18

MONOGRAPH

OF THE

FOSSIL SQUALIDÆ OF THE UNITED STATES.

BY

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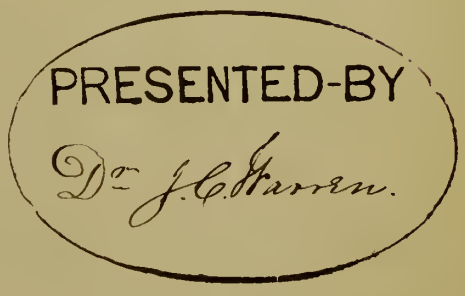

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TO SAMUEL GEORGE MORTON, M. D., &c.

My dear Sir:—

At your instance I was induced to undertake this Monograph. Allow me to inscribe it to you, as a small tribute for your distinguished contributions to American science, and in testimony of my respect and esteem.

Sincerely yours,

ROBERT W. GIBBES.

FOSSIL SQUALIDÆ OF THE UNITED STATES.

"When CUVIER closed his researches in this department, he had named and described for the guidance of the geologist, ninety-two distinct species of fossil-fish; nor was it then known that the entire geological scale, from the *Upper Tertiary* to the *Grauwacke*, inclusive, contained more. AGASSIZ commenced his labours, and in a period of time little exceeding fourteen years, he has raised the number of species to sixteen hundred. And this number, great as it is, is receiving accessions almost every day."—*The Old Red Sandstone*, by Hugh Miller.

"Grandiaque effossis mirabitur ossa sepulchris."—*Virgil*, 1 *Georgic*, 493.

My collection of fossils is rich in the teeth of *Squalidæ*, from the Tertiary beds of South Carolina. I say rich, in comparison with the meagreness of the public museums and private cabinets with which I am acquainted. With the aid of the admirable work of PROFESSOR AGASSIZ, "*Sur les poissons fossiles*," I have been able to identify many of them; and finding several new forms, I have concluded to attempt their classification and description. Following the minute distinctions of that eminent observer, I had extended my list largely with new species, when a favourable opportunity occurred of submitting my specimens to his inspection.

With the candor of a conscientious lover of true science, and the kindness and liberality of a mind free from all selfish consideration, he informed me that many of his species had been described from single specimens and the observations of others—that farther knowledge has induced him to reject several species and to unite others—and that he had formerly considered as forming distinctions, characters not sufficiently fixed to constitute uniform differences. In the present effort for the advancement of American Palæontology, it becomes me at the threshold to acknowledge the essential aid of the labours of this eminent naturalist, to whom I am indebted for the ability to arrange this synopsis. With his acknowledgement,—"mais c'est aussi la partie la plus difficile de l'Icthyologie, celle sur laquelle, de l'aveu même de tous les naturalistes, l'on possède le moins de renseigmens prècis, celle enfin qui, avec le temps, devra recevoir les additions les plus considerables,"—I trust that others may be induced to extend what I have commenced. With the

exception of the figures published by Dr. Morton,* and a few by Dr. Harlan,† no attention has been given by American naturalists to the fossil *Squalidæ*. In the publications on Tertiary Geology, by Conrad, Vanuxem, Lea, Rogers, Hodge, &c., they are merely noticed as occurring, but no attempt has been made to arrange or describe them.

In some of the early works on Fossils, we find notices of the teeth of *Squalidæ* under the names of *Bufonites* and *Glosso-petræ*,‡ and in Sir John Hill's "History of Fossils," (London, 1748,) are some very good figures of species easily recognized in our collections. His general description being condensed, I take from it the following graphic and comprehensive, though poetical paragraph:

"In shape they are usually somewhat approaching triangular, and some simple, others tricuspidate or having a smaller point on each side the large one; some of them are very long, others shorter, and some very broad in proportion to their length; others as remarkably slender, and narrow; many also of them are quite straight, but they are not unfrequently met with crooked, and are bent in all the different directions, some inward, some outward, and some sideways, either to the right or left. Many of them have their edges plain, others are serrated more or less deeply, and some of them are undulated or shaped like the figure of a flaming sword at their extremities, and more slightly serrated besides; they are of as various sizes as figures, the larger ones being found of between four and five inches long, and the smaller of less than a quarter of an inch. They are found in vast numbers in Germany, but nowhere so common as in the island of Malta."

Malta seems, even in our time, to be the prolific source of these fossils, as M. Agassiz mentions the frequency of specimens in various European collections marked from this locality.

In attempting to trace the history of fossil *Squalidæ*, I find little to refer to that M. Agassiz has not given, and I am forced again to acknowledge, as Dr. Mantell has emphatically done in his "Medals of Creation," as to fossil Fishes, that to his great work am I indebted for a large portion of my text.

Formerly the character of the skeleton, whether osseous or cartilaginous, and the number and position of the fins, were the bases of classification of Fishes, but the observation and experience of the distinguished naturalist I have named, have caused him to arrange them by the form and structure of the scales. His division into *orders* has been continued into *genera*, founded on his own and the microscopic researches

* Synopsis of Organic Remains, &c. † Medical and Physical Researches.

‡ Scilla was the first who detected as the teeth of sharks the supposed *Glosso-petræ* (petrified tongues of serpents.) Even at this day I have had them sent to me as petrified birds' tongues.

of Professor Owen, of London, who has given to the world a splendid result of laborious and scientific study in his Odontography.*

The family of *Squalidæ*, which it is proposed here to illustrate, belongs to the first *order* of Agassiz, denominated Placoids (from πλαξ, a broad plate.) The skin is irregularly covered with enamelled plates, sometimes large, but often in the form of small points, forming shagreen in sharks, and tubercles in rays. Of these families no remains are found in a fossil state other than teeth and vertebræ; though an exception should be noticed in the discovery of the *mouth of an Hybodus*, lately reported by Sir Philip Egerton, from the secondary of the Isle of Wight, in which the cartilaginous alæ were traceable, and a part of the anterior cranial cavity.†

The *Squalidæ* constitute a large portion of the fossil remains of Fishes, and are confined to the *secondary* and *tertiary* formations. An interesting observation of Agassiz's is here worthy of notice.

"De la comparaison des espèces fossiles avec les espèces vivantes, il résulte un fait bien curieux, conforme à ce que l'ètude du developement génétique du règne animal nous apprend de tous les groupes bien étudiés, c'est que les types génériques qui prévalent dans la création actuelle, ou n'ont pas de représentans parmi les fossiles, ou bien sont limités aux terrains tertiaries et crétacés; tandis que les genres qui paraissent isolés dans notre époque, comme les genres *Mustelus* et *Cestracion*, sont représenté par de nombreux genres analogues dans toute la sérié des terrains secondaries."‡

Notwithstanding the differences we observe in the many forms of teeth of sharks, they all possess one essential character of structure, namely, a base or osseous root, of variable form, fixed in the integument, and a crown or exposed portion projecting into the mouth, covered with a greater or less thickness of enamel, assuming many modifications by which the genera are characterized. These teeth only adhere to the integuments and the covering of the jaw, and possess great mobility. They are usually in rows, of which the anterior having been used fall out and are replaced by others; and new teeth are constantly forming within to succeed the outer as they are lost. The base of these teeth is large and wide, rounded and hollowed or grooved, but never conical nor terminated in acute points; the root is osseous, more or less compact or spongy, without any inner cavity. The crown is variable in form and size in different genera, and even in different parts of the same jaw. In some which are subulate and more or less triangular and compressed, those in the anterior portion of the jaw are straighter and sharper than those in the posterior parts, which are oblique and obtuse. There are marked differences sometimes in the teeth of the

* Odontography: or a Treatise on the Comparative Anatomy of the Teeth; their physiological relations, mode of developement, and microscopic structure; illustrated by upwards of one hundred and fifty plates. By Richard Owen, F. R. S., &c. London. 1845.

† Quarterly Journal of the Geological Society, London, vol. i. p. 198. ‡ Poissons Fossiles, vol iii. p. 75.

upper and lower jaw, being straighter and more acute in one than in the other. When the front teeth are similar to those at the sides, they are usually smaller and more pointed, and at the symphysis in both jaws often there is a small tooth, or several of a peculiar form.

The teeth are also characterized by serratures varying in size, and by small lateral denticles, which are not always present in young teeth and do not form specific distinctions, though in adults assist in referring them to species.

Professor Agassiz has pointed out a distinction between *Carcharias* and *Carcharodon*, in the dentine of the former presenting a hollow cone, while in the latter it is solid, the only character they have in common being their microscopic structure. As the latter genus is one of the most prolific in species and prominent in size and form, I commence the series with it.

Genus CARCHARODON, *Smith.*

SPECIES.

1. C. MEGALODON, *Agass.*
   - *Var.* RECTIDENS, *Agass.*
   - " SUBAURICULATUS, *Agass.*
2. C. ANGUSTIDENS, *Agass.*
   - *Var.* LANCEOLATUS, *Agass.*
   - " HETERODON, *Agass.*
   - " MEGALOTIS, *Agass.*
   - " AURICULATUS, *Agass.*
   - " TURGIDUS, *Agass.*
   - " SEMISERRATUS, *Agass.*
   - " TOLIAPICUS, *Agass.*
3. C. ACUTIDENS, *Gibbes.*
4. C. MORTONI, *Gibbes.*
5. C. LANCIFORMIS, *Gibbes.*
6. C. SULCIDENS, *Agass.*

The general form of the teeth of *Carcharodon* is that of an isoceles triangle, those in the upper jaw being usually a little larger than in the lower, and not as dissimilar as the upper and lower teeth of *Carcharias*. At the symphysis they are almost entirely straight; the next have their edges sloping, and the last are almost without the middle cone. In the lower jaw they are pointed and sloped similarly on both edges; but what distinguishes them particularly from those of the upper jaw, is a very perceptible furrow in the enamel at the base of the crown. The whole circumference of the cutting edges is covered with fine notches, (dentelures) very

distinct and uniform in the teeth of both jaws. In many fossil species there are lateral denticles on both edges at the base of the cone, which assist in distinguishing species, but are not uniform characters. In the geological distribution of the species of this genus, it is a remarkable fact that a large number are found fossil, while there is but a single representative in the recent *C. lamia ;* and the reverse is the case with *Carcharias*, which includes numerous recent species, and has but few fossils. AGASSIZ mentions only one, and doubts of another. The genus *Carcharodon* is not found beyond the *Tertiary*, the oldest remains being found in the *calcaire grossiere* (Eocene.) In Europe he mentions the SWISS *molasse*, (Miocene,) as prolific in this genus, while in South Carolina I find the Eocene more largely productive of them. I have received a few from the former localities, while I have them abundantly from the Eocene. I learn from PROFESSOR AGASSIZ that Mr. Tuomey, who has collected *Squalidæ* in the Tertiary beds of Virginia, has found more specimens of *Carcharodon* in the *Miocene.*

1. C. MEGALODON. Figs. 1 to 9.—The general form is equilateral, the anterior and posterior edges differ somewhat in the upper and lateral teeth, in consequence of the slope and obliquity backwards. The marginal indentations are uniform over the whole contour of the edges. The enamel is thin but strong, and extends to the root on the outer surface, while there is a large triangular space between them on the inner. This space in large and old specimens is rough with longitudinal cracks or superficial fissures. The thickness is very considerable, in which it differs from the European co-species. The inner face is prominent and the outer flat, in some depressed next the edges and elevated in the middle, giving an undulated appearance. The root is very thick, forming one-third or more of the depth of the tooth; it is concave on the lower surface between the basal extremities, which are rounded or flattened and for the most part symmetrical. The osseous structure is dense and compact, and frequently cracked with fissures. The enamel is also usually striated with longitudinal cracks.

