THE CEPHALOPODS OF THE NORTH-EASTERN COAST OF AMERICA.

PART I.

The Gigantic Squids (Architeuthis) and their Allies; with observations on similar large species from foreign localities.

By A. E. VERRILL.

[From the Transactions of the Connecticut Academy of Sciences, Vol. V.]

New Haven, Conn., December, 1879–March, 1880.

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REPORT

ON

THE CEPHALOPODS

OF THE

NORTHEASTERN COAST OF AMERICA.

BY

A. E. VERRILL.

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The Cephalopods of the North-eastern Coast of America.

By A. E. Verrill.

Part I.—The gigantic squids (*Architeuthis*) and their allies; with observations on similar large species from foreign localities.

The early literature of Natural History has, from very remote times, contained allusions to huge species of Cephalopods, often accompanied by more or less fabulous and usually exaggerated descriptions of the creatures.* In a few instances figures were attempted, which were largely indebted to the imagination of their authors for their more striking peculiarities.

In recent times many more accurate observers have confirmed the existence of such monsters, and several fragments have found their way into European museums.

To Professor Steenstrup and to Dr. Harting, however, belongs the credit of first describing and figuring, in a scientific manner, a sufficient number of specimens to give a fair idea of the real character and affinities of these colossal species. More particular accounts of the specimens described by these and other recent writers will be given farther on.

Special attention has only recently been called to the frequent occurrence of these 'big squids,' as our fishermen call them, in the waters of Newfoundland, and the adjacent coasts. The cod-fishermen, who visit the Grand Banks, appear, from their statements, to have been long familiar with them, and occasionally to have captured and used them for bait. The whalemen have also repeatedly stated that sperm whales feed upon huge squid, and that, when wounded, they

* The description of the "Poulpe" or devil-fish by Victor Hugo, in "The Toilers of the Sea," with which so many readers have recently become familiar, is quite as fabulous and unreal as any of the earlier accounts, and even more bizarre. His description represents no real animal whatever. He has attributed to the creature habits and anatomical structures that belong in part to the *polyps* and in part to the '*poulpe*' (Octopus). His description appears to have been derived from descriptions of these totally distinct groups of animals contained in some cyclopedia, which he has confounded and hopelessly mixed up.

often vomit large fragments of them in such a condition as to be recognizable.* The first reliable account, known to me, of specimens actually taken in American waters by our fishermen and whalemen was published by Dr. A. S. Packard, in 1873.† In that article Dr. Packard described a portion of a jaw from a large specimen (our No. 1) taken by the Gloucester fishermen on the Grand Banks, and a very large pair of jaws taken from the stomach of a sperm whale, (our No. 10). Soon after this, in 1873, a large living specimen was encountered by two fishermen in Conception Bay, and one of the tentacular-arms, which was secured, was preserved in the museum of St. John's, Newfoundland, by the Rev. Mr. Harvey and Mr. Alexander Murray, (our No. 2). Both these gentlemen wrote good and interesting accounts of this specimen, which were extensively copied in the magazines and newspapers, while a photograph of the arm itself was also secured and distributed.

This important addition to our knowledge of these creatures was followed, a few weeks later, by the capture of a nearly perfect specimen of the same species, near St. John's. Mr. Harvey and Mr. Murray likewise secured this specimen and published detailed accounts of it, which gave a more accurate idea of the character of the genus and species than any previous descriptions.

My own attention was specially directed to these large Cephalopods, at that time, on account of being so fortunate as to secure for study most of the preserved portions of all the specimens referred to above, with some additional ones, detailed below. For these very interesting specimens I am especially indebted to the zeal and kindness of the Rev. Mr. Harvey, and to Professor S. F. Baird. To Dr. A. S. Packard I am indebted for the use of the jaws of No. 10. Mr. Pourtales, of the Museum of Comparative Zoology, has also kindly sent the specimens belonging to that museum, and Mr. W. H. Dall has contributed his specimens and drawings of a species from Alaska. Special acknowledgments to others will be found in connection with the descriptions of the specimens.

Although I have, in several former papers,‡ given details of the

* See Maury's Sailing Directions; also articles by N. S Shaler, American Naturalist, vol. vii, p. 3, 1873; by Dr. Packard, op. cit., p. 90; and by Mr. W. H. Dall, op. cit., p. 484.

† American Naturalist, vol. vii, p. 91, February, 1873.

‡ American Jour. Science, vol. vii, p. 158, Feb., 1874; vol. ix, pp. 123, 177, Plates II–V, 1875; vol. x, p. 213, Sept., 1875; vol. xii, p. 236, 1876; vol. xiv, p. 425, Nov., 1877. American Naturalist, vol. viii, p. 167, 1874; vol. ix, pp. 21, 78, Jan. and Feb., 1875.

time and place of occurrence of fourteen of the specimens enumerated below, it seems desirable to bring together, at this time, accounts of all these, as well as of several additional specimens, in order that the various descriptions and measurements may be more readily compared, and also that some errors in the former accounts may be corrected and new information added. To facilitate the comparison of the general accounts of the twenty examples that I am now able to enumerate from our coast, I have given, by themselves, the statements of the time and place of their occurrence, with such general descriptions and measurements of each, as are most available, reserving the more detailed special descriptions of the preserved specimens for the systematic part of this article.

This seemed the more desirable because the information concerning many of the specimens is so scanty as to render it impossible to refer them, with certainty, to either of the species now recognized or named. It is probable, however, that only three distinct forms exist among the large Newfoundland specimens of *Architeuthis*, and two of these may be merely the males and females of one species. One of the principal differences usually indicated by the measurements is in respect to the size and length of the shorter arms, one form having them comparatively stout, often "thicker than a man's thigh," while the other form has them long and slender, (usually three to five inches in diameter, with a length of six to eleven feet). In case these differences prove to be sexual, those with stout arms will probably be the females, judging from analogy with the small squids nearest related.* The two specimens, of which I have seen the arms, both have them long and slender, but in one the arms are much longer in proportion to the body than in the other, and there are marked differences in the denticulation of the suckers of the short arms. These differences appear to indicate two species.

A few words of explanation may be desirable in regard to the relative value of the measurements usually given, and also with reference

* By examinations of very numerous specimens of the common squids, *Ommastrephes illecebrosa* and *Loligo Pealii*, I have satisfied myself that the females of both differ from the males by having the head, the siphon, the arms, and the suckers relatively larger and stronger than in the males. In comparing specimens of the two sexes having the body and fins of the same length, this difference is very evident. The large suckers of the tentacular arms show this increased size in a very marked degree. The short arms show a greater increase in diameter than in length. In my former article, by an unfortunate error, the increase in size of these parts was inadvertently said to be in the male. In these common squids I have found scarcely any variation in the relative size and form of the caudal fins, when adult.

to the parts most useful to preserve when, as will usually happen, the whole cannot be saved. The measurements of the soft external parts of Cephalopods are, for the most part, only approximate, and they are not all of equal value, for some parts are more changeable in size and shape than others. The long, contractile tentacular-arms, especially, are liable to great variation in length according to their state of contraction or extension, and therefore their relative length is of little or no value in discriminating species. Unfortunately this, either by itself or combined with the length of the 'body' as total length, is often the principal one given. The circumference of the body varies, likewise, according to its state of contraction or relaxation, and the 'breadth' of the body, when such soft creatures are stranded on the shore, will depend much upon the extent to which it is collapsed and flattened from its proper cylindrical form, and is of less value than the circumference. Measurements of the length of the body to the mantle edge, and to the base of the arms; length and circumference of the various pairs of short arms; of the length and circumference of the head; size of the eyes; length and breadth of the tail-fin; size of the largest suckers on the different arms; and size of the 'club' of the long arms, are all very useful and valuable. The shape of the tail-fin should be carefully noted, also the presence or absence of eye-lids, and of a sinus or groove at the front edge of eye-lids. The size and shape of the thin internal 'bone' or 'pen' is particularly desirable. Usually it will not be possible to preserve the pen in any satisfactory shape by drying, for it cracks in pieces and curls up. It may be preserved packed in salt, in brine, or in alcohol. The same is true of the beak. The horny rims of the suckers can usually be dried, but are better by far in alcohol or brine. The parts most useful for preservation in alcohol or salt, in cases when only a portion can be saved, are the long tentacular-arms, especially their terminal 'clubs' with the suckers in place; the short arms, with their suckers; of these the left arm of the lower, or ventral, pair will probably be the most valuable, being probably the one that will show the sexual distinction, by the alteration of its suckers toward the tip or in some other part; the lateral arms next to the ventral are next in importance; the caudal fin, and if possible the entire head, should be preserved; also the 'pen,' if possible. In cases where the head cannot be saved entire, even with the arms removed, the beak and tongue, and other fleshy parts in and behind the beak, should be carefully preserved, as nearly entire as possible, either in strong brine or alcohol.

General account of the several specimens, and of their occurrence.

No. 1.—Grand Banks specimen, 1871. (*Architeuthis princeps.*)

PLATE XVIII, FIGURE 3.

This specimen was found floating at the surface, on the Grand Banks of Newfoundland, in October, 1871, by Captain Campbell, of the schooner "B. D. Haskins," of Gloucester, Mass. It was taken on board and part of it used for bait.* Dr. A. S. Packard has given, in the American Naturalist, vol. vii, p. 91, Feb., 1873, the facts that have been published in regard to the history of this individual. But its jaws were sent to the Smithsonian Institution, and were sent to me by Professor Baird to be described and figured. The horny jaw or beak from this specimen is thick and strong, nearly black; it is acute at the apex, with a decided notch or angle on the inside, about ·75 of an inch from the point, and beyond the notch is a large prominent angular lobe. The body of the specimen from which this jaw was taken is stated to have measured 15 feet in length and 4 feet 8 inches in circumference. The arms were mutilated, but the portions remaining were estimated to be 9 or 10 feet long, and 22 inches in circumference, two being shorter than the rest. It was estimated to weigh 2000 pounds.

No. 2.—Conception Bay specimen, 1873. (*A. Harveyi ?.*)

A large individual attacked two men, who were in a small boat, in Conception Bay, October 27, 1873. Two of the arms, which it threw across the boat, were cut off with a hatchet, and brought ashore. Full accounts of this adventure, written by Rev. M. Harvey, have been published in many of the magazines and newspapers.† A portion of one of these arms, measuring 19 feet in length, was preserved by Rev. M. Harvey and Mr. Alexander Murray for the museum at

* I have been informed by many other fishermen that these 'big squids,' as they call them, are occasionally taken on the Grand Banks and used for bait. Others state that they have seen them in that region, without being able to capture them. Nearly all the specimens hitherto taken appear to have been more or less disabled when first observed, otherwise they probably would not appear at the surface in the day-time. From the fact that they have mostly come ashore in the night, I infer that they inhabit chiefly the very deep and cold fiords of Newfoundland and come up to the surface only in the night.

† See Amer. Jour. Science, vol. vii, p. 158, 1874; and American Naturalist, vol. viii, No. 2, p. 120, Feb.. 1874, in a letter from Mr. Alexander Murray. Also, Proc. Zool. Soc. Lond., p. 178, 1874. Proc. Boston Soc. Nat. Hist., xvi, p. 161, 1873.

St. John's, Newfoundland. It was photographed, and cuts copied from the photograph were published in some of the English magazines.* Before it was secured for preservation it had been considerably injured, many of the larger suckers having been torn off or mutilated. Owing to this fact they were originally described by Mr. Harvey as destitute of marginal denticulations, but he subsequently reëxamined the specimen, at my request, and informed me that they were all originally denticulated. Of this specimen I have seen only the photograph and some of the smaller suckers. This fragment represents the distal half of one of the long tentacular-arms, with its expanded terminal portion or "club," originally covered with cup-shaped suckers, about 24 of which, forming two central rows, are very large, the largest being 1·25 inches in diameter; others, alternating with these along each margin, are smaller, with the edge supported by a serrated ring. The tip of the arm is covered with numerous smaller suckers, in four rows. The part of the arm preserved measured, when fresh, 19 feet in length, and 3·5 inches in circumference, but wider, "like an oar," and 6 inches in circumference, near the end, where the suckers are situated.

It is stated that six feet of this arm had been destroyed before it was preserved, and the captors estimated that they left from six to ten feet attached to the creature, which would make the total length between 31 and 35 feet. According to Mr. Murray, the portion preserved measured but 17 feet in length, when he examined it, Oct. 31, 1873, after it had been a few days in strong brine. The other arm was destroyed and no description was made; but the portion secured was estimated by the fishermen to have been 6 feet long and 10 inches in diameter; it was evidently one of the eight shorter sessile arms, and its size was probably overestimated. The fishermen estimated the body of this individual to have been about 60 feet in length and 5 feet in diameter; but if the proportions be about the same as in the specimens since captured, (No. 5 and No. 14), as I believe, then the body could not have been more than about 10 feet long, and 2·5 feet in diameter, and the long arms should have been about 32 feet in length.† Allowing two feet for the head, the total length would, therefore, be about 44 feet.

* See Annals and Magazine of Natural History, IV, xiii, p. 68, Jan., 1874; and "The Field," Dec. 13, 1873. The central line of this photograph is reduced four and a quarter times, while the front part is reduced about four times.

† Doubtless these long arms are very contractile, and changeable in length, like those of the ordinary squids.

No. 3.—Coombs' Cove specimen, 1872. (*A. Harveyi?*, ♀.)

Another specimen (No. 3), probably considerably larger than the last, was captured at Coombs' Cove, Fortune Bay, Newfoundland. The following account has been taken from a newspaper article of which I do not know the precise date,* forwarded to me by Professor Baird, together with a letter, dated June 15, 1873, from the Hon. T. R. Bennett, of English Harbor, N. F., who states that he wrote the article, and that the measurements were made by him, and are perfectly reliable.†

"Three days ago, there was quite a large squid run almost ashore at Coombs' Cove, and some of the inhabitants secured it. The body measured 10 feet in length and was nearly as large round as a hogshead. One arm was about the size of a man's wrist, and measured 42 feet in length; the other arms were only 6 feet in length, but about 9 inches in diameter, very stout and strong. The skin and flesh were 2·25 inches thick, and reddish inside as well as out. The suction cups were all clustered together, near the extremity of the long arm, and each cup was surrounded by a serrated edge, almost like the teeth of a hand-saw. I presume it made use of this arm for a cable, and the cups for anchors, when it wanted to come to, as well as to secure its prey, for this individual, finding a heavy sea was driving it ashore, tail first, seized hold of a rock and moored itself quite safely until the men pulled it on shore."

Mr. Bennett, in a memorandum subsequently given to Mr. Sanderson Smith, and communicated to me by him, states that both the tentacular-arms were present and that the shorter one was 41·5 feet in length. The large diameter of the short arms, compared with their length, and with that of the long arms, and their shortness compared with the length of the body, are points in which this specimen apparently differed essentially from those that have been preserved and are better known. It was probably a female. The total length, as I understand the measurements, was 52 feet.

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* The exact date of this capture I do not know, but it was probably in the autumn or winter of 1872.

† Through Mr. Sanderson Smith, who visited Mr. Bennett after the publication of my former articles, I learn that this specimen is the same as the one designated as No. 6 in my previous papers, and that the measurements of No. 6, as given to me by Mr. Harvey, are incorrect, owing to a mistake in supposing that 42 feet was the *total length*, instead of the length of the longer tentacular-arm.

No. 4.—Bonavista Bay specimen. (*A. Harveyi?*.)

PLATE XVI, FIGURES 5, 6.

A pair of jaws and two of the suckers from the tentacular-arms were forwarded to me by Professor Baird of the Smithsonian Institution. These were received from Rev. A. Munn, who writes that they were taken from a specimen that came ashore at Bonavista Bay, Newfoundland; that it measured thirty-two feet in length (probably the entire length, including the tentacular-arms); and about six feet in circumference. The jaws are large and broad, resembling those of No. 5, both in size and form, but much thinner than those of No. 1, and without the deep notch and angular lobe seen in that specimen. The suckers also agree with those of No. 5, but are a little smaller.

No. 5.—Logie Bay specimen, 1873. (*Architeuthis Harveyi*, type.)

PLATE XIII. PLATE XIV. PLATE XV, FIGURES 1, 2, 3. PLATE XVI, FIGURES 1 TO 4.

A complete specimen was captured in November, 1873, at Logie Bay, near St. John's, Newfoundland. It became entangled in herring-nets and was secured by the fishermen with some difficulty, and only after quite a struggle, during which its head was badly mutilated and severed from the body, and the eyes, most of the siphon-tube, and part of the front edge of the mantle were destroyed. It is probable that this was a smaller specimen of the same species as No. 2. Fortunately this specimen was secured by the Rev. M. Harvey of St. John's. After it had been photographed and measured, he attempted to preserve it entire in brine, but this was found to be ineffectual, and after decomposition had begun to destroy some of the most perishable parts, he took it from the brine and, dividing it into several portions, preserved such parts as were still undecomposed in strong alcohol. These various portions have all been examined by me and part of them are now in my possession, and with the photographs have enabled me to present a restoration, believed to be tolerably accurate, of the entire creature (plate XIV). In this figure the eyes, ears, siphon-tube and front edge of the mantle have been restored from a small squid (*Ommastrephes*). The other parts have been drawn directly from the photographs and specimens.* There were two photographs of the

* The figure was originally made, from the photographs only, by Mr. P. Rœtter, of the Museum of Comparative Zoology, but after the arrival of the specimens it had to be altered in many parts. These necessary changes were made by the writer, after a careful study of the parts preserved, in comparison with the photographs and original measurements. As published in my former papers, the eyes and back of the head of

specimen:* one showing the entire body, somewhat mutilated anteriorly; the other showing the head with the ten arms attached (plate XIII). The body or mantle of this specimen was about seven feet long, and between five and six feet in circumference; the relatively small caudal fin was arrow-shaped and twenty-two inches broad, but short, thick, and very pointed at the end; the two long tentacular-arms were twenty-four feet in length, and two and a half inches in circumference, except at the broader part near the end; the largest suckers, which form two regular alternating rows, of twelve each, were 1·25 inches in diameter, with serrated edges. There is also an outer row of much smaller suckers, alternating with the large ones, on each margin; the terminal part is thickly covered with small serrated suckers; and numerous small suckers and tubercles are crowded on that portion of the arms where the enlargement begins, before the commencement of the rows of large suckers. The arrangement of the suckers is nearly the same as on the long arm of No. 2, but in the latter the terminal portion of the arm, beyond the large suckers, as shown in the photographs, is not so long, tapering, and acute, but this may be due to the different conditions of the two specimens. The eight short arms were each six feet long; the two largest were ten inches in circumference at base; the others were 9, 8 and 7 inches. These short arms taper to slender acute tips, and each bears about 100 large, oblique suckers, with serrated margins.

The portions of the pen in my possession belong mostly to the two ends, with fragments from the middle region, so that although neither the actual length nor the greatest breadth can be given, we can yet judge very well what its general form and character must have been. It was a broad and thin structure, of a yellowish brown color, and translucent. Its anterior portion (plate XV, fig. 3) resembles that of *Loligo*, but its posterior termination is entirely different, for instead of having a regular lanceolate form, tapering to a point at

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the figure were restored as in *Loligo*. Subsequent studies and additional specimens show that this genus is closely allied to *Ommastrephes*. Therefore, the head would have been more correctly shown had it been restored with reference to that genus, which has been done in this paper. The most obvious difference is in the eyes, which have distinct lids and an anterior sinus.

* Cuts made from these photographs have been published in several magazines and newspapers, but they have been engraved with too little attention to details to be of much use in the discrimination of specific differences. I have, therefore, prepared new figures from these photographs with the greatest care possible. These figures are particularly valuable, as showing the arrangements of the suckers on the short arms.

the posterior end, as in *Loligo*, it expands and thins out toward the posterior end, which is very broadly rounded or irregularly truncate, fading out insensibly, both at the edges and end, into soft membrane. The anterior end, for about an inch and a half, was rapidly narrowed to a pen-like point, as in *Loligo;* from this portion backward the width gradually increases from 1·2 inches to 5 inches, at a point 25 inches from the end, where our specimen is broken off; at this place the marginal strips are wanting, but the width is 5 inches between the lateral midribs (*d*, *d''*), which were, perhaps, half an inch from the margin. Along the center of the shell, there is a strong, raised, rounded midrib, which fades out a short distance from the posterior end, but is very conspicuous in the middle and anterior sections. On each side of the midrib is a lateral rib of smaller size. These at first diverge rapidly from the central one, and then run along nearly parallel with the outer margin and about ·4 of an inch from it, but beyond 11 inches from the point the margins are torn off. Like the midrib the lateral ribs gradually fade out before reaching the posterior end; near the place where they finally disappear, they are about six inches apart.*

No. 6 (of former articles).—Same as No. 3.

No. 7.—Labrador specimen.

Dr. D. Honeyman, geologist, of Halifax, Nova Scotia, has published, in a Halifax paper, a statement made to him by a gentleman who claims to have been present at the capture of another specimen (No. 7) in the Straits of Belle Isle, at West St. Modent, on the Labrador side. "It was lying peacefully in the water when it was provoked by the push of an oar. It looked fierce and ejected much water from its funnel; it did not seem to consider it necessary to discharge its sepia, as mollusca of this kind generally do, in order to cover their escape." . . . . "The length of its longest arm was 37 feet; the length of the body 15 feet; whole length 52. The bill was very

* Mr. Harvey published popular accounts of this specimen and of the previously captured arm of the larger one (No. 2), in the Maritime Monthly Magazine of St. John, N. B., for March, 1874, and in several newspapers. Acknowledgments are also due to Mr. Alexander Murray, Provincial Geologist, who coöperated with Mr. Harvey in the examination and preservation of these specimens, and who has also written some of the accounts of them that have been published. See also the American Naturalist, vol. viii, p. 122, February, 1874; American Journal of Science, vol. vii, p. 460; Nature, vol. ix, p. 322, February 26, 1874; and Appleton's Journal, January 31, 1874; Forest and Stream, p. 356 (with figure), Jan., 1874.

large. The suckers of its arms or feet, by which it lays hold, about 2 inches in diameter. The monster was cut up, salted, and barreled for dog's meat." In this account the length given for the 'body' evidently includes the head also. This creature was probably disabled, and perhaps nearly dead, when discovered at the surface, and this seems to have been the case with most of the specimens hitherto seen living. Animals of this sort probably never float or lie quietly at the surface when in good health.

Nos. 8 and 9.—Lamaline specimens, 1870-71.

Mr. Harvey refers to a statement made to him by a clergyman, Rev. M. Gabriel, that two specimens (Nos. 8 and 9), measuring respectively 40 and 45 feet in total length, were cast ashore at Lamaline, on the southern coast of Newfoundland, in the winter of 1870–71.

No. 10.—Sperm Whale specimen. (*Architeuthis princeps.*)

PLATE XVIII, FIGURES 1, 2.

This specimen, consisting of both jaws, was presented to the Peabody Academy of Science, at Salem, Mass., by Captain N. E. Atwood, of Provincetown, Mass. It was taken from the stomach of a sperm whale, but the precise date and locality are not known. It was probably from the North Atlantic. The upper jaw was imperfectly figured by Dr. Packard in his article on this subject.* It is one of the largest jaws yet known, and belonged to an apparently undescribed species, which I named *Architeuthis princeps*, and described in my former papers, with figures of both jaws.

No. 11.—Second Bonavista Bay specimen, 1872.

The Rev. M. Harvey, in a letter to me, stated that a specimen was cast ashore at Bonavista Bay, December, 1872, and that his informant told him that the long arms measured 32 feet in length, and the short arms about 10 feet in length, and were "thicker than a man's thigh." The body was not measured, but he thinks it was about 14 feet long, and very stout, and that the largest suckers were 2·5 inches in diameter. The size of the suckers is probably exaggerated, and most likely the length of the body also. It is even possible that this was the same specimen from which the beak and suckers described as No. 4, from Bonavista Bay, were derived, for the date of capture of that specimen is unknown to me. The latter, however, was much smaller than the

* American Naturalist, vol. vii, p. 91, 1873.

above measurements, and it will, therefore, be desirable to give a special number (11) to the present one.

No. 12.—Harbor Grace specimen, 1874-75.

Another specimen, which we have designated as No. 12, was cast ashore in the winter of 1874–1875, near Harbor Grace, but was destroyed before its value became known, and no measurements were given.

No. 13.—Fortune Bay specimen, 1874.

PLATE XVII.

A specimen was cast ashore December, 1874, at Grand Bank, Fortune Bay, Newfoundland. As in the case of several of the previous specimens, I was indebted to the Rev. M. Harvey for early information concerning this one, and also for the jaws and one of the large suckers of the tentacular-arms, obtained through Mr. Simms, these being the only parts preserved. Although this specimen went ashore in December, Mr. Harvey did not hear of the event until March, owing to the unusual interruption of travel by the severity of the winter. He informed me that Mr. George Simms, Magistrate of Grand Bank, had stated in a letter to him that he examined the creature a few hours after it went ashore, but not before it had been mutilated by the removal of the tail by the fishermen, who finally cut it up as food for their numerous dogs; and that the long tentacular arms were 26 feet long and 16 inches in circumference; the short arms were about one-third as long as the long ones; the "back of the head or neck was 36 inches in circumference," (evidently meaning the head, behind the bases of the arms); the length of the body "from the junction to the tail" was 10 feet, (apparently meaning from the base of the arms to the origin of the caudal fins). He thought that the tail, which had been removed, was about one-third as long as the body, but this was probably overestimated. In No. 14 the tail, from its origin or base, was about one-fifth as long as the balance of the body and head. Applying the same proportions to No. 13, the head and body together would have been 12 feet. In a letter to me, dated Oct. 27, 1875, Mr. Simms confirmed the above measurements, but stated that the long arms had been detached, and that the bases of the arms measured as those of the tentacular-arms (they had previously been cut off about a foot from the head), were triangular in outline, the sides being respectively 5, 6, 5 inches in breadth, the longest or outer side being convex and the two lateral sides straight.

He moreover says that *all* the arms were covered with large suckers, *from the base outward.* Hence it is probable that he made a mistake as to these stumps, and that they really belonged to a pair of sessile arms. Probably the tentacular-arms, when extended, had been cut off so close to their contractile bases that their stumps had afterwards become contracted within their basal pouches, and were, therefore, overlooked. He adds that the body was three feet broad (doubtless it was much flattened from its natural form), and that the measurements were made while the body lay upon uneven ground, so that its exact length could not be easily ascertained, and that the caudal-fin had been cut off at its base. As the tail-fins of Nos. 5 and 14 were about one-fifth the length of the rest of the body and the head together, this specimen, if belonging to either of those species, should have been about 12 feet from the base of the arms to the tip of the tail.

The large sucker, in my possession, is one inch in diameter, across the denticulated rim, and in form and structure agrees closely with those described and figured by me from the tentacular-arms of Nos. 4, 5 and 14, (Plate XVI, figs. 3, 5, 6, and Plate XVII, figures 1, 1ª).

The jaws are still attached together, in their natural position, by the cartilages. They agree very closely in form with the large jaws of *Architeuthis princeps* V. (No. 10), figured on Plate XVIII, but they are about one-tenth smaller.

No. 14.—Catalina specimen, 1877. (*Architeuthis princeps.*)

PLATE XVII, FIGS. 1–5. PLATE XIX. PLATE XX.

A nearly perfect specimen of a large squid, was found cast ashore after a severe gale, at Catalina, Trinity Bay, Newfoundland, Sept. 24, 1877. It was living when found. It was exhibited for two or three days at St. John's, and subsequently was carried in brine to New York, where it was purchased by Reiche & Brother for the New York Aquarium. There I had an opportunity to examine it, very soon after its arrival.* I am also indebted to the proprietors of the aquarium for some of the loose suckers. Other suckers from this specimen were sent to me from Newfoundland, by the Rev. M. Harvey. Although

* See American Journal of Science and Arts, vol. xiv, p. 425, Nov., 1877. When examined by me it was loose in a tank of alcohol. Dr. J. B. Holder gave me valuable assistance in making this examination, and also made one of the drawings of the caudal fin. It was afterwards "prepared" for exhibition by a taxidermist, who misplaced the arms, siphon, and other parts, and inserted two large, round [illegible] eyes close together on the top of the head!

somewhat mutilated, and not in a very good state of preservation when received, it is of great interest, being, without doubt, the largest and best specimen ever preserved. The Catalina specimen, when fresh,* was 9·5 feet from tip of tail to base of arms; circumference of body, 7 feet; circumference of head, 4 feet; length of tentacular-arms, 30 feet; length of longest sessile arms (ventral ones), 11 feet; circumference at base, 17 inches; circumference of tentacular arms, 5 inches; at their expanded portion, 8 inches. Length of upper mandible, 5·25 inches; diameter of large suckers, 1 inch; diameter of eye-openings, 8 inches. The eyes were destroyed by the captors. It agrees in general appearance with *A. Harveyi* (No. 5), but the caudal fin is broader and somewhat less acutely pointed than in that species, as seen in No. 5; it was two feet and nine inches broad, when fresh, and broadly sagittate in form. The dried rims of the large suckers are white, with very acutely serrate margins; the small smooth-rimmed suckers, with their accompanying tubercles, are distantly scattered along most of the inner face of the tentacular arms, the last ones noticed being nineteen feet from the tips. The sessile arms present considerable disparity in length and size, the ventral ones being somewhat larger and longer than the others, which were, however, more or less mutilated when examined by me; the serrations are smaller on the inner edge than on the outer edge of the suckers. On the smaller suckers the inner edge is often without serrations.

No. 15.—Hammer Cove specimen, 1876.

In a letter from Rev. M. Harvey, dated Aug. 25, 1877, he states that a big squid was cast ashore Nov. 20, 1876, at Hammer Cove, on the southwest arm of Green Bay, in Notre Dame Bay, Newfoundland. When first discovered by his informant it had already been partially devoured by foxes and sea-birds. Of the body, a portion 5 feet long remained, with about 2 feet of the basal part of the arms. The head was 18 inches broad; tail, 18 inches broad; eye-sockets, 7 by 9 inches; stump of one of the arms, 2·5 inches in diameter.

The only portion secured was a piece of the 'pen' about 16 inches long, which was given to Mr. Harvey.

No. 16.—Lance Cove specimen, 1877. (*Architeuthis princeps ?*, ♀.)

In a letter dated Nov. 27, 1877, Mr. Harvey gives an account of another specimen which was stranded on the shore at Lance Cove,

* Measurements of the freshly caught specimen were made by the Rev. M. Harvey, at St. John's, and communicated to me.

