

# On the Palaeontology of the Middle and Upper Lias.

---

BY MR. CHARLES MOORE.

---

**I**N my school-boy days, my half holidays were often spent in collecting the Ammonites with which the beds of the Upper Lias in the neighbourhood of Ilminster abound, for the purpose of rubbing them down to shew their sparry chambers; but having soon to engage in the active bustle of life, this amusement was quickly forgotten.

During my residence in Bath a few years since, an occasional ramble into the quarries around it, served to revive a dormant taste for geology, a taste which when once cultivated is rarely lost. To those whom this science interests, nature presents herself in newer and more attractive forms, and whether it be in wonder at the mighty forces that have been in action in raising our mountain chains to their present elevations, and thereby exposing to our view riches which otherwise would have been unknown, and without which our favoured country could not have attained its present glory; whether we consider the more gradual operations of former seas, to the agency of whose waters the neighbourhood of this fair city especially, and

the country generally are indebted for the pleasing and varied characters they present; or whether we enter the field of organic life, and by a more minute examination, study the workings and the ways of Providence, so far as they have been revealed to us, we are enabled to see the handy-work of an all-powerful Designer, who appears to have been superintending all for the comfort and happiness of His creatures, and who when He rested from His work (if in our sense of the word He can be said to do so) could with infinite truth pronounce that all His works were good.

About the time my attention was re-directed to Geology, an incident occurred at Ilminster which more particularly caused me to consider it a field of no little geological interest. An old school house was being renovated, and two of the boys were amusing themselves with a pebble or nodule they had found in the rubbish. This in rolling from one to the other separated, and by a lucky chance the pieces were looked at and preserved. In the centre, and naturally at the point of separation, was a beautiful fish of the extinct genus *Pachycormus*. As my visits to Ilminster were then but for a few days at a time, it is only since my residence there, that I have been able to arrive at a general knowledge of the beds and their contents.

Until very recently these beds, which belong to the Marlstone or middle Lias and the upper Lias, were supposed to be members of the Inferior Oolite,—which was an error; for not only have they a well marked position between the lower or blue Lias, which is found at Twerton and in places near Bath, and the Inferior Oolite, which also has an extensive development there, but they have organic remains peculiarly their own, and altogether distinct from those of either formation. Some confusion may arise in

studying these beds, from the fact, that at the base of the Marlstone resting on the higher members of the lower Lias, there are beds of yellow micaceous sand, very similar to the lowest beds of the Inferior Oolite, and which may be readily mistaken the one for the other, and the more so from their containing but few distinctive organic remains. On the lower sand are the workable beds of the Marlstone or middle Lias, which have a thickness of from ten to twenty feet. Next in ascending order is a thin bed of greenish sand, principally characterized by containing innumerable Belemnites, an internal shell to an animal like the Cuttle Fish. These Belemnites also abound in the stone below. Then comes another thin bed of stone. With this the middle Lias terminates, and with one solitary exception, there is an entire change in the nature of the organic remains from those contained in the beds above. The upper Lias commences with laminated clays about two feet in depth. About the centre of these there is an occasional bed of yellow limestone, having an average thickness of three or four inches, than which, from the nature of the remains it encloses, or for the beauty of their preservation, there can rarely be a bed of greater interest. Above succeed thin bands of rubbly stone and clay, on which, above all, is seen the sand of the Inferior Oolite. One of the best sections may be seen at Shepton Beauchamp, near Ilminster.

Compared in thickness with the great series of formations, the beds I am speaking of appear insignificant, and their development is not considerable. At Ilminster they have a range of a few miles towards South Petherton and Yeovil; they are found on the Tor Hill at Glastonbury, at Radstock, in the cutting of the Railway at Box, again at Cheltenham, after which I am not aware that they are found until the Yorkshire coast is reached.