Fig. 1 is a lower tooth, and fig. 2 an upper lateral one ; fig. 4 is of the variety *C. rectidens*, and figs. 5 and 6 of *C. subauriculatus*, both which Agassiz now refers to this genus ; fig. 3 is probably a symphysial tooth ; figs. 7 and 8 are young teeth, the last destitute of dentelures and probably form the extreme posterior portions of the jaw ; fig. 9 resembles *C. sulcidens*, but intermediate specimens prove it to belong to *C. megalodon.* I have various specimens from the *Eocene* of South Carolina, and *Miocene* of Virginia and Maryland. The largest individual measures six and a half inches in height, and five inches across the extremities of the root.

Professor Owen in his Odontography (p. 30) says:

"Fossil teeth, precisely corresponding in form with those of the *Carcharodon*, occur abundantly in the tertiary formations of both the old and new continents; some of these teeth exhibit the extraordinary dimensions of six inches in length, and five inches across the base. If, therefore, the proportions of these extinct *Carcharodons* corresponded with those of the existing species, they must have equalled the great mammiferous whales in size; and, combining with the organization of the shark its bold and insatiable character, they must have constituted the most terrific and irresistible of the predaceous monsters of the ancient deep."

"In the United Service Museum there are preserved the jaws of a *Carcharodon*, of which the upper one measures four feet and the lower one three feet eight inches, following the curvature. The length of the largest tooth is two inches, the breadth of its base one inch nine lines: the total length of the shark was thirty-seven feet."

Mr. Charlesworth has given a good figure of *C. megalodon* in the *Magazine of Natural History*, (Vol. i. 1834,) and considers it from the *Miocene*, and Agassiz views it as proper to the *Medial Tertiary*. In the United States we must consider it as common to both Eocene and Miocene.

There are several fine specimens in the Museum of the Medical College of the State of South Carolina, at Charleston, from the *Eocene*, and others in the Academy of Natural Sciences of Philadelphia, but their locality is not given.

Professor Hitchcock, in his "Geology of Massachusetts," p. 431, has given a figure of a tooth from the *Eocene* of Gay's Head, which is probably *C. megalodon*.

In my autograph collection of distinguished men, I have the originals of the following letters, indicating that in 1806 Dr. William Reid, of Charleston, had forwarded to Mr. Jefferson specimens of *C. megalodon*, from the Eocene beds of Cooper river. I am indebted to J. Harleston Reid, Esq., for the specimens and the letters:

"Charleston, S. C., February 11th, 1806.

"*Sir*,—Observing you attentive to Natural Philosophy as well as to other branches of science, I take occasion to present you with a fossil, which you may consider a curiosity, and not unworthy of your contemplation. It was found on Ricehope Estate on Cooper river, in forming a canal twenty feet under the surface of the earth, and ten feet above the level of the river swamp. It lay with several others of similar form, in a stratum of earth resembling decayed sea shells, two hundred feet distant from the swamp. I likewise send you a broken one, lest your Excellency should choose to direct a chemical analysis on it. From my experiments, they prove dentous. The curious here have concluded these fossils to be the teeth of some monster unknown at this day.

"I remain with all due respect and the highest consideration, your Excellency's very humble servant, William Reid."

Thomas Jefferson, Esq.

"Th: Jefferson presents his thanks to dr. Reid for the curious fossil teeth he has been so kind as to forward to him, and which have been safely received. he will immediately send them to the Philosophical Society at Philadelphia, which is the best disposition he can make of them for obtaining satisfactory enquiry into their character and origin. he prays dr. Reid to accept his salutations and assurances of respect.

Washington, Feb. 23, '06."

2. C. ANGUSTIDENS, *Agassiz*. Figs. 10 to 38. PROFESSOR AGASSIZ has decided to refer to this species several which he has described by other names, and among them *C. lanceolatus*, *C. heterodon*, *C. megalotis*, *C. auriculatus*, *C. turgidus*, *C. semi-serratus*, and *C. toliapicus*. At the time his descriptions were given he had seen but few specimens, and rather hastily decided upon characters which subsequent experience and the examination of many specimens induce him to refer to one species. My collection contains a very full series of individuals of many varieties of form of *C. angustidens*. Figures are given of them all. While *C. megalodon* is broad and flat, this species is more lanciform and narrower—the former is destitute of lateral winglets while this is characterized by them well developed on both sides—in some specimens distinctly separate from the principal cone, while in others placed on the same base, the enamel being continuous over both at the radicle. In nearly all the individuals the crown is perpendicular, occasionally tending slightly inwards, but oftener outwards. The bodies are arched on the inner surface, flat outwardly, and are covered with a dense firm enamel, usually preserving a beautiful polish, the apex is more or less acute and the edges indented with well marked serratures, which in the winglets are so prominent as to make them appear often as if separated into several. In the larger specimens the root is thick and prominent on the inner face and somewhat concave on the outer, its branches are generally symmetrical. In old teeth there is an interspace void of enamel next the root on the inner face, while on the outer the enamel extends to the root.

Figs. 10, 11, 12, represent what Agassiz described as *C. angustidens*; figs. 13, 14, 15, 16, *C. turgidus*; figs. 17, 18, *C. toliapicus*; figs. 19, 20, 21, 22, 23, *C. lanceolatus*; figs. 24, 25, 26, 27, 28, 29, *C. megalotis*; figs. 30, 31, 32, *C. heterodon*; figs. 33, 34, 35, 36, are lateral teeth resembling *C. semi-serratus*; figs. 37 and 38, are probably lateral teeth of an old individual from their greater thickness, and of the variety *C. heterodon*.

Most of my specimens are from the *Eocene* of South Carolina. Fig. 12 is from the *White limestone* (Eocene) of Alabama, and fig. 13 from the same deposit in Wayne county, Mississippi. For these specimens I am indebted to C. S. Hale, Esq., of Mobile. The largest variety in my cabinet is from the *Eocene* Green sand of Santee,

South Carolina, the locality whence I procured the bones of *Basilosaurus, Dorudon, Pristis Agassizi, Crocodilus macrorynchus, &c.* Fig. 14 belongs to the Medical College of South Carolina, and is from the bank of Ashley river (Eocene.) Fig. 15 is from the marl of Ashley river, and was presented to me by Dr. William G. Ramsay, of Charleston.

3. C. ACUTIDENS, *Gibbes.* Figs. 39 to 44 —I published this new species in the Proceedings of the Academy of September last, from which I take the description:

This beautiful species resembles *C. angustidens*, Agassiz, but is very acutely pointed. Of four specimens which are in my cabinet, the largest cone (fig. 39) measures three inches, and it is more than three times the depth of the root, which is concave, very thick and prominent on the inner face. The body of the tooth, or enamelled portion is conical, the lower third swollen, widest next the lateral denticles, which are distinct from it. The inner face is arched, while the outer is nearly flat, though undulated by depressions next the edges, and having a deep furrow longitudinally in the middle near the base of the enamel, which extends to the root. This does not extend as low on the inner face, and is sloped, leaving an interspace next the root. The cutting edges are sharp and finely indented, the serratures very close. Most of my specimens are straight, (figs. 40, 43, 44,) but I have two which are oblique, figs. 39, 41. All are from a locality of (Eocene) Santee limestone in Orangeburg district, South Carolina, with the exception of fig. 41, which is from the marl of Cooper river, sent to me by Col. John Harleston, of Elwood.

There are several of this species in the cabinet of the Academy, labelled from New Jersey, and I have a cast of a fine one found in New Jersey, by Mr. C. Barclay, of Troy, New York.

4. C. MORTONI, *Gibbes.* I have only two specimens, both broken. That which is figured, (fig. 45) and of which a cast is in the collection of the Academy, was probably four inches deep and three inches across the root; the upper third is wanting. It is somewhat inequilateral, the anterior edge sloped inwards, and the posterior arched, both the outer and inner surfaces are convex and prominent, the latter trebly so. The enamel is thin but strong, cracked in striæ parallel to the edges, and as in most other species converging and disappearing towards the apex: it is sloped on the inner face. The cutting edges are finely indented, the dentelures (if I may be allowed to adopt an expressive word from the French) are very small, and more minute near the base of the enamel. Next the edges on both faces is a longitudinal flattening, giving the appearance of undulations. The root is immensely thick, an inch and a half, and constitutes more than half the bulk of the tooth; it is concave, but the extremities being broken, the form cannot be given; the structure of

the dentine is not as compact as in *C. megalodon.* I have named this fine species in honour of the distinguished pioneer of Tertiary Geology in the United States, Dr. Samuel George Morton.

This species appears to be rare. I have seen a single specimen in the cabinet of F. S. Holmes, Esq., of Charleston, and have met with none elsewhere.

5. C. LANCIFORMIS, *Gibbes.* Figs. 46, 47, 48, 49, 50, 51.—Very flat, acutely pointed, triangular, nearly equilateral; the posterior edge slightly sloped, while the anterior is straight. The root is not much thicker than the base of the cone, very concave, the rami not symmetrical, one being much longer than the other; in the small lateral teeth this, however, is scarcely perceptible. The edges are sharp and finely indented; the inner face elevated, the outer plane, in some specimens concave. Viewed laterally some are much bowed or arched forward. In the middle of the outer face near the base of the enamel, is a longitudinal depression, the sides of which are elevated, and unite above the horizontal middle line, and form a ridge to the apex. It has lateral appendages, which are not distinct from the principal cone. The enamel extends lower on the outer face than on the inner.

