ORDINARY MEETING.

FRIDAY, MAY 7TH, 1886.

W. TOPLEY, Esq., F.G.S., Assoc.Inst.C.E., President, in the Chair.

The donations to the Library since the previous meeting were announced, and the thanks of the Association accorded to the various donors.

The following were elected Members of the Association :—H. B. Armstrong, F.G.S.; E. F. Bates; Colin Docwra, F.G.S.; A. M. Dunlop; Miss Ewart; Spencer Galloway; W. H. Hill; S. S. Naylor; S. Rideal, B.Sc., F.G.S., F.C.S.; T. Roberts, B.A., F.G.S.; and J. D. Stokes.

The following papers were then read :—

‘On some Trilobites from the Skiddaw Slates,’ by J. POSTLETHWAITE and J. G. GOODCHILD.

‘Observations upon the Stratigraphical Relation of the Skiddaw Slates,’ by J. G. GOODCHILD.

The authors exhibited the specimens described in the first paper, and Mr. J. Logan Lobley exhibited and remarked on some specimens of volcanic ejectamenta from Vesuvius.

ON SOME TRILOBITES FROM THE SKIDDAW SLATES.

By J. POSTLETHWAITE, F.G.S., and J. G. GOODCHILD, H.M. Geol. Survey, F.G.S., F.Z.S.

A few words first in regard to the history of the present communication. Up to the time of the publication of Clifton Ward's Memoir on the Northern Part of the Lake District the fauna of the Skiddaw Slates, as then made known, included, amongst other fossils, trilobites identified as *Phacops nicholsoni*, *Agnostus morei*, two or more species of *Æglina*, *Ogygia selwyni*, *Trinucleus gibbsii*, *Niobe docteri*, *Cybele ovata*, a form referred with doubt to *Asaphus*, and one or two others that did not admit of satisfactory determination. The discovery of these fossils was mainly due to the researches of Messrs. Harkness, Nicholson, Wyatt-Edgell, and W. Kinsey Dover. Other collectors had, of course, been at work, and the publication of the Geological Survey memoirs, maps, and sec-

tions has done much to extend the interest felt in the fossils of this ancient group of rocks, and has led several other enthusiastic workers resident in or around Keswick to search these rocks for fossils more diligently than ever. Amongst the results brought to light in consequence are several specimens of trilobites, which, quite as much as those found at earlier dates, present many points of considerable interest, both in their palæontological aspect and in regard to the new light they throw upon the stratigraphical position of the old sediments whence they were derived. For some time past these fossils have been carefully studied by Mr. Postlethwaite, and in 1885, after many consultations with several fellow-workers in the same field of research, he drew up descriptions of the principal characters presented by these new trilobites, and read a paper on the subject at the annual meeting of the Cumberland and Westmoreland Association held at Ambleside in that year. After the paper was written the whole of the fossils described by Mr. Postlethwaite were confided to my care, to enable me to make some large diagrams in illustration of the paper. With the permission of the several owners of the fossils, and with Mr. Postlethwaite's concurrence, these trilobites were shown to several well-known palæontologists, who one and all agreed with us in regarding these fossils as new or undescribed forms. To illustrate Mr. Postlethwaite's paper * I volunteered to draw the four lithographic plates accompanying this ; and, in making the minute examination of these obscure and fragmentary fossils absolutely necessary for their correct delineation, it has not been difficult, with well-stored museums and libraries close at hand, to form independently some definite opinions regarding the affinities of the fossils themselves. After the fossils were lithographed I suggested to Mr. Postlethwaite that we should reconsider the subject together, and lay a joint paper before the Geologists' Association. This was agreed to. All the Skiddaw Slate trilobites we could lay hands upon were got together and passed under notice, and the results, such as they are, are given in the following pages.

