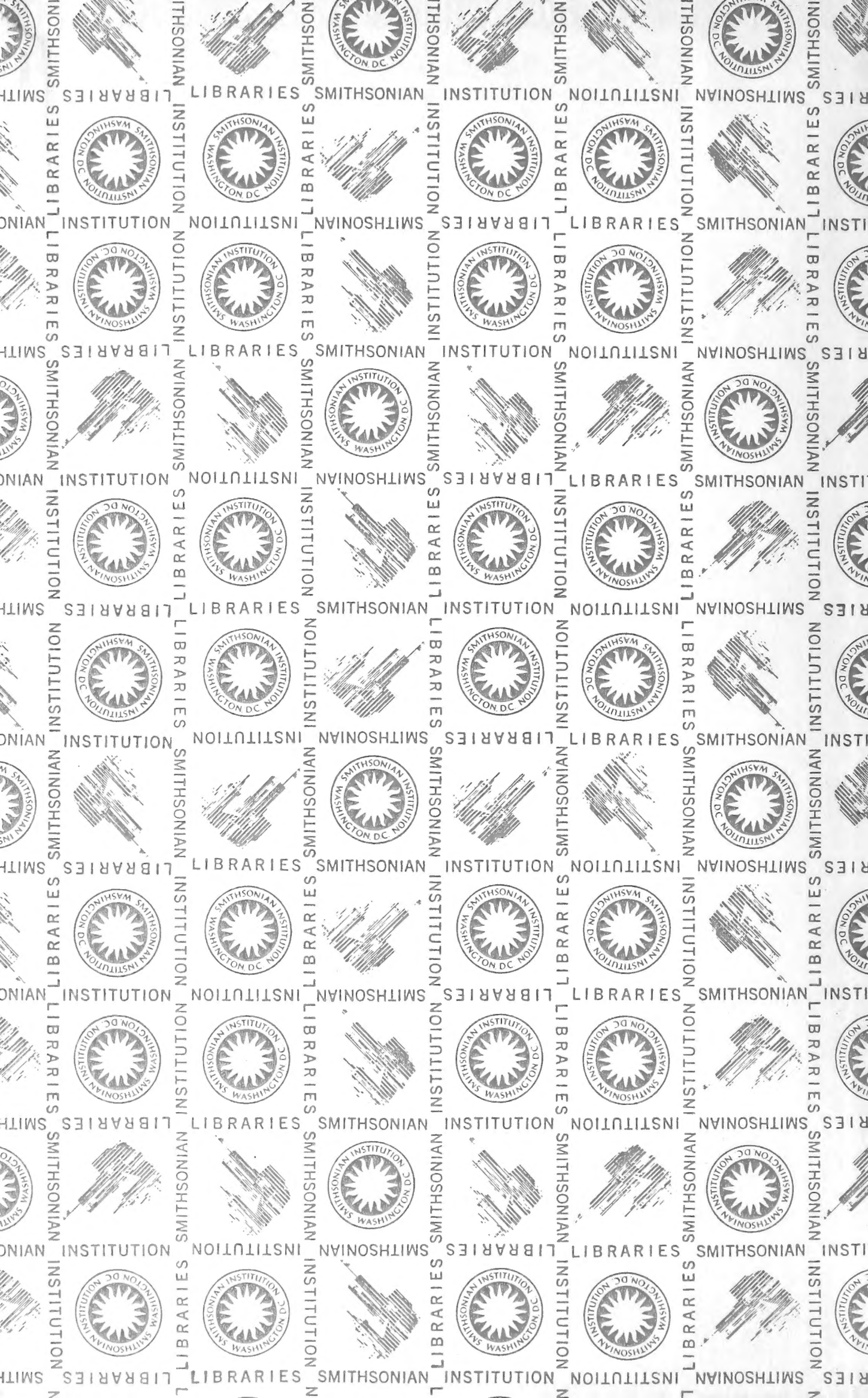
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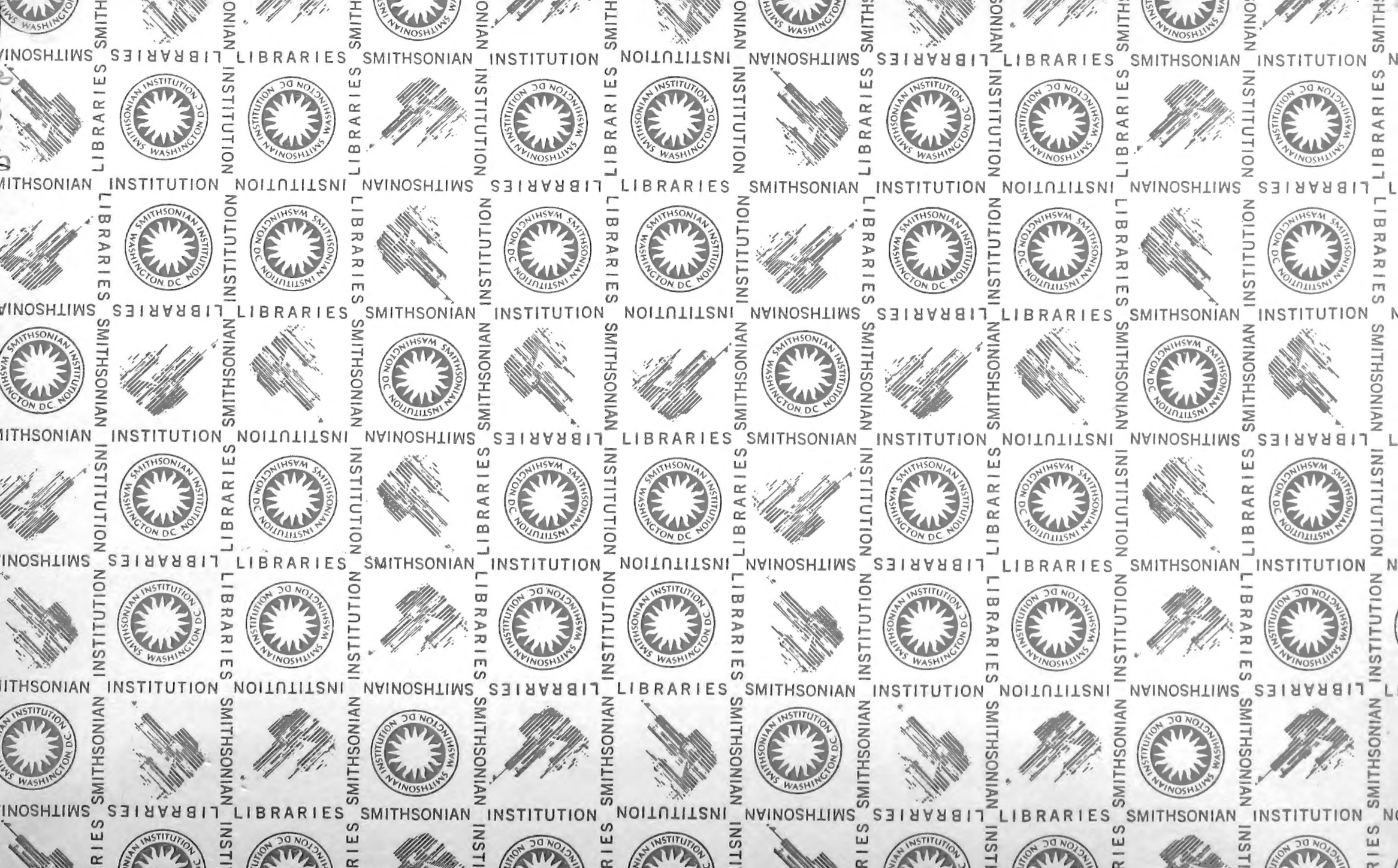
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# WAGNER FREE INSTITUTE OF SCIENCE

OF

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# REPORT UPON SOME FRESH-WATER SPONGES COLLECTED IN FLORIDA BY JOS. WILLCOX, ESQ.

BY EDWARD POTTS.

These sponges, although not strikingly novel in character, are of great interest on account of the unusual situations and circumstances in which they were found

The larger number, as well as the largest specimens, had grown upon the stems of coarse grasses, forming spindle-shaped masses 1–4 inches in length by an extreme of, say, 2 inches in thickness. Mr. Willcox writes: "The sponges on the stems of grass and roots of mangrove trees were found on the meadows or prairie on the margin of the Everglades of Florida, near the head of Allen's Creek, which empties into Chuckalusky Bay, about fifteen miles north of Lostman's Key and ten or twelve miles east of the Gulf of Mexico. The meadow or prairie is not more than 12 inches higher than the water in the creek, which at the time of my visit was salty. The nearest residents to that vicinity state that during the rainy season of the summer and autumn the land there is flooded with fresh water, which subsides in December or January. After the subsidence of the fresh water the land is occasionally flooded with salt water during the prevalence of southwest gales. The fresh-water sponges are found there in great abundance, usually lying upon the ground; their weight, when wet, in most cases having caused the prostration of the stems of grass after the subsidence of the waters."

Their temporary submergence in salt water is shown by the fact that all the specimens were either partially or entirely covered by a salty efflorescence. Notwithstanding this and their subsequent desiccation of weeks or possibly of months, the gemmules of these sponges still retained their vitality, as they germinated freely after being placed in water in a watch-glass. In another experiment, a complete sponge that had been weighted and sunk to the bottom of a jar containing water, remained for many weeks apparently unchanged, then gradually disintegrated, and the liberated gemmules on rising to the surface of the water germinated there.

I find that these sponges belong to the genus *Meyenia*, and may be classed with the well-known species *M. fluviatilis;* their most obvious

feature being an unusual abundance of gemmules—a fact particularly noticeable in those from the mangrove roots. A more minute examination shows that the gemmules of the latter are roughened, while the surfaces of those from the grass-stems are singularly smooth, and that this difference is caused by the unequal lengths of the gemmule birotulates in the one case and their uniformity in the other. Their average length is rather less in the latter sponge, but this is almost the only difference between them. Both forms remind the observer of *Meyenia subdivisa* from the St. John's River, Florida, in the general character of the gemmule spicules and in the subdivision of their spines, but neither equals the typical forms of that species in the robustness of its parts. The shafts of the birotulates of both are, however, much longer than those of the ordinary type of *M. fluviatilis*. On the whole, I cannot satisfy myself that either can properly claim specific distinction, and I incline, for the present, to consider them only as connecting links amongst the many fluviatiloid forms.

Another package received from Mr. Willcox contained fresh-water sponges, many of which incrusted such well-known marine organisms as barnacles and the calcareous tubes of *Serpulæ*. He writes: "The sponges adhering to the barnacles were found on the rocky bottom of a rapidly flowing creek four or five feet deep, about twelve to fifteen miles east of Lostman's Key, which is twenty-five miles north of Cape Sable, on the southwest coast of Florida. The presence of the barnacles can only be accounted for by the action of the strong southwest winds which sometimes back up the salt water into the rivers and creeks. The young barnacles, having followed the influx of salt water and attached themselves to the rocks on the bottom, may have attained a portion of their growth while immersed in fresh water, after the subsidence of the salt water." He names Dr. Leidy as supporting the probability of this theory, and also as stating that their early growth must be relatively rapid, from the size they are known to have attained upon such perishable supports as apples and cranberries.

A few of the sponges collected at this place are *Meyenias* and do not seem to differ from those just mentioned; the greater number, however, belong to the genus *Spongilla* and are clearly allied to the cosmopolitan *S. lacustris*. Two points alone seem to warrant me in honoring it, at least provisionally, with the name of the noble institution of which Mr. Willcox is an active manager. These are the abnormal local conditions just mentioned and the unprecedented multitudes of its dermal spicules.

Anticipating the technical description given below, I would call attention to the unusually white color of these sponges when dry, and to the appearance of a compact incrustation resulting from the massing upon the surface of the dermal spicules just alluded to; to the singular habit of hiding away their gemmules within the barnacles or amongst the convoluted stems

of the serpulæ; to the upright positions of the spicular armature of these gemmulæ (resembling in this respect certain lacustrine forms already described, as found upon the Catskill Mts., N. Y., at White Haven, Pa., and at May's Landing, N. J., and in strong contrast with the idea of a typical *tangential* position); and to the striking resemblance of these spicules to those of *Spongilla fragilis*, rather than to the corresponding spicules of any form of *S. lacustris*.

**Spongilla Wagneri.** N. sp.

Sponge (as examined), white; incrusting, thin. Proper skeleton texture loose and open, but entirely hidden by a compact layer of dermal spicules upon the outer surface, where they crowd even to the projecting points of the skeleton spicules, thus presenting a comparatively flat but greatly roughened surface.

Gemmules rather abundant within the lower layers of the skeleton spicules or, more generally, hidden away within the cavity of the barnacles or amongst the coils of the serpula upon which the sponge has grown. Chitinous body relatively small, but surrounded by an extremely thick granular crust, charged with an abundance of unusually long gemmule spicules, erect, but crossing each other's lines in every direction.

Skeleton spicules long, robust, smooth, fusiform, slightly curved; gradually sharp-pointed.

Dermal spicules excessively abundant, both upon the outer and interstitial surfaces; long, slender, delicately pointed, curved, entirely spined; spines erect, cylindrical, round-ended, longest near the middle of the spicule.

Gemmule spicules relatively long, cylindrical, irregularly curved, entirely spined; spines acute, erect; distant along the body of the shaft, often recurved and more numerous at the extremities of the spicules, where they form a head or bur.

Measurements: Skeleton spicules, 0.0144 inches long by 0.0007 inches thick; length of dermal spicules, 0.0049 inches; of gemmule spicules 0.0048 inches.

# NOTICE OF SOME FOSSIL HUMAN BONES.

BY PROF. JOSEPH LEIDY.

Science confirms the declaration of Ecclesiastes that "a man hath no pre-eminence above a beast," and in our accepting the theory of animal evolution we may reasonably look with confidence for the discovery of the "missing link" connecting him with his immediate predecessor. In this view, all remains of man coming in the category of fossils are examined with interest. We have satisfactory evidence in fossil remains that man was contemporaneous with many well-known and now extinct animals far back in the quaternary period. The aboriginal man was probably as restricted in his habitation as are now some of his nearest relatives, the orang and gorilla; and this may be a reason why his remains are so rare or absent among those of his numerous cotemporaries of other species and genera. The nearer relation of man with the old- than with the new-world primates, the many discoveries of prehistoric races in Europe and contiguous countries, and traditions together, render it probable that he had his origin in the old world and migrated elsewhere. Hence early traces of man are scarcely known in America. To be sure, instances of their occurrence have been reported, but generally they have not been convincing and in most cases are untrustworthy.

In 1846, Dr. M. W. Dickeson exhibited to the Academy of Natural Sciences of Philadelphia a collection of fossil bones, obtained by him in the vicinity of Natchez, Mississippi, among which was a human os innominatum.* The collection of fossils, yet contained in the museum of the Academy, are well preserved, firm in texture and stained chocolate-brown from ferruginous infiltration. The fossils consist of a nearly entire skull and other bones of *Megalonyx Jeffersoni*, teeth of *Megalonyx dissimilis* and *Ereptodon priscus*, bones of *Mylodon Harlani*, bones and teeth of *Mastodon americanus*, and teeth of *Equus major* and of *Bison latifrons*. The human innominatum, somewhat mutilated, presents the same condition of preservation and color as the other fossils with which it was found associated. As the specimen has been the subject of much curiosity, it is now represented

* Proc. Acad. Nat. Sci. 1846, 107.

in figure 1, plate II. It differs in no respect from an ordinary average specimen of the corresponding recent bone of man. At the time of the first published notice of the discovery of the specimen, when the attention of naturalists was awakened to the importance of such evidences of the earlier existence of man than had previously been believed, it so much interested Sir Charles Lyell, that on the occasion of his last visit to this country he was induced to extend his trip and examine the locality in which the bone was found. The specimen, with its associated fossils, was obtained, in a ravine, from a deposit of clay, the talus of a neighboring cliff, on the top of which were some old Indian graves. In a subsequent interview with the writer, Mr. Lyell expressed the opinion that although the human bone may have been contemporaneous with those of the extinct animals with which it had been found, he thought it more probable it had fallen from one of the Indian graves and had become mingled with the older fossils which were dislodged from the deeper part of the cliff. At the time of making his communication, Dr. Dickeson intimated that the human bone was found at a lower level, beneath bones of the *Megalonyx*, etc., but this would not prove its age to be greater than or contemporaneous with the latter. In the wear of the cliff the upper portion, with the Indian graves and human bones, would be likely to fall first and the deeper portion with the older fossils subsequently on the latter.

In the spring of 1886, Mr. Joseph Willcox and Prof. Angelo Heilprin, while cruising in Sarasota Bay, on the west coast of Florida, were informed by the captain of their vessel that fossil human bones had been found on the eastern shore of the bay. Prof. Heilprin visited the locality, where from a partially indurated ferruginous sandstone he obtained a rock fragment containing a pair of human vertebræ, of which he has given an account in his interesting article, "Explorations on the West Coast of Florida," published in the first volume of these Transactions. The following spring Mr. Willcox visited the locality and obtained several additional specimens of human fossils, of which the best preserved is a calcaneum, represented in figure 2, plate II. The bones are well preserved and are actually converted into hard limonite. They do not differ in any respect from corresponding recent human bones. Mr. Willcox again visited the locality last February, but found no other human fossils. He informs us that the bones were found in a hard, ferruginous sandstone, which is exposed on the shore of the bay and is there subjected to the action of the water at high tide. The formation is overlaid by the surface soil from fifteen to eighteen inches in depth. In one position, in which a trench was dug through the rock, it was found to be from two and a half to three feet thick, with sand beneath.

Human bones, of the same kind, from Sarasota Bay, are noticed in the Seventh Annual Report of the Peabody Museum of Archæology and Ethnology, Cambridge, 1874, p. 26, remarkable for their weight, due to the

infiltration of iron oxide. A thigh-bone is stated to weigh 492 grains, while a recent one of the same length weighed 353 grains. About fifty feet north of the locality where the former bones were found, the rock occupying the same relative position beneath the surface soil is lighter colored and harder, and apparently is of the same age as that containing the bones. About seventy-five yards north of the locality, what appears to be the same sandstone is also lighter and harder, and is overlaid by a soft sandstone. The latter where visible is not more than eight to ten inches thick and full of fossils, among which were recognized *Fulgur perversus*, *Strombus pugilis*, *Fasciolaria gigantea*, *Melongena corona*, *Venus Mortoni*, etc.