I have a series of specimens from the Eocene beds of Ashley and Cooper rivers, South Carolina.

6. C. SULCIDENS, *Agassiz.* Figs. 52, 53.—These are remarkable for their pointed form and flatness and thinness. They have the form of an isosceles triangle, and are about one-third deeper than long in their bodies. The inner face is a little rounded, the outer is flat, appearing even concave. On the inner face near the base of the enamel there is a series of plaits or folds, which causes grooves or vertical furrows. The root forms a fourth, sometimes a third of the height of the tooth, it is regularly concave and is recognized always by its spongy appearance. The base of the enamel is nearly parallel to the base of the root, at least on the outer face.

I have two large specimens from the *Miocene* of Darlington, South Carolina, one of which is figured, fig. 52, and several from the *Eocene* of Orangeburg, South Carolina. of which fig. 53 is the largest.

Of Professor Agassiz's other species which he retains, I have not met with, specimens from the United States of the following:

C. PRODUCTUS. C. LEPTODON.
C. POLYGYRUS. C. ESCHERI.

Genus CARCHARIAS, *Cuvier.*

This genus differs from CARCHARODON, in the dentine presenting a hollow cone internally, while it is solid in *Carcharodon.*

I have seen only a single specimen from the United States of *Carcharias tenuis,* from the Eocene S. C., too imperfect for description. Agassiz expresses some sui-

prise, that while the recent species are numerous, there are so few fossil. He met with only two.

Genus GALEOCERDO, *Muller and Henle.*

This genus, separated from GALEUS of Cuvier, comprises many species. In *Galeus* the teeth are smooth on the anterior edge, and have few dentelures on the posterior—in *Galeocerdo* they are crenated on the whole extent, but rather unequally—the base particularly has large notches, while the point has but fine indentations. Agassiz had found specimens so uniform in the indentations of the whole contour, that he constituted a genus based on this character, which he called CORAX. I have his authority for the reunion of it with GALEOCERDO, since he has seen many other specimens.

In GALEOCERDO the teeth are equal in both jaws—nearly as deep as long—the anterior edge is regularly arched, the posterior strongly notched, and below the notch are the largest crenatures. The outer face is flat, the inner more or less elevated; the root is not very thick, generally concave and parallel to the base of the crown. Of the species given by Agassiz four are from *the chalk*, and three from the *tertiary*.

1. G. ADUNCUS, *Agassiz*. Figs. 54, 55, 56, 57, 58.—This species is usually about a half inch in length and the same in height—occasionally longer—the anterior edge is a regular arch finely indented, the posterior angulated, more or less obtuse; below the angle the dentelures are well marked, but are scarcely visible above. The base of the enamel is less sloped on the outer than on the inner face, where it forms almost a right angle. The root is more or less concave and moderately thick, as in all *Galeocerdos*. Agassiz's specimens are from the *Miocene* of Europe—mine from the *Eocene* of South Carolina.

2. G. LATIDENS, *Agassiz*. Figs. 59, 60, 61, 62.—Is much less massive and thinner than *G. aduncus*, but is longer in proportion to the height. The anterior edge is less arched than in other species. The cone is short and very pointed on the posterior edge, the angle is very acute in the European species, I think less so in the American. Below the angle the dentelures are well marked, while at the cutting point and on the anterior edge they are very fine. In some specimens they are more distinct near the base on the anterior edge, while in Agassiz's specimens he mentions the reverse, and makes it distinctive of a species. The base of the crown is parallel to the lower edge of the root on the outer face, and differs very slightly on the inner. I have several specimens from the *Eocene* of South Carolina, and one from the *Miocene* of Maryland. For the latter I am indebted to my friend F. Markoe, Jr., of of Washington.

3. G. MINOR, *Agassiz*. Figs. 63, 64, 65.—Very similar in form to *G. latidens*, but

not arched, very small, and the cone more acute. It is almost as high as long—the base of the crown extended—the summit very sharp pointed, edged with fine dentelures on both sides. The root is thick and irregular, the enamel more sloped on the inner or elevated face.

I have specimens from the *Eocene* of South Carolina, and from the *Miocene* of Maryland—the latter sent me by J. G. Bruff, Esq., of Washington.

4. G. EGERTONI, *Agassiz.* Figs. 66, 67, 68, 69.—This was described by Agassiz as *Corax.* The cone is acutely pointed, and nearly perpendicular, sloped on both edges, forming almost an angle on the posterior side in some specimens. The edges are more uniformly indented than in other species. The outer surface is elevated above the level of the root and undulated; the inner much more prominent and smooth. The root is very thick and deep, and forms two-thirds of the height of the tooth. The enamel extends lower on the outer than on the inner face.

My specimens are abundant from the *Eocene* of South Carolina. I have a few given me by Professor Wyman, from Richmond, Virginia, and others from Calvert Cliffs, Maryland, (*Miocene*) by F. Markoe, Jr., and from Hollis Cliffs, Virginia, by J. G. Bruff, Esq.

The large specimen (Fig. 66) is of unusual size. It is from Pocotaligo, South Carolina, presented to me by G. C. Mackay, Esq.

5. G. PRISTODONTUS, *Agass.* Fig. 70.—This species is remarkable for its pyramidal form, and the great size of its crown; from the posterior edge being but slightly sloped, and the anterior forming a sort of elbow, and not a regular arc; the point is nevertheless acute and cutting. The whole height including the root about equals the length, which is sometimes three-fourths of an inch. The dentelures are very equal, though sometimes more strongly marked on the anterior edge. The root is thick and more than half the depth. The enamel extends much lower on the outer face.

The specimen figured is the only one I have seen. It was given me by Professor Frost, of Charleston, and was sent to him from Alabama, and I am disposed to think from the company with which it came, that it is from the *cretaceous* formation. There is another specimen in the Medical College of South Carolina, and I think there are several in the Cabinet of the Academy from the *Cretaceous* of New Jersey.*

6. G. CONTORTUS, *Gibbes.* Figs. 71, 72, 73, 74.—This is an undescribed species, which is very abundant in the *Eocene* of South Carolina and *Miocene* of Virginia.

* I have lately received several specimens from New Jersey, for which I am indebted to Mr. Samuel P. Wetherill, and Mr. L. J. Germain, of Burlington.

The cone is longer and more acute with a twist outwardly in its upper third, which is characteristic. The inner face is rounded, while the outer is undulated; the edges are regularly indented, and on the anterior next the root the dentelures are more developed. The root is very thick and deep.

Genus HEMIPRISTIS, *Agassiz.*

The species included in this genus are somewhat intermediate between GALEOCERDO and CARCHARODON, but the peculiar distinctive character is in the disposition of the marginal serratures. They extend only a certain distance towards the point, leaving it on both sides entirely smooth. The dentelures are very strongly marked, as much so as in any species of GALEOCERDO; in other respects these teeth resemble them. They are pyramidal, larger at the base, acute at the summit, and more or less curved backwards. The outer side is almost flat, the inner prominent. The enamel is perfectly smooth, and no folds exist even at the base of the crown.

Agassiz described two species, but has rejected *H. paucidens*, and preserved

H. SERRA. Figs. 75 to 85.—This has the form of a flat pyramid curved backwards, the edges are cutting, and the notches, which are strongly developed, are continued in some nearly to the point, while in others they are few and low down on the lateral edges. They differ in this respect in the two jaws, as is the case in *Notidanus* and other genera. In the lower jaw they are more conical, higher, more straight at the base, and less curved at the summit. Some are very acutely pointed, so much so as to lead to the belief of there being more than one species. I have, however, a large number, and have traced them in a series of gradual change of size from the broad to the slender forms.

They are flat outwardly and prominent on the inner face, which in some specimens is compressed laterally at the lower third, so as to be very protuberant, giving them the form of a solid triangle. The base of the crown is nearly horizontal, while that of the root is notched in the middle. The root is moderately thick.

My specimens from South Carolina are all from the *Eocene*. I have received several from the *Miocene* of Maryland, from F. Markoe, Jr., and from the *Miocene* of Virginia, from J. G. Bruff, Esq. Agassiz described specimens from the *Miocene* of Europe, but mentions that count Munster had specimens from *the chalk* which he thought similar.

Genus GLYPHIS, *Agassiz.*

The teeth of this genus are peculiarly formed. They are lanciform, with a thick solid and expanded base. The body of the cone is awl-shaped and a little below the point is wider, resembling a graver. The upper portion next the point is flat and

finely dentelated, while the lower part is free from serratures, and in some specimens rounded.

Agassiz describes a single species *G. hastalis*, from the London clay.

G. SUBULATA, *Gibbes*. Figs. 86, 87.—In this species the cone is shorter and thicker proportionally than in *G. hastalis*, Agassiz, and is more straight, convex on both surfaces, more so on the inner; the upper third of the outer face is flat, and the point, which is compressed, has a tendency outward. A sharp lateral edge extends from the apex equally on both sides two-thirds the length of the cone, and is finely and uniformly indented. The root is thick; the enamel extends lower on the outer face and to the root on both. In the smallest specimen figured, the root is very broad and not so thick, and the enamelled base has fine dentelures.

The specimens figured are all I have met with, and are from the *Eocene* of South Carolina.*

Genus SPHYRNA, *Rafinesgue*. ZYGÆNA, *Cuvier*.

The form of the hammer-headed sharks is very remarkable, but there is nothing as peculiar in the character of their teeth by which they can be readily distinguished when isolated, and they differ in the two jaws.

The outer face is flat, and the inner prominent, the marginal indentations are very minute, though often absent, especially in young and lower teeth.

S. PRISCA, *Agassiz*. Figs. 88, 89, 90.—These are flat, thin, and triangular, sharp pointed, the apex turned back; the enamelled base extended equally on both sides from the cone; the serratures are very minute, in some specimens not visible to the naked eye, and in others absent, except on the lateral basal extension. The root is thick, flat on the outer, and convex on the inner side.

These teeth are often found precisely similar except in being crenated and smooth, the former most likely belonging to the upper and the latter to the lower jaw.

Agassiz describes specimens from *the chalk* of Malta, and from the *Swiss molasse;* all mine are from the *Eocene* of South Carolina.

S. LATA, *Agassiz*. Figs. 91, 92, 93.—Distinguished by an enlarged and pyramidal form, as well as by the well marked though fine dentelures over the whole contour of the edges; anterior edge somewhat rounded, posterior notched, outer face flat, inner swollen. The enamel extends low down on the root, which is very thick. The locality of Agassiz's specimens was unknown. Mine are from the *Eocene* of South Carolina.

