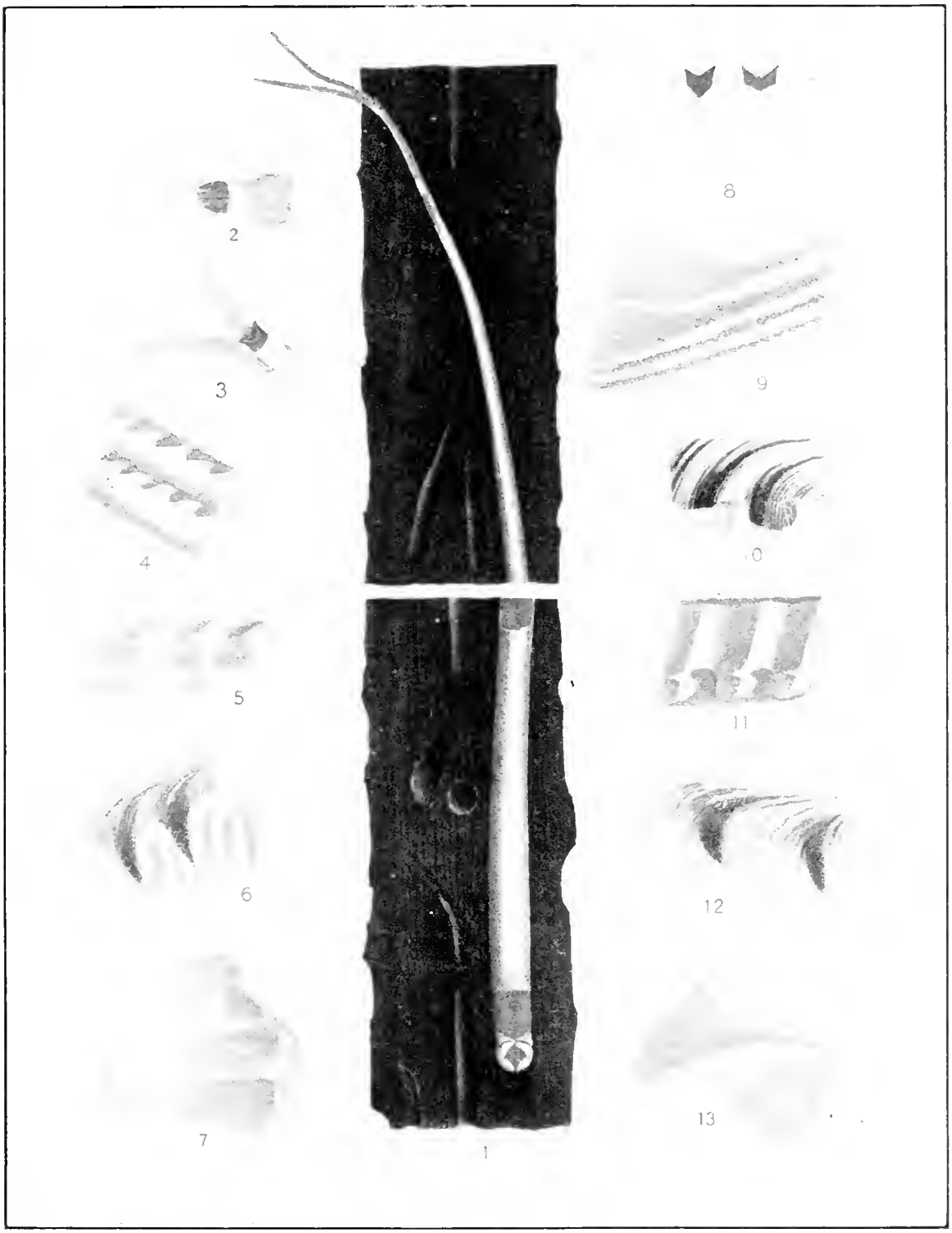
PLATE 36.

FIG. 1. Pallets of *Teredo* (*Psiloteredo*) *sigerfoosi* Bartsch.
2. Pallets of *Teredo* (*Psiloteredo*) *dilatata* Stimpson.

PLATE 37.

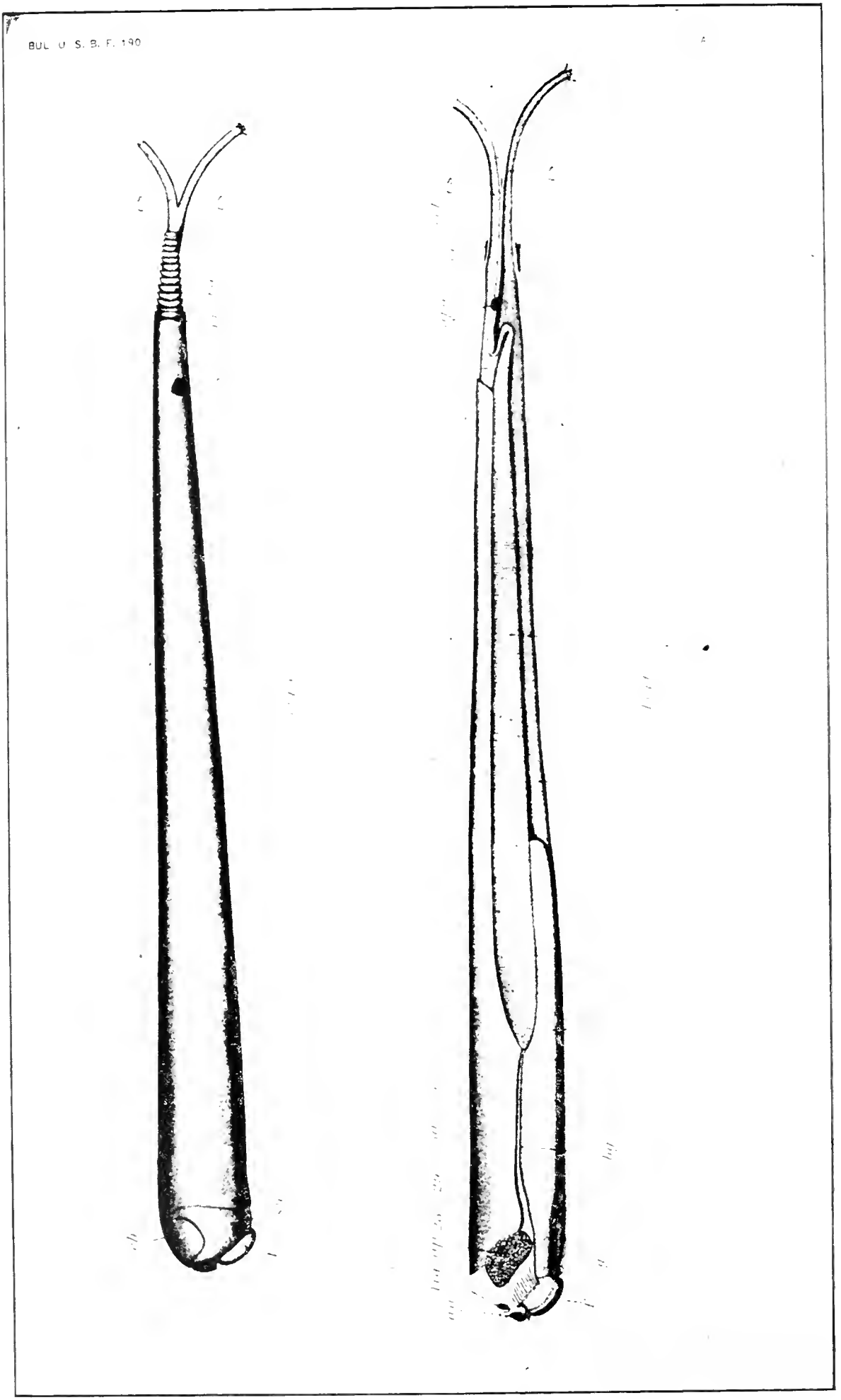
Copy of Wright's Plate 64 in the Transactions of the Linnean Society, vol. 25.