FIG. 1.—This represents the impression of a large trilobite from "Skiddaw" lent from the collection of W. Kinsey Dover. It has been redrawn from the original, because the figure on Plate xii. of Mr. Ward's memoir does not show some of the points observable

* Published in No. x. of the 'Transactions of the Cumberland and Westmoreland Association,' and now in the library of the Geologists' Association.

upon the specimen itself. The remarkably convex axis and the short, falcate pleuræ are noticeable. These, combined with the general form of the whole fossil, have suggested affinities with *Paradoxides*. But in the case of fossils coming from strata known to have been affected by so many disturbing forces, the effects of distortion, perhaps in more directions than one or two, have to be taken into account, and duly allowed for, in any description. There are traces of eleven body segments, but the lower four may possibly belong to the pygidium, and if that is the case, there are seven, and not eight, thoracic segments. Mr. Etheridge has described this fossil in detail in Mr. Ward's memoir, and has referred it with much doubt to *Asaphus*. Dr. Woodward, who courteously devoted much time to an examination of the whole of the fossils here described, was much struck with its resemblance to *Paradoxides*, as indeed have been most that have seen it. Dr. Hicks thinks it may be an Asaphid allied to *Niobe*, and it certainly does bear much resemblance to *Niobe menapiensis*, Hicks, figured in 'Quart. Journ. Geol. Soc.' xxix, Pl. iv, Fig. 1-9.* Professor Hughes thought it was related to *Anopolenus*. Under these circumstances it is perhaps advisable not to venture to give the fossil any name at all until better and more complete material shall be forthcoming. (J. G. G.)

FIG. 2 (*Phacops nicholsoni*, Salter).—The upper and the lower figure represent different parts of the same fossil, separated on the original specimen. These are redrawn from the original specimen described by Salter. This is from Whiteside, and was obtained by Harkness, and is now, with the rest of his collection, located in the Carlisle Museum. In the original figure ('Q. J. G. S.' xix, p. 486) one or two features visible upon this specimen were omitted, and, on the other hand, some other features in Salter's figure had been worked in from the specimens described next below.

It is noteworthy that the present form was obtained from beds near the very base of the subdivision of the Skiddaw Slates that Ward referred to the Tremadoc. The resemblance between this *Phacops* and the *Phacops llanvirnensis* of Dr. Hicks is striking and significant. Under any circumstances these two forms of *Phacops* represent the oldest known members of the genus. The occurrence

* I almost venture to think that the No. 1 of this paper and Dr. Hicks' *Niobe menapiensis* are different species of an undescribed genus—possibly an annectant genus between the Olenids and the Asaphids. (J. G. G.)

of such highly-organized trilobites in beds so low down in the series, and associated with fossils of so ancient a type, is a point of considerable interest to geologists. (J. G. G.)

FIGS. 3 and 4 represent portions of trilobites from "Skiddaw" collected by the late Wyatt-Edgell, and now in the Museum of Practical Geology. They were regarded by Salter as the same species as the last. It is much to be regretted that the precise lodgment of this fossil was not recorded. (J. G. G.)

FIG. 5.—A much-weathered and obscure fragment of a trilobite obtained by Harkness from Highside, Bassenthwaite. At first I was disposed to regard this as part of the thorax of a species of *Homalonotus* like *H. bisulcatus*; but Dr. Woodward at once pointed out its resemblance to the distorted pleuræ of some of the larger Asaphids. The original is in the Carlisle Museum. (J. G. G.)

FIG. 6.—This specimen has all the characters of an *Æglina*, but is too obscure to admit of specific identification. It is from Randel Crag, and is from the cabinet of W. Kinsey Dover.

FIG. 7 is redrawn from the specimen of *Agnostus morei*, Salter, figured in 'Q. J. G. S.' xix, p. 486. The species is also figured and described in 'Decades Geol. Surv.' xi, p. 7, Pl. 1, Fig. 13, (1864), from other specimens obtained in the shales west of the Stiperstones. Our specimen was obtained from Ellergill, Milburn, by the late Professor Harkness. Several other specimens have been obtained from this same locality by Professor H. A. Nicholson. The resemblance of this fossil to the *Agnostus perrugatus* of Barrande ('Trilobites of Bohemia,' Vol. I, Supt., Pl. xiv, Fig. 14-16) is very marked, and may amount to specific identity. Barrande's Fossil is from his Etage D. Ours is unquestionably from beds low down in the series, but at what depth below recognizable Bala horizons can never be determined, as the beds where the fossils were got are in the midst of a great area of disturbance connected with the Pennine Faults, and neither their base nor their top is seen. (J. G. G.)