Smith's Sound, Trinity Bay, about twenty miles farther up the bay than the locality of the Catalina Bay specimen (No. 14). He received his information from Mr. John Duffet, a resident of the locality, who was one of the persons who found it and measured it. His account is as follows: "On Nov. 21, 1877, early in the morning, a 'big squid' was seen on the beach, at Lance Cove, still alive and struggling desperately to escape. It had been borne in by a 'spring tide' and a high inshore wind. In its struggles to get off it ploughed up a trench or furrow about thirty feet long and of considerable depth by the stream of water that it ejected with great force from its siphon. When the tide receded it died. Mr. Duffet measured it carefully, and found that the body was nearly 11 feet long (probably including the head); the tentacular-arms, 33 feet long. He did not measure the short arms, but estimated them at 13 feet, and that they were much thicker than a man's thigh at their bases. The people cut the body open and it was left on the beach. It is an out-of-the-way place, and no one knew that it was of any value. Otherwise it could easily have been brought to St. John's, with only the eyes destroyed and the body opened." It was subsequently carried off by the tide, and no portion was secured.

This was considerably larger than the Catalina specimen.

The great thickness of the short arms of this specimen, and of some of the others, indicates a species distinct from *A. Harveyi*, unless the sexes of that species differ more than is usual in this respect, among the smaller squids. The length of the sessile arms, if correctly stated, would indicate that this specimen belonged to *A. princeps*. In the female *Ommastrephes illecebrosa*, the common northern squid, the head is larger and the short arms are stouter and have larger suckers than in the male, of the same length.

No. 17.—Trinity Bay specimen, 1877.

Mr. Harvey also states that he had been informed by Mr. Duffet that another very large 'big squid' was cast ashore in October, 1877, about five miles farther up Trinity Bay than the last. It was cut up and used for manure. No portions are known to have been preserved, and no measurements were given.

No. 18.—Thimble Tickle specimen, 1878.

The capture of this specimen has been graphically described by Mr. Harvey, in a letter to the Boston Traveller, of Jan. 30, 1879.

"On the 2d day of November last, Stephen Sherring, a fisherman

residing in Thimble Tickle, not far from the locality where the other devil-fish [No. 19], was cast ashore, was out in a boat with two other men; not far from the shore they observed some bulky object, and, supposing it might be part of a wreck, they rowed toward it, and, to their horror, found themselves close to a huge fish, having large glassy eyes, which was making desperate efforts to escape, and churning the water into foam by the motion of its immense arms and tail. It was aground and the tide was ebbing. From the funnel at the back of its head it was ejecting large volumes of water, this being its method of moving backward, the force of the stream, by the reaction of the surrounding medium, driving it in the required direction. At times the water from the siphon was black as ink."

"Finding the monster partially disabled, the fishermen plucked up courage and ventured near enough to throw the grapnel of their boat, the sharp flukes of which, having barbed points, sunk into the soft body. To the grapnel they had attached a stout rope which they had carried ashore and tied to a tree, so as to prevent the fish from going out with the tide. It was a happy thought, for the devil-fish found himself effectually moored to the shore. His struggles were terrific as he flung his ten arms about in dying agony. The fishermen took care to keep a respectful distance from the long tentacles, which ever and anon darted out like great tongues from the central mass. At length it became exhausted, and as the water receded it expired.

"The fishermen, alas! knowing no better, proceeded to convert it into dog's meat. It was a splendid specimen—the largest yet taken—the body measuring 20 feet from the beak to the extremity of the tail. It was thus exactly double the size of the New York specimen, and five feet longer than the one taken by Budgell. The circumference of the body is not stated, but one of the arms measured 35 feet. This must have been a tentacle."

No. 19.—Three Arms specimen, 1878. (*Architeuthis princeps ?.*)

Mr. Harvey has also given an account of this specimen, in the same letter to the Boston Traveller, referred to under No. 18. This one was found cast ashore after a heavy gale of wind, Dec. 2, 1878, by Mr. William Budgell, a fisherman residing at a place called Three Arms. It was dead when found, and was cut up and used for dog meat. Mr. Harvey's account is as follows:

"My informant, a very intelligent person, who was on a visit in that quarter on business, arrived at Budgell's house soon after he

had brought it home in a mutilated state, and carefully measured some portions with his own hand. He found that the body measured 15 feet from the beak to the end of the tail, which is five feet longer than the New York specimen. The circumference of the body at its thickest part was 12 feet. He found only one of the short arms perfect, which was 16 feet in length, being five feet longer than a similar arm of the New York specimen, and he describes it as "thicker than a man's thigh." The statement that the sessile arms were longer than the head and body together, indicates that this was a specimen of *A. princeps*, like No. 14, but larger.

No. 20.—Banquereau specimen, 1878. (*Architeuthis megaptera* V. ?.)

This consists of the terminal part of a tentacular arm, which was taken by Capt. J. W. Collins and crew, of the schooner "Marion," from the stomach of a large and voracious fish (*Alepidosaurus ferox*) together with the only specimen hitherto discovered of the remarkable squid, *Histioteuthis Collinsii* V. The fish was taken on a halibut trawl-line, N. lat. 42° 49′; W. long. 62° 57′, off Nova Scotia, 1879. This fragment, after preservation in strong alcohol, now measures 18 inches in length. It includes all the terminal club, and a portion of the naked arm below it. The club is narrow, measuring but ·75 inch across its front side, while the naked arm is 1·25 broad, and rather flat, where cut off. From the commencement of the large suckers to the tip, it measures 9·25 inches. It had lost most of its suckers, so that it cannot be identified with certainty. Part of the large suckers and some of the marginal ones still remain, though the horny rings are gone; diameter of large suckers, ·50 inch; of marginal ones, about ·12. The suckers have the same form and arrangement as in the larger specimens of *Architeuthis*. It may, perhaps, belong to *Architeuthis megaptera*, or to a young *A. Harveyi*.

No. 21.—Cape Sable specimen. (*Architeuthis megaptera* V.)

PLATE XXI.

This specimen was found thrown on the shore near Cape Sable, N. S., after a very severe gale, several years ago. It is preserved in alcohol, entire, and in good condition, in the Provincial Museum at Halifax, where it is well exhibited in a large glass jar. It is the type specimen of *Architeuthis megaptera*, described by me, Sept., 1878.* It is a comparatively small species, its total length being but 43

* American Journal of Science, xvi, p. 207, 1878.

inches; its head and body together, 19 inches; body alone, 14 inches; its tentacular-arms, 22 and 24 inches; short arms, from 6·5 to 8·5 inches; tail-fin, 13·5 inches broad and 6 long.

This species differs widely from all the others in the relatively enormous size and breadth of its caudal fin, which is nearly as broad as the body is long, and more than twice as broad as long. It will form the type of a new generic group.

No. 22.—Brigus specimen, 1879.

Mr. Harvey states that portions of another large squid were cast ashore near Brigus, Conception Bay, in October, 1879.

Two of the short arms, each measuring eight feet in length, were found with other mutilated parts, after a storm.

No. 23.—James's Cove specimen, 1879.

From Mr. Harvey I have also very recently received an account of another specimen, which was captured entire about the first of November last, at James's Cove, Bonavista Bay, N. F. It seems to have been a fine and complete specimen, about the size of the Catalina Bay specimen (No. 14). Unfortunately the fishermen, as usual, indulged immediately in their propensity to cut and destroy, and it is doubtful if any portion was preserved. The account referred to was published in the *Morning Chronicle*, of St. John's, N. F., Dec. 9, 1879, and was credited to the *Harbor Grace Standard*. The author of the article is not given. The following extract contains all that is essential: "A friend at Musgrave Town sends us the following particulars relative to the capture of a big squid at James's Cove, Goose Bay, about a month ago. Our correspondent says: Mr. Thos. Moores and several others saw something moving about in the water, not far from the stage. Getting into a punt they went alongside, when they were surprised to see a monstrous squid. One of the men struck at it with an oar, and it immediately struck for the shore, and went quite upon the beach. The men then succeeded in getting a rope around it, and hauled it quite ashore. It measured 38 feet altogether. The body was about 9 feet in length, and two of its tentacles or horns were 29 feet each. There were several other smaller horns, but they were not so long. The body was about 6 feet in circumference. When I saw it, it was in the water, and was very much disfigured, as one of the men had thoughtlessly cut off the two longest tentacles, and had ripped the body partly open, thereby completely spoiling the appearance of the creature. The foregoing particulars I obtained from Mr. Moores."

Histioteuthis Collinsii Verrill.

In addition to the foregoing examples, all of which are believed to be referable to the genus *Architeuthis*, I have in a former article* described a very remarkable squid, belonging to the genus *Histioteuthis*, in which a broad thin membrane or 'web' unites the six upper arms together, nearly to their tips, while the lower ones have a shorter web uniting them to the rest. Although small, when contrasted with some of the gigantic specimens of *Architeuthis*, it is considerably larger than any of the common small squids, and as it inhabits the same localities with *Architeuthis*, and has some points of resemblance to the latter genus, especially in having the smooth-rimmed suckers for uniting together the long tentacular-arms, I have thought it best to describe it in this part of my article, in connection with the species of *Architeuthis*. The only specimen known was obtained (with No. 20) from the stomach of a large and voracious fish (*Alepidosaurus ferox*), having a formidable array of long sharp teeth, eminently adapted for the capture of such prey. It was taken by Captain J. W. Collins and crew of the schooner Marion, in deep water off the coast of Nova Scotia, and presented to the U. S. Fish Commission. This species (*H. Collinsii*) is figured on Plate XXII, and will be described farther on.

Onychoteuthis robusta (Dall, MSS.).

In this connection I may also refer to a gigantic Pacific Ocean species, obtained by Mr. W. H. Dall, on the coast of Alaska, in 1872, which will be described as fully as possible in another part of this article, when discussing the foreign species of large Cephalopods, (see Plates XXIII and XXIV.) Three specimens were observed and measured by Mr. Dall. The largest measured, from the base of the arms to the end of the body, 8·5 feet. The ends of all the arms had been destroyed, in all the specimens. It was formerly† briefly described by me under Mr. Dall's MSS. name, *Ommastrephes robustus*, but a more careful study of the parts preserved, especially the 'cone' of the 'pen' and the odontophore, has convinced me that it belongs to the genus *Onychoteuthis*, characterized especially by having rows of sharp claws or hooks on the 'club' of the tentacular-arms, instead of suckers. All the species of this genus previously known are of small size, and pelagic in their habits. It is, therefore, of especial interest to add another generic type to the list of gigantic species.

* American Journal of Science, vol. xvii, p. 241, 1879.

† American Journal of Science, vol. xii, p. 236, 1876.

Comparative measurements of the specimens (in inches).

	Architeuthis Harveyi?									Architeuthis princeps?									
	No. 2.	No. 3.	No. 4.	No. 5. Fresh.	No. 5. Presv'd.	No. 8.	No. 9.	No. 11.	No. 15.	No. 1.	No. 7.	No. 10.	No. 13.	No. 14.	No. 16.	No. 18.	No. 19.	No. 22.	No. 23.
Total length, to tip of tentacular-arms,	--	624	384	382	--	480	540	--	--	--	624	--	450?	480	528	660	--	--	456
Total length, to tip of short arms,	--	--	--	166	--	--	--	--	--	--	--	--	--	246	--	--	--	--	--
Base of arms to insertion of tail-fin,	--	--	--	75	--	--	--	--	--	--	--	--	120	95	--	--	--	--	--
Base of arms to tip of tail,	--	120	--	92	--	--	--	168?	--	170?	180	--	140?	114	132	240	180	--	108
Head, length (base of arms to mantle),	--	--	--	10	--	--	--	--	--	--	--	--	--	14?	--	--	--	--	--
Mantle edge to tip of tail, above,	--	--	--	82	--	--	--	--	--	--	--	--	--	100?	--	--	--	--	--
Circumference of body,	--	90?	72	66	--	--	--	--	--	56?	--	--	--	84	--	--	144	--	72
Circumference of head,	--	--	--	--	--	--	--	--	--	--	--	--	36	48	--	--	--	--	--
Breadth of head, across eyes,	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--	--	--
Breadth of eye-openings,	--	--	--	--	--	--	--	--	7 × 9	--	--	--	--	8	--	--	--	--	--
Length of tail-fins, (tip to insertion),	--	--	--	18?	17	--	--	--	--	--	--	--	20?	19 p.	--	--	--	--	--
Breadth of tail-fins,	--	--	--	22	16	--	--	--	18	--	--	--	--	28 p.	--	--	--	--	--
From outer angle to tip of tail-fins,	--	--	--	27?	23	--	--	--	--	--	--	--	--	24·5p.	--	--	--	--	--
Outer angle of tail-fin to side of body,	--	--	--	--	6·5	--	--	--	--	--	--	--	--	10 p.	--	--	--	--	--
Length of tentacular-arms,	348?	504	--	288	161	--	--	384	--	--	444	--	312	360	396	420	--	--	348
Length of 'club,' bearing rows of suckers,	30	--	--	30	30	--	--	--	--	--	--	--	--	30·5p.	--	--	--	--	--
Part bearing largest suckers,	18	--	--	15	14	--	--	--	--	--	--	--	--	19 p.	--	--	--	--	--
Length of longest sessile arms,	--	72	--	72	--	--	--	120	--	120+	--	--	104?	132	156?	--	192	96	--
Circumf. of largest sessile arms (at base),	--	9	--	10	3	--	--	--	10·5	22	--	--	16?	17	--	--	--	--	--
Breadth of largest sessile arms (at base),	--	--	--	--	8	--	--	--	3·5?	--	--	--	--	6	--	--	--	--	--
Circumf. of tentacular-arms (middle),	4	--	--	2½–3	2·75	--	--	--	--	--	--	--	--	5	--	--	--	--	--
Circumference of 'club' of same,	6	--	--	--	4·5	--	--	--	--	--	--	--	--	6 p.	--	--	--	--	--
Diameter of largest suckers, of club,	1·28	--	·92	1·25	1·15	--	--	2·25?	--	--	2	--	1·10	1·15	--	--	--	--	--
Diameter of largest suckers of short arms,	--	--	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--
Upper jaw, total length,	--	--	3·55	--	3·85	--	--	--	--	--	--	5	4+	5·25	--	--	--	--	--
Upper jaw, breadth (front to back),	--	--	2·5+	--	2·50	--	--	--	--	--	--	3·50	3·24	3·88	--	--	--	--	--
Lower jaw, total length,	--	--	--	--	3	--	--	--	--	--	--	3·63	3·24	3·75	--	--	--	--	--
Lower jaw, total breadth,	--	--	--	--	2·65	--	--	--	--	--	--	--	3·08	3·88	--	--	--	--	--
Lower jaw, tip of beak to notch,	--	--	.62	--	·65	--	--	--	--	65	--	·80	·71	·87	--	--	--	--	--

* The measurements given from the preserved specimen of No. 14 are designated by (p) affixed.

Special Descriptions of the Atlantic Coast Species.

Architeuthis Steenstrup.

Oplysninger om Atlanter, Collossale Blæksprutter, Förhandlinger Skand. Naturf., 1856, vii, p. 182, Christiana, 1857.

Size large. Body stout, nearly round, swollen in the middle. Caudal fin, in the typical species, very small, sagittate (very large, broad, rhomboidal in *A. megaptera*).* Head large, short. Eyes very large, oblong-ovate with well-developed lids and anterior sinus. Sessile arms stout, their suckers large, very oblique, with the edges of the horny rings strongly serrate, especially on the outer margin. The margin has around it a free-edged membrane, which closely surrounds the denticles when the sucker is used, and allows a vacuum to be produced. Tentacular-arms very long and slender, in extension, the proximal part of the club furnished with an irregular group of small, smooth-rimmed suckers, intermingled with rounded tubercles on each arm, the suckers on one arm corresponding with the tubercles of the other, so that, by them, the two arms may be firmly attached together without injury, and thus used in concert; other similar suckers and tubercles, doubtless for the same use, are distantly scattered along the slender part of these arms, one sucker and one tubercle always occurring near together. The internal shell (known only in one species) is thin and very broad, expanding from the anterior to the posterior end, with divergent ribs.

This genus is closely allied to *Ommastrephes*, from which it may be best distinguished by the presence of the peculiar suckers and tubercles for uniting the tentacular-arms together. A small cluster of smooth-edged suckers also occurs at their tips.

Architeuthis Harveyi Verrill.

Megaloteuthis Harveyi Kent, Proc. Zool. Soc. London, 1874, p. 178.

Architeuthis monachus Verrill, Amer. Journal Science, vol. ix, pp. 124, 177, Pl. ii, iii, iv, 1875; vol. xii, p. 236, 1876. American Naturalist, vol. ix, pp. 22, 78, figs. 1–6, 10, 1875, (*? non* Steenstrup).

Ommastrephes harveyi Kent, Proc. Zool. Soc. London, 1874, p. 492.

Ommastrephes (*Architeuthis*) *monachus* Tryon, Manual of Conchology, I, p. 184, Pl. 83, fig. 379, Pl. 84, figs. 380–385, 1879. (Descriptions compiled and figures copied from the papers by A. E. V.)

PLATES XIII, XIV, XV, XVI, XVI*a*.

The diagnostic characters of this species, so far as determined, are as follows: Sessile arms unequal in size, nearly equal in length,

* This species differs so much in dentition and other characters from the typical forms, as to deserve separation, as a subgenus, or perhaps as a distinct genus, which I propose to call *Sthenoteuthis*.

decidedly shorter than the head and body together, and scarcely as long as the body alone, all bearing apparently similar suckers; their tips slender and acute. Tentacular-arms, in extension, about four times as long as the short ones; about three times as long as the head and body together. Caudal fin small, less than one-third the length of the mantle, sagittate in form, with the narrow lateral lobes extending forward beyond their insertions; the posterior end tapering to a long acute tip. Jaws with smaller notch and lobe than in *A. princeps*. Suckers of the sessile arms (so far as seen) with numerous acute teeth all around the circumference, all similar in shape, but those on the inner margin smaller than those on the outer. Sexual characters are not yet determined.

Special description of the specimen, No. 5.—The preserved parts of this specimen (see p. 184), examined by me, are as follows: The anterior part of the head, with the bases of the arms, the beak, lingual ribbon, etc.; the eight shorter arms, but without the suckers, which dropped off in the brine, and are now represented only by a few of the detached marginal rings; the two long tentacular-arms, which are well preserved, with all the suckers in place; the caudal fin; portions of the 'pen' or internal shell; the ink-bag; and pieces of the body.

The general appearance and form of this species* are well shown by Plates XIII and XIV. The body was relatively stout. According to the statement of Mr. Harvey, it was, when fresh, about 213^{cm}

* Mr. W. Saville Kent, from the popular descriptions of this species, gave it new generic and specific names, viz: *Megaloteuthis Harveyi*, in a communication made to the Zoological Society of London, March 3, 1874 (Proceedings Zool. Soc, p. 178; see also Nature, vol. ix, p. 375, March 12, and p. 403, March 19). My former identification was based on a comparison of the jaws with the jaws of *A. monachus*, well figured and described by Steenstrup in proof-sheets of a paper which is still unpublished, though printed several years ago, and referred to by Harting. The agreement of the jaws is very close in nearly all respects, but the beak of the lower jaw is a little more divergent in Steenstrup's figure. His specimen was a little larger than the one here described and was taken from a specimen cast ashore at Jutland, in 1853. Mr. Kent was probably unacquainted with Steenstrup's notice of that specimen when he said (Nature, ix, p. 403) that *A. monachus* "was instituted for the reception of two gigantic Cephalopods, cast on the shores of Jutland in the years 1639 and 1790, and of which popular record alone remains." In his second communication to the Zoological Society of London, March 18, 1874, (Proc., p. 490), he states (on the authority of Crosse and Fischer) that a third specimen "was stranded on the coast of Jutland in 1854, and upon the pharynx and beak of this, the only parts preserved; the same authority founded his species *Architeuthis dux*." The specimen here referred to is

(seven feet) long and five and one-half feet in circumference. The 'tail' or caudal fin (Plate XIII, fig. 2, and Plate XVI, fig. 2) is decidedly sagittate, and remarkably small in proportion to the body. It is said by Mr. Harvey to have been 55·9^{cm} (22 inches) across, but the preserved specimen is considerably smaller, owing, undoubtedly, to shrinkage in the brine and alcohol. The posterior termination is unusually acute and the lateral lobes extend forward considerably beyond their insertion. In the preserved specimen the total length, from the anterior end of the lateral lobes to the tip of the tail, is 58·4^{cm} (23 inches); from the lateral insertions to the tip, 48·2^{cm} (19 inches; total breadth about 38^{cm} (15 inches); width of lateral lobes, 15·2^{cm} (6 inches). The eight shorter arms, when fresh, were, according to Mr. Harvey's measurements, 182·9^{cm} (six feet) long and all of equal length,* but those of the different pairs were respectively 25·4,

evidently the same that Steenstrup named *A. monachus*, in 1856. The confusion in reference to these names is evidently due to this mistake.

The statement that *Architeuthis dux* Steenstrup is known from the beak alone is evidently erroneous. Steenstrup, himself, Harting, and Dr. Packard, in their articles on this subject, all state that the suckers, parts of the arms, and the internal shell or pen were preserved, and they have been figured, but not published, by Prof. Steenstrup. Harting has also given a figure of the lower jaw, copied from a figure by Steenstrup. In the proof-sheets that I have seen, this specimen is referred to as "*A. Titan*," but Harting cites it as *A. dux* Steenstrup, which is the name given to it by Steenstrup in his first notice of it, in 1856. Therefore two distinct species were confounded under this name by Kent.

I have more recently been led to consider our species distinct from the true *A. monachus* by correspondence with Professor Steenstrup, from whom I learn that the caudal fin in his species does not agree with that of the species here described, and that in his species the ventral arms differ from the others, both in form and in the character of the suckers. Certain differences in the arms can be detected in the photograph of our specimen (reproduced on Plate XIII) in which, fortunately, the ventral arms are well-displayed; but their suckers do not appear to differ, except in size. Unless these differences prove to be sexual characters, which is not likely, they would indicate a specific difference. Therefore, I have, for the present, adopted the specific name given by Kent to the Newfoundland specimens. The name was given, as a well-merited compliment to the Rev. M. Harvey, who has done so much to bring these remarkable specimens into notice. Nevertheless it is probable that when the original specimens of *A. monachus* shall have been fully described and figured, one of our species may prove to be identical with it. At present I am unable to decide whether the affinities of *A. monachus* may not be with *A. princeps*, rather than with *A. Harveyi*. With the former it apparently agrees in having two forms of suckers on the short arms.

* It is possible that they may have been originally somewhat unequal, and that mutilation of their tips made them appear more nearly equal than they were in life.

22·9, 20·3 and 17·8^{cm} (ten, nine, eight and seven inches) in circumference.* They are, except the ventral, compressed trapezoidal in form and taper very gradually to slender acute tips. Their inner faces are occupied by two alternating rows of large obliquely campanulate suckers, with contracted apertures, surrounded by broad, oblique, thin, horny, marginal rings, much broader on the outer side than on the inner, and armed with strong, acute teeth around their entire circumference, but the teeth are largest and most oblique on the outside (Plate XVI, fig. 4; XVI*a*, figs. 6–8). These suckers gradually diminish in size to the tips of the arms, where they become very small, but all that are preserved are similar in form and structure. The ventral pair of arms still have, as they show in the photograph, the inner face much broader than it is in the others, especially near the base, and they are more nearly square than any of the others. Their suckers are more numerous, farther apart transversely, and closer together in the longitudinal series, there being about 46 on the proximal half (36 inches) of each, while on each of the subventral arms there are only about 30 on the corresponding portion; the suckers also diminish rather abruptly in size at about 26 to 30 inches from the base, beyond which they are scarcely more than half as large as those on the second and third pairs of arms, at the same distance from the base. The largest of these suckers are said, by Mr. Harvey, to have been about an inch in diameter, when fresh. The largest of their marginal rings, in my possession, are 14^{mm} to 16^{mm} in diameter, at the serrated edge, and 18^{mm} to 20^{mm} beneath.

The horny rings are yellowish horn-color, oblique, and more than twice as wide on the back side as in front. A wide peripheral groove runs entirely around the circumference, just below the denticulated margin; it is narrower and deeper on the front side. On the front side the edge is nearly vertical, and the denticles point upward or are but slightly incurved; but on the outer or back side the edge and denticles are bent obliquely inward; along the side the edge is more or less incurved and the denticles are inclined more or less forward, toward the front edge of the sucker. The denticles are golden yellow, or when dry, silvery white; those on the outer and lateral

* In the original statement it is not mentioned to which pairs of arms these dimensions apply. After having been five years in alcohol the ventral arms now measure 7·5 inches in circumference, and one of the lateral ones (perhaps one of the third pair) 8 inches. The marginal membranes or crests had decayed, apparently, before the arms were preserved; their terminal portions are also gone, so that the real length cannot be given.

margins are largest, flat, lanceolate, with sharply bevelled lateral edges and acuminate tips; those on the front margin are shorter, narrower, acutely triangular, and in contact at their bases. On the largest of these suckers there are forty-eight to fifty denticles. Some of the suckers of rather smaller size (*a*, *b*,) are more oblique, with the outer side of the horny rings relatively wider and more incurved; the denticles of the outer margin are strongly incurved and decidedly narrower and more acute than the lateral ones, which are broad-triangular; the inner or front denticles are rather smaller, acute-triangular, and usually inclined somewhat inward. On these there are forty to forty-six denticles. No suckers of this specimen have been found with the denticles rudimentary or wanting on the front edge, as is frequently the case in those of *A. princeps*. Nor is there so much contrast in the form and size of the inner and outer denticles of the largest suckers as in that species. The rings of the smaller suckers are still more oblique and more contracted at the aperture than those of the larger ones, with the teeth more inclined inward, those on the outside margin being largest.

Measurements of suckers of short arms (millimeters).

	a (alc.)	*b* (alc.)	*c* (alc.)	*d* (dry.)
Transverse diameter, outside,	17	17	20	18
Diameter of aperture,	13	10	16	14
Breadth of horny ring, back side,	7·5	9	8	7
Breadth of horny ring, front side,	3	3	3·5	3
Number of distinct denticles,	46	41	50	49

The two long tentacular-arms are remarkable for their slenderness and great length when compared with the length of the body. Mr. Harvey states that they were each 731·5^{cm} (24 feet) long and 7^{cm} (2·75 inches) in circumference when fresh. In the brine and alcohol they have shrunk greatly, and now measure only 411·5^{cm} (13·5 feet) in length, while the circumference of the slender portion varies from 5·7^{cm} to 7·25^{cm} (2·25 to 3·25 inches). These arms were evidently highly contractile, like those of many small species, and consequently the length and diameter would vary greatly according to the state of contraction or relaxation. The length given (24 feet) probably represents the extreme length in an extended or flaccid condition, such as usually occurs in these animals soon after death. The slender portion is nearly three-cornered or triquetral in form, with the outer angle rounded, the sides slightly concave, the lateral angles prominent, and the inner face a little convex and generally smooth.

The terminal portion, bearing the suckers, is 76·2^{cm} in length and expands gradually to the middle, where it is 11·4^{cm} to 12·7^{cm} in circumference (15·3^{cm} when fresh), and 3·9 to 4·1^{cm} across the inner face. The sucker-bearing portion may be divided into three parts. The first region occupies about 17·8^{cm} (7 inches); here the arm is rounded-triquetral, with margined lateral angles, and gradually increases up to the maximum size, the inner face being convex and bearing about forty irregularly scattered, small, flattened, saucer-shaped suckers, attached by very short pedicels, and so placed in depressions as to rise but little above the general surface. The larger ones are 5 to 6^{mm} in external diameter; 3^{mm} across aperture; 1·5^{mm} high. The smaller ones have a diameter of 4^{mm}; aperture 2·5^{mm}; height 1^{mm}. The horny ring (Plate XVI*a*, figs. 9, 9*a*) is circular, thin, and of about uniform breadth all around; the edge is smooth and even, slightly everted; just below the edge there is a groove all around; below this a prominent, rounded ridge surrounds the periphery, below which the lower edge is somewhat contracted. A thick, soft membrane surrounds the edge. These suckers are at first distantly scattered, but become more crowded, distally, forming six to eight irregular alternating rows, covering the whole width of the inner face, which becomes 4·1^{cm} broad. Scattered among the suckers are about an equal number of low, broad, conical, smooth, callous verrucæ, or wart-like prominences, rising above the general surface, their central elevation corresponding in form and size to the apertures of the adjacent suckers. These, without doubt, are intended to furnish secure points of adhesion for the corresponding suckers of the opposite arm, so that, as in some other genera, these two arms can be fastened together at this wrist-like portion, and thus may be used unitedly. By this means they must become far more efficient organs for capturing their prey than if used separately. The absence of denticulations prevents the laceration of the creature's own flesh, which the sharp teeth of the other suckers would produce, under pressure, and the verrucæ prevent the lateral slipping, to which unarmed suckers applied to a smooth surface would be liable. Between these smooth suckers and the rows of large ones there is a cluster of about a dozen small suckers, with sharply serrate margins, from 5 to 8^{mm} in diameter, attached by slender pedicels. They are arranged somewhat irregularly in four rows, those of the outer rows more oblique and corresponding in form with the larger marginal suckers.

The second division, 35·6^{cm} in length, succeeds the small suckers. Here the arm is flattened on the face, well-rounded on the back, and provided with a sharp dorsal carina, increasing in width toward the tip. It bears two alternating rows of about twelve very large serrated suckers, and an outer row of smaller ones, on each side, alternating with the large ones. The upper edge is bordered by a rather broad, regularly scalloped, marginal membrane, the scallops corresponding to the large suckers, while prominent transverse ridges, midway between the large suckers, join the membrane and form its lobes. On the lower edge there is a narrower and thinner membrane, which runs all the way to the tip of the arm. In one (the lower) of the rows of large suckers there are eleven, and in the other ten, above 20^{mm} in diameter. The former row has one additional sucker at its proximal end 15^{mm} in diameter, and three others at its distal end, respectively 16, 12, and 8^{mm} in diameter. The other row, of ten suckers, is continued by a proximal sucker 10^{mm} in diameter, and by two distal ones, respectively 15 and 13^{mm} in diameter. The number of 'large' suckers in each row may, therefore, be counted as 12, 13, or 14, according to the fancy of the describer, there being no well-defined distinction between the larger and smaller ones in either row. The largest suckers, along the middle of the rows, are from 24^{mm} to 30^{mm} in diameter (Plate XVI, fig. 3, *a*). They are attached by slender but strong pedicels, about 10^{mm} long and 6 to 7^{mm} in diameter. The outer or back side of these suckers is 16 to 18^{mm} high; the front side 10 to 11^{mm}, so that the rim is about 24 to 28^{mm} above the surface of the arm. The horny rings are 7 to 8^{mm} high and have the aperture 20 to 23^{mm} in diameter. Each one is situated in the center of a pentagonal depressed area, about 25^{mm} across, bounded by ridges, which alternate regularly, and interlock on the two sides, so as to form a zigzag line along the middle of the arm. These large suckers are broadly and obliquely campanulate, but much less oblique than those of the short arms; the marginal ring is strong, and sharply serrate all around; the denticles are acute-triangular and nearly equal. The rings are somewhat calcified and rather rigid when dried; a well-marked broad groove runs around the entire circumference, below the bases of the denticles.