A letter from Mr. Wm. H. Dall states that he had received for identification from Mr. Willcox some rock specimens with fossil shells supposed to be the same as that to which the fossil bones belong. Mr. Dall continues, the rock is composed of silicious and calcareous sand with shells, and is of the same kind as that on the little island on Lake Monroe, near Enterprise, Florida, where Portales found human bones thirty years ago. The shells are all of living species and consist of *Donax variegatus* Say, *Natica pusilla* Say, *Glandina truncata* Say, *Helix uvulifera* Shuttl., *Helix cereolus* Muhlf. var. *microdon* Deshayes, *Succinea avara* Say, *Strobila labyrinthica* Say, etc., all common in the vicinity to-day.

A more characteristic human fossil, found in a similar position and deposit almost half a dozen miles south of the former locality, was submitted to the writer for examination by the Smithsonian Institution. The specimen consists of the base of a skull, the vault broken off and lost, but retaining part of the face and a fragment of the mandible. The alveolar portions of the jaws and teeth are also absent. The fossil beneath is embedded in a mass of hard bog ore, while the bottom of the cranial cavity is occupied by fine coherent silicious sand. It was found in digging a trench through the formation enclosing it, by Mr. John G. Webb, of Osprey, Florida, and was presented by him to the Smithsonian Institution. By request, Mr. Webb made further search in the place where the skull was discovered, and found a number of broken bones in the same condition as the skull. Mr. Webb remarks that the bones were "in a heap, as if the man to whom they belonged had been buried in a sitting position." Such an observation would make it appear as if a human body had been buried in the formation in which the remains were found, and therefore that they do not actually belong to it as cotemporary fossils.

The fossil skull itself is converted into limonite, like the bones obtained by Prof. Heilprin and Mr. Willcox, and the portions where exposed are well preserved and not in the slightest degree eroded or water-worn. The specimen, represented in figures 1, 2, plate I., indicates a well-proportioned ovoid skull, and closely approximates in shape an ordinary prepared French skull, such as the writer has lying at the side of the fossil. The forehead

and contiguous portions of the face accord with the usual condition in a white man's skull. The superciliary ridges are but moderately produced and the nasal bones are large and prominent. The occiput has the usual appearance, while its muscular markings are not more developed than commonly.

Comparative measurements of the fossil with a French skull are as follows :

| | Fossil Skull. | French Skull. |
|---|---|---|
| Glabella to occipital protuberance, . . | 170 mm. | 178 mm. |
| Breadth above the auditory meatuses, . . | 131 " | 132 " |
| Breadth of forehead at the temporal ridges, . | 102 " | 104 " |

Among the discoveries of Mr. Willcox, in Florida, are some remains of the great extinct *Bison latifrons*, consisting of a huge horn-core, subsequently lost by accident, and the proximal portion of a radius. The specimens were found on Rocky Creek, thirty miles north of Sarasota Bay, about two and a half or three feet below the surface, in a formation which Mr. Willcox regards as of more recent age than the sandstone in which the human bones were discovered.

The fragment of the radius mentioned comprises eleven inches of the proximal portion of the bone. It accords closely in anatomical character with the corresponding portion of the radius of the recent *Bison americanus*, differing only in its greater size. Its comparative measurements are as follows :

| | B. latifrons. | B. americanus. |
|---|---|---|
| Proximal end of radius, transversely, . . | 130 mm. | 92 mm. |
| Middle of shaft of " " . . . | 68 " | 48 " |
| " " " in thickness, . . . | 46 " | 36 " |

## DESCRIPTION OF MAMMALIAN REMAINS FROM A ROCK CREVICE IN FLORIDA.

BY PROF. JOSEPH LEIDY.

In a visit to Florida, last winter, Mr. Joseph Willcox obtained a small but interesting collection of quaternary mammalian fossils from the vicinity of Ocala, Marion Co. The fossils were discovered in a crevice of the rock exposed in quarrying limestone on the property of Mr. F. M. Phillips, who obligingly presented the specimens remaining in his possession to Mr. Willcox; others having been carried away as curiosities or lost. The limestone, in which was the crevice, is chalk-white, nummulitic and regarded to be of oligocene age. In some masses of the rock, in a quarry of Mr. B. P. Richards, in the vicinity, Mr. Willcox found embedded some remains apparently of a *Zeuglodon* or perhaps of a *Squalodon.* The fragments consist of a portion of a mandible with the much mutilated traces of a couple of large two-fanged molar teeth, part of the crown of a large conical tooth with strongly rugose enamel, and portions of several immature vertebræ with fragments of a detached epiphysis of a centrum. The remains are too imperfect to determine positively to what species or even genus they may belong.

The fossils from the limestone rock crevice submitted to examination consist of remains of a species of Horse, Llama, Sabre-tooth Tiger and an Elephant. They present the usual appearance of fossils from dry caves, being well preserved in form, not rolled or water-worn, and white and friable from the loss of ossein. Other specimens were lost, as usual under such circumstances, leading to the sad reflection that many similar records of the past, after having been sealed up and preserved for ages, on discovery are destroyed through ignorance of the finder.

The most interesting of the fossils are fragments of the skull of a Sabre-tooth Tiger, which was about as large as the existing Tiger of Asia. The two fragments comprise the nearly complete cranium and the greater portion of one side of the face retaining the alveoli, as represented in figure 1, plate III. The skull when found appears to have been entire and contained the teeth, including the characteristic long canine, but these unluckily were extracted by the finder and distributed as relics.

An effort has been made to recover them, but thus far without success.

The Ocala skull compared with the plaster cast of that of the *Machairodus neogaeus* of Brazil, preserved in the Natural History Museum of Paris, shows a close resemblance, but exhibits differences which are perhaps sufficient to indicate another species, and in this view the name of *Machairodus floridanus* would seem to be appropriate.

The Ocala skull is rather more than an inch less in its chief measurements than that of the *M. neogaeus* and the zygoma is actually of greater depth and is flatter on its outer face. The alveoli in the specimen are those for the incisors, the canine and for two molars:—a premolar and the succeeding sectorial tooth. A tubercular molar had been shed and its alveolus is obliterated.

The canine alveolus measures 41 mm. fore and aft, and 20 mm. transversely, and would therefore accommodate a tooth nearly as large as that of the *Machairodus neogaeus*, represented by Dr. Burmeister in figure 8, plate IX., of his description of that animal, found in the Argentine Republic.* The hiatus back of the canine alveolus is 16 mm.; and that in advance is considerably smaller than in *M. neogaeus*, indicating a proportionately smaller inferior canine tooth.

The alveolus of the sectorial molar is 36 mm. fore and aft, and would thus indicate a considerably smaller tooth than that of *M. neogaeus* as represented in the plate of Dr. Burmeister.

In comparison with the skull of the Bengal Tiger the cranium of the fossil has nearly the same size and proportions. The temporal fossæ are of much greater depth, but proportionately of less width, as the zygomæ are not so prominent laterally. The posterior root of the zygoma is deeper and its anterior surface more vertical.

The mastoid process, very much larger than in the Tiger, appears as a conspicuous fore and aft compressed cylindroid process directed obliquely downward and forward to the outer side and extending below the auditory bulla. It is horizontally truncated and transversely notched at the lower extremity. From its greater prolongation and direction the archway to the auditory meatus is of much greater vertical depth than in the Tiger, and instead of expanding is contracted below.

The paramastoid process is a pyramidal tuberosity behind the base of the former and of the auditory bulla, tapering horizontally inward to the basi-occipital.

The auditory bulla is fore and aft laterally compressed oval. Its anterior extremity is impressed with a pit just behind the entrance of the carotid canal.

The neural foramina at the base of the cranium and those of the sphenoid bone directed toward the orbit have about the same character and relative position as in the Tiger. The median part of the cranial basis is much

* Description Physique de la Republique Argentine; Mammiferes, 1881.

narrower and not flattened as in the Tiger, and the basi-occipital is more strongly carinated and deeply impressed at the sides for muscular attachment.

The occiput is much less narrowed above than in the Tiger, and its ridges and depressions are more strongly produced.

The glenoid articulation is of less transverse extent, but is wider fore and aft, especially at the inner part, so that in outline it appears more transverse-ovoid than elliptical.

The hard palate is less level than in the Tiger, and exhibits the same conspicuous depressions represented in Dr. Burmeister's figure of the same part in *Machairodus neogaeus*.

Comparative measurements of the skull of *Machairodus floridanus*, the cast of the skull of *M. neogaeus* of Brazil, from the Paris Museum specimen, and Dr. Burmeister's figures of the same animal of the Argentine Republic are as follows:

| | Florida. | Brazil. | Argentine. |
|---|---|---|---|
| Length from occipital condyle to incisive border, | 285 mm. | 330 mm. | 330 mm. |
| Breadth of skull at widest part of zygoma, | 190 " | 230 ? " | 230 " |
| Depth of skull at post-glenoid tubercle, | 125 " | 160 ? " | 164 " |
| Distance from back of zygoma to incisive border, | 210 " | 225 " | 245 " |
| Breadth at mastoid processes, | 126 " | 140 " | 143 " |
| Width of narrowest portion of cranium, | 57 " | | 57 " |
| Breadth at paramastoid processes, | 105 " | | 112 " |
| Breadth at occipital condyles, | 63 " | | 60 " |
| Breadth of occiput above the latter, | 100 " | | |
| Transverse diameter of occipital foramen, | 30 " | | |
| Length of occipital condyle from above downward, | 38 " | | |
| Width of space between the auditory bullæ, | 21 " | | |
| Length of mastoid process, | 33 " | | |
| Thickness fore and aft, | 21 " | | |
| Breadth of face at sectorial teeth, | 150 " | | 170 " |
| Breadth of face at canines, | 94 " | 112 ? " | 112 " |
| Fore and aft space of the teeth, | 140 " | 163 " | 146 " |
| Fore and aft space of two molars, | 55 " | 63 " | 62 " |
| Transverse space of incisors, | 58 " | 55 " | 66 " |
| Width fore and aft of canine alveolus, | 40 " | 53 " | 45 " |
| Width fore and aft of premolar " | 16 " | 18 " | 18 " |
| Width fore and aft of sectorial molar alveolus, | 37 " | 42 " | 43 " |

| | Florida. | Brazil. | Argentine. |
|---|---|---|---|
| Length of palate to incisor alveoli, . | 136 mm. | | |
| Width transversely of glenoid articulation, . . . . . | 50 " | | 50 mm. |
| Width fore and aft of glenoid articulation, . . . . . | 25 " | | 25 " |
| Depth of face at infra-orbital margin, | 60 " | 53 mm. | 55 " |
| Depth of zygoma, . . . . | 46 " | 43 " | 38 " |
| Vertical diameter of infra-orbital foramen, | 21 " | | |
| Transverse, " " " " | 14 " | | |
| First incisor alveolus fore and aft, . | 14 " | | |
| First incisor alveolus transversely, . . | 5 " | | |
| Second incisor alveolus fore and aft, . | 14 " | | |
| Second incisor alveolus transversely, . | 8 " | | |
| Third incisor alveolus fore and aft, . | 17 " | | |
| Third incisor alveolus transversely, . . | 11 " | | |

The fossils found in association with the *Machairodus* skull are mostly the remains of young animals and are perhaps remnants of the feasts of the great carnivore. Those of the Horse consist of a broken cervical vertebra, six lower molar and five incisor teeth. The specimens accord in size and other respects with the corresponding parts of the ordinary sized Domestic Horse, presenting no anatomical marks of having belonged to a different species. The molar teeth indicate at least three different individuals; half of them, including the last of the series, being entirely unworn. Another last molar is just sufficiently worn so as to exhibit the usual characteristic folding of the enamel of the triturating surface; and a third specimen is about one-fourth worn away, exhibiting the same arrangement of the enamel folding. Of the incisor teeth, two lateral ones are folded at the sides and have a wide groove behind, but do not enclose an enamel pit as in the other incisors which pertain to the intermediate ones of the series.

Remains of Horses, not distinguishable in anatomical character from the corresponding parts of the Domestic Horse, are of frequent occurrence in our quaternary deposits in association with those of well-recognized species and genera of extinct animals. Some of these with little doubt pertain to the Domestic Horse and are accidental associates of the other fossils, but there appears strong evidence that many if not most of them actually belonged to an indigenous species of Horse, whose osteological and dental characters, so far as we know them, were the same as in the domestic animal. In this view, the remains of the Horse found in association with the *Machairodus* skull may be regarded as having pertained to the species which I have elsewhere named *Equus fraternus*.*

* Proc. Acad. Nat. Sc. 1858, 11.

From a pliocene shell bed, on the Caloosahatchie River, Florida, Mr. Willcox obtained some remains of a Horse consisting of two cervical vertebræ and the fragments of a mandible with the first and second molar teeth. The interior of the jaw fragment is filled with limestone, with shells of *Planorbis*, etc. The remains in no respect differ from the corresponding parts of the ordinary sized Domestic Horse, and probably pertain to the *Equus fraternus*.

The remains of a Llama found with the former consist of a single specimen, a last inferior molar tooth, represented in figure 5, plate III. It is like the corresponding tooth of the recent *Auchenia llama* of South America, but is larger. It probably pertains to the smallest of three species which I recently named *Auchenia minimus*, *minor* and *major*, from a number of bones found in association with those of a Rhinoceros and Mastodon, at Archer, achua ~~Levy~~ County, Florida. (Proc. Acad. Nat. Sc., p. 11, 1886.)

Comparative measurements of the fossil are as follows;

| | Fossil Llama. | Recent Llama. |
|---|---|---|
| Fore and aft diameter of last lower molar, | 35 mm. | 26 mm. |
| Transverse diameter at fore part, | 13 " | 12 " |

The remains of the Elephant of the rock crevice are two teeth. Of these, one is a first milk molar and resembles in shape and size the corresponding tooth of the *Elephas primigenius*, as represented in Mr. Leith Adams' Monograph on the British Fossil Elephants. The tooth has a long trihedral crown with a pair of fore and aft divergent fangs. The rounded triturating surface exhibits four transverse series of enameled tubercles enclosed in an abundance of cementum. The tubercles in succession are one, two, two and three, and the summits of most of them are just worn through so as to expose the interior dentine. The specimen, represented in figures 6, 7, plate III., measures 18.5 millimetres fore and aft and 17 millimetres transversely.

The other tooth, presented to Mr. Willcox by Mr. E. W. Agnew, of Ocala, represented in figures 8, 9, is an upper left second or third milk molar. It is nearly complete and is worn away at the anterior two-thirds, exposing an oval, flat triturating surface crossed by seven enamel lobes. The unworn, rounded back portion of the crown appears to contain four additional lobes. The worn enamel lobes present ellipses with wide cemental intervals, characteristic of the so-called coarse-plated variety of the *Elephas americanus*, or the *E. columbi*. A single fang occupies the fore part of the tooth, followed by a pair, one outer and the other inner, and behind these is a quadrate column of connate fangs.

The measurements of the tooth are as follows:

| | |
|---|---|
| Fore and aft diameter of the crown, | 110 mm. |
| Greatest thickness, | 46 " |
| Fore and aft diameter of the worn triturating surface, | 84 " |
| Greatest transverse breadth of triturating surface, | 44 " |

# DESCRIPTION OF VERTEBRATE REMAINS FROM PEACE CREEK, FLORIDA.

BY PROF. JOSEPH LEIDY.

The fossils which form the subjects of the present communication are for the most part from Peace Creek, Florida. Some of them were obtained by Mr. Joseph Willcox, who recently visited the locality accompanied by Mr. William M. Meigs. The gentlemen were aided in their search by Mr. T. S. Moorhead, manager of the Arcadia Phosphate Company, who has since sent to Mr. Willcox additional specimens of interest. The fossils were collected in Peace Creek, at Arcadia, from a sand-bar which is exposed when the water is low. The bar is explored for so-called phosphates, which occur in nodular masses, and are collected in large quantities for commercial purposes. Mr. Moorhead informed Mr. Willcox that the source or main bed, from which the materials of the bar are chiefly derived, extends for miles along the shores of Peace Creek, and is about eight feet thick. Others of the Peace Creek fossils were previously received by the writer for examination from the Smithsonian Institution.

The fossils of Peace Creek, besides a number of mostly uncharacteristic fragments of bones and other specimens undetermined, consist of the following:

1. Three well-preserved crowns of upper molar teeth, and fragments of others of those of a Tapir, in no respect differing from those of the existing *Tapirus americanus* of South America.

2. Teeth of Horses; 13 upper molars, 7 lower molars, and 2 incisors, of different individuals ranging in size and age. They indicate animals about the size of ordinary varieties of the Domestic Horse, large and small, but not so large as the largest variety of the living form. In several of the upper molars, the worn triturating surface exhibits the characteristic enamel islets with a somewhat more folded condition than is usual in the Domestic Horse. It is very uncertain whether to regard these teeth in part or whole as having pertained to an indigenous species of *Equus*, or to view them as belonging to the Domestic Horse.

Accompanying the teeth is an ungual phalanx having the same character and size as the corresponding bone of the Domestic Horse. Another

phalanx and an astragalus, in the collection from the Smithsonian Institution, likewise accord with the same bones in the latter animal.

3. An interesting fossil from Peace Creek is a pastern bone or first phalanx, which I suspect to belong to the three-toed Horse, *Hippotherium*. The specimen, represented in figure 2, plate III., indicates a small animal of slender proportions. It is related in size with an astragalus and an upper molar tooth, from Archer, Levy Co., Florida, on which were based the *Hippotherium ingenuum*, noticed in the Proceedings of the Academy of Natural Sciences, p. 33, Philadelphia, 1885. The three specimens accord in size with one another, as do three corresponding specimens from Archer, Florida, on which was based another species under the name of *Hippotherium plicatile*.

The pastern, from Peace Creek, regarded as belonging to *Hippotherium ingenuum*, in comparison with that of *H. plicatile* from Archer, and another found in association with the former and not differing from the pastern of the Domestic Horse, show the following comparative measurements:

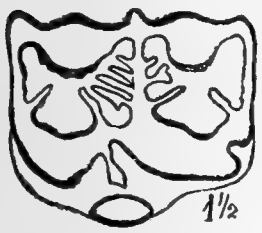
| | H. ingenuum. | H. plicatile. | Equus. |
|---|---|---|---|
| Length of the pastern, . . . | 58 mm. | 50 mm. | 60 mm. |
| Transverse diameter of proximal extremity, | 23 " | 35 " | 50 " |
| " " middle of shaft, . | 15 " | 25 " | 33 " |
| " " distal extremity, | 19 " | 27 " | 42 " |

The astragalus of *Hippotherium ingenuum* from Archer, Levy County, Florida, is represented of the natural size in figure 4, plate III. It differs in no respect anatomically from the corresponding bone of the Domestic Horse except size. Its comparative measurements with a specimen pertaining to *H. plicatile* from the same locality, and another of the Horse from Peace Creek, are as follows:

| | H. ingenuum. | H. plicatile. | Equus. |
|---|---|---|---|
| Height of the tibial trochlea internally, | 36 mm. | 49 mm. | 67 mm. |
| Width of the tibial trochlea at middle, | 28 " | 40 " | 60 " |
| Fore and aft width of scaphoid articulation, | 20 " | 29 " | 37 " |
| Transverse width of calcanean articulation, | 26 " | 35 " | 50 " |

The upper molar tooth originally described as characteristic of *Hippotherium ingenuum* is represented in figure 3, plate III. In its extreme length, at the outer fore part, it is 47 mm., and in size approximates a similar tooth, from the phosphate beds of Ashley River, South Carolina, described under the name of *Hippotherium venustum*, in Holmes' Post-pliocene Fossils of South Carolina, 1860, p. 105, pl. XVI., fig. 33. In the Ashley specimen the inner column of the tooth is lost, but otherwise the

arrangement of the enamel on the worn triturating surface is sufficiently like that of the Archer tooth, as represented in the subjoined woodcut, to render it probable they might belong to the same species. However, in another specimen from Ashley River, as seen in fig. 32 of the work just indicated, the inner column of the tooth is retained and is observed to be cylindrical or regularly circular in transverse section, whereas in the Archer tooth it is compressed cylindrical or in section elliptical, from which difference it may be inferred that the latter pertains to another species from the former.



