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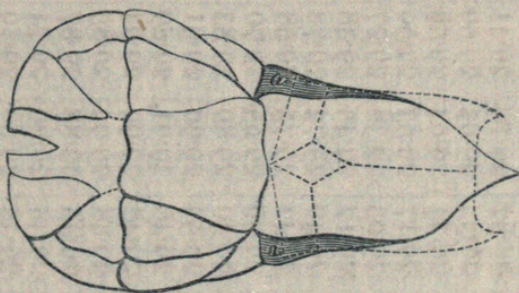
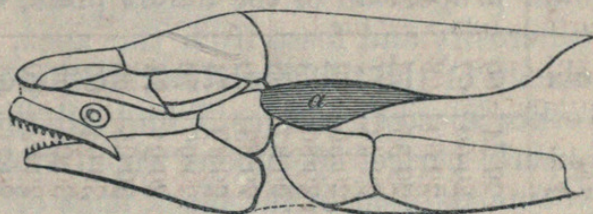
No. 11. NOVEMBER 1848.

XXXII.—On some new *Ichthyolites* from the Scotch-Old Red Sandstone. By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.*

PLACODERMI†.

Coccosteus (Ag.).

IN the *C. latus* (Ag.) I have observed a pair of lateral plates on the anterior part of the dorsal aspect of the carapace, which seem to have escaped the notice of M. Agassiz, and are omitted in his restored figures of the genus, although represented in the small figure given by Mr. H. Miller in his "Old Red Sandstone." Those plates are lengthened and triangular, the base in front parallel with the truncated anterior margin of the great dorsal plate, with which one of the long sides of each is articulated; the apex reaching to about half the length of the dorsal plate, terminating a little in front of the lateral angle on each side; the base being connected with the head and the outer margin with the anterior lateral ventral plate on each side. Those two peculiar plates might be called the "dorso-lateral plates."



Profile and dorsal aspect of the carapace of *Coccosteus* —the shaded plates *a* are the dorso-lateral plates.

* Drawings of all these species were sent to Prof. Phillips at the Meeting of the British Association at Swansea for the inspection of geologists.

† The characters of this group were noted by the author in the 'Annals of Natural History' for July 1848.

I might also remark that the posterior latero-ventral plates, instead of joining precisely in the middle, overlap considerably, that of the left side being in all the species larger externally than that of the right.

Coccosteus pusillus (M'Coy).

Sp. Char. Head and carapace orbicular, width about $2\frac{1}{2}$ inches, length 3 inches ; tail about as long as the head and carapace, of very numerous small, weak (? slightly ossified) apophyses ; dorsal fin small, weak ; dorsal plate subpentagonal, 1 inch and 5 lines long, greatest width (at the lateral angles) 8 lines, tapering to a sharp point retrally, also narrowing about one-sixth towards the subtruncate anterior margin, all the margins concave, the anterior most so, middle of the plate obtusely keeled, the tuberosity and fossa (for lodging the dorsal spine ?) rather more than one-third the length from the posterior apex ; all the plates of the carapace minutely and regularly tuberculated, granules nearly equal, about their own diameter apart, fourteen in the space of a quarter of an inch, intervening spaces very minutely granulated ; teeth slender, cylindrical, pointed, their own diameter apart, one-third of a line in diameter, nearly a line long.

The very small size and imperfect development of the vertebral apophyses, together with the small size and orbicular form of the cephalothorax, easily distinguish this species. The peculiar proportion of the dorsal plate, as well as the distance of its tuberosity and fossa from the apex, and the minuteness and regularity of the tuberculation, distinguish it from the young of the other species ; besides, I find all the characters constant in five nearly perfect specimens which I have examined.

Not uncommon in the black flags of the old red sandstone at Orkney.

(*Col.* University of Cambridge.)

Coccosteus microspondylus (M'Coy).

This species resembles the *C. oblongus* (Ag.) in size and granulation, but has a much shorter dorsal plate, and the posterior external angles of the posterior ventral plates are produced into long curved processes as in the *C. latus* (Ag.), from which it differs in its strong, regular, close granulation ; it differs besides from both species in the plates of the carapace being shorter, and most remarkably in the much smaller size and slight ossification of the vertebræ, giving a peculiarly weak and slender appearance to the tail. The bodies of the vertebræ have all left their separate impressions, so that the vertebral column was certainly not in this case a continuous cartilaginous cord as suggested by M. Agassiz in the case of the *C. latus*, in which they leave no trace. There is evidence of a thick spine, about an inch long, being

attached to the tuberosity of the dorsal plate. The dorsal plate is $2\frac{1}{2}$ inches long and $1\frac{1}{4}$ wide, with straight parallel sides, not being perceptibly narrower in front than at the lateral angles, in which it differs from the *C. pusillus* (M'Coy) as well as in size.