FIG. 1–5. *Bactronophorus australis* Wright.
6–12. *Bactronophorus thoracites* Gould, the type of the genus.



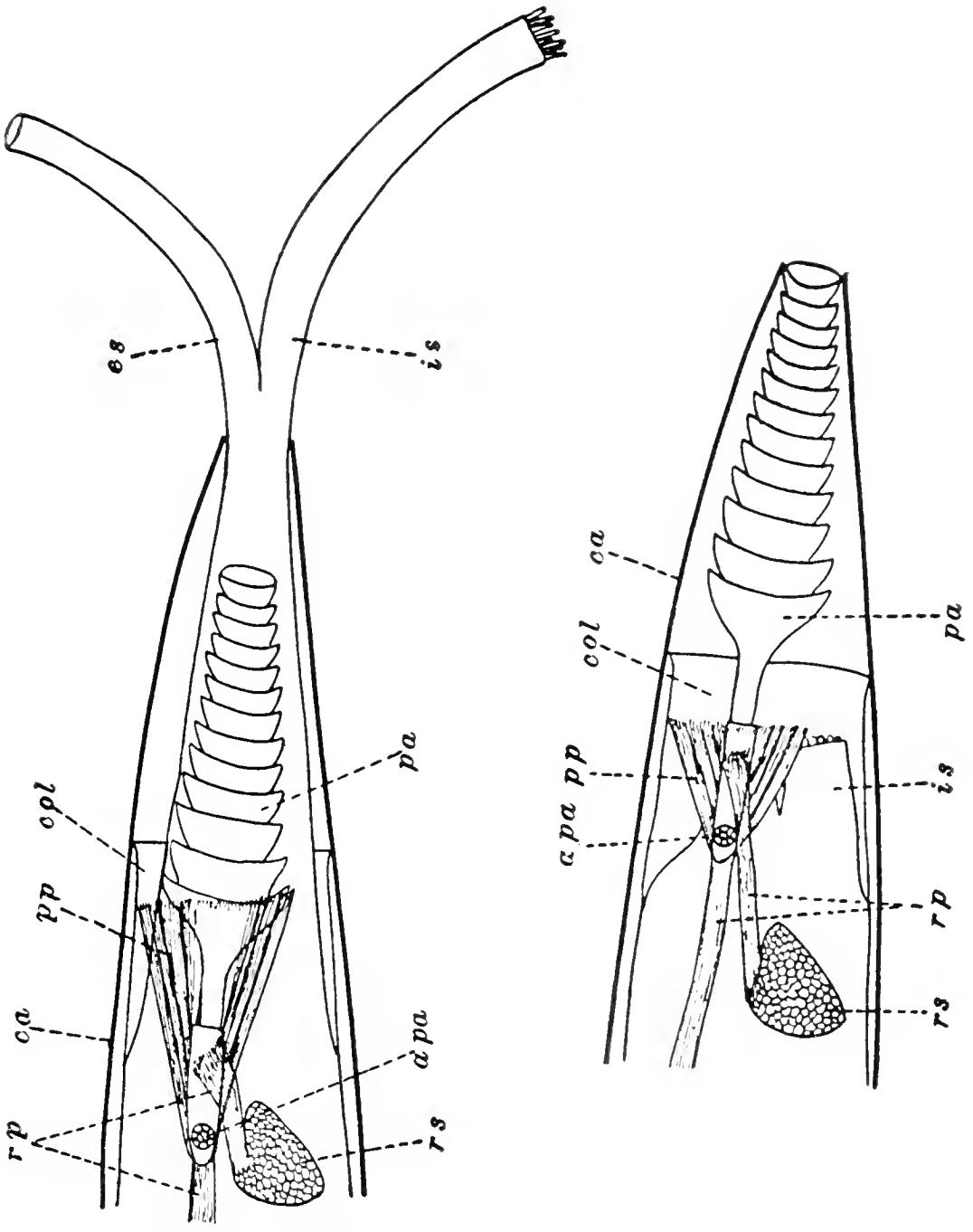
TEREDO NAVALIS LINNAEUS (AFTER MEYER AND MÖBIUS).

FOR EXPLANATION OF PLATE SEE PAGE 45



GOULD SHIPWORM (AFTER SIGERFOOS).

FOR EXPLANATION OF PLATE SEE PAGE 45.