Hippotherium ingenuum.

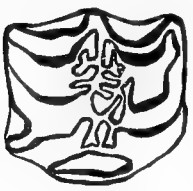
Later, an additional specimen, received from Archer, is a last upper molar referable to *H. ingenuum*. It is scarcely worn and so closely accords in size and other respects with the tooth above described as even to render it probable it may have belonged to the same individual.

In relation with the above, it is a fit opportunity to describe a few remains of another species of *Hippotherium*, previously noticed in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1882, p. 290, under the name of *Hippotherium montezuma*. The specimens, submitted to the examination of the author by the Secretary of the Smithsonian Institution, were presented to it by Mr. Ellis Clarke, Jr., who obtained them from near Lacualtipan, Hidalgo, Mexico. They consist of a couple of bone fragments and three molar teeth, and are stated to have been found in a bed of clay beneath one of shell limestone and above a four-foot bed of coal. The strata are probably of late tertiary age.

The fossils indicate an animal smaller than *Hippotherium plicatile* and about the size of *H. ingenuum*. Of the bone fragments, one is the upper extremity of a metatarsal, represented in figs. 5, 6, plate V. It exhibits at the sides well-marked impressions of the lateral, smaller metatarsals. The articular end measures 27 mm. transversely and 23 mm. fore and aft. The other fragment is the extreme, proximal articular end of a pastern represented in fig. 7, of the same plate. It is considerably wider transversely than the corresponding part in *H. ingenuum* and of less width fore and aft, measuring 29 mm. in the former and 16.5 mm. in the latter direction. It would appear to indicate a broader, less thick and perhaps shorter foot than in *H. ingenuum*.

Of the teeth, two are lower molars, apparently from different individuals. One, a fourth or fifth of the series, is little worn, and it has lost its exterior cementum. It is about 2 inches long and at the triturating surface is 20 mm. fore and aft, and 9 mm. transversely. The other, probably the third molar, is about half worn, but is broken away below and yet retains its exterior cementum. It measures 19 mm. fore and aft and 11 mm. transversely.

The remaining tooth, the most characteristic of the specimens, is an upper molar, probably the fourth of the right series, represented in fig. 10, plate V. It is but little worn; just sufficiently to expose the course of the enamel folding on the surface of the trituratting surface, represented in the adjoining woodcut. It is well preserved and retains completely its exterior cementum. It is a little larger than the tooth attributed to *H. ingenuum*, but its inner enamel column is nearly double the fore and aft diameter. The measurements of the tooth compared with those of corresponding teeth regarded as characteristic of the species *H. ingenuum* and *H. plicatile* are as follows :



H. montezuma.

| | H. montezuma. | H. ingenuum. | H. plicatile. |
|---|---|---|---|
| Fore and aft diameter externally, | 20 mm. | 19 mm. | 20 mm. |
| Transverse diameter at middle, | 17 " | 16.5 " | 22 " |
| Fore and aft diameter of internal column, | 8.2 " | 5.5 " | 7 " |

4. An upper true molar tooth and a first phalanx of an Ox according in size with those of *Bison americanus*.

5. Fragments of antlers, bones, and teeth of Deer, not differing from the corresponding parts of *Cervus virginianus*.

6. Remains of the American Elephant. Incidentally Mr. Willcox tells us that in his visits to Florida he had received information of the occurrence of teeth of the Elephant in different parts of the State.

A nearly entire specimen, a last upper molar tooth of huge size, represented in plate VII., from Peace Creek, was presented to Mr. Willcox by the finder, Mr. T. M. Rickards, of Candler, Marion County, Florida. In its present condition it weighs 24¾ pounds, and it now measures about 13 inches long and 11 inches in breadth fore and aft. It has about twenty-three constituent plates; the exact number being somewhat obscured from the posterior extremity of the tooth being doubled on itself, a deformity which is not uncommon in the existing Elephant, due to a want of sufficient room in the jaw for the perfect development of the tooth. The worn trituratting surface, 8 inches fore and aft and 3½ inches transversely, displays ten of the usual characteristic ellipses, according with so many plates or lobes of the tooth.

In a Monograph of the British Fossil Elephants, the author, Mr. A. L. Adams, records many specimens of the last upper molar of the *Elephas primigenius*. In the dwarf variety of this to the largest form, the tooth ranges from 6¾ inches in fore and aft extent to twice that dimension, and with from eighteen to twenty-seven ridges, or constituent plates, which, however, hold no proportion with the size of the tooth. In the largest molars, from 10½ to 13½ inches in breadth, eight plates occupied a space

ranging from $3\frac{1}{5}$ to 5 inches. In the Peace Creek molar eight plates of the triturating surface occupy a space of $6\frac{2}{5}$ inches.

In a recent visit to London, in the British Museum, the writer observed a specimen similar to the Peace Creek molar, labelled *Elephas primigenius*, San Felipe de Austin, Texas.

A sketch of another specimen, preserved in the cabinet of Wabash College, Crawfordsville, Indiana, has been submitted to the writer by Prof. E. O. Hovey, who gives the weight of the tooth as 21½ pounds and the dimensions as follows: Length from the upper back to the lower fore part, 15 inches; height, 13 inches; fore and aft breadth of the triturating surface, 7½ inches; transverse breadth, 3¾ inches. The triturating surface of the sketch displays about a dozen transverse ellipses or plates.

Submitted to the writer, from the Smithsonian Institution, are two specimens pertaining to the American Elephant, both from Peace Creek, and presented to the Institution by Mr. J. F. Le Baron. One of the specimens is the intermediate and greater portion of a last upper molar tooth agreeing with the corresponding portion of the tooth above described. The other specimen is the greater part of the right ramus of a mandible containing the last molar tooth. It is represented in figure 2, plate VIII. The jaw-bone accords pretty closely with the corresponding part of that of the *Elephas primigenius* as represented in Mr. Adams' Monograph above quoted. The tooth is worn its entire breadth, and on the triturating surface measures 10¾ inches fore and aft and $3\frac{1}{5}$ inches transversely, and displays twelve ellipses or plates, which appear to be the complete number entering into the constitution of the tooth. Eight of the ridges occupy a space $6\frac{2}{5}$ inches.

In the museum of the Academy of Natural Sciences of Philadelphia is a specimen consisting of the posterior and greater portion of a last molar tooth from the Caloosahatchie River, Florida, presented by Mr. Hamilton Disston. It resembles the corresponding portion of the tooth in the jaw fragment above described. Of the triturating surface $4\frac{1}{5}$ inches are occupied by the posterior eight constituent plates.

In his Monograph, Mr. Adams says he has not seen a lower last molar of the *Elephas primigenius* with so low a ridge formula as eighteen plates. He records a number of specimens ranging from 9 to 13 inches in breadth with from nineteen to twenty-four plates. In different teeth eight plates occupied a space ranging from 3¼ to 5 inches.

The Florida teeth evidently indicate an Elephant with much coarser-plated molars than those ascribed to the *Elephas primigenius* of Europe, Northern Asia and Northern America. As first distinctly indicated by Dr. Falconer (Palæontological Memoirs, 1868, Vol. II., page 212), they pertain to another variety or perhaps species, which he named the *Elephas Columbi*, and which lived in the regions bordering the Gulf of Mexico.

7. Perhaps the most interesting of the Peace Creek fossils are a number of dermal plates of several species of the giant, armadillo-like Glyptodonts, heretofore chiefly known from their remains found in the quaternary formations of South America.

Five specimens submitted to my examination by Mr. Willcox, and two others by Mr. Meigs, resemble so closely two similar ones from bone caverns of Brazil, represented by Dr. Lund, and described by him under the name of *Chlamydotherium Humboldtii*,* that it is not improbable they may have belonged to the same species. They are also exceedingly like a number of similar specimens recently observed by me in the collection of the British Museum and labelled with the same name, from the caves of Minas Garaes, Brazil. Four of the Peace Creek specimens are represented in figures 3–6, plate IV. Five of the plates are variably hexahedral in the outline of their breadth as exemplified in figs. 3, 6, one is petagonal, fig. 5, and the other oblong quadrate, as seen in fig. 4. The thinnest hexagonal plate, nearly uniform, is 8 mm. thick; three other hexagonal plates, nearly alike in thickness in different parts, are from 9 to 10 mm. thick; the pentagonal plate is from 7 to 13 mm. thick; and the oblong quadrate plate is 7.5 mm. thick at one extremity and 11 mm. at the other. The hexagonal plate of fig. 3 is the thickest, and measures from 11 to 16 mm.

The exterior surface of the plates to within 3 to 5 mm. of the borders is elevated and is everywhere more or less porous. The elevated portion of the surface is somewhat depressed concentrically, but rises in a variable low, elliptical eminence centrally. The borders of the plates are rugged, and the under surface is slightly concave and exhibits a few perforations.

The hexagonal plate, figure 3, is 49 mm. in its greatest breadth; another is 55 mm.; that of fig. 6 is 48 mm.; and another is 45 mm. The pentagonal plate, fig. 5, is 44 mm. broad; and the oblong quadrate one, fig. 4, is 55 mm. in its greater and 29 mm. in its smaller breadth.

Since writing the foregoing, Mr. Willcox has submitted to my examination a collection of twenty-eight additional plates, collected in Peace Creek and presented by Mr. T. S. Moorhead. Most of the plates accord with those already described, but several are different. One of them is pentahedral, oblong, 55 mm. in its greater and 36 mm. in its smaller breadth. One, probably a marginal plate, is pentahedral, with an angular border above and a convex border below. Another, represented in fig. 12, plate V., probably a marginal plate, is pentahedral, angular at the upper border and convex below, and with its exterior produced in a conical eminence with the apex directed downward. Its breadth is 36 mm., its height about the same, and its thickness to the apex of the conical eminence 22 mm.

Of fifteen hexahedral plates, the largest is 52 mm. in its greatest breadth, 35 mm. in its smallest breadth and 15 mm. in thickness; the smallest is 42

* Danske Vidensk. Selskab., Afhand., 1841, taf. XI.

mm. in the greater and 33 mm. in the lesser breadth and 9 mm. in thickness.

Several of these plates have been previously noticed by me in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1889, p. 97, and are referred to a species with the name of *Glyptodon septentrionalis*. They probably belong to the same species as the *Chlamydotherium Humboldtii* of South America.

Other *Glyptodon* remains from Peace Creek, collected by Mr. T. S. Moorhead, and sent to Mr. Willcox, consist of five dermal plates, which resemble those of *Hoplophorus euphractus* of Dr. Lund, found with *Chlamydotherium Humboldtii*, in the bone caverns of Brazil. In the American Naturalist, 1888, p. 345, Prof. Cope described a dermal plate of a *Glyptodon* from Nueces Co., Texas, which appears to be of the same kind as those under consideration. Prof. Cope several years previously reported the existence of a nearly complete carapace of a *Glyptodon* in the National Museum of Mexico, and another, together with the jaws and teeth, in the Museum of the School of Mines, discovered in the valley of Mexico.* The Texas specimen Prof. Cope refers to a species with the name of *Glyptodon petaliferus*, and says it is of the same type as the *Glyptodon* of Mexico, but is doubtful as to its identity.

The Florida plates are thick and hexahedral, with rugged borders. The exterior surface presents a nearly circular raised area surrounded with smaller areas divided from each other by radiating grooves. The surfaces of the raised areas are on the same plane, and are closely pitted. The dividing grooves are also pitted, and that enclosing the circular area exhibits to one side two larger perforations. In the specimen, represented in figure 9, plate IV., the greatest breadth is 44 mm., and the thickness 19 mm. A second, rather larger specimen has the same thickness; a third, about the same size, is not quite so thick, and a smaller specimen is 16 mm. thick. The remaining specimen, represented in figure 1, plate VI., is 53 mm. in its greatest breadth, and is 15 mm. thick. The areas of its outer surface are less coarsely pitted than in the others.

Accompanying the foregoing there is a specimen of an ungual phalanx, somewhat water-worn, probably pertaining to the fore foot of a *Glyptodon*. It is 52 mm. in length along its upper part, and is 28 mm. high and 30 mm. wide at base. The articular surface, somewhat broken, has been about 22 mm. wide and 17 mm. high.

Among the Peace Creek fossils sent by Mr. Moorhead to Mr. Willcox are a number of somewhat enigmatic character, which are nevertheless supposed to be dermal bones of Glyptodonts. They bear a general resemblance to the conical bones of the tail of *Glyptodon* or *Schistopleurum*

*Proc. Amer. Philos. Soc., Phila., 1885, 2.

*asper*, as represented in Dr. Burmeister's plate XL., in the Annales del Museo Publico de Buenos Aires, 1870–74.

A specimen, represented in figure 11, plate V., is a stout cone with the apex bent downward. The base is thick, irregularly circular, rounded and imperfectly defined from the cone by a shallow, irregular groove. Beneath, it is slightly concave, and the sides of the cone are smooth. The greater breadth at base is 42 mm., the smaller 38 mm., and the height 28 mm. A second, rather larger specimen is nearly like the former. A smaller specimen with an hexagonal oval base, 39 by 34 mm. in breadth, is 19 mm. high and has the apex to one side, but not abruptly bent as in the former.

A fourth specimen, smaller than the preceding, has a hexahedral base, and the cone partakes in a measure of the same form. It is 30 mm. in its greater breadth and 20 mm. high.

Five specimens, most alike, have the form of an oblique cone with the apex to a variable degree on one side. The base is circular or more or less rounded polygonal, slightly concave or flat beneath, and obtusely rounded at the border. It is also more or less defined by an irregular partial groove. In one of the largest specimens, the sides of the cone are most prominently convex, and the apex is rather abruptly bent so as to overhang the base. In a second specimen, of greater width in one direction than the former, the apex of the cone is not so prominent and does not overhang the base. In the third specimen, nearly as broad as the first, the cone is much depressed, being about a third lower, is flattened especially on the longer side, and has the apex straight and more blunt. The remaining two specimens, of which one is represented in figs. 2, 3, plate VI., are nearly the same size, but much smaller than the others. They are flattened cones with the apex overhanging the base; the one being considerably more depressed than the other. The measurements of the specimens are as follows:

| | | | | | |
|---|---|---|---|---|---|
| Greatest breadth of base, . . | 41 mm. | 43 mm. | 39 mm. | 24 mm. | 24 mm. |
| Smallest " " . | 37 " | 38 " | 35 " | 22 " | 20 " |
| Height of cone, . . . | 28 " | 25 " | 19 " | 15 " | 10 " |

A dermal bone, of much greater breadth than the preceding specimens, has a mammillary eminence most prominent to one side, and defined from the thick, ovoidal, flat base by a continuous groove. Its greater breadth is 57 mm., its smaller one 50 mm., and its height 23 mm.

A small dermal bone with a hexagonal base has a conical eminence with the apex to one side. Its greatest breadth is 29 mm., the smaller 26 mm., and the height 22 mm.

Another specimen is a flat, pointed cone with an elliptical convex base. Its greater breadth is 24 mm., its smaller one 11 mm., and its height 29 mm.

Three dermal bones of greater length than breadth are variably curved conical, and have a thick base. That represented in figs. 10, 11, plate III., is nearly straight and has its base nearly flat. In another, about the same size, the cone is most curved and pointed, and the base is thick and convex. In the remaining and largest specimen, the cone is more pyramidal and the base thicker and convex. It is hollow and contains a nucleus which rattles when the specimen is shaken. The measurements of the specimens are as follows:

| | | | |
|---|---|---|---|
| Breadth of base, . . . . . | 24 mm. | 27 mm. | 34 mm. |
| Height of cone, . . . . . | 40 " | 37 " | 46 " |

A more enigmatic specimen than the conical dermal bones above described is the one represented in figures 7, 8, plate IV. It has a thick, elongated hexagonal basis, from which spring two unequal conical tubercles separated by a valley, divided by a grooved ridge. The measurements of the specimen are as follows:

| | |
|---|---|
| Length of the bone, . . . . . | 59 mm. |
| Thickness of the base, . . . . . | 11 " |
| Breadth opposite the larger tubercle, . . . . . | 30 " |
| Breadth opposite the smaller tubercle, . . . . . | 24 " |
| Height at the larger tubercle, . . . . . | 32 " |
| Height at the smaller tubercle, . . . . . | 30 " |

8. Among the Peace Creek fossils occurs a single bone of the *Megalonyx Jeffersonii*, a first phalanx, like that represented in figures 3, 7, plate X., of "A Memoir on the Extinct Sloth Tribe of North America." The length of the specimen is 30 mm., its depth 52 mm., and its breadth 32 mm.

9. Fragments of ribs of a Manatee, *Manatus antiquus*.

10. Half a dozen vertebræ and several teeth of several Cetacea of the family of the Dolphins; undetermined.

11. Remains of several species of Emyds, consisting of fragments of the carapace and plastron. Among them the only specimen sufficiently characteristic for determination is the nuchal plate represented in fig. 1, plate IV. It is remarkable for its deeply sculptured condition, greatly exceeding in this respect the corresponding bone in our known recent species of *Emys*. The areas defining the scutes which impress the plate are deeply cut and are crossed by prominent ridges separated by deep furrows. The fossil probably indicates an extinct species, for which the name of *Emys euglypha** has been proposed. The measurements of the specimen are as follows:

* Proc. Acad. Nat. Sc., 1889, 97.

| | |
|---|---|
| Length of nuchal plate in median line, | 57 mm. |
| Breadth " " " at lateral angles, | 72 " |
| " " " " at anterior extremity, | 37 " |
| " " " " at posterior border, | 23.5 " |
| Thickness at the first marginal suture, | 21 " |
| Length of first vertebral scute impression, | 38 " |
| Breadth of " " " " | 50 " |
| Length of nuchal scute impression, | 20 " |
| Breadth of first marginal scute impression, | 30 " |

12. Fragments of the carapace and plastron of one or two species of *Trionyx*, undetermined.

13. Remains of a huge Tortoise with a very thick shell, estimated to have been about five feet in length, presented by J. F. Le Baron to the Smithsonian Institution. They consist of a number of fragments of the shell and some of the limb bones of one individual mingled with a few fragments of the shells of two others. A number of the specimens are so imperfect that I have failed to correlate them.