FIG. 8 belongs to the same genus, and is from the same locality as the last. It was regarded by both Mr. Salter and Professor Harkness as the same species as the last. The specimen is in the Carlisle Museum, and might be worth a closer examination and further comparison by anyone thoroughly conversant with the range of variation of form in the species of this genus. (J. G. G.)

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FIG. 9.—This specimen consists of an incomplete impression of the thorax and pygidium of a very peculiar species: the three lobes are of equal size, and each tapers rapidly to a point. The edge of one lobe is broken off, but when complete the entire width at the front margin would be about six-tenths, and the length only four-tenths, of an inch. Each lobe is well-rounded, and would probably have eight segments—the number cannot be clearly determined, as they are filled up at the caudal extremity. There is no trace of the head. If trilobites cast their shells at certain periods, like crabs, this specimen may represent the dorsal portion of a cast-off shell.

Locality—Outerside, on the north-east of Causey Pike. From Mr. Dover's cabinet. (J. P.)

The figure on the plate is taken from a reverse, or counterpart, of the fossil described, which was presented to the Carlisle Museum by Mr. Dover. This specimen was incomplete; hence any discrepancy between the figure and the description.

This fossil presents a certain amount of resemblance to *Calymene brevicapitata*. It is not unlike some forms of *Neseuretus*, but is too imperfect to admit of any determination of value. (J. G. G.)

FIG. 10.—This is the largest trilobite that has been found in the Skiddaw Slate formation, but unfortunately it is in a very imperfect state; the pygidium, right pleuræ, and a part of the cephalic shield are broken off. When complete, it would be at least nine inches in length and five inches in width. The general surface of the body is faintly rounded, the cephalic shield almost semi-circular in shape, the glabella large, and apparently devoid of ornament, except a faintly-arched furrow at the base, and the axial furrows curve boldly outwards from the base to the margin of the cephalic shield. The right cheek has disappeared, but the left fixed cheek is clearly defined: it is about one-fourth the size of the glabella, and in form resembles a gothic arch; the outer posterior angle being prolonged in the form of a small spine. The axis is about one-third wider than the pleuræ, and tapers gently towards the pygidium; there are seven well-defined thoracic segments, and it is probable that the number may have been eight: they are faintly arched, and the ends adjoining the axial furrows are well-rounded. The front segments measure nearly half an inch in width, but they are a little narrower towards the pygidium. The

segments of the pleuræ correspond with those on the axis, and maintain the same curve; they are also well-rounded at the end adjoining the axial furrow, but are obtusely pointed at the outer end.

Locality—Randel Crag. From my own cabinet. (J. P.)

Nearly all the palæontologists that have seen the specimen above described agree in regarding it as an Asaphid, with more or less superficial resemblance to some forms of *Paradoxides*. The remarkably-wide glabella at once distinguishes it from any Asaphid yet described, and seems to warrant us in referring it, at least provisionally, to a new genus, which we propose to name *Eurymetopus*, in allusion to the distinguishing feature referred to. We are at present disposed to regard it as belonging to an aberrant genus of the Asaphidæ. The materials for a complete description of the genus are, however, at present much too scanty, and we are content to await the discovery of specimens in a better state of preservation before formulating any further description of the group. We propose to name it *Eurymetopus cumbrianus*, P. & G.

