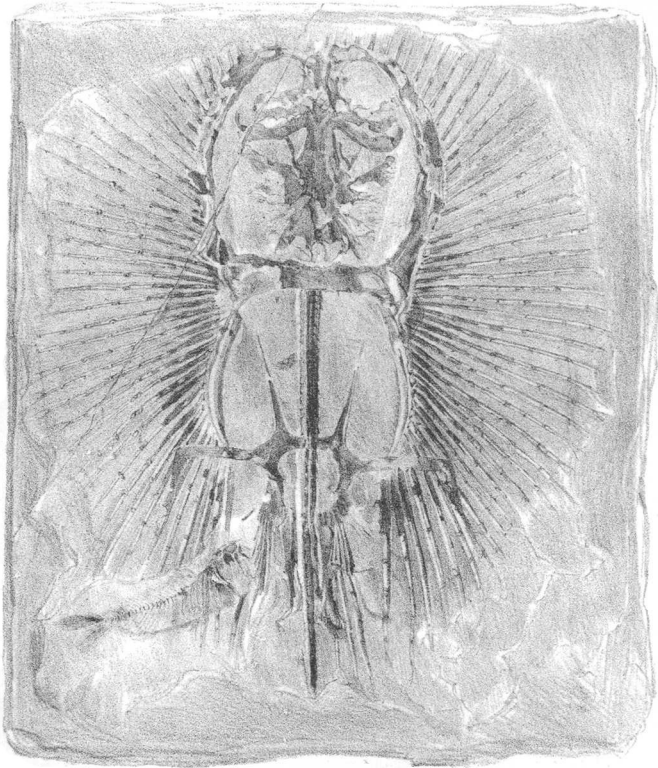
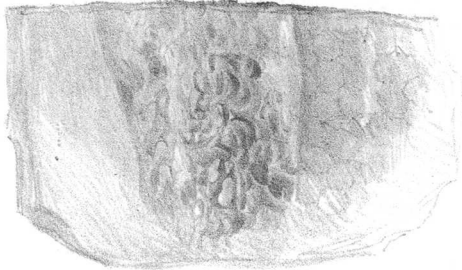


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formation, or at least not sufficiently distinguishable from it, to entitle it to rank as an independent formation; but, inasmuch as the Great oolite very much thins off where associated with Stonesfield slate, it would appear that the Stonesfield slate and its accompanying "ragstone" were deposited by the same sea which formed the Great oolite itself, and that it partly owed its origin to certain mixed conditions, arising from the influx of rivers into an ocean interspersed with numerous scattered islands, abounding in a luxuriant vegetation, and inhabited by numerous terrestrial animals; and this opinion seems more probable from the quantity of plants which occurs throughout the Stonesfield slate beds, and also from the relics of land animals, such as the *Didelphis* and *Pterodactylus*.

We also find that the Great oolite thins out towards the northern end, whilst the Inferior oolite thins out in like manner towards the southern end of that long chain of hills of which the Cotteswolds form a part.

3dly. If the beds just referred to belong to the Great oolite, it is just possible that the clays by which they are super-imposed in this district, may be the equivalent, or a sort of representative of the Bradford clay, judging at least from their position and the analogous fossils which they contain. Or, supposing this to be incorrect, we venture to conclude that these clays are the equivalent of certain clay-beds containing *Apiocrinites*, which in Wiltshire separate the freestone from a lower stratum of freestone of a coarser texture.

2. *Description of a FOSSIL RAY from MOUNT LEBANON (Cyclobatis oligodaetylus)*. By Sir PHILIP GREY EGERTON, Bart. M.P., F.R.S., F.G.S.

I AM indebted to the liberality of Professor Edw. Forbes for many valuable specimens of fossil fishes, procured by Capt. Graves from the Lebanon range; and amongst the number, for the subject of the present memoir, one of the most interesting and remarkable ichthyolites ever brought to light by palæontological research. The cases of the discovery of fishes belonging to the placoid order, in a condition at all approaching to completeness, are exceedingly rare. The destructible nature of the endoskeleton, and the loose attachment of its component members, attest the probability that decomposition would complete its work ere these records could be engrossed in imperishable characters. That this order was nevertheless extensively represented from the earliest fossiliferous period to the present time, is manifest from the frequent occurrence of the palatal tritones, teeth, and defensive fin bones of the Cestracions, Hybodons, and Squales; and of the dental apparatus, caudal weapons, and dermal tubercles of the Rays.

