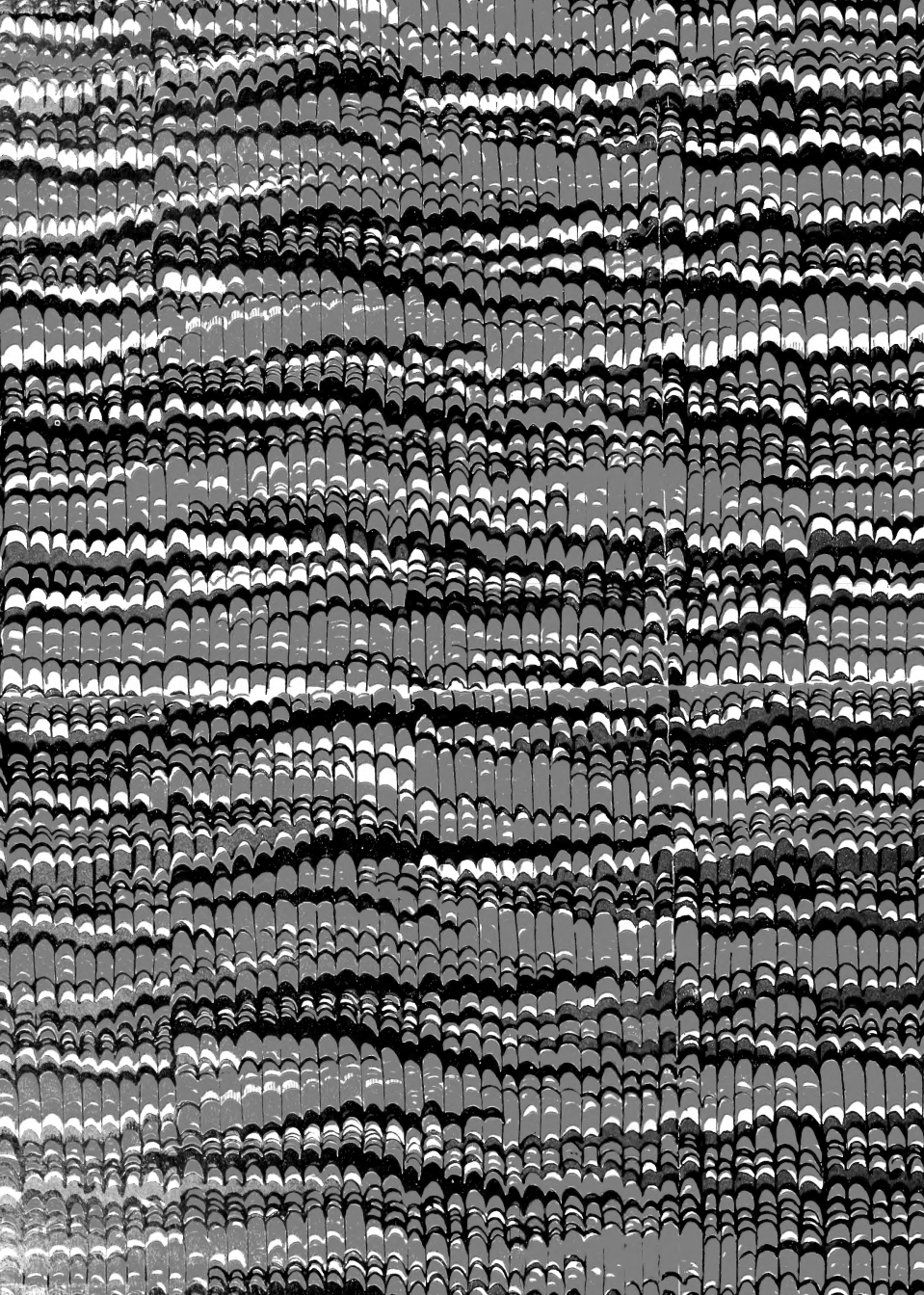
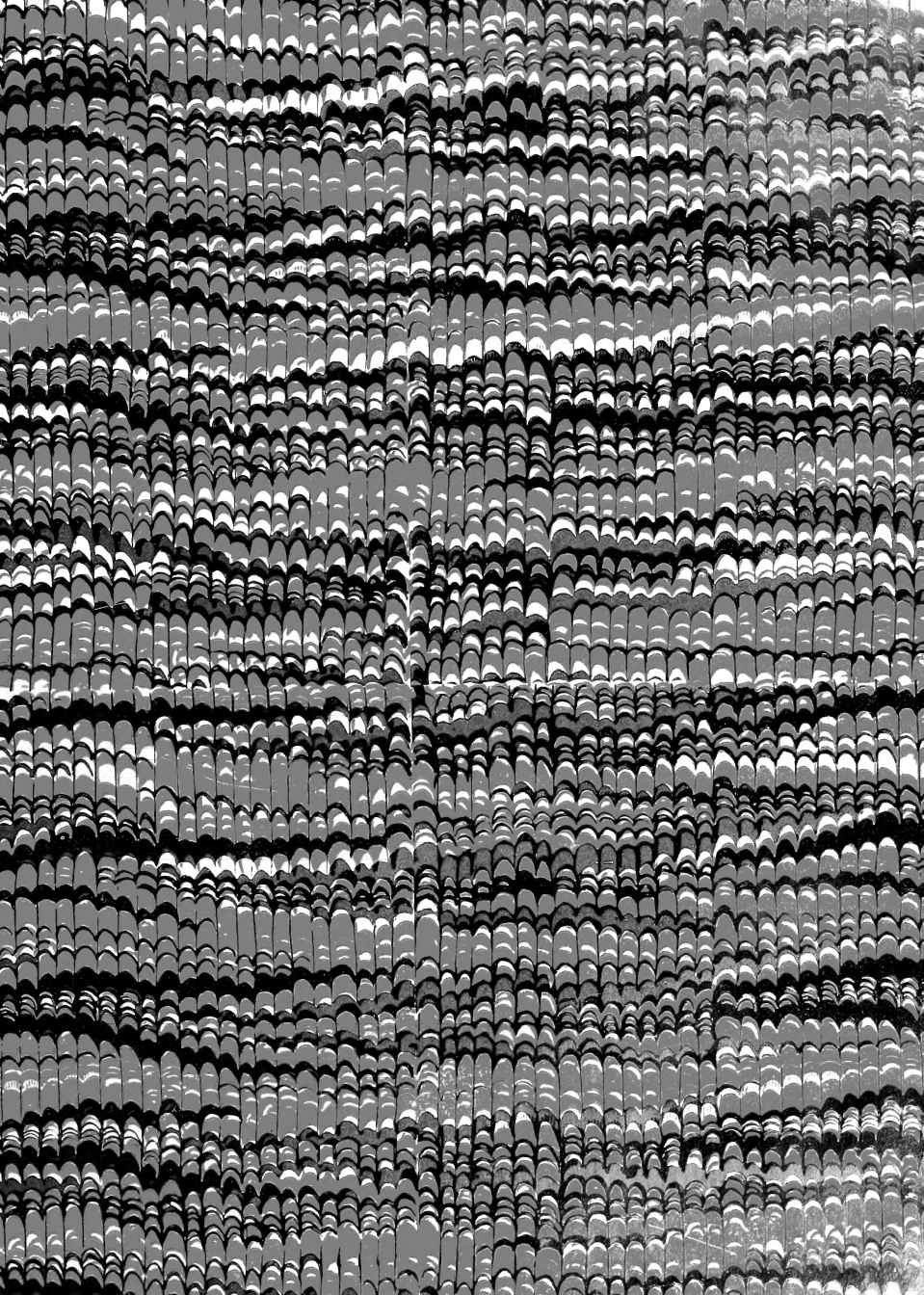