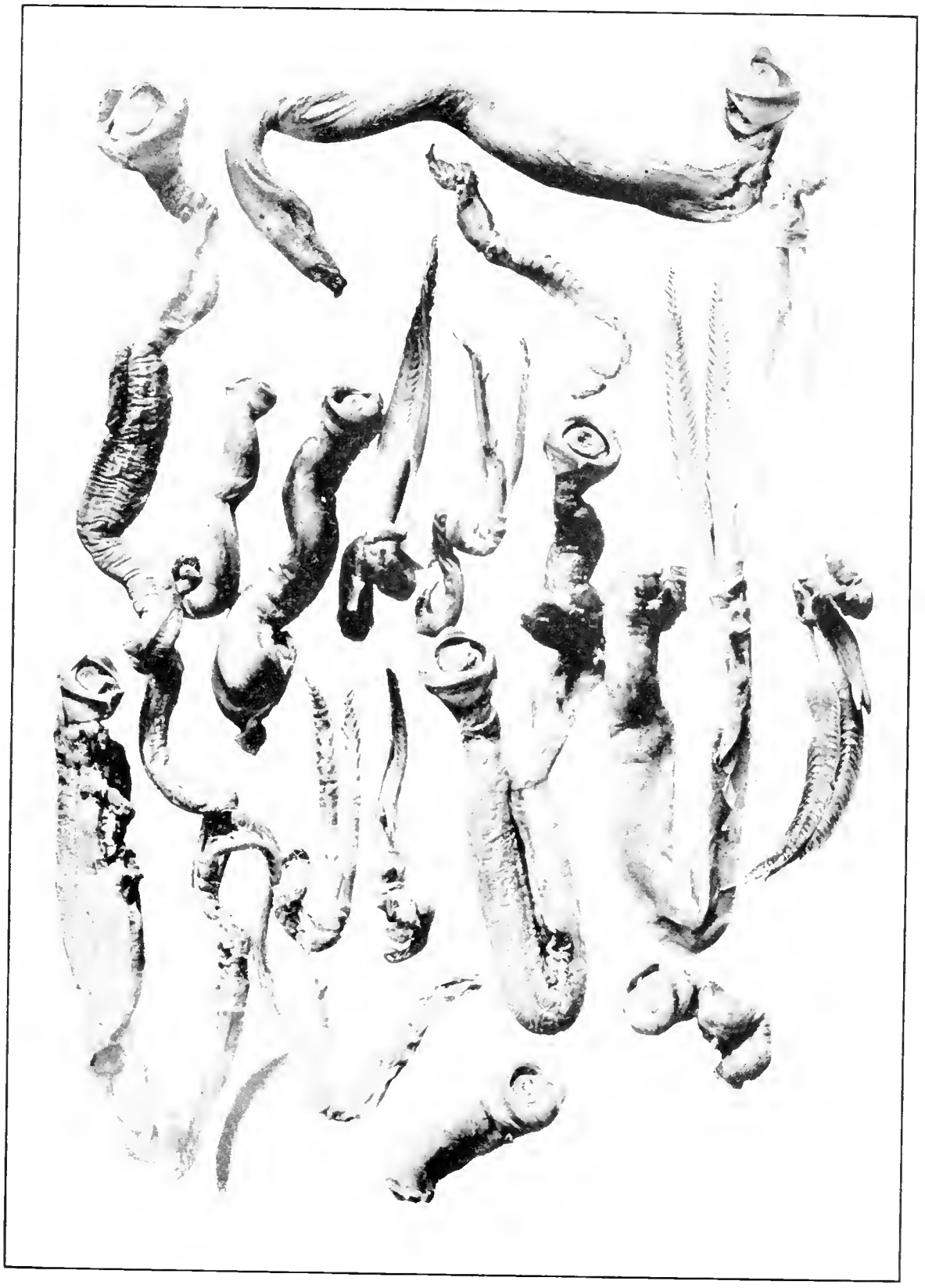


DETAIL OF SIPHON AND PALLET OF GOULD SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 45.

NORTHWEST SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 45

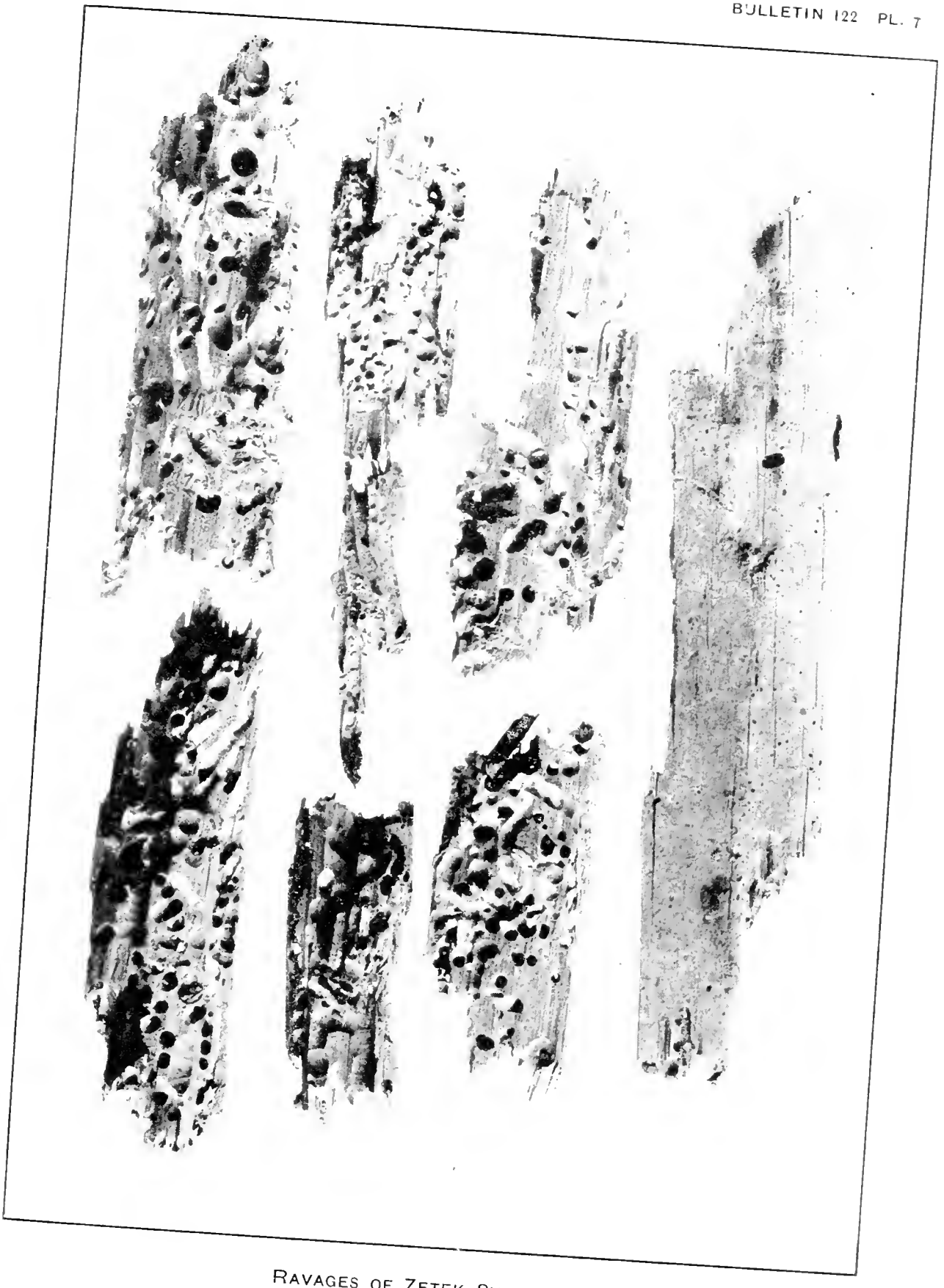


NORTHWEST SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 45.

ZETEK SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 45.

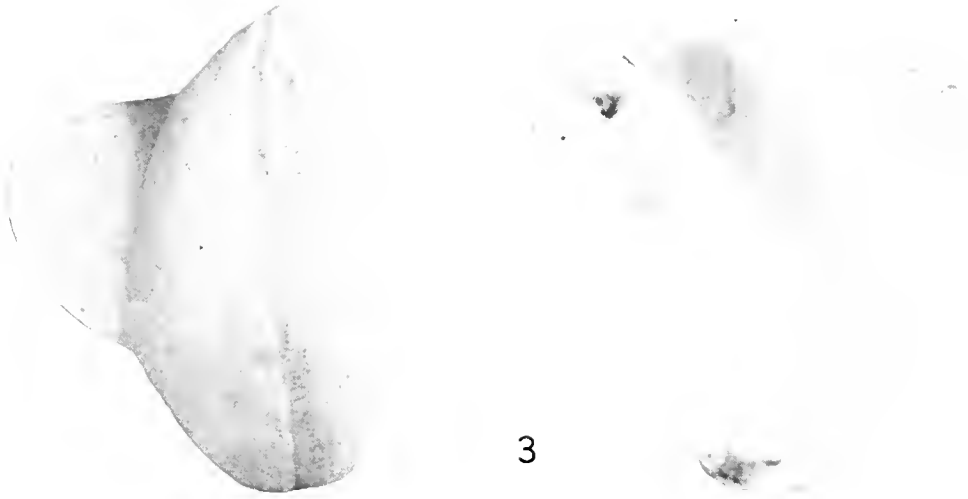


RAVAGES OF ZETEK SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 46.

1

2



3

1, MEXICO; 2, GULF; AND 3, GOULD SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 46.

SPECIMENS OF GOULD SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 46.

GREATLY ENLARGED POSTERIOR END OF GOULD SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 46

RAVAGES BY GOULD SHIPWORM AT CHARLESTON, SOUTH CAROLINA.

FOR EXPLANATION OF PLATE SEE PAGE 46

RAVAGES BY GOULD SHIPWORM AT CHARLESTON.

FOR EXPLANATION OF PLATE SEE PAGE 46

RAVAGES BY GOULD SHIPWORM AT MIAMI, FLORIDA.

