

XXXVI.—*Note on the Dislocation of the Tail at a certain point observable in the Skeleton of many Ichthyosauri.*

By RICHARD OWEN, Esq., F.R.S., F.G.S., Hunterian Professor to the Royal College of Surgeons, London.

PLATE XLII.

[Read March 21st, 1838.]

IF the *Cetacea*, like the *Enaliosauria*, were known only by their fossilized skeletons, it can hardly be doubted but that their conjecturally-restored figures as when entire and alive, would have resembled, so far at least as regards the form of the tail, those which have been published of the *Ichthyosaurus*. It may, I think, be safely affirmed, that the depressed or flattened shape of the small vertebral centres which terminate the gradually tapering tail in the skeleton of the Dolphins and Whales, would never of themselves have suggested the existence, in the recent and entire animal, of so large and important an instrument of locomotion, due entirely to unossified and readily decomposable material, which the actual presence of these fish-like Mammalia in the existing state of things, places beyond the necessity of speculation and conjecture.

The relation, however, which the slight modification of the terminal caudal vertebræ above alluded to bears to the presence of a large, horizontal, ligamentous fin, induced me some time ago to examine such specimens of skeletons of *Ichthyosauri* and *Plesiosauri*, having the tail complete, as were accessible in London, with the view to obtain evidence of the possible existence or trace of a similar structure in these species; but I was then unable to obtain from the imbedded vertebræ satisfactory proof of their exchanging a compressed for a depressed form at this part, or deviating in any way (save in size, number of articular surfaces, and, in the *Plesiosauri*, in the greater excavation of their anterior and posterior surfaces of articulation) from the rest of the vertebræ of the tail. I concluded, therefore, that these air-breathing inhabitants of the ancient deep, partly from being cold-blooded, as the condition of the ossification of their skeleton proves, and therefore slow breathers, and more especially on account of the superaddition of posterior paddles, were devoid of any locomotive organ analogous to the tail-fin of the *Cetacea*; and

that the hinder paddles principally served the purpose, in the absence of such a horizontal terminal fin, in bringing the head to the surface for the purpose of breathing.

Having recently examined many saurian skeletons now in London, the greater part of which have been disencumbered of their earthy shroud by the chisel of Mr. Hawkins, a condition of the tail which, on a former occasion, in a single instance had arrested my attention, but without calling up any theory to account for it, now more forcibly engaged my thoughts, from observing that it was repeated, with scarcely any variation, in five instances. The condition to which I allude is an abrupt bend or dislocation of the tail at about one-third of its whole length distant from the end; generally about the thirtieth caudal vertebra in the *Ichthyosaurus communis*; the terminal portion continuing, after the bend, almost as straight as the portion of the tail preceding it. In short, the appearance presented is precisely that of a stick which has been broken, and with the broken end still left attached, and depending at an open angle.

Now there is no modification of the vertebræ, where this bend takes place in the tail of the *Ichthyosauri* indicative of the tail having possessed, during the lifetime of the animal, greater mobility at this particular point than at any other; and it is scarcely possible to conceive how any force operating on the dead carcase at the bottom of the sea, or when it was imbedded in sedimentary deposits, could produce a fracture or dislocation of the tail at the precise point at which we find it in so many specimens, otherwise very dissimilar in regard to their general position and degree of perfection. I incline to believe, therefore, that the appearance is due to the operation of some force acting upon a ligamentous fin attached to that part of the extremity of the tail which is thus bent down; and that this force operated while the dead animal was floating and buoyed up by the gases generated by putrefaction, and when the ligaments and other connexions of the caudal vertebræ had been so far loosened as to allow the force which previously would have bent down the tail in a general curve like the top of a fishing-rod, to overcome the diminished resistance of the decomposing joints immediately proximal of its point of action, and dislocate the vertebræ at that part. The two portions of the tail, like the rest of the skeleton, would then continue to be held together by the common integument, until the rupture of the parietes of the abdomen would allow the pent-up gas to escape, and the body to sink to the bottom.

In thus descending through a sufficiently tranquil medium, the back being weighted with the heavy vertebral column, would be most likely the first part to touch the bottom; and if this consisted of soft clay or mud, a heavy trunk,

like that of the *Ichthyosaurus*, would immediately subside therein back downwards, while the broken tail, supported by its flat surface, would afterwards be dragged down at an angle with the trunk, and with its extremity directed towards the ventral—now, as when the body floated, the uppermost side of the body: this is, in fact, the position in which the broken part of the tail is generally placed in the fossil skeletons.

The prevailing amount of dislocation which most of the skeletons of the *Ichthyosauri* present, is exactly such as might be conceived to take place in a dead animal body buoyed up sufficiently long to allow of a partial separation of the connecting ligaments and cartilages; the probable toughness of the integuments of the Enaliosaurians would tend to retain the gases generated by putrefaction sufficiently long to enable this extent of decomposition to take place while the animal floated, at least in regard to the ribs and bones of the pectoral and pelvic arches. The bones of the paddles on the contrary, and those of the tail, being connected together by denser ligaments and surrounded by a less proportion of soft animal matter, would be more likely to sink comparatively undisturbed, with the rest of the trunk, when the buoyant gases were ultimately set free.