Rare in the black flags of Orkney.

(Col. University of Cambridge.)

Coccosteus? trigonaspis (M'Coy).

Sp. Char. Mesial ventral plate subtrigonal, slightly convex, 13 lines long and 7 lines wide at the lateral angles, which are only 2 lines behind the rounded or very obtusely angular anterior end; lateral posterior margins straight, converging to form the retral point; four or five irregular rows of tubercles, half a line in diameter, and less than their diameter apart, run round the margin, leaving a central, ovate, convex space more obscurely tuberculated; each tubercle consists of a hemispherical smooth centre (frequently perforated in the middle), surrounded by a thickened base which is radiatingly ridged, intervening space irregularly dotted.

This beautiful species is easily distinguished from all others by the shortness of the anterior end of its ventral mesial plate, which is the only part yet known. The tubercles resemble those of a small *Cidaris* or *Asterolepis*.

(Col. University of Cambridge.)

(*Acanthodidæ.*)

Chiracanthus pulverulentus (M'Coy).

Sp. Char. Elongate, fusiform, tapering very gradually from the pectorals, where the depth is little more than one-sixth of the length; tail moderate, lunately forked; the bony ray of the dorsal fin is slightly nearer the anal than the ventral fins, those latter being half-way between the pectorals and anal; the ventral spines are about half the depth of the body at their base, the others are about two-thirds of the depth; scales flat, rhomboidal, but the length and width nearly equal, apparently not imbricated, the posterior, inferior angle tumid, pointed; seven scales occupy a space of two lines; surface dull, covered with an exceedingly minute, crowded granulation (only visible under a strong lens). Length 8 inches.

The squamation of this species is so peculiar that a comparison with its congeners is rendered unnecessary; in general appearance it resembles the *C. Murchisoni* (Ag.). The head is imperfect, but seems rather pointed and about one-sixth of the entire length.

Rare in the old red flags of Orkney.

(Col. University of Cambridge.)

Chiracanthus grandispinus (M'Coy).

Sp. Char. Elongate, fusiform; tail slender, caudal fin large, moderately lobed; bony spines of the anal, ventral and pectoral fins of great size, their length being about three-fourths of the depth of the body at their base; the spine of the anal fin is gently curved backwards, those of the ventrals and pectorals straight; dorsal spine also of great thickness, but its length unknown, situated a little behind the line of the ventrals; scales rhomboidal, length and width nearly equal, about seven in the space of two lines, convex, strongly striated diagonally in the direction of the length of the fish, one of the diagonal grooves generally much deeper than the rest in the middle. Length from base of pectoral fin to extremity of tail nearly 8 inches, depth of body at base of dorsal fin 2 inches; pectoral and ventral spines nearly $1\frac{3}{4}$ inch long and $1\frac{1}{2}$ line wide at base, all apparently smooth.

In the great size and strength of its spines this resembles a great *Diplacanthus* rather than one of the comparatively feebly armed *Chiracanthus*; it however has got no second dorsal opposite the anal fin, and is clearly a peculiar species of the latter genus, from all the species of which the very large spines and strongly striated scales distinguish it. The branchiostegous rays are very numerous, slender and distinctly ossified; the cincture supporting the pectorals is very strong and bony.

Rare in bituminous flags of the old red at Orkney.

(*Col.* University of Cambridge.)

Chiracanthus lateralis (M'Coy).

Sp. Char. Slender, fusiform; dorsal nearly intermediate between the anal and ventral fins, slightly nearer the latter; spines of the ventral and anal fins very small, slightly curved, not more than half the depth of the body at their base, the dorsal spine about one-fifth longer than the others; sides of the body impressed by a strong, straight, lateral line, rather nearer the ventral than the dorsal margin; scales rhomboidal, a little higher than wide, smooth, each with a vertically diagonal, strong, angular mesial gibbosity, about six scales in the space of one line; length of anal spine 7 lines, depth of body at base of dorsal $1\frac{1}{4}$ inch.

I have only seen two tolerably good specimens of this species, which in size and general form both of body and spines resembles closely the *C. pulverulentus* (M'Coy), from which it is distinguished by its smaller and more pointed, vertically gibbous smooth scales, and having slightly smaller spines, and the ventral and anal spines being proportionally further apart, being

about equal to the depth of the body at the ventrals in the former, but exceeding it in the present species. What renders the *C. lateralis* most remarkably distinct from the other species of this and the allied genera, is the presence of a very strongly marked lateral line.

Rather rare in the old red sandstone flags of Orkney.

(Col. University of Cambridge.)