FOR EXPLANATION OF PLATE SEE PAGE 461

RAVAGES BY GOULD SHIPWORM AT PORT TAMPA, FLORIDA.

FOR EXPLANATION OF PLATE SEE PAGE 46.

RAVAGES BY GOULD SHIPWORM AT PORT TAMPA, FLORIDA.

FOR EXPLANATION OF PLATE SEE PAGE 46.

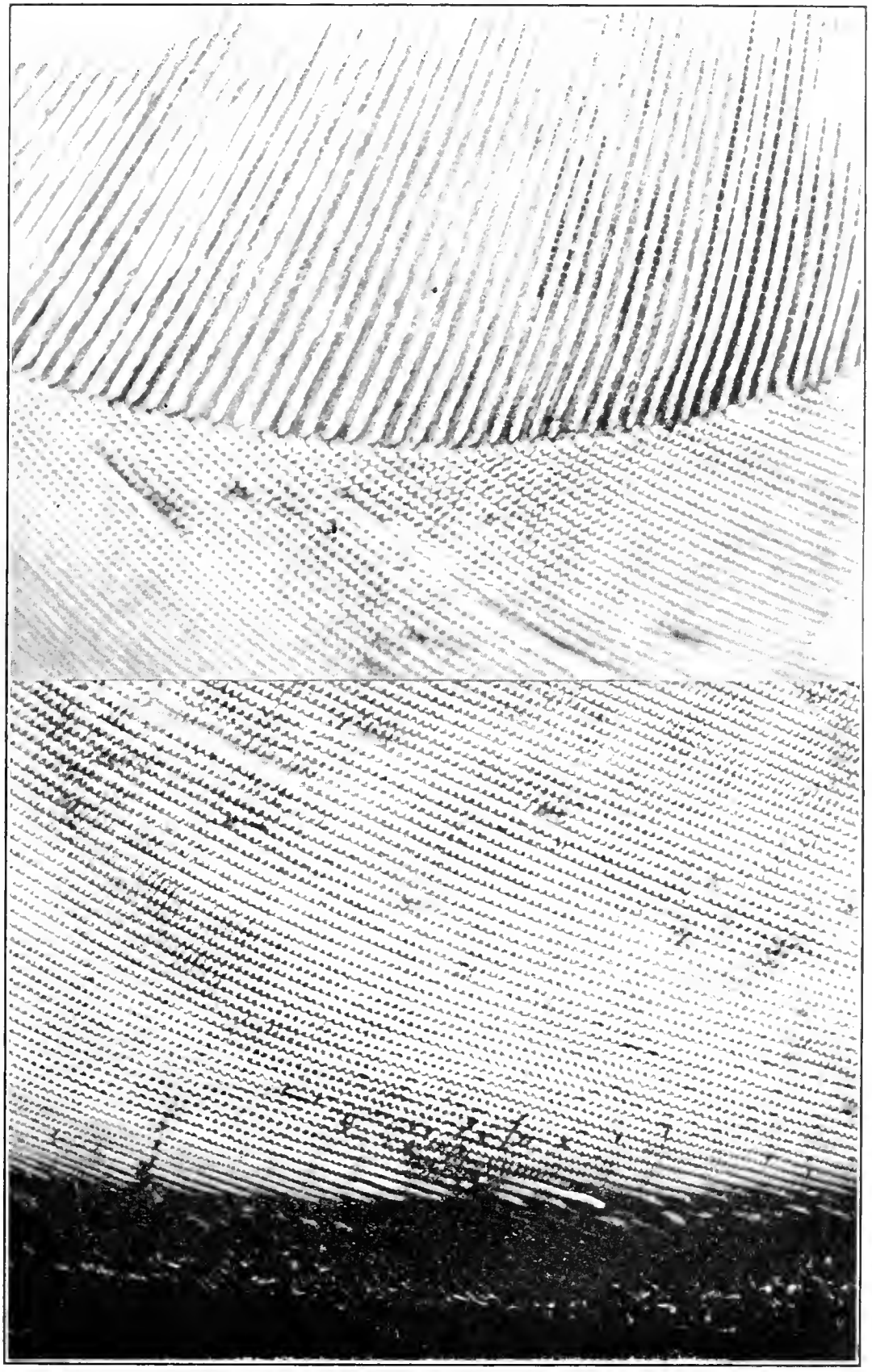
RAVAGES BY GOULD SHIPWORM AT PORT TAMPA, FLORIDA.

EXTERIOR OF DALL SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 46.

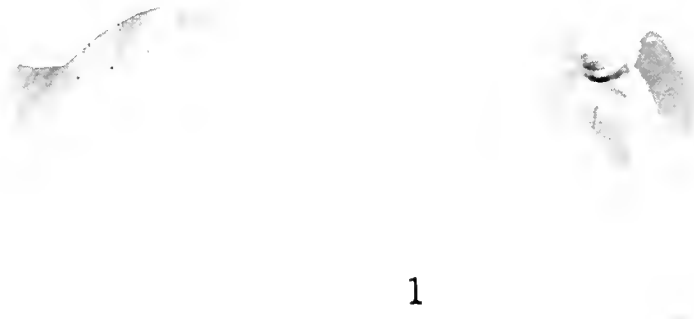
INTERIOR OF DALL SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 46.



DENTAL RIDGES OF DALL SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 47



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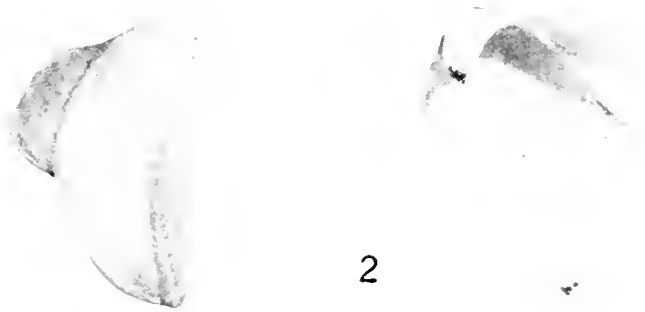


2

3

1, BEACH; 2, JEFFREYS; AND 3, BRAZIL SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 47

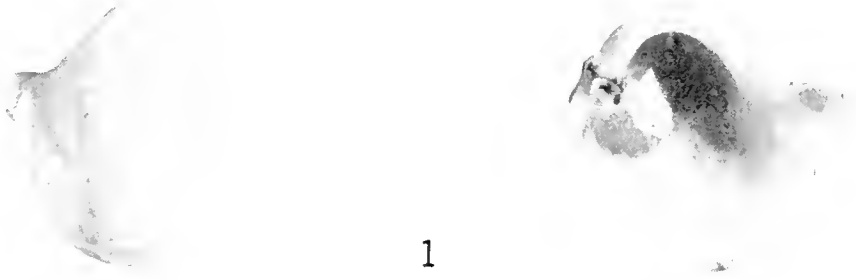
1

2

3

1, TWO-PARTED; 2, DOMINICA; AND 3, NEW ENGLAND SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 47



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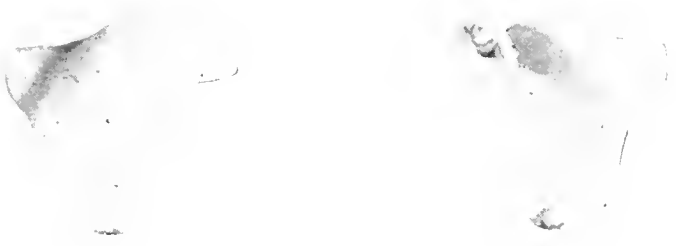

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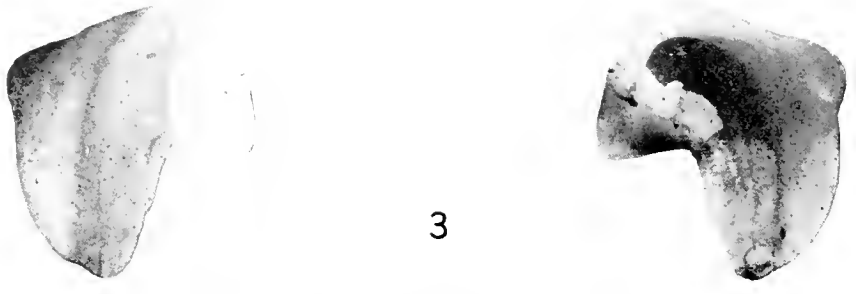

3

1, FLORIDA; 2, TOWNSEND; AND 3, SAN DIEGO SHIPWORMS.