* I have recently received several specimens from the *Green Sand* of New Jersey, presented by Mr. S. P. Wetherill.

S. DENTICULATA, *Agassiz*. Fig. 94.—Professor Agassiz is in doubt whether this species differs from *S. prisca*. The perpendicular form and acute isosceles-triangular form, and regular distinct and symmetrical denticulations induce me to think it a separate species. I have, however, seen but a single specimen, the one figured.

Genus NOTIDANUS, *Cuvier*.

"In the genus NOTIDANUS, the teeth are not only of different forms in the upper and lower jaws, but also vary considerably in this respect, at the anterior and posterior regions of the same jaw. In the upper jaw, the anterior teeth are large, compressed triangular plates, with the pointed apex arched backwards, and the margins slightly dentated, except in the two anterior ones. The posterior teeth are in the form of simple obtuse furrowed tubercles. In the lower jaw, the large anterior teeth have the apex less produced; the anterior margin is finely serrate, and the posterior divided into three or more denticles. The posterior minute teeth resemble those in the upper jaw. Of the larger teeth there are rarely more than four in each vertical row."—*Owen*.*

N. PRIMIGENIUS, *Agassiz*. Fig. 95.—I have given a figure of the only perfect specimen I have met with, and think it belonged to the lower jaw. It was kindly presented to me by Professor J. Wyman, of Boston, who procured it from the *Eocene* of Richmond, Virginia. I have fragments from other localities. The crown consists of a series of sharp oblique cones, of which the first is the largest and least oblique, the others gradually diminishing in size towards the posterior edge. The large cone is strongly indented on its lower outer half. The length of the tooth greatly exceeds its height; the inner and outer faces are both prominent and differ very little, though the enamel is lower on the inner surface. The root is thick, and equal in depth to the height of the principal cone. Agassiz has met with no fossil teeth of the upper jaw. He describes several species.

Genus LAMNA, *Cuvier*.

C. L. Bonaparte, and Muller and Henlé, include under *Lamna* four genera—*Lamna*, Cuvier; *Oxyrhina*, Agassiz; *Carcharodon*, Smith; and *Selache*, Cuvier—all the characters being drawn from the external form, and no regard being had to the skeleton or teeth. These genera have teeth so dissimilar that they are easily distinguished; but *Odontaspis*, which is included in another family, has teeth so like *Lamna*, that when detached they cannot with certainty be distinguished. Agassiz

* Besides those of Agassiz, good figures are given of various forms of *Notidanus* in the old work of SCILLA, *De corporibus marinis*, Romæ, 1747, and in the recent elaborate work of C. L. Bonaparte, *Iconographia della Fauna Italica*, Romæ, 1832—1841. I find also others in *Oryctographie de Bruxelles*, by F. X. Burtin, Bruxelles, 1784.

is doubtful about separating them, though there are some fixed differences which will aid in classing species. Teeth of *Lamna* are flat, and approach in form *Otodus*, from which they differ in being of less breadth, and having smaller lateral cones. Those of *Odontaspis*, on the contrary, are more cylindrical, more twisted, and have lateral cones longer and more pointed. The number varies—*Odontaspis taurus* has usually only one on each side, while *O. ferox* has two, sometimes three.

Agassiz includes under LAMNA all straight teeth provided with small lateral denticles, and doubts when the species described seems to approach nearer to *Odontaspis* than to *Lamna cornubica.*

When well preserved, there is no difficulty in distinguishing *Lamna* from *Oxyrhina*, since the latter have no lateral denticles. The distinction is more difficult with *Otodus*, as *Lamna compressa* and *Otodus appendiculatus.*

He also includes under LAMNA another type, which he thinks should form a separate genus, *Sphenodus.*

1. L. ELEGANS, *Agassiz.* Figs. 96 to 102.—Lanciform, regular and straight; thickness considerable towards the base of the root, but tapering off towards the point. Inner face ornamented with vertical striæ, very fine and numerous, very distinct near the enamel, extending above the middle of the cone. This is a distinctive character, which we usually find better preserved in small teeth.

The lateral denticles are very small points, sometimes absent, the root is thick, with the branches well developed. Outer face plane or a little elevated, inner very convex so that the tooth has almost the appearance of a slender cone cut through the middle, the edges are smooth and cutting. The enamel extends lower on the outer face, the base straight and horizontal, while it is curved on the inner.

This species is very common in the *Eocene.* I have fine specimens from Claiborne, Alabama, kindly sent me by C. S. Hale, Esq., of Mobile, from Richmond, Virginia, by Professor Wyman, and from Maryland by J. G. Bruff, Esq. In South Carolina they are abundant.

Agassiz mentions them from the Crag (*Miocene*) of England. I have not met with them in the *Miocene* of the United States.

2. L. CUSPIDATA, *Agassiz.* Figs. 103 to 106.—This species is described by Agassiz as common in the Swiss molasse, (*Miocene.*) I have it from the *Eocene* of Washington, Georgia, from Rev. George White, of Savannah, and from the mouth of Potomac Creek, Virginia, presented me by J. G. Bruff, Esq. It is very like *L. elegans*, is in general very thick, of moderate breadth, equilateral, straight, or a little curved back. The edges are smooth and cutting the whole length; external face perceptibly elevated; inner more so. The base of the enamel, which is smooth, is usually sloped at a right angle on the outer face, which is not as well marked on

the inner. The peculiar distinction from *L. elegans* is that it is smooth on both faces, having no striæ. The root is more largely developed than in other species, and cases occur where the branches exceed in length the height of the cone.

Agassiz now refers *L. denticulata* to this species.

3. L. COMPRESSA, *Agassiz*. Figs. 107 to 112.—These resemble much in general appearance the small teeth of *Otodus obliquus*. They are more flat and less broad, the root is less prominent, and the passage to the crown less marked. They are more lanciform, and the cone more slender than in *Otodus*. The denticles are irregular, generally larger in the posterior teeth.

All my specimens are from the Santee Canal, (*Eocene*,) South Carolina. Agassiz described this from imperfect specimens, as *Oxyrhina leptodon*, which he now withdraws.

4. L. ACUMINATA, *Agassiz*. Figs. 113, 114, 115.—This species is of medium size, very thick at the base, edges cutting, nearly equal, outer surface flat, curved outwardly near the apex; inner face prominent; lateral denticles well developed; root thick.

I have met with only three specimens, all from the *Eocene* of Orangeburg, South Carolina.

5. L. CRASSIDENS, *Agassiz*. Figs. 116, 117, 118.—The name of this species indicates its form, which is short and thick. The outer face is flat, the inner prominent and curved backward, the root very thick, and prominent inwardly; edges cutting.

Found in the *Eocene* of South Carolina.

6. L. (*Odontaspis*) CONTORTIDENS, *Agassiz*. Fig. 119.—Agassiz describes this as of a subulate irregular form, much curved inwardly, its internal face having distinct folds from the base to the summit; the root well developed and thick, the branches of the root of moderate size and approaching, the outer face near the point is plane, lower down, and on the inner rounded, the edges near the point are alone cutting; the base of the cone cylindrical. I have seen but few specimens answering this description, and the latter characters, the cutting edge and the cylindrical form of the base are the only points in which it differs from *Lamna elegans*.

Agassiz describes it as abundant in the *Miocene* of Europe. I do not know the locality of the specimens I have, which are figured.

I am lately indebted to Lieut. J. W. Abert of the Topographical Corps, United States Army, for two specimens of teeth (Fig. 119, Pl. xxvi.) from the *Cretaceous*

formation at Poblazon, in New Mexico. They are well marked specimens of *Lamna contortidens*, and are figured by him in his published report to the Secretary of War.

7. L. (*Odontaspis*) HOPEI, *Agassiz*. Figs. 120, 121, 122, 123.—This is the broadest of the subulate teeth, some are thick others more slender, all are nearly cylindrical at the base, edges prominent and cutting towards the point, in proportion as the tooth is flat, root thick and narrow. The nutritive canal is very perceptible at the most prominent part of the inner face of the root. The lateral cones are small and awl-shaped, often rudimentary, seldom preserved in large teeth. Outer face flat near the point, insensibly rounded towards the base, where it is almost as round as on the inner, compressed laterally, smooth, no trace of striæ.

Found in the *Eocene* of South Carolina.

8. L. (*Odontaspis*) VERTICALIS, *Agassiz*. Figs. 124, 125, 126, 127.—Not as twisted as *L. Hopei*, nor like *L. compressa*, because thicker: nor like *L. elegans*, because there are no striæ on the inner face. The prominent characters are straightness and thickness at the base of the enamel, and of the root. The edges even are cutting to the root. Lateral denticles are well marked, base of the enamel more sloped on the outer than on the inner face; the nutritive foramen distinct.

My specimens are from the *Eocene* of South Carolina.

9. L. (*Odontaspis*) GRACILIS, *Agassiz*. Figs. 128, 129, 130.—This is the most slender of known fossil *Lamnæ*, is very slender, has cutting edges the whole length, outer face flat, inner sensibly swollen, no striæ on inner face; branches of root well developed. I think *L. subulata*, Agassiz, identical with this species.

From the *Eocene* of South Carolina.

Genus OTODUS, *Agassiz*.

This is known only fossil. Agassiz has established it as intermediate between *Oxyrhina* and *Lamna* and *Carcharodon*, but easily distinguishable from both. It differs from *Carcharodon* by the entire absence of marginal dentelures, which are of importance, especially in fossil species. The species are in general less in size than *Carcharodon*, and the largest are seldom as large as the smallest of them.

It is more difficult to distinguish *Otodus* from *Oxyrhina;* it has the same broad flat form, smooth at the edges, but *Otodus* is specially characterized by the presence of a lateral denticle on each side, usually equal; often it is rounded, sometimes compressed and sharp, rarely angular or indented. *Lamna* and *Odontaspis* have it, but always smaller, cylindrical, and more pointed and lanciform. The root is largely developed, very deep and thick, but has no elongated branches as *Lamna*. When the root and lateral denticles are detached, it is hard to distinguish *Lamna* from

Otodus and *Oxyrhina*. Agassiz describes several species as of doubtful genus on this account.

1. O. OBLIQUUS. Figs. 131 to 137.—This species is common in New Jersey, whence there are fine specimens in the Cabinet of the Academy. I have casts also of several from Mr. C. Barclay, of Troy, from the *Eocene* of New Jersey. I have no specimen of *O. obliquus* from South Carolina.