A single vertebral plate, of greater breadth than length, is hexagonal, with the exterior surface rugose and porous, but not sculptured. A strong carina beneath marks its conjunction with the corresponding vertebræ. Its measurements are as follows:

| | |
|---|---|
| Greatest breadth between the lateral angles, | 150 mm. |
| Breadth at the anterior border, | 100 " |
| Breadth at the posterior border, | 110 " |
| General thickness, | 30 " |
| Depth at the median carina, | 50 " |
| Length fore and aft in the median line, | 100 " |

Of two fragments of costal plates one is 135 mm. wide fore and aft and is 25 mm. thick.

A large marginal plate is everted and has a thick, obtusely rounded free border, rugose or much eroded in the specimen. Its upper surface forms a continuous concave curve from the inner to the outer border, and is crossed about the middle by a groove defining the investing scutes. The under part of the plate is concave above, and convex below where marked by the scutal areas. The measurements of the specimen are as follows:

| | |
|---|---|
| Breadth in a straight line transversely above, | 230 mm. |
| Breadth fore and aft at the outer border, | 140 " |
| Breadth of the scutal border transversely beneath, | 170 " |
| Thickness toward the outer border, | 55 " |
| Thickness of the upper or inner border, | 22 " |

Another marginal plate of much less breadth than the former is strongly concave above in a transverse direction and has the free border obtusely rounded. The upper surface is marked by grooves above and below, as well as along the middle, separating the upper scutal areas from those beneath the plate; but this condition may be anomalous in the specimen, and is not obvious in others. The measurements of the plate are as follows:

| | |
|---|---|
| Width in a straight line transversely, . . . . . | 120 mm. |
| Breadth above fore and aft, . . . . . | 160 " |
| Greatest thickness, . . . . . | 40 " |

Two other marginal plates, somewhat mutilated, have nearly the size and form of the preceding, but have their free border acute, and resemble the corresponding everted plates in the Red-leg Terrapin, *Emys rugosa*. They are crossed by grooves of the investing scutes, but do not exhibit those running near the outer border in the former specimen.

A fragment, the outer part of a marginal plate, which has been about 200 mm. in breadth fore and aft, is very thick and rounded, and resembles in these respects the specimen of a marginal plate, referred to *Eupachemys rugosus*, from the phosphate beds of Ashley River, S. C., described in the Journal of the Academy of Natural Sciences of Philadelphia, 1877, p. 232, plate XXXIV., figs. 4, 5. It is uncertain whether it belongs to the same individual, or even species, with the former specimens.

Considerable portions of the anterior and posterior extremities of a plastron, which in its entire extent was upwards of four feet in length. The anterior portion, represented in figure 4, plate VI., consists of the greater part of the left epiplastron with the contiguous part of the entoplastron and the outer portion of the corresponding hyoplastron, and part of the right epiplastron. The posterior portion consists of the posterior and outer parts of both xiphiplastrons, with the adjacent outer parts of both hyoplastrons adjoining the inguinal notches, as represented in figure 5, plate VI.

The plastron beneath, coextensive with its fragments, is quite flat, rough and porous, but nowhere sculptured. Its anterior extremity is moderately projecting beyond the postero-lateral borders of the gular scute areas. The posterior or caudal notch is broad and shallow.

The groove defining the gular scute area behind crosses the epiplastron in advance of the middle, at first curving inward from the free margin of the plastron, and then abruptly backward and inward on the anterior extremity of the entoplastron. The area of the pectoral scute is large, and the groove defining it behind passes in a slightly oblique line from the axillary notch backward and then turns directly inward. The groove defining the caudal scute areas in front crosses the xiphiplastrons a short distance back of their middle, making an abrupt bend at the outer third of its course.

Measurements of the plastron, in part approximate and estimated, are as follows :

| | |
|---|---|
| Length of anterior extremity in median line to a level with the bottom of the axillary notches, | 280 mm. |
| Length of posterior extremity to a level with the bottom of the inguinal notches, | 260 " |
| Depth of axillary notch from fore part of epiplastron, | 390 " |
| Depth of inguinal notch from end of xiphiplastron, | 315 " |
| Breadth of plastron at bottom of axillary notches, | 520 " |
| " " " inguinal " | 520 " |
| " at posterior groove of the pectoral scutes, | 640 " |
| " at anterior groove of the femoral scutes, | 640 " |
| Greatest thickness of epiplastron at median suture, | 70 " |
| Breadth of xiphiplastron along anterior suture, | 250 " |
| Greatest thickness of hyoplastron, | 46 " |
| Breadth of entoplastron, | 250 " |
| Breadth of caudal notch, | 200 " |
| Depth of " " | 45 " |
| Thickness of hyoplastron near bottom of inguinal notch at groove of the inguinal scute, | 90 " |
| Breadth of xiphiplastron along anterior groove of the caudal scute, | 180 " |
| Length of caudal scute area laterally, | 100 " |

The specimens of the limb bones consist of fragments of the bones of the shoulder and pelvis of one side, the shaft of a humerus, a mutilated femur, and a tibia, all of which resemble the corresponding bones of recent Tortoises. Of the scapula, the intermediate portion with the glenoid articular surface is preserved. The adjacent part of the acromial process is 47 mm. in its greater and 22 mm. in its lesser diameter.

A mutilated coracoid from the glenoid articulation is 155 mm. long, and at the articulation is 60 mm. in breadth.

The shaft of a humerus is much more robust than the corresponding portion of the femur. The deltoid insertion, strongly marked, extends to near the middle of the shaft. A shallow but conspicuous groove descends from the front of the latter towards the outer condyloid ridge and appears to substitute the vascular canal in a nearly similar position in recent Tortoises. The measurements of the specimen are as follows :

| | |
|---|---|
| Circumference of shaft of humerus where narrowest, | 125 mm. |
| Fore and aft diameter " " " | 41 " |
| Lateral " " " " | 43 " |
| Breadth of distal extremity, estimated, | 76 " |

The measurements of the femur, figure 6, plate VI., are as follows:

| | |
|---|---|
| Length of femur, | 210 mm. |
| Breadth of proximal end, head and outer trochanter, | 100 " |
| Breadth of head laterally, | 80 " |
| " " fore and aft, | 65 " |
| Circumference narrowest part of shaft, | 140 " |
| Diameter fore and aft, | 40 " |
| " laterally, | 33 " |
| Breadth of distal extremity transversely, | 80 " |
| " " " fore and aft externally, | 60 " |

The tibia, figure 7, plate VI., closely resembles the same bone in recent Tortoises. Its measurements are as follows:

| | |
|---|---|
| Extreme length outwardly, | 152 mm. |
| Length in front at the middle, | 143 " |
| Circumference of shaft where narrowest, | 85 " |
| Fore and aft diameter " " | 23 " |
| Lateral " " " | 26 " |
| Breadth of head transversely. | 63 " |
| " " fore and aft, | 46 " |
| Breadth of distal end transversely, | 46 " |
| " " " fore and aft, | 36 " |

The species, which seems to be distinct from known forms, may be named *Testudo crassiscutata.*

14. Two vertebræ of a large serpent, undetermined.

15. Several teeth, a fragment of the mandible, and several dermal plates of a Crocodile, probably the *Alligator mississippiensis.* A dermal plate has its greater breadth 70 mm. and its shorter 53 mm. Its boss is elliptical and thick, 43 mm. by 15 mm. and 27 mm. high. A smaller plate, represented in fig. 2, plate IV., is 50 by 45 mm. in breadth, and has its boss 40 by 20 mm. broad and is 24 mm. high.

16. Associated with the foregoing are a few remains of fishes consisting of several vertebræ of Sharks and Teleosts, the swollen interspinal bone of *Ephippus gigas,* several large caudal spines and dermal tubercles of rays and teeth of *Diodon, Myliobates, Oxyrhina* and *Galeocerdo.*

## NOTICE OF SOME MAMMALIAN REMAINS FROM THE SALT MINE OF PETITE ANSE, LOUISIANA.

BY PROF. JOSEPH LEIDY.

The subject of the present communication is a collection of fossil bones and teeth from the salt mine of Petite Anse Island, on the coast of Louisiana.

The fossils were presented to the Smithsonian Institution in 1883 and 1884, by Mr. William Crooks, of the American Salt Works, New Iberia, Louisiana, and were submitted to the examination of the writer by the Secretary of the Institution, the late Prof. Baird.

Several letters accompanying the collection give the information that the fossils were found while sinking an air shaft, to the salt mine, in a ravine the surface of which is about 20 feet above mean tide; the hills bounding the ravine being from 20 to 50 feet higher. The bed of salt at this point is from 19 to 21½ feet below the surface of the ravine and thus practically about the sea level. The overlying strata consist of the following: 1, superficial sandy soil, 6 feet; 2, sands, 4 feet; 3, black earth, like that of the neighboring bogs, containing fragments of pottery, 4 feet; 4, sands, 2 feet; 5, dark coarse sand and gravel, in contact with the salt bed, and varying in depth from 6 inches to 2 feet according to the dip of the latter bed. In this deepest layer the fossil bones together with vegetal remains were found, many of them close to if not actually in contact with the salt. The bones and teeth are stained chocolate brown and black, are otherwise little altered, and are not rolled or water-worn. They consist of remains of *Mastodon americanus*, *Mylodon* and of a Horse. The Mastodon remains, besides several fragments of vertebræ and other bones, consist of well-preserved molar teeth, the last two of the lower series.

The remains of *Mylodon* consist of a mutilated malar bone, a cervical, two thoracic and four caudal vertebræ, the distal articulation of a humerus, two tibiæ, an ungual phalanx, and three teeth.

The malar bone, with its three branches, nearly resembles that of *Mylodon robustus*, as represented in plate II. of Owen's "Description of the Skeleton of an Extinct Gigantic Sloth," London, 1842.

The distal fragment of a humerus exhibits the radio-ulnar articulation,

which is like that of *Mylodon robustus*, as represented in the same work. The breadth of the articulation is 130 mm.

The tibia, of which a representation is given in figure 1, plate V., also closely resembles that of the *Mylodon robustus*, both in its form and proportions, as given in Prof. Owen's figures, plate XX., of the work above mentioned. It is a short, exceedingly robust bone, the breadth of the proximal extremity being upwards of three-fourths its length. The shaft, compressed cylindroid and expanding towards the extremities, at its narrowest part is nearly twice the width transversely that it is fore and aft. The proximal surface, reniform in outline, exhibits the usual pair of articular surfaces. Of these, the outer, very much the larger, is oval and deeply concave, with its longer diameter directed obliquely from before inward and backward. The outer articular surface, nearly plane except a small portion behind, is half circular outwardly and forms two sides of a square inwardly. The patellar tubercle is a thick triangular eminence bent outwards. Beneath the tuberosity supporting the outer condylar surface is that for the fibula; a large elliptical plane sloping from without inward and backward and looking downward, and surrounded with a thick rugged border for ligamentous attachment.

The distal extremity of the tibia presents the articular surface of the ankle-joint divided into three portions, of which the inner two are for the astragalus, and the third, smallest, outer, half circular one for the fibula. Of the astragalar articulation the inner division is a deep, half conical, concave recess; the outer a wide, reniform, nearly flat or slightly concave surface.

The internal malleolus presents a deep, wide groove descending obliquely from the back of the shaft forward for the flexor and adductor tendons of the foot. The outer part of the distal extremity forms a thick, rough tuberosity for ligamentous attachment with the fibula.

The measurements of the tibia are as follows:

| | |
|---|---|
| Extreme length along the inner border, | 233 mm. |
| Length along the fibular border, | 183 " |
| Breadth of proximal extremity, | 180 " |
| Longer diameter of the inner condylar articulation, | 95 " |
| Shorter " " " " " | 87 " |
| Transverse diameter of outer articulation, | 72 " |
| Fore and aft " " " | 70 " |
| Extreme breadth of distal extremity, | 144 " |
| Greater " " " fore and aft, | 100 " |
| Breadth of distal articulation transversely, | 123 " |
| " " " " fore and aft, | 92 " |
| Greater breadth of upper fibular articular surface, | 64 " |
| Smaller " " " " " | 34 " |

| | |
|---|---|
| Circumference of shaft where narrowest, | 236 mm. |
| Transverse diameter " " | 92 " |
| Fore and aft " " " | 54 " |

In comparison with two tibiæ of *Mylodon harlani*, from Missouri, referred by Dr. Harlan to the *Orycterotherium missouriense*, in "A Description of the Bones of a New Fossil Animal of the Order Edentata," American Journal of Science and Arts, 1843, 69, the corresponding measurements are as follows:

| | Louisiana specimens. | Missouri specimens. |
|---|---|---|
| Total length, | 10 in. | 10 in. 10½ in. |
| Transverse diameter proximal extremity, | $7\frac{2}{10}$ " | $5\frac{3}{10}$ " $6\frac{7}{10}$ " |
| " " distal " | $5\frac{8}{10}$ " | 5 " 5½ " |
| Circumference at middle of shaft, | 9½ " | 9½ " $10\frac{7}{10}$ " |

In comparison with the tibia of *Mylodon robustus*, as described in Prof. Owen's memoir, the measurements are as follows:

| | Mylodon harlani. | M. robustus. |
|---|---|---|
| Greatest length along the middle, | 10 in. | 8 in. 6 lines. |
| Smallest circumference of the shaft, | 9 " 5 lines. | 8 " 6 " |
| Breadth of proximal articular surface, | 7 " | 6 " 6 " |
| " " distal " " | 4 " 6 " | 4 " 6 " |

The ungual phalanx, represented in figure 2, plate V., resembles that of the second toe of the hind foot of *Mylodon robustus*, as seen in Prof. Owen's figures in the work above indicated. It pertains to the largest of the four toes of the foot. The specimen has its osseous sheath of the nail broken away, except the root or base. The lower part of this extends nearly half the length of the bone beneath. The matrix of the claw is thick and transversely convex above as well as in the length. The measurements of the specimen are as follows:

| | |
|---|---|
| Extreme length to the end of the bone, | 166 mm. |
| Depth obliquely at the proximal extremity, | 65 " |
| Transverse breadth at the " " | 50 " |

In comparison with the corresponding phalanx of *Mylodon robustus* as given in Prof. Owen's memoir, the measurements are as follows:

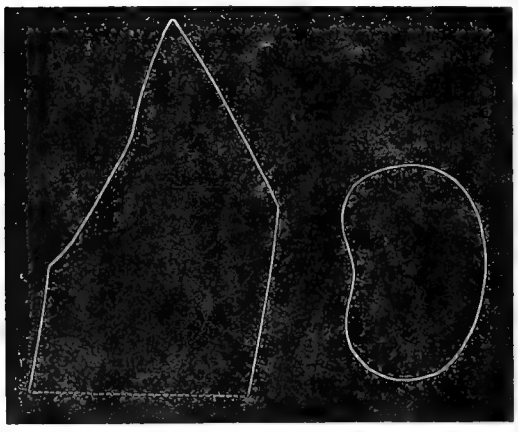
| | M. harlani. | M. robustus. |
|---|---|---|
| Length, | 6 in. 8 lines. | 5 in. 4 lines. |
| Greatest height near middle, | 2 " 2 " | 1 " 10 " |
| Circumference " " | 6 " 2 " | 6 " 3 " |
| Breadth " " | 1 " 3 " | 1 " 9 " |

The three teeth above indicated, from their association with the bones just described, and from their relation with others previously referred to *Mylodon harlani*, are regarded as also belonging to this species, the dentition of which is yet imperfectly known.

One of the specimens accords in form and size with the third molar contained in the fragment of a mandible, from Big-bone-lick, Kentucky, on which the species was originally established, represented in figures 1, 2, plate XIV., of "A Memoir on the Extinct Sloth Tribe of North America," by the writer. It also accords in character with an isolated tooth of the *Mylodon harlani*, from Missouri, referred by Dr. Harlan to *Orycterotherium missouriense*, represented in figs. 3, 4, plate I., of the American Journal of Science and Arts for 1843.

The triturating surface of the tooth, the greater part of its extent, forms a horizontal plane, worn off in a short slope at the inner fore and outer parts and with a concave pit on the inner lobe. The breadth of the tooth at the middle obliquely from without forward and inward is 28 mm.; the fore and aft breadth of its inner lobe 24 mm. and of its outer lobe 14 mm. At the constriction between the lobes it is 12 mm.

A second specimen accords in form and size with the first lower molar retained in a fragment of the mandible of *Mylodon harlani*, from Missouri, represented in figure 2, plate III., of Dr. Harlan's description above indicated. The tooth is reniform in transverse section, and in this respect accords with a fragment of the tooth in the mandibular specimen on which the species was first established. The biting extremity is remarkably different from that of the corresponding tooth of *Mylodon robustus*, as represented in the plates of Prof. Owen's memoir, in which it ends in a single slightly oblique plane. In the specimen under consideration, as represented in figure 3, plate V., and in the subjoined woodcut, it forms an acute pyramid, from the apex of which a sharp crest extends inward and downward; and from the crest a plane slopes downward and forward, and a steeper, longer and curved surface descends behind; so that the tooth resembles more the tooth of the living two-toed Sloth, *Unau*, than that of the *Mylodon robustus*, or the more posterior molars of the species to which the tooth belongs.

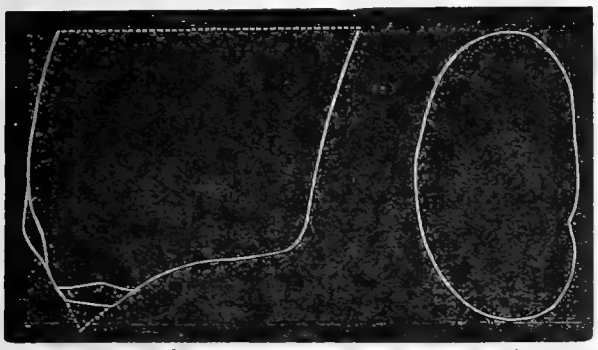


1 2

First lower molar tooth, Mylodon harlani. 1, outline of upper extremity; 2, transverse section.