The small marginal suckers (fig. 3, *b*) are similar in structure, but much more oblique, and mostly 9 to 11^{mm} in diameter; they are attached by much longer and more slender pedicels, and their marginal teeth are relatively longer, sharper and more incurved, especially on the outer margin. The peripheral groove is broad and deep,

but is interrupted on the outer side for about a third of the circumference; the outer third portion of the horny ring is somewhat flattened from the circular form.

The terminal division of the arm is 22·8^{cm} long. It gradually becomes much compressed laterally, and tapers regularly to the tip, which is flat, blunt and slightly incurved. Just beyond the large suckers, where this region begins, the circumference is 9^{cm}. The face is narrow and bears a large number of small pedicellate suckers, (Plate XVI*a*, figs. 10, 10*a*) arranged in four regular, alternating rows, gradually diminishing in size to near the tip of the arm, where the rows expand into a small cluster of about ten smooth-edged suckers. The suckers, except in the final group, are much like the marginal ones of the previous division, and at first are 5 to 7^{mm} in diameter, but decrease to about 2·5^{mm} near the tip of the arm. They have sharply serrate, oblique, marginal rings, broader on the outer side, with a peripheral groove on the front and sides only. In our preserved specimens the rings are gone from many of these small suckers, but those of the two rows next to the lower margin appear to have been larger than the others.

The suckers of the final group are close to the tip, which is slightly recurved over them. They are flat, attached to short pedicels, and provided with a narrow horny rim, which has the edge smooth, or nearly so, and surrounded by a thick membranous border. The diameter of these suckers is from ·5 to 2^{mm}. They are rather crowded and the cluster is broader than long.

The color of the body and arms, where preserved, is pale reddish, with thickly scattered small spots of brownish red.

The form of the jaws* of this specimen is well shown by Plate XV, figs. 1 and 2. When in place the tips of these jaws constitute a pow-

* In order to explain the terms employed in describing the various parts of the jaws of Cephalopods, as used in this article, I have introduced figures of the jaws of one of our common small squids (*Loligo pallida* V.) from Long Island Sound. The nomenclature adopted is essentially that used by Professor Steenstrup.

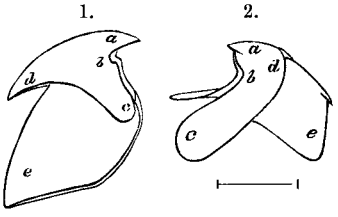


Figure 1. Upper mandible: *a.* rostrum or tip of the beak; *b.* the notch; *c.* the inner end of ala; *d.* the frontal lamina; *e.* the palatine lamina; *ab.* the cutting edge of beak; *bc.* anterior or cutting edge of ala.

Figure 2. Lower mandible: *a.* rostrum; *ab.* cutting edge; *bc.* anterior edge of ala; *d.* mentum or chin; *e.* gular lamina.

erful beak, looking something like that of a parrot or hawk, except that the upper jaw shuts into the lower, instead of the reverse, as in birds. The color is dark brown, becoming almost black toward the tip, where its substance is thicker and firmer and smoothly polished externally. The upper jaw (Plate XV, fig. 1), in 1875, measured 97^{mm} in total length; 25^{mm} in transverse breadth; and 66^{mm} in breadth or height. The lower jaw (fig. 2) was 76^{mm} long, 70^{mm} transversely, and 67^{mm} broad, vertically. It was larger when first received, but has subsequently shrunk considerably more, in alcohol.

The upper mandible has the rostrum strong, convex, acute, and curved considerably forward, with concave cutting edges, and a slight notch at its base. The anterior edges of the alæ are irregular and uneven. The palatine lamina is broad and thin.

The lower mandible has the rostrum stouter and less curved, the tip acute, with a distinct notch just below the tip, the cutting edges nearly straight, and with a moderately deep and rather narrow notch at its base; a ridge runs backward, from near the tip, in a curved line, circumscribing a more flattened area, on which are grooves and ridges parallel with the notch. Beyond the notch, on the anterior edges of the alæ, there is, on each side, a broad, low, obtuse lobe or tooth, beyond which the edge is even and slightly concave, to near the end of the alæ. The lamina of the mentum is short and strongly emarginate in the median line. Detailed measurements of the parts are given in the table of measurements on a subsequent page.

The roof of the mouth, or palate, between the anterior portions of the palatine laminæ, is lined with a rather firm, somewhat chitinous or parchment-like membrane,* having its surface covered with strong, acute, recurved, yellowish teeth, apparently chitinous in nature, attached by broad, oval or roundish, flattened bases (Plate XVI, fig. 1; XVI*a*, fig. 4). These teeth are mostly curved, and very unequal in size and form, the various sizes being intermingled. They are arranged in irregular quincunx, in many indefinite rows. Many irregular, roundish, rough, white, stony granules are also attached to this membrane, among the teeth. Similar granules (Plate XVI*a*, fig. 5) occur in large numbers on the thinner extension of this membrane, which everywhere lines the mouth and pharynx.

* In my first examination of this species, this tooth-bearing membrane was found, like the surrounding parts, much mutilated, and was mistaken for the odontophore, and described and figured as such. The real odontophore was discovered later, loose in another can, with other fragments of the same specimen, and this serious mistake was corrected in the American Journal of Science, vol. xii, p. 236, 1876.

The odontophore is about 64^{mm} in total length, with the dentigerous portion, where widest, about 11^{mm} in width. The teeth are in seven rows, with an exterior row of small, unarmed, thin, rhomboidal plates on each side, thus conforming to the arrangement in the other ten-armed cephalopods. The teeth are deep amber-color to dark brown, and not unlike those of *Loligo* and *Ommastrephes* in form. Those of the median row have three fangs, the central one longest; those on the next row, on either side, have two fangs; while those of the two outer lateral rows, on each side, are acute and strongly curved; the outermost longest and simple, the next to the outer often having a small denticle on the outer side, near the base. (See Plate XVI*a*, figs. 1, 2, 3.)

The membrane of the odontophore is broad, firm and thick; the dentigerous portion occupies only about a third of its width, in the middle or broader portion, where it is bent abruptly back upon itself. The lower or ventral portion measures, from the anterior bend to the end, 20^{mm}; it narrows gradually to the broad obtuse end, the width of the dentigerous portion decreasing from 9 to 5^{mm}, the naked lateral membrane decreasing from 8^{mm} to a very narrow border. The upper portion, from the bend to the end, measures 42^{mm} in length (in a straight line). The upper surface is deeply concave and infolded, at first, with the lateral membrane broad and recurved; farther back it becomes more flattened, with the dentigerous portion broader (11^{mm}), while the lateral membrane is abruptly narrowed and then extends to the end as a very narrow border. Toward the end the rows of teeth become more separated and the teeth smaller and paler, while the membrane becomes thinner and narrower.

The internal shell, or 'pen,' was represented by numerous detached pieces, which, after much trouble, I succeeded in locating and matching, so as to restore both the anterior and posterior ends, and thus to gain a fair idea as to what its original structure must have been. The texture, form and structure of the pen was somewhat like that of *Loligo*, but it was thinner, and had less definite outlines, and less of the peculiar quill-shape seen in the latter. The posterior end, instead of being pointed and regular in outline, appears to have been broadly rounded, or somewhat truncated, with an indefinite outline, thinning out gradually on all sides into a soft fibrous membrane, while the shaft, or quill-portion, was not so distinctly differentiated from the broader central portion, but increased in width quite regularly, from near the anterior end. The fragments in my possession belong to four more or less separated sections. The first section includes eleven

inches of the anterior end, from close to the extreme tip backward; the second section includes about nine inches, belonging to the anterior portion, and extends to about twenty-five inches from the anterior end, but lacks the extreme lateral margins, outside the costæ (Plate XV, fig. 3); the third section consists of about 7·5 inches belonging to the middle region, but does not include the whole width on either side of the midrib; the fourth section is about 10 inches in length, and comes from close to the posterior end, apparently representing nearly the whole width, on both sides.

From these fragments we can restore, pretty accurately, the first twenty-five inches, and the last twelve inches or more, though the precise form of the indefinite posterior margin must remain doubtful. The extreme anterior tip is broken off, but it was evidently pointed and pen-shaped, as in *Loligo*. At the mutilated end the breadth is now about a third of an inch. From this point the lateral edges diverge rapidly with a slightly concave outline, for about 1·25 inches, where the breadth becomes 1·20 inches; beyond this the margins are nearly straight and diverge gradually to the end of the first section, at eleven inches from the tip. At this place the breadth is 3·10 inches, the marginal portions, outside of the lateral costæ, being about ·40 of an inch, and the midrib about ·25 of an inch broad. Beyond this point a section about 4·75 inches long is entirely wanting, and the succeeding section lacks the marginal portions, the lateral costæ forming the margins on both sides. At 19·50 inches from the tip, the breadth, between the lateral costæ, is 3·75 inches; at 25 inches it is 5 inches broad. Whether the marginal portions originally extended to this point with a breadth as great as they have at 11 inches is uncertain, for their breadth decreases backward to that point from a point about 4 inches from the tip, where their breadth is ·60 of an inch. The midrib is strongly marked, being raised into a semi-cylindrical form, and of somewhat thicker material than the lateral portions; its breadth and height steadily increases throughout both these sections and the following one, until it becomes nearly half an inch broad, but in the section from near the posterior end it is low and narrow and decreases rapidly toward the end. The lateral costæ are well-marked, considerably elevated, and well rounded; they run, at first, close to and nearly parallel with the midrib, but after the first three inches they diverge quite regularly to the point, at 25 inches from the end, beyond which we cannot trace them, until they reappear in the first part of the posterior section, where they are quite small and soon fade out entirely, at some distance from

the extreme end. Near the anterior end, between the principal costæ and the margin, there are two additional costæ, much less distinct, and many faint radiating lines on each side. But these diverge more rapidly and mostly run into the margin at six to eight inches from the anterior end. The anterior portions and posterior portions are pale yellow or buff, fading to whitish at the thin margins, and deepening into pale amber at the midrib. Their substance is flexible, translucent, and very thin—scarcely thicker than parchment, except at the midrib and costæ.

The third section evidently came from the middle region, where the shell was thickest and broadest. This piece is 7·50 inches long, and 4·10 broad, with a strongly convex midrib, ·30 to ·35 of an inch broad, running through the center, but without any lateral costæ. In this portion the shell is much thicker and firmer than in the others, and of a decided brownish yellow, or dull amber-color, but quite translucent; it is finely striated with close, nearly parallel lines. The breadth and form of this middle portion must remain undetermined, for the present. The posterior section is quite incomplete, but is over ten inches long, and shows an extreme width of about six inches, or 5·75 where the lateral costæ disappear. Some of the fragments extend backward eight inches or more beyond that point, and gradually fade out, both at the ends and lateral margins, into a white, soft but tough, fibrous membrane. So far as this portion is preserved, it indicates a broadly rounded and ill-defined posterior termination.

To this species I refer, with some doubt, the tentacular-arm of No. 2, preserved in the museum of St. John's, Newfoundland. It agrees essentially in form and size, as will be seen from the description and measurements, with the corresponding arms of No. 5. Still it must be remembered that, as yet, no reliable distinctions have been made out between the tentacular-arms of *A. Harveyi* and *A. princeps*.

The total length of the tentacular-arm of No. 2 was estimated at 30 to 35 feet. The portion saved measured, when fresh, 579·12^{cm} (19 feet). The circumference of the slender portion was 9 to 10^{cm}; of the enlarged sucker-bearing part, 15·24^{cm} (6 inches); length of the part bearing suckers, 76·2^{cm} (30 inches); diameter of the largest suckers, 3·17^{cm} (1·25 inches). Calculating from the photograph, the portion bearing the larger suckers was about 45·7^{cm} (18 inches) in length, and about 6·35^{cm} (2·5 inches) broad, across the face; distance between attachments of large suckers, 4·27^{cm} (1·68 inches); outside diameter of larger suckers, 2·95 to 3·18^{cm} (1·16 to 1·25 inches); inside

diameter, 1·86 to 2·54^{cm} (·74 to 1 inch); diameter of the small suckers of the outside rows, 1·02 to 1·22^{cm} (·40 to ·48 of an inch). Mr. Harvey afterwards sent to me a full series of measurements of this arm, as then preserved. It had contracted excessively in the alcohol, and was only 13 feet one inch in length (instead of 19 feet, its original length), the enlarged sucker-bearing portion being 27 inches; the large suckers occupied 12 inches; the terminal part bearing small suckers, 9 inches; circumference of slender portion, 3·5 to 4·25 inches; of largest part, 6 inches; breadth of face, among large suckers, 2·5 inches; from face to back, 1·62 inches; diameter of largest suckers outside, ·75 of an inch; aperture, ·63 of an inch. It will be evident from these measurements, when compared with those made while fresh and from the photograph, that the shrinkage had been chiefly in length, the thickness remaining about the same, but the suckers (which had lost their horny rims, and therefore their size and form,) were considerably smaller than the dimensions previously given. Comparing all these dimensions with those of the Logie Bay specimen, and calculating the proportions as nearly as possible, it follows that this specimen was very nearly one-third larger than the latter, but the large suckers appear to have been relatively smaller, for they were hardly one-twelfth larger than in the Logie Bay specimen. As the relative size of the large suckers is a good sexual character in certain species of squids, it is possible that this difference may be a sexual one, in this case.

To this species I formerly referred the jaws and two large suckers from the 'club' of the tentacular-arms of the Bonavista Bay specimen (No. 4, see p. 194). In form, size, and proportions the jaws resemble those of the specimen (No. 5), described above, so that the size of these two individuals must have been about the same. These jaws had been dried and were very badly broken when received, so that only part of their dimensions could be ascertained, at first, but I have recently partially repaired them, so as to study them more fully, (see table under *A. princeps*). The total length of the upper mandible was about 105^{mm}. Tip of beak to notch 16^{mm}; notch to end of proper cutting edge of alæ, 75^{mm}. The lower mandible (Plate XXV, figs. 5, 5*a*) shows both sides of the rostrum and alæ. The notch and tooth are well-marked, and the tooth in front of it is narrower and much more elevated on one side than on the other. It is, therefore, quite possible that it belongs to *A. princeps*. The suckers (Plate XVI, figs. 5 and 6) had been dried, and have lost their true form, but the marginal rings are perfect, and only 23·4^{mm} (·92 of an inch) in

diameter, but though somewhat smaller than in the specimen just described, they have the same kind of denticulation around the margin. Their smaller size may indicate that the specimen was a male, but they may not have been the largest of those on the arm.

Architeuthis princeps Verrill.

Architeuthis princeps Verrill, Amer. Journ. Science, vol. ix, pp. 124, 181, Plate V, 1875; American Naturalist, vol. ix, pp. 22, 79, figs. 25–27, 1875.

Ommastrephes (Architeuthis) princeps Tryon, Manual of Conchology, p. 185, Pl. 85, 1879 (figures copied and description compiled from papers by A. E. V.).

PLATE XVII, PLATE XVIII, PLATE XIX, PLATE XX.

This species is distinguished by the length and inequality of the short arms, of which the longest (ventral or subventral) exceed the combined length of the head and body by about one-sixth; by the denticulation of the suckers of the short arms, of which there are two principal forms, some having very oblique horny rings with the outer edge very strongly toothed and the inner edge slightly or imperfectly denticulated; the others having less oblique rings with the denticles similar in form all around, though smaller on the inner margin; by the stronger jaws, which have a deeper notch and a more elevated tooth on the anterior edge; and by the caudal fin, which is short-sagittate in form, with the posterior end less acuminate than in the preceding species.

This species was originally based on the lower jaw, mentioned as No. 1, and on the upper and lower jaws, designated as No. 10, in the first part of this article. The jaws of No. 10 were obtained from the stomach of a sperm whale taken in the North Atlantic, and were presented to the Essex Institute by Capt. N. E. Atwood, of Provincetown, Mass., but the date and precise locality of the capture are unknown. The size and form of these jaws is well shown in Plate XVIII, figs. 1, 2. The total length of the upper jaw (fig. 1) is 127^{mm} (5 inches); greatest transverse breadth, 37^{mm} (1·45 inches); front to back, 89^{mm} (3·5 inches); width of palatine lamina, $58{\cdot}9^{mm}$ (2·32 inches). The frontal portion is considerably broken, but the dorsal portion remaining appears to extend nearly, but not quite, to the actual posterior end, the length from the point of the beak to the posterior edge being $86{\cdot}4^{mm}$ (3·4 inches). The texture is firmer and the laminæ are relatively thicker than in *A. Harveyi*. The rostrum and most of the frontal regions are black and polished, gradually becoming orange-brown and translucent toward the posterior border, and marked with faint striæ radiating from the tip of the beak, and

by faint ridges or lines of growth parallel with the posterior margin; a slight but sharp ridge extends backward from the notch at the base of the cutting edge, and other less marked ones from the anterior border of the alæ. The tip of the beak is quite strongly curved forward, and acute, with a slight shallow groove, commencing just below the tip, on each side, and extending backward only a short distance and gradually fading out. The front or cutting edge is nearly smooth and well curved, the curvature being greatest toward the tip; at its base there is a broad angular notch, deepest externally. The inner face of the rostrum is convex in the middle and concave or excavated toward the margins, which are, therefore, rather sharp. The anterior borders of the alæ are convex, or rise into a broad, but low, lobe or tooth beyond the notch, but beyond this they are nearly straight, but with slight, irregular lobes, which do not correspond on the two sides. The anterior edges of the alæ make nearly a right angle with the cutting edges of the rostrum. The palatine lamina is broad, thin, and dark brown, becoming reddish brown and translucent posteriorly, with a thin, whitish border. The surface is marked with unequal divergent striæ and ridges, some of which, especially near the dorsal part, are quite prominent and irregular; the posterior border has a broad emargination in the middle, but the two sides do not exactly correspond.

The lower jaw (Plate XVIII, fig. 2) was badly broken, and many of the pieces, especially of the alæ, are lost, but all that remain have been fitted together. The extreme length is 92^{mm} (3·63 inches); the total breadth, and the distance from front to back cannot be ascertained, owing to the absence of the more prominent parts of the alæ; from tip of beak to posterior ventral border of mentum, $42{\cdot}6^{mm}$ (1·68 inches); from tip of beak to posterior lateral border of alæ, $55{\cdot}9^{mm}$ (2·20 inches); from tip of beak to posterior ventral border of gular lamina, 60^{mm} (2·37 inches); from tip of beak to bottom of notch at its base, 20^{mm} (·80 inch); tip of beak to inner angle of gular lamina, 47^{mm} (1·85 inches); height of tooth from bottom of notch, $6{\cdot}25^{mm}$ (·25 inch); breadth between teeth of opposite sides, 15^{mm} (·60 inch); breadth of gular lamina, in middle, $44{\cdot}5^{mm}$ (1·75 inches). The beak is black, with faint radiating striæ, and with slight undulations parallel with the posterior border; the rostrum is acute, slightly incurved, with a notch near the tip, from which a very evident groove runs back for a short distance, while a well marked angular ridge starts from just below the notch, and descends in a curve to the ala, opposite the large tooth, defining

a roughened or slightly corrugated and decidedly excavated area between it and the cutting edges; the cutting edge below this ridge is nearly straight, or slightly convex; the notch at its base is rounded and deep and strongly excavated at bottom; the tooth is broad, stout, obtusely rounded at summit, sloping abruptly on the side of the notch, and gradually to the alar edge. The anterior edge of the alæ, beyond the tooth, is rounded and strongly striated obliquely; it makes, with the cutting edge, an angle of about 110°. The innner surfaces of the two sides of the internal plate of the rostrum form an angle of about 45°.

The lower jaw of No. 1 (Plate XVIII, fig. 3) is represented only by its anterior part, the alæ and gular laminæ having been cut away by the person who removed it.* It agrees very well in form and color with the corresponding parts of the one just described, but is somewhat smaller. The lateral ridges of the rostrum are rather more prominent, and the area within it is narrower and more deeply excavated, especially at the base of the notch, where the excavation goes considerably lower than the inner margin. The notch is narrower and not so much rounded at its bottom. The tooth is about the same in size as that of No. 10, and appears to be even more prominent, because the anterior edge of the alæ is more concave at its outer base; it is also more compressed and less regularly rounded at summit. This jaw measures 32·5^{mm} (1·30 inches) from the tip to the posterior ventral border of mentum; 17^{mm} from the tip to the bottom of the notch; 4^{mm} from bottom of notch to tip of the tooth.

Both these lower jaws agree in having a very prominent tooth on the alar edge, with a large and deeply excavated notch between it and the cutting edge of the beak, and in this respect differ from the lower jaw of *A. Harveyi*, for in the latter the tooth or lobe is broad and less prominent, while the notch is narrower and shallower. This seems to be the best character for distinguishing the jaws of the two species. But they also differ in the angle between the alar edge and the cutting edge of the rostrum, especially of the lower jaw, for while in *A. Harveyi* this is hardly more than a right angle, in *A. princeps* it is about 110°. Moreover, the darker color and firmer texture of the jaws of the latter seem to be characteristic.

To this species I have referred the Catalina specimen (No. 14, p. 189), preserved in the New York Aquarium. The jaws of the latter, which were examined and carefully measured by me, agree very

* The specimen was given to the Smithsonian Institution by Mr. G. P. Whitman, of Rockport, Mass., in 1872. (No. 2524).

closely, both in form and size, with those of No. 10, the type of the species, but are a trifle larger. The total length of the upper mandible is 133^{mm}; greatest breadth, 99^{mm}; from inner angle of anterior edge to the dorsal end of frontal lamina, 95; tip of rostrum, or beak, to the dorsal end of frontal lamina, 92; tip of rostrum to bottom of notch, 19; notch to inner end of anterior edge, 38; transverse breadth between anterior edges, 17^{mm}.

The total length of the lower mandible is 95^{mm}; breadth, from gular lamina to inner end of alæ, 99; front edge of jaw to posterior end of gular lamina, 83; breadth of alæ, 41; posterior edge of alæ to end of gular lamina, 44·5; tip of beak to bottom of notch, ·22; notch to inner angle of alæ, 70; depth of notch, 3·5^{mm}.

The general form of this species is very well shown on Plate XX. This figure has been based upon the sketches and measurements made by me soon after the specimen was received in New York and before it had been "mounted" (see page 189). The head was, however, so badly injured that it could not be accurately figured, and this part is, therefore, to be regarded as a restoration, as nearly correct as could be made under the circumstances. It may require considerable corrections, both as to size and form. The caudal fin is remarkable for its small size, as in *A. Harveyi.* Its breadth is scarcely more than that of the greatest diameter of the body. It is short-sagittate in form, with strongly divergent side lobes, which extend forward beyond their lateral insertions, and end in a rounded or blunt angle. The posterior end is somewhat prolonged and acute, but less so than in that of *A. Harveyi*, which it otherwise resembles. One of the figures (Plate XIX, fig. 2), was made by me several weeks after it had been placed in strong alcohol, and had shrunk considerably; the other (fig. 1) was made by Dr. J. B. Holder after it had been in alcohol only a few days.

When fresh, the caudal fin was 84^{cm} in breadth, but when sketched by Dr. Holder its breadth was 71^{cm}; its length, from posterior tip to lateral insertions, 48·3^{cm}; from tip to end of lateral lobes, 61^{cm}.

The length of the body and head together, when fresh, was about 289^{cm} (9·5 feet); but when measured by me it was about 218^{cm}.

The sessile arms were unequal in size and length, the longer ones considerably longer than the head and body together. Mr. Harvey found that the longest arms, said to be the ventral ones, were 335^{cm} (11 feet) long, and 43·2^{cm} (17 inches) in circumference at base. When first examined by me the ventral arms measured 10·5 feet, and were longer than any of the others, but all the rest were more

or less mulitated at the tips, and several had thus lost a considerable portion of their length, so that it is quite probable that originally the sub-ventral arms (or third pair) were actually longer than the ventral ones. The circumference of the third pair of arms, when measured by me, was considerably greater than that of the ventral ones; the former being 11·25 inches; the latter 10 inches. Hence I have inferred that the greatest circumference (17 inches), measured by Mr. Harvey, applies to the third pair of arms.

The ventral arms have both outer angles bordered by a strong, thick marginal membrane, about an inch wide. The arms are all more or less trapezoidal in form, and taper to very slender tips. When examined by me they had already lost nearly all their suckers. A few remained near the base of one of the arms of the third pair. These were 25^{mm} (1 inch) in diameter, with the aperture $15{\cdot}5^{mm}$ (·62 inch) across; the denticles on the outer border of the marginal ring were broad-triangular, acute, and strongly incurved, much larger than those on the inner margin.

Of the detached suckers, I have been able to study, with care, 18 specimens from the sessile arms. Part of these are represented only by the horny marginal rings. The three largest differ from the rest in having the denticles less incurved and more nearly alike all around the margin, those on the inner edge being only somewhat smaller and more slender than those on the outer margin, while the rings themselves are less oblique and eccentric. These may have come, perhaps, from the ventral arms, near the base. The other suckers all belong to one type, like those seen upon the third pair of arms, described above. They differ, however, very much in size, in the number of denticles, and in the presence or absence of more or less perfect denticles on the inner margin, this, in the smaller ones, often being without any distinct denticles whatever; the horny rings are very oblique and the aperture eccentric. The diameters vary from 8^{mm} to 24^{mm} externally; the apertures from $3{\cdot}5^{mm}$ to 20^{mm}.

One of the most perfect of these suckers (*b*) is preserved in alcohol with the soft parts (Plate XVII, figs. 5, 6), and was sent to me from Newfoundland by Mr. Harvey. This has a greater external diameter of 22^{mm}; diameter of aperture, 10^{mm}; height of cup (outside), 16^{mm}; height at center, 15^{mm}, height near inner margin, at attachment of pedicel, 6^{mm}; length of pedicel, 14^{mm}; diameter of pedicel, $1{\cdot}5^{mm}$. In a side-view the sucker is oblique and gibbous; the lower surface is convex centrally, but has a deep notch or pit near the front margin, in the bottom of which the slender but strong pedicel is attached,

and the horny ring has a corresponding notch; the outer or back portion is much swollen and produced downward and backward, and here the horny ring is correspondingly broad. The aperture is nearly circular, but is rather shorter from front to back than transversely. In this and some of the other suckers of similar size, the entire circumference of the margin is furnished with rather large sharp denticles which are strongly inclined inward and considerably larger on the outer than on the inner margin. There are about thirteen of the large teeth, occupying rather more than half the circumference; these are broad at base, bevelled off to an acute edge on the sides, and somewhat acuminate, with sharp tips. Those on the middle of the outer border point inward to the center of the sucker, but those along the sides point rather obliquely to the front margin. The front margin is occupied by about seventeen smaller, unequal, acute, denticles, those in its center the smallest and most regular; these are acute-triangular and their points are directed more upward than those of the opposite edge. The horny rings are light yellow (when dried they are white and osseus), their denticles yellowish white, and often silvery white and lustrous at tip and along their edges, especially when dried. The suckers smaller than the above have fewer of the larger outer teeth, and usually fewer and less perfectly formed teeth along the front margin. Those that have the aperture 7^{mm} or less in diameter usually have the front margin of the ring only irregularly fissured, with the intervals minutely denticulate or crenulate, while the outer half of the margin may bear nine or ten large and well-developed denticles, with broad stout bases and sharp edges and tip; the edges of these teeth along the middle are usually convex, and then the outline is incurved to the acute point. One of the smaller suckers examined has the aperture about $4{\cdot}5^{mm}$ in diameter, with the same form as the larger ones; this has about six large, sharp, denticles, like those above described, on the outer half of the margin of the rings, while the front margin is nearly entire and smooth. The smallest one (*j*) is similar, with but four distinct, large denticles, with another imperfect, lobe-like one, on one side, and with a smooth front margin.

The three largest suckers, (Plate XVII, fig. 9), supposed to be from near the base of the ventral arms, have about 45 marginal denticles, of nearly uniform size, and less incurved than in those above described. In these the back side of the horny ring is less expanded, and therefore the suckers were less oblique than in the smaller ones. The largest of these (*a*) had the aperture 20^{mm} in diameter.

Measurements of suckers of short arms (millimeters).

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*j.*
Transverse diameter, outside,	24	21	20	20	17	16	16	10	9·5	8
Diameter of aperture, inside,	20	10·5	9	9	8·5	8	7	5	4·5	3·5
Breadth of horny ring, back side,	10	....	11	12	11	11	11	...	7	5
" " " front side,	5	....	3·5	3	3	2·5	3	...	2	1·5
Number of large denticles,	23	13	12	12	9	12	10	7	6	4
Number of small denticles,	22	17	10	17	12	15	....	....	....	....

The long tentacular-arms agree very closely with those of *A. Harveyi* (No. 5) in form and in the arrangement of the suckers on the 'club.' When fresh they measured 914·4^{cm} (30 feet) in length with a circumference of about 12·7^{cm} (5 inches), except at the enlarged club, which was 20·32^{cm} (8 inches) in the middle. But when first examined by me they had shrunk to 731·5^{cm} (24 feet) in length, and the circumference of the slender portion was 9 to 10^{cm}; that of the club was 15·24^{cm} (6 inches). At that time the 'club' was 77·47^{cm} (30·5 inches) long; that portion bearing the larger suckers was 48·26^{cm} (19 inches); the wrist or portion bearing the smaller and partly smooth-rimmed suckers and tubercles was 15·24^{cm} (6 inches) long; the terminal portion, bearing small denticulated suckers was 22·86^{cm} (9 inches); the breadth of the front of the club was 7·62^{cm} (3 inches). The terminal portion had a strong carina-like membrane or crest along the back, and was here 5^{cm} (2 inches) wide, from front to back.

The large suckers (Plate XVII, figs. 1, 1*a*) of the tentacular-arms are nearly circular in outline, and are broad, depressed, little oblique, constricted just below the upper margin, and then swelled out below the constriction to the base. The calcareous ring is strong, white, and so ossified as to be somewhat rigid and bone-like. The margin is surrounded by numerous (about 45 to 50) nearly equal, acute-triangular teeth, sometimes separated by spaces equal to their breadth, at other times nearly in contact at their bases; their edges are so bevelled as to be sharp; while there is a triangular thickening in the middle of each, at base. A wide, deep and concave groove extends entirely around the rim a short distance below the margin; below this the lower part of the rim is somewhat expanded and irregularly plicated, varying in width. The largest ring studied by me measures 31^{mm} in its greatest diameter externally; the aperture is 26^{mm} and 23^{mm} across its longer and shorter diameters;* greatest

* This specimen is somewhat warped, by drying, so that the aperture is not so circular as when fresh.

height or breadth of rim, 11^{mm}; least height, 8^{mm}; breadth of groove, 1·5 to 2^{mm}.