Diplacanthus gibbus (M'Coy).

Sp. Char. Very thick, fusiform, depth of the body behind the pectorals equal to the distance between the two dorsal spines; the dorsal spines are equal, about 1 inch long and 1 line wide, the first dorsal less than the depth of the body at its base; anal spine much shorter than the second dorsal; scales rhomboidal, length and width nearly equal, each with a large, vertically diagonal, oval gibbosity occupying nearly its entire area, about five scales in one line, surface seems very minutely granular. Length about $4\frac{1}{2}$ inches, greatest depth $1\frac{1}{2}$ inch.

This species has more equal-sided scales than the *D. striatus* (Ag.), and is nearly double the proportional depth; the spines are longer and more slender than in the *D. crassispinus* (Ag.), besides the difference in the scales.

Very rare in the old red flags of Orkney.

(Col. University of Cambridge.)

Diplacanthus perarmatus (M'Coy).

Sp. Char. Body thick, short, fusiform; tail very short, nearly square, its width only two-thirds the length of the second dorsal spine, the upper lobe projecting but little beyond the lower; spines smooth, extremely long, first dorsal equal in length to the space between the first and second dorsals, slightly less than the depth of the body at its base, gently curved; posterior spine straighter and about one-eighth longer than the anterior; pectoral spines half the length of the second dorsal; anal spine curved, only two-thirds the length of the second dorsal; ventral, medial and thoracic spines slightly curved and of moderate length; scales slightly higher than wide, nearly flat, minutely granulated (the impressions only seen), about three in the space of one line. Length from the base of the pectoral to the tip of the tail $4\frac{1}{2}$ inches.

This is most allied to the *D. longispinus* (Ag.), but has still longer spines, the second dorsal being especially remarkable; the dorsal spines are much longer in proportion to the distance between them and the depth of the body, the anal spine being on the other hand comparatively shorter; the tail is still smaller and more equal-lobed, and the scales much smaller and with the pro-

portion of length to width reversed ; I am doubtful about their surface, but the impressions seem distinctly though minutely and irregularly granulated.

Rare in the old red sandstone flags of Orkney.
(*Col.* University of Cambridge.)

Chirolepis velox (M'Coy).

Sp. Char. Very slender ; head slightly longer than the greatest depth of the body at the base of the pectorals, but less than one-fifth the entire length of the fish ; body tapering gradually from the head ; tail deeply forked, lobes narrow ; pectorals very large, broadly rounded, height two-thirds the depth of the body at their base ; ventrals nearly equalling the pectorals in length, and two-thirds their height ; there is only one-third of their length interval between those fins ; at the same distance behind the ventral is placed the large triangular anal ; it is larger than the dorsal, which is scarcely one-third of its length posterior to it ; both of those fins exceed in height the depth of the body at their base, and are more than their own length in advance of the caudal ; scales very convex, rhomboidal, diagonally sulcated, four in the space of one line. Length 9 inches. Fulcral scales of tail very slender, from 2 to 3 lines long and about $\frac{1}{3}$ rd of a line wide.

From its slender form, very large fins and forked tail, this would seem to have been one of the swiftest-swimming fishes of the Old Red period, and the above specific name will remind the ichthyologist of those characters. Its lengthened body and small head distinguish it from all of the genus except the *C. uragus* (Ag.), from which it differs in the great size of all the fins, their height in proportion to the depth of the body, the deeply forked tail, and the dorsal and anal fins being so far removed from the caudal. (Described from two beautifully perfect specimens.)

Old red bituminous flags of Orkney.
(*Col.* University of Cambridge.)

Chirolepis curtus (M'Coy).

Sp. Char. Short, fusiform, mouth very oblique ; head very large, nearly one-third the entire length of the fish ; body rapidly tapering from the head to the tail which is very small, and with a shallow concave posterior margin ; fins small, ventrals nearly three times longer than high, reaching to the anus, where the anal begins ; the anal is about twice the height of the ventral fins, and not quite so long, rather less than its own length in advance of the caudal ; the dorsal is slightly less in all directions than the anal, and is about one-third of its length behind it ; scales rhomboidal, four in the space of one line, each with a long, prominent, oval tubercle in the middle,

parallel with the posterior margin (some of those on the tail are diagonally sulcated in the direction of the length of the fish).

In the form and position of its fins this much resembles the *C. Cummingiæ* (Ag.), from which it differs in its larger head, more oblique mouth, smaller tail, and much shorter and more rapidly tapering body and tuberculated scales; by the latter character it approaches the *C. Traillii* (Ag.), from which it differs in the position of its fins, and equally with the *C. Cummingiæ* (Ag.) in the other characters mentioned above. Length $7\frac{1}{2}$ inches, greatest depth of body $1\frac{1}{2}$ inch. Fulcral scales broad, oval, 2 lines long and $\frac{5}{4}$ ths of a line wide.