It is massive, with a well developed root, so large that in some the depth equals more than half the height of the crown. The outer face is nearly flat, grooved longitudinally in the middle at the base of the enamel, the inner surface is very prominent, viewed *en profil* the root seems deeper on the inner face, where is a space deprived of enamel; below this the root is thickest. The lateral appendages are thick and irregular, more developed in arched than in upright teeth. Agassiz thinks the presence of the lateral denticles not important for species, but much so for the genus.

The prominent character of *Otodus obliquus* is its massive size and preponderance of root. The enamel is dense and very full at the base of the crown. The species described as *Otodus lanceolatus*, by Agassiz, he thinks most probably belongs to *O. obliquus*.

2. O. APPENDICULATUS, *Agassiz*. Figs. 138, 139, 140.—Distinguished by large lateral denticles, compressed and usually obtuse, but some are very sharp. The root is not large, and thinner, and not so deep as that in *O. obliquus;* base of the crown nearly horizontal. The root is absent in two of my specimens, which are from the Green Sand of New Jersey.

3. O. LEVIS, *Gibbes*. Fig. 141.—The tooth here figured I published* as new, and upon reference to the figures given by Agassiz, I find he has one resembling it, (Fig. 7, Tab. 32,) which he doubted about separating from *O. appendiculatus*. The following is my description:

"OTODUS *levis*.—This has very much the form of *Lamna cuspidata*, but the position, form and size of the lateral winglets, mark it as a true *Otodus*. It is more slender than any other of this genus, lanciform, equilateral, straight, convex on the inner face, and undulated on the outer from a triangular depression near the base, extending longitudinally nearly to the apex. The lateral cones are broad and thick, and detached from the base of the enamel, which extends lower on the outer face than on the inner. I have a single specimen (Fig. 141) from the *Eocene* of South Carolina." I have since seen one in the cabinet of the Academy from New Jersey.

4. O. CRASSUS, *Agassiz*. Fig. 142.—This species is distinguished by a considerable thickness, but not as thick as *O. obliquus*. Contrary to other species,

* Proceedings of Academy, September, 1847.

the root has not a marked preponderance. Instead of the outer face being swollen, or strongly prominent, in this it is flat, even at the base of the enamel. The height of the cone does not equal the length of the root. The surface of the enamel is finely striated on both faces. The lateral cones are absent in the only specimen I have seen, but of the identity of the species I have no doubt.

It is from the *Cretaceous* of Alabama.

5. O. MACROTUS, *Agassiz.* Figs. 143, 144.—This is flat in proportion to its size, and is characterized by large compressed, rounded, lateral denticles, detached from the principal cone. The outer face is a plane, the inner full, moderately rounded, with faint striæ visible. The base of the enamel is nearly horizontal, and equal on both faces. The larger specimen figured (Fig. 144) is from the *Eocene* of South Carolina, the smaller (Fig. 143) from the mouth of Potomac Creek, Virginia, given me by J. G. Bruff, Esq.

6. O. TRIGONATUS, *Agassiz.* Figs. 145, 146.—These are small teeth on an elongated base. The cone is straight, pointed, and narrow, with sharp edges. The thickness is not great, the outer face is flat, the inner convex. The lateral denticles are rounded. From Santee, (*Eocene*) South Carolina.

7. O. APICULATUS, *Agassiz.* Fig. 147.—This species is on the confines of *Otodus*, resembles *Oxyrhina hastalis*, but may be distinguished by a very minute lateral denticle on each side of the cone. It is sharp pointed, the apex a little turned back. The anterior edge is straight or slightly arched, the posterior curved. The outer face is plane, the inner swollen, though less so than in other species of *Otodus*, which makes it so flat.

I have figured the only specimen I have seen of this species, from the *Eocene* of South Carolina.

Genus OXYRHINA, *Agassiz.*

This genus is established on the character of the absence of lateral appendages in teeth allied to *Otodus*. It is an important character in fossil genera and species, and the distinction can only be doubtful when the base and root of the specimen are imperfect, as there is then a difficulty in assigning it to *Otodus*, *Lamna*, or *Oxyrhina*.

Oxyrhina is generally known by its broad lanciform shape, differing from *Lamna* which is always narrow and straight. The resemblance is greater between *Otodus* and *Oxyrhina*—*Otodus* is generally larger, more triangular, thicker, and not so flat. The root of *Oxyrhina*, particularly is less thick, and the branches less developed. In other respects *Oxyrhina* approaches *Lamna*.

1. O. HASTALIS, *Agassiz.* Figs. 148 to 152.—The variety of form and dimensions of these teeth, according to their position in the jaw, render their distinction difficult. They are large, elongated and lanciform, the larger teeth mostly equilateral, probably occupying the front; others are more or less arched, very thin, not half as thick as the breadth of the base of the enamel. The root is never as prominent as in *Otodus*, and the terminal portions less developed. The inner face is regularly convex from the base to the summit, and serves to distinguish this species from *Ox. xiphodon*, which is more flat on this side. The base of the enamel is slightly sloped on the outer face, and descends lower on the inner, and is more hollowed on that face. The outer face is flat; on each side parallel to the edge is a vertical furrow, which extends two-thirds or three-fourths of the height; the middle is slightly prominent, with a small depression near the base of the enamel.

I have specimens from the *Miocene* of South Carolina, from T. W. Porcher, Esq., from the *Miocene* of Virginia and Maryland, from J. G. Bruff, Esq., and F. Markoe, Jr., and from the *Eocene* of South Carolina.

2. O. XIPHODON, *Agassiz.* Figs. 153, 154.—There is a single prominent character which distinguishes this species from *Ox. hastalis*, viz., on the inner face, which is ordinarily regularly rounded, at the base of the enamel, is a remarkable flattening, as if ground; unless this face be well preserved you cannot distinguish it; usually *Ox. xiphodon* is larger. All are curved outwardly at the summit. The base of the enamel is almost the same on both sides, a little lower on the outer face. The root, though a little thicker than the base of the crown, is still less developed than in other species. On the outer face are parallel furrows next the edges, which give it an undulated appearance.

The specimens I have seen are all from the *Eocene* of South Carolina.

Agassiz now considers *Ox. quadrans* and *Ox. retroflexa* as forms of this species.

3. O. PLICATILIS, *Agassiz.* Figs. 155, 156, 157.—This is broad, flat and of moderate thickness, resembling somewhat *Ox. xiphodon.* It is distinguished from all others of this genus, by having folds on the outer face at the base of the enamel, numerous and well marked in the middle of the tooth. There is a broad furrow near the edges, and two others exist next the middle. The root is thick, without lateral branches, the base of the enamel is parallel on both faces to the base of the root.

Agassiz described this species as always straight, and *Ox. retroflexa* as distinct from its oblique form. He now considers the latter as belonging to *Ox. xiphodon.* *Ox. trigonodon* he thinks should be referred to this species.

My specimens are mostly from the *Miocene* of South Carolina, though I have several from the *Eocene.*

4. O. MANTELLII, *Agassiz.* Fig. 158.—This resembles *Ox. hastalis* and *Ox. xiphodon*, but is much thicker and has the root better developed. The outer face is flat, with furrows next the edges on the lower half, and a depression in the middle at the base of the enamel, the surface is thus undulated. The inner face is regularly arched, the anterior edge is arched and the posterior curved in the specimen figured. The enamel is horizontal at the base, the root thick and distinctly separated into branches.

The only specimen I have seen is from the *Cretaceous* of Alabama.

5. O. CRASSA, *Agassiz.* Figs. 159, 160.—Is very massive, thicker than any species except that which I will describe as *Ox. Desorii.* It is curved inwardly, the outer face is elevated and presents faint traces of furrows, which are so developed in *Ox. hastalis.* It is nearly equilateral, the edges cutting, though thick, the point tends outwardly; the root is very thick, the base of the enamel angular on the outer, arched on the inner face.

My specimens are from the *Eocene* of South Carolina.

6. O. MINUTA, *Agassiz.* Figs. 161 to 164.—This species is quite small. They are sub-cylindrical, with point and edges rather obtuse. They are mostly straight; the root very thick in proportion to the size of the teeth.

Numerous in the *Eocene* of South Carolina.

7. O. SILLIMANI, *Gibbes.* Figs. 165 to 168.—Among twelve specimens from the *Eocene* of South Carolina, there is much uniformity. The cone is straight or very slightly bowed on the inner edge, equilateral, acutely pointed, both surfaces convex, the inner more so. A peculiarity exists in the great breadth of the enamel at the base, which is similar on both aspects. The root is thick, and forms one third of the height of the tooth. I attach to it the name of Professor B. Silliman, the veteran co-labourer in American science.*

8. O. DESORII, *Gibbes.* Figs. 169 to 171.—Professor Agassiz described under this name specimens, which subsequent experience induces him to consider identical with *Lamna cuspidata*, with which he had noticed a resemblance.

I take pleasure in restoring the name of the distinguished M. Desor, the friend and co-labourer of Agassiz, in this department of science, to a fine species in my Cabinet.

It is very massive, thicker than any other of this genus, in this respect resembling *Ox. crassa*, but not so broad. Viewed *en profil*, the form is similar to *Lamna Hopei*, much curved inwardly, except near the apex, which is flat. The edges are cutting in their whole extent, the base of the enamel arched, and nearly equal on both faces, the root very thick compact and heavy. I have several specimens from the *Miocene*, and others from the *Eocene* of South Carolina.

* *Ox. Desorii* and *Ox. Sillimani* were described in the Proceedings of September, 1847.

9. O. WILSONII, *Gibbes.*—Figs. 171, 172,173.—This resembles somewhat *Ox. hastalis*, but is convex on the outer face, the root also is thicker and more largely developed. The cone is straight, equilateral, and very acute, slightly curved near the base. The root is very convex on the inner and concave on the outer face, the branches irregular. The enamel is arched on the inner face, and waved on the outer.

I believe this species distinct from other American varieties, and propose for it the name of Dr. Thomas B. Wilson, the patron of the Academy.

When I commenced my investigation of the *Fossil Squalidæ*, it was my purpose to attempt a microscopic arrangement. Professor Agassiz having informed me of his intention to undertake such researches, both of the recent and fossil genera, I prefer to yield to his experience and opportunities what I could but partially and imperfectly effect. In the present state of our knowledge, it is convenient to make a pro tempore division of the *Squalidæ*, into those having crenated teeth, and those which are smooth, as follows :

FAMILY SQUALIDÆ.