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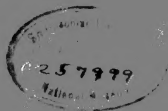
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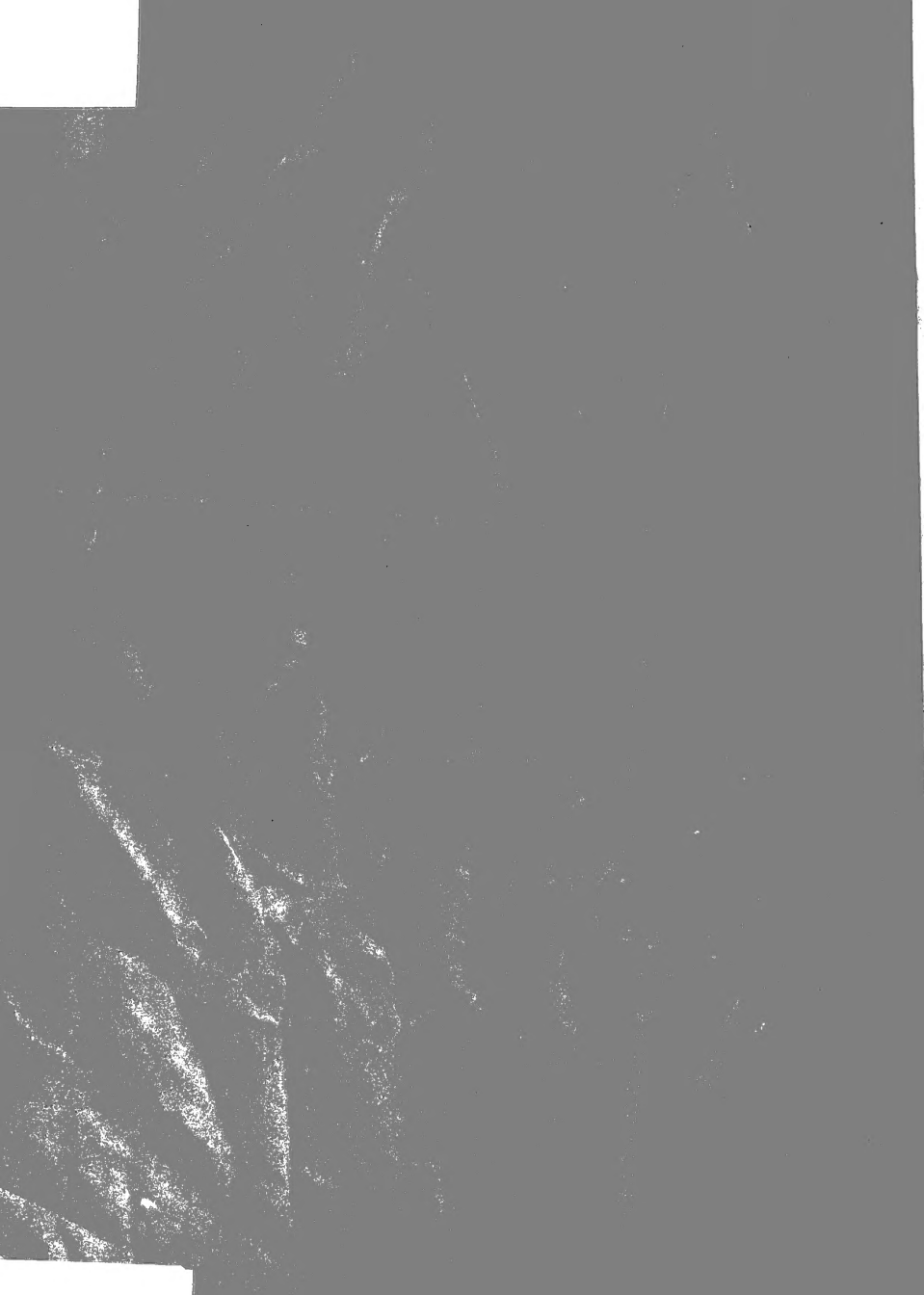
PHILADELPHIA.

NEW SERIES. VOL. I. PART I.

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ART. I. — *On the Fossil genus Basilosaurus, Harlan, (Zeuglodon, Owen,) with a notice of Specimens from the Eocene Green Sand of South Carolina.* By ROBERT W. GIBBES, M. D., of Columbia, South Carolina, Correspondent of the Academy of Natural Sciences of Philadelphia; of the New York Historical Society, &c.

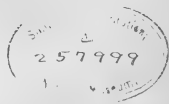
Among the interesting discoveries of modern Geology, none have excited more notice than the relics of immense Sauria and Cetacea.

In 1832, Dr. Harlan described a gigantic vertebra, weighing forty-four pounds, sent to him by Judge Bry from the banks of the Wachita river, which he referred to a new genus of the class ENALIOSAURI, of Coneybeare, and proposed for it, from its analogies and gigantic size, the name of *Basilosaurus*.\* He subsequently procured from the plantation of Judge Creagh, in Clark county, Alabama, remains of similar vertebræ, and portions of other bones evidently belonging to the same fossil, which he afterwards described more at length, and figured, in his "Medical and Physical Researches."