FIG. 21.—General form oblong, tapering a little towards the tail: a small portion of the front margin of the cephalic shield is wanting. When complete, the length would be about three inches and eight-tenths, and the width two inches and three-tenths. The glabella is slightly convex and very large, occupying about three-fourths of the cephalic shield, and the axial furrows curve outwards in front of the cheeks, which are small and almost triangular in shape. The eyes are indistinct, but appear to be placed near the glabella, about three-tenths of an inch from the posterior margin of the cheeks. The axis is large, and tapers rapidly towards the caudal extremity, the front portion being nearly double the width of the pleuræ. There are eight thoracic segments on the axis, they are well-rounded and quite straight near the head, but faintly arched near the pygidium: on the pleuræ they droop backwards, and the evenly-rounded surface gives place to a deep furrow. The pygidium consists of a large oval shield along the posterior margin of which there is a broad depressed band; the remainder of the surface is slightly gibbous, but perfectly smooth, except where the raised axis crosses it to the margin of the depressed band.

Locality—This beautiful and well-preserved specimen was found by Mr. Harrison at Randel Crag. (J. P.)

This, one of the best preserved trilobites yet obtained from the Skiddaw Slates, will be seen, on comparison with *Eurymetopus cumbrianus* (Fig. 10), to possess many characters in common with that form. It is, however, a much smaller form; and as it seems clearly distinguished by some other characters, notably by the form of the inner ends of the pleuræ, we regard it as a distinct species, and propose to name it *Eurymetopus harrisoni*, after Mr. Harrison, of Keswick, who has worked so hard to advance our knowledge of the fauna of the Skiddaw Slates. The peculiar tooth-like projection on the posterior margin of the fixed cheek in *E. cumbrianus* is noticeable, and whereas no trace of any repetition of this ornament can be detected on the pleuræ in this species, in *E. harrisoni* it forms a well-marked and conspicuous feature on each of the eight pleuræ on each side. On our figure, no traces are shown of any of the decussating wrinkles so commonly seen on many of the Asaphids. Dr. Hicks at once detected these on the original specimen, and called our attention thereto. We consider that it will be better to await the discovery of additional individuals before venturing upon a full description of the genus.

FIG. 11.—A small and very obscure impression of a trilobite from Buzzard Crag, on the north-west side of Skiddaw, in the collection of W. Kinsey Dover.

There seems to be much doubt as to what this trilobite really is. Mr. Postlethwaite thought it might be a crushed *Æglina*. It seems to me just possible that it may be some form of *Remopleurides*; but nothing certain can be made out of it. (J. G. G.)

FIG. 12 is redrawn from the original specimen of Fig. 3, Pl. xii, of Mr. Ward's memoir above mentioned. Mr. Etheridge identified it as an *Æglina*, but he cautiously refrained from any opinion as to what species it was to be referred to. In the plate just referred to it is accidentally misprinted *Niobe doveri*. It is from Great Knot, Randel Crag. Kinsey Dover collection. (J. G. G.)

FIG. 13.—Redrawn from the original specimen of *Niobe doveri*, Etheridge, described in Ward's memoir, Pl. xii, Fig. 2. In the original figure drawn by the late talented palæontological artist Mr. C. R. Bone, just before the illness that terminated in his death, two or three features of minor importance were omitted. One of these is the spine-like processes from the genal angle of the head, which appear to me to be visible in the original. Another is the curiously inflexed inner border of the fascia on the pygidium.

The fossil is much distorted, and it is this reason that explains why, at first sight, there seem to be only five body-rings; there may be six, or even more, for the head, as Dr. Hicks noticed, is evidently thrust backward over the thorax, and may thus cover the remaining segments. I venture to express a doubt as to whether my friend and former colleague, Mr. Etheridge, was right in referring this form to *Niobe* at all. In some respects it reminds one of *Psilocephalus*; but *Psilocephalus* has an ungrooved tail without any border, and in other respects this fossil appears to be as far removed from that genus as it is from any known species of *Niobe*. We must wait until better specimens are brought to light before expressing any definite opinion upon its exact affinities.

This specimen is from the screes below Randel Crag. W. Kinsey Dover collection. (J. G. G.)