TEETH WITH CRENATED EDGES.

GENERA.

GLYPHIS, *Agassiz.*
CARCHARODON, *Smith.*
CARCHARIAS, *Cuvier.*
CARCHAROPSIS, *Agassiz.*
SPHYRNA, *Rafinesque.* ZYGÆNA, *Cuvier.*
GALEOCERDO, *Muller and Henle.*
HEMIPRISTIS, *Agassiz.*
NOTIDANUS, *Cuvier.*
AELLOPOS, *Agassiz.*

TEETH WITH SMOOTH EDGES.

GENERA.

LAMNA, *Cuvier.*
OTODUS, *Agassiz.*
OXYRHINA, *Agassiz.*
SCYLLIODUS, *Agassiz.*
THYELLINA, *Munster.*
ARTHROPTERUS, *Agassiz.*

GENERA AND SPECIES DESCRIBED

CRENATE TEETH.

Genus CARCHARODON, *Smith.*

Sp. 1. C. MEGALODON, *Agass.* Pl. xviii. figs. 1 to 9.
Var. RECTIDENS, *Agass.* Pl. xviii. fig. 4.
" SUBAURICULATUS, *Agass.* Pl. xviii. figs. 5 and 6.
2. C. ANGUSTIDENS, *Agass.* Pl. xix. and xx. fig. 10 to 38.
Var. LANCEOLATUS, *Agass.* Pl. xx. figs. 19 to 23.
" HETERODON, *Agass.* Pl. xx. figs. 30, 31, 32.
" MEGALOTIS, *Agass.* Pl. xx. figs. 24 to 29.
" AURICULATUS, *Agass.* Pl. xix. fig. 12.
" TURGIDUS, *Agass.* Pl. xix. figs. 13 to 16.
" SEMISERRATUS, *Agass.* Pl. xx. figs. 33 to 36.
" TOLIAPICUS, *Agass.* Pl. xix. figs. 17, 18.
3. C. ACUTIDENS, *Gibbes.* Pl. xxi. figs. 39 to 44.
4. C. MORTONI, *Gibbes.* Pl. xxi. fig. 45.
5. C. LANCIFORMIS, *Gibbes.* Pl. xxi. figs. 46 to 51.
6. C. SULCIDENS, *Agass.* Pl. xxi. figs. 52, 53.

Genus GALEOCERDO, *Muller and Henle.*

Sp. 1. G. ADUNCUS, *Agass.* Pl. xxv. figs. 54 to 58.
2. G. LATIDENS, *Agass.* Pl. xxv. figs. 59 to 62.
3. G. MINOR, *Agass.* Pl. xxv. figs. 63 to 65.
4. G. EGERTONI, *Agass.* Pl. xxv. figs. 66 to 69.
5. G. PRISTODONTUS, *Agass.* Pl. xxv. fig. 70.
6. G. CONTORTUS, *Gibbes.* Pl. xxv. figs. 71 to 74.

Genus HEMIPRISTIS, *Agassiz.*

Sp. 1. H. SERRA, *Agass.* Pl. xxv. figs. 75 to 85.

Genus GLYPHIS, *Agassiz.*

Sp. 1. G. SUBULATA, *Gibbes.* Pl. xxv. figs. 86, 87.

Genus SPHYRNA, *Raf.* ZYGÆNA, *Cuv.*

Sp. 1. S. PRISCA, *Agassiz.* Pl. xxv. figs. 88, 89, 90.
2. S. LATA, *Agassiz.* Pl. xxv. figs. 91, 92, 93.
3. S. DENTICULATA, *Agass.* Pl. xxv. fig. 94.

Genus NOTIDANUS, *Cuv.*

Sp. 1. N. PRIMIGENIUS, *Agassiz.* Pl. xxv. fig. 95.

SMOOTH TEETH.

Genus LAMNA, *Cuv.*

Sp. 1. L. ELEGANS, *Agass.* Pl. xxv. figs. 96 to 102.
2. L. CUSPIDATA, *Agass.* Pl. xxv. figs. 103 to 106.
3. L. COMPRESSA, *Agass.* Pl. xxv. figs. 107 to 112.
4. L. ACUMINATA, *Agass.* Pl. xxv. figs. 113 to 115.
5. L. CRASSIDENS, *Agass.* Pl. xxvi. figs. 116 to 118.
6. L. CONTORTIDENS, *Agass.* Pl. xxvi. fig. 119, and 119*a*.
7. L. HOPEI, *Agass.* Pl. xxvi. fig. 120 to 123.
8. L. VERTICALIS, *Agassiz.* Pl. xxvi. figs. 124 to 127.
9. L. GRACILIS, *Agass.* Pl. xxvi. figs. 128 to 130.

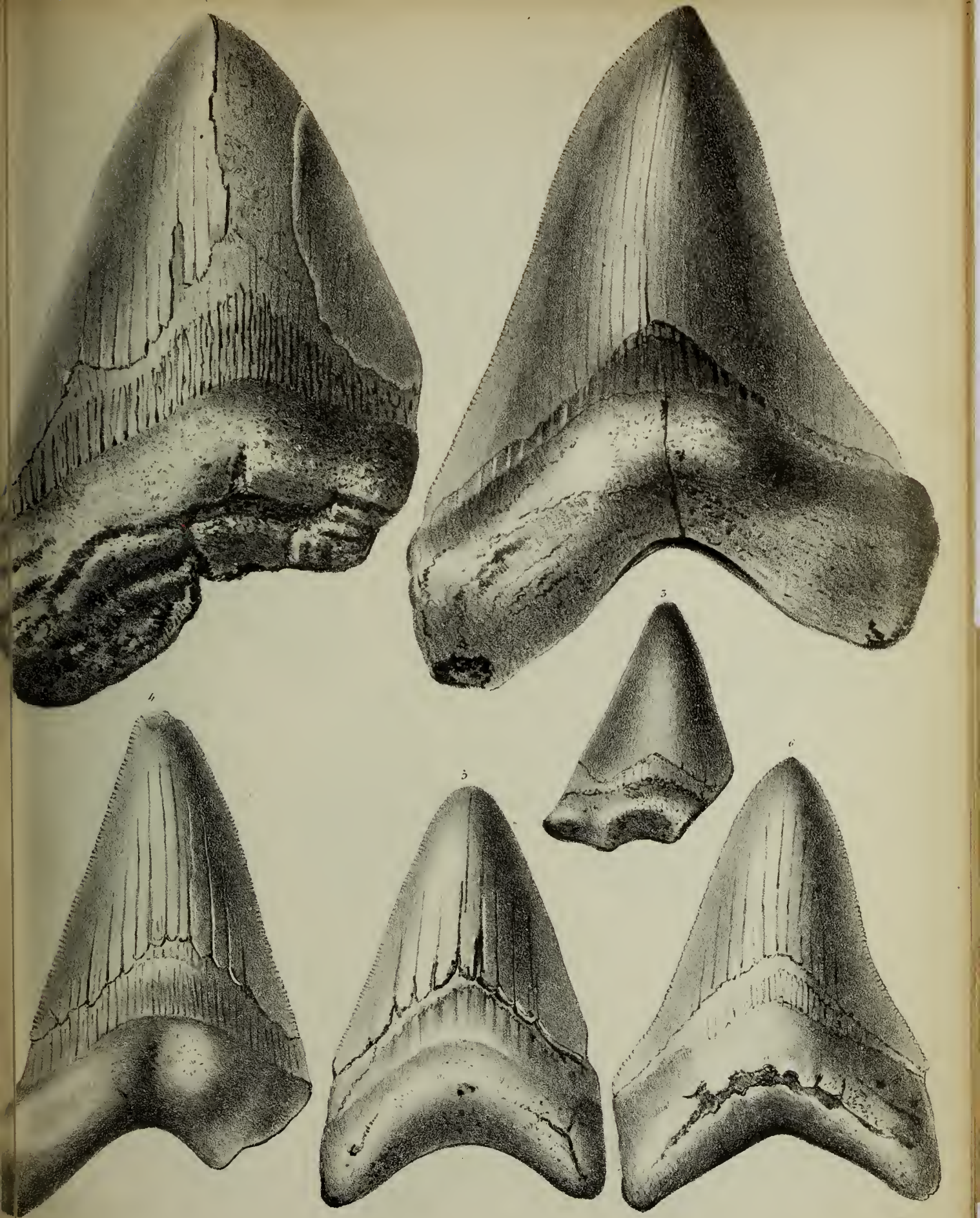
Genus OTODUS, *Agassiz.*

Sp. 1. O. OBLIQUUS, *Agass.* Pl. xxvi. figs. 131 to 137.
2. O. APPENDICULATUS, *Agass.* Pl. xxvi. figs. 138 to 140.
3. O. LEVIS, *Gibbes.* Pl. xxvi. figs. 141.
4. O. CRASSUS, *Agass.* Pl. xxvi. fig. 142.
5. O. MACROTUS, *Agass.* Pl. xxvi. figs. 143, 144.
6. O. TRIGONATUS, *Agass.* Pl. xxvi. figs. 145, 146.
7. O. APICULATUS, *Agass.* Pl. xxvi. fig. 147.