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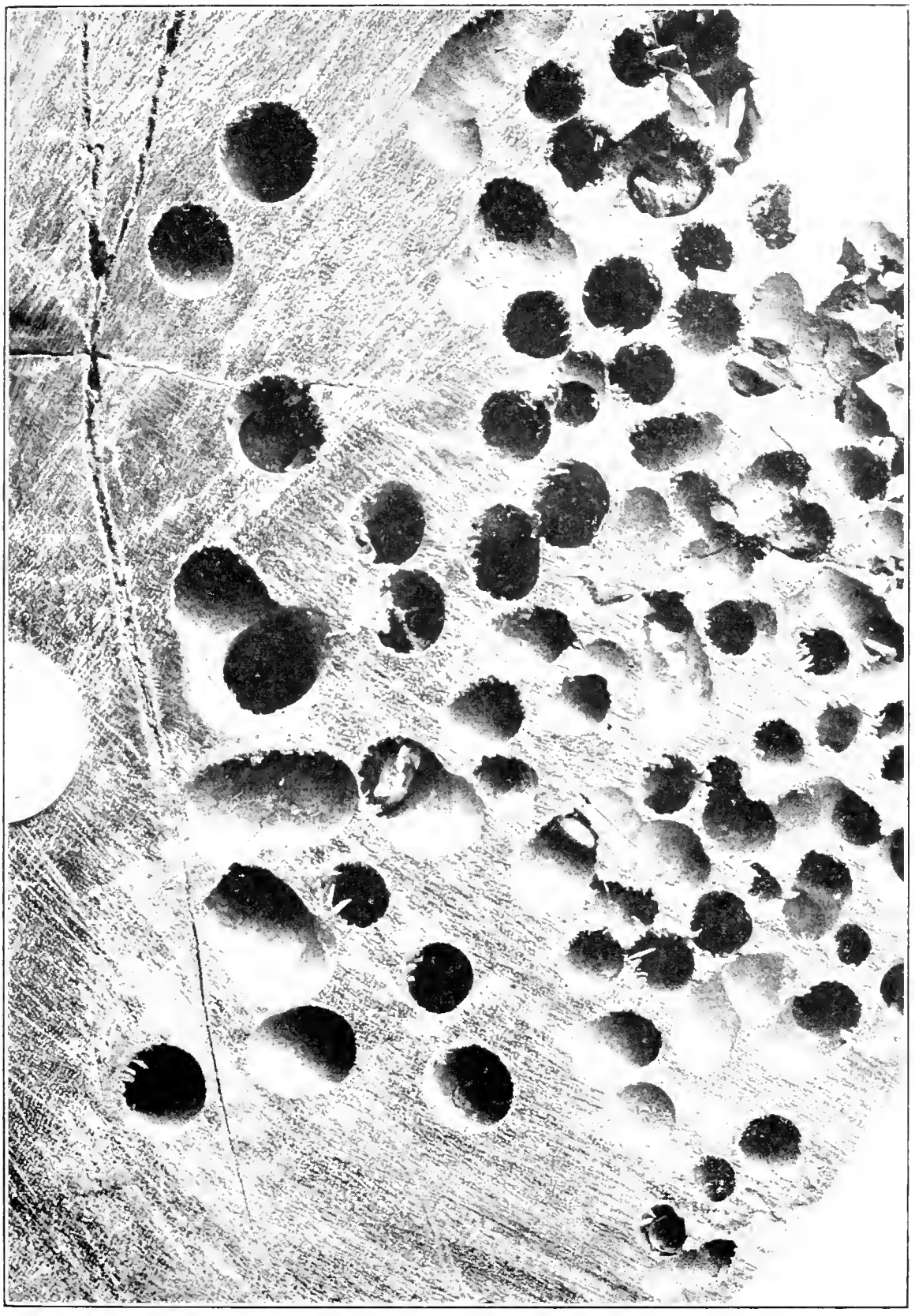
REYNE SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 47

MIRAFLORA SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 47



RAVAGES BY MIRAFLORA SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 47.

THOMSON SHIPWORM.

FOR EXPLANATION OF PLATE SEE PAGE 47.

1 AND 2, ST. VINCENT; 3 AND 4, PANAMA SHIPWORMS.

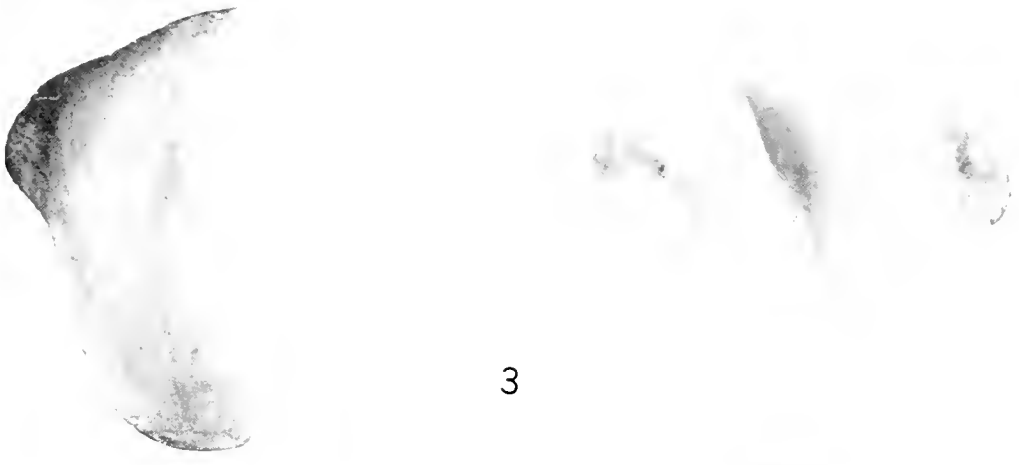
FOR EXPLANATION OF PLATE SEE PAGE 47.

1, BIG-EARED; 2, SIGERFOOS; AND 3, STIMPSON SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 47.

1

2



3

1, JAMAICA; 2, KNOX; AND 3, TRYON SHIPWORMS.