In 1835, Professor Agassiz visited England, and observed in the collection of the University of Cambridge, a singular tooth, of which Scilla had given a figure. He regarded it as a Mammalian, and published his views of it soon after in Valentin's "Repertorium für Anatomie und Physiologie." Viewing it as nearly allied to the seal family, he proposed for it the name of *Phocodon*. (Pl. II., fig. 9.)

In 1840, M. Grateloup published at Bordeaux a "Description d'un fragment de machoire fossile d'un genre nouveau de reptile (Saurien) voisin de l'Iguanodon."

\*Transactions of the American Philosophical Society, Vol. IV., N. S.



This fossil was found at Léognan, a few leagues south of Bordeaux, in the *calcaire grossier*, or *Eocene*. The form of the fragment he describes thus :

“Le museau est allongé, déprimé et va en s'amincissant comme dans le rostre des crocodiles et de certains lézards. Sa longueur est d'environ dix-huit pouces, et n'est pas même complète. \* \* \* Ce qui rend cet os fossile fort précieux, c'est la présence de quatre dents postérieures, implantées dans leurs alvéoles. Le sommet des trois est un peu endommagé, mais la plus grande est d'une intégrité admirable. Elles sont fortes, épaisses, subtriangulaires, pointues, comprimées, et aplaties latéralement, un peu arquées en dedans, fortement dentées en scie, ou plutôt crénelées en leurs bords; celui-ci est tranchant. Les dentelures sont profondes, inégales, plus multipliées du côté de la tête de l'animal. Il y en a cinq sur ce bord, à la dent intègre, et deux seulement au bord opposé. Les dentelures présentent, à leur tour, de fines denticulations. En résumé, la forme de ces dents rappellent celles des dents de squal; et les détails des dentelures, rappellent faiblement aussi, ceux de la structure des dents de l'iguanodon. La hauteur de la dent bien conservée est de seize lignes, hors de l'alvéole, d'un pouce. Le diamètre, sur ce point, est de six lignes, tandis que vers la pointe il n'a que deux lignes et demie. La racine est de forme conique; sa longueur doit éгалer celui de la profondeur de la cavité alvéolaire, qui est de neuf à dix lignes, comme je viens de l'indiquer.” (Pl. I., fig. 5.)

He doubted whether to refer it to *Cetacea* or *Sauria*; and finally came to the conclusion that it constituted a new order of amphibious reptile—a carnivorous marine animal of the tertiary period—perhaps a connecting link between the Lacertians and the Sharks, and proposed for it the name of *Squalodon*.

In 1839, Dr. Harlan submitted his specimens to Professor Owen, of London, who, upon a careful examination, expressed the conviction that they were not the bones of a reptile, but of a great *cetacean*. The microscopic character of the texture of the teeth, satisfactorily proved them to be mammiferous, and they were compared with those of the few mammalia whose teeth are devoid of enamel. Professor Owen, with his paper on the subject, has given figures of the teeth; but subsequent specimens show them to have been imperfect from the absence of the enamel and a portion of the crown.\*

He found the humerus approaching more to the mammalian than to the saurian types: the vertebræ were strictly mammalian and cetacean; the teeth being freely implanted in distinct sockets with double fangs, had much resemblance, in their intimate structure, to those of the Dugong; and he was thus induced to place it in the class and order where it now remains. He says—“It is to the teeth of the Cachalot and Dugong, that those of the *Basilosaurus* offer the nearest resemblance in the particulars already cited, and I conceive its position in the natural system to have been

\*Transactions of the Geological Society of London, Vol. VI.

in the cetaceous order, intermediate between the Cachalot and the herbivorous species." The peculiar form of a horizontal section of the tooth, suggested the generic name of *ZEUGLONDON*, (*yoke-tooth*) (Pl. I., fig. 8,) and the affinity with Cetacea, the specific term *cetoides*. The following extract from Prof. Owen's paper embodies his remarks:

"The teeth in their combination of an exaggerated condition of the conjugate form—which is but indicated in certain teeth of the Dugong, with two distinct fangs, in their oblique position in the jaw, and the irregular interspaces of their alveoli—present very striking peculiarities; and when to these dental characters we add the remarkable and abrupt contraction of the distal end of the humerus, which is nevertheless provided with an articulating surface for a ginglymoid joint, and its remarkably diminutive size,—a cetaceous character which is here carried to an extreme; and when we also consider the dense laminated structure of the ribs, and the third exaggeration of a cetaceous structure in the extreme elongation of the body of the caudal vertebræ, we cannot hesitate in pronouncing the colossal *Zeuglodon* to have been one of the most extraordinary of the Mammalia, which the revolutions of the globe have blotted out of the number of existing beings." The geological position of these remains was for a long time undetermined; but Mr. Conrad and Mr. Lyell have satisfactorily referred them to the Eocene period, as well those found in South Carolina and Alabama, as those originally described by Dr. Harlan from the Wachita river, in Louisiana.

In 1843, the greater portion of a skeleton of this huge denizen of a former world, was procured from Clark county, Alabama, and taken to New York by Mr. S. B. Buckley, who published an account of the bones in the *American Journal of Science and Arts*;\* and a subsequent number of the *Journal* contains another notice by Mr. Buckley of these specimens.† They were sent to Albany, and placed by Dr. Emmons in the saloon of the State geological collection, where I saw them in 1845. They are now in the possession of Dr. J. C. Warren, of Boston, and have been in part described by Professor Emmons, in the *Quarterly Journal of Agriculture and Science*.‡ The figures given are from perfect teeth, vertebræ and ribs; and Prof. Emmons, after noticing the drawings of Prof. Owen, expressed his conviction that, after taking all the circumstances into consideration, the two descriptions pertain to the same animal, and adds—"Of the bones, besides the vertebræ, we have a femur or humerus, and the ulna and radius, with a portion of a scapula, a portion of an enormous pelvis, several ribs, two or three bones corresponding to the wrist, both extremities of the lower jaw, and the extremity of the upper jaw, and many other fragments of some importance. The vertebræ extend in a line 65 feet."

This is the most extensive collection of bones of this animal hitherto found, except-

\* Vol. XLIV., for April, 1843.

† Vol. II., for July, 1846, new series.