During one of my visits to Ilminster, happening to go into a quarry which had not been worked for some years, I found a small piece of stone having traces of the rib bones of an *Ichthyosaurus*. As no more could then be found, I was somewhat careless about its preservation. However, it was preserved. Next year, in the same place, I found another piece, which was also taken care of. This was the more fortunate, since two years after, in visiting the same locality, I perceived in the section of the quarry indications of more of the creature, and piece by piece I was enabled to disentomb a Saurian, the first traces of which I had four years before discovered. Owing to a considerable amount of other geological labour, I have not finished clearing this specimen, and if I had, it would have been too large to have brought with me. I have therefore been content to bring but a small part of it as its representative. In the clay in which this specimen was found are some ammonites, and I thought, when at work, I had dug up a couple, and was about to throw them away; but seeing a peculiarity in them, I was led to look more narrowly, and then I found it was part of the *Ichthyosaurus*,—actually its eyes lying loose in the clay. They display very distinctly the character of the eye of the *Ichthyosaurus*, which is made up of a number of horny plates—in fact, they served the purpose of a telescope, and, by being contracted or enlarged, enabled the creature to see to a greater or lesser distance, a provision of Providence, which the more readily enabled it to supply its voracious appetite. Nothing came amiss to it, even the young and the weaker of its own kind, being occasionally made to minister to its wants. Of these Saurians, including those from the lower Lias, I have many fine specimens. In the lower Lias the *Plesiosaurus* is associated with the *Ichthyo-*

*saurus*, but I have never obtained any traces of it in the Middle or Upper Lias, although it is found occasionally in the beds above.

Not the least interesting, because more rare, amongst the Saurians, is the *Teleosaurus*, which first appears in the beds I am speaking of. Unlike its relatives, the Ichthyosaur and Plesiosaur, which had soft skins, the *Teleosaurus* is covered with bony scutes or scales, and bears a close resemblance to the gavial of the present day. One specimen in my possession died with its head almost erect. The bony scales in this have been just enough displaced, to enable me to develop the vertebral column, and other parts of the skeleton, a work requiring no little care and labour. The vertebræ are much more elongate than those of the Ichthyosaurus. Another specimen, a head only, has its jaws well armed with sharp teeth, nearly one hundred and fifty in number, and it is as perfect as the first moment it was covered up. A third is a *baby Saurian*, and although but thirteen inches in length, is nevertheless in most perfect preservation. Its bony scales are undisturbed, except where covering its stomach. Their loss in the latter case was a fortunate circumstance. I have before mentioned that animals of this class are voracious. This one has not eaten one of its own young, but there is now in its stomach the last meal it was destined to devour—a small fish of the genus *Leptolepis*. The *Teleosaurus* in some instances attained considerable size. By way of comparison with my little specimen, I would notice one belonging to the Museum of the Literary Institution of Bath, found in the Oxford Clay of Wiltshire. It is a head, and looks at first sight as much like the trunk of a tree as the head of an extinct



creature. The specimen to which this belonged must have been twenty feet in length. With these Saurians are associated fishes of several genera. The largest prevailing form is the *Pachycormus*. Hugh Miller, in his "Footprints of the Creator," vividly describes the perfectness of some of the specimens disintombed by him, in the Old Red Sandstone, which at one time was considered to have but few organic remains. With them what was once the blood, and muscles, and nerves of the ancient fish, still lie under their bones, sometimes assuming the appearance of thick tar, at others being more indurated, so that it may be used tolerably well as wax for sealing a letter. He says the specimens may have been broken ere they were first covered up, or in being disentangled from their rigid embrace, but that they have caught no harm under its care.

This may be said of the *Pachycormus* of the Upper Lias, and although the specimens retain no traces of animal matter, there does not, in some instances, appear to have been a scale disturbed, and even their fins are extended as if at the moment of their destruction they were in the act of progression. It would seem as though they had been sporting in a tranquil estuary, until by an irruption of muddy water they were suffocated, for in most instances the fish of this genus have perished with their mouths open, as if gasping for the element necessary to their existence.

Perhaps the specimen of most interest amongst these fishes, is one which has been in the hands of several eminent Ichthyologists, who as yet have been unable to determine its affinity to any fossil or existing genus. In clearing it, I at first worked out the upper part of the head, which is remarkably flat, and when only partly uncovered, it looked not unlike a toad. Being unable to ascertain what it was,

I commenced operations on the other side, and I then found it was part of the head of a fish, which I succeeded in completely removing from its matrix, clearing the roof of the mouth, and luckily preserving three or four small teeth in the upper jaw, which appear to have been all it had left when it was covered up. The lower jaw is entirely wanting.

The genus of fishes most abundant is the *Leptolepis*. They are of small size, and the specimens may be seen to vary from an inch to three or four in length. In the whole, I have about 100 of this genus, some of them being new species. One has been described by Sir Philip Egerton, in the Sixth Decade, published by the Geological Society, under the name of *Leptolepis concentricus*. There are also traces of the genera *Pholodophas* and *Dapedium*.