Genus OXYRHINA, *Agassiz.*

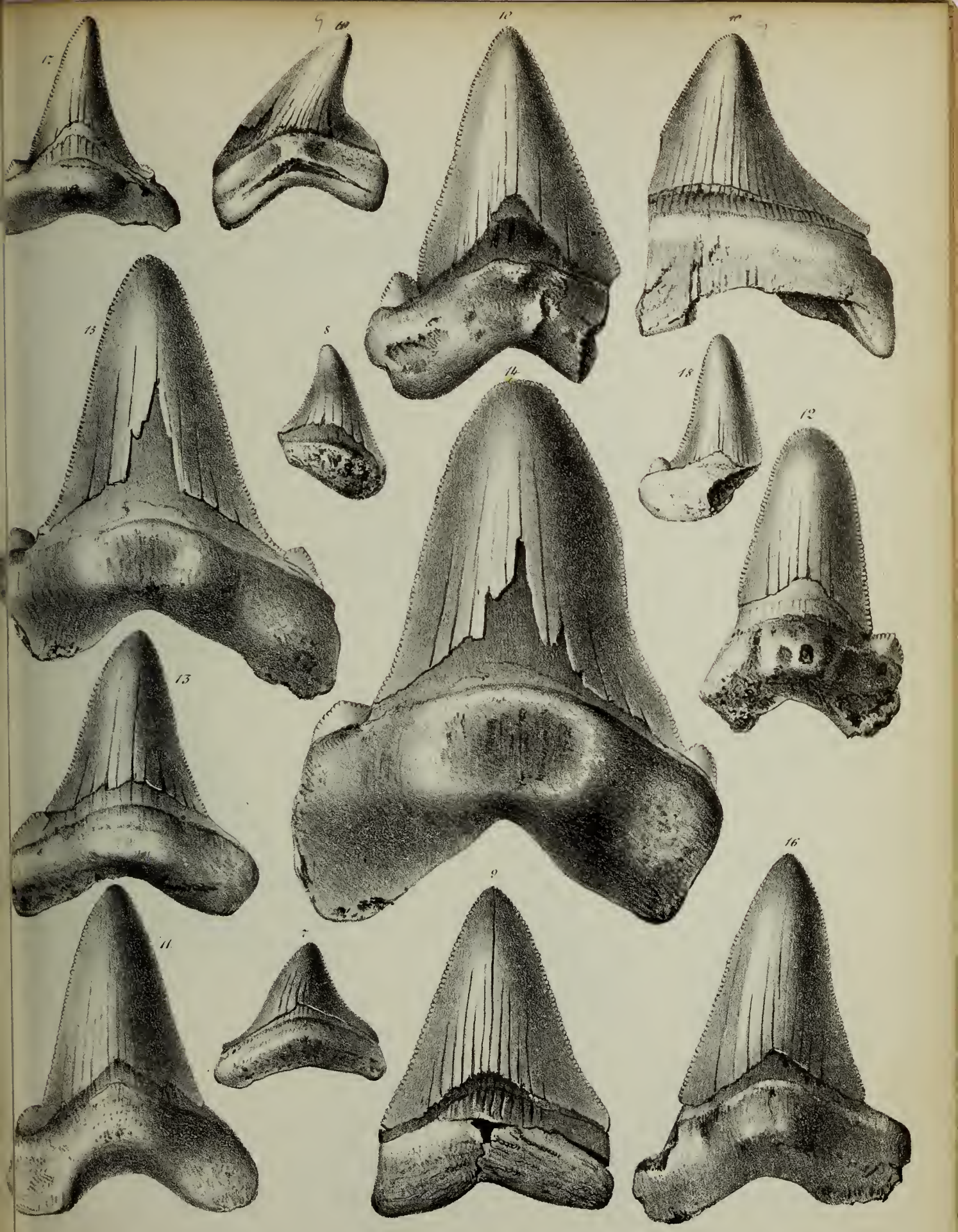
Sp. 1. O. HASTALIS, *Agass.* Pl. xxvi. figs. 148 to 152.
2. O. XIPHODON, *Agass.* Pl. xxvi. figs. 153, 154.
3. O. PLICATILIS, *Agass.* Pl. xxvi. figs. 155 to 157.
4. O. MANTELLI, *Agass.* Pl. xxvi. figs. 158.
5. O. CRASSA, *Agass.* Pl. xxvi. figs. 159, 160.
6. O. MINUTA, *Agass.* Pl. xxvi. figs. 160 to 164.
7. O. SILLIMANI, *Gibbes.* Pl. xxvi. figs. 165 to 168.
8. O. DESORII, *Gibbes.* Pl. xxvi. figs. 169 to 171.
9. O. WILSONII, *Gibbes.* Pl. xxvi. figs. 171 to 173.

This monograph will be continued from time to time as specimens are procured.



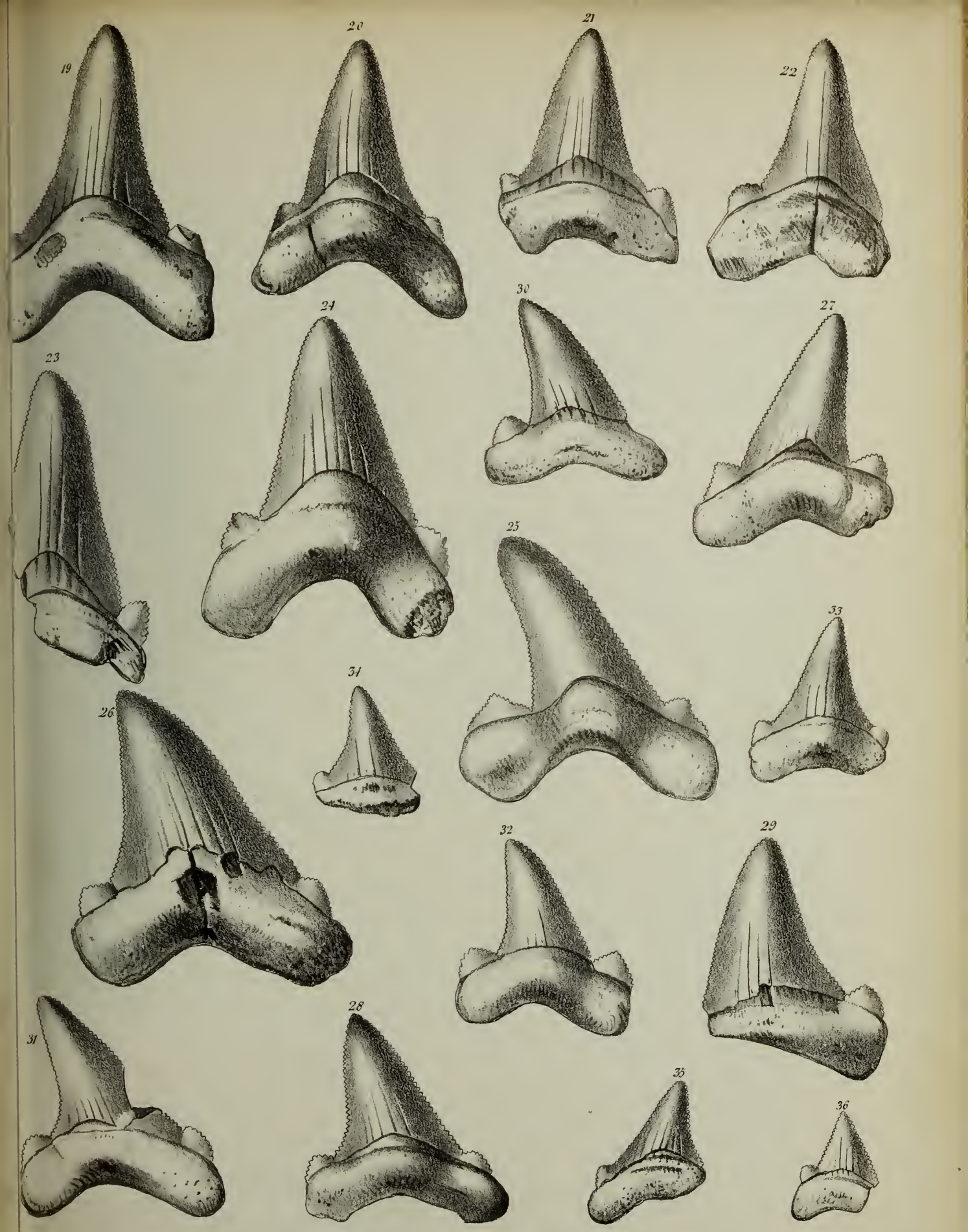
FOSSIL TEETH OF THE GENUS CHARCHARODON.

Figs 1 to 6 Charcharodon Megalodon



FOSSIL TEETH OF THE GENUS CHARCHARODON.

Figs 8 & 9 C. Megalodon



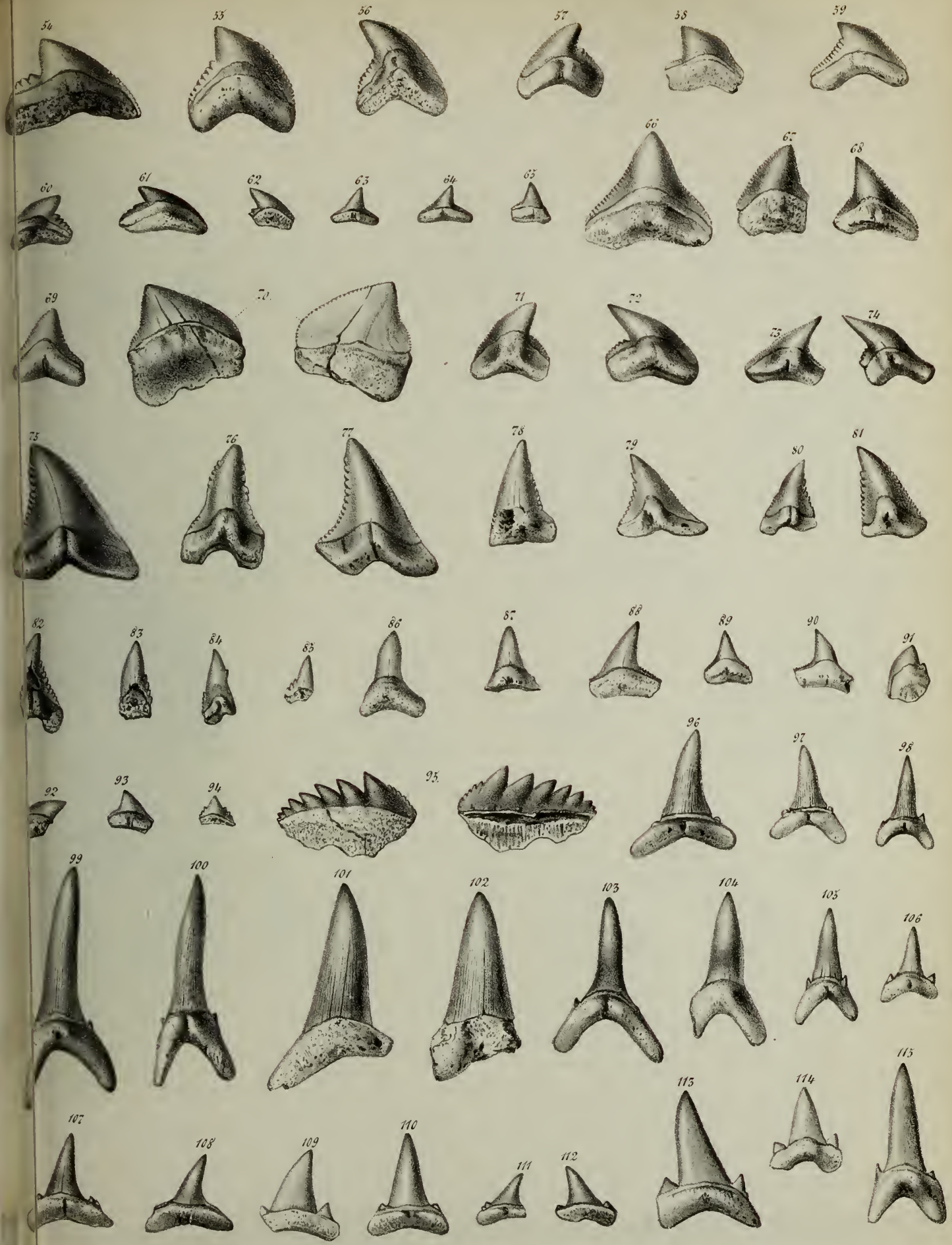
FOSSIL TEETH OF THE GENUS CHARCHARODON.