The marginal suckers (Plate XVII, fig. 10), alternating with the large ones on the 'club,' are very oblique, with the rings strong and very one-sided, the height of the back being more than twice that of the front margin. The aperture is not circular, the outer portion of the margin being incurved or straight. The groove below the margin is narrow and deep, especially on the sides, but only extends around the front and sides, being entirely absent on the outer third of the circumference. The denticles are about 22 to 24, slender, acute, not crowded, the most of them being separated by spaces greater than their breadth at base. The outer ones are strongly incurved; those along the sides are curved forward obliquely toward the front margin, while those on the front margin point upward and sometimes rather outward. The denticles are of nearly equal length, but those of the front margin are both more slender and more acute; they all have sharp bevelled edges and a thickened median ridge or tubercle. The largest ring examined was 14^{mm} in diameter, height or breadth of back side of rim, 8^{mm}; of front side, 3·5^{mm}.

The small suckers, covering the last division of the club, are very similar to the marginal ones last described, except that they are much smaller and more delicate, with a narrower and less oblique rim. The denticles of the inner margin are very acute and point obliquely outward and upward. Greatest diameter of the one described, 6^{mm}; height of back side of rim, 4^{mm}; of front side, 1·5^{mm}.

The small terminal group of smooth-rimmed suckers, seen in No. 5, were not noticed, but they were not looked for specially.

To this species I have also referred the specimen (No. 13) from Grand Bank, Fortune Bay, (see page 188, where the general measurements are given). Fortunately, Mr. Simms was able to obtain the jaws in pretty good condition, and also one of the largest suckers of the tentacular-arms. These specimens were forwarded to me by the Rev. M. Harvey. They had been dried, and the jaws, which were still attached together by the ligaments, had cracked somewhat, but all parts were present, except the posterior end of the palatine lamina, which had been cut or broken off. Although these jaws had undoubtedly shrunken considerably, even when first received, they were afterwards put into alcohol and have since continued to shrink, far more than would have been anticipated, so that, at present, the decrease in some of the dimensions amounts to 20 per cent., while even

the harder portions have decreased from 5 to 10 per cent. from the measurements taken when first received by me.* When first received in 1875, the upper mandible measured 111^{mm} in total breadth (front to back); 88^{mm} from tip of beak to anterior end of palatine lamina; 20^{mm} from tip of beak to the bottom of the notch. The lower mandible measured 96^{mm} in total length; 80^{mm} from tip of beak to inner end of alæ; 19^{mm} from tip to bottom of notch.

At the present time (Jan., 1880), the breadth of the upper mandible is about 90^{mm}; from tip of beak to anterior end of palatine lamina (at junction with anterior edge of alæ) 89^{mm}; tip of beak to bottom of notch, 19^{mm}; breadth of palatine lamina, 58^{mm}; beak to posterior end of frontal lamina, 90^{mm}; beak to posterior lateral edge of alæ, 43^{mm}; notch to end of anterior edge of alæ, 33^{mm}; notch to end of hardened or black portion of same (proper cutting edge), 17^{mm}; transverse breadth at notches, 16^{mm}. The lower mandible measures, in length, 82^{mm}; beak to inner end of alæ, 67; to bottom of notch, 18; breadth, alæ to mentum, 78; end of alæ to outer side of gular lamina, 84; inner side of gular to mentum, 50; breadth of gular, 44; breadth of alæ, anterior to posterior edge, laterally, 29; tip of beak to posterior ventral end of mentum, 33; tip to posterior lateral border of alæ, in line with cutting edge of rostrum, 45^{mm}; posterior lateral border of alæ to end of gular, 40; depth of notch, 3; breadth of tooth, 8; notch to end of cutting or hardened edge of alæ, 20; to inner end of alæ, 55; breadth transversely, across teeth, 16^{mm}, (see also table of measurements of jaws).

The beak of the upper mandible is sharp, strongly and regularly curved, most so near the tip; a radial ridge runs from the notch to the lateral border of the alæ; the anterior or cutting edges of the alæ are somewhat convex and irregularly crenulate. The lower mandible has a sharp beak, with a slight notch close to the tip; the cutting edges of the rostrum are otherwise nearly straight; the notches at the base are deep and narrow V-shaped. The teeth are rather prominent, obtuse, slightly bilobed at the summit; the one on the right side of the mandible is more prominent than the other, owing to the fact that the edge of the ala, beyond it, is more concave in outline. There is also a broad and slightly prominent lobe in the middle of the

* There is no reason to suppose that the shrinkage has been any more in this case than in the others, but I have not had an opportunity for making comparative measurements from the same specimens when recently preserved, and again after long preservation in alcohol, except in one other instance (No. 5), in which a similar shrinkage was evident.

anterior edge of the alæ. The sides of the rostrum are strongly excavated toward the base and around the notches, and radially striated. The jaws are dark brown, becoming blackish toward the tips.

Comparative measurements of jaws (in inches).*

	A. Harveyi.			A. princeps.				
	No. 4.	No. 5. Rec.	No. 5. Later.	No. 1.	No. 10.	No. 13 Fr'sh	No. 18. Pres'd.	No. 14.
Upper mandible:								
Length, beak to end of palatine,	3·55	--	3·85	--	5·	--	3·75+	5·25
Greatest breadth, palat. to frontal,	2·49+	2·84	2·60	--	3·50+	4·50	3·54+	3·88
Greatest transverse diameter,	--	--	1	--	1·45	--	1·15	--
Inner end of alæ to dorsal end of frontal,	--	--	2·50	--	3+	--	2·95+	3·75
Tip of beak to same,	2·37+	--	2·55	--	3·40+	--	3·17	3·62
Tip to anterior end of palatine lamina,	--	2·06	--	--	--	3·57	--	--
Tip to bottom of notch,	·63	·69	·61	--	·75	·81	·75	·75
Notch to end of anterior edge of alæ,	--	--	1·10	--	1·15	--	1·30	1·50
Transverse breadth at notch,	·60	--	--	--	--	--	·63	--
Transverse breadth between edges of alæ,	--	--	--	--	--	--	1	·69
Breadth of palatine lamina,	--	--	1·70	--	2·32	--	2·30	--
End of palatine to edge of frontal lamina,	--	--	2·20	--	3·15	--	--	3·50
Beak to posterior edge of alæ, laterally,	--	--	1·40	--	1·95+	--	1·70	--
Lower mandible:								
Total length, beak to end of gular,	--	3·44	3	--	3·63	3·89	3·24	3·75
Mentum to inner end of alæ,	2·60+	--	2·55	--	--	--	3·08	--
Total breadth, gular lamina to end of alæ,	--	--	2·65	--	--	--	3·32	3·88
Breadth of gular lamina,	--	--	1·50	--	1·75	--	1·74	--
Anterior edge of alæ to end of gular lamina,	--	--	2·45	--	3·15	--	2·68	3·25
Tip of beak to end of mentum, medially,	--	--	·85	1·30+	1·68	--	1·31	--
Tip to end of gular lamina, medially,	--	--	1·85	--	2·37	--	2·40	--
Breadth of alæ (laterally),	1·18	--	·93+	--	1·50	--	1·15	1·62
End of gular lamina to alæ, laterally,	--	--	1·50	--	1·60	--	1·58	1·75
Tip of beak to bottom of notch,	·62	·69	·60	·67	·80	·77	·71	·87
Tip to post. edge of alæ, laterally,	1·67	--	1·50+	--	2·20	--	1·78	--
Tip to inner end of alæ,	2·33	2·63	2·10+	--	--	3·45	2·67	--
Tip to inner angle of gular lamina,	1·20	--	1·18	--	1·85	--	1·28	--
Notch to inner angle of alæ,	1·92	--	1·77	--	--	--	2·17	2·75
Depth of notch,	·12	--	·12	·15	·15	--	·12	·13
Breadth of tooth in front of notch,	·30	--	--	·35	·32	--	·32	·38
Spread of jaws, between teeth,	--	--	--	--	·60	--	·64	--

* Nos. 1 and 10 had been dried for many years; all the others had been preserved in alcohol: Nos. 4 and 13 for several years; No. 5 about one year; No. 14 for only a few days. The amount of shrinkage is considerable in those preserved long in alcohol, or dried.

Comparative measurements of Architeuthis Harveyi and A. princeps (in inches).

	No. 5, A. Harveyi.		No. 2. A. Harveyi.		No. 14. A. princeps.	
	Fresh.	Pres'd.	Fr'h.	Pres'd.	Fr'h.	Pres'd.
Total length, to tips of short arms,	166?	--	--	--	246	212
Total length, to tip of tentacular-arms,	382?	--	--	--	480	372
From base of arms to tip of tail,	92?	--	--	--	114	86
From base of arms to origin of fins,	75?	--	--	--	95	67
Head, from base of arms to mantle (above),	10?	--	--	--	14?	12
Body, edge of mantle to tip of tail (above),	82	--	--	--	100?	74
Tip of tail to insertion of fin,	18?	17	--	--	--	19
Breadth of caudal fin,	22	16	--	--	33	28
From end of body to outer angle of fin,	27?	23	--	--	--	24·5
Front edge of fin, outer angle to side of body,	2--	6·5	--	--	--	10
Circumference of body,	66	--	--	--	84	66
Circumference of head.	--	--	--	--	48	
Length of tentacular-arms,	88	161	348?	--	360	289
Length of sucker-bearing portion,	30	30	30	27	36	30·5
Length of dorsal arms (1st pair),	72?	--	--	--	--	81+
Length of lateral arms (2d pair),	72?	--	--	--	--	100+
Length of lateral arms (3d pair),	72?	--	--	--	--	76+
Length of ventral arms (4th pair),	72	--	--	--	132	126
Circumference of 1st pair of arms, at base,	7	--	--	--	--	9
Circumference of 2d pair of arms, at base,	8	--	--	--	--	9·50
Circumference of 2d pair, 3 ft. from base,	--	--	--	--	--	7·50
Circumference of 3d pair, at base,	10	8	--	--	17	11·25
Circumference of 3d pair, 3 ft. from base,	--	--	--	--	--	9
Circumference of 4th pair, at base,	9	7·5	--	--	--	10
Circumference of 4th pair, 4 ft. from base,	--	--	--	--	--	8·5
Circumference of tentacular-arms,	3·75	2·75	4	3½–4¼	5	4
Circumference of terminal club of same,	--	4·5	6	6	8	6
Diameter of largest sucker of tentacular-arms,	--	1·15	1·28	1·25	1·25	1
Diameter of largest sucker of sessile arms,	1	·84	--	--	1	1
Aperture of latter,	--	·68	--	--	·80	·80
Details of tentacular-arms:						
Length of 'club' or expanded portion,	31	30	30	27	--	30·5
Of part of club bearing 24 largest suckers,	15	14	18	14	--	19
Of 'wrist' or part with group of small suckers,	7	7	--	--	--	6
Of terminal part, with small suckers,	9	9	--	9	--	9
Breadth of 'club' in middle,	--	1·5	2·5	2·5	--	3
Breadth of wrist,	--	1·6	2·6	1·5	--	3
Breadth of slender middle portion,	--	1·15	--	--	--	1·5
Breadth of tip (from front to back),	--	1·75	--	1·5	--	2
Circumference of club,	--	4·5	--	5·5	--	6
Circumference of wrist,	--	5	--	6	--	6
Circumference of middle portions of arm,	2⅜–3½	2¼–3¼	--	3½–4¼	--	3½–4
Distance between pedicels of large suckers,	--	1·15	1·68	1·44	--	
Distance between pedicels diagonally,	--	1	1·32	1·31	--	
Details of suckers of 'club':						
Largest suckers, diameter in middle,	1·25	1·15	1·28	1·24	1·25	
Largest suckers, diameter of horny ring,	--	·92	--	--	1·15	1·15
Diameter of facets around suckers,	--	1	--	1·40	--	1·25
Largest suckers, height from attachment,	--	1	--	--	--	·75
Largest suckers, length of pedicels,	--	·40	--	--	--	·50
Largest suckers, height of ring,	--	·32	--	--	--	·42
Secondary suckers, next to wrist, diameter,	--	·24	--	--	--	·44
Marginal suckers, diameter of rings,	--	.40	--	·48	--	·60
Marginal suckers, height of rings, outer side,	--	·28	--	--	--	·35
Sessile suckers of wrist, diameter,	--	·12	--	·28	--	--
Suckers of terminal section, diameter,	--	¼–$\frac{1}{16}$	--	--	--	--

The dried sucker from the tentacular-arm appears to have been one of the largest, (Plate XVII, fig. 11). At the present time the transverse diameter of the ring, outside, is 28^{mm}; diameters of the edge, 24 and 22^{mm}; greatest breadth of the ring, including denticles, $9{\cdot}5^{mm}$; least breadth, on inner side, $6{\cdot}5^{mm}$. There are 48 marginal denticles, which are nearly the same in size and form, all around. They are narrow, triangular, acute, with the edges bevelled sharp, and with a central, thickened, triangular ridge on the outside. The ring is white, hard, smooth, and osseous in appearance.

Of the other specimens enumerated in the first part of this paper, it is probable, judging from the proportions given, that Nos. 16, 18, and 19 also belonged to *A. princeps*. Nos. 18 and 19 appear to have been much larger than any of the examples of which portions have been preserved, and it was very unfortunate that the persons who secured them did not know their value, for they were both found within a few miles of the settlement at Little Bay Copper Mine, on the south arm of Notre Dame Bay, and could easily have been taken to St. John's.

Additional note on the suckers of Architeuthis Harveyi.

After printing the description of *A. Harveyi* some additional loose sucker-rims, from specimen No. 5, were found. Among these are some of the second or oblique kind, described as existing on the sessile arms of *A. princeps*. Therefore the remarks (on p. 201), in respect to the supposed absence of suckers on the former, will no longer hold good. These suckers of the second kind differ, however, from the corresponding ones of *A. princeps* in having, on the outer margin, more numerous, more slender and sharper teeth, which taper regularly from base to tip and are not so flattened. The larger of these sucker-rims (*i*) are $14{\cdot}5^{mm}$ in diameter, across the base; aperture, 9^{mm}; height at back, 7^{mm}; in front, 2^{mm}; number of large denticles on outer margin, 10 to 14; the inner margin, except in the smaller ones, is either finely toothed or distinctly crenulated, and there are usually one or more irregular, broad, sharp, lobes or imperfect teeth on the lateral margins. The teeth of the outer margin are regular, strongly incurved, tapering from the base to the very sharp tips, and sharply bevelled on the edges. A smaller one (*j*) 11^{mm} across the base, and 4·5 across the aperture, with height of back, 6^{mm}, has five regular sharp teeth on the outer margin; two broad irregular ones on each side, while the front edge is nearly entire.

With these there were also some of the largest and least oblique

of the suckers, some of them (*e*, *g*) slightly exceeding the largest of those described on p. 201, but showing no distinct variation; others (*h*) are completely intermediate between the two principal forms, having very oblique rims, with a small aperture, but distinctly denticulate all around, the denticles on the inner margin being distinctly smaller than on the outer.

The following table of measurements will supplement those on page 201.

Measurements of sucker-rims from short arms (millimeters).

	e.	*f.*	*g.*	*h.*	*i.*	*j.*
Diameter, at base,	21	19	20·5	16	14·5	11
Diameter of aperture,	17	16	16·5	9·5	9	4·5
Height or breadth of ring, at back,	8	7·5	7·5	9·5	7	6
" " " front side,	3	3	3	3	2	1·5
Number of distinct denticles,	50	48	49	34	14	7

Sthenoteuthis, gen. nov.

(Type *Architeuthis megaptera* Verrill.)

This group is instituted to include certain species of squids, remarkable for the large size and high development of their organs of locomotion, especially of the caudal fin and siphon, and for the presence of a broad, thin web along the lower side of the lateral arms, outside the suckers.

The tentacular-arms are, like those of *Architeuthis*, very long, slender, and provided, at the base of the club, with smooth-rimmed suckers alternating with rounded tubercles, for the mutual adhesion of the two arms; the central part of the club is, as in *Architeuthis*, provided with two central rows of large serrated suckers, and a row of smaller marginal ones, on each side, of different form, alternating with them. The lateral arms have a well-developed median crest, (most developed on the third pair) along the outer side; on the lower inner angle there is a thin, membranous web, often more than twice as wide as the arm, along the whole length, much more highly developed than in typical *Ommastrephes*, in which a narrow marginal membrane occurs. On the ventral arms the inner face is broader than on the others, and the two rows of suckers are wider apart. The suckers on all the sessile arms are strongly denticulated on the outer side of the rim, with smaller or obsolete teeth on the inner side.

Caudal fin very large, rhomboidal. Internal bone or pen similar to that of *Ommastrephes*.

Odontophore with seven rows of teeth, median tooth with three

large denticles; inner lateral teeth with two unequal points; two outer laterals simple, slender. Eyes as in *Ommastrephes.*

This group is related on one side to *Architeuthis*, on the other to *Ommastrephes.* The armature of the tentacular-arms will distinguish it from the latter, and the large caudal fin and broad membrane of the sessile arms from the former.* The dentition of the type is peculiar, so far as known. In addition to the typical species, this genus will doubtless include several species with marginal webs, that have hitherto been referred to *Ommastrephes;* but they are mostly too indefinitely described and figured to show the special characters referred to. Thus, *O. pteropus* Steenstrup belongs to this genus, if a specimen from Bermuda, now in my possession, be correctly identified.†

Sthenoteuthis megaptera Verrill.

Architeuthis megaptera Verrill, Amer. Journ. Science, vol. xvi, p. 207, 1878. Tryon, Manual of Conchology, vol. i, p. 187 (description copied from preceding paper).

PLATE XXI, figures 1–9.

Much smaller than the species of *Architeuthis*, the total length of the body and head being but nineteen inches. Body relatively short and thick. Caudal fin more than twice as broad as long, the length about half that of the body. Its form is nearly rhombic, with the lateral angles produced and rounded, and the posterior angle very obtuse, the posterior edge, as preserved, being slightly concave.

The ventral anterior edge of the mantle is concave centrally, with a slight angle to either side, about ·75 inch from the center; from these angles it is again concave to the sides; on the dorsal side the edge advances farther forward than beneath, terminating in a slightly prominent, obtuse angle in the middle of the dorsal edge. The external ear consists of a slightly elevated, transverse lamina, with three thicker and much more elevated laminæ which extend forward, on the head, one in the median line of the eye, with one above and one below it, the lower one longest and least elevated, curving downward beneath the head. The two upper ones are broadly rounded at top. Behind the transverse fold there is a deep, irregularly crescent-shaped fossa. The eye-sockets are large, oblong, and furnished with distinct

* According to the statement of Gervais, *Architeuthis dux* has similar membranes.

† *S. Bartramii* (*Ommastrephes Bartramii* (Leach) D'Orb.) also belongs to this genus, but is a more slender species. It has the characteristic smooth suckers and tubercles on the wrist of the 'club,' and a very broad caudal fin. It lives in the region of the Gulf Stream.

lid-like margins. The eyes are large, prominent, oblong, and naked; the anterior portion is swollen laterally on both sides. The short arms are trapezoidal, the dorsal ones somewhat shorter (about 1·25 inch) and smaller than the others, which are nearly equal in length, the second pair being stouter than the rest, and a little longer. The dorsal arms have a slightly prominent membrane along the outer angles; the subdorsal or upper lateral arms are narrowed to an acute edge or crest on the outer angle, but on the inner angle have a broad, thin, marginal membrane, outside the suckers. The lower lateral arms are similar in size and form, and also have a very broad, lateral, marginal membrane, next to the suckers, on the lower side. The ventral arms are more slender and a trifle longer, and have narrower marginal membranes. The tentacular-arms are slender, elongated, expanded toward the tip, and have suckers arranged much as in the gigantic species, even to the smooth-edged suckers and opposing tubercles, proximal to the large suckers, as I have described them in *A. Harveyi*. The sucker-bearing portion is margined by a membrane on each side.

The small proximal suckers of the tentacular-arms occupy about 44·5^{mm} (1·75 inches) at the commencement of the terminal club; they are about 1·5^{mm} in diameter, circular, regularly cup-shaped, with a nearly even, smooth rim; they are raised on slender pedicels. Alternating with these are smooth rounded tubercles, which are also on pedicels and slightly larger than the intervening suckers. There are four suckers and four tubercles in the row along the inner margin; along the outer margin there are fewer, smaller suckers, but without horny rings; if they originally had such rings they were probably smaller than the others. The large suckers (Plate XXI, fig. 9), forming the two central rows on the terminal club, are furnished with a somewhat oblique, dark brown ring, very strongly and sharply toothed around the outer portion of the edge, and usually with one tooth larger and longer than the rest, on the middle of the outer margin; inner margin with much smaller, very acute teeth, of unequal size. The teeth are gold-colored at tip.

Larger suckers of the sessile arms are very oblique, with the rim strong, dark brown, bearing large, strong, sharp, much incurved, unequal teeth on the outer side of the rim; the inner margin is entire. The ventral arms bear about 44 similar suckers, exclusive of the minute ones close to the end; the largest ones are situated beyond the middle of the arm. The lateral arms bear about the same number of large suckers, with numerous minute ones at the tip. The

dorsal arms bear, each, about 30 suckers, exclusive of the small terminal ones.

The 22d sucker of the left ventral arm (Plate XXI, figs. 8, 8*a*), has a strong, somewhat elliptical rim, with 7 strong and very acute incurved teeth on the outer side, and with the opposite margin on the inner side smooth for more than a third of the circumference. The median tooth on the outer margin is decidedly larger and longer than the others, and abruptly bent inward above its base. It is elongated and gradually tapered to the very acute tip, but thick and channelled externally at its base. To the right and left of this are three similar, but smaller, unequal teeth, all strongly curved inward toward the inner margin, (not convergent to the center). Of these the second from the central tooth, on each side, is the largest, and the third is the smallest. Between the latter and the smooth inner edge there is a small rounded lobe, or blunt tooth. Peduncle broad toward the rim, tapering rapidly to the slender base. Outer sides of rim much higher than inner. Greater diameter, 10^{mm}; lesser, 7^{mm}; greater interior diameter, 7^{mm}; total height, 13^{mm}; longest tooth, $2{\cdot}5^{mm}$.

The exposed portion of the upper mandible is black; the point is strongly curved, acute, with a smooth cutting edge, separated from the inner lobe by a deep, acute notch; inner lobe or edge of alæ thin, broadly rounded, with a slightly rounded, uneven edge. Length of mandible, 29^{mm}; distance from bottom of notch to tip, 10^{mm}; internal breadth between lobes, 8^{mm}.

The lining membrane of the palate (Plate XXI, fig. 2), is pale, translucent, covered with rather large, whitish, translucent teeth, variable in form and size, but mostly rather broad at base and tapering to an obtuse tip; some are more slender and acute. No granules were detected on the membrane.

The odontophore (Plate XXI, figs. 3–7), was too much injured to show its general form, but it appeared to resemble that of *A. Harveyi*. The lateral membrane was broad in the middle, translucent, white. No plates outside the lateral teeth could be detected. The teeth all have slender, acute tips. The median teeth have three points of equal length; the inner lateral ones have two points, the outer one considerably shorter and smaller than the other; the two outer lateral teeth are simple, long, acute, the outermost rather narrower at base and somewhat longer.

Total length, 109^{cm} (43 inches); length of body and head, $48{\cdot}2^{cm}$ (19 inches); length of body from dorsal edge of mantle, $35{\cdot}56^{cm}$ (14 inches); from ventral edge, $33{\cdot}16^{cm}$ (13 inches); of head from edge

Measurements of Sthenoteuthis megaptera and S. pteropus (in inches).

	S. megaptera. N. Scotia.	S. pteropus. Bermuda.	S. megaptera? Sable I.Bk.
Length, tip of tail to end of dorsal arms,	25·5	27·5	
" tip of tail to end of 3d pair	--	29·5	
" to end of tentacular-arms,	43	--	
" to base of arms,	19	20·5	
From base of arms to mantle,	5	6·25	
Tip of tail to edge of mantle (above),	14	14·75	
" " " (below),	13	14·5	
Tip of tail to center of eye,	--	18·5	
Length of caudal fin (tip to insertion),	6	6·75	
Breadth of caudal fin,	13·5	11·25	
Breadth between lateral insertions,	2·33	2	
End of body to outer angle of fin,	7	7·25	
Front edge of fin, from outer angle to insertion,	6·5	5·5	
Circumference of body,	12·5	11·5	
Breadth of body,	5	4·75	
Breadth of head,	4	3+	
Diameter of eye-opening (longitudinal),	1·25	1·75	
" " (transverse),	·75	1·25	
Length of tentacular-arms,	24	--	
Length of dorsal arms, (1st pair,)	6·5	7·25	
" subdorsal " (2d pair,)	8	8·75	
" subventral " (3d pair),	8·5	9·25	
" ventral " (4th pair.)	8	9·25	
Breadth of 1st pair of arms, at base,	·75	·75	
" 2d "	1·12	·80	
" 3d "	1·00	·90	
" 4th "	1·00	·90	
" tentacular-arms,	·33–·50	40–75	
" terminal club of same,	·75	--	
Length of siphon, in middle,	--	2·5	
Breadth of siphon, at base,	--	2	
Breadth of aperture of siphon,	--	1	
Details of tentacular-orms:			
Length of 'club,' or expanded part,	6·5	--	
" part bearing large suckers,	3·25	--	
" 'wrist.' bearing smaller suckers,	1·25	--	
" tip, with small suckers,	1·50	--	
Breadth of 'club,' in middle,	·75	--	
" middle of arm,	·50	--	
Details of suckers:			
Diameter of largest suckers of tentacular-arms,	·40	--	
" rims of same,	·32	--	
" largest suckers of dorsal arms,	--	·28	
" rims of same,	--	·20	
" largest suckers of 2d pair,	--	·40	
" rims of same,	--	·28	
" largest suckers of 3d pair,	--	·32	
" rims of same,	--	·24	
" largest suckers on ventral arms,	·40	·30	
" rims of same,	·32	·22	
Jaws:			
Upper mandible—total length,	1·16	1·68	1·25
" " tip of beak to bottom of notch,	·40	·40	·34
" " tip to dorsal edge of frontal lamina,	--	1·32	·98
" " breadth between anterior lobes of alæ,	·32	·32	·25
" " breadth of palatine,	--	·84	·70
Lower mandible—total length,	--	1·16	·91
" " depth, end of alæ to mentum,	--	1·12	·87
" " beak to notch,	--	·44	·31

of mantle to base of arms, 12·7^{cm} (5 inches); length of long tentacular-arms, 55·8 and 60·9^{cm} (22 and 24 inches) respectively; of first (dorsal) pair of arms, 16·5^{cm} (6·5 inches); of second pair, 20·3^{cm} (8 inches); of third pair, 21·6^{cm} (8·5 inches); of fourth pair, 20·3^{cm} (8 inches); length of caudal fin, 15·24^{cm} (6 inches); breadth, 34·3^{cm} (13·5 inches); transverse distance between insertions of caudal fins, 5·9^{cm} (2·33 inches); breadth across body in middle, 12·7^{cm} (5 inches); circumference of body, 31·7^{cm} (12·5 inches); length of eye-opening, 3·2^{cm}; its breadth, 1·9^{cm}; length of sucker-bearing portion of tentacular-arms, 16·5^{cm} (6·5 inches); of portion bearing large suckers, 8·25^{cm} (3·25 inches); breadth, 1·9^{cm} (·75 inch); length of terminal portion, 3·8^{cm} (1·5 inches); diameter of naked or peduncular portion, ·8 to 1·25^{cm}; breadth of dorsal arms at base, 1·9^{cm}; of second pair, 2·57^{cm}; of third pair, 2·54^{cm}; of fourth pair, 2·54^{cm}; diameter of largest tentacular suckers, 9^{mm} to 10^{mm}; of their rims, 7 to 8^{mm}; diameter of largest suckers of ventral arms, 10^{mm} (·40 inch); of their rims, 7 to 8^{mm}.

Color, in alcohol, reddish or purplish brown, speckled with darker brown, on the dorsal surface of body; upper side of head and outer sides of arms thickly covered with specks of purplish brown; inner surfaces paler, much as in the common small squids; sides yellowish brown, under surfaces yellowish brown, tinged with purplish.

This unique specimen was cast ashore, during a severe gale, near Cape Sable, N. S., several years ago, and was secured for the Provincial Museum at Halifax by J. Matthew Jones, Esq. It is preserved entire, in alcohol, and is still in good condition.

I refer doubtfully, to this species, an entire beak, with the odontophore, presented by Capt. Geo. A. Johnson and crew, of the schooner "A. H. Johnson." It was taken at Sable Island Bank, Nova Scotia, in 280–300 fathoms, Sept., 1878. This beak has the exposed parts black; the internal laminæ reddish brown. The upper mandible is sharp and strongly incurved, with a small narrow notch at its base, from which runs a raised lateral line; beyond the notch the anterior edge of the ala is convex and slightly uneven. The lower mandible has a small notch below the incurved tip; below this, the cutting edge is slightly concave to the basal notch, which is narrow on the right side, but broader and V-shaped on the left; beyond the notch the alar tooth is narrow, prominent and truncate on the right, but broader and blunt on the left. Opposite the notch and tooth the side of the beak is strongly excavated. Total length of upper mandible, 31^{mm}; height, palatine to frontal, 24; tip to bottom of notch, 8·5; tip to dorsal edge of frontal laminæ, 24·5; breadth between anterior lobes

of alæ, 6·2; breadth of palatine, 17·5. Total length of lower mandible, 23^{mm}; height, mentum to inner end of alæ, 22; tip to notch, 7·8; tip to end of mentum, 8·2; tip to dorsal end of gular, 16; transverse breadth at alar teeth, 7^{mm}. (See Plate XXVI).

The odontophore is similar to that of *S. megaptera*, but the lateral denticles of the median and inner lateral teeth are relatively shorter, and these, with some other differences, render it doubtful whether this beak can belong to that species. The odontophore is 4^{mm} broad; the teeth are all sharp, rather slender, pointed, and pale amber-color. A slight, smoothish, marginal ridge borders the dentigerous zone on each side, but is scarcely divided into distinct plates. The median teeth have three sharp, rather slender denticles, the median about a third longer than the lateral; the inner lateral teeth have a long point, with the acute outer denticle much shorter; the teeth of both outer rows are long, considerably incurved, acute, the outer ones the more slender.

Sthenoteuthis pteropus Verrill.

Ommastrephes pteropus Steenstrup?

PLATE XXVI.

A large squid, 74·8^{cm} (29·5 inches) long from tail to tip of longest sessile arms, similar in size and form to the preceding, and closely allied to it, has been sent to me by Mr. G. Brown Goode, who collected it at Bermuda. It is probably the *Ommastrephes pteropus* of Steenstrup, but I have seen no full description of the latter, and figures only of the mandibles.