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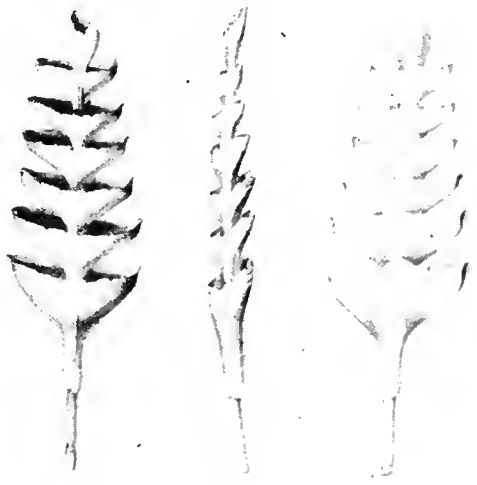
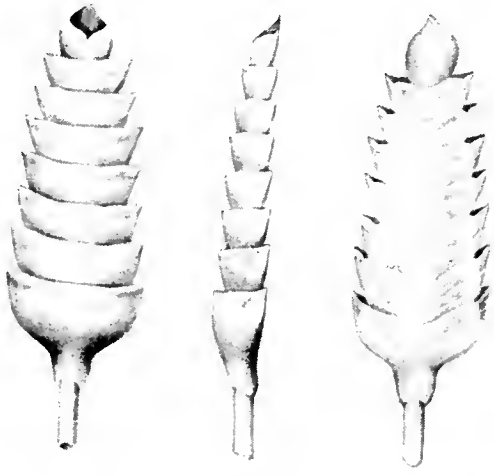
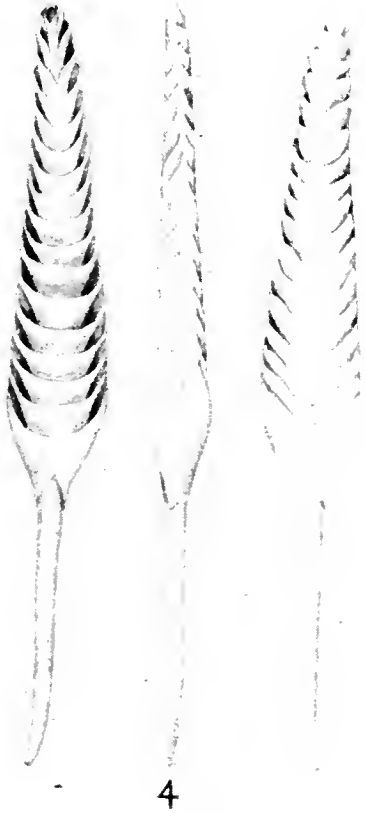