The discovery of the remains of *insects* of several species was noticed by Dr. Buckland, in his Bridgwater Treatise; but it was not then known, or even suspected, that anything like an enlarged and correct data of the entomology of a former world could ever be arrived at. And no wonder. One can account for the enamelled scales and bones of fishes, and the testaceous coverings of other animals being preserved; but how could it be supposed that an organization so delicate as is presented in the forms of some of the insect world, could be preserved through ages, of the duration of which we can form but little conception. Nevertheless such is the case. In the bed containing these fishes and saurians, there are indelibly impressed the remains of insects in great variety. The gaudy dragon fly, the ephemera, with its short day of life, and the minuter creatures whose sportive dances may be noticed in our daily walks, are there. The order *Coleoptera*, with their hard wing cases, too abound,

but the description of Collins in his "Ode to Evening," could not be correctly applied to them. He says :

" Now air is hushed, save  
Where the beetle winds  
His small but sullen horn ;  
As oft he rises 'midst the twilight path,  
Against the *pilgrim*, borne in heedless hum ;"

for these creatures were not seen by mortal eye, nor was their hum music to mortal ear. Upwards of 1000 insects have been obtained by me in this bed, belonging to various orders. So perfect are they in some instances that the nervures of the wings are to be distinctly seen, and some of the *Coleopterous* insects seem to be staring at you, their eyes being at times well defined in the stone. They are found in all stages, from the caterpillar, the larva, to the perfect insect. Contemporaneously with my obtaining these insects, the Rev. Peter Brodie had been employed in the same work in Gloucestershire, which he has recorded in his book on the "Insects of the Secondary Formations;" but those described by him are principally from the Lower Lias, and the Wealden, although he notices their presence in the bed from which I have obtained my series.

Of the order *Crustacea*, animals having hard crusts or coverings, there are remains of various families ; but in a perfect state they are not numerous. They are represented by the lobster, the prawn, and the shrimp. In the beds of clay of the Upper Lias the loose claws of crustaceans are very frequent.

All the specimens I have hitherto mentioned have been found in the thin bed of Yellow Limestone, which may well be designated the *saurian*, *fish*, and *insect bed*. It was no doubt deposited either in an estuary, or near a coast, and



during a time of comparative quiet. There are frequent traces of carbonized wood, and one piece had evidently been floating on the surface of the water before it was covered up, for a colony of Cirripides, to which family our Barnacle belongs, had made it their resting place, and were covered up with it. That the bed has not been subject to any violent action of the sea, may be inferred from the fact that the nodules are not *rolled*—they are generally flatter on their under side, shewing that they have not been moved out of their position. The bed was probably once continuous, but now it is found in fragmentary and detached parts, of greater or less size, the softer parts having given way to the continuous action of the water. Where any organic remains were enclosed, the stone has become more indurated; the nodules are then generally worn down so as to assume the form of the skeletons they cover; from this cause I have in some instances been able to tell the genus of a fish enclosed in one of them, without seeing any part of it. Another reason why it must have been deposited near a coast, would be arrived at from the state in which the insects are preserved; for had they been carried far out to sea, they could not have been in the same condition. Vegetable remains are not uncommon, and now and then a fruit is to be found.

Those of you who are in the habit of frequenting the sea side may know a fish which the fishermen call the Ink Fish. It is the Cuttle fish, and the Cuttle bone may frequently be picked up on the sands of the sea shore. It is related to the Nautilus, but not like it, having an external shell, Providence has provided it with another means of defence, in giving it a bag containing a black fluid, which, when in danger, it discharges, darkening the water in its immediate neighbourhood, and thereby endeavouring to es-

cape its enemies. The Cuttle fish is an ugly looking, and sometimes a formidable creature. It is provided with arms, which are arranged around its mouth, covered with powerful suckers and horny hooks; with these it firmly lays hold of, and endeavours to secure, its prey. In the Indian seas it attains considerable size, and an instance is recorded of its climbing up the side of a boat, and fastening itself upon one of its occupants, who could only be released by cutting off the arms of his formidable antagonist. It is from these the sepia used for painting is prepared. In a nodule I have opened, there is the ink bag of a Cuttle Fish with its ink perfectly preserved, which, with a little trouble, would be ready for use.