Our specimen is entire, except that it has lost the 'clubs' of the tentacular-arms. It is in fair condition, though considerably contracted by long preservation in too strong alcohol. The head, however, has been pulled out from the mantle to an unnatural extent, so as to increase the total length from 3 to 4^{cm}, at least. The ventral arms do not show any of the sexual modifications characteristic of the male squids, and, therefore, it is doubtless a female.

Most of the measurements are given in the table with those of *S. megaptera;* some of the more general are as follows: length from end of body to tip of dorsal arms, 69·8^{cm} (27·5 inches); to edge of mantle, dorsally, 37·5^{cm} (14·75 inches); to base of dorsal arms, 52^{cm} (20·5 inches); to center of eye, 47^{cm}; to lateral insertion of fin, length, 17^{cm} (6·75 inches); to outer angle of fin, along posterior edge, 18·4^{cm} (7·25 inches); breadth of fins transversely, 28·5^{cm} (11·25 inches); outer angle to lateral insertion, along front edge, 14^{cm} (5·5 inches); between

lateral insertions, 5^{cm} (2 inches); breadth of body, 11·9^{cm}; circumference of body, 29·2^{cm} (11·5 inches).

The body is stout, acuminate posteriorly; the anterior border of the mantle, beneath, is even, and not distinctly emarginate in the middle.

The caudal fin is large, broad, transversely rhomboidal, but neither so broad nor so large proportionally as in *S. megaptera*. The siphon is very large and broad, (63^{mm} long by 50 broad), with a large aperture, 25^{mm} wide. The eye-balls are very large, elongated, measuring, although somewhat collapsed, about 42^{mm} long by 31^{mm} broad. The eye-openings, as distended, are large, oblong, elliptical, with a broad sinus, and slightly thickened edges.

The arms are stout and rather long, the third and ventral pairs being nearly equal in length; those of the second pair are about 12·5^{mm} shorter than those of the third; the dorsal ones about 63^{mm} shorter than those of the second. The dorsal arms are 18·4^{cm} long, trapezoidal in form, the outer face convex and about 1·9^{cm} broad; the lateral and inner faces, 1·2^{cm}; along the inner angles there is a narrow membrane, outside the suckers. Those of the second pair are 24·7^{cm} in length; their transverse breadth is about 2^{cm}; from inner face to outer angle, 1·9^{cm}; along the outer angle, in these, is a thick acute-edged crest, widest in the middle of the arm; along the lower inner angle, outside the suckers, there is a broad and very thin membrane, 2·5^{cm} or more in width; along the upper inner angle, is a similar membrane, about ·6^{cm} wide.

The arms of the third pair are 26^{cm} long, (31^{cm} from center of eye to tip of arms); they are compressed, 2·25^{cm} broad at base; on the outer angle, along the middle, there is a very prominent crest, so that, in this part, the distance from inner face to outer angle, is 4^{cm}; along the lower-inner angle there is a very broad, thin, delicate web, where widest at least 5 to 7^{cm} (2 to 2·75 inches) wide, (it is considerably torn and may have been still wider); it is widest beyond the middle of the arm; on the upper-inner angle the corresponding membrane is about 0·6^{cm} wide. Transverse, thick, fleshy ridges run out from between the suckers a short distance on these membranes, and then fade out. The ventral arms are 2·25^{cm} broad at base, and trapezoidal; they have a smaller crest along the outer angle, and a narrow membrane along each inner angle.

All the sessile arms bear similar suckers, all of which are provided with 7 to 13 large, very acute, incurved teeth on the outer margin of the very oblique, horny rings, and with much smaller, sometimes rudimentary ones on the inner margin, much as in *S. megaptera*.

The largest of all the suckers are near the middle of the second pair of lateral arms, from the sixth to the sixteenth, and especially from the ninth to the fourteenth; the diameter of the ninth is 10^{mm}, the edge of its rim, 8^{mm}. On the dorsal arms the eighth to the thirteenth are the largest; the diameter of the ninth is 7^{mm}; edge of horny rim, 5^{mm}. On the third pair the eighth to the fourteenth are largest; the diameter of the tenth is 8^{mm}; its rim 6^{mm}. On the ventral arms the fourteenth to the twentieth are largest; the diameter of the fifteenth is $7{\cdot}5^{mm}$; its rim $5{\cdot}5^{mm}$. On the ventral arms the rows of suckers are more separated than on the others, its inner face being wider. On the lateral arms, toward the base, the two rows are nearer together, while the suckers of each row are distant, so that they almost form one irregular row, at first. The suckers are all very oblique, with the horny rims very low or narrow in front, and very high on the outer side; these rings are dark brown, but the teeth have a golden luster.

The thick fleshy margin, outside the denticulated edge of the horny ring, is completely covered all around, by a series of thin, bracket-shaped, horny plates, light brown in color, arranged radially and movable with the membrane to which they are attached for the most of their length; both the outer and the inner ends are free and turned upward, like a small tooth or denticle; those of the inner end are mostly acute, and form a circle of minute movable denticles, nearly in line with the large teeth of the horny ring, five to ten occupying the intervals between the large teeth of the largest suckers; those plates that stand opposite the teeth of the horny ring are shorter than the others, and often broader, and have no denticle on the flat or upcurved inner ends, which fit to the form of the base of the tooth in front of them; the outer ends are abruptly bent upward and often inward, forming a denticle or flattened hook, usually rounded at the end. These marginal plates vary greatly in width and form, even on the same sucker, according to position, and small, imperfectly developed, wedge-shaped ones are interpolated between the larger ones, around the periphery.

One of the largest suckers (the twelfth of the second pair of arms) has 22 teeth on the horny ring; of these five are small, but sharp, on the middle of the inner border; nine, on the outer border, are largest; and four, on each side, are intermediate in size. The median tooth on the outer margin is largest, and the one next to it, on each side, is a little smaller than the second one from it. The thirteenth sucker of the ventral arms has, on its rings, eighteen denticles; of these nine

are very large, with the median more decidedly the largest, and the one on each side of it is shorter as compared with the next; six, on the inner margin, are minute, and these are connected, by one or two somewhat larger ones, at each end of the inner border, with the larger series.

The stumps of the tentacular-arms are flattened, oval, and smooth, measuring about 10 by 18^{mm}, near the base; their length is about 28^{cm} (11 inches), which is doubtless less than half their original length.

The exposed parts of the jaws are black and polished; the laminæ are reddish brown, with broad, thin, yellowish-white margins. The upper mandible has a long sharp rostrum, with regularly curved cutting edges, and a small, well-defined, V-shaped notch, from which a short groove runs backward, beyond which there is a slight ridge; anterior edge of alæ, beyond the notch, forming no distinct lobe or tooth, but slightly convex, and irregularly crenulate; posterior lateral borders of alæ with a broad sinus in the middle; palatine lamina long and thin, with sinuous posterior margins; frontal lamina broad, extending well backward.

The total length of the upper mandible is 42^{mm}; tip to posterior end of frontal, 33^{mm}; to notch, 10^{mm}; greatest breadth (or height), from palatine to end of frontal, 30^{mm}; transverse breadth, across frontal, 15^{mm}; transverse breadth, across anterior edges of alæ, 8^{mm}.

The lower mandible has a strongly incurved beak, with the cutting edges rather suddenly incurved at about the proximal third, and a well-developed, broad, V-shaped notch at base, beyond which there is a slightly prominent, broad tooth; alæ broad, the inner ends broader than the middle, well-rounded; mentum short, with a broad dorsal emargination; gular lamina short, the inner edges incurved.

The total length of the lower mandible is 29^{mm}; tip of beak to end of mentum, 10^{mm}; to ventral end of gular, 21^{mm}; to bottom of notch, 11^{mm}; to inner ends of alæ, 24^{mm}; breadth, from inner ends of alæ to mentum, 28^{mm}; breadth of gular lamina, 17^{mm}; breadth of alæ, 12·5^{mm}; greatest transverse breadth, across alæ, 32^{mm}; transverse breadth, across anterior edges of alæ, at teeth, 11^{mm}.

These jaws agree pretty nearly, in form and size, with those of *O. pteropus*, figured by Steenstrup, but the latter have a deeper notch in the upper mandible, with a more evident lobe beyond it, while the lower mandible has a broader and less triangular notch.

The buccal membrane is large, thin, prolonged into seven acute angles or lobes, of which the upper is in the median plane, opposite

the interval between the dorsal arms; the six others are opposite the three other pairs of sessile arms. The inner surface of this membrane is covered, near the periphery, with small rounded papillæ; externally it is connected to the arm by seven membranous bridles, corresponding to the seven angles; of these the dorsal one forks, one branch going to the inner margin of each dorsal arm; the upper lateral ones join the marginal membrane of the upper angle of the upper lateral arms; the lower lateral ones join the lower marginal membrane of the third pair of arms; the ventral ones join the marginal membrane outside of the sucker-bearing face of the ventral arms. In front of the bases of each of the dorsal and tentacular arms there is a large opening to the space beneath this membrane.

The beak is closely surrounded by a thick, prominent, lobed and wrinkled, fleshy collar, with papillæ on its inner surface; outside of this there is a smooth, sharp-edged, erect collar, less prominent than the inner one.

The odontophore is similar to that of *Ommastrephes;* it is sharply bent upon itself anteriorly, with the ventral end less than half as long as the dorsal; the dentigerous zone is yellowish brown in color and bordered laterally by a thin ridge formed by a row of small plates; the lateral membrane is broad, thin, and pale yellow, running straight across, from the ventral end, at right angles to the dorsal portion, and then folding back upon itself, joins the dorsal part of the odontophore farther back, near its middle; beyond this point it is very narrow and rolled in. Length of the dorsal portion, 19^{mm}; of the ventral, 9; breadth of the dentigerous zone, anteriorly, 5^{mm}; breadth of marginal membrane, anteriorly, 7^{mm}.

The median teeth are broad, with three stout points, the middle one nearly twice as long as the lateral; the inner lateral teeth are much longer, with one long stout point and a short denticle on the outer side, below the middle; the two outer rows have simple, long, and rather stout, curved teeth, those of the outermost row a little longer and narrower than the others. The teeth differ decidedly from those of *S. megaptera* in the shortness of the lateral denticles of the median and inner lateral teeth; moreover all the teeth are stouter and less acute.

The pen resembles that of *Ommastrephes;* it is long, widest anteriorly, bordered by strong ribs, obtusely pointed at the anterior end, gradually narrowing to the very narrow slender portion, about three inches from the posterior end, beyond which there is a thin margin, which expands into a lanceolate form, widest at 1·25 inches from the

end; the terminal portion forms a short, hollow hood, formed by the infolding of the margin, and marked by slender, divergent, raised lines, stronger laterally, and with a dorsal keel. The central rib begins at the anterior end, increases in size to the middle region, then narrows to the slender part, where it forms a slender, prominent rib, only visible dorsally, and then becoming confluent with the lateral ribs, extends as a sharp keel to the end. The lateral ribs commence at about ·75 inch from the anterior end, and each at first consists of three riblets; farther back another appears on the outside margin but is separated only by a slender groove, and toward the slender part of the pen they all coalesce into a single rib on each side, which nearly meet in the middle line ventrally, where they are separated by a slender groove, which disappears farther on. Total length of pen, 349^{mm} (13·75 inches); greatest breadth, 22·5^{mm} (·90 inch); length of posterior cone or hood, ·9^{mm} (·35 inch); breadth of posterior expansion, 15^{mm}.

This specimen was collected at Bermuda, by Mr. G. Brown Goode, and now belongs to the Museum of Wesleyan University, Middletown, Conn. Mr. Goode informs me that it was picked up on the north shore of the island, in December, 1876, and that it was regarded by the inhabitants as a novelty or great rarity, and was noticed as such in the local newspapers.

Histioteuthis D'Orbigny, 1839.

Histioteuthis Férussac & D'Orbigny, Histoire naturelle des Céphalopodes Acétabuliferes, p. 226.

This genus is remarkable for having the six upper, sessile arms united together nearly to their tips by a thin elastic membrane or web. The ventral arms are also united together for a part of their length and their common web is joined to the great web, in the median line, by a bridle-like membrane. The tentacular-arms are very long, and have expanded clubs, with a broad dorsal keel. As in *Architeuthis* and *Sthenoteuthis*, they are furnished with a series of small smooth-rimmed suckers, alternating with tubercles, on the proximal part of the club and adjacent part of the arm, for the purpose of uniting the arms together, at will, but in the following species a row of such suckers and tubercles also extend along one side of the club, opposite part of the large central suckers. The large suckers are serrated, and alternate in two rows; two rows of large marginal suckers exist on one side and two rows of much smaller ones on the other. At the extreme tip of the arm there is a cluster of small smooth-edged suckers, as in *Architeuthis*.

The mouth is surrounded by a broad buccal membrane, with six angles or lobes, but without suckers. The body is relatively short, with short bilobed caudal fins. The eyes are large, and have distinct lids. The dorsal bone or pen is thin, short, lanceolate, and somewhat quill-shaped, with long, lateral expansions.

The species, so far as known, are brilliantly colored, having occellated spots on raised verrucæ, in addition to the ordinary coloration of squids.

The two foreign species, hitherto described, are both from the Mediterranean.

Histioteuthis Collinsii Verrill.

American Journal of Science, vol. xvii, p. 241, March, 1879. Tryon, Manual of Conchology, i, p. 166, 1879 (description copied from the original).

PLATES XXII and XXVI.

A large and handsome species, with the broad, thin, dark brown web, extending between and nearly to the ends of the six upper arms. The outer surface of the head and arms is covered with large, slightly raised warts or tubercles, which are dark blue with a whitish center, specked with brown; three rows extend along the ventral arms and two along the others; a circle of these surrounds the eye-lids, but the edges of the eye-lids are narrowly bordered with dark brown. Color, between the warts, pale purplish brown, with small, raised, dark brown spots, reddish specks, and white granules; web and inner surface of arms uniform dark reddish or purplish brown; suckers yellowish white, their pedicels specked with brown; tentacular-arms light orange-brown. Eyes mutilated; their lids form a large simple, rounded opening.

Tentacular-arms slender, about two feet long and expanding near the end into a broad, long-oval, sucker-bearing portion or 'club,' which is bordered by a membrane, widest on the upper edge; it ends in a tapering tip, on the back of which there is a thin, crest-like membrane or keel, enlarging proximally to its end, where it forms a rounded lobe. The most expanded portion of the 'club' bears six rows of suckers, with finely serrate horny rings; the two central rows contain much the largest suckers, four or five in each; the more central of these two rows contains four suckers, larger than the rest, and of these the two median are largest; outside of these two median rows, are two regular marginal rows of nearly equal, medium-sized, serrate suckers, on the upper edge; and along the lower edge of the club there is one row of few, similar, but smaller ones; outside of these there is an incomplete

alternating row of much smaller marginal ones. On the lower edge of the proximal portion of the club, extending from the middle backward, there is a row of four small, smooth-edged, unequal suckers, alternating with rounded, sessile tubercles that fit into corresponding suckers on the other arm; a row of similar but smaller suckers extends for about six inches along the inner surface in the median line of the arm, alternating at first singly, and then two by two, with tubercles, and gradually becoming more distant. The end of the arm, beyond the expanded club, bears minute serrate suckers, at first in six rows, decreasing to two toward the end. The extreme tip bears a small group of minute, smooth-edged suckers. The largest suckers of the club are decidedly constricted below the margin, and then swell out at the basal portion. The edge of the horny rim is divided into very numerous, small, incurved and crowded denticles, nearly equal in length, but part are thickened and obtuse, while the rest are more slender and acute. Diameter of the largest suckers, 6·5^{mm}; of the largest in the second row, 5·5; of the largest in the lateral rows, 3 to 4; of the largest smooth-rimmed marginal suckers, 2 to 2·5; of the smooth-rimmed suckers of the wrist, 1·5 to 2.

Sessile arms stout, trapezoidal, tapering to slender tips, and bearing two rows of numerous suckers. All the arms on the left side are an inch or more longer than the corresponding right ones. The dorsal and ventral arms, of the same side, are about equal, and decidedly shorter than the two lateral pairs, which differ but little in length. Web about two-thirds as broad as the length of the arms, uniting the upper three pairs together, and as a narrowing border extending along their sides, to the tips. The lower lateral arms have a thin, crest-like membrane on their outer, median surface, commencing at the basal fourth and extending nearly to the tips. The ventral arms are united together, toward the base, by a web, which is also joined to the main web, in the median plane. A narrow outer web, arising from the outer angles of the arms, also unites all the arms together for a short distance above their bases.

The suckers are all similar in form. The larger ones on the dorsal arms are, perhaps, a little larger than those on the lateral and ventral ones. The largest are subglobular, laterally attached, and gibbous; the aperture is small, usually with three or four flat, blunt, or rounded lobes or denticles on the outer margin, with none on the inner margin. The pedicels of the larger suckers are very stout at base, tapering up to their attachment on the lower side of the sucker, where they are small and slender. The largest suckers of the dorsal arms are 5^{mm}

in diameter; their apetures 2^{mm}; length of pedicels 4 to 5^{mm}. The largest suckers on the ventral arms are not so large as those on the others; the largest are 4^{mm} in diameter. Only a few suckers (5 or 6), and these of very small size and nearly in one row, extend below the level of the ventral web, which is attached along the inner margin, inside the row of suckers. The larger ventral suckers are depressed and oblique, with a very one-sided horny ring, which has a small oblique aperture, with about three bluntly rounded, slightly prominent lobes or denticles on the outer margin; while the inner margin is smooth.

The membranes about the mouth are arranged nearly as in *Ommastrephes*. The mouth is surrounded externally by a broad, elevated, smooth, dark chocolate-brown buccal membrane or collar, which is prolonged into six angular lobes, corresponding to all the intervals between the arms, except those between the 2d and 3d pairs; this buccal collar is connected to the interbrachial membrane by six membranous bridles, corresponding to the six lobes; on both sides of the dorsal and ventral bridles are large pouches. The beak is immediately surrounded by a thick, fleshy, lobed and wrinkled collar, and outside of this by another less prominent and less wrinkled one.

The exposed parts of the mandibles are black; the inner laminæ bright reddish brown. The beak of the upper mandible is very acute, strongly incurved, with scarcely any distinct notch at the base of the cutting edge, but with a conspicuously excavated V-shaped area; the anterior edges of the alæ are irregularly and slightly denticulate or crenulate. The lower mandible has a much incurved beak, with the cutting edges decidedly concave, and a very small notch at their bases, but with a broad excavated area along their sides and bases; the anterior edges of the alæ are slightly convex and form a very obtuse angle with the edges of the beak or rostrum; a small, thin tooth exists just beyond the notch; the alæ are broadest near their inner ends; the gular lamina is peculiar in having a prominent, thickened, curved, lateral rib, on each side, running to the end of the prolonged and subacute lateral lobes; and another dorsal one, running to the dorsal emargination. Length of upper mandible, 30^{mm}; height, palatine to frontal, 20; height (or breadth) of palatine 14; tip of beak to end of frontal, 22; to base of cutting edge (notch), 7·5; notch to inner end of alæ (union with palatine), 7·5; beak to posterior lateral border of alæ, 13·5; transverse breadth across outer side of alæ, 9·5. Lower mandible, length, 23^{mm}; inner ends of alæ to mentum, 22·5; tip of beak to dorsal border of gular lamina, 17; to inner ends of alæ, 18; to notch, 8·5; breadth of alæ in middle, 8; greatest

transverse breadth across alæ, 23; across anterior edge, at teeth, 7·5; notch to union of gular lamina and alæ, 6·5; breadth of gular lamina, 12·5.

The odontophore is rather short, the dorsal portion not much exceeding the ventral in length; the lateral membrane is broad and thin, its posterior border extending transversely straight across to the dorsal fold, nearly at right angles to the dorsal portion of the odontophore; the dentigerous portion, including a thickened lateral ridge, outside the teeth, is light red in color. Length of dorsal portion, from anterior bend, 8·5^{mm}; of ventral portion, 8; breadth of dentigerous zone, 3.

The median teeth are short, with a strongly incurved, acute central point, and with small inconspicuous or rudimentary, blunt lateral denticles on each side; the inner lateral teeth are considerably longer, without a distinct lateral denticle; the two outer rows have simple, rather slender, strongly incurved, acute teeth, the outermost a little longer and more slender. The plates along the border appear to be so closely united as not to be easily separated entire; they form a continuous, but slight, narrow ridge, which has an undulated surface. The membrane lining the palate bears pale yellowish, scattered, stout, not very acute, and but slightly curved teeth, with bases not much enlarged; among these are clusters of small, stony, smoothish granules, often aggregated into masses of considerable size. The gular membrane also bears aggregations of small, smoothish, rounded and angular granules, with others that are larger, oblong and oval, smooth, and more or less regularly arranged. The œsophagus is very long and slender, dark-colored.

Measurements of Histioteuthis Collinsii.

	Millimeters.	Inches.
Tentacular-arms, length	609 and 635	24 and 25
Diameter at base	12·5	·50
Breadth of club, without membrane	17·5	·70
Its membranous border	6·2	·25
Length of club	69	2·75
Length of the slender tip	31	1·25
Of dorsal crest	37	1·50
Length of dorsal arm of left side	355	14
Of 1st lateral (2d pair)	432	17
Of 2d lateral (3d pair)	438	17·25
Of ventral	361	14·25
Breadth of lateral arms, at base	22·5	·90
Thickness	19	·75
Diameter of eye-opening	22·5	·90
Diameter of head, at base of arms	87	3·50
Breadth of web, between arms	203 to 254	8 to 10
Diameter of largest suckers of tentacular-arms	6·5	·26

Taken from the stomach of *Alepidosaurus ferox*, lat. 42° 49′, long. 62° 57′, off Nova Scotia, by Capt. J. W. Collins and crew of the schooner "Marion," 1879.

All parts back of the eyes are absent, the eyes are mutilated, but the specimen is otherwise in excellent preservation, even the web and suckers being nearly uninjured.

Observations on some of the more important specimens described from other localities.

We are largely indebted to Professor Steenstrup and to Dr. Harting for our knowledge of the specimens preserved in European museums, or cast ashore on the European coasts. Professor Steenstrup* has given accounts, compiled from contemporary documents, of a specimen taken at Malmö, Sweden, about 1546 or 1549, and of two specimens of huge cephalopods cast ashore at Iceland, in 1639 and Nov. or Dec., 1790.

The specimen of 1790, described in the MSS. of Svend Paulsen, 1792, had tentacles 3 fathoms long; the body (with head) was 3½ fathoms long. That of 1639, described in Olafsens og Povelsens Reise til Island, ii, 716, was 4 to 5 fathoms long.

In the article published in 1857, he also briefly mentioned a specimen cast ashore at Jutland, Dec., 1853, of which the jaws were preserved, and on which he then based the species *Architeuthis monachus;* and another specimen, which he named *Architeuthis dux*, taken by Capt. Vilh. Hygom, in the western Atlantic. He has also since described and figured† the jaws of the specimen of *Architeuthis monachus*, obtained at Jutland, in Dec., 1853.

In the same memoir, of which I have seen only the first part, there are references to a description and figures of '*A. Titan*,' obtained in 1855, by Capt. Hygom, in N. lat. 31°, W. long. 76°. The latter specimen appears to be the same as that referred to in 1856, as *A.*

* Meddelelse om tvende Kiæmpestore Blæksprutter, opdrevne 1639 og 1790 ved Islands Kyst, og om nogle andre nordiske Dyr. Förhandlinger Skandinaviske Naturforskeres, v, pp. 950–957, 1847, Copenhagen, 1849.

Oplysninger om Atlanter colossale Blæksprutter Förhandlinger, Skand. Naturf., 1856, vii, p. 182, Christiania, 1857. Cephalopodum, qui in Museis Hafn. inveniuntur, Kjobenhavn Oversigt., 1861, pp. 69, 165.

† In a paper of which I have seen some proof-sheets, given by him to Dr. Packard, entitled "Spolia Atlantica." This memoir has not been published. The plate (1) that I have seen is marked "Vid. Selsk. Skrifter, V. Række, naturv. og mathem. Afd. iv Bind;" and there are references to three other plates, illustrating '*A. Titan*,' etc.

dux, and the same that Harting* mentioned, under the name '*Architeuthis dux* Steenstrup,' as collected at the same time and place, and of which he published an outline figure (see Plate XXV, fig. 2) of the lower jaw, copied from a drawing furnished to him by Steenstrup.

Harting states that the pen or 'gladius' of this specimen is six feet long. Many important parts of this specimen were secured, and I regret that I have been unable to see the figures and description of it, referred to by Harting as forming part of Professor Steenstrup's unpublished memoir. But to judge by the outline figure given by Harting, it is a species quite distinct from those described by me. The lower jaw resembles that of *A. Harveyi* more than *A. princeps*, and is a little larger than that of our No. 5. The beak is more rounded dorsally, less acute, and scarcely incurved; the notch is narrow, and the alar tooth is not prominent.

M. Paul Gervais, in the Journal de Zoologie, iv, p. 90, 1875, gives a short description of this species, based apparently on the proof-sheets and unpublished plates, not seen by me, of Steenstrup's article, referred to above. He describes it as follows: A large species, of which a fragment of an arm preserved in the Museum of Copenhagen is nearly as large as the arm of a man. The sucker-bearing surface of the arm is extended bilaterally into a membrane exceeding, on each side, the arm itself. Diameter of the opening of the suckers, 0·020; of the suckers themselves, 0·030. Length of the dorsal bone (pen), 2^m; breadth [longueur, by error], measured in the middle of its length [longueur], 0·17. He refers to Steenstrup's Plates, III and IV.

In a letter to the writer, dated Sept. 4, 1875, Professor Steenstrup states that in addition to the specimens above mentioned, there are, in the Museum of the University of Copenhagen, two complete specimens of *Architeuthis*, preserved in alcohol. Both are of comparatively small size. One, from the northern coast of Iceland,† he refers to *A. monachus*. It has tentacular-arms 10 feet long, and sessile arms 4 feet long. The other is a still smaller one, from the warmer parts of the Atlantic, possibly the young of *A. dux*.

It is evident, therefore, that at no distant day, most of the remaining doubtful points in respect to the structure and relationship of the

* Description de quelques fragments de deux Céphalopodes gigantesques. Publiées par l'Académie Royale des Sciences à Amsterdam. 1860. 4to, with three plates (Verh. K. Akad. Weten., ix, 1861.) The figures have been partly copied in Tryon's Manual of Conchology, i, plates 60 and 86.

† This one is referred to by Dr. Packard, Amer. Naturalist, vol. vii, p. 94, 1873.

species of this genus, can be cleared up by Professor Steenstrup, even if additional specimens should not be obtained.

The publication of Professor Steenstrup's detailed memoir upon this genus would give great pleasure and satisfaction to all students of this class of animals. His thorough knowledge of the group, and his numerous and important investigations of the Cephalopods, published during many years, will give especial value to his conclusions.

Harting, in the important memoir referred to, describes specimens of two species, both of which are apparently distinct from all the Newfoundland specimens enumerated by me.

The first of these (his Plate I) is represented by the jaws and buccal mass, with the lingual dentition, and some detached suckers, preserved in the museum of the University of Utrecht, but from an unknown locality. These parts are well figured and described, and were referred to *Architeuthis dux* by Harting. The form of the lower jaw (see Pl. XXV, fig. 1) is unlike that of *A. dux*, for the beak is very acute, the cutting edge is concave, the notch shallow and broad, and the alar tooth is somewhat prominent. The size is about the same as our No. 5. The suckers (Pl. XXV, fig. 1*a*, 1*b*) are from the sessile arms, and agree pretty nearly with those of *A. Harveyi*. The edge is strengthened by an oblique, strongly denticulated ring, which, in all the suckers figured, including both larger and smaller ones from the short arms, has regular, acute, sub-equal denticles all around the circumference, in this respect agreeing with *A. Harveyi*. The internal diameter of the largest of these suckers is ·75 of an inch; the external, 1·05 inches. They were furnished with slender pedicels, attached obliquely on one side. The lingual teeth (see Plate XVI, fig. 8, copied from Harting) are in seven regular rows, and resemble closely those of *Loligo*. On that account mainly, in a former paper, I proposed to designate it by the name of *Loligo Hartingii*. But since that time I have been able to study the dentition of species of *Architeuthis* and *Sthenoteuthis*, and now refer Harting's species to *Architeuthis* without hesitation, although the dentition is poorly figured. Professor Steenstrup, in a letter to me, subsequent to the publication of my former papers, also expressed the opinion that Harting's specimen belongs to *A. monachus*. If distinct, however, as is possible, it may be called *Architeuthis Hartingii*.

The other species described by Harting was from the Indian Ocean, and belongs to the genus *Enoploteuthis*.

In this genus there are large, sharp, curved claws (Pl. XXV, figs. 4, 4*a*), both on the club of the tentacular-arms and on the sessile arms,

in place of the suckers of ordinary squids. The teeth of the odontophore, in Harting's species, are remarkably small and simple (see fig. 4, *b*), after Harting. As this species does not appear to have had a special name, I propose to call it *Enoploteuthis Hartingii.*

D'Orbigny* gave the name *Enoploteuthis Molinæ* to a large species, of which the body was estimated to be about 4 feet long, found floating and mutilated in the South Pacific, S. lat., 30° 44′; W. long. 110° 33′, by Banks and Solander, in 1769, on Capt. Cook's second voyage. Of this, fragments are preserved in the Museum of the College of Surgeons, London.†

A similar species, perhaps identical, had previously been recorded by Molina, from the coast of Chili, as *Sepia unguiculata.*

According to Jeffrey's British Conchology, vol. v, p. 124, a huge Cephalopod was stranded in 1860 or 1861, between Hillswick and Scalloway, on the west of Shetland. "From a communication received by Professor Allman it appears that the tentacles were 16 feet long, the pedal-arms about half that length, and the mantle sac, 7 feet; the mantle was terminated by fins; one of the suckers examined by Professor Allman was $\frac{3}{4}$ inch in diameter."

Mr. Kent, in the articles already referred to,‡ mentions a sessile arm of a giant cephalopod, which has been long preserved in the British Museum, but of which the origin is unknown. He states, in the first article, that it is just 9 feet long and 11 inches in circumference at the base, tapering off to a fine point. There are about 150 suckers, in each of the two alternating rows, those at the base being ·75 of an inch in diameter.

In his second article he refers this arm doubtfully to *Ommastrephes todarus*, and gives the following description:

"The length of this arm, from one extremity to the other, is just 9 feet; the circumference at the base 11 inches; and from this it gradually decreases, terminating in a fine point. The suckers are arranged in two rows throughout the extent of the arm, numbering, approximately, 150 to each row, or a total of 300 to the whole organ. Forty-three suckers only are stationed on each side in the first or proximal half of the arm; one hundred on each side occupy the whole length, with the exception of 14 inches, this smaller length including the remaining fifty on each side, which are very minute and crowded

* Histoire Nat. des Céphalopodes Acétabuliferes, p. 339, 1845.