Rare in the old red sandstone of Lethen Bar.

(Col. University of Cambridge.)

Chirolepis macrocephalus (M'Coy).

Sp. Char. Body thick, fusiform; tail short, abruptly narrowed from behind the anal fin to half the depth of the body at the pectorals; head very large, nearly one-third the entire length; teeth nearly equal, conical, pointed, width of the base two-thirds of the height, their bases nearly in contact; pectoral fins narrow, oval; ventrals nearly central, of moderate size, half their length distant from the anal, which is triangular, its height two-thirds its length, although less than half the depth of the body at its base; the dorsal is only two-thirds the length of the anal, but its height slightly exceeds its length; its anterior extremity is vertically over the middle of the anal fin, the posterior extremity extending slightly behind the extremity of the anal; caudal very large, deeply forked, but the upper lobe twice the length of the lower; fulcral scales very slender, about half an inch long and half a line wide, granulated; scales rhomboidal, four in the space of one line, gibbous, strongly sulcated diagonally except at the posterior angle. Total length 11 inches.

The great proportional size of the head distinguishes this from all its congeners except the *C. curtus* (M'Coy), from which it differs in the form and position of its fins, large tail, and diagonally sulcated scales.

Rare in the old red sandstone of Orkney.

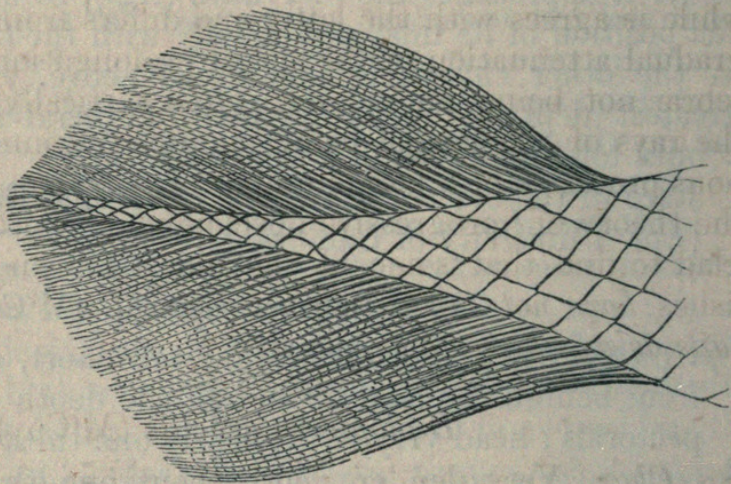
(Col. University of Cambridge.)

(*Saurodipteri*dæ.)

Diplopterus (Ag.).

M. Agassiz has described the species of this genus as having heterocercal tails, and in his 'Monog. des Poissons Foss. du Vieux Grès Rouge' he gives a restored figure of the genus with

a heterocercal tail, the caudal fin large, obliquely subtruncate or slightly concave in the middle of the posterior margin, and confined to the lower side of the spine. I find, from the examination of probably more perfect specimens than were at the disposal of Prof. Agassiz, that the tail of this genus really presents a very different and peculiar structure; so far from being truly heterocercal*, there is almost as great a development of fin-rays above as below the spinal prolongation, the caudal fin having a rhomboidal form, the posterior margin pointed in the middle; the spinal prolongation is much attenuated, reaching nearly to the extremity of the fin; it is not precisely in the middle, but a little



Diphycercal tail (*Diplopterus*).

above it, as in the sketch. This form of tail I find in all the species of *Diplopterus* (Ag.), and also in *Gyroptychius* (M'Coy), and as it is in some measure intermediate in appearance between the "homocercal" and "heterocercal" types, though possessing some structural peculiarities of its own, I would propose to designate it in the descriptions by the term "diphycercal" (from *διφύνης*, *duas habens naturas*, and *κέρκος*, *cauda*). In the "homocercal" or ordinary form of tail of most recent and the newer fossil fishes, we usually find a few of the last vertebræ anchylosed, and from the terminal mass so formed the greater portion of the caudal fin is developed, as much from the upper as from the lower aspect, and only the few short rays at the commencement of the fin being intercalated with the spinous processes of the preceding normally-formed vertebræ; in the "heterocercal" type the vertebræ do not coalesce into a terminal