‡ July, 1845, and April, 1846.

ing those crowded together by Mr. Koch, a German collector, and exhibited by him as the remains of a single individual, from a single locality, under the erroneous name of *Hydrarchos*. It is well known that most if not all of these gigantic bones belong to the *Zeuglodon*, the supposed exceptions being some of the caudal vertebræ, which may have pertained to another animal. The identity of the *Zeuglodon* and *Hydrarchos*, was demonstrated to Mr. Koch himself, before he published his description; and subsequently Dr. Wyman of Boston confirmed and illustrated this fact in a masterly manner. Prof. Müller of Berlin, who is now engaged in examining Mr. Koch's collection with a view to publication, has come to the same conclusion; on which point, however, no one could have a moment's doubt who has any knowledge of the subject.\*

I have in my collection a large vertebra which was presented to me by Mr. Cooper, of Claiborne, Alabama, and which is the specimen noticed by Mr. Buckley in the American Journal of Science for July, 1846. It measures eighteen inches in length, and twelve inches in diameter on the articulating surfaces; and although destitute of the processes and somewhat broken, it weighs sixty-five and a half pounds! With it I received several portions of ribs, corresponding in character with those described by Dr. Harlan and Prof. Emmons.

I have lately had an opportunity of examining the cranium of a small *Zeuglodon*, (Pl. V.) discovered by Prof. Lewis R. Gibbes, of Charleston, and described by Prof. Tuomey in the Proceedings of the Academy.† The characters of this skull afford additional evidence that Prof. Owen was correct in assigning to the animal a place among the Cetacea, for it shows a striking affinity to the genus *Delphinus*. Prof. Tuomey thinks it belonged to a young animal; but the solidity of the bones and the tooth, with the apparent full development of enamel, incline me to a contrary belief. Since I have seen Grateloup's description of *Squalodon*, and his figure, (Pl. I. fig. 5,) I suspect the two may even prove specifically identical. The teeth are thinner, the form of the crown more conical and the serratures more vertical, the crenatures smaller and shorter, and the neck, at the insertion into the alveolus, more contracted in the Charleston and Léognan specimens than in the other species now under consideration.

My supposed discovery of what I called *Dorudon*, described in the Proceedings of the Academy for June, 1845, adds another species to this genus. In the notice I then published, these remains appeared to me to differ generically from the *Z. cetoides*,

\* Mr. Lyell has published sufficient evidence to show that Mr. Koch's specimens were obtained in various parts of Alabama. This is further proved by a letter from Dr. Lister, of Alabama, published in the Proceedings of the Boston Society of Natural History; and Dr. Dickeson, who has recently made a geological exploration of that state, confirms the now proverbial fact, that the so-called *Hydrarchos* was obtained from several different and even distant localities.

† February, 1847.—Prof. Tuomey's description is republished in the present volume.

which I had examined in Albany. I founded the distinction on the hollowness of the teeth and the more elongated, gavial-like form of the beak. The following is the description, slightly amended, which I then gave of these teeth. (Pl. IV. figs. 1, 2, 4.) "Teeth spear-shaped, the crowns compressed laterally, and in distinct, deep sockets, with double fangs; the bifurcation commencing a half inch below the enamel, which extends from the point of the tooth one inch; enamel smooth, except near the base, where it is wrinkled vertically; the serræ longitudinal, diminishing in size from the apex of the tooth, which is seven-eighths of an inch from the first lateral point; length of the tooth  $3\frac{3}{4}$  inches; breadth  $2\frac{1}{4}$  inches; thickness of the body below the enamel, a half inch; the anterior root a cone, compressed laterally; the other prismatic, thicker on the posterior side, which is fluted so as to present the appearance of being partially divided into two fangs: where the fangs are united, the neck is contracted, so that a horizontal section presents the yoke-shape of the *Zeuglodon* of Owen. In one of the teeth the distance from the extremities of the fangs across is  $2\frac{1}{4}$  inches."

Besides the serrated molar teeth, which are figured in a portion of a lower maxilla, and which are all similar, I have two kinds of perfect canine tooth of a single fang each, one of which was then, and both of which are now, figured. One is curved, compressed and pointed, resembling very much a figure given by Faujas de St. Fond\* of a tooth of the Asiatic crocodile or gavial; though it has no appearance of a secondary tooth, and is contracted at the extremity of the fang, and inserted obliquely in the socket. It is much compressed laterally and longitudinally, and is hollow, the dentine thin, but the enamel developed. A depression on each lateral surface almost gives it the appearance of being lobed, showing the tendency to the yoke form in the section. It has also cutting edges on the anterior and posterior compressed sides of the enamelled crown, and in appearance resembles very much the teeth of *Megalosaurus*, though the edges are not serrated, (Pl. IV., fig. 3.) The other canine tooth, (Pl. II., fig. 1.) is more straight until within the distance of the enamel from the point, which is slightly curved. The body below the enamel bulges out, and is not compressed laterally like the former specimen. Casts of both these teeth, and of the molars, were forwarded to Prof. Owen by my friend Dr. S. G. Morton, who has kindly favoured me with a letter from that distinguished naturalist, containing his impressions on the subject.

"ROYAL COLLEGE OF SURGEONS, NOV. 11, 1845.

"I have been much gratified by finding, on my return from a tour in Italy, additional examples of your friendly remembrance in the interesting cast of the tooth on which Dr. Gibbes has founded his genus "*Dorudon*." It reminds me of the character of the serrated teeth described by M. Grateloup in the "*Jahrbuch für Mineralogie*," 1841, p. 830, as those of a fossil carnivorous cetacean for which he proposes the name

\* Fossiles de St. Pierre à Maestrecht, Pl. XLIX., A.

*Squalodon*. I have not, however, seen these teeth, and know them only by Grateloup's brief description.

"With regard to *Dorudon*, I have a stronger suspicion that the large two-fanged, compressed, serrated tooth which you have transmitted to me, may prove to be an anterior tooth of *ZEUGLONDON* (*Basilosaurus*, Harlan.) It would be desirable to determine accurately the modifications of form of the teeth in different parts of the jaws of that very remarkable cetacean, and to this end I trust Mr. Koch's late discovery in Alabama may contribute.

"In the same box was the cast of the tooth of the *Mosasaurus*, and also two uncoloured casts of simple t.eth. One I take to be the canine of a bear. Were these found with the serrated teeth of *Dorudon*?"

Subsequently he says—

"I had written the foregoing before discovering in the pyramid of papers accumulated during my absence, the packet of memoirs which accompanied the casts. I observe therein that Dr. Gibbs has made the comparison of his *Dorudon* with *Zeuglodon*, and founds a distinction in the form of the jaw. With regard to the hollowness of the teeth of *Dorudon*, this might perhaps arise from the immaturity of the individual which yielded the fossils.