† See also Todd's Cyclopedia of Anatomy and Physiology, i, p. 529.

‡ Proceedings Zoological Society of London for 1874, pp. 178 and 493.

together. The comparative distances between the suckers throughout the whole length in each row are as follows:—between the first and second sucker, 1½ inch; halfway up the arm, 1 inch; at three quarters of the entire length, ½ inch; and within six inches of the distal extremity, ¼ inch. The relative diameters of the suckers at similar distances are:—at the base, extreme outside measurement ¾ inch, inside measurement of corneous ring ½ inch; and, those suckers a little past the first few being the largest, halfway down ½ inch outside and ½ inch inside measurement, at three quarters length ¼ inch, and at 6 inches from the extreme point ⅛ inch outside measurement, gradually diminishing from here to the size of a pin's head.

The shape and structure of the suckers upon this British-Museum specimen agree with those of *Ommastrephes todarus* as given by D'Orbigny, corresponding also with those figured by Harting, referred by him to the same species, and anticipated by the same authority to be also identical with Prof. Steenstrup's *Architeuthis dux*. More minutely they may be described as hemispherical in shape, the stalk or peduncle being attached laterally at the base of the hemisphere, the point of insertion of the same in the cup being marked by a conspicuous pit-like depression. The horny ring is obliquely set, and much deeper at the side opposite the insertion of the stalk; the inner margin is serrated; and in most examples the serratures bordering the deeper side are considerably larger than in the other portions of the circumference; in some instances the serratures, except at the particular point mentioned, are altogether aborted, having the inner margin of the ring quite smooth; in other examples, and more especially among the larger suckers, the teeth or serratures are equal or subequal. The average number of the teeth of the largest rings is twenty."

Mr. Kent, unfortunately, does not state to which pair this arm belongs. But from his description, it is, perhaps, a ventral arm. It evidently belongs to an *Architeuthis*, and is very near to our *A. princeps*.

Lieut. Bouyer, of the French steamer 'Alécton,' encountered a huge cephalopod, in November, 1860, between Madeira and Teneriffe. Its body was estimated to be between 15 and 18 feet in length. A long and laborious attempt was made to capture it, and a slipnoose was passed around the body, but on attempting to hoist it on board the rope cut through the soft flesh and the tail alone was secured. A sketch of the animal was made by one of the officers, and Messrs. Crosse and Fischer* have, from this figure and the narrative of the

* Journal de Conchyliologie, 3d ser., vol. ii, p. 138, 1862. See also Tryon's Manual of Conchology, vol. i, p. 87, Plate 59, 1879 (figure copied from the original).

officers,* proposed to establish a species for this specimen, which they named *Loligo Bouyeri.* The figure is very imperfect, but evidently represents a ten-armed cuttle-fish, though only eight arms are shown, and the tail is represented as truncated. In fact, there is nothing about the figure or description sufficient to indicate specific, or exact *generic* characters. The eight short arms, shown in the figure, are stout, tapered, and less than half the length of the head and body together. It was more probably a species of *Architeuthis*, to judge from the caudal fin, described as consisting of two rounded lobes, of small size. It may be designated as *A. Bouyeri*, provisionally.

In the Journal de Zoologie, vol. iv, No. 2, p. 88, 1875, M. Paul Gervais has given a partial summary of the gigantic Cephalopods previously known, and has mentioned an additional species (*Architeuthis Mouchezi* Vélain), of which portions were brought to Paris by M. Vélain, from the Island of St. Paul, Indian Ocean, where it was cast ashore in November. He also quotes the brief notice of the animal by M. Vélain (in Comptes Rendus, t. lxxx, p. 1002, Seance du April 19, 1875). It is stated that this example belongs to the same group with *Ommastrephes.* A description and a rude figure of it, made from a photograph taken in the position in which it lay upon the shore, has also been published by M. Vélain in the Arch. de Zool. Exper., vol. vi, p. 83, 1877. The figure has been copied in Tryon's Manual of Conchology, vol. i, Pl. 82. According to this figure the tentacular-arms were very long and the short arms were truncated, probably owing to mutilation. One of the tentacular-arms was saved, and, with the beak, is preserved in Paris. The caudal fin was narrow and lanceolate, adhering to the sides of the body by its entire length. In the latter feature this is very different from any of the northern species.†

In the Archives de Zool. Experimentale, vol. vi, 1877, M. Vélain has proposed a new genus (*Mouchezia*) for this specimen. The peculiarity of the pen appears to be the only character, of any importance, referred to by him.

In The Zoologist, London, 2d Series, No. 118, p. 4526, July, 1875, there is an article entitled, "Notice of a gigantic Cephalopod (*Dinoteuthis proboscideus*), which was stranded at Dingle, in Kerry, two hundred years ago. By A. G. More, F.L.S." The article is chiefly a reprint of the rude, but interesting, popular accounts written at the time of the capture, and upon these Mr. More attempted to found a new genus and species. The character which he mainly relied upon,

* See Comptes Rendus, Acad. Sci., vol. 53, pp. 1263–7, 1861.

† See also Tryon's Manual of Conchology, i, pp. 89 and 184, 1879.

as of generic value, is the power of projecting the beak in the form of a proboscis. But this is habitually done by the various common species of *Ommastrephes*, *Loligo*, etc., and perhaps by all ten-armed cephalopods. There is not sufficient evidence, from the published accounts, that this specimen differed in any way from the *Architeuthis monachus*. It was described as 19 feet in total length; the long arms having been mutilated, the part remaining was 11 feet long, and as thick as a man's arm; the short arms varied from 6 to 8 feet in length, and were as thick as a man's leg, and had two rows of large serrated suckers; the proboscis (buccal mass with beak) was the size of a man's fist; the beak was "somewhat like to an Eagle's Bill, but broader." The whole animal was said to have been as large as a large horse. The length of the head and body together was 8 feet.

Mr. More has kindly sent me a tracing from the original figure. This shows a broad, oval, flat body, and a small caudal fin. The body or mantle had evidently been split open and spread out flat.

This fact is also evident from the original descriptions reprinted by Mr. More, in which the sides of the mantle are described as follows: "Over this Monster's back was a mantle of a bright Red Color, with a fringe round it, it hung down on both sides like a Carpet on a table, falling back on each side, and faced with white." The liver, according to the descriptions, had been removed: "When it was dead and opened the liver wayed 30 pound." The proboscis had also been removed before it was exhibited, and it is therefore very probable that the figure and descriptions represent it as more extended than was natural.

The measurements given indicate a specimen smaller than several of the American examples, and but little, if any, larger than our No. 5, from Logie Bay.

In the Zoologist, June, 1875, p. 4502, and August, p. 4569, and in the August number of the Annals and Magazine of Natural History, vol. xvi, p. 123, the same writer gave an account of the capture, and briefly described the beak, odontophore, and portions of the tentacles and arms of another specimen, taken off Boffin Island, on the west coast of Ireland, April, 1875. The tentacular-arms are said to have been 30 feet long; the expanded portion 2 feet 9 inches; the large central suckers nearly 1 inch in diameter; those of the outer rows ·5 of an inch; one short arm is said to have been 8 feet long, and 15 inches in circumference at the base, when fresh. It had small suckers without teeth on the horny rings, on the 'wrist' of the 'club' and

scattered along the tentacular-arms, as do our specimens. The rounded tubercles that always accompany these smooth-rimmed suckers are not mentioned, but doubtless they were also present. The beak was 5·25 inches long and 3·5 broad, dark reddish brown, "with a large tooth in both margins of the inner mandible and a much smaller notch on each side of the outer mandible."

Mr. More believed this to be distinct from the Newfoundland species and referred it to *A. dux*, but his description agrees closely with the corresponding parts of *A. Harveyi* (No. 5) described by me, except in the relatively somewhat greater size of the sessile arms at base. In this respect, however, it is equalled or surpassed by our No. 14, and by others of the Newfoundland examples. This may also be only a peculiarity of the female. The measurements indicate a specimen intermediate in size between our Nos. 5 and 14, but the description is not sufficient to indicate with certainty to which of our species it was nearest related. A more detailed description, with figures of the suckers and odontophore, would probably settle this point. Mr. More supposed that the lateral suckers of the tentacular-club were larger in his example than in *A. Harveyi*, but that is not the case.

A large cephalopod, referred doubtfully to *Ommastrephes*, has been recorded from Japan and described by Dr. F. Hilgendorf.* It was taken on the east coast of Japan, N. lat. 35° to 36.° It had been split open, salted, and partly dried, and the viscera had been removed. The ends or clubs of the tentacles were also gone. In this condition it was on exhibition in Yedo. The following are the measurements given: Tip of tail to front edge of mantle, 186^{cm} (6 feet, 1 inch); mantle to mouth, about 41^{cm} (1 foot, 5 inches); longer sessile arms, 197^{cm} (6·5 feet); from tip of tail to tip of sessile arms, 414^{cm}; total expanse across outstretched tentacles, 600^{cm}; circumference of mantle (breadth as cut open), 130^{cm}; length of caudal fin, 60^{cm}; breadth of caudal fin in middle, 45^{cm}; breadth of forward end of caudal fin, 28^{cm}; diameter of posterior tip, 1^{cm}; tongue of funnel, 10^{cm} broad, 6^{cm} long; eye-opening, which was oblong-oval, without an obvious sinus, 19^{cm}; distance between eyes, 26^{cm}; diameter of oval skin of lip, 12^{cm} by 8^{cm}; breadth of sessile arms, 11^{cm}; of tentacles, 2 to 3^{cm}; diameter of horny rings of suckers, on base, 1·5^{cm}; height, 0·7^{mm}; number of denticles, 37.

* Mittheilungen der deutschen Gesellschaft für Natur und Välkerkunde Ostasiens. Herausgegeben von dem Vorstande, 1st Heft, p. 21, May, 1873, Yokohama, Japan. See also American Journal of Science, vi, p. 237, Sept., 1873.

The following species, although the specimens, when found, had lost some of their most characteristic parts, appears to be nearly related to *Onychoteuthis*, a genus having sharp claws instead of suckers on the 'club' of the tentacular-arms, and a cluster of small tubercles and smooth suckers on its 'wrist,' to unite the arms together. It probably belongs to the group *Lestoteuthis*, characterized below.

Onychoteuthis robusta (Dall).

Ommastrephes robustus (Dall, MSS.) Verrill, American Journal Science, vol. xii, p. 236, 1876.

PLATES XXIII and XXIV.

This large and very interesting species* was discovered by Mr. W. H. Dall, near Iliuliuk, Unalashka I., off the coast of Alaska.† He found three specimens thrown upon the beach, April 26 and May 8, 1872. He made descriptions, measurements, and some very valuable drawings of them, while fresh. The specimens had all been more or less mutilated by the ravens before they were discovered. He preserved the pharynx, beak, and odontophore of No. 1; part of the 'bone,' a piece of the caudal fin, and the basal part of one of the ventral arms, with five of the suckers adhering, from one of the other specimens, (No. 2), and has generously placed them in my hands for examination, together with his drawings, measurements and notes.

The parts remaining of the largest specimen, No. 3, when found had a total length of 427^{cm} (14 feet), but the ends of the tentacular-arms had been destroyed; length from tail to base of tentacular-arms, 559^{cm} (8 feet, 6 inches); to front edge of mantle, 232·4^{cm} (7 feet, 7½ inches); width across fins, 107^{cm} (42 inches); diameter of body, 45·7^{cm} (18 inches); slender basal portion remaining of tentacular-arms, 155^{cm} (61 inches); their diameter, 6·3^{cm} (2·5 inches); short arms (ends gone), 76 to 102^{cm} (30 to 40 inches); length of pen, 226^{cm} (7 feet, 5 inches).

According to Mr. Dall's notes the color was reddish, in fine red dots on a whitish ground, with a darker stripe on the outer median line of the arms. The eyes were bluish-black, furnished with lids, and with a small sinus in front; diameter of the opening, 2·5^{cm} (1 inch).

The mandibles retracted into a short, yellow, puckered muzzle, which was included in a longer, plain, proboscis-like tube, extending an inch or two beyond. Siphon, short and thick.‡ Region of the eye

* This is the species referred to as perhaps *Onychoteuthis Bergi* by Mr. Dall in his note upon large cephalopods, in the American Naturalist, vol. vii, p. 484, 1873.

† The first specimen was found by Mr. M. W. Harrington, of Mr. Dall's party, on the west shore of Amaknak Island. Captain's Harbor, Unalashka, April 26th.

‡ No valve is shown in Mr. Dall's sketches.

somewhat raised. The nuchal collar is well-marked, and slightly above it, on each side, is a raised epidermal ridge, from which three wavy, raised bands or frills, attached at their inner edge, pass obliquely backward, on each side. No cranial cartilage was observed. Mantle firm and dense. The neck has one median dorsal and two ventral facets, long, oval-shaped, with a median depressed line, but otherwise smooth and white; the dorsal moves on a smooth part of the inside of the mantle; the ventrals move on similar raised facets of the mantle beneath. The caudal fin was rather broad, lanceolate or spear-shaped, acute at tip. Gills yellowish olive, with obliquely transverse laminæ. Gizzard, yellowish, the muscles laid like a coil of spun-yarn, in layers transverse to one another.

The pen, (Pl. XXIII, figs. 4, 5,) was gone from the first specimen (No. 1) and broken in the others. It was found unattached, in the dorsal cavity. It had a thickened median rib, but becomes very thin at the sides, and is divided by sharp, stiff ribs or folds into three longitudinal areas, on each side (Pl. XXIII, fig. 6). The posterior end is one-sided, funnel-shaped close to the tip, which is inserted into a long, round, thick, firm, cartilaginous cone, which tapers to a point posteriorly. The portion of the pen (of No. 2) preserved* and forwarded to me, includes all the cone and a part of the posterior end of the quill-portion, attached within the concavity of the cone (Pl. XXIV, fig. 7). The anterior end of the cone is concave and very obliquely terminated, the dorsal side extending forward some distance along the dorsal side of the quill. The whole length of the preserved cone, (doubtless much shrunken by the alcohol) is 44·5^{cm} (17·5 inches); of the oblique anterior termination, 15·25^{cm} (6 inches); greatest diameter, 4^{cm} (1·6 inches). The cone is nearly round, firm, translucent, brownish, or deep amber-color, and composed of numerous distinct concentric layers. The concavity of the anterior end firmly embraces the remnant of the funnel of the quill, which has numerous small costæ converging to the apex; two of the dorsal costæ are much stronger than the rest, forming a strong ridge each side of the smaller median costa, which lies in a deep median depression or furrow.

The tentacular-arms had lost their clubs; but the part remaining was cylindrical, 2·5 inches in diameter. The other arms were some-

* Mr. Dall states that he attempted to dry the rest of this pen, and that of No. 3, but they turned brown, and then black, effloresced, and decomposed. He also states that the pen, when fresh, was translucent whitish, and that it changed to brownish yellow in the alcohol.

what thicker. The few suckers remaining on them, were attached by slender pedicels, and arranged in two alternating rows; they were furnished with horny rims having the edge entire, except where irregularly broken away; those of the distal part of the arms were gone.

The portion of the arm of the second specimen, preserved in alcohol and sent to me, came from the base of the left ventral arm. It is 65^{mm} in length; diameter, from inner to outer surface, not including marginal membrane, 45^{mm}; including membrane, 64^{mm}. It is well rounded on the inner face, but more flattened on the upper side, while the outer surface is broadly rounded; the outer angle has a strong, thick, marginal membrane, 19^{mm} wide (see section of this arm, Plate XXIV, fig. 8, *c*). The sucker-bearing surface is broad, with a slight marginal membrane along each margin (*b*, b^1) rising into broad, flat, somewhat thickened blunt lobes alternating with the suckers. Two alternating rows of firm, smooth, rather irregular-shaped tubercles, run along the median region, between the rows of suckers, with which they alternate, on each side.

This segment of the arm still bears five suckers, which appear to represent the 1st, 2d, and 4th pairs, though there may possibly have been others before the first of these. They are all similar, rather small in proportion to the arm, round, but little oblique, decidedly convex beneath, and with a rather long, slender pedicel, (fig. 8, *a*). The horny marginal rings are dark brown, yellowish at the thin edge, which is entire and nearly smooth, except where broken. The largest of these remaining suckers are $8{\cdot}5^{mm}$ in diameter, outside; aperture, 5^{mm}; height of cup, 7^{mm}; length of pedicel, 3^{mm}.

The exposed parts of the jaws are black and polished; their internal laminæ are reddish brown, becoming translucent yellowish toward the margins.

The upper mandible (Plate XXIV, fig. 5), has an elongated, tapered, considerably incurved and sharp rostrum; the notch is rather narrow and deep, and a well-developed, triangular, lateral groove runs down from the notch for some distance, its upper border being in line with the cutting edge of the rostrum. The anterior edge of the alæ, so far as normally exposed, is nearly straight, but slightly undulated.

The lower mandible (Plate XXIV, fig. 6), has the cutting edges of the rostrum slightly concave, with a slight notch close to the tip, which is small and incurved; the notch at the base is broad and shallow, bordered externally by a slight, angulated ridge; the exposed anterior edges of the alæ have, each, two slight lobes, but are otherwise nearly straight; the alæ are broader toward the inner end, which is obtusely rounded.

The lower mandible now measures, from the tip of the rostrum to the posterior dorsal border of the mentum, 13mm; tip to the extreme posterior end of the gular lamina, 50mm; to the dorsal angle of the same, 33mm; tip to the inner end of the alæ, 46mm; to the bottom of the notch, 13mm; breadth of alæ, 24mm; transverse breadth at notches, 12mm.

The upper mandible, from the tip of the beak to the end of the palatine lamina, is 71mm long; from tip of beak to end of frontal lamina, 53mm; to bottom of notch, 11mm; length of exposed (dark) portion of anterior edge of alæ, 14mm.

The odontophore (Plate XXIV, figs. 1–4), has a very broad, thin, marginal membrane, yellowish-white in color, becoming brown and thickened toward the dentigerous portion, where there is a row of very small, thin plates, bordering the outer row of teeth; the ventral portion of the dentigerous band is dark brown, regularly convex, and narrowed gradually to the obtuse end; the dorsal portion is considerably longer, abruptly bent backward, with the borders incurved, gradually decreasing to the posterior end; on this part the teeth become much smaller and paler.

The outer lateral teeth, on the anterior portion, are long, slender, sharp, and strongly curved; the median ones are much shorter, with a sharp, strongly curved central point and a very small, almost rudimentary denticle on each side; the inner laterals are a little longer than the median, with a stout incurved point; on the outer side of its base there is a small denticle; the teeth of the two outer rows, on each side, are simple.

Length of odontophore, from anterior bend to posterior tip of dorsal end, 22mm; to tip of ventral end, 14mm; breadth of lateral membrane, in middle, 11mm; of dentigerous belt, anteriorly, 3mm.

The following measurements were made by Mr. Dall, from the fresh specimens.

Table of measurements (in inches).

	No. 1.	No. 2.	No. 3.
Total length (to mutilated ends of tentacles),	80+	110+	167+
Base of arms to tip of tail (head and body),	51	67	102
Base of arms to edge of mantle (head),	5	6	10·5
Edge of mantle to tip of tail (body),	46	61	91·5
Length of tail-fins (insertion to tip),	--	33·75	48
Breadth of tail-fins,	13·5+	25·5	42
Length of 'pen,'	--	60	89
Breadth of pen, in middle,	--	--	12·25
Length of tentacular-arms (ends gone),	30+	43+	61+
Length of longest sessile arms (ends gone),	30+	23·5+	40+
Diameter of body,	7·5	--	18
Breadth between insertions of fins,	--	3·5	5
Diameter of eye,	--	1	1·25

The generic affinities of this species must be regarded as still somewhat doubtful, owing to the absence of the tentacular-clubs, and most of the suckers of the sessile arms. The characters of the 'pen;' of the dentition, especially of the median teeth; of the nuchal frills; of the siphon; and of the cartilaginous facets of the neck, all indicate that it belongs in the family *Onychoteuthidæ*, near *Onychoteuthis*. But in this family there is great diversity as to the arrangement of the hooks and suckers, constituting the armature of the arms. Some of these combinations are as follows:

Sessile arms with suckers only.

Onychia.—Tentacular-club with two central rows of hooks, rows of small suckers along each margin, and a cluster of suckers and tubercles on the 'wrist.' Sessile arms with smooth suckers.

Onychoteuthis (typical).—Tentacular-club with two rows of hooks, with an apical cluster of suckers, and with a cluster of suckers and tubercles on the wrist. Sessile arms with suckers in two rows.

Ancistroteuthis (typical).—Two central rows of hooks, with proximal and apical suckers on the club, as in the last. Pen with a long, terminal, cartilaginous cone.

Ancistroteuthis Krohnii.—Tentacular-club with one row of suckers and one of hooks in the middle portion.

Dosidicus.—Tentacular-club with hooks. Sessile arms with large suckers on the proximal portion and small ones on the distal. Pen with a solid cone.

Sessile arms with both suckers and hooks.

Gonatus.—Tentacular-club with one or two central hooks proximally, and with numerous, multiserial, small suckers, distally. Sessile arms with four rows of suckers, those of the two central rows with a median hook, the outer ones serrate.

Abralia.—Tentacular-club with two rows of alternating hooks and suckers, in the middle, and with clusters of suckers on the wrist and apex. Sessile arms with hooks on the basal portion, and suckers toward the tips.

Lestoteuthis (gen. nov.).—Tentacular-club with numerous suckers, and few large central hooks. Sessile arms dissimilar; lower ones with four rows of suckers; upper with two central rows of hooks, and with marginal suckers on each side. Pen with a long terminal cone. (Type *A. Kamschatica* Middendorff, sp.)

Sessile arms with hooks only.

Verania.—Tentacular-club with suckers only; sessile arms with hooks only.

Acanthoteuthis.—Tentacular and sessile arms with hooks (fossil).

Ancistrocheirus.—Tentacular and sessile arms with hooks in two rows. Pen dilated at both ends.

Enoploteuthis (typical).—Tentacular-club with two rows of hooks, and with a cluster of small suckers on the wrist. Sessile arms all with hooks in two rows, extending to the tips.

It will be evident from these characters, that Mr. Dall's species, having two rows of smooth suckers, at least on the basal portion of the ventral arms, can belong to none of these genera, except those in the first group and *Lestoteuthis* in the second. Of these, *Gonatus* would be excluded from consideration by its different pen and four rows of suckers; *Onychia* and typical *Onychoteuthis* by the form of the pen. After this elimination we still find three generic groups to either of which it might belong, so far as its armature is known, viz: *Ancistroteuthis*, *Dosidicus*, and *Lestoteuthis*. The first of these is, perhaps, nothing more than a sub-genus of *Onychoteuthis*, the principal difference being in the pen, which is somewhat pennate and lanceolate in the typical species of the latter, but nearly linear with a solid cartilaginous terminal cone in the former. In this last character, and in the general form of the pen, *O. robusta* somewhat approaches *A. Lichtensteinii*. But *Dosidicus* and *Lestoteuthis* also have a solid cartilaginous cone, and the latter, especially, agrees most closely in the general form of the body and caudal fin; and its pen has very nearly the form and structure seen in *O. robusta*.

So far as we can judge, therefore, with our present imperfect data, the relationship of *O. robusta* appears to be rather with *Lestoteuthis* than with any other known group. It is possible, however, that its affinities may prove to be closer to *Ancistroteuthis*, when the armature is discovered.

Lestoteuthis, gen. nov.

The characters of *Lestoteuthis Kamschatica*, which I propose to take as the type of this generic group, are not yet fully known. The peculiarities in the armature, both of the sessile and tentacular-arms, as given above (p. 250) are quite sufficient, however, to warrant its separation from all the other genera. Its pen, as figured, also differs from all others, hitherto described. It is narrowest anteriorly, gradually and slightly expanding backward to the one-sided conical

hood or cone, which appears to be inserted into a solid terminal cone, much as in *L. robusta,* but the cone is relatively shorter. The caudal fin is large, rhomboidal, and acute posteriorly, as in the latter. The tentacular-club bears two large, abruptly curved, claw-like hooks in the middle, with numerous small suckers around them, and on the proximal part. The length of the head and body of the original example was about 28^{cm} (11 inches).

Mr. Dall has described a small species (probably young) from the coast of California, which may possibly belong to the same group. He referred it doubtfully to *Onychoteuthis* (*O. lobipennis* Dall).

Professor G. O. Sars, in his recent work (Mollusca Reg. Arct. Norvegiæ, p. 377), also mentions a specimen of *Architeuthis* (12 feet long), cast ashore on the Norwegian coast, at Foldenfjord, in 1874. He refers it doubtfully to "*A. dux* Steenstrup," (from the Kattegat) by which we should understand *A. monachus*, without doubt.

Note on Large Species of Octopus.

Although this article relates specially to the gigantic species of ten-armed Cephalopods, it may not be amiss to add a few lines in respect to species of *Octopus*, that attain large dimensions. It is certain, however, that none of the latter that have hitherto been examined by naturalists reach dimensions to be compared with those of the species of *Architeuthis*, *Onychoteuthis* (or *Lestoteuthis*) *robusta* and their allies.

The common *Octopus* of the west coast of North America (*O. punctatus* Gabb) is one of the largest of its tribe, hitherto studied. According to Mr. W. H. Dall,* it occurs abundantly at Sitka, and there "reaches a length of sixteen feet or a radial spread of nearly twenty-eight feet, but the whole mass is much smaller than that of the decapodous cephalopods of lesser length. In the Octopus above mentioned, the body would not exceed six inches in diameter and a foot in length, and the arms attain an extreme tenuity toward their tips." Dr. W. O. Ayres tells me that he has often seen this species exposed for sale in the markets of San Francisco (where it is eaten chiefly by the French), and that specimens with the arms 6 or 7 feet long are common. A smaller specimen, presented to the museum of Yale College, was over 4 feet long, and weighed 14½ pounds.

Prof. W. H. Brewer states that he has seen specimens in the San Francisco markets which spread fourteen feet across the outstretched arms.

* American Naturalist, vii, p. 485, 1873.

The common *Octopus vulgaris* ("poulpe" or "devil-fish") of the Mediterranean, sometimes grows to a somewhat formidable size. According to Verany, the largest one seen by him was 9 feet long and weighed 25 kilogrammes (Tryon). This one was captured by a fisherman, with his hands only.

A large species, perhaps the same, occurs in the West Indies. According to Professor B. G. Wilder,* a correspondent, Mr. J. S. George, of Nassau, N. P., mentions, in a letter, the occurrence there of an *Octopus* "ten feet long, each arm measuring five feet; the weight was estimated at between two hundred and three hundred pounds." It was found dead on the beach.

Specimens of similar size have been recorded from other parts of the world, while more or less fabulous accounts of more gigantic forms are numerous, especially among the early writers. But at present it seems most probable that the large fragments recorded as being frequently vomited by wounded sperm whales, belong to species allied to *Architeuthis*, though such fragments have often been referred to *Octopus*.

There is no satisfactory evidence that any of these species of *Octopus* ever intentionally attack man, or that any one has ever been seriously injured by them. They are rather sluggish and timid creatures, seeking shelter in holes and crevices among rocks. They feed mainly upon bivalve mollusks, but will also eat fish, and might, perhaps, like lobsters and crabs, devour dead bodies. Their power and ferocity, as well as their size, have often been excessively exaggerated.

ERRATA.

Page 190, line 32, for 2·5, read 3·5.
Page 193, line 11, for 1878, read 1879.

* American Naturalist, vol. vi, p. 772, 1872.

EXPLANATION OF THE PLATES.

PLATE XIII.

Figure 1.—*Architeuthis Harveyi* (No. 5). Head and arms, $\frac{1}{9}$ natural size, from a photograph of the specimen when freshly caught. The back of the head rests upon an oar so as to cause the beak to protrude, while the arms hang down in a reversed position. The diameter of the bathing tub was 38·5 inches: *a*, left, and *a'* right ventral arms; *b*, left, and *b'* right arms of the third pair; *c*, left, and *c'*, right arms of the second pair; *d'*, right dorsal arm, mostly concealed behind the others; *e*, left and *e'*, right tentacular-arms, folded several times over the oar; *i* to *iv*, the 'club'; *i* to *ii*, the 'wrist'; *ii* to *iii*, the part bearing large suckers; *iii* to *iv*, the terminal division; *o*, the beak.

Figure 2.—Part of the body and caudal fin of the same specimen, $\frac{1}{9}$ natural size, from a photograph made at the same time with the preceding; *u*, mantle cut open; *t*, tip of tail; *b*, right and *l*, left lateral lobes of caudal fin.

PLATE XIV.

Figure 1.—*Architeuthis Harveyi*. A restoration, $\frac{1}{12}$ natural size, based on the preceding figures and on the specimens received. (See note, p. 184).

PLATE XV.

Figure 1.—*Architeuthis Harveyi* (No. 5). Upper mandible, natural size.

Figure 2.—Lower mandible of same, natural size; lacks a small piece at *a*.

Figure 3.—Anterior part of the 'pen' of the same specimen, $\frac{1}{8}$ natural size. The dotted lines indicate missing parts. (Restored and drawn by the author).

Figures 1 and 2 were drawn by Mr. J. H. Blake, from alcoholic specimens.

PLATE XVI.

Figure 1.—*A. Harveyi* (No. 5). Portion of the lining membrane of the palate, enlarged.

Figure 2.—*A. Harveyi* (No. 5). Caudal fin, $\frac{1}{10}$ natural size, drawn from the preserved specimen.

Figure 3.—*A. Harveyi* (No. 5). Suckers of tentacular-arm, natural size; *a*, one of the largest suckers; *b*, one of the marginal suckers.

Figure 4.—The same. Horny marginal ring of one of the suckers from a sessile arm, enlarged 2 diameters.

Figure 5.—*A. Harveyi* (No. 4). One of the larger suckers from the tentacular-arms, natural size. From a dried specimen.

Figure 6.—Portion of the marginal ring of the same sucker, enlarged.

Figure 7.—*Loligo pallida* V. Part of odontophore, much enlarged.

Figure 8.—*Architeuthis Hartingii* V. Part of odontophore, enlarged. Copied from Harting's figures.

Figures 5 and 6 were drawn by J. H. Emerton; the rest by the author.

PLATE XVI*a*.

Figure 1.—*Architeuthis Harveyi* V. (No. 5). Teeth of the odontophore, from the anterior portion, enlarged 18 diameters; *a*, median; *b*, inner lateral; *c*, and *d*, the two outer lateral teeth; *e*, marginal plates.

Figure 2.—The same. Teeth from the same specimen, from farther back, on the dorsal portion of the odontophore. Lettering as in figure 1.

Figure 3.—The same. Anterior portion of odontophore, showing the teeth nearly in their natural positions, enlarged.

Figure 4.—The same. Portion of the membrane lining the palate, showing teeth and hard granules, enlarged.