The remaining tooth, regarded as a first upper molar of *Mylodon harlani*, figure 4, plate V., is also remarkably different from the corresponding tooth

of *M. robustus*. Its proportions indeed are so different, that it may be questioned whether it really belonged to the same animal as the preceding specimens, and if so, in view also of the difference in the first lower molar tooth, whether it does not indicate another genus. It resembles more nearly the first molars of both jaws of *Megalonyx* in its proportions and form than it does the corresponding teeth of *Mylodon robustus*. In its proportions it is like the last lower molar, but in form is more like the first one of *Megalonyx*. In transverse section it is elliptical, more convex internally, somewhat flattened externally and indented slightly along the anterior third. The biting extremity descends in a point at the anterior third, but to a far less degree than in the lower tooth. The point extends in a transverse crest whence the triturating surface slopes forward in a short plane, and backward in a longer sloping concavity. An outline of the extremity of the tooth and of the transverse section are represented in the subjoined woodcut. The fore and aft diameter of the tooth is 33 mm., the transverse diameter 18 mm.



1 2

First upper molar tooth, Mylodon harlani. 1, outline of lower extremity; 2, transverse section.

The remains of the Horse, of the Petite Anse collection, consist of half a dozen broken vertebræ, portions of several limb bones, fragments of a mandible and a number of teeth of several individuals which were about the size of the largest variety of the Domestic Horse. Though they present no anatomical characters distinguishing them from the corresponding parts of the latter, from the circumstances under which they were found, in association with the remains of undoubted extinct animals, and at a considerable depth, taken into consideration with similar evidence from other sources, it is rendered probable that they belonged to an indigenous and extinct species of Horse.

Two specimens of the atlas show the following measurements:

| | | |
|---|---|---|
| Breadth at the anterior or condylar articulation, . . | 91 mm. | 98 mm. |
| Fore and aft length of the vertebral arch, . . . | 40 " | 40 " |

The distal extremity of a humerus at the articulation is 84 mm. in breadth.

The distal extremity of a radius is 83 mm. in breadth, and at the carpal articulation is 68 mm. wide.

The distal extremity of a tibia has the greater breadth 95 mm. and fore and aft 54 mm.

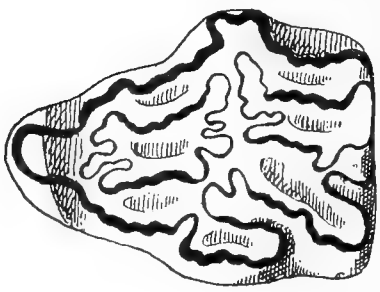
The teeth consist of nine upper and five lower molars and five incisors, and appear to have pertained to three different individuals. Seven of the upper molars seem to have belonged to the same individual, young but mature; the teeth being but slightly worn. One of them measures along the fore part of its outer curvature 112 mm. in length. Two other upper molars appear to have belonged to an older and somewhat smaller individual; and the lower molars to a third, larger and still older individual. The teeth have the sharper part of their roots broken away as if they had been somewhat water-rolled, and their cavities are filled with indurated gravel.

Specimens of upper molars of the Horse found under similar circumstances as the preceding, when approximating in size more or less those of the largest variety of the Domestic Horse, and exhibiting on the worn triturating surface of the teeth a variably greater degree of folding of the enamel than usual in the latter, have been supposed to belong to an indigenous extinct species, which was named by Dekay the *Equus major.*

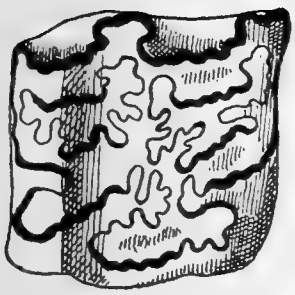
Other specimens of upper molar teeth, found associated with the former or under similar circumstances alone, not differing in any respect from those of ordinary varieties of the Domestic Horse more than the teeth of this do among themselves, have been conjectured to indicate another indigenous species, for which the name of *Equus fraternus* has been proposed. Admitting the probable former existence of these two indigenous species, many specimens which have been found of intermediate character render it impossible in many cases to separate or distinguish them.

The remains of the Horse of the salt mine of Petite Anse, from their relative size and the in general somewhat greater degree of complexity of folding of the enamel in most of the upper molar teeth, we would refer to the *Equus major.*

The adjoining figure represents one of the specimens, an upper first large molar tooth, in which the triturating surface presents no greater degree of folding of the enamel than is usual in the Domestic Horse. The tooth presents the following measurements:



| | |
|---|---|
| Length of crown at its back outer border, | 50 mm. |
| Fore and aft breadth of the triturating surface, | 44 " |
| Transverse breadth, | 30 " |



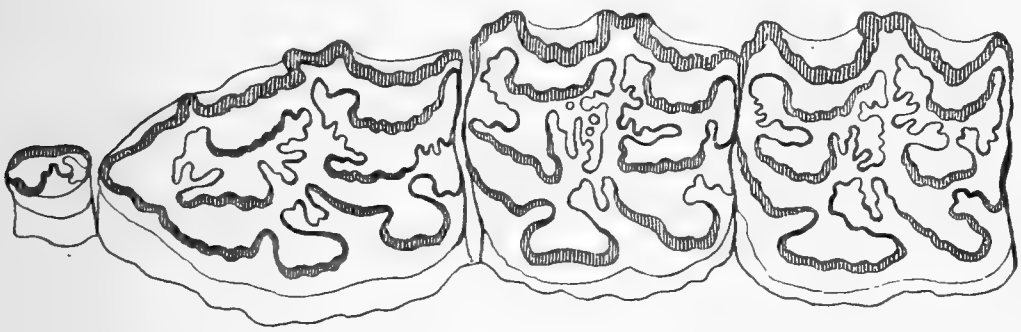
The second figure represents a third large upper molar, in which the triturating surface presents rather more folding of the enamel than is commonly observed in the corresponding tooth of the Domestic Horse. The measurements of the tooth are as follows :

| | | |
|---|---|---|
| Length of crown at the fore part outward, | 70 | mm. |
| Fore and aft breadth of triturating surface, | 31.5 | " |
| Transverse " " " | 31 | " |

An inferior molar measures 33 mm. fore and aft and 22 mm. transversely.

A lateral incisor has no pit, but is slightly incurved at the sides. It is 20 mm. in breadth. An intermediate incisor on the worn triturating surface is 22 mm. broad transversely and 13 mm. fore and aft.

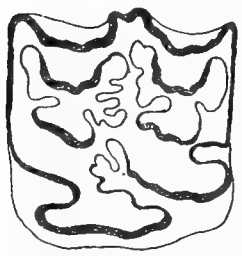
Incidentally may be described a specimen, the fragment of an upper jaw with teeth of a Horse, submitted to my examination by Prof. A. H. Worthen, State Geologist, Springfield, Illinois. It was found in a bog on the confines of Bond and Fayette County, Illinois. A view of the triturating surfaces of the teeth is represented in the subjoined woodcut.

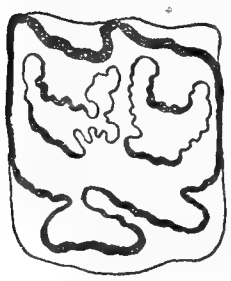


The teeth in the jaw consist of the anterior small premolar and the succeeding three large ones, all worn sufficiently to display the course of the enamel on the triturating surfaces. From the size of the teeth and the greater degree of folding of the enamel than is seen in ordinary varieties of our Domestic Horse, I suspect the specimen to belong to the indigenous species *Equus major ;* though it may be a fragment from a variety of the introduced Horse. In the specimen, in the maxilla, which is preserved in advance of the premolars to the premaxillary articulation, in a distance of 3¼ inches, there is no trace of a canine alveolus. The measurements of the fossil are as follows :

| | |
|---|---|
| Length of maxilla from behind the fifth molar alveolus to the premaxillary articulation, | 224 mm. |
| Fore and aft diameter of first premolar, | 9 " |
| " " " second " | 42 " |
| " " " third " | 32 " |
| " " " fourth " | 31 " |
| Transverse diameter of first premolar, | 5 " |
| " " second " | 30 " |
| " " third and fourth premolar, | 31 " |

In a collection of fossils from Northern Nicaragua submitted to the inspection of the author by Mrs. Dr. B. F. Guerrero, and forming the subjects of a notice in the Proceedings of the Academy of Natural Sciences, 1886, page 275, were two molar teeth of the Horse in association with remains of Elephant, Mastodon, Megatherium, Ox, *Toxodon burmeisteri* and *Hydrochoerus robustus*. The teeth of the Horse, most probably of an indigenous species, are not distinguishable from those of the Domestic Horse, and most likely pertain to the South American extinct species distinguished by Prof. Owen with the name of *Equus curvidens*. One of the specimens, of which a view of the triturating surface is given in the upper subjoined cut, is 65 mm. long at its outer fore part and has a breadth of 26.5 mm. The other specimen, considerably more worn, has the crown at the outer fore part 40 mm. long, and the triturating surface, represented in the annexed cut is 23 mm. fore and aft and 27 mm. transversely.





# ON PLATYGONUS, AN EXTINCT GENUS ALLIED TO THE PECCARIES.

BY PROF. JOSEPH LEIDY.

*Platygonus* is an extinct genus, closely related with the Peccaries, *Dicotyles*, of which two species, the *D. labiatus* and *D. tajassu*, live in South America, and according to Prof. Cope, a third, the *D. angulatus*, in North America extending up to Texas. The remains of *Platygonus* belong to the quaternary formations of North America.

Recently, the writer procured through purchase for the Academy of Natural Sciences of Philadelphia, from the able naturalist and explorer, Prof. Henry A. Ward, of Rochester, New York, a collection of remarkably well-preserved remains of two adult individuals of *Platygonus compressus*, which were found in making a railway excavation, in a gravel bank, a few miles from Rochester. Of one individual there is the greater part of the skeleton, consisting of the nearly perfect skull with the teeth, represented in figure 1, plate VIII., twenty-one vertebræ, the sacrum, the long bones of both pairs of limbs, the imperfect scapulæ, an innominatum and part of a second, both pairs of principal metacarpals, one pair of principal metatarsals, an astragalus, a calcaneum, portions of a sternum and fragments of three ribs. Of the second individual there is a less perfect skull with the upper teeth, but without the mandible.

In the collection of Prof. O. C. Marsh, at Yale College, New Haven, Conn., I saw the less well-preserved remains of half a dozen skeletons of the same species of *Platygonus*, found near Columbus, Ohio.

Formerly I described a nearly complete skull, admirably preserved, of an individual which though nearly adult had not yet shed the temporary molar teeth. It was found in a cave in Kentucky in 1805, and remained in the collection of the American Philosophical Society nearly half a century before its character was discovered. The specimen is described and figured in the Transactions of the Society for 1856, page 323, plates XXXV. and XXXVI.

The genus was originally made known by Dr. John L. Le Conte, from remains found in the crevices of the lead-bearing rocks near Galena, Illinois.

(Am. Jour. Sci., 1848, 102; Mem. Amer. Acad. Sci. and Art, 1848, 257.)

The two skulls of *Platygonus compressus*, from New York, found together, are nearly identical in condition of age and anatomical character. As exemplified by figure 1, plate VIII., of the better preserved specimen, the skull approximates in size as well as in shape and construction that of the larger South American species of Peccary, *Dicotyles labiatus*. It is on the whole somewhat larger, and especially has the cranium of greater breadth and the face considerably longer and more tapering. The temporal fossæ are of less extent fore and aft and have nearly the same depth and width, so that they have actually less proportionate capacity and thus indicate less powerful temporal muscles. The sagittal crest has about the same extent, but the temporal ridges are shorter and are more widely divergent.

The forehead is of much greater breadth, but proportionately shorter, and it is flatter, while the supra-orbital ridges are more elevated or brought nearer to the same level. Its fore part, nearly on a line with the front of the orbits, slants more abruptly, and the top of the face is thence to the end of the snout more convex.

The orbits are situated more posterior and higher and are of greater depth. The supra-orbital ridge is more prominent outwardly and the infra-orbital ridge is everted. The entrance is more open behind and is bounded in front by a larger and conspicuous conical lachrymal eminence defined by deep notches.

The supra-orbital foramina hold nearly the same relative position, but are not quite so much advanced, and from them proceed conspicuous neuro-vascular grooves in the same manner as in the Peccaries.

The zygoma has the same form and construction as in *Dicotyles labiatus*, but is of considerably greater vertical depth. Its posterior abutment with the ascending angular process and relative position of the glenoid articulation and auditory meatus is the same. The quadrate notch forming the outer limit of the temporal fossa is deeper, but of less extent fore and aft. The malar portion of the arch is more elevated above the temporal zygomatic process, so that the latter seems more projecting beneath and the glenoid articulation appears more dependent. The outer face of the malar is more vertical and is concave.

In *Dicotyles labiatus*, the malar crest, forming the most prominent portion of the skull laterally, appears as an acute ridge defining the zygoma below and ascending obliquely from the glenoid articulation to near the middle of the face. In *Platygonus* it forms a semicircular ridge defining the malar below from behind the post-orbital process to the maxilla, where it is continuous with a less acute ridge not extending so far as in the Peccaries. The malar crest ceases above the position of the infra-orbital foramen, corresponding with that of the last premolar tooth. The surface in advance of the orbit slopes as in the Peccaries, but is less depressed, and is remarkably

roughened, extending to the fore part of the malar crest, instead of being smooth.

The masseteric groove beneath the zygoma is more conspicuous, being longer, wider and deeper than in *Dicotyles labiatus*, indicating larger masseter muscles, to compensate for the smaller temporals, than in the latter.

The depth of the face below the anterior abutment of the zygoma is very much greater than in *Dicotyles labiatus*. The deep fossa in the latter, below the malar crest in advance of the masseteric groove, is represented by a shallow impression in *Platygonus*.

The infra-orbital foramen is placed above the last premolar, intermediate to the position it occupies in *Dicotyles labiatus*, and *D. angulatus*. A foramen at the fore part of the fossa, into which the former opens, extends as a canal above the alveolar border of the jaw.

The muzzle of *Platygonus* is not only longer and more tapering than in *Dicotyles labiatus*, but is of more uniform thickness transversely from above downward. It is especially prolonged in advance of the position of the molar teeth, the hiatus between these and the canines being very much greater. The top, formed by the nasals, is more regularly demicylindrical or less flattened, and turns more down at the end, which is much narrower and tapering.

The remarkable process of the canine alveolus is more conspicuous than in the Peccaries, having a considerably greater size than in *Dicotyles labiatus*, though the canine teeth are smaller. Its upper extremity is more produced, and reaches to about the middle of the position of the lateral nasal notch, whereas in the Peccaries it is more posterior in relation with the latter.

The premaxillaries are narrower and more tapering than in the Peccaries.

The occipital region or inion closely resembles that of *Dicotyles labiatus*, except that its upper part is of greater relative width compared with the lower part, and has a comparatively thin, delicate border instead of the thick, rough one of the latter.

The basi-occipital region conforms to that of the Peccaries. The basilar process is much more strongly marked, and its fore part is produced with a conspicuous pair of tuberosities instead of the shallow, roughened eminences of the latter. The paramastoid processes, auditory bullæ, and occipital condyles have the same character and the contiguous foramina the same relationship as in the Peccaries. The guttural region does not exhibit the narrow, contracted condition of the latter, but a remarkably inflated arrangement. The basi-sphenoid turns up almost at a right angle from the basi-occipital, and with the pre-sphenoid curves forward and produces a deep carina articulating with the vomer. On each side of this, included by the pterygoids, the sphenoid forms a pair of capacious, deeply concave recesses, opening forward into the nares; a condition which is an exaggeration of that in the same position of the Peccaries. Further, between the nares and

the roof of the mouth is another capacious and deeply concave recess bounded laterally by the palate bones and pterygoids. Below the bottom of the orbit a cellular expansion extends backward from between the maxilla and the palate bone, as in *Dicotyles labiatus*, but proportionately much greater.

The roof of the mouth or hard palate is narrower than in *Dicotyles labiatus*, and though in general roughened, it scarcely exhibits the transverse lateral ridges of this animal. In advance of the molar teeth it resembles more that of *D. angulatus* than of the former, and the incisive foramina are larger. Its back part, from the position of the last molars, is depressed into a broad cavity instead of a narrow groove as in *Dicotyles labiatus*.

The glenoid fossæ have a more downward position than in the Peccaries, and they are less transverse, *i. e.*, their long diameter has a more backward inclination.

The mandible is nearly like that of *Dicotyles*. The angle is of greater extent fore and aft; is produced less backward and more downward and forward. Its outer surface slopes downward and outward, while in the Peccaries it is quite vertical. Its semicircular border is decidedly everted and forms a strongly projecting ridge which is but feebly produced in the latter animals.

The symphysis of the jaw, instead of forming a flat inclined plane as in *Dicotyles*, is contracted into a prominent obtuse carina.

The fore part of the jaw is more tapering and less robust than in *Dicotyles labiatus*.

The ascending portion of the ramus of the mandible of *Platygonus* is shorter than in the latter and is directed backward to such an extent that the condyle forms the most posterior part of the jaw, whereas in *Dicotyles* it bends forward and the angle is the most posterior part of the mandible. The coronoid process is shorter than in *Dicotyles labiatus*, less tapering and slightly inclined backward instead of forward as in the latter.

The mandibular condyle is decidedly smaller than in *Dicotyles labiatus*, and in comparison with that of the latter is, as it were, cut off at the inner extremity.

The formula of dentition of *Platygonus* is the same as in *Dicotyles*, and the teeth have the same essential construction, but proportionately are not quite so robust.

The molar teeth in general conspicuously differ in the greater proportionate production in length of the chief constituent lobes of the crown, which appear separated by deeper and more conspicuous valleys, and they are further provided with a more distinct basal ridge. In the Peccaries the malars have a decided suilline aspect, but in *Platygonus* they assume to a greater degree than in the former an ordinary ruminant likeness.

In the premolars of *Dicotyles* there is an evident disposition to continue the appearance of the true molars, being less well developed forms of the same pattern, whereas in *Platygonus* they exhibit but a single pair of well-produced lobes with a well-developed and distinct basal ridge.

The true molars of *Platygonus* are narrower transversely in proportion to their extent fore and aft than in *Dicotyles*.

The last premolars of *Dicotyles* especially are less well developed forms of the succeeding molars, with four constituent lobes to the crown. In *Platygonus* they consist of a pair of well-developed lobes with a distinct and wide tubercular heel behind and a narrower basal ridge in front.

The second premolars of *Dicotyles* are more reduced patterns of the molars, while in *Platygonus* they are smaller repetitions of the last premolars.

In the first upper premolars of *Dicotyles labiatus*, there are usually three constituent lobes to the crown, with a fourth more rudimental one. Those of *Platygonus* repeat the condition of those behind reduced in size.

In the first lower premolars of *Dicotyles*, the hinder lobes of the succeeding teeth are reduced into the condition of a strong tubercular heel and the anterior pair of lobes are completely connate.