"The figure subjoined to Dr. Gibbs's most interesting paper reminded me of the very old figure in "SCILLA, *de corporibus marinis; tab. XII. fig. 1, 1747*," of serrated teeth, which have been the subject of much speculation.\* My last views of them were that they were apparently premolars of the fossil Hippopotamus.† Dr. Gibbs's discovery may prove them to belong to the very curious family of extinct cetacea of which *BASILOSaurus* is the type, and to which it is most probable that *Dorudon* belongs.

"The tooth like the canine of a bear" (Pl. II. fig. 1, †) "is not that which Dr. Gibbs has figured," (Pl. IV., fig. 3); "the figured tusk or canine belongs to a different genus from the tooth I have likened to a bear's canine, and may probably be from the lower jaw of *Dorudon*, as Dr. Gibbs supposes."

The figured tusk alluded to by Prof. Owen, was subsequently proved to be from the lower maxilla, for I found it inserted in a fragment of that bone. (Pl. III., fig. 2.) During an extensive exploration of the bed of green sand at the locality, with the hope of turning up other portions of the skeleton, fragments of a lower maxilla containing the then unfigured tusk were procured, with twelve caudal vertebrae. These I was disposed to consider as belonging to another species, if not a new genus as suggested by Prof. Owen, but a careful examination of Prof. Warren's specimens convinces me that I must refer them to *Z. cetoides*.

\* I learn from M. Agassiz that the tooth in the University of Cambridge is the original which furnished the figure given by Scilla. I have copied one of these teeth from Scilla. (Pl. II., fig. 9.)

† Odontography, p. 564.

‡ This tooth was not figured in my original memoir, but a cast was sent to Prof. Owen.



I have two fragments of this maxilla—one five inches long, containing a canine tooth with the alveoli of two others, (Pl. IIL, figs. 5 and 6,) and the other of the opposite side, about three inches. The characters of these specimens I thought were more Saurian than Cetacean; there being distinct pits on the outer surface of the jaw, showing the overlapping of the upper teeth as in Saurians; and the vertebræ having a strong tendency to become convex posteriorly. However, I am now satisfied that they belong to *Z. cetoides*.

Among the fossils of the Eocene period found with these relics, are tympanic bones and teeth of cetacea resembling *Physeter macrocephalus*, and *Balæna affinis*, Owen, as given in his "British Fossil Mammalia." Several vertebræ of a *Delphinus*, teeth of a true crocodile, and others with a compressed lateral cutting edge similar to figures given by Prof. Owen in his *Odontography*, as of extinct Saurians, which Prof. Agassiz informs me have been figured by H. Von Meyer, under the name of *Madrimosaurus*; a fossil that appears to me to have an analogue in the *Crocodylus macrorhynchus* of Harlan.\*

Here also I found teeth of a large *Pristis*, (Pl. I., fig. 6 and 7,) differing from *P. acutidens*, Agassiz.† The prevalence of Cetacea and Sauria at this period, together with that of fossils common to the cretaceous and Eocene beds, are interesting facts. These Eocene beds are the lowest in the series, and contain *Gryphæa mutabilis*, (Morton,) and *Terebratula Harlani*, (Morton,) which are also found in the cretaceous formation; while *Cardita planicosta*, (Sowerby,) *Scutella Lyelli*, (Conrad,) *Pecten membranosus*, (Morton,) and other fossils, characterize them as Eocene.

When the *Maestricht monitor* was discovered, it was a long time before naturalists were able to decide its position in the scale of organized beings. Camper and Van Marum considered it Cetacean; Hoffman, Drouin, and Faujas de St. Fond insisted that it was a Crocodile; but Adrien Camper decided it was neither cetacean, fish, nor crocodile, and referred it to a new genus of *Sauria* related to the *Monitor*, and to which Coneybære gave the name of *Mosasaurus*. Subsequently Cuvier confirmed the opinion of Camper.‡ Since that period various new genera have been added to this remarkable class of fossil reptiles, yet doubts have existed whether some of them do not possess affinities to the *Mammalia*. Cuvier has laid down the following rule, which is now generally admitted:

"En Zoologie, quand la tête, et surtout les dents et les machoires, sont données,

\* Medical and Physical Researches, p. 380; and Journal of Academy of Natural Science, Vol. IV., p. 15, 1824.

† This *Pristis* bears some resemblance to *P. acutidens*, Agassiz, but differs in tapering more gradually from the root to the point which is more acute. The root is thicker and longer in proportion, and the groove or channel on the posterior edge is deeper, and extends to the point of the tooth. The body is rather more pyramidal than conical, as in *P. acutidens*. I propose for it the name of *Pristis agassizii* as a small tribute to the distinguished author of the great work "*Sur les Poissons Fossiles*."

‡ Cuvier, Ossemens Fossiles, Tome V., p. 314.

tout le reste est bien près de l'être, du moins pour ce qui regarde les caractères essentiels ; aussi n'ai je point eu de peine à reconnaître à classer les vertèbres quand une fois j'ai bien connu la tète."\*

There is, however, an exception in the case of *Megalosaurus* and *Geosaurus*. Von Meyer says of the former, "that notwithstanding the similiarity of the teeth with those of *Geosaurus*, the structure of the rest of the skeleton differs very considerably. Among the bones yet found some remind us of the *Crocodile*, others of the *Monitor*, while others have not been sufficiently determined. The beak appears to have been straight and elongated; the width of the vertebræ at present discovered, exceeds their length by a third. They are contracted in the middle, as in *Streptospondylus*; both surfaces are plane."† And he again observes of them, that "the teeth are very similar, while they have nothing else in common." Although, in the recent crocodiles, the vertebræ are convex on one surface and concave on the other, still there are some fossil species which are plane or concave on both surfaces, and thus resemble those of *Cetacea*.

"In the recent crocodile," says Dr. Mantell, "the vertebræ are convex posteriorly, and concave anteriorly; but those from Tilgate, like the vertebræ of the crocodile of Caen, and of one of the species of Havre, are, with but few exceptions, slightly concave at both extremities"‡. In *Megalosaurus* both surfaces are slightly concave; in *Iguanodon*, they are almost flat on one side and slightly depressed on the other; in *Geosaurus* slightly concave; in *Streptospondylus* "the vertebræ are distinguished by the very remarkable peculiarity, that their anterior surface is convex, and the hinder concave; consequently the reverse of those of the Crocodiles, and formed like the cervical vertebræ of the whole order of terrestrial mammalia."§ On this peculiarity the genus *Streptospondylus* is founded. Cuvier also says:

"Mais il y a des vertèbres de grands reptiles, qui ressemblient si fort à celles de certains dauphins qu'il est facile de s'y tromper; toujours faudrait-il examiner leur position avec beaucoup de soin, et voir s'il n'y aurait point, à cet egard, de difference entre ces os de cétacés et ceux de reptiles."||

For several varieties of vertebræ of fossil Saurians differing from the recent species, I refer to Dr. Mantell's work on the Fossils of Tilgate Forest. These remarks and references are necessary in relation to the description of my later specimen, which possesses characters belonging to the *Cetacea* and *Sauria*, though the former predominate.