* Some of the recent examples of heterocercal tails do not present the strongly-marked characters of the older fossil Ganoids; I allude particularly to the sharks, which when the skin is removed show a fringe of fin-rays *above* the spine, although much smaller than the great fins developed from the under side, thus making an approach to our fossil "diphycercal" type; this has been also noticed by Prof. Müller of Berlin, who hence remarks that the heterocercal and homocercal types pass into each other; in the fossils however the distinction is generally speaking a very marked and valuable one, and is scarcely affected by the discovery of the peculiar structure above illustrated, the notice of which will on the other hand remove some erroneous impressions.

mass, but diminish gradually in size to the last, forming a very slender prolongation of the body, inclining upwards, and the rays of the caudal fin being developed from the under side only, and being intercalated with the spinous processes of a great number of vertebræ; the "diphycercal" type agrees with the "homocercal" in the nearly mesial position of the termination of the body, and the nearly equal development of the caudal fin above and below; in those points it differs from the "heterocercal," while it agrees with the latter and differs from the former in the gradual attenuation of the spinal prolongation, the terminal vertebræ not being anchylosed into a vertically dilated mass, and the rays of the caudal being manifestly connected with the spinous processes of a large number of vertebræ. Those who think the theory of 'progressive development' worth refuting may be glad to find that some of the oldest-known *perfect remains* of fishes *have not exclusively heterocercal or "embryonic" types of tails as was hitherto supposed.*

Diplopterus gracilis (M'Coy).

Sp. Char. Very slender, depth about one-eighth of the length, nearly equal from head to tail; head narrow, subtrigonal, obtusely pointed, about one-fourth longer than wide; pectorals placed rather far back, small, narrow, ovate, about three-fourths the depth of the body, their base covered with scales as large as those of the tail, but more square; dorsal and anal fins nearly equal, opposite each other, their own length apart; they are triangular and pointed, their height exceeding their length; tail diphycercal, of moderate size; attenuated prolongation of the body nearly medial, the caudal fin itself being rhomboidal, pointed in the middle retrally; scales rhomboidal, those of the flanks about $2\frac{1}{2}$ lines high and $1\frac{1}{2}$ long, those of the tail smaller, more obliquely rhombic, but still with nearly equal sides; all appear under the lens minutely and closely punctured, the under side with a strong mesial articular ridge extending about two-thirds the length. Total length about 14 inches, head about one-seventh of the length.

Its small head and extremely narrow elongate form easily distinguish it from the other species.

Not uncommon in the old red flags of Orkney.

(*Col.* University of Cambridge.)

Osteolepis brevis (M'Coy).

Sp. Char. Very short, fusiform, length about 5 inches, body broadest at the anterior part, where the width is rather more than one-fourth the length, tapering abruptly to the tail, the pedicle of which is about one-third the depth of the body;

head very obtusely rounded, nearly semicircular, depressed, twice as wide as long, the length being only two-thirds the depth of the body; scales thick, nearly equilateral except on the flanks, where they are one-third higher than long, length of each about one line, surface minutely and uniformly punctured under the lens, the pores rather distant; two anal fins very small, ovate, their own length apart, the second touching the caudal; one large triangular dorsal fin, longer than high, opposite the space between the two anal fins (anterior dorsal not seen).

Easily distinguished from the other *Osteolepi* by its very wide, short figure, and from the great width of the head it is almost always found with the anterior part of the body crushed vertically. The teeth are very small, close and slender.

I have seen five specimens from the old red schists of Caithness and Orkney.

(Col. University of Cambridge.)

Tripterus (M'Coy), n. g.

Gen. Char. General shape of the body and form of the plates of the head and body as in *Osteolepis*, but having only one dorsal fin, which is precisely over the first anal fin.

The fishes of this genus are very much allied to *Osteolepis* in general habit, but instead of having two dorsal alternating with two anal fins, there is but one dorsal, which instead of alternating with or being vertically over the interval between the anal fins (as would be the case in *Osteolepis*, if only one fin was preserved), is *precisely over* the first anal as in *Diplopterus*, which it also greatly resembles, but from which it differs in wanting the second dorsal, and in having a perfectly heterocercal tail—a character which I have ascertained does not exist in *Diplopterus*.

Tripterus Pollexfeni (M'Coy).

Sp. Char. Ovate, gradually tapering from the head, which is broad, depressed, semi-elliptical, obtusely pointed in front, its width at base equal to its length, and being about one-fifth the entire length of the fish; pectoral fins small, broad, ovate, their height about two-thirds the width of the body at their base; tail small, perfectly heterocercal, retral margin very concave, and the upper lobe twice the length of the lower; two anal fins nearly equal, triangular, one-third higher than long, rather more than their own height apart, the second almost touching the caudal fin; dorsal fin narrow, ovate, almost twice as high as long, precisely over the first anal; scales rhomboidal, those of the body flat, about one-third higher than long, those of the tail longitudinally gibbous, lozenge-shaped, and about twice as long as high; under the lens they are all

very minutely and uniformly punctured as in *Osteolepis* and *Diplopterus*. Total length about 7 inches, greatest width of body $1\frac{1}{4}$ inch, length of body scales $1\frac{1}{2}$ line.