In the bed whose contents have so far formed the subject of my paper, there have not yet been found any traces of the *Pterodactyle*, a flying reptile, the remains of which have been found in the Lower Lias, and more frequently in the Oolite and chalk above, nor are there any traces of birds, although during the deposition of the New Red Sandstone, if we may judge by the impressions of footsteps, left in numerous instances when it must have been in the state of a soft mud, they must have abounded. But what is remarkable, none of their bones have ever been found in it. Another important class is wanting; viz: Mammalia, the first remains of which are found in the Stonesfield Slate above. I do not despair that these may some day be found to have their representatives in the Upper Lias.

Leaving this bed of Yellow Limestone, we will shortly consider the organic remains that are to be found in other portions of the series. In the Marlstone, are several species of Ammonites and Nautili, but they are more frequent in the beds of the Upper Lias, where thousands are to be found. One species, and the most abundant, is *Ammonites*

*Walcottii*; and, although so numerous, the species appears to have found its last resting place in these beds, as it has never been found in those of a later age. The class *Brachiopoda*, animals having long extensile arms, to which the *Spirifer* and *Terebratula* belong, are numerously represented.

The state in which some of the *Spirifers* are found, has enabled dissections to be made of their interiors; and an enlarged sketch of the remarkable structure they present, may be seen in the volume of the Palæontographical Society for 1850. Having paid more than ordinary attention to shells of this family, I have been able to add materially to known forms.

Until lately, only fourteen species belonging to the genera *Lingula*, *Orbicula*, *Spirifer*, and *Terebratula*, were published, from all the Lias beds of this country. Three new genera, viz: *Leptæna*, *Thecidea*, and *Crania*, including in the whole nineteen species, have since been figured and described by my friend Mr. Davidson, in the last year's volume of the Palæontographical Society, from my collection, since which I have discovered about ten others, thereby increasing the species in this family, from the Lias from fourteen to forty-three.

The *Leptænæ* were supposed to have become extinct at the termination of the Palæozoic period; but as five or more species existed at the time of the deposition of the Upper Lias, this was not the case, but they have become much degenerated in size, one species, the *Leptæna Bouchardii*, not being much larger than the head of a good sized pin. These shells are found in the beds of clay intervening between the Marlstone and the fish bed. They seem to have been deposited very slowly; and although they are of inconsiderable thickness (in the whole but

twenty-four inches), almost every inch of clay seems to have a shell peculiar to itself, not found higher or lower; the deposition of such a minute part of the earth's crust being the period during which a new species was introduced, again to become extinct. For instance, the *Leptæna Mooreii*, with which is associated *Leptæna Bouchardii*, is found only in the first inch, resting on the Marlstone; the latter passes a little higher, and is then lost. Above these is found a new species, and the smallest known *Spirifer*—*Spirifer Ilminsteriensis*, which has its habitat, if I may so speak, in a higher band of clay. These shells can only be obtained by washing the beds—a process somewhat similar to that pursued by the Australian gold seekers, but unfortunately not so profitable. I mentioned that I had found but one species of shell common to the beds of the Middle and Upper Lias, that was a solitary specimen of *Spirifer rostratus*, which is as yet the *last Spirifer*.

There is a remarkable persistence in the distribution of organic remains, in beds of the same age, over large areas. If a piece of clay were sent to me from however remote a country, and it contained a single specimen of a species of *Leptæna* identical with one in the Upper Lias, the conclusion would at once be arrived at, that the beds were equivalents. Since these *Brachiopods* have been described, they have been sought for on the continent; and I have lately been informed that M. Deslongchamp, an eminent French geologist, has obtained them from beds in the neighbourhood of Caen, in Normandy, but associated with some new forms not yet found here. I have also heard that one of my species of *Thecidea*, a shell not so large as a pea, has been obtained at the Kitzburg, in the Austrian Alps.