In the lower maxilla (Pl. III., figs. 4 and 6) there are marked differences from the former, (Pl. III., figs. 1 and 3.) The external surface is convex, the inner hollowed,

\* Cuvier, Art. Sauriens, Vol. V., p. 326.

† On the structure of Fossil Saurians, in Charlesworth's Magazine of Natural History, Vol. I., p. 341.

‡ Geology of South East of England, p. 263.

§ H. Von Meyer, ut supra, p. 352.

|| Letter to G. Mantell, Geology of South East of England, p. 282.

the two meeting in a sharp angle within and above the longitudinal median line of the lower surface, which is well exhibited in the sections, (Pl. III., figs. 3 and 4,) posterior to the insertion of a canine tooth. The latter specimen, (fig. 4,) upon a careful comparison with that of Prof. Warren, I am satisfied is identical with it. From Prof. Emmons's description I was disposed to consider them different; but he was mistaken in describing the anterior portions of the lower maxilla as being united, and having a groove or sulcus; whereas they are only united at the terminal extremities of the rami anteriorly; the interspace being filled with the matrix, which requires to be closely scrutinized to show the fact. I pointed it out to Prof. Wyman when we lately examined the specimen together. A little above the longitudinal median line on the inner face, the inner alveolar process arises like a continuous parapet, of a half-inch in thickness, extending nearly as much above the insertion of the canine tooth (Pl. III., fig 5, *a*), which is placed almost perpendicularly in the alveolus. In this respect it is directly the opposite of the *Megalosaurus*, where the external edge of the jaw rises almost an inch above the margin, forming a lateral buttress to support the teeth externally. Immediately anterior and posterior to this canine, are hollow pits or depressions on the outer surface of the jaw for the overlapping of the tusks of the upper jaw. In Prof. Warren's specimen, this inner thick plate or buttress is distinctly marked, but Dr. Emmons's figure does not represent it. In my first specimen there is no such additional plate, or projecting alveolar process, on the inner side of the maxilla. In the latter case, the pits, of which two exist in each lateral fragment, certainly show an approximation in the animal to the *Saurian* rather than to the *Cetacean* type. Both are hollow.

"In all the genera of Crocodylians," observes Prof. Owen, in his *Odontography*, "the teeth of the upper and lower jaws are so placed that their points, instead of meeting, interlock. In the Crocodiles, (genus *Crocodylus*,) the first tooth in the lower jaw is received into a notch excavated in the side of the alveolar border of the upper jaw, and is visible externally when the mouth is closed." "In the Gavials, (genus *Gavialis*,) the first as well as the fourth tooth in the lower jaw, passes into a groove in the margin of the upper jaw, when the mouth is closed." p. 286.

I have not yet seen a perfect upper maxilla, but supposing from the form of the groove that a similar tusk existed in the upper jaw, here would be another approach to the Gavials, (so far as the canines are concerned,) since their teeth are nearly equal in size and form in both jaws. In the figures given by Faujas de St. Fond of the Asiatic and African crocodiles, these pits or depressions in the lower jaw are obvious characters.

Of the caudal vertebræ I received twelve, six larger (Pl. II., figs. 6 and 7) destitute of spinous processes, and six smaller (Pl. II., figs. 4 and 5) without any processes—merely rudimentary notches. The largest of the former is three and a half inches long, and four inches in the width of the articular surfaces, which are circular

the anterior face is irregularly concave, with a depression in the centre, while the posterior is slightly convex; in the smaller vertebræ (fig. 4) which have no processes, the concavo-convex character is more marked. Several of the larger vertebræ resemble the description given by Dr. Mantell\* of *Cetiosaurus*; but instead of becoming bi-concave as they approach the caudal extremity, the posterior surface becomes more convex. In this respect they resemble the *Monitor*. All the caudal vertebræ of the *Monitor* have the anterior surface concave, and the posterior convex. Pl. II., fig. 8, represents the caudal vertebræ in position.

The centrum or body of the six larger vertebræ, which differ very little in size, is somewhat contracted in the middle; and on the sides of the processes is a little depressed: the transverse processes are pyramidal, the base extending the whole length of the body, next to which, in the centre, is a large oval perforation. This I find in some of the vertebræ in Prof. Warren's collection. He has no small caudal vertebræ. On the abdominal surface of the body is a longitudinal depression, which might almost be called a groove, in the centre of which is a large foramen, in all the vertebræ. It is remarked by Professor Owen,† that the bodies of the vertebræ in most species of *Plesiosaurus*, are traversed vertically by two vascular canals, which lead from the medullary or spinal canal to the inferior surface of the centrum, where they terminate each by an orifice, and sometimes by two orifices, on each side of the middle line. These orifices, however, are not a constant character of the genus *Plesiosaurus*, neither are they peculiar to this genus, being present in the vertebræ of the *Cetacea* as well as those of the *Sauria*. The medullary cavity is formed by two lateral processes extending upward and forward, connected by an arched, bony band. All the apophyses seem ankylosed, for I can find no trace of a suture. In the larger specimens are tubercles for the attachment of chevron bones.

In making a distinction between my two specimens, in addition to the more elongated and tapering form of the jaw, I urge the difference in form of the tusks, the oblique position of the fangs, and the freedom from the projecting inner plate of the alveolus; and I still think the character of hollowness is not entirely to be set aside. Prof. Wyman is of opinion that the thinness of the dentine and the hollowness are indicative of the immaturity of the animal; while Prof. Agassiz inclines to the belief that it is not a young animal, as the enamel is perfectly developed and smooth—not wrinkled as in young animals. Apart from this character he considers it a different species from *Z. cetoides*. With these impressions, I propose for it the specific name of *serratus*.

The question now arises whether Dr. Harlan's original name of *BASILOSaurus* should or should not be restored to the remarkable remains now under consideration. That it is objectionable in a critically zoological point of view, we grant; but it is not more so than many other names that are admitted in the systems, among which we

\* Medals of Creation, p. 727.