So completely identical are the plates of the head of this fish with those of the *large imperfect* example figured by Agassiz (Pois. Foss. vol. ii. pl. 2 b, fig. 2), that I cannot help suspecting that that figure may represent a portion of a fish of the present species, the imperfection of the retral part of the body having perhaps permitted M. Agassiz to refer it to the *Osteolepis macrolepidotus*, although even without seeing the fins we might distinguish it by its wide, rapidly tapering figure from that species, which is correctly represented by the fig. 1 of the same plate so far as it goes. The teeth are minute, slender, conical, rather distant, apparently in several rows, and of irregularly unequal size. I have examined three perfect specimens of this species presented to the University collection at Cambridge by the Rev. W. Pollexfen, by whom nearly all the Orkney fishes here noticed were collected, and whose zeal I am happy to commemorate by dedicating this to him.

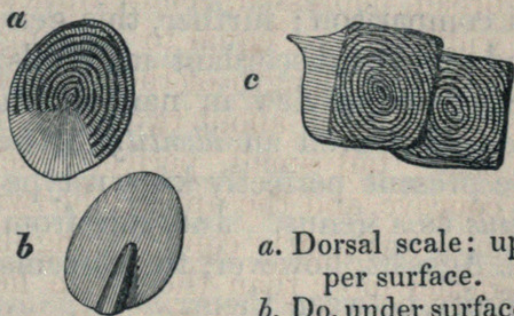
Not uncommon in the flags of the old red sandstone at Orkney.
(Col. University of Cambridge.)

(CÆLACANTHI.)

Gyroptychius (M'Coy), n. g.

Gen. Char. Slender elongate ganoid fishes, with large semi-oval depressed heads, from which the body gradually tapers to the tail, which is diphyccercal, the caudal fin being rhomboidal, pointed in the middle of the retral margin, and the prolongation of the body extending a little above the medial line nearly to the end; two small elliptical dorsal fins exactly opposite two similar anal fins; pectoral fins broad, rounded, placed rather far back; scales subrhomboidal on the flanks, nearly oval on the back, imbricated, the exposed portion of each with minute rough ridges which converge towards the retral end, seeming to gyrate round a nearly central point; the anterior concealed portion nearly smooth (or under a strong lens minutely radiated as

Scales of *Gyroptychius* $\times$ two diameters.



a. Dorsal scale: upper surface.
b. Do. under surface.
c. Lateral scales.

in *Holoptychius*); under surface of each scale nearly smooth, with a strong mesial keel which extends from the anteal edge

only as far as the central point, where it abruptly terminates to allow of the imbrication of the remainder of the scale on the next behind; bones of the head covered with granules which are sometimes confluent into short ridges; teeth small, conical, nearly equal.

In form, number and position of the fins and structure of the tail these fishes resemble *Diplopterus*, while the imbrication of the scales, as well as their sculptured, instead of simply porous surface, places them close to *Holoptychius*, and in a different family of Agassiz's system from the former; while from the latter they differ in form and number and position of the fins, structure of the tail, and in the ridge on the under side of the scales, which reminds us of what we see in *Osteolepis* and many other fishes with juxtaposed scales, but instead of extending entirely across the scale, it only reaches half-way, the half-ridge of one scale joining that of the next behind and before when in their natural imbricated position. The *Gyroptychii* are thus intermediate between *Holoptychius* and *Diplopterus*, and serve to connect the great groups of Coelacanth and Sauroid fishes to which those genera respectively belong, having at the same time a style of sculpturing of the scales peculiar to themselves and easily recognizable. There are two imperfectly known and imperfectly characterized genera of M. Agassiz, *Glyptopomus* and *Platygnathus*, which require a few words in connexion with the present fishes. The first of those genera is founded on a short, thick, fusiform sauroid fish, with simply juxtaposed, rhomboidal, granulated scales; the fins being nearly unknown. The slender form, and the shape, sculpturing and imbrication of the scales are sufficient distinctions, the fins being unknown. *Platygnathus* is a genus founded by Agassiz on the jaw of one fish and the tail of another; the jaw agrees nearly with *Bothriolepis*, but has fewer laniary teeth and needs no comparison with *Gyroptychius*; the tail portion is more analogous, but the great scales seem to have simply the structure of *Holoptychius*, and the fins are developed beyond all comparison; further, this genus is founded on such imperfect and perhaps discordant materials, and the jaw seeming to have been most in view in naming and defining the genus, it is obvious that even an *identity* between *one* of those elements and the present perfectly known type would not invalidate *Gyroptychius* as a genus. Judging from the figure and description of M. Agassiz, however, there seems, as above noted, to be no great affinity between them.