In a paper such as the present, it is impossible to notice

in detail all the organic remains such beds yield. The *Echinodermata* enter largely into the composition of some of them. Their spines are innumerable, but I have not been able to obtain more than seven or eight perfect specimens of the shell. This may be partly accounted for when its complicated structure is considered. It is made up of upwards of 2,000 plates; and if the shell was washed about before being covered up, the plates would readily be disjoined and scattered. There are also fragmentary remains of the Star Fish. One of this family has the power of breaking itself to pieces. Professor Forbes mentions how he was taken in by one of them. He had been dredging off the coast, and caught a *Luidia*, which he got into his boat perfect. When about to remove it, to his surprize, he found it had dissolved itself. The next time he went out, he was determined not to be so cheated; he therefore carried a bucket, which, when a *Luidia* came up, he sank to the mouth of the dredge, and gently proceeded to raise the specimen. Whether the cold air was too much for him, or the bucket too terrific, is not known, but in a moment he proceeded to dissolve his corporation, and at every mesh of the dredge his fragments were seen escaping. In despair, he grasped at the largest, and brought up the extremity of an arm, with its terminating eye, the spinous eyelid of which opened and shut, with something exceedingly like a wink of derision.

In the Marlstone, *Sponges* are occasionally found; and two new species of *Corals* have been described, from my collection, by M. Milne Edwards, the Director of the Garden of Plants, at Paris. Not more than two other species have, I believe, been found in the Lias.

From the investigations of scientific men, it is now known that organic life exists in beings so inconceivably small, as



to require the most powerful microscopes for their development; and they have also proved to us that such beings have existed in much earlier times, and that their skeletons have added more to the crust of the earth, than those of animals of a greater size and higher organization. In the tertiary beds, and the chalk, they have for some time been known to abound. So inconceivably minute are some of them, that in an article, which is called Tripoli powder, used by servants for polishing plate, and which is wholly composed of shells of these creatures, as many as forty thousand millions are congregated in the space of a cubic inch; and they form beds of considerable thickness and extent. When those monuments which have so long withstood the levelling hand of time, the Pyramids of Egypt, were erected, they were probably intended as memorials of their designer's glory; but in their erection more than this was done, for they are monuments displaying the wonderful works of Providence. The stone of which they are built is an aggregation of the remains of creatures once endowed with life. It is a limestone, composed of the *Nummulite*, a small shell belonging to the family *Foraminifera*. On the microscopic shells of this class, from the tertiary basin of Vienna, a work has been edited by D'Aubigny, for the Austrian Government. He mentions the occurrence of several species in the Oolites and Lias, and they are also stated to have been found by Mr. Phillips, in the Limestone of Cannington Park, near Bridgwater. If so, this would be the oldest bed in which they have been found. For some years I have been occupied in forming a series from the Lias, and with considerable success. It now consists of many thousands of specimens, amongst which fifty new species have been determined; but their description is a work yet to be done. Owing to their size, this is not to

be effected without some trouble and perseverance. Notwithstanding that all the animals of this class are of a simple kind, and low in the point of organization, nature has been lavish in the eccentricity and beauty of their outer coverings. As it is not probable you can clearly distinguish the forms of the shells themselves, I have prepared some enlarged drawings of a few of the genera, which will shew you how varied and curious are their structures.

I need scarcely tell you, that neither the remains of man, nor his works, are to be found in the beds of which I have been speaking. The fossilized skeleton of a negro is in the British Museum, but this was found in a bed now in course of formation, on the coast of one of the West India islands. In the year 1725 some remains were found, about which a German philosopher wrote a treatise, in which they were described as an antediluvian man, one of the wicked beings who perished at the flood. Unfortunately he overlooked several important facts, that the specimen had no teeth, that there were no ribs, and, worst of all, that attached to the body there was a very long tail. This specimen would have been a very lucky one for the author of the "Vestiges of Creation," who could have argued most learnedly, that, in our higher developement from this period, we had left this important appendage behind us. These remains have since been proved to belong to a Salamander.

The world, then, on which proud man has now his brief resting place, has long been a scene of life, and a manifestation of eternal wisdom and benevolence. The grand object of Providence seems to have been to provide the greatest happiness and enjoyment for His creatures. But why should mortal man be proud? for he only shares, in common with all God's creatures, in His benevolence; and if he refuses an acknowledgement of his Creator's goodness, there

shall still ascend, as there has during the mutations of time, a hymn of gratitude and praise, from universal nature, to His throne.

“ Was ever faltering tongue of man,  
Almighty Father ! silent in Thy praise,  
Thy works themselves would raise a general voice,  
Even in the depths of solitary woods,  
By human foot untrod, proclaim Thy power ;  
And with the choir celestial Thee resound,  
The eternal cause, support, and end of all.”

---