Figs. 19. to 36. C. Angustidens.

FOSSIL TEETH OF THE GENUS CHARCHARODON.

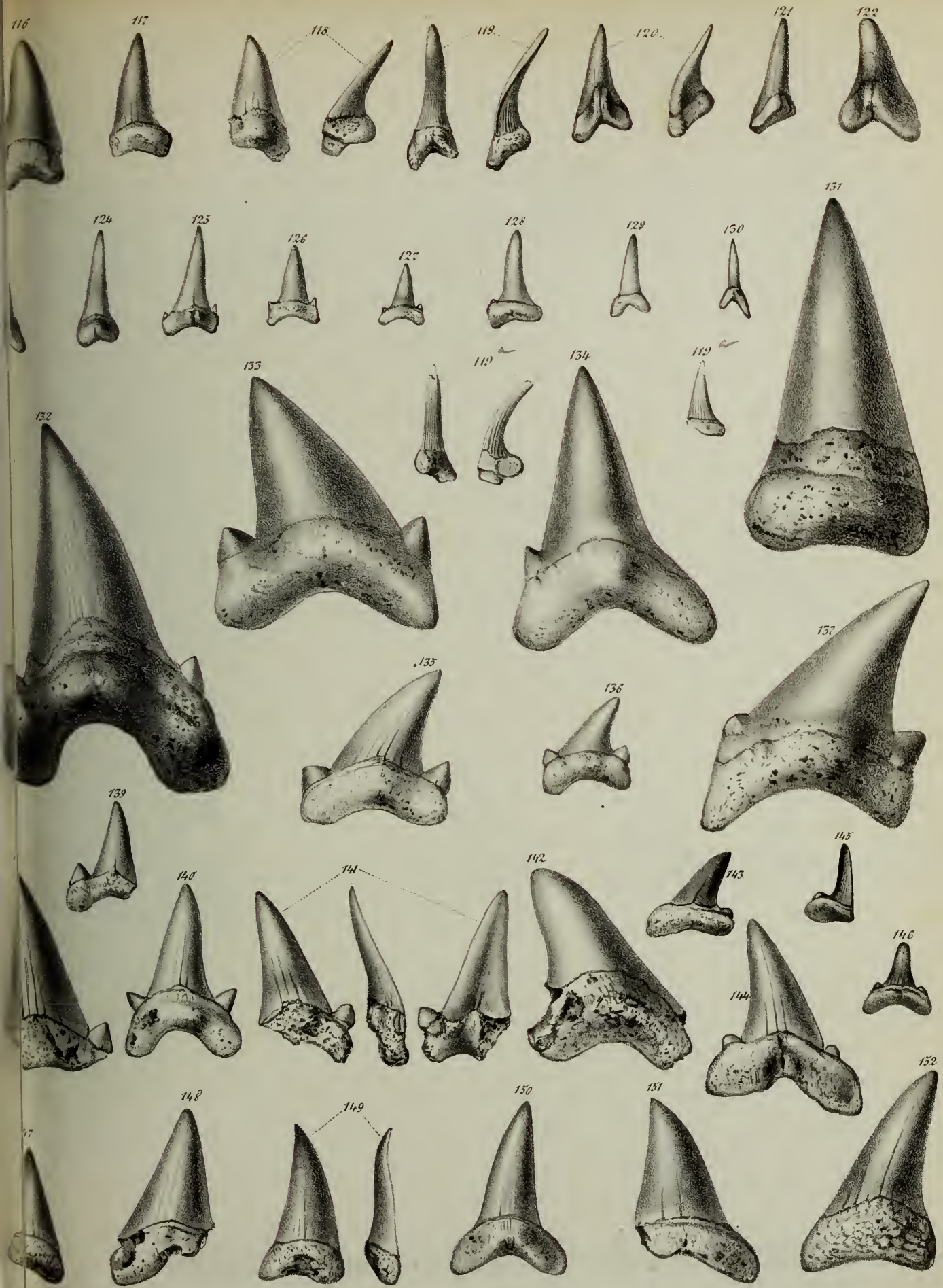
Figs. 37 to 38. C. Angustidens.
Figs. 39 to 44. C. Acutidens.
Figs. 52 to 53. C. Sulcidens.
Fig. 45. C. Mortoni.
Figs. 46 to 51. C. Lanciformis.

T. Sinclair's Lith. Phil.



TEETH OF FOSSIL SQUALIDÆ

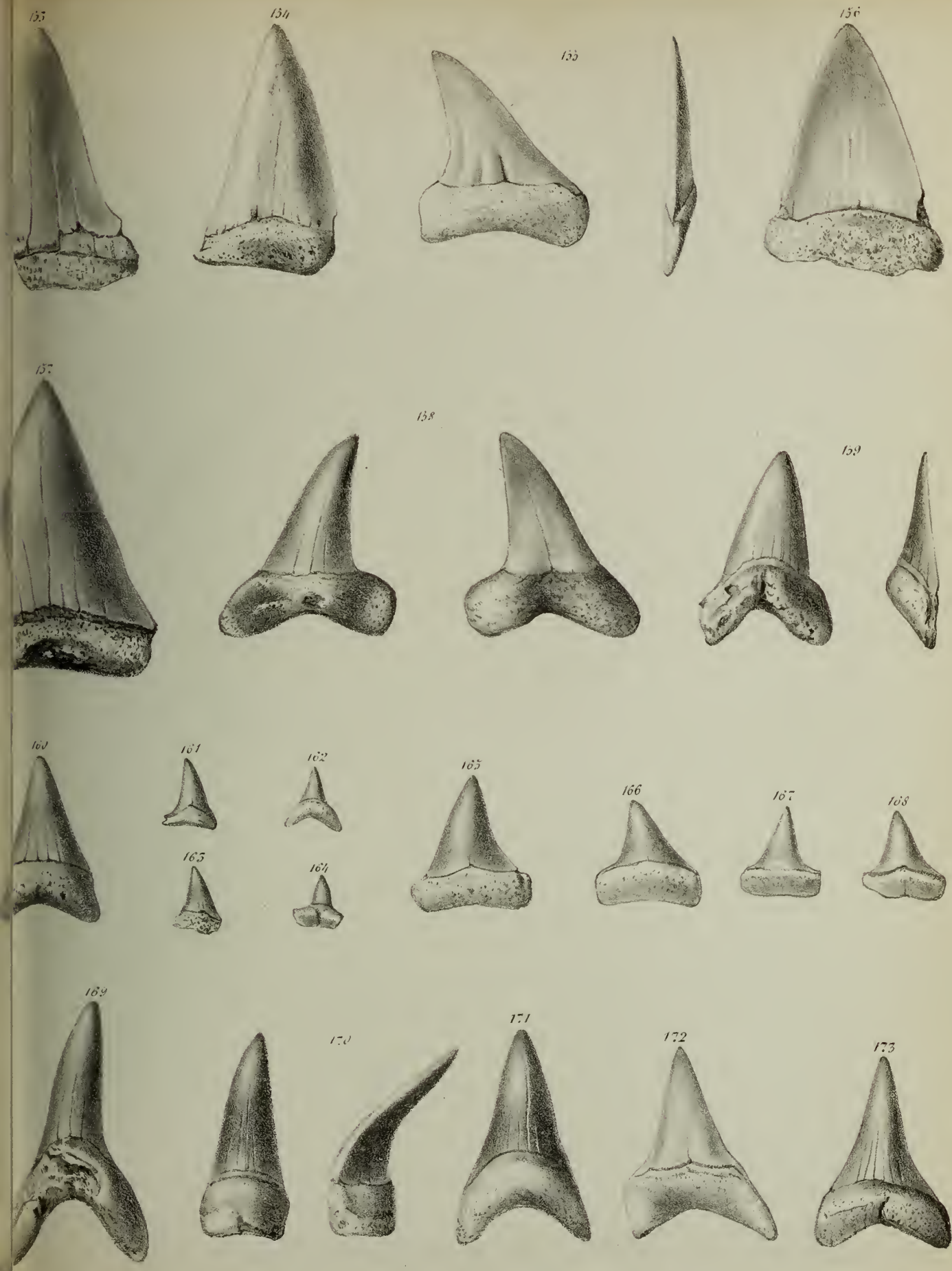
Galeocerdo	*aduncus*	54 to 58
"	*latidens*	59 " 62
"	*minor*	63 " 65
"	*Egertonii*	66 " 69
"	*pristodontus*	70
Galeocerdo contortus		71 to 74
Hemipristis serra		75 " 85
Glyphis subulata		86 " 87
Sphyrna prisca		88 " 90
"	*lata*	91 " 93
"	*denticulata*	94
Notidanus primigenius		95
Lamna elegans		96 to 102
"	*cuspidata*	103 " 106
"	*compressa*	107 " 112
"	*acuminata*	113 " 115



TEETH OF FOSSIL SQUALIDÆ.

Lamna crassidens.	116 to 118	*Lamna gracilis.*	128 to 130.	*Otodus macrotus*	143 to 144.
" *contortidens.*	119.	*Otodus obliquus.*	131 " 137	" *trigonatees.*	145 " 146.
" *Hopei.*	120 " 125	" *appendiculatus*	138 " 140	" *apiculatees.*	147.
" *verticalis.*	124 " 127	" *levis*	141	*Oxyrhina hastalis.*	148 " 158.
		" *crassus.*	142		

J. French. T. Sinclairs lith. Phil.a



TEETH OF FOSSIL SQUALIDÆ.

Oxyrhina xiphodon	153 to 154	Oxyrhina Mantellii	158.	Oxyrhina Desorii	169 to 171
plicatilis	155 157	crassa	159 160	Wilsonii	172 173
		minuta	161 to 164		
		Stillimani	165 168		

T. Sinclair's lith. Phil.