Gyroptychius angustus (M'Coy).

Sp. Char. Head semi-oval, obtusely pointed, about one-sixth the entire length; depth of the body greatest immediately be-

hind the head, where it is one-seventh of the length, tapering very gradually from thence to the tail, the pedicle of which is about one-third the greatest depth of the body; caudal fin large, rhomboidal, obtusely pointed behind, lower side largest, the supramedial spinal prolongation extending nearly to the end; posterior anal fin semi-elliptical, equalling the depth of the body at its base in height, which is about double the length; both the posterior anal and dorsal fins nearly touch the caudal, and are fully their own height behind the anterior and dorsal fins, which are about one-third less in size; the pectoral fins are broad ovate, scarcely two-thirds the depth of the body at their base in height, and placed nearly their own height behind the head; scales about 2 lines high (or wide) and about one-third longer, elliptical and with a small, nearly central boss, round which seem to gyrate very numerous minute rough ridges, less than their own diameter apart, which are arranged in converging curved lines parallel with the margin of the elliptical free end of the scale; the small portion of the ridges anterior to the central boss are frequently broken into little tubercles; the more anterior concealed portion is smooth or very minutely radiated, the (? articular) ridge on the under side strongly marked; bones of the head closely sculptured with small granules and short vermicular ridges. Length nearly 1 foot; length of exposed portion of scales slightly more than 2 lines.

This beautiful fossil much resembles the *Diplopterus gracilis* (M'Coy) in form, but is at once distinguished by the structure and sculpturing of the scales.

Rare in the old red sandstone of Orkney.

(Col. University of Cambridge—two fine examples.)

Gyroptychius Diplopteroides (M'Coy).

Sp. Char. Head semi-elliptical, depressed, sides flattened, slightly longer than wide, pointed in front, about one-fifth of the entire length; body tapering rapidly from the head to the tail, the pedicle of which is less than half the width of the body; caudal fin rather large, rhomboidal, submedial spinal prolongation slender; posterior dorsal elliptical, twice as high as long, close to the base of the caudal, and reaching about half the length of its lateral angle; anterior dorsal little more than half the size of the posterior; pectorals short, broadly rounded, placed rather more than their own length behind the head; scales of the back oval, imbricated; concealed portion, anterior to the subcentral point, smooth or very minutely radiato-punctate, all the posterior or exposed portion rough with small, irregular, minutely flexuous ridges, those of each side running

parallel with the curved margin of the scale, and of course converging towards the middle, they are crossed by fine radiating striæ; scales of the sides rhomboidal, nearly square and juxtaposed, each scale articulated to the preceding and superior one by a narrow smooth border on the superior and anterior sides, extending into an angular articulating process at the anterior superior angle (as in *Osteolepis*, &c.); the quadrate exposed portion has a small central point, round which the little rough ridges gyrate diagonally; bones of the head sculptured with small vermicular ridges and granules.

Length about 11 inches, greatest width of body 2 inches; length of exposed portion of scales about 2 lines.

The different shape of the scales, and the wide, short, rapidly tapering figure easily distinguish this from the last.

Not uncommon in the old red schists of Orkney.

(Col. University of Cambridge.)

Holoptychius (Ag.).

Although so large a number of species of this genus are now published, I believe the form of the tail, and number and position of the vertical fins remain unknown. I have recently ascertained that the tail is short and perfectly heterocercal, and that one dorsal and one anal fin, nearly equal, but the dorsal largest, exist close to the caudal fin, and opposite each other; the ventrals are broad, placed behind the middle of the fish near the anal fin.

Holoptychius princeps (M'Coy).

Sp. Char. Scales subquadrate, slightly convex, each about 3 inches wide and $2\frac{1}{2}$ inches long; anterior concealed margin widest, convex; posterior, exposed portion about one-third narrower, subtruncate rounded, sides slightly concave; whole of the exposed surface closely covered with irregular tubercles about half a line in diameter and half their diameter apart; most of the tubercles are a little elongated, but in irregular directions, and towards the anterior margin a few of them are generally confluent at their bases, forming short, irregularly twisted, strongly tuberculated ridges; concealed anterior portion and interval between the tubercles minutely porous.

This species far exceeds the *H. nobilissimus* (Ag.) or *H. giganteus* (Ag.) in size; it is easily distinguished by its entirely tuberculated surface. A fragment of this species is well figured (without a name) in Murchison's 'Silurian System,' pl. 2 bis, fig. 3.