1



2

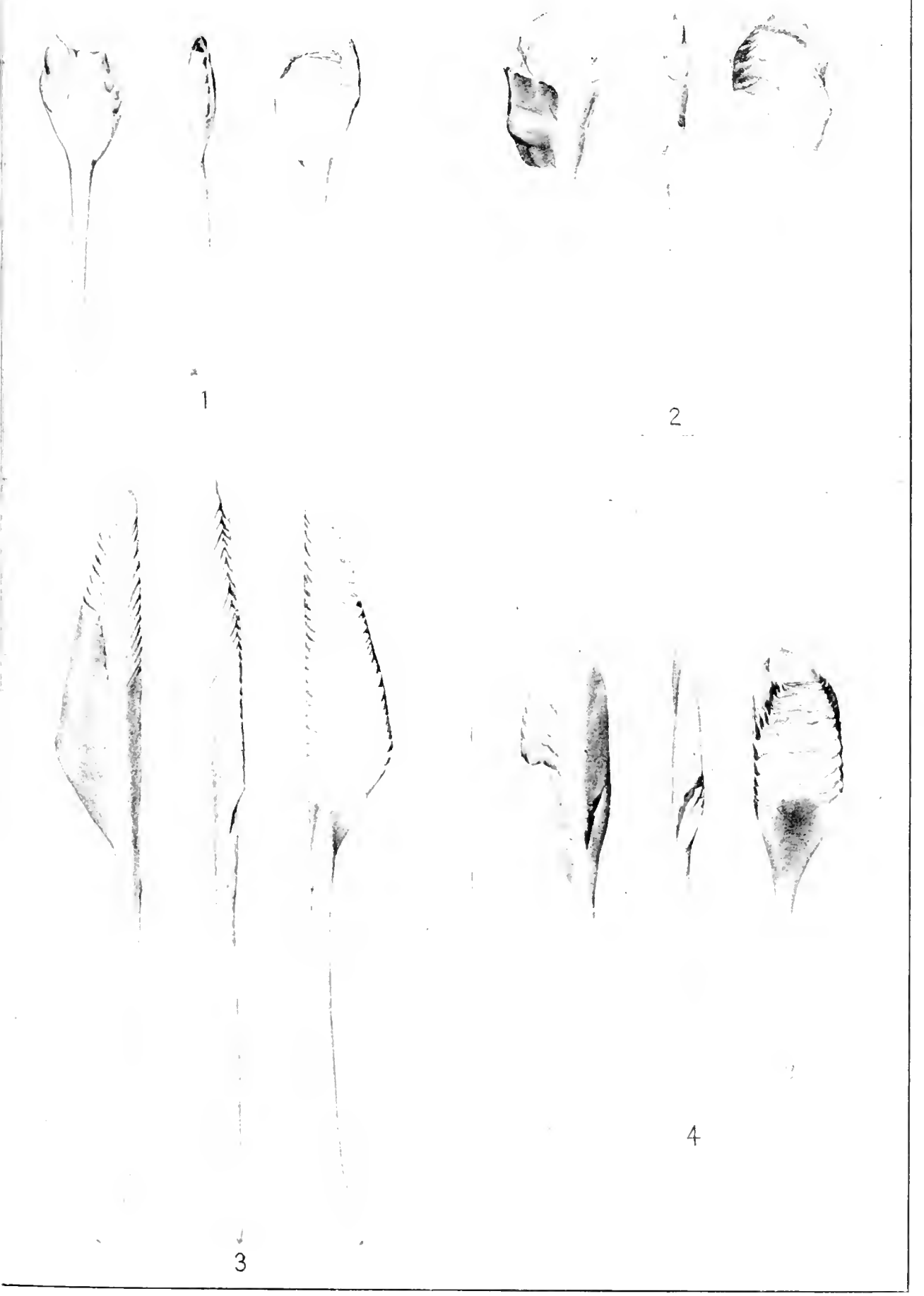
3



4

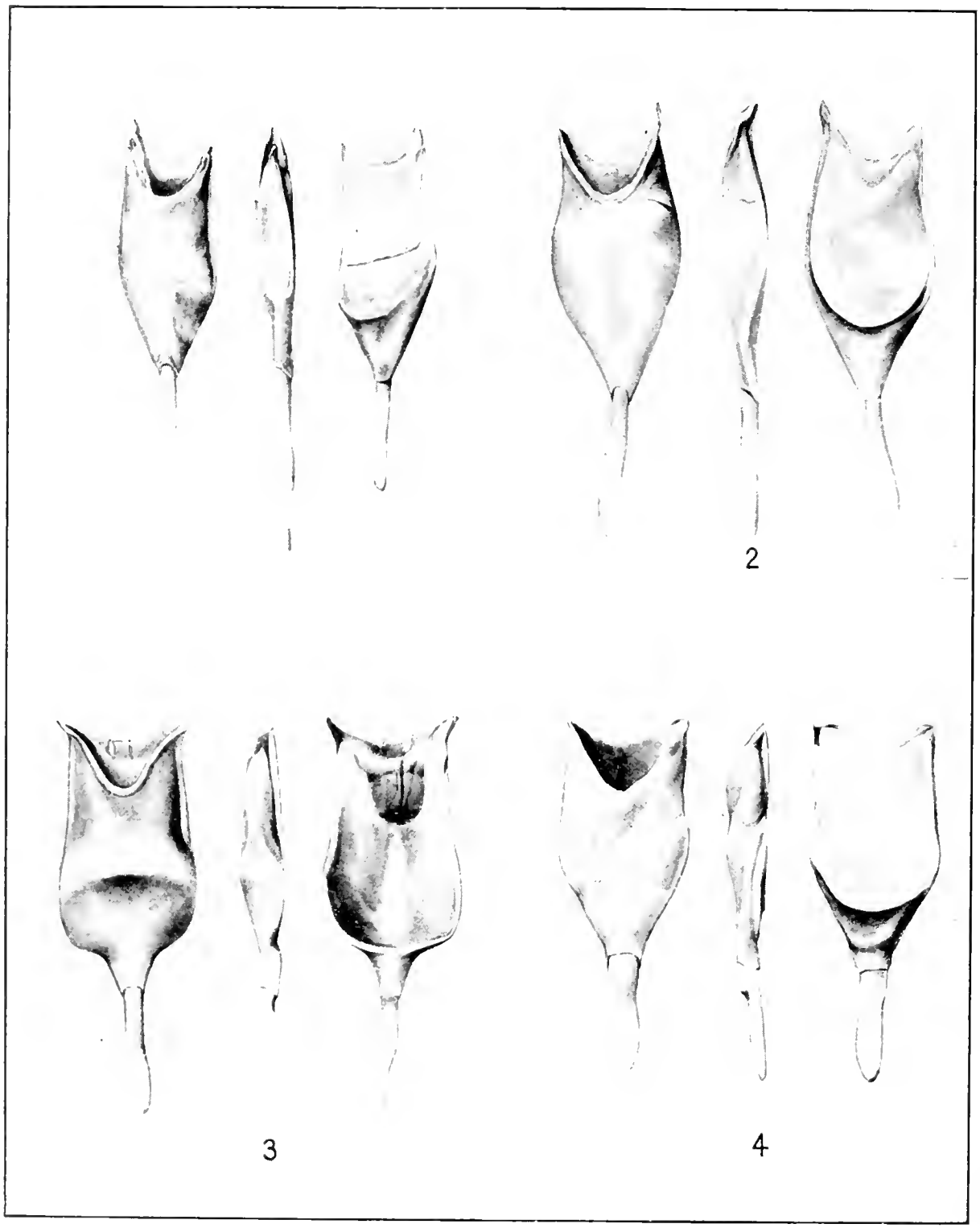
1, ZETEX; 2, MEZICO; 3, NORTHWESTERN; AND 4, GOULD SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 48.



1, BRAZIL; 2, JEFFREYS; 3, DALL; AND 4, GULF SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 48.



1, BEAUFORT; 2 TEREDO NAVALIS; 3, NEW ENGLAND; AND 4, BEACH SHIPWORMS.

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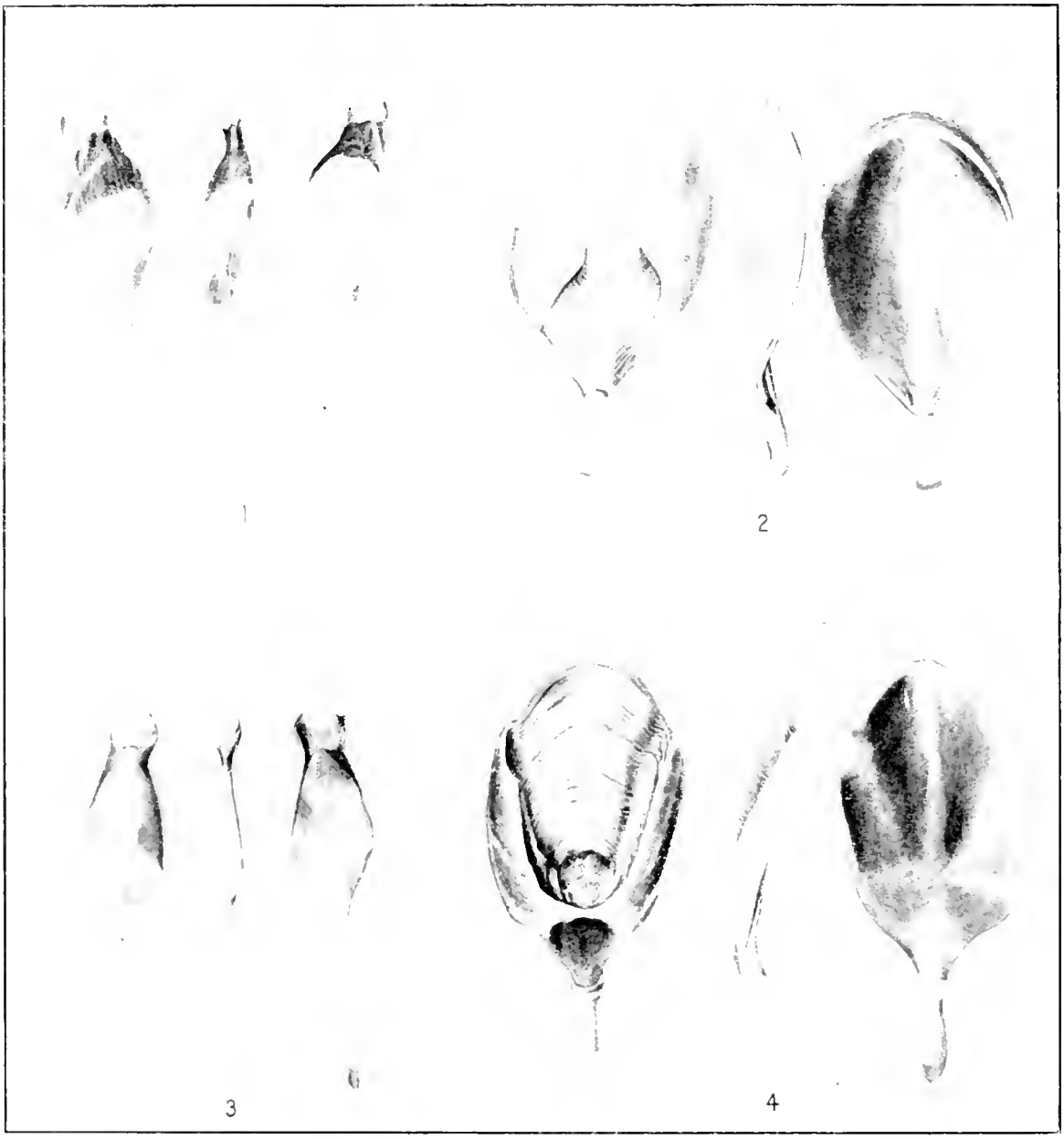
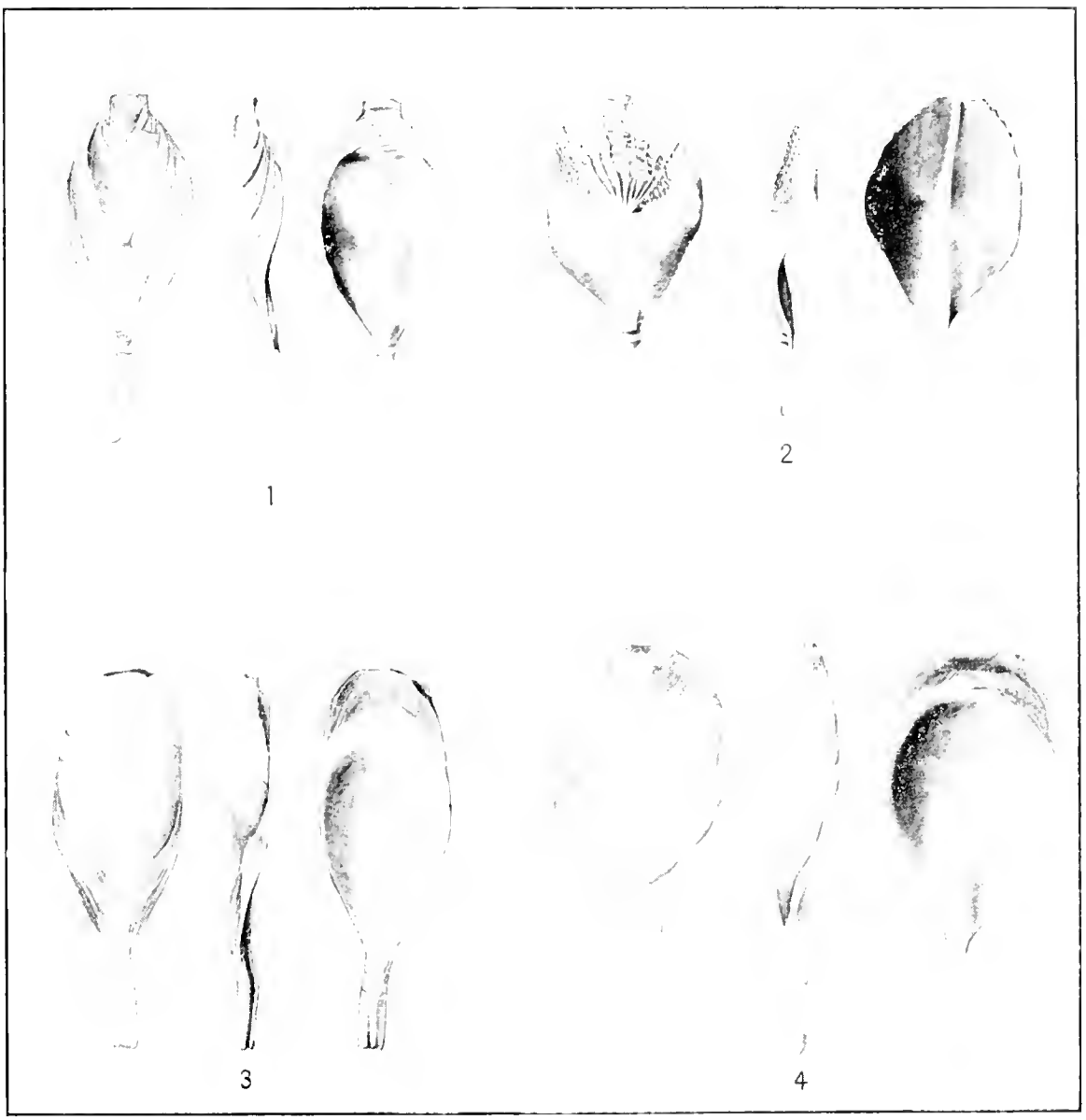
1, Dominica; 2, Townsend; 3, Reyne; and 4, Two-Parted Shipworms.