In *Platygonus*, the first lower premolars are like the succeeding ones, with the constituent lobes quite distinct.

The canine teeth of *Platygonus* are like those of *Dicotyles*, but are proportionately more slender and less robust, and they are laterally less divergent.

The number of incisors in *Platygonus* is the same as in *Dicotyles*, but the third or last of the series appears to be later retained in the latter; for in the adult mandible of the former it is absent and its alveolus is obliterated, and in a younger specimen both alveoli are so shallow as to render it probable the teeth had been shed.

The incisors of *Platygonus* are very much smaller than in *Dicotyles*, barely more than half the size.

The young skull of *Platygonus*, mentioned in the early part of the present article, is a little longer and narrower than the adult specimens above described. The zygoma below the orbit is almost flat on the outer surface from the absence of the eversion of the upper and lower borders in the adult skulls. The angle of the mandible is less produced downward, is less everted and has the bordering ridge less well developed.

Comparative measurements of the skulls of *Platygonus compressus*, adult and young, and of *Dicotyles labiatus*, adult:

| | Platygonus. | | Dicotyles. |
|---|---|---|---|
| | Adult. | Young. | Adult. |
| Length of skull from top of inion to end of nasals in median line, . . . | 292 mm. | 304 mm. | 268 mm. |
| Length from anterior margin of occipital foramen to end of premaxillaries, . | 268 " | 275 " | 240 " |

| | Platygonus. Adult. | Platygonus. Young. | Dicotyles. Adult. |
|---|---|---|---|
| Length of forehead from inion to line of infra-orbital foramina, | 103 mm. | 98 mm. | 121 mm. |
| Breadth at post-orbital processes, | 115 " | 113 " | 94 " |
| " of face at middle of zygomas, | 135 " | 123 " | 118 " |
| " " at lachrymal eminences, | 103 " | 93 " | 70 " |
| Height of cranium from a level, | 112 " | 118 " | 104 " |
| " supra-orbital margin from a level, | 105 " | 108 " | 87 " |
| " of face at infra-orbital foramina, | 82 " | | 82 " |
| Height of face at middle of canines, | 63 " | | 55 " |
| Width of face at last molars, | 51 " | 52 " | 51 " |
| " " at first premolars, | 38 " | 36 " | 62 " |
| " " at side of nose in same line with the latter, | 41 " | 34 " | 42 " |
| Width of face at canine alveoli, | 69 " | 58 " | 66 " |
| Width of premaxillaries, | 29 " | 33 " | 35 " |
| Depth of zygoma from end of post-orbital process to end of preglenoid process, | 69 " | 62 " | 51 " |
| Depth of zygoma at middle below the orbit, | 36 " | 32 " | 23 " |
| Length of temporal fossa from inion to post-orbital process, | 80 " | 80 " | 93 " |
| Depth of temporal fossa, | 127 " | 121 " | 119 " |
| Depth from angular process on root of zygoma to end of post-glenoid process, | 94 " | 87 " | 83 " |
| Distance of angular process to post-orbital process of zygoma, | 54 " | 55 " | 71 " |
| Height of inion, | 94 " | 89 " | 96 " |
| Breadth of upper part of inion, | 60 " | 54 " | 43 " |
| Breadth opposite the auditory bullæ, | 116 " | 102 " | 111 " |
| Breadth at the glenoid fossæ, | 125 " | 116 " | 120 " |
| Breadth of occipital foramen, | 26 " | 26 " | 21 " |
| Height of " " | 28 " | 27 " | 23 " |
| Distance between ends of paramastoid processes, | 50 " | 52 " | 52 " |
| Distance between post-glenoid processes, | 83 " | 80 " | 70 " |
| Length of hard palate from back of last molar tooth to premaxillaries, | 170 " | 180 " | 154 " |
| Width between the molars of the two sides, | 21 " | 21 " | 22 " |
| Length of molar series, | 73 " | 80 " | 73 " |
| Length of hiatus in advance of latter, | 44 " | 48 " | 27 " |
| Height of canine tuberosity, | 39 " | 30 " | 24 " |
| Length of mandible from condyle to symphysis, | 220 " | 223 " | 196 " |
| Height of mandible at the condyle, | 74 " | 74 " | 86 " |

| | Platygonus. Adult. | Platygonus. Young. | Dicotyles. Adult. |
|---|---|---|---|
| Height of mandible at coronoid process, | 82 mm. | 84 mm. | 94 mm. |
| Depth of mandible below the premolars, | 36 " | 37 " | 38 " |
| Depth obliquely at the symphysis, | 78 " | 73 " | 65 " |
| Width at the canine alveoli, | 36 " | 35 " | 36 " |
| Length of the lower molar series, | 78 " | 82 " | 83 " |
| Length of the hiatus in advance, | 52 " | 54 " | 31 " |
| Transverse diameter of the condyle, | 24 " | 23 " | 30 " |

Comparative measurements of the molar teeth in two adult skulls and a young skull of *Platygonus compressus*. In the former the teeth occupy their functional position and all are worn. In the young skull the permanent premolars and the last true molar had not protruded and are therefore unworn. Measurements in millimetres:

| | Adult. Upper teeth. | | Adult. Lower teeth. | Young. Upper. | Young. Lower. |
|---|---|---|---|---|---|
| Length of the molar series, | 74 mm. | 74 mm. | 80 mm. | 80 mm. | 83 mm. |
| " of the true molar series, | 45 " | 46 " | 49 " | 50 " | 51.5 " |
| Length of the premolar series, | 29 " | 28 " | 29.5 " | 31 " | 31 " |
| Fore and aft diam. last true molar, | 19 " | 17 " | 22 " | 20.5 " | 22 " |
| Transverse diam. last true molar, | 14.5 " | 13 " | 12 " | 14.5 " | 12 " |
| Fore and aft diam. second true molar, | 15 " | 16 " | 15.5 " | 16 " | 17 " |
| Transverse diam. second true molar, | 15 " | 15 " | 12 " | 15 " | 11 " |
| Fore and aft diam. first true molar, | 12 " | 14 " | 13 " | 14 " | 14.5 " |
| Transverse diam. first true molar, | 12 " | 13 " | 10.5 " | 12 " | 10.5 " |
| Fore and aft diam. last premolar, | 10 " | 11 " | 11 " | 10 " | 11.5 " |
| Transverse diam. last premolar, | 12.5 " | 13 " | 9.5 " | 11 " | 10 " |
| Fore and aft diam. second premolar, | 10 " | 10 " | 11 " | 11 " | 10 " |
| Transverse diam. second premolar, | 11 " | 11 " | 8 " | 11.5 " | 9 " |
| Fore and aft diam. first premolar, | 9.5 " | 9 " | 9.5 " | 9.5 " | 9 " |
| Transverse diam. first premolar, | 9.5 " | 9.5 " | 8 " | 9 " | 8 " |

Measurements of bones of an adult skeleton of *Platygonus compressus:*

| | |
|---|---|
| Humerus—Extreme length from greater tuberosity to outer condyle, | 190 mm. |
| Length from head to posterior process of inner condyle, | 168 " |
| Greatest breadth of proximal extremity, | 57 " |
| Greatest breadth of head, | 33 mm. |
| " " of distal extremity, | 39 " |
| " " of distal articulation, | 30 " |
| Ulna—Extreme length, | 214 " |
| Radius— " " | 156 " |
| Breadth of proximal articulation, | 29 " |
| Ulna and radius—Breadth of distal extremity, | 36 " |
| Femur—Extreme length, head to inner condyle, | 193 " |
| Diameter of head fore and aft, | 27 " |
| " " transversely, | 32 " |
| Breadth at condyles, | 46 " |
| " of trochlea, | 21 " |
| Tibia—Extreme length internally, | 196 " |
| Breadth proximal extremity, | 46 " |
| " distal " | 28 " |
| Metacarpals—Extreme length together, | 93 " |
| Breadth proximal articulation, | 31 " |
| " distal " | 30 " |
| Metatarsals—Extreme length, | 100 " |
| Breadth proximal articulation, | 27 " |
| Scapula—Length along posterior border, | 184 " |
| Greater width of glenoid articulation, | 23 " |
| First thoracic vertebra—Length from anterior inferior margin of centrum to end of spinous process, | 146 " |
| Length of centrum, | 24 " |
| Lumbar vertebra—Extreme height, | 66 " |
| Length of centrum, | 34 " |
| Sacrum—Length at middle, | 120 " |
| Breadth at base, | 83 " |
| " of lumbar articulation, | 33 " |
| " of posterior extremity, | 30 " |
| " of coccygeal articulation, | 18 " |
| Innominatum—Extreme length, | 233 " |
| Extent of pubic symphysis, | 68 " |
| Diameter of acetabulum, | 33 " |
| Astragalus—Extreme length, | 43 " |
| Breadth, | 21 " |

| | |
|---|---|
| Calcaneum—Extreme length, | 76 mm. |
| Depth at fore part, | 32 " |

Remains of *Platygonus compressus*, less complete than those above indicated and described, from other localities, I have mentioned in "Observations on the Extinct Peccary of North America," published in the Transactions of the American Philosophical Society, 1856. They were from Benton County, Missouri; Augusta County, Virginia, and from Iowa. Prof. Cope also noticed the occurrence of remains of the same species from Tequixquiac, Mexico. (Proc. Am. Philos. Soc., 1885, 15; Annales del Museo Nacional de Mexico, 1886, 339.)

Remains of a larger species, found in Mifflin County, Pennsylvania, I have noticed in the Proceedings of the Academy of Natural Sciences, 1883 301, under the name of *Platygonus vetus*. A fuller account of the same, with illustrations, will shortly appear in a "Notice and Description of Fossils in Caves and Crevices of the Limestone Rocks of Pennsylvania," to be published in one of the reports of the Geological Survey of Pennsylvania. Remains, more complete, apparently of the same species, from Guanajuato, Mexico, under the name of *Platygonus alemanii*, are described by Dr. Alfredo Duges, with illustrations, in La Naturaleza, Mexico, 1887, page 16, plates I., II.

Prof. O. C. Marsh has given brief notices of several other species, as follows: *Platygonus Ziegleri*, from Grizzly Buttes, Uintah Mountains, Wyoming; *P. striatus*, from the pliocene sands of Loup Fork River, Nebraska, and *P.? Condoni*, from the pliocene beds of Oregon. (Am. Jour. Sc., 1870, 40, 41.)

The various remains originally described and now regarded as pertaining to *Platygonus compressus* were early attributed to nearly half a dozen different species and genera, founded on slight differences, which, before the prevalence of the evolution theory, were looked upon as being of a fixed character and all-sufficient for the distinction of species, and were so adjudged by a master who has since passed from among us.

Of the remains described by Dr. Duges, under the name of *Platygonus alemanii*, in La Naturaleza, all those represented in plates I. and II., except the upper jaw with the molar teeth and the scapula, have been submitted to my inspection through the Smithsonian Institution.

The mandible with the molar teeth is an amplified repetition of that of *Platygonus compressus* and appears to differ only in the less backward position of the condyle, which in this direction is less than the angle as in the Peccaries. The angle is very conspicuously everted, is bounded by a strong ridge, and is deeply concave on the outer surface. The coronoid fossa is also deeply impressed.

The measurements of the specimen are as follows :

| | |
|---|---|
| Height of mandible at condyle, | 100 mm. |
| " " coronoid process, | 104 " |
| Depth at premolars, | 45 " |
| Space occupied by the molar series, | 91 " |
| Length of hiatus in advance of series, | 62 " |
| Breadth of condyle, | 33 " |

One of the specimens consists of the bones of a hind foot except those of one toe. The metatarsals are co-ossified. The entire length of the foot from the end of the heel is 285 mm.

The calcaneum is 85 mm. long ; its depth at the fore part 46 mm.

The astragalus is 44 mm. long and 26 mm. broad.

The extreme length of the co-ossified metatarsals is 110 mm.

*Platygonus* and the Peccaries of the genus *Dicotyles* appear to have been the substitute for the Hippopotamus and Hog in America, for as yet no authentic remains of the latter genera have been discovered in our country.

## REMARKS ON THE NATURE OF ORGANIC SPECIES.

BY PROF. JOSEPH LEIDY.

The now prevailing idea as to the nature of an organic species is widely different from what it was formerly. Then it was regarded as an independently created form, distinguished by characteristic marks which were within a limited range permanent; now it is viewed as a peculiar form comparatively stable in distinctive characters, but descended from others by gradual transformation. Could we see all the organic forms which have existed, we would fail to recognize any species, for all, through infinite variation, would blend with one another. The distinction of species at any given time is generally fairly marked and of ready reference, but in many cases also it fails in its application. While we all look at the Horse, Ass and Zebra as distinct species, we do not look on the White Man, the Mongolian and the Negro in the same light. In the inspection of any extensive series of a genus we commonly recognize a number of well-marked species, but closer investigation often reveals intermediate forms which more or less invalidate the distinction. In some large collections of fossil shells of the later tertiary formations, I have repeatedly been struck with evidences that many of our recent species are really the direct descendants of recognized and distinct fossil species. Among several cases in point, my friend Joseph Willcox has recently directed my attention to an instance. He writes: "I submit to you some shells which may interest you, and of which you are at liberty to publish a notice if you think it worth the while." He continues: "The shells are part of a considerable series which appear to illustrate the transformation or evolution of an extinct form into that of a living species. All, except the recent specimen, were collected by me in a pliocene bed of South Florida. From an inspection of the series (see plates IX., X.) I think it may be admitted that the fossil *Fulgur contrarius*, heretofore regarded as extinct, is still living in a modified form as *Fulgur perversus*. Fig. 1, plates IX., X., represents the Florida form of *Fulgur contrarius*, the original of which was found in the miocene formation of North Carolina, and was described by Conrad in Am. Journal of Science, XXXIX., p.

37; also illustrated by him in 'Fossils of the Miocene Formation of the U. S.,' pl. XLV., fig. 11.

"Conrad's type was stated by him to be 4 in. long. The specimens which he gave to the Academy of Natural Sciences are still smaller. The specimen which I send to you is 7¼ in. long; but one, of the same species, 9 in. long was found by Prof. Heilprin and myself in Florida in 1886.

"Fig. 2 represents the same species with the shoulder angle slightly developed, but it has no rudimentary spines.

"In Fig. 3 the angle of the shoulder is a little more pronounced, and rudimentary spines are visible.

"In Fig. 4 the spines are still more developed on one side.

"Fig. 5 represents the fossil *Fulgur perversus* with spines not developed to the proportions of the common living species.

"Fig. 6 represents the typical fossil *Fulgur perversus*.

"Fig. 7 is a fair sample of the *Fulgur perversus* now living on the west coast of Florida. A few specimens of this species when young have been found nearly similar to the fossil Fig. 3. They are not common; but they indicate an occasional reversion towards the original ancestral form Fig. 1, which is now extinct, as well as Fig. 2.

"More specimens are seen like Fig. 4, and still more like Fig. 5; but they are not common.

"I have other shells, from the same bed, which illustrate intermediate characters between all the forms in the collection which I send to you.

"In the same pliocene bed, while such great changes were progressing with the *Fulgurs*, there were other species of shells which, at the time, indicated great stability in character; though they evince a considerable amount of variability at the present time. I refer to the *Strombus pugilis* and the *Melongena corona*.

"More than one hundred specimens of fossils of the former have been examined without finding any spines on them; while, at the present time, this species is found on the west coast in great abundance, with the spines in all the different stages of development. It thus appears that the non-spinose variety *Strombus alatus* was the original form of *S. pugilis*.

"Another shell, the *Melongena corona*, found in the same bed, manifests great uniformity in structure; while, at the present time, it is probably the most variable shell living on the coast of Florida. The form found in the fossil bed is considered by Prof. Heilprin to be entitled to be classed as a different species from its descendant, the living form; and he has described it as *Melongena subcoronata*.

"We thus find, in the same bed, one genus that was widely variable in character, which now manifests much greater stability in structure; and also two genera that were quite fixed or stable, that, at the present time, are very inconstant.

"An apparently anomalous condition of affairs existed, when this fossil bed was being deposited, which promoted at the same time such a diversity of action among several different genera. The following suggestion is offered as a possible explanation for it.

"No species has been found to be constant or permanent during a long period of geological time; and there appear to have been periods of rest and periods of activity in the transmutation of species.

"Surviving from the miocene age, the *Fulgur contrarius* may have been ripe for a change, which was stimulated into action by a cause that would not affect other species, especially such as had not been in existence long. For the same reason the *Melongena corona* and the *Strombus pugilis* may be active in their inconstancy now, as they have survived from a former geological period."

## PLATE I.

Two views of a fossil human skull, embedded in bog-iron ore, from Florida. Natural size. See page 11.

Fig. 1. Upper portion of the face and base of the cranium, with a portion of the mandible, right side.

Fig. 2. Front view of the portion of the face.

## PLATE II.

Fig. 1. Fossil human innominate bone, from near Natchez, Mississippi. Outer view. Natural size. See page 9.

Fig. 2. Fossil human calcaneum. From Florida. See page 10.

## PLATE III.

Fig. 1. **Machairodus floridanus.** View of the right side of a skull, one-half natural size. From Ocala, Florida. See page 13.

Figs. 2–4. **Hippotherium ingenuum.** Natural size. Page 20.

Fig. 2. Pastern, front view. The upper articular surface is represented in figure 8, plate V. From Peace Creek, Florida.

Fig. 3. Upper last molar tooth, outer view. From Archer, Florida. Fig. 4. Astragalus. Front view of the left bone. From the same locality.

Fig. 5. **Auchenia.** Last lower molar tooth, right side, outer view. Natural size. From Ocala, Florida. See page 17.

Figs. 6–9. **Elephas.** From Ocala, Florida. Page 17.

Figs. 6, 7. First milk molar. 6. View of the triturating surface. 7. Outer view. Natural size.

Figs. 8, 9. Second or third milk molar, one-half natural size. 8. Triturating surface. 9. Lateral view of the tooth.

Figs. 10, 11. A conical dermal bone of a supposed **Glyptodon.** Natural size. From Peace Creek, Florida. 10. View of the base. 11. Lateral view. Page 27.

## PLATE IV.

All the figures of the natural size. Specimens from Peace Creek, Florida.

Fig. 1. **Emys euglypha.** A nuchal plate, upper view. Page 27.

Fig. 2. **Alligator mississippiensis.** Dermal plate. Page 31.

Figs. 3–6. **Chlamydotherium humboldtii.** Dermal plates. Page 24.

Figs. 7 and 8. Two views of an enigmatic bone. Page 27.

Fig. 9. **Glyptodon petaliferus.** A dermal plate. Page 25.

## PLATE V.

Figs. 1–4. **Mylodon harlani.** Half the natural size. All from New Iberia Louisiana. Page 33.

Fig. 1. Front view of the left tibia.

Fig. 2. Under view of an ungual phalanx.