Figure 5.—The same. Two of the granules from the membrane lining the mouth, enlarged 18 diameters.

Figures 6 and 6ª.—The same. One of the largest and least oblique of the horny rings from the suckers of the sessile arms; top and side-views, enlarged 1½ diameters.

Figures 7 and 7ª.—The same. One of the medium sized, and more oblique suckers of the sessile arms; top and side-views, enlarged 1½ diameters.

Figure 8.—The same. Another similar sucker, but smaller and more oblique; top-view, enlarged 1½ diameters.

Figures 9 and 9*a*.—The same. One of the horny rings from one of the smooth-rimmed suckers on the 'wrist' of the 'club' of the tentacular-arms; top and side-views, enlarged 3 diameters.

Figures 10 and 10*a*.—The same. One of the small suckers from the terminal portion of the 'club,' top and side-views, enlarged 3 diameters.

Figures 1 to 5, and 8, are camera-drawings by the author. The others are by J. H. Emerton.

PLATE XVII.

Figures 1 and 1ª.—*Architeuthis princeps* Verrill (No. 14). A marginal ring from one of the large suckers of the tentacular-arm; 1, side-view, enlarged 1½ diameters; 1ª, portion of the rim, enlarged 3 diameters.

Figures 2 and 2ª.—The same. One of the medium-sized oblique sucker-rims from a sessile arm, enlarged 1½ diameters; top and side-views.

Figures 3 and 4.—The same. Top and side-views of one of the smaller sucker-rims from a sessile arm, enlarged 3 diameters.

Figures 5 and 6.—The same. Top and side-views of a complete sucker, with its pedicel, from a sessile arm, enlarged 1½ diameters.

Figure 7.—The same. Top-view of one of the smaller, very oblique sucker-rims from a sessile arm, enlarged 3 diameters.

Figure 8.—The same. Portion of the horny rim of a medium-sized sucker from a sessile arm; top-view, enlarged 6 diameters, from a camera-drawing.

Figure 9.—The same. Side-view of the horny ring of one of the largest and least oblique of the suckers of the sessile arms, enlarged 1½ diameters.

Figure 10.—The same. Side-view of the horny ring of one of the marginal suckers of the tentacular-club, enlarged 3 diameters.

Figure 11.—*A. princeps* (No. 13). Portions of the horny ring of one of the large suckers of the tentacular-arm, much enlarged; *a* and *b*, portions of the margin, from the outside; *c*, portion seen from the inside.

Figures 8 and 11 are camera-drawings by the author; all the others are by J. H. Emerton.

PLATE XVIII.

Figure 1.—*Architeuthis princeps* V. (No. 10). Upper jaw, natural size.

Figure 2.—The same. Lower jaw; the dotted line shows the parts that are present on the opposite side.

Figure 3.—*Architeuthis princeps* (No. 1). Part of lower jaw, natural size.

Figures 1 and 2 were drawn by the author; figure 3 by J. H. Emerton.

PLATE XIX.

Figure 1.—*Architeuthis princeps* V. (No. 14). Caudal fin from beneath; from the specimen a few days after it had been placed in alcohol.

Figure 2.—The same specimen, after it had been preserved several months in strong alcohol.

Figure 1 was drawn by J. B. Holder, M.D.; figure 2, by the author.

PLATE XX.

Architeuthis princeps V. (No. 14). General figure; from the recently preserved specimen; restored, in part, in accordance with the measurements of the freshly caught specimen; $\frac{1}{13}$ natural size. Drawn by the author.

PLATE XXI.

Figure 1.—*Sthenoteuthis megaptera* Verrill. Body seen from beneath, $\frac{1}{8}$ natural size; from the alcoholic specimen.

Figure 2.—The same. Part of the membrane lining the palate, enlarged 8 diameters; *a*, and *b*, from different places.

Figure 3.—The same. A single row of teeth from the odontophore, enlarged 8 diameters.

Figure 4.—The same. Teeth from the odontophore, enlarged 16 diameters; *a*, two median teeth; *b*, inner lateral teeth; *c* and *d*, teeth of the two outer lateral rows.

Figure 5.—The same. Two of the outer lateral teeth, profile-view, enlarged 16 diameters.

Figure 6.—The same. Several lateral teeth in their natural sequence, enlarged 16 diameters.

Figure 7.—The same. Two of the next to the outer lateral teeth, enlarged 16 diameters.

Figures 8 and 8ª.—The same. Twenty-second sucker from the ventral arm; front and side-views, enlarged 3 diameters.

Figure 9.—The same. One of the largest suckers from the club of the tentacular-arm; front view, enlarged 3 diameters.

Figures 8, 8ª and 9 are by J. H. Emerton; the others by the author; 2 to 7 are camera-drawings.

PLATE XXII.

Histioteuthis Collinsii Verrill. Side-view of the head and arms; from the preserved specimen, $\frac{1}{7}$ natural size. Drawn by J. H. Emerton.

PLATE XXIII.

Figure 1.—*Onychoteuthis robusta* (Dall). Side-view of one of the specimens, as found on the beach, $\frac{1}{15}$ natural size.

Figure 2.—The same. Dorsal view. The dotted lines indicate portions of the arms that had been destroyed.

Figure 3.—The same. Side-view of the head and siphon, with the anterior part of the mantle, cut open; *e*, the eye; *s*, siphon; *o*, *o'*, *o''*, the three nuchal frills; *c*, *c'*, *c''*, the smooth facets. where the mantle bears upon the neck; *c*, ventral facet of mantle; *c'*, ventral facets at base of siphon; *c''*, dorsal facet of neck; *m*, *m'*, cut edge of mantle.

Figure 4.—The same. The entire dorsal 'pen'; side-view, $\frac{1}{12}$ natural size.

Figure 5.—The same. Ventral view.

Figure 6.—The same. A portion from the middle of the 'pen,' less reduced.

All the figures were made from the fresh specimens by Mr. W. H. Dall.

PLATE XXIV.

Figure 1.—*Onychoteuthis robusta* (Dall). Odontophore; side-view, enlarged $3\frac{3}{4}$ diameters.

Figure 2.—The same. Part of a row of the teeth from near the anterior bend of the odontophore, × 22 diameters; *a*, median tooth, front view; *a'*, side-view of same; *b*, first lateral; *b'*, the same, side-view; *c*, second lateral, front view; *d*, outer lateral, front view.

Figure 3.—The same. One of the inner lateral teeth, side-view. × 54 diameters.

Figure 4.—The same. Median tooth, side-view, × 54 diameters.

Figure 5.—The same. Upper mandible, natural size.

Figure 6.—The same. Lower mandible, natural size.

Figure 7.—The same. Anterior end of cone of pen, showing portion of posterior end of quill inserted into it, $\frac{1}{2}$ natural size.

Figure 8.—The same. Section of a ventral arm, close to the base, natural size; *a*, one of the suckers, side view; *b*, and *b*, marginal membranes; *c*, crest on membrane along outer angle; *e*, median vessel near inner surface.

Figures 1 to 4 are camera-drawings by the author; the rest are by J. H. Emerton.

PLATE XXV.

Figure 1.—*Architeuthis Hartingii* V. Lower mandible, showing anterior portion only, natural size; 1*a*, section of a sucker of sessile arm of same; 1*b*, horny ring of same, natural size. After Harting.

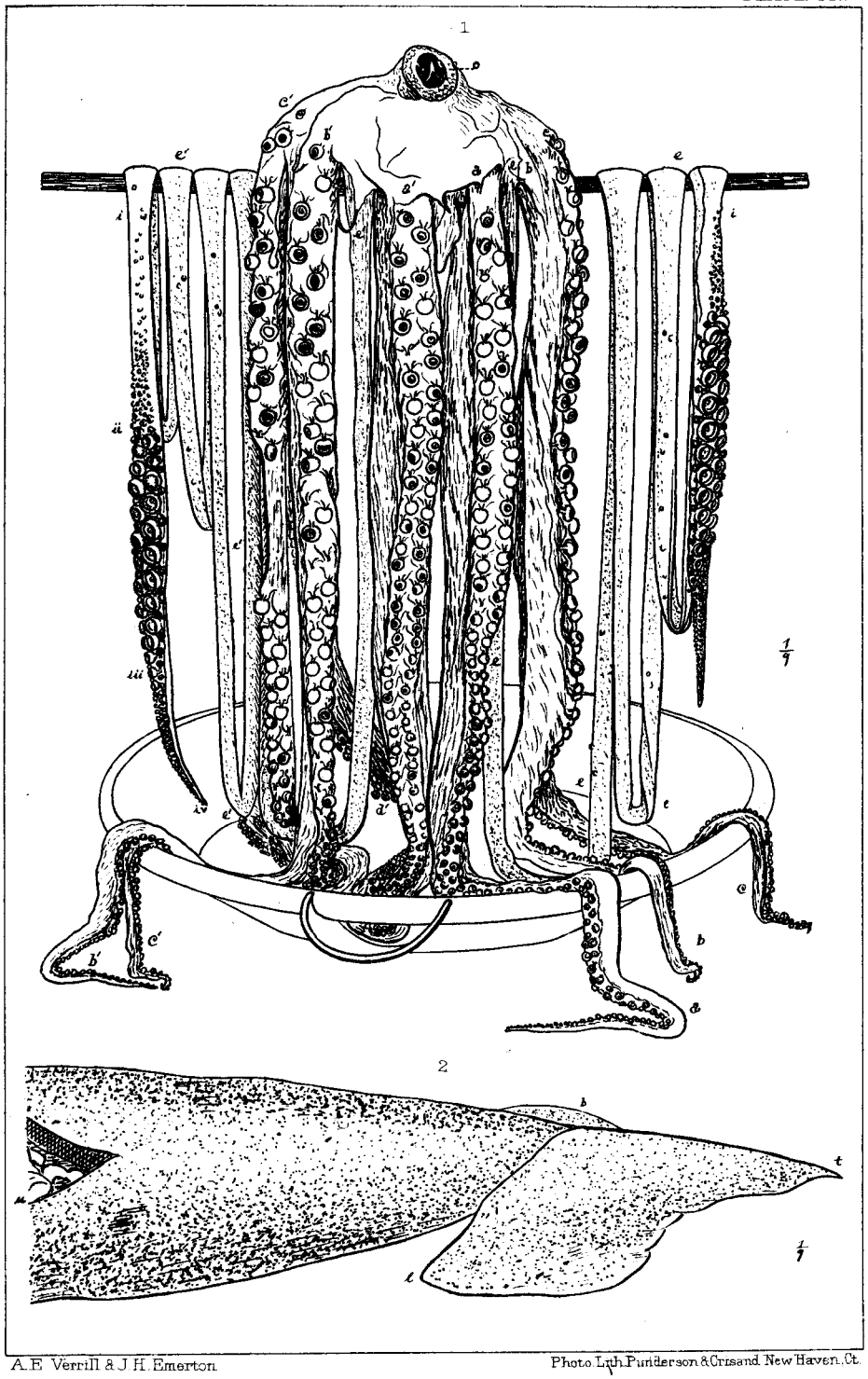
Figure 2.—*Architeuthis dux* Steenstrup. Lower mandible, natural size. Copied from Harting's figure, after Steenstrup.

Figure 3.—*Architeuthis monachus* Steenstrup (type specimen). Lower mandible, natural size. After Steenstrup.

Figure 4.—*Enoploteuthis Hartingii* Verrill. A section of one of the claw-bearing suckers, somewhat enlarged; 4*a*, the horny claw, isolated; 4*b*, median and lateral teeth of odontophore. After Harting.

Figures 5 and 5*a*.—*Architeuthis Harveyi* V. (No. 4). The two halves of the lower mandible, natural size. Camera-drawings from the specimen, by the author.

The author is greatly indebted to Professor S. F. Baird, U. S. Commissioner of Fish and Fisheries, for the use of a large number of the excellent drawings made by Mr. J. H. Emerton, of Salem, Mass., under the direction of the author, for the Fish Commission, many of which are included in these plates.



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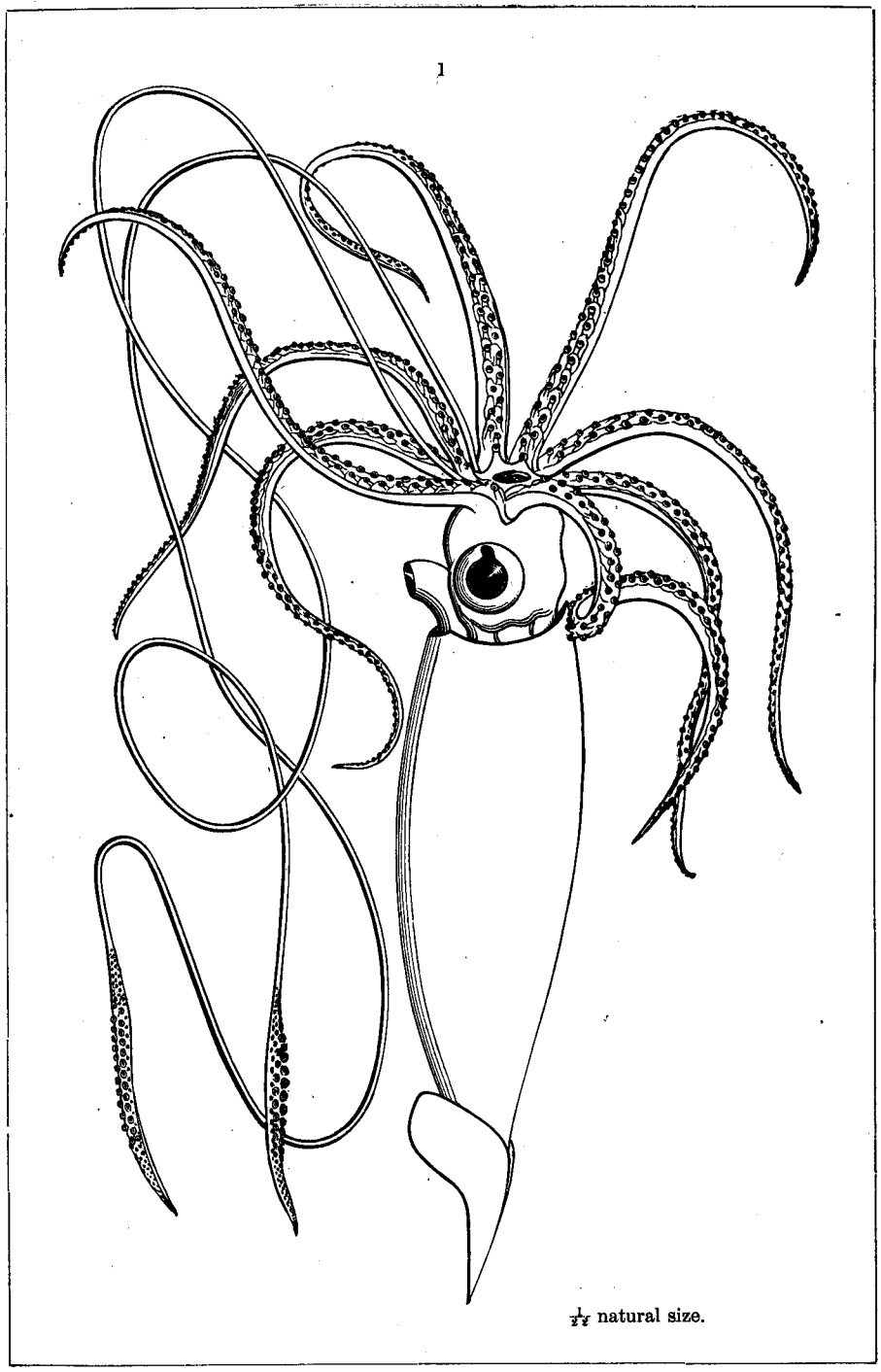
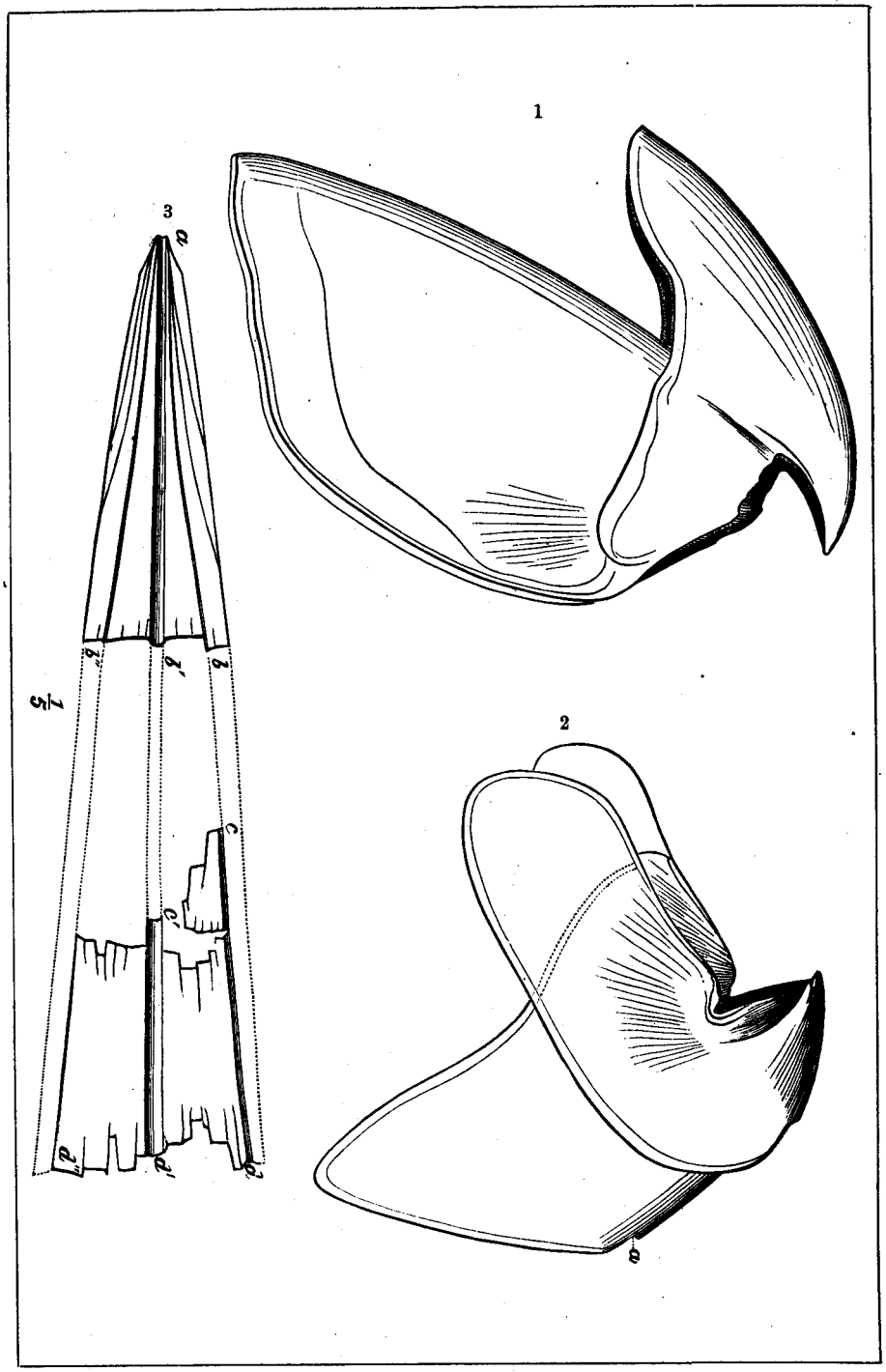
ARCHITEUTHIS HARVEYI VERRILL



Architeuthis Harveyi.



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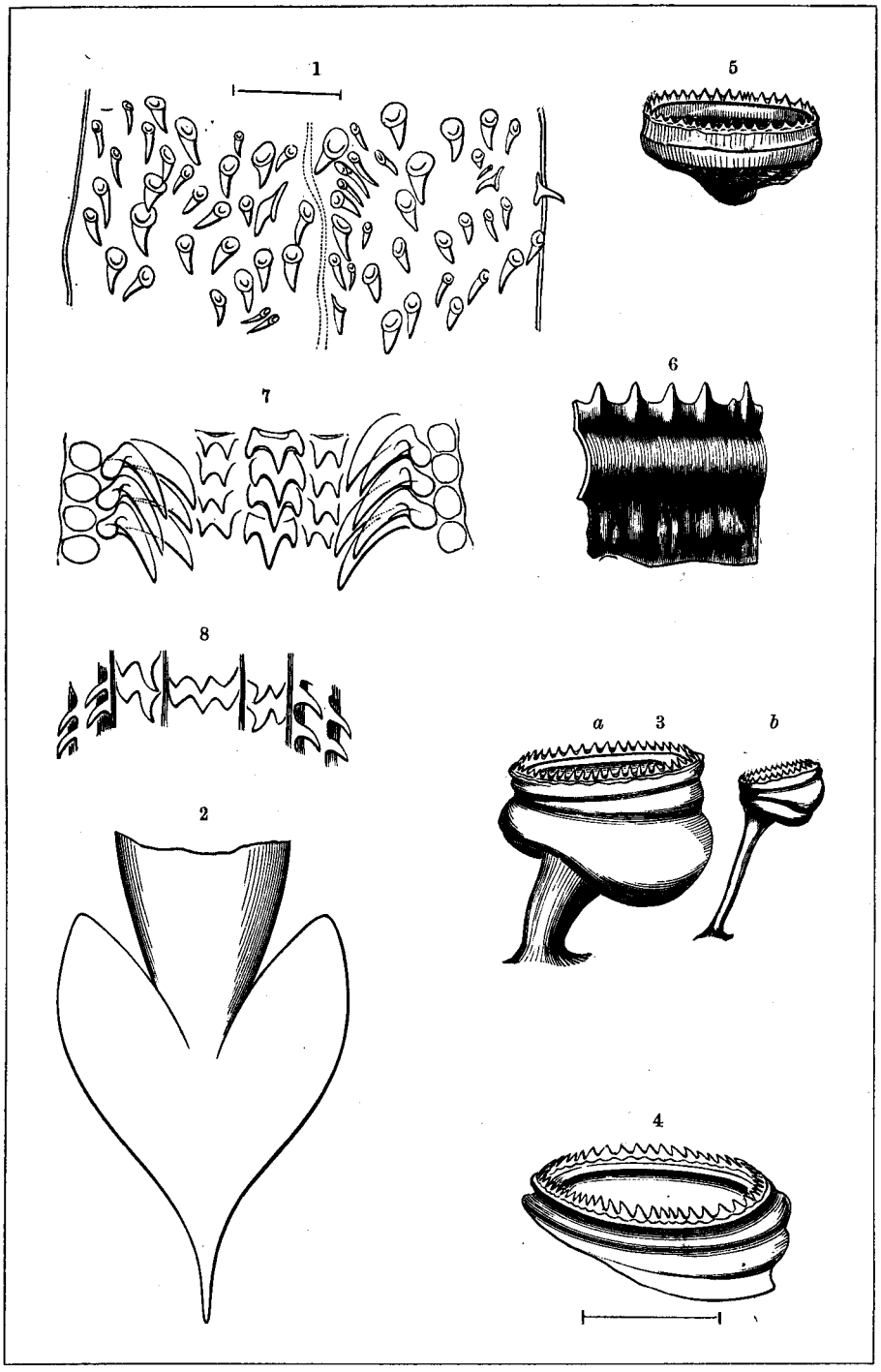
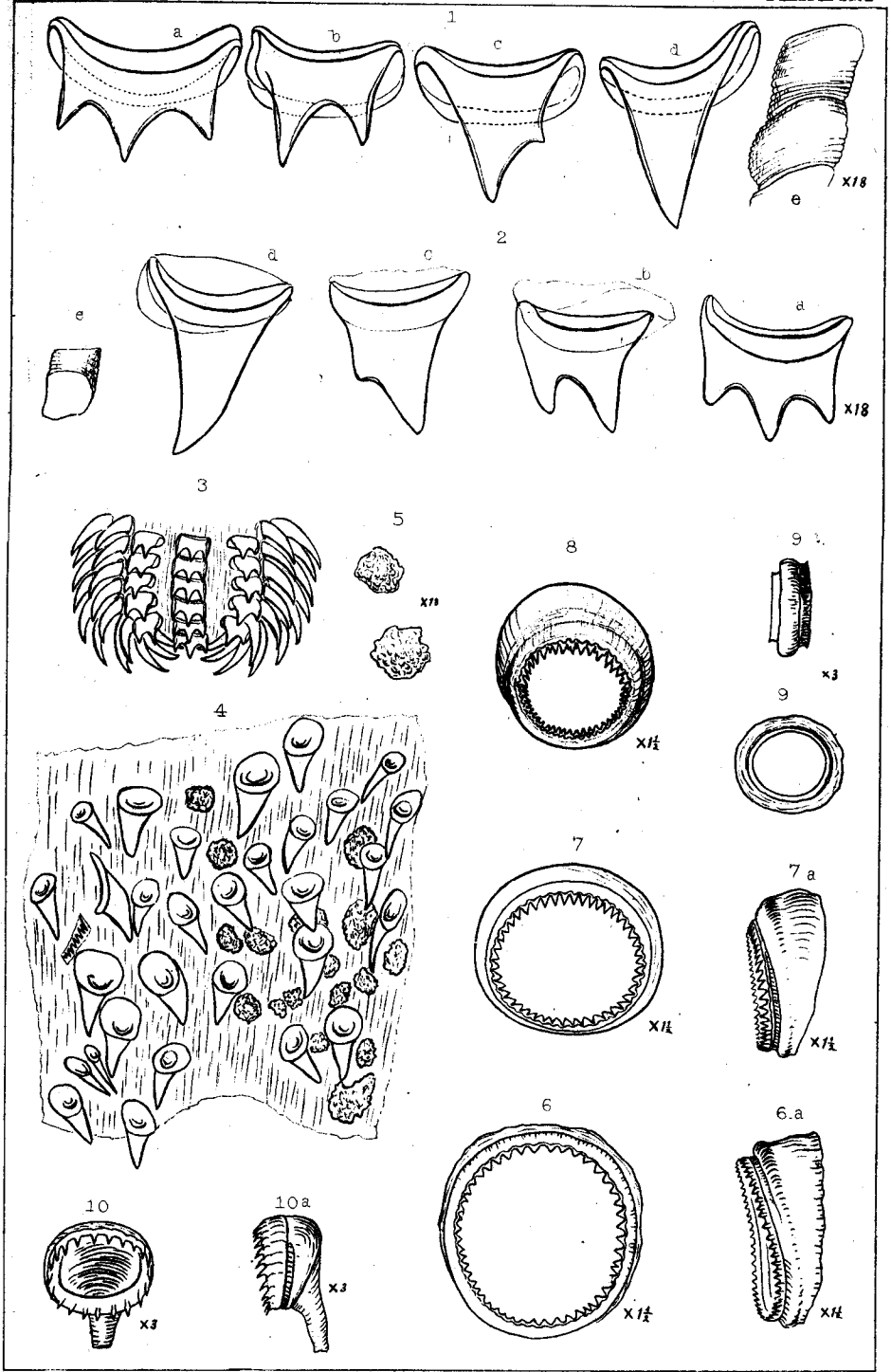


Architeuthis Harveyi, etc.