For explanation of plate see page 48.



1, Florida; 2, Knox; 3, San Diego; and 4, Thomson Shipworms.

For explanation of plate see page 48

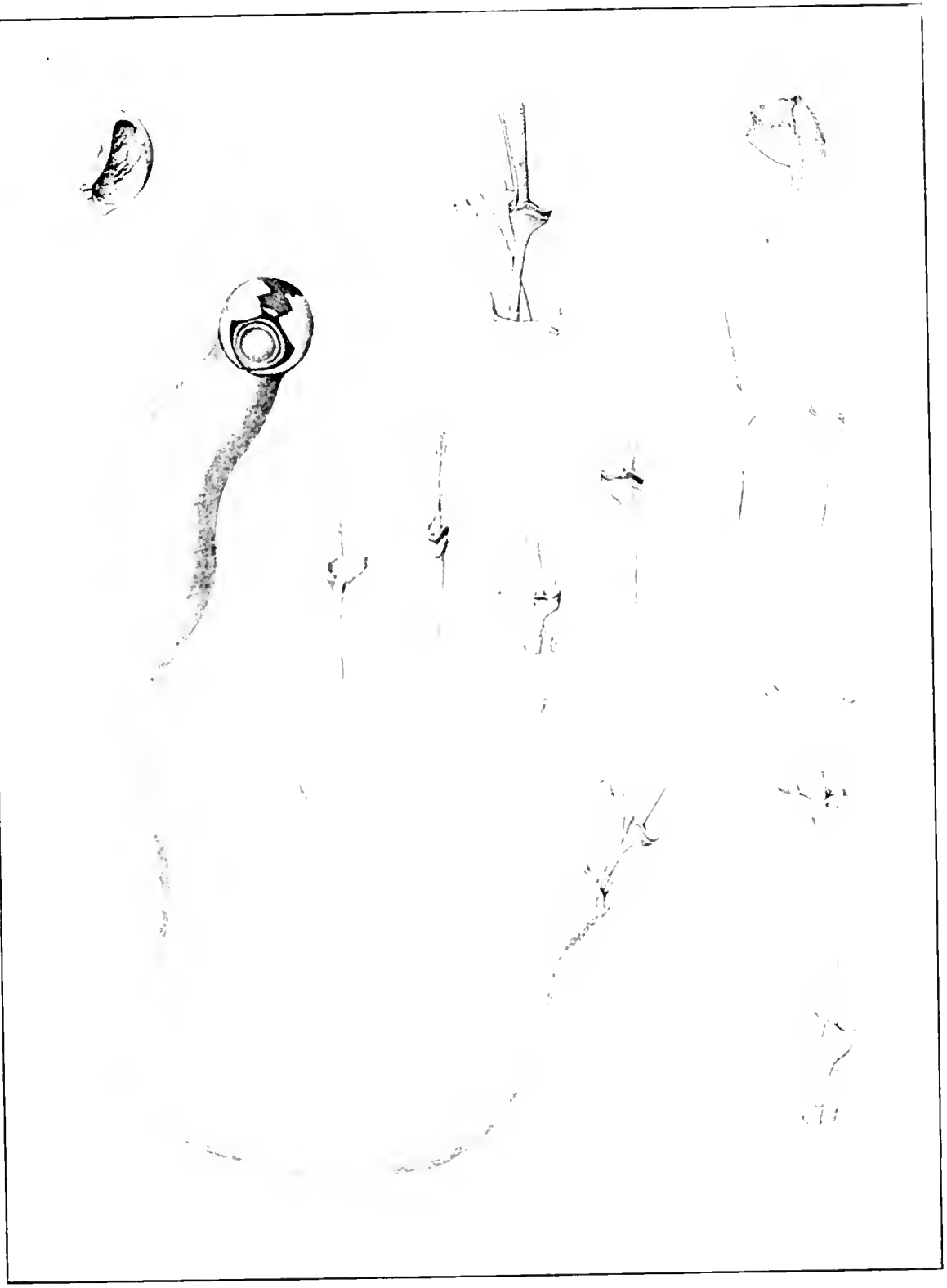


1, JAMAICA; 2, PANAMA; 3, STIMPSON; AND 4, TRYON SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 48.

1, SIGERFOOS; AND 2, BIG-EARED SHIPWORMS.

FOR EXPLANATION OF PLATE SEE PAGE 48.



1-5, BACTRONOPHORUS AUSTRALIS; AND 6-12, B. THORACITES.

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