Fig. 3. First lower tooth, right side, outer view.

Fig. 4. First upper tooth, left side, outer view.

Figs. 5–10. All of natural size.

Figs. 5–7, 10. **Hippotherium montezuma.** From Mexico. Page 21.

Fig. 5. Upper extremity of a right metatarsal, front view.

Fig. 6. Articular surface of a right metatarsal.

Fig. 7. Upper articular surface of a pastern.

Fig. 8. Upper do. of **Hippotherium ingenuum.** From Peace Creek, Florida. Page 21.

Fig. 9. Upper do. of **Hippotherium plicatile.** From Archer, Florida.

Fig. 10. Right upper molar tooth, outer view, **Hippotherium montezuma.** The triturating surface represented in woodcut on page 22.

Figs. 11, 12. Dermal bones of a **Glyptodon.** Natural size. From Peace Creek, Florida. Page 26.

Fig. 11. Lateral view of a dermal bone.

Fig. 12. Outer view of a dermal bone.

## PLATE VI.

Fig. 1. **Glyptodon petaliferus.** A dermal plate, natural size. Page 25.

Figs. 2, 3. Dermal bone of a **Glyptodont.** 2. Outer view. 3. Lateral view. Natural size. Page 25.

Figs. 4–7. **Testudo crassiscutata.** 4, 5. Anterior and posterior portions of the plastron, one-fourth the diameter. Page 29.

Fig. 6. Femur, of the left side, front view, one-half size. Page 31.

Fig. 7. Tibia, of the left side, front view, one-half size. Page 31.

## PLATE VII.

**Elephas columbi.** A last upper molar tooth, right side, lateral view, one-half the natural size. From Peace Creek, Florida. See page 23.

## PLATE VIII.

Fig. 1. **Platygonus compressus.** Complete skull, one-half the natural size. From near Rochester, N. Y. Page 41.

Fig. 2. **Elephas columbi.** Left ramus of a mandible with the last molar tooth, with a view of the triturating surface of the latter; one-half the natural size. From Peace Creek, Florida. Page 23.

## PLATES IX. AND X.

Fig. 1. **Fulgur contrarius.** From the Pliocene formation of Florida, closely conforming to the original of that species from the Miocene formation of North Carolina. The illustration of Conrad's type of the species is from a male individual. That of our figure 1 and several others of the same plates are from female forms; the canal in these being wider than in the male forms. Size of the shell 7¼ inches. Page 51.

Fig. 2. The same species, with the angle of the shoulder slightly pronounced. 3⅝ inches.

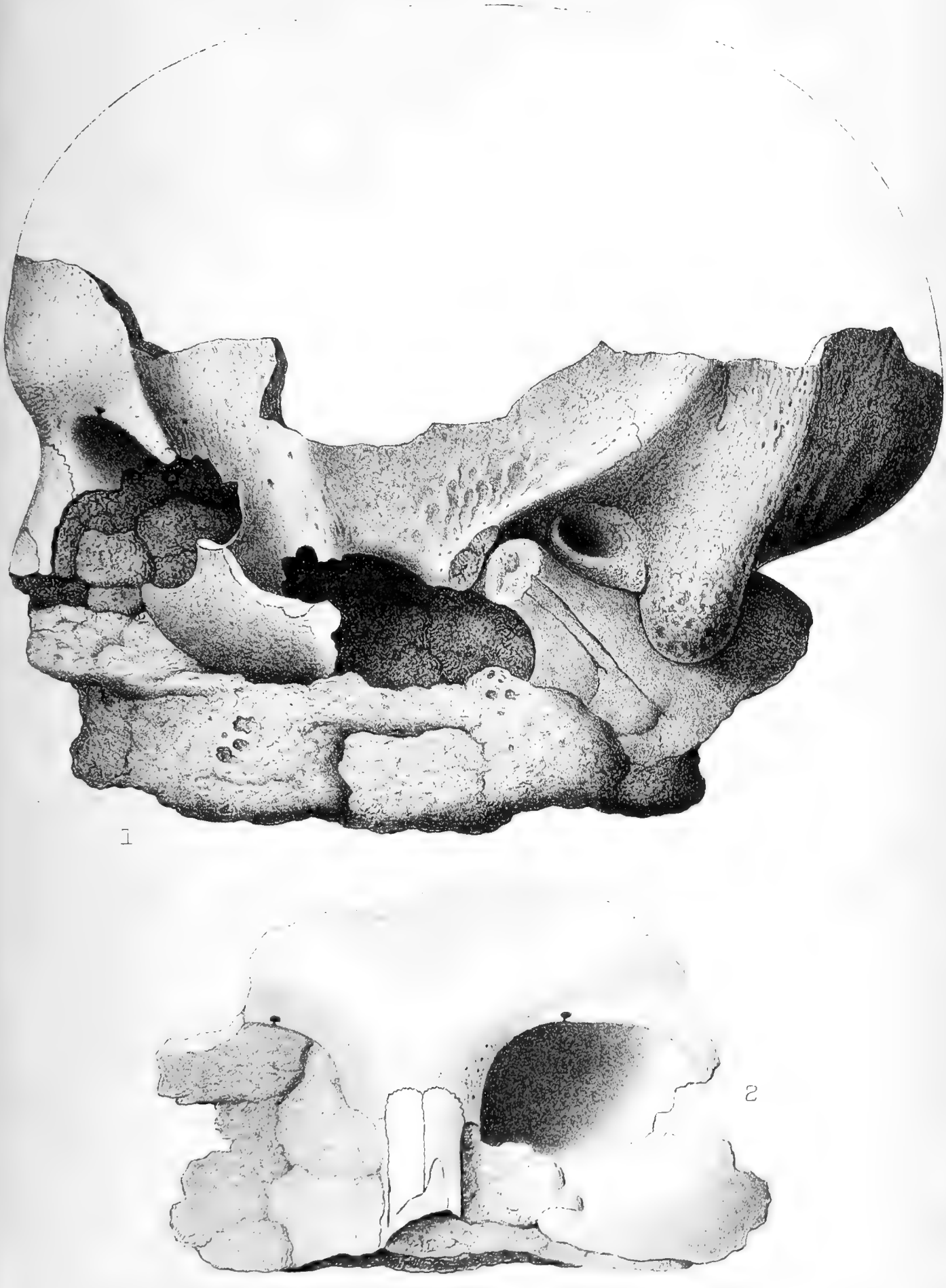
Fig. 3. The same, with angle still more pronounced and with rudimental spines. 4 inches.

Fig. 4. The same, with spines better developed. 6 inches.

Fig. 5. Fossil **Fulgur perversus,** with less produced spines than usual. 7½ inches.

Fig. 6. Fossil **Fulgur perversus.** 5⅝ inches.

Fig. 7. An average specimen of the living **Fulgur perversus** of the west coast of Florida. 7½ inches.

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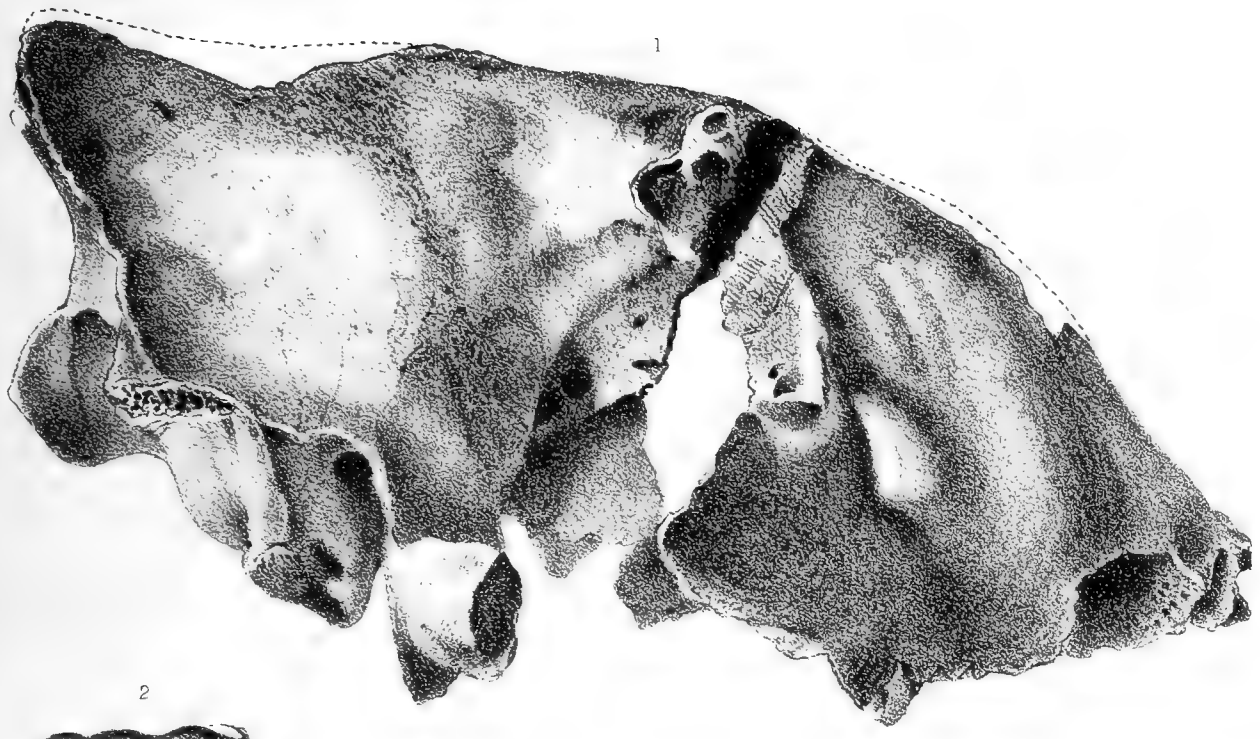



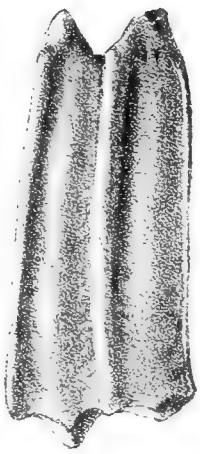



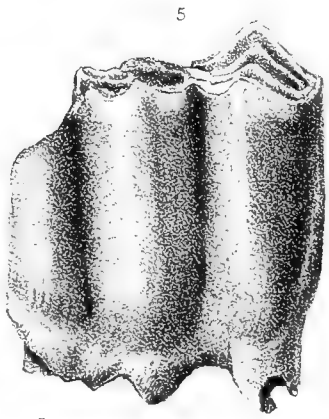



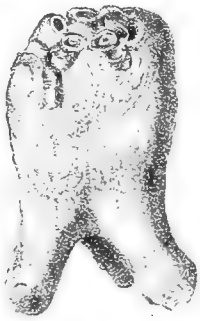


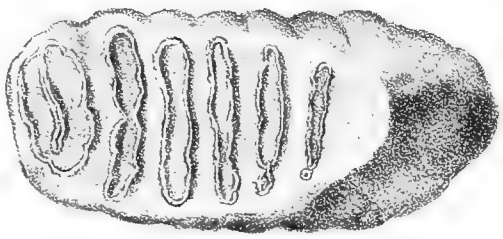


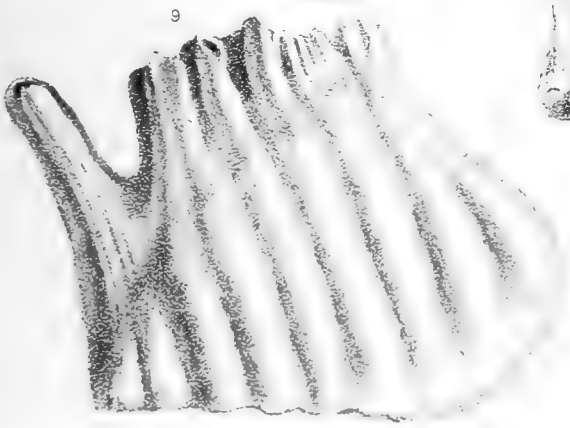




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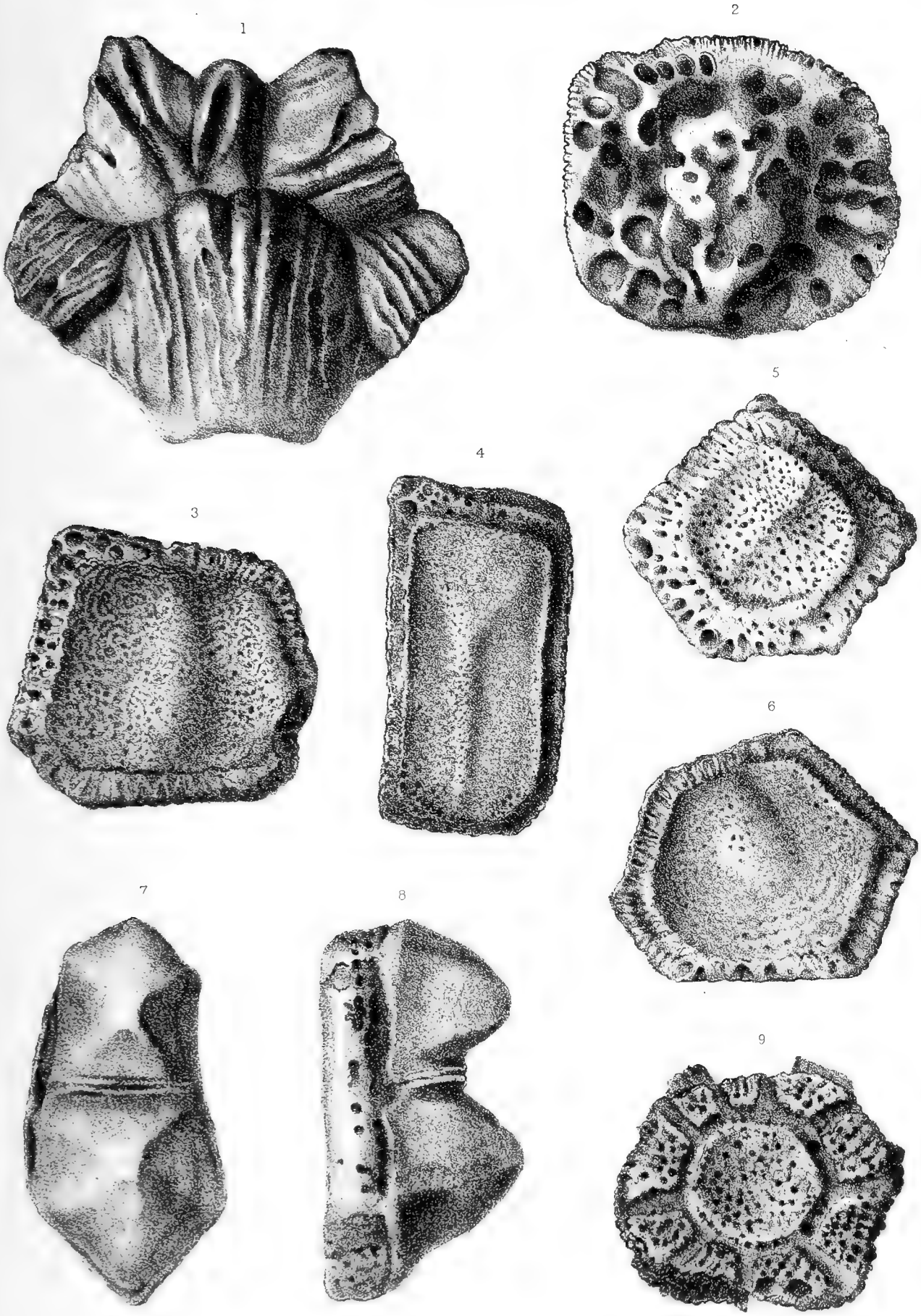


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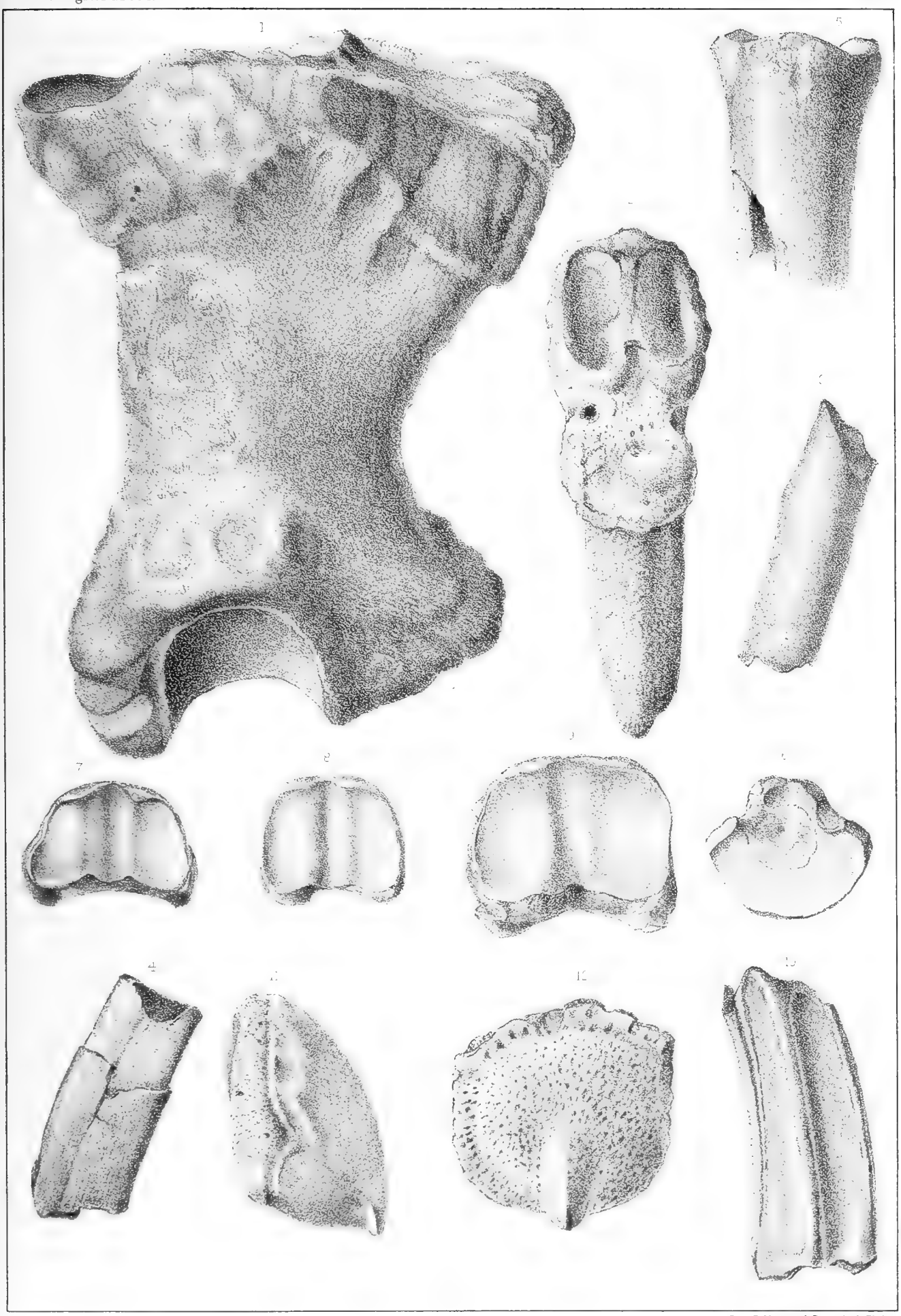