† Report on British Reptiles.

may, by way of example, refer to that of *Saurus*, which Cuvier has applied to a genus of Fishes. In the order of priority, Prof. Agassiz's *Phocodon* supercedes *Zeuglodon*, which latter designation only expresses a character of the teeth, which is equally present in some of the Dugongs and Seals. Of the several names—*Basilosaurus*, *Phocodon*, *Squalodon*, *Zeuglodon* and *Dorudon*, which have been successively applied to these fossil remains, I respectfully suggest the propriety of restoring the original appellative of the discoverer; and in so doing I further propose, in the present state of our knowledge, to recognize three species of this extraordinary genus, thus:

BASILOSAURUS. *Harlan.*

1. *B. cetoides.* Owen.
2. *B. serratus.* Gibbes.
3. *B. squalodon.* Grateloup.

REFERENCE TO THE PLATES.

PLATE I.

- Figs. 1 and 2. Anterior extremity of lower maxilla, (reduced.) Dr. Emmons's collection.  
 " 3. Molar tooth, (natural size.) Dr. Emmons's collection.  
 " 4. Large vertebra, (reduced.) Dr. Emmons's collection.  
 " 5. Fragment of upper maxilla, from Léognan in the Gironde. *Squalodon* of M. Grateloup.  
 " 6 and 7. *Pristis Agassii*, (nobis.)  
 " 8. Section of molar tooth of *Basilosaurus cetoides*, from Prof. Owen's Odontography.

PLATE II.

- Fig. 1. Two views of canine teeth of *B. cetoides*. The author's collection.  
 " 2. Section of canine tooth of *B. serratus*. The author's collection.  
 " 3. Section of canine tooth of *B. cetoides*. The author's collection.  
 " 4. Small caudal vertebra of *B. cetoides*, (natural size.) The author's collection.  
 " 5. Small caudal vertebra, posterior articular surface, (natural size.)  
 " 6 and 7. Large caudal vertebrae of *B. cetoides*, (one-fourth natural size.) The author's collection.  
 " 8. Twelve caudal vertebrae reduced, and in relative position.  
 " 9. Tooth of the *Basilosaurus* of Malta, copied from Scilla. *Phocodon* of Prof. Agassiz.

PLATE III.

- Fig. 1. Fragment of lower maxilla of *B. serratus*. The author's collection.  
 " 2. Fragment of lower maxilla of *B. cetoides*. The author's collection.  
 " 3. Section of fig. 1.  
 " 4. Section of fig. 2.  
 " 5. Upper surface of fig. 6.  
 " 6. Anterior fragment of lower maxilla of *B. cetoides*. The author's collection.

PLATE IV.

- Fig. 1. Fragment of lower maxilla and teeth of *B. serratus*.  
 " 2. Edge view of molar tooth of *B. serratus*, (natural size.)  
 " 4. Lateral view of the same tooth.  
 " 3. Two views of a canine tooth of *B. serratus*.

PLATE V.

Cranium of *Basilosaurus*, found in the Eocene near Charleston, South Carolina.

ART. II.—*Notice of the Discovery of a Cranium of the Zeuglodon, (Basilosaurus).\**

By M. TUOMEY, State Geologist of South Carolina; Corresponding Member of the Academy of Natural Sciences of Philadelphia.

Almost every day adds something to our knowledge of those remarkable forms which, in the revolutions, of time have passed out of existence. In 1832, Dr. Harlan described and figured in the American Philosophical Transactions some fossil bones from Alabama, consisting of portions of the upper and lower maxillæ of an animal to which he gave the name of *Basilosaurus*, from an impression that they belonged to a gigantic Saurian. An examination of the teeth, however, satisfied Prof. Owen that these remains pertained to a Cetacean, to which he has given the name *Zeuglodon*.

The first description of an entire tooth of this animal, was given by Mr. Buckley, in a concise account of the discovery of a considerable portion of the skeleton, published in the American Journal of Science in 1843. In 1845, Dr. R. W. Gibbes, of South Carolina, published in the Proceedings of the Academy of Natural Sciences of Philadelphia, accurate figures of similar teeth with fragments of the lower maxilla. The teeth being hollow, and in his opinion presenting other important differences, he constituted for them a new genus, *Dorudon*.

The *Hydrarchos*, I believe, has passed away without advancing our knowledge upon this interesting subject, excepting perhaps that Prof. Wyman discovered in the extremity of the ribs some cetacean characters.

The next important development consisted in the publication, by Prof. Emmons, in the American Quarterly Journal of Agriculture, of beautiful figures of the teeth, the anterior portion of the lower maxilla, part of the ramus having the coronoid process and condyle almost perfect, together with cervical and caudal vertebræ, and a rib. But up to the present time, no notice has appeared of the discovery of any considerable portion of the cranium proper—for the mutilated head of the so-called *Hydrarchos* can scarcely be considered an exception.

Early in January I was presented by F. S. Holmes, Esq., with a portion of the left upper maxilla, containing one tooth and the alveoli of several others, which he discovered in the Eocene beds of Ashley river, about ten miles from Charleston. Soon after, Prof. Lewis R. Gibbes, of the College of Charleston, visited the same locality, and had the good fortune to find the rest of the skull, much fractured, but so carefully were the fragments collected, that with a little patience we were enabled to restore them to their proper places. It is then altogether to these gentlemen that we owe a knowledge of this valuable relic.