Old red conglomerate of Scat Craig.

(Col. University of Cambridge.)

Holoptychius Sedgwickii (M'Coy).

Sp. Char. Body fusiform, very thick, depth in the middle one-third of the length, abruptly narrowed towards the tail, the pedicle of which at the base of the anal and dorsal fins is scarcely half the depth of the body; head more than one-fourth of the length; tail very short, nearly square, the thick, articulated, frequently branched rays developed from the under side, forming a broad triangular caudal fin, obliquely truncated on its posterior margin; dorsal rather larger than the opposite anal fin, both semi-elliptical, twice as high as long; the anal about one-third the length of the base in advance of the caudal; ventral fins broad, their length about equalling their height, rather more than the length of their bases in advance of the anal fin; lateral line nearly medial, strongly marked: scales thin, rounded, those of the flanks half an inch in diameter, subtrigonal, posterior margin semicircular, concealed anterior margin very broad, subtruncate, with very minute radiating punctate striæ; immediately in front of this a small space towards the middle of the scale is covered with a distinct granulation (frequently but not always seen when the scales are *in situ*); all posterior to this, or the constantly exposed portion covered with a minute, longitudinal, irregularly flexuous, striate punctation, intermixed with numerous sharp, narrow, irregularly interrupted, longitudinal thread-like ridges, of very irregular number and length, but usually two or three times their diameter apart; the exposed part of the scales of the flanks, when *in situ*, is about one-third higher than long. Teeth conical, one-third longer than wide, half the diameter of their bases apart.

Length 11 inches, depth nearly 4 inches; length of teeth $\frac{3}{4}$ of a line.

This species, like the *H. Flemingii* (Ag.), is remarkable for being found on its side, indicating apparently a compressed, instead of a depressed form; it also resembles that species in the sculpturing of the scales, but has them (in the same parts of the body) smaller, more rounded, and the exposed portion much less high in proportion to their length.

Not uncommon in the old red sandstone flags of Orkney.

(Col. University of Cambridge.)

Conchodus (M'Coy), n. g.

Gen. Char. (Teeth in pairs in each jaw as in *Ceratodus* ?); each tooth large, somewhat semicircular, pointed in front, subtruncate behind, deeply concave on the grinding surface; internal margin straight, thickened, and with an abruptly

deflected edge; external border convex, much raised and strongly undulato-plicate, the ridges being largest in front, and gradually diminishing towards the external and posterior portion of the tooth; the plicæ are produced by a thickening of the substance of the ridges and a scooping-out of the intervening hollows, so that the under side of the tooth remains even; under surface coarsely osseous; upper surface polished, with small obscure undulations and minutely porous.

This genus is closely allied to *Ceratodus* and *Ctenodus*, but differs in the grinding surface being concave, the tooth resembling the inside of a plicated oyster. The internal microscopic structure was developed for me by the kindness and skilful manipulation of my friend Mr. Anthony of Caius College, Cambridge; it was very complex and peculiar, but the prepared fragment has unfortunately been mislaid, so that I am unable now fully to describe it. I only know one species, the following.

Conchodus ostreaformis (M'Coy).

About $1\frac{1}{2}$ inch long, 1 inch wide, and $1\frac{1}{2}$ line thick, the grinding surface deeply concave, the surface of attachment equally convex; the external semicircular margin gives origin to six or seven coarse, rugged, converging ridges, the most anterior about 7 lines long and slightly inclined to the straight inner margin, the most posterior is about 2 lines long and at right angles with the inner margin; the ridges are separated by deep, wide hollows.

Found along with *Dendrodus latus* (Ow.), *Holop. giganteus* (Ag.), and *Hol. princeps* (M'Coy), in the old red conglomerate of Scat Craig.

(Col. University of Cambridge.)

XXXIII.—On an apparently undescribed state of the Palmellæ; with a few observations on Gemmation in the lower tribes of Plants. By G. H. K. THWAITES, Lecturer on Botany and Vegetable Physiology in the Bristol Medical School.

[With a Plate.]

THE importance—the necessity, it may be said,—of an acquaintance with the lower forms of the vegetable kingdom, in order to afford a clear insight into the real character of the phænomena of growth and reproduction in the higher tribes of plants, is now pretty generally felt and acknowledged by physiologists. From the study of the simpler organisms only can we hope to obtain a correct understanding of the changes which take place



McCoy, Frederick. 1848. "XXXII.—On some new ichthyolites from the Scotch Old Red Sandstone." *The Annals and magazine of natural history; zoology, botany, and geology* 2, 297–312. <https://doi.org/10.1080/03745485809494718>.

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