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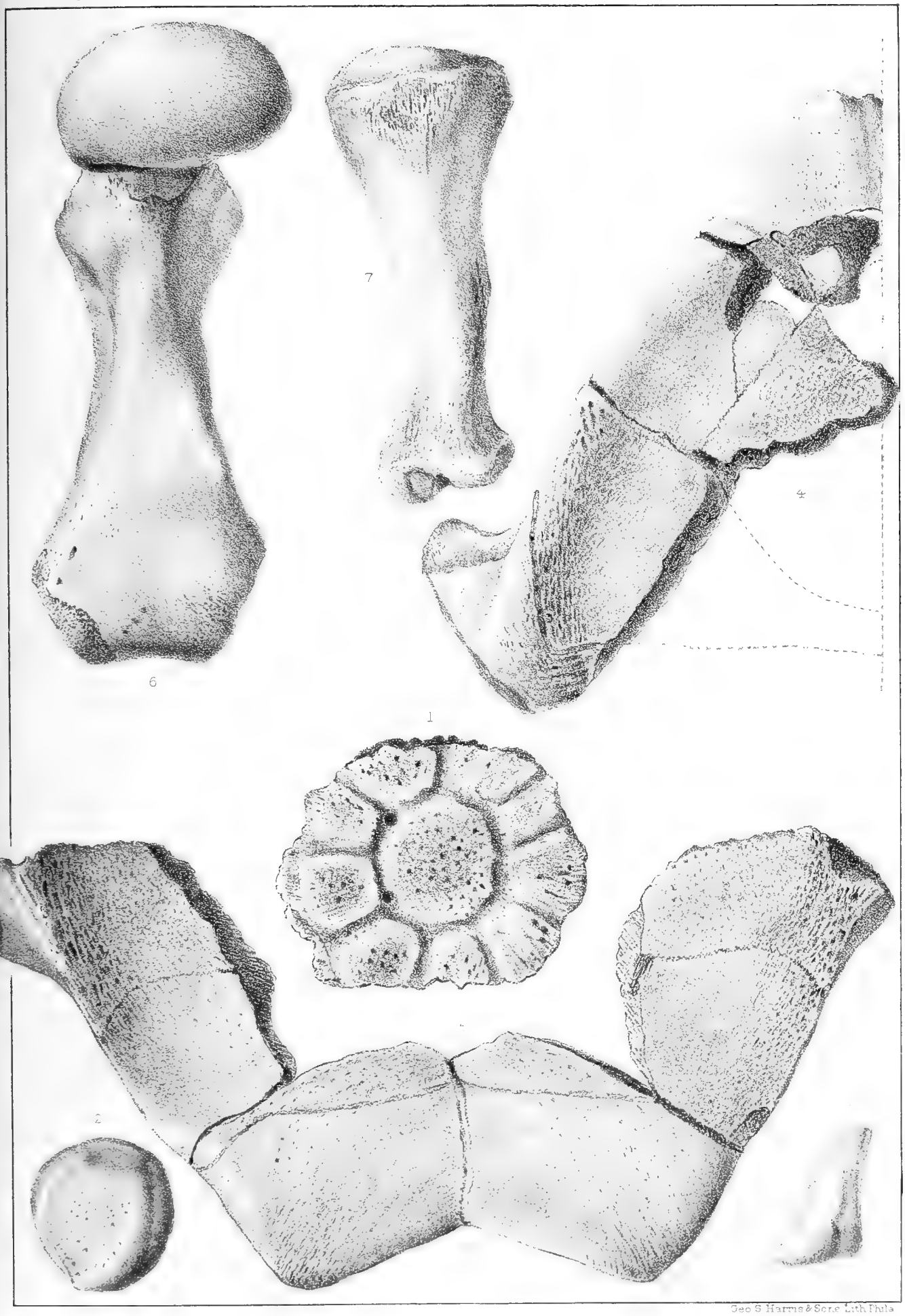


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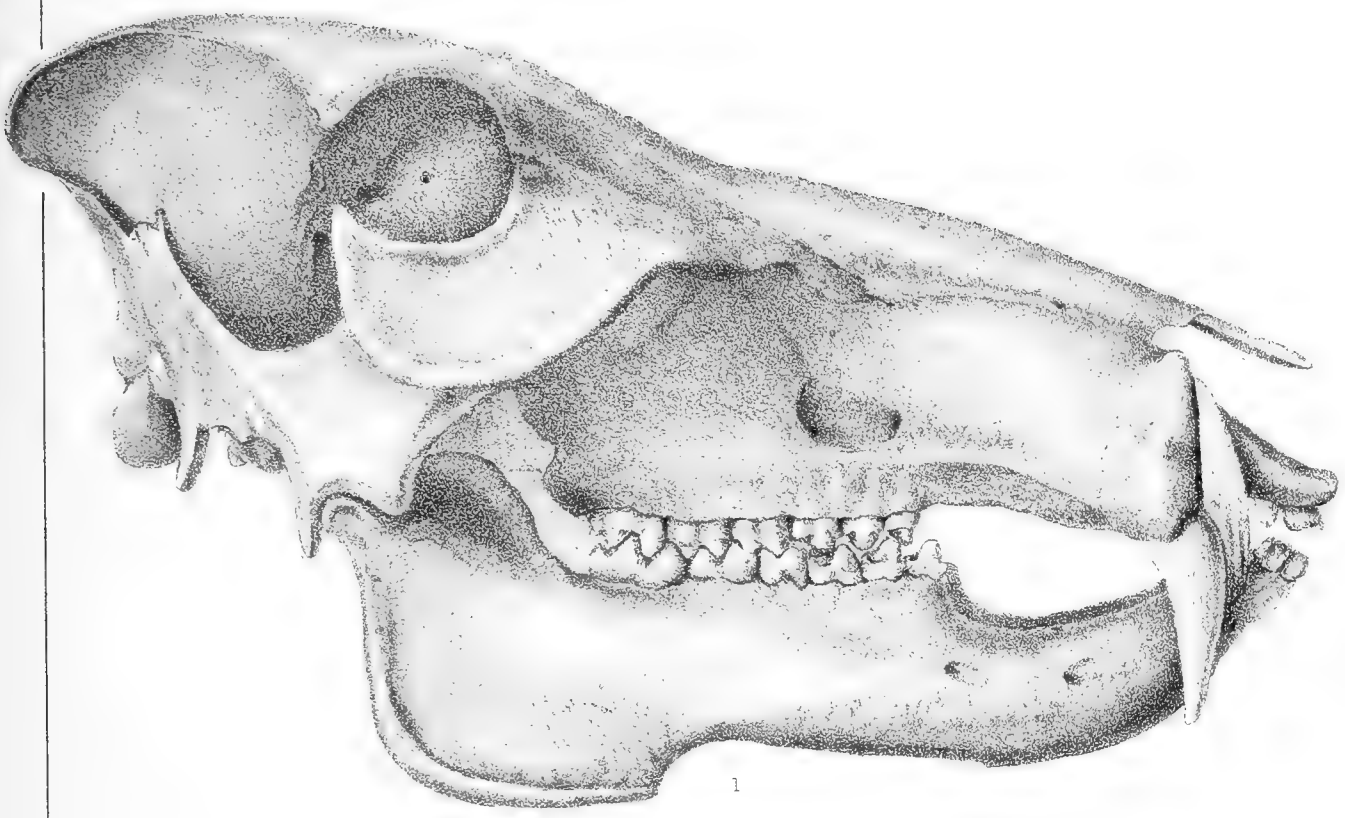

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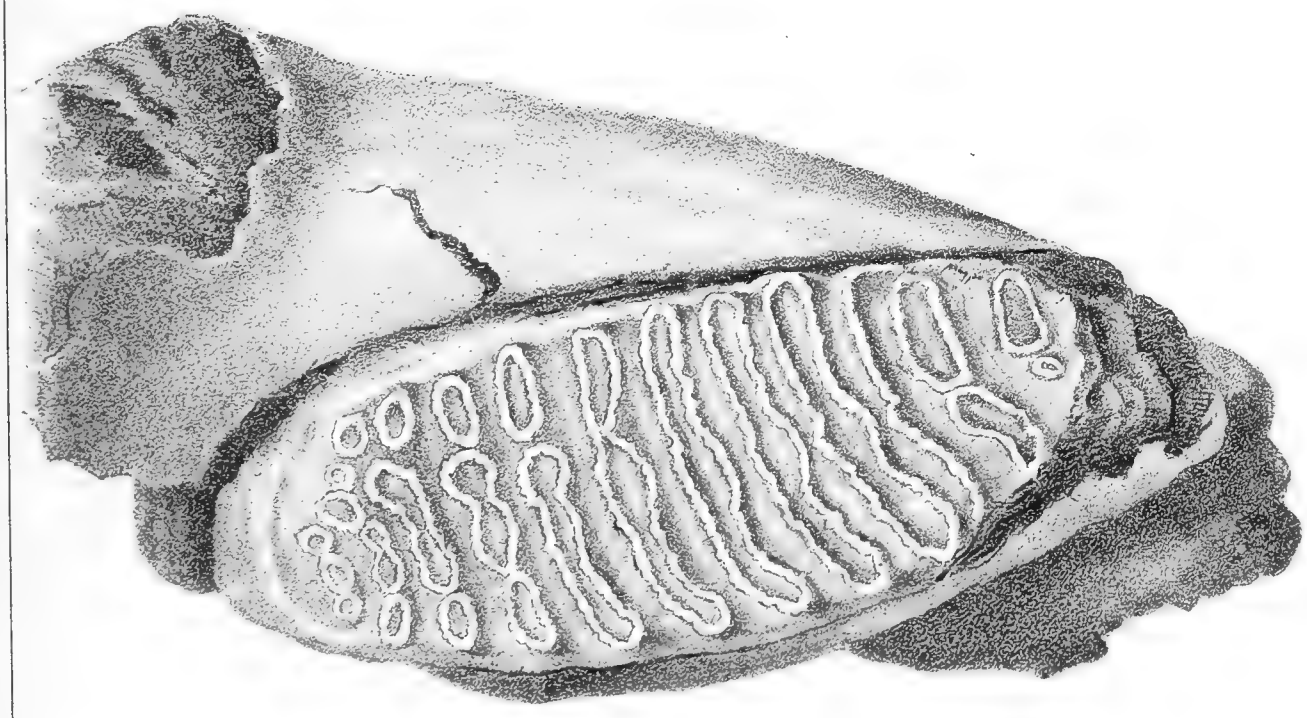

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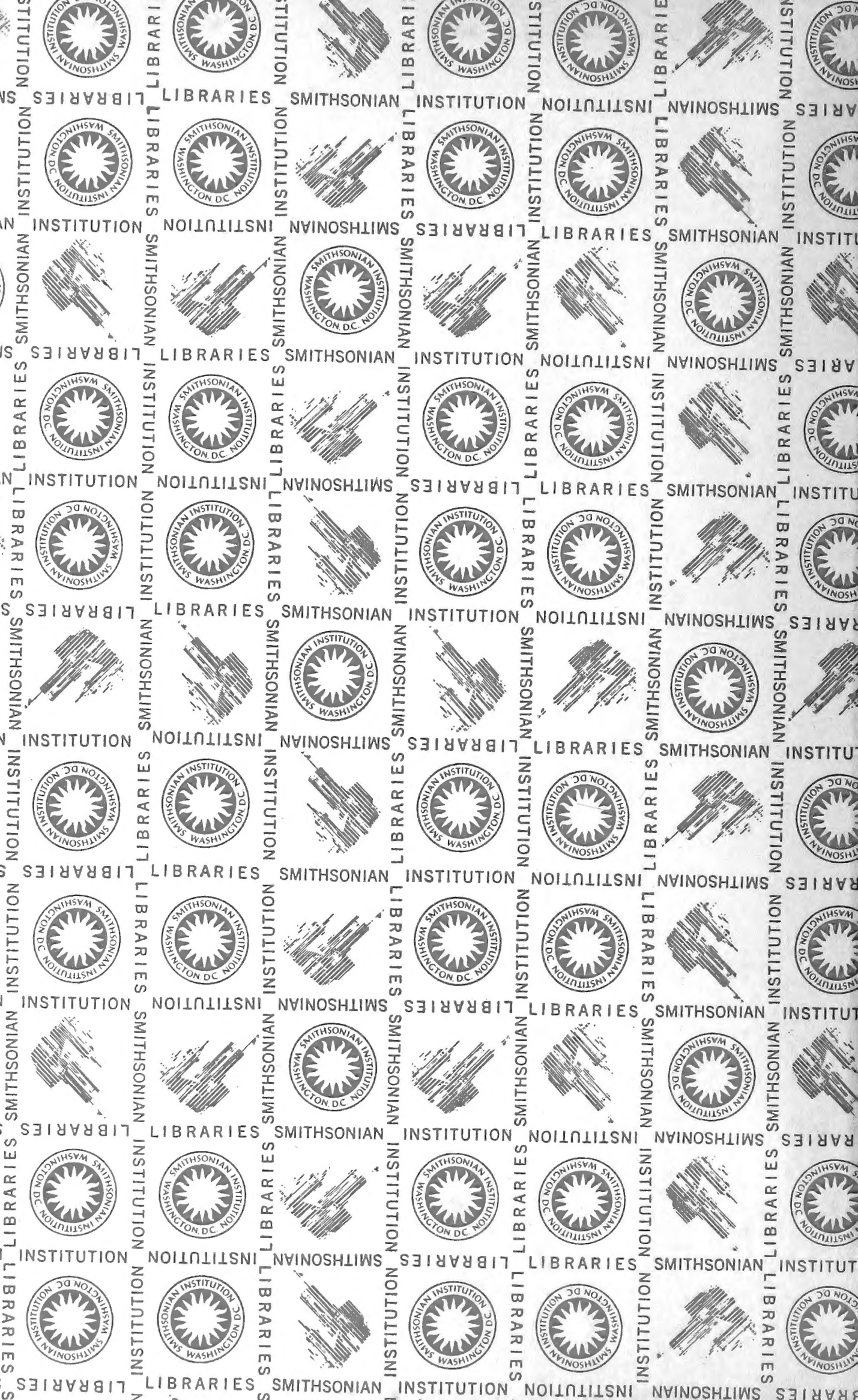
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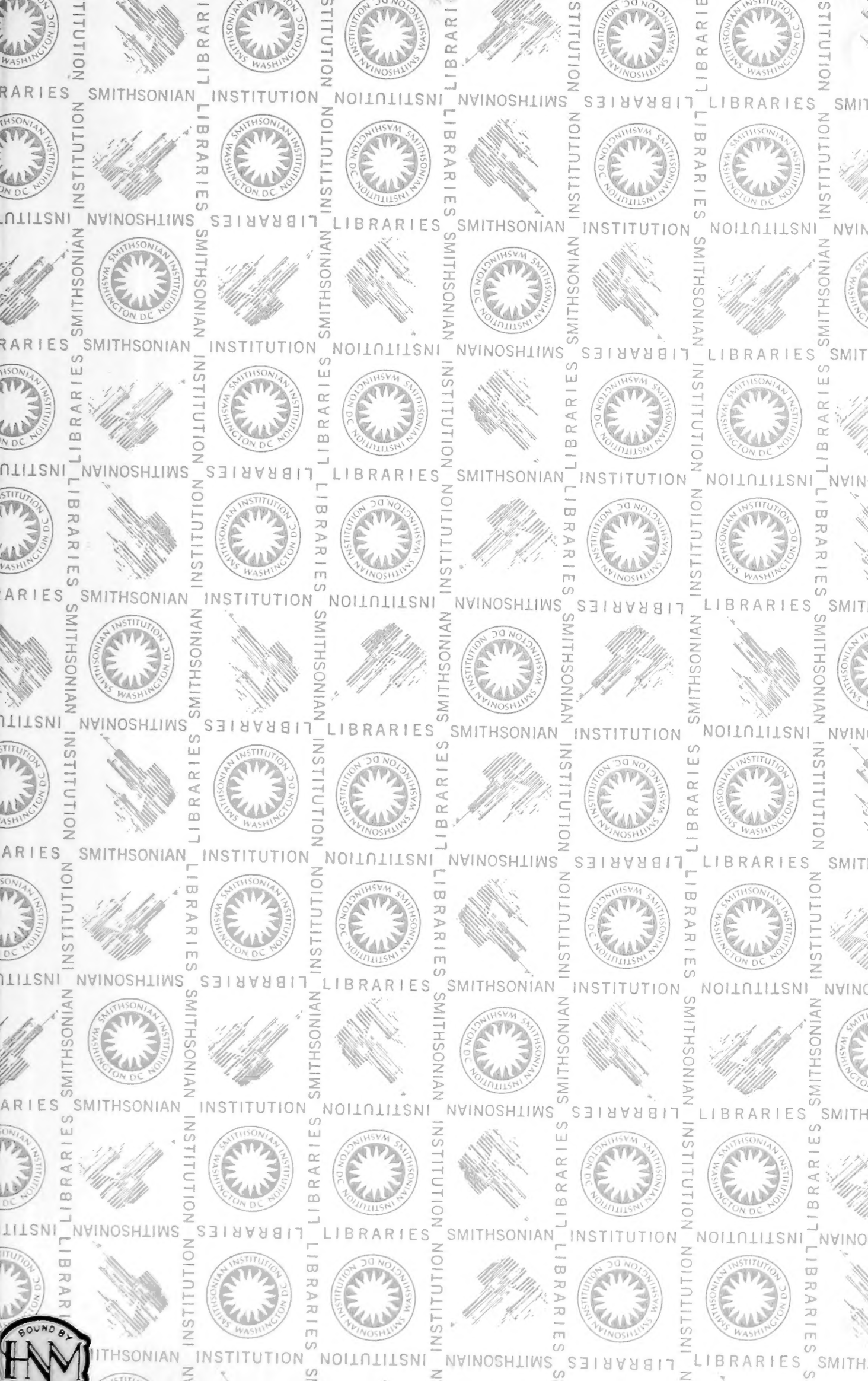
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