The specimen presented to me by Mr. Forbes is a remarkable exception to the general rule, the parts being perfectly preserved, so far as they are exhibited by the fracture of the matrix. The fish is in its natural position *ventre à terre*. The dorsal integuments being removed, the skeleton is distinctly exposed as seen from above. The outer margins of the pectoral fins, and the caudal vertebræ from the termination of the ventral fins, are deficient. The preservation of the claspers proves it to have been a male, and (to judge from the development of these organs) of mature age. It corresponds in size with the unique specimen of *Asteroderma* from the Solenhofen oolite in the collection of the Society, but has little resemblance in other respects to that genus. The negative facts of the absence of all trace of dermal armature, as also of the caudal ribs described in the "Poissons Fossiles," would sufficiently distinguish it; we have, however, the positive evidence of the structure of the vertebral column, which is that of a true ray, without any approach to the squaloid character displayed in *Asteroderma*. As compared with the recent genera, the circular form of the head eliminates the Lebanon Ray from all save the Torpedos. From the latter family it is distinguished by the smaller number and greater length of the rays of the pectoral fins, by the smaller size of the ventral fins and the tail, as also by other characters, which will be sufficiently manifested in the sequel. The aspect of this fossil is very singular: it may not inaptly be compared to the figure 8, surrounded by a circular border of long divergent rays. The generic name of *Actinobatis* at first struck me as conveying a good idea of this peculiarity; but, finding that Agassiz had already appropriated this title to a fossil Ray of which some dermal tubercles have been found at Plaisance, I have substituted the name *Cyclobatis*, which expresses equally well the most striking character of this singular fossil. The anterior or cephalothoracic cavity is circumscribed by the carpal bones carrying the fin digits, which join the rostral cartilage at an obtuse inverted angle. The mouth extends nearly from side to side; the teeth are only seen near the symphysis of the jaw, where they are small and discoid; the tympanic pedicle, extending from the angle of the jaw to the cranium, is broad and strong. The cartilages of the head are crushed; but the cranial cavity appears small, as also the orbits. Traces of the branchial apparatus are preserved; but the number of the arches cannot be decyphered. The cartilages composing the thoracic girdle, which forms the fulcrum for the action of the pectoral fins, are broad and strong. The anterior carpal ossicles are also largely developed, being at least a third broader than in a recent ray of similar size. These dimensions are continued until they abut against the anterior part of the head. The posterior prolongations of the carpal apparatus diminish in size as they recede from the thoracic girdle, and terminate at the insertion of the last pectoral digit a little behind the pelvic arch. The pectoral fins are very remarkable, and contribute chiefly to the peculiar characters of this ray.

They extend anteriorly to the nasal cartilages, completely surrounding this portion of the cephalo-thorax: the distal margins exceed those of the ventral fins. The component digits are 47 on each side. They increase in length and breadth as they recede from the head, the terminal ray being the largest of the series. In the recent Rays the pectoral digits number from 80 to 100, and in the Torpedos nearly 60.

The arrangement of the fin rays in *Cyclobatis* resembles that of the recent Rays, radiating in regular gradation from the centre to the extremities, but the smaller number of the digits causes their divergence to be greater, and the interspaces consequently of larger extent. The actinated appearance of these organs is due to this peculiarity, which has suggested the title of *oligodactylus* for the species. The form of the phalanges is intermediate between that of the Rays and that of the Torpedos, combining a greater length and denser structure than we find in the latter, with breadth and thickness exceeding the comparative dimensions of these parts in the former. The digital articulations are more distant and fewer in number than in the recent genera. The fork occurs at the sixth articulation,—in the recent genera not before the tenth. The phalangeal ossicles do not contract in diameter between the articulations; they have a projecting longitudinal midrib, from whence they slope off to the margin, so that a transverse section would show a lozenge-shaped outline. The coarse granulated structure of these bones is distinctly traceable, causing a jointed appearance between the articulations. The abdominal cavity, or that portion behind the thoracic girdle, is nearly as large as the anterior or cephalothoracic, and in this respect differs most remarkably from the Torpedos, where the anterior area is at least twice as large as the posterior. In form it is slightly oval; the pelvic arch differs from that of all the recent Rays I have had opportunities of consulting, in the developement of two elongated styloid processes, from the horns of the transverse pubic cartilage, and extending forwards over two thirds of the abdominal cavity. This structure recalls vividly the marsupial bones of the Australian mammals. The transverse cartilage of the pelvis sends out two broad processes, extending backwards for the attachment of the ventral fins. The proximal digit on either side is unusually large; it extends laterally at right angles to the spinal column, and at the first articulation forms a second right angle; the remaining phalanges being directed backwards, parallel to the spinal column. This digit is detached from the remainder of the ventral fin, and is inserted considerably nearer the transverse cartilage. The other fin rays are six in number on each side: the first is considerably smaller than the succeeding five, and curves outwards. The remainder agree in character with the pectoral digits. The tarsal bones which support the ventral rays, are considerably smaller than in the recent Skaits, in accordance with the smaller number of these bones, which in the latter species range from fifteen to twenty. The impressions of the claspers show these organs to have been compa-