FIG. 14.—General form oblong, tapering slightly towards the head: length fourteen-twentieths, and width eleven-twentieths, of an inch. The axis is well-rounded, and is about one-third wider than the pleuræ: it maintains its width from the anterior margin of the part preserved to the fourth segment, and then tapers rapidly to the extremity, which is about one-twentieth of an inch from the margin of the caudal shield: at that point its width is one-tenth of an inch. There are five thoracic segments exposed and five on the pygidium. The thoracic segments of the pleuræ are very clearly defined: they spread outwards horizontally from the deep axial furrow, but curve backwards at the outer extremity. The caudal shield is large and semi-circular. The pleural segments of the pygidium, as well as those on the caudal portion of the axis, are fainter than the thoracic segments: the first three of the former extend to the margin of the pygidium, but the remainder of the caudal shield terminates posteriorly in a broad fascia of equal width all round.

Locality—This specimen was found, I believe, by Mr. Ward, placed on a large stone at the roadside, beneath White Pike. It is imbedded in a fragment of the hard Skiddaw Slate grit which occurs near that place. It now belongs to the Keswick Museum. (J. P.)

This specimen presents some resemblance to certain forms of *Barrandeia*, and as this view of its affinities has been independently adopted by Mr. Etheridge as well as by other palæontologists of

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almost equal authority in such matters, it may be provisionally referred to that genus. The curiously-hooked, falcate form of the pleuræ will serve to distinguish it at once from any species of that, or any allied, genus that has yet been described, and we therefore propose to name it, provisionally, *Barrandeia falcata*; the specific name having reference to the form of the pleuræ.

FIG. 15 represents a species of *Æglina*, from "Skiddaw," preserved in the Museum of Practical Geology, as part of the Wyatt-Edgell collection.

In some respects the size, the general form, and the proportion on this fossil remind one of *Æglina rediviva*, Barr. 'Tril. Boh.,' Vol. I, Supt., Pl. 14, Figs. 9-11. But the imperfect state of preservation of our fossil forbids more than a conjecture as to their identity. (J. G. G.)

FIG. 16.—This is a very beautiful and almost perfect specimen. The head is nearly half the entire length of the body, well-rounded in front, but a little narrower than the truncated pygidium: length two inches and a tenth, width an inch and three-tenths. Glabella large and balloon-like in shape. The eyes appear to occupy the greater part of the cheeks, which are not more than one-eighth the size of the glabella. The front portion of the axis is about three times the width of the first segments of the pleuræ, it then tapers with a rapid curve nearly to the posterior margin of the caudal shield, where it is considerably less than half the width of the opposite end. There are six thoracic segments: the first two are straight, but the remaining four are slightly arched. The posterior segments of the pleuræ are almost double the length of the front segments: all of them curve gently backwards. The caudal shield is an elongated oval, along the posterior margin of which there is a raised rounded band.

Locality—Outerside. From Mr. Harrison's cabinet.

The matrix in which it is imbedded is the light grey indurated Skiddaw Slate which occurs at that place. If the slate had been of the ordinary type the fossil would have disappeared long ago, as the rock to which it was attached projected about eighteen inches from the ground, and the fossil being on the upper surface must have been subjected to the abrading action of the weather for a great length of time. I was in company with Mr. Harrison when he found it, and had the pleasure of chiselling it from the rock. (J. P.)

There can be no doubt about this being an *Æglina*; the only question is, to what species is it to be referred. Amongst the Arenig fossils described by Dr. Hicks and figured in 'Q. J. G. S.,' xxxi, Pl. x, Fig. 3, from Llanvirn Quarry, is *Æglina obtusicaudata*, Hicks. Dr. Hicks' description of this species (p. 185, *op. cit.*)—after making allowance for possible modifications due to distortion in the case of our specimen—will apply almost exactly to this, as anyone may see by comparing Mr. Postlethwaite's description with that given by Dr. Hicks. Our specimen is, however, much more perfect. It is among the largest species of *Æglina* yet made known. (J. G. G.)