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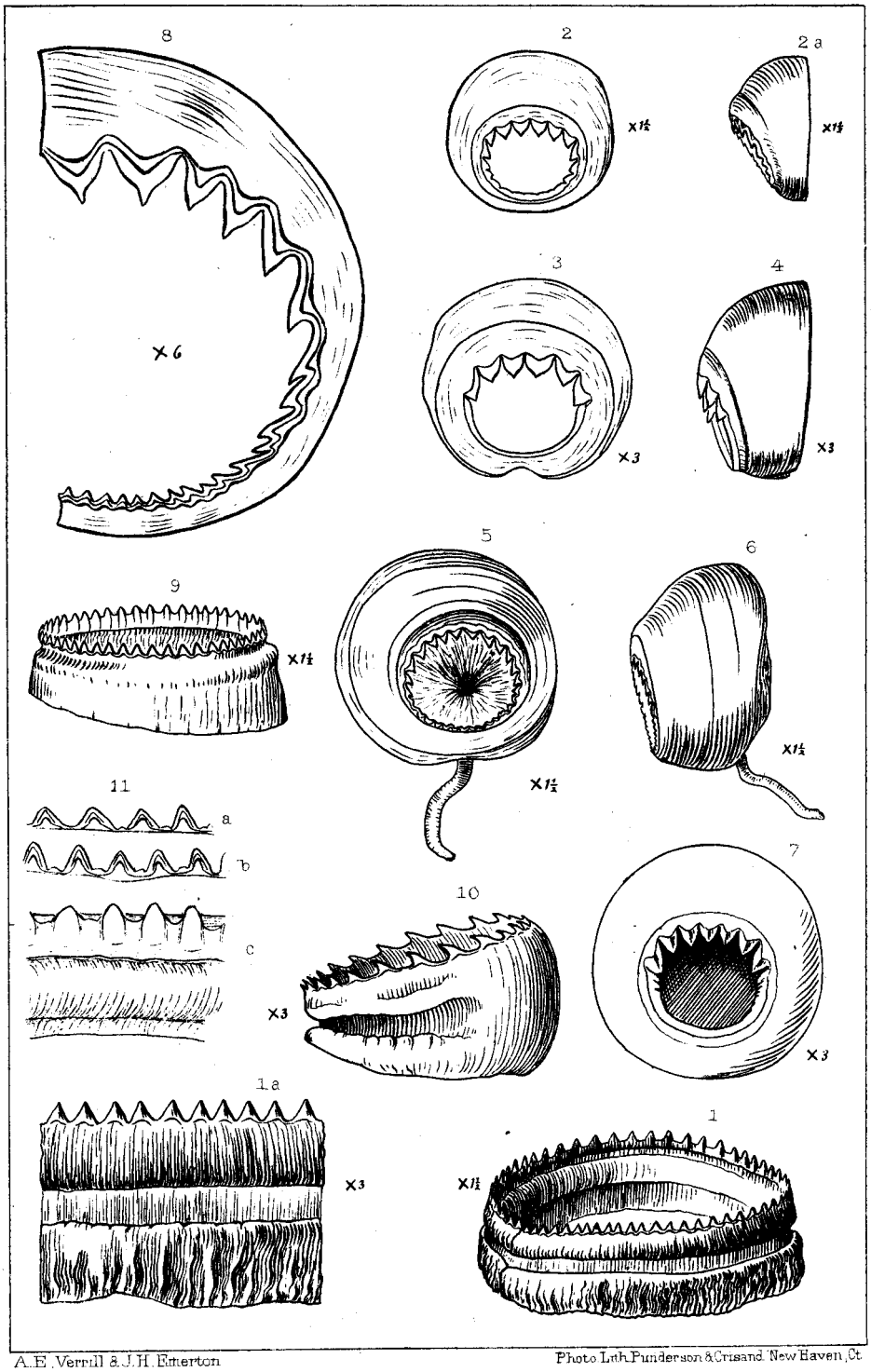
ARCHITEUTHIS HARVEYI VERRILL



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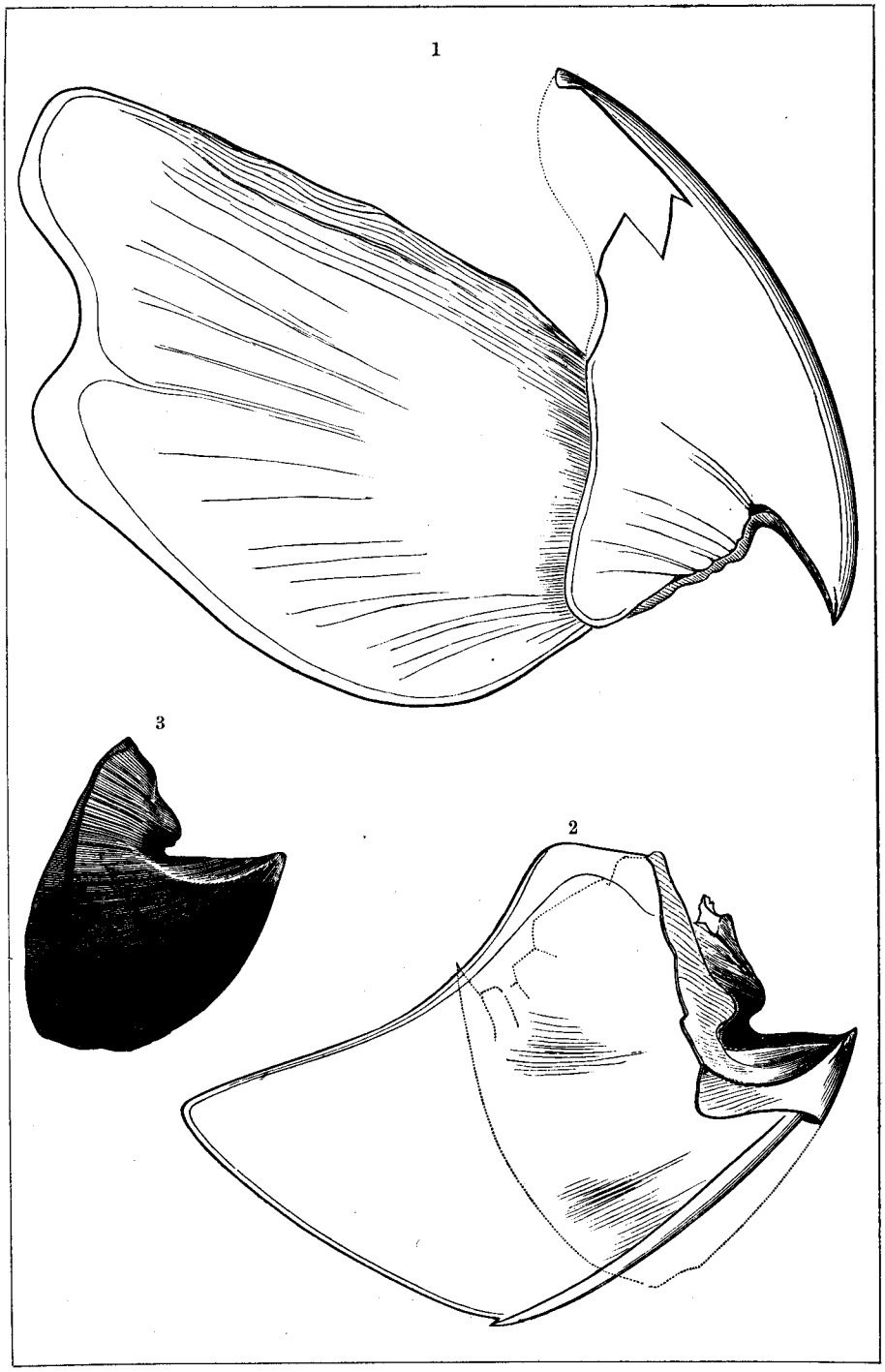
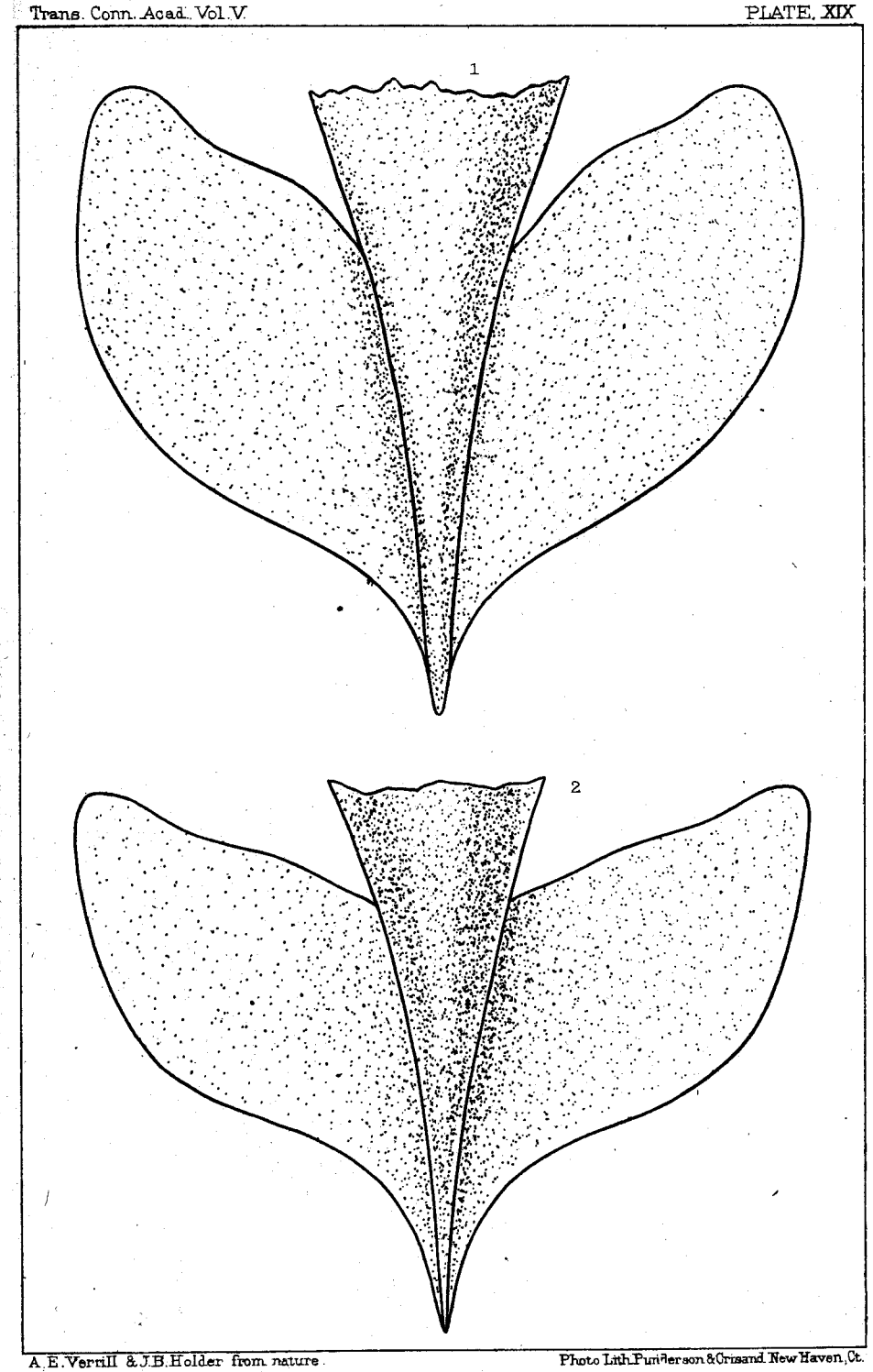
ARCHITEUTHIS PRINCEPS VERRILL



Architeuthis princeps.



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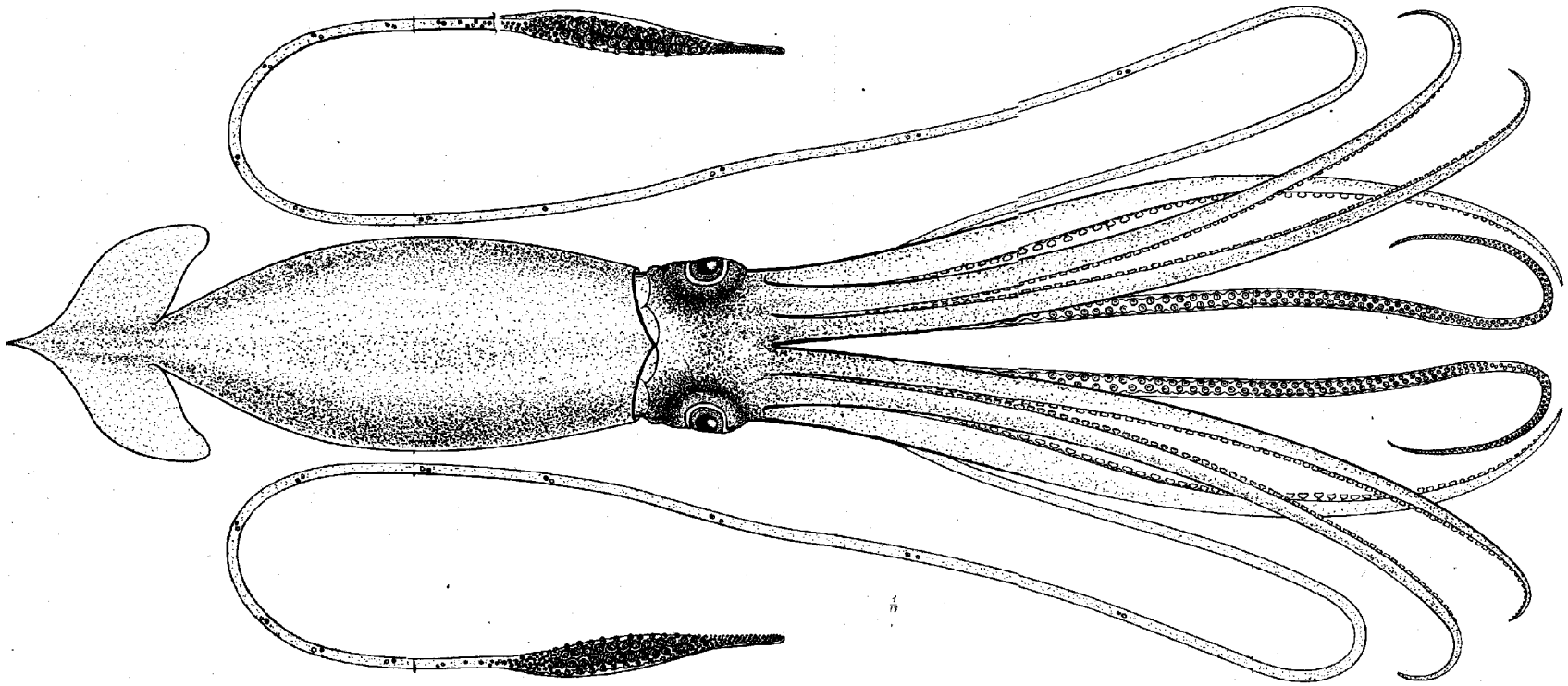
ARCHITEUTHIS PRINCEPS VERRILL



ARCHITEUTHIS PRINCEPS VERRIL.

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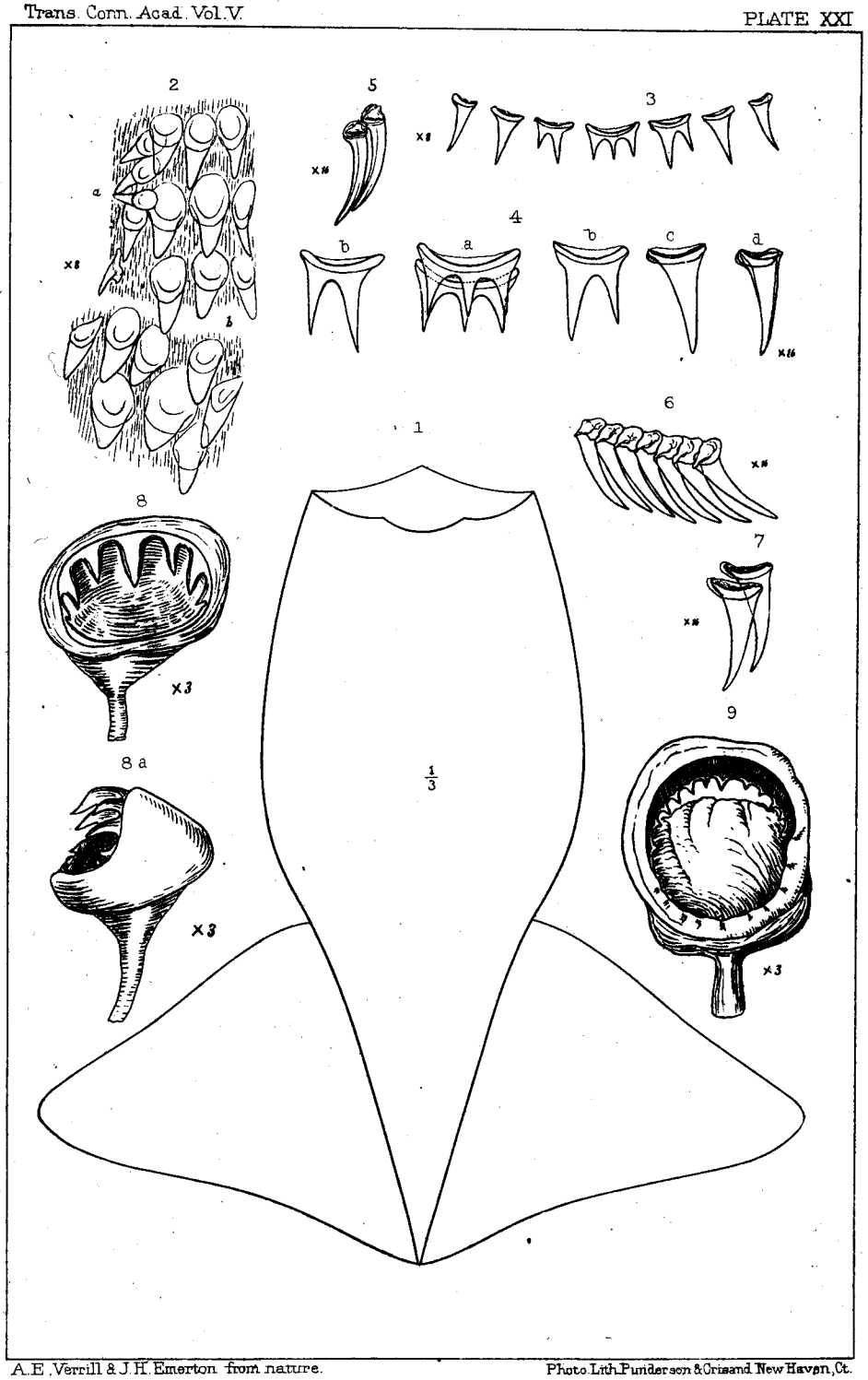

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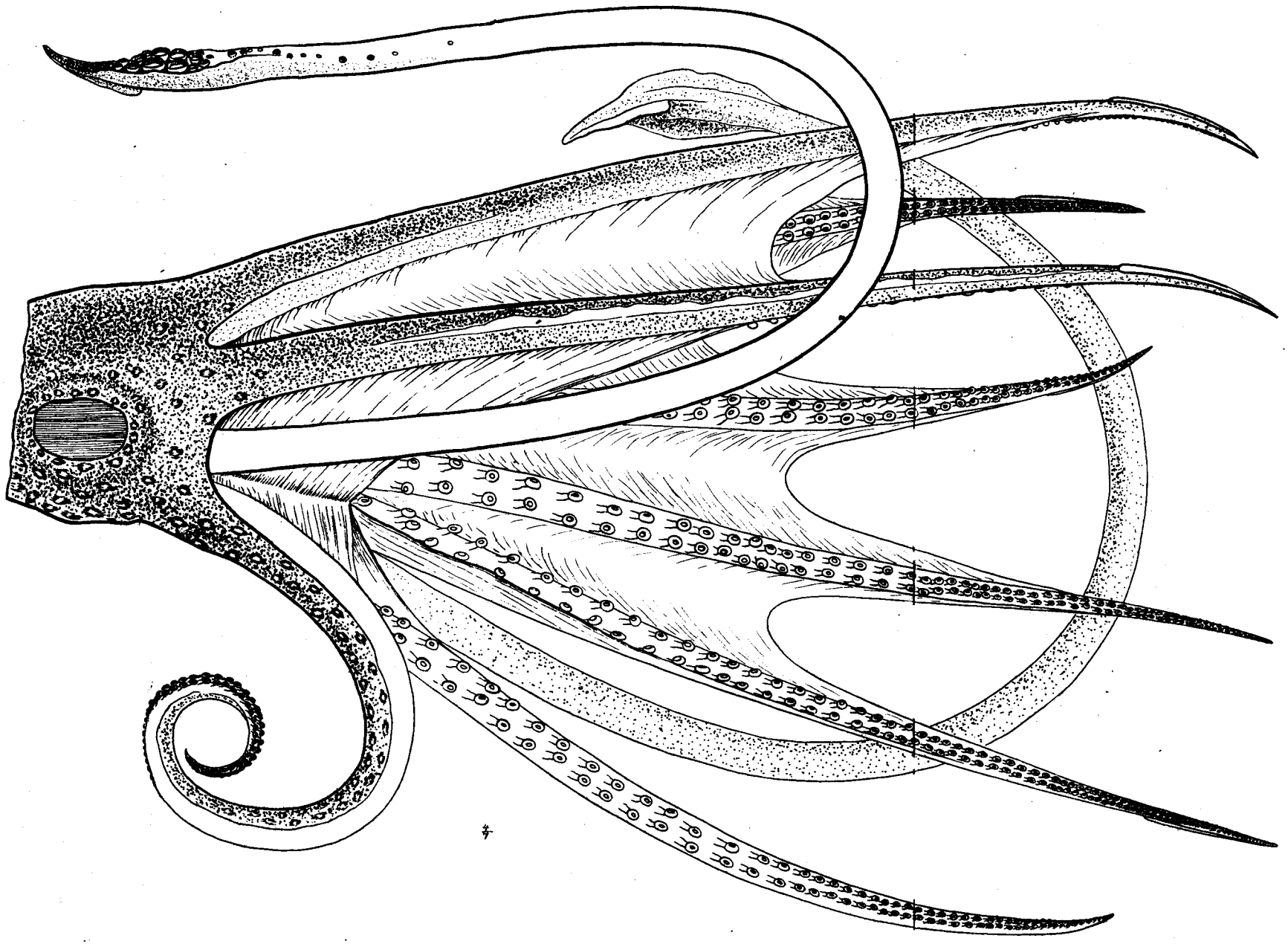
ARCHITEUTHIS MEGAPTERA VERRILL



HISTIOTEUTHIS COLLINSII VERRILL

H. Emerton from nature.

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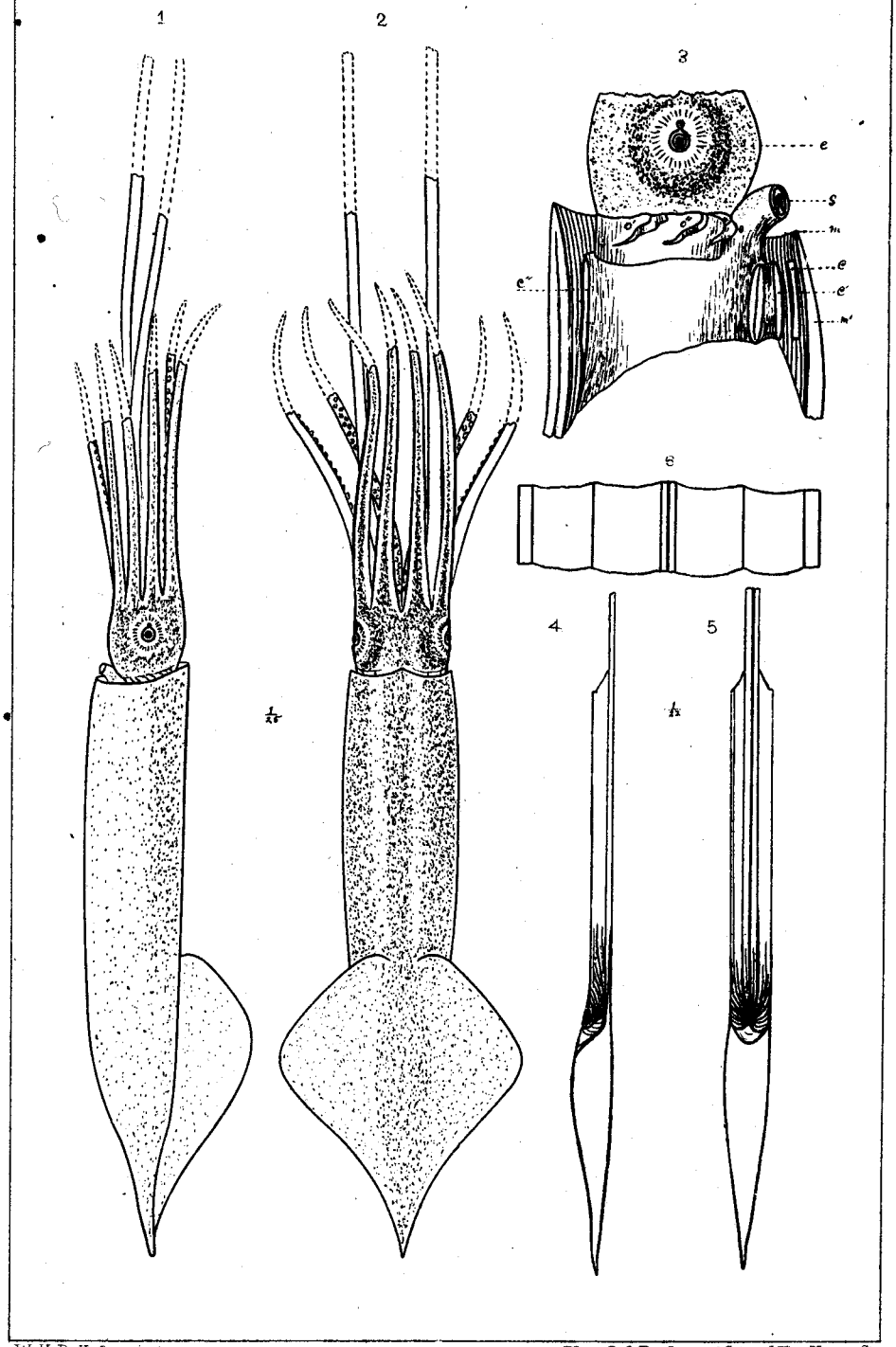

W. H. Dall from nature.

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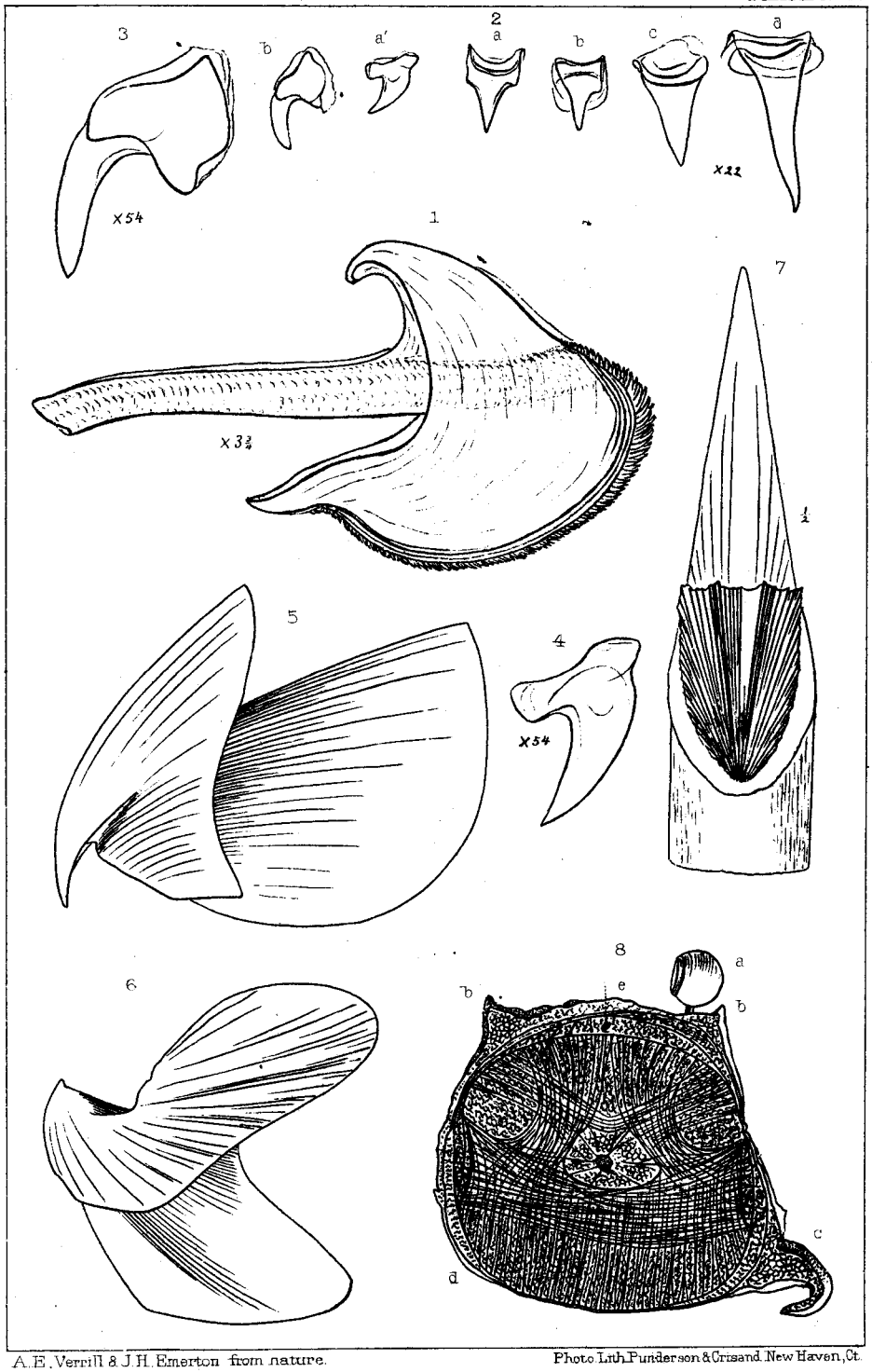
ONYCHOTEUTHIS ROBUSTA (Dall.)



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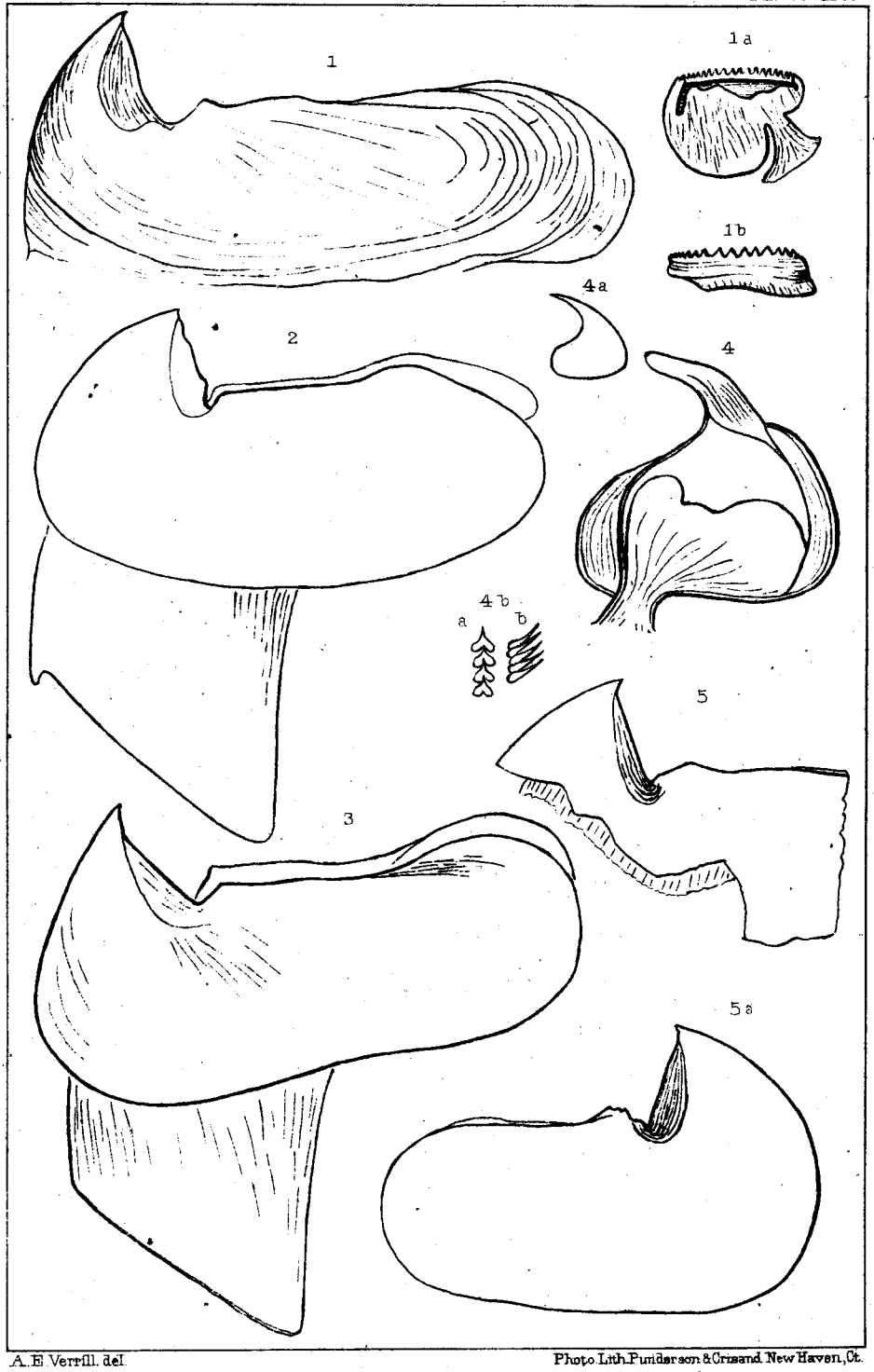
ONYCHOTEUTHIS ROBUSTA (Dall.)



A. E. Verrill. del. Photo. Lith. Punderson & Crisand. New Haven, Ct.