ratively large, and of complicated form. The whole of the pelvic apparatus, with its appendages, as compared with the rays of the present period, presents remarkable modifications. The small size of the ventral fins is conclusive evidence against the supposition that these differences could have relation to locomotion. If we seek to explain them with reference to the internal structure of the animal, the absence of the soft parts deprives us of the means of arriving at any satisfactory results. Analogical considerations, however, would suggest the idea, that the peculiar features of these parts have some relation to the generative system. The vertebral column corresponds with that of the recent rays in the form and character of the vertebræ, and has no approximation to the squaloid type found in the fossil Ray from Solenhofen, in the Society's collection. The anteroposterior dimensions of the vertebræ are rather greater than in a specimen of *Raia* of similar size with the fossil: the extremity of the tail is deficient, but judging from the rapid contraction of the caudal vertebræ preserved in the specimen, this organ must have been small and powerless, presenting a remarkable contrast to that of the torpedos. There is no trace of the existence of a defensive weapon; nor, indeed, would the proportions and form of this part of the specimen lead one to infer that this fish could have been provided with such an organ.

To recapitulate the features of this remarkable fish, we have a small ray, much resembling those of the present period, but entirely surrounded by a broad flexible cartilagino-membranous fin, the skin smooth, the teeth and eyes small, the tail slender, and no trace of dermal spines, tubercles, or defensive weapons. It is impossible to resist a speculation, as to how an animal apparently so destitute of the means of offence or defence could have existed. We find in the recent Rays various provisions adapted to these ends. *Trygon* and *Myliobatis* are armed with weapons so powerful and deadly, that they have been adopted by savage nations for the armature of their war spears. Other genera have the nasal cartilages prolonged in the form of a cut-water, to enable them both to evade by flight those enemies they could not encounter in single combat, and to overtake the smaller fishes on which they subsist; and most of the recent forms have their integuments studded with spines or osseous plates, forming a species of defensive armour for the body, while a similar armature on the long and flexible tail renders this organ an effectual weapon for keeping intruders at a respectful distance. Our fossil possessed none of these advantages: the large development and anterior extension of the pectoral fins must have rendered the locomotive efforts of *Cyclobatis* little more effectual than the systole and diastole of a Medusa. The safety of the fish, then, could not depend upon flight. But these organs, however ill adapted for speed, are admirably formed for concealment, and when applied to the sand at the bottom of the ocean, would act as the leather suckers with which mischievous boys draw up the paving-stones in the streets, retaining the fish stationary, while

the smoothness of the skin would present no obstacle to the passers by, and possibly its colour may have contributed to render the concealment more effectual. The position of the mouth forbids the idea that this Ray buried itself in mud, as the *Lophius* and other predatory fish are known to do. The difficulty of defence being thus surmounted, we have still to devise how this fish procured its subsistence. It may be that it fed upon some of the smaller and more helpless denizens of the deep; but at the same time I am inclined to believe, from a comparison of the oral apparatus with the recent forms, that its food was not dissimilar. Some of these forms, too, if found in a fossil state, would cause the zoological reasoner full as great embarrassment as the subject under discussion, from the absence of the ordinary provisions for self-preservation so familiar to all. Yet the Creator of the Universe has not formed them helpless; so far otherwise, he has endowed them with a subtle armoury, more powerful than the dental *chevaux-de-frise* of the marauding shark, — more deadly than the serrated lance of the fireflare, — more effectual than the speed of the dolphin, or the aerial excursions of the flying-fish. I allude to the electric apparatus of the Torpedo. The Lebanon Ray in many points of structure has presented analogies with this genus; and although, in the absence of all positive evidence to the fact, it would not be justifiable to infer that it was provided with a similar organ, yet I do not conceive that in drawing attention to this consideration in the passing allusion I have made above, I have overstepped those bounds of probability which ought to be rigidly observed by every observer in the rich and inexhaustible field of nature.*

3. *On some New Species of FOSSIL FISH, from the Oxford Clay at CHRISTIAN MALFORD.* By SIR PHILIP GREY EGERTON, Bart., M.P., F.R.S., F.G.S.†

THROUGH the kindness of Lord Northampton and Mr. Pratt I have had an opportunity of examining several specimens of fossil fish found with the beautiful *Ammonites* and *Belemnites* already described by Mr. Pratt and Professor Owen, in the Oxford clay, at Christian Malford, near Chippenham. Some of these *ichthyolites* are in an excellent state of preservation; others are mere fragments. Those genera I have been able to identify belong to the *Lepidoid* and *Sauroid* families of the *Ganoid* order of Agassiz, viz. *Lepidotus*, *Leptolepis*, and *Aspidorhynchus*. These three genera

* In the accompanying plate, fig. 1. represents this fossil of its natural size, and fig. 2. is a magnified view of part of the jaw.