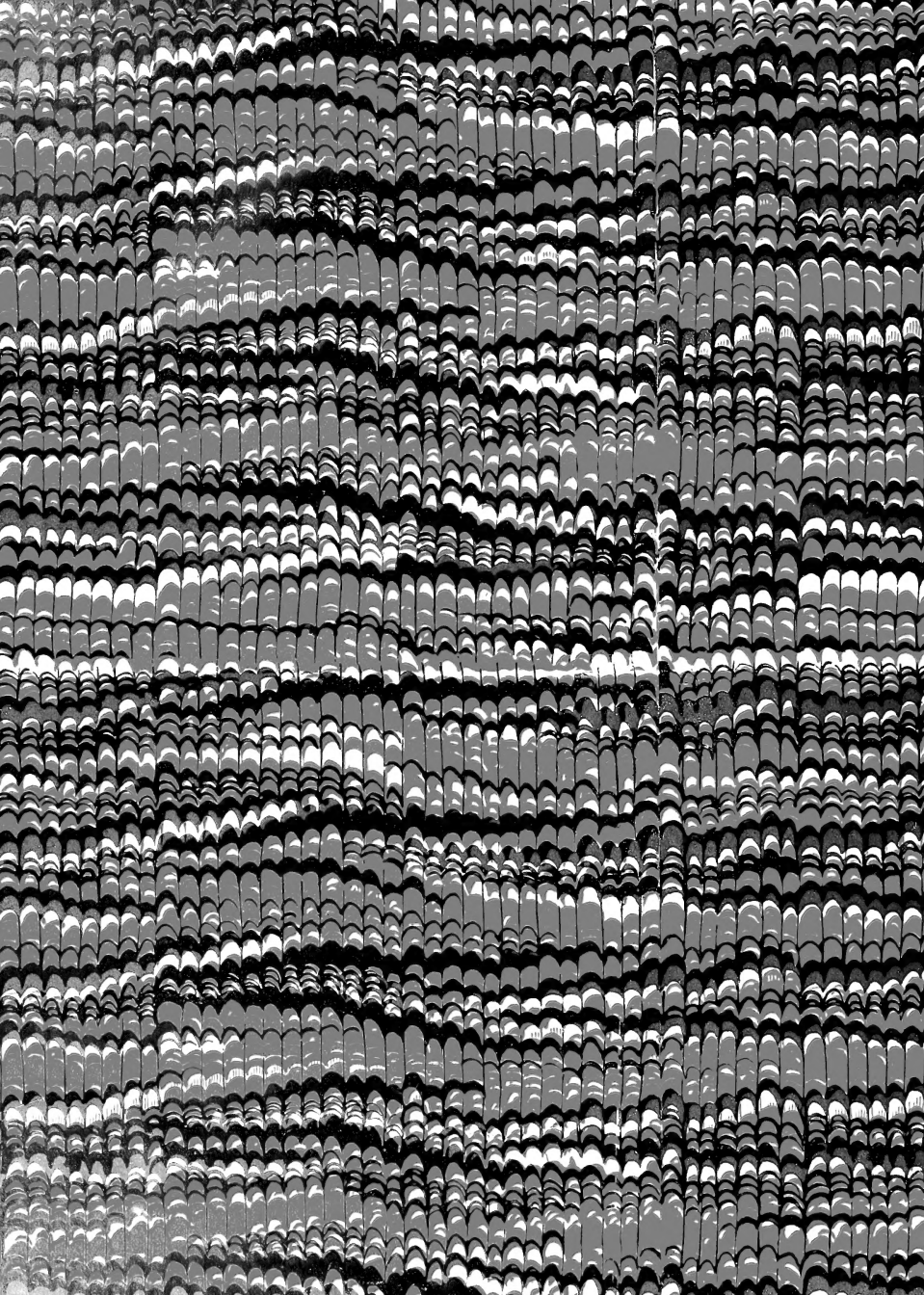
\* Proceedings of the Academy of Natural Sciences, February, 1847.

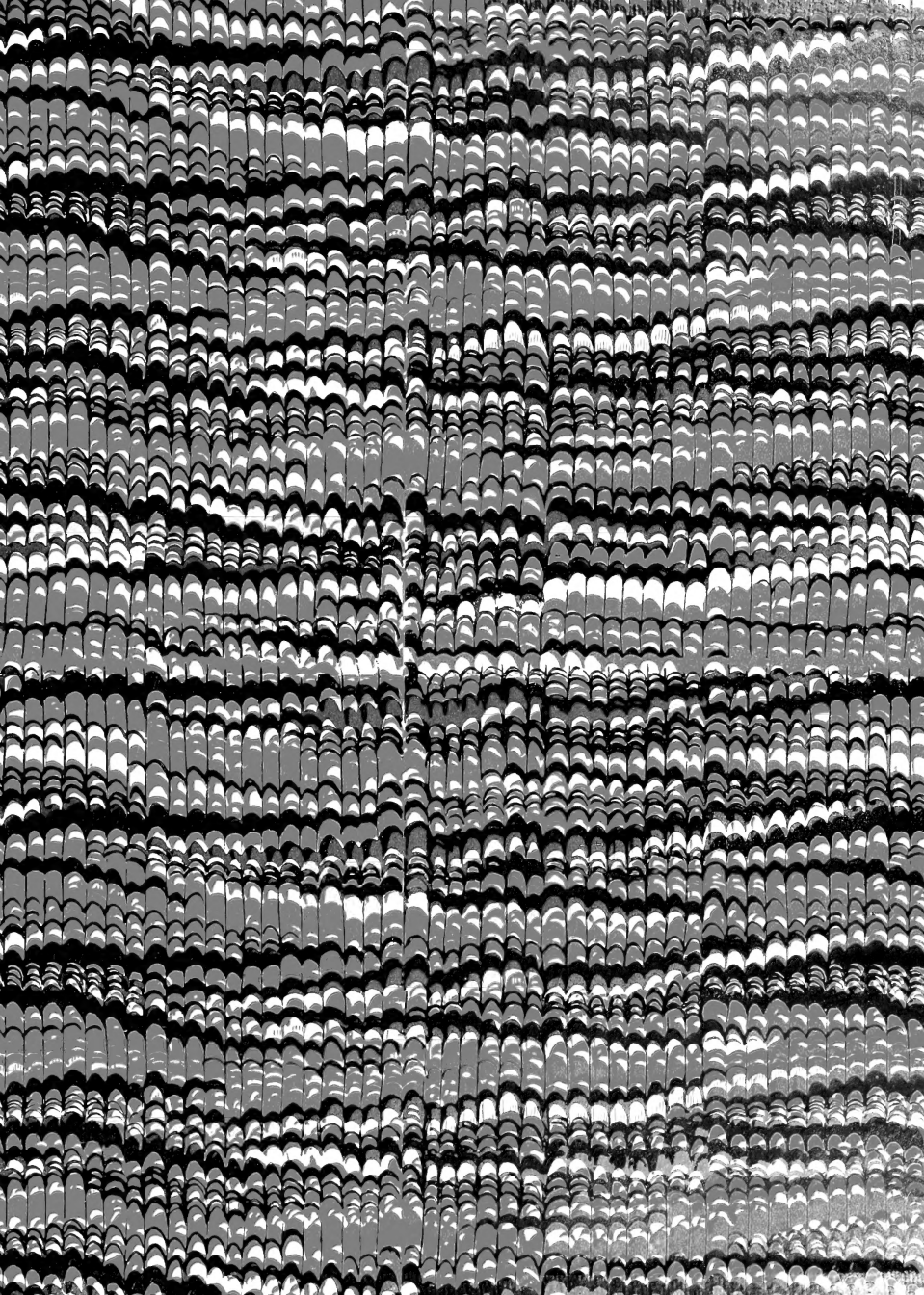












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