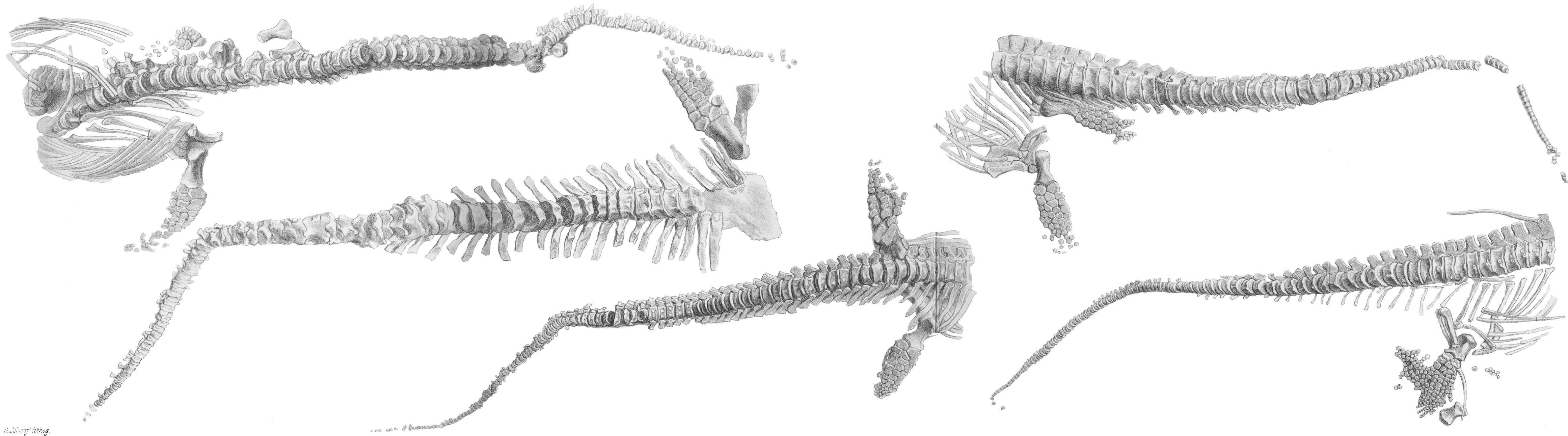
The dead carcasses of the *Ichthyosauri* would of course be subject to such dislocations and separations as the attacks of predatory animals on a floating dead body would produce; but the appearance in the tail of the *Ichthyosaurus* here alluded to, is too uniform and common to be due entirely to an accidental and extrinsic cause. I am therefore disposed to attribute it to an influence connected with some structure of the recent animal; and most probably to the presence of a terminal tegumentary and ligamentous caudal fin, which, either by its weight, or by the force of the waves beating upon its extended surface, or by the action of predatory animals of strength sufficient to tug at without tearing it off, might, under the circumstances already mentioned, give rise to a dislocation of the caudal vertebræ immediately proximal of its attachment. We have evidence, however, in the form of the vertebræ that the supposed fin was not a horizontal one, and I have already observed that the superaddition of posterior paddles in these air-breathing marine animals is the compensation for the absence of such an organ; and, therefore, a tegumentary fin, if developed at the extremity of the tail, would probably be placed in the position best adapted to produce with rapidity those lateral movements of the head most needed in a short-necked predatory aquatic animal.

Since the preceding notes were written and read to the Society, I have had the opportunity of detaching some of the terminal caudal vertebræ of an *Ichthyosaurus communis* from the substance in which they were imbedded;

514 R. OWEN, Esq., *on the Dislocation of the Tail of the Ichthyosauri.*

and have received, through the kindness of Sir Philip Grey Egerton, a separate terminal caudal vertebra of an *Ichthyosaurus* from Lyme Regis, all of which exhibit a compressed form nearly as well marked, in comparison to the vertebræ of the rest of the spine, as is the depressed form in the terminal vertebræ of the *Cetacea*. This structure offers additional and very satisfactory proof of the existence of a caudal tegumentary fin expanded in the vertical direction. Such a fin would be especially useful in the short- and stiff-necked Ichthyosaur; while in the Plesiosaur, where the length and structure of the neck are so favourable for rapid lateral inflections of the head, an instrument like that which produces the corresponding movements in fishes would be unnecessary. Now, it is an interesting fact, that in all those skeletons of Plesiosaurs in which the tail is perfect, it is straight; and there is no indication of the partial fracture or bend in them, which is so common in the tails of the Ichthyosaurs.

March 18th, 1838.



*Disarticulated Tails of Ichthyosaurus*  
p. 511