FIG. 17.—The body is broadly ovate, tapering slightly towards the caudal extremity: the entire length is eight-tenths, and the width six-tenths of an inch; axis, narrow; pleuræ about one-half wider than the axis. The cephalic shield is short and broad, the glabella expanding slightly towards the front, which is well-rounded, and the upper, middle, and basal lobes well developed. The cheeks are ornamented with lateral ridges and furrows, in a line with the lobes and furrows of the glabella; axial furrows clearly defined; eyes indistinct. The axis expands slightly from the posterior margin of the glabella to the middle of the thorax, and then tapers gently towards the tail. There are nine thoracic segments left, but probably the number may have been greater, as the remainder of the thorax and pygidium are wanting, the outer shelly covering having disappeared; but the size and shape are indicated by a smooth surface on the slate. The first segments of the pleuræ curve backwards at the extremities, and the curvature increases towards the pygidium, until at the ninth segment it commences one-tenth of an inch from the axis. This specimen, which is only a cast or mould in the slate, approaches very nearly in general form, size, and structure to *Cybele ovata*, the principal difference being that our specimen shows no trace of the upward curve at the extremities of the pleuræ.

Locality—summit of Skiddaw. The specimen was found by a lady tourist, who, having climbed to that elevation with much toil and fatigue, wished to carry away some memento of her exploit, and picked up a piece of slate for that purpose, near the base of the pile of stones which marks the highest point. Looking at it closely, she observed what she supposed to be a shell, and on returning to Keswick submitted it for examination to Mr. Birkett,

assistant-curator of the Museum of Local Natural History, and he induced her to place it in the museum. The locality is within the area over which the metamorphic action of the Skiddaw Granite extends, and the slate contains numerous well-developed crystals of chialstolite. (J. P.)

The resemblance of this fossil to *Cybele ovata*, Eth., figured here for the first time (Fig. 19), has struck many that have compared the two. In *Cybele ovata*, however, there seemed to me to be distinct traces of ornamentation, as I have drawn them in the figure; and this ornamentation was noticed long before I saw the fossil, by Mr. Etheridge, and is referred to in his original description. These markings cannot be traced upon the fossil under notice; nor is there any sign of the continuous, arched glabella furrows in No. 17 that are so clearly seen on *Cybele ovata*. No trace of the facial suture can be made out in either case, so that the precise affinities of both fossils have to be inferred from other and less reliable data. The form of the glabella in No. 17 cannot be made out with certainty, as the fossil has been somewhat distorted; but for that consideration, there is much about the aspect of the fossil under notice that might have suggested its affinity to *Olenus*.

The present specimen, as Mr. Postlethwaite has pointed out, is of interest in another way; here we have the clearest possible proof of the coexistence of fossils with evidence of metamorphic action. And it is important to note that this stage of metamorphic action represented by the alteration of the mudstones of the Skiddaw Slate into chialstolite-slate is only one extreme of a series of changes whose other is represented by the kind of mica-schist that is seen in the valley of the Cawda, a mile or so to the north-east of the spot whence this particular fossil was obtained. The passage from unaltered Skiddaw Slate into the mica-schist is gradual and complete, and there seems to be no reason why traces, at least, of fossils should not be found in the mica-schist itself. (J.G.G.)

FIG. 19.—*Cybele ovata*, Etheridge, described in Mr. Ward's Memoir, p. 112, and here figured for the first time. It is from Sandy Beck, three miles south of Cockermouth. Keswick Museum.

FIG. 18.—This specimen is a good deal distorted, especially the head. Length six-tenths, and width four-tenths, of an inch. The glabella appears to have been comparatively small, and almost circular, while the cheeks are large, swelling out in front beyond the margin of the glabella, which is rather depressed. The thorax

and the pygidium are slightly rounded and well-defined; axial furrows deep; axis double the width of the pleuræ in front, and tapering to a point at the caudal extremity; thoracic segments seven in number. The body maintains its width nearly to the tail, caudal shield obtusely pointed, and terminated by a small thread-like ridge, which extends round the margin.

Buzzard Crag, on the north-west side of Skiddaw, from the Cabinet of Mr. W. Kinsey Dover. (J. P.)

There can be no doubt that this is another species of *Æglina*; but in the present state of preservation it is difficult to assign it a specific name, especially as the limits of variation of form in the several members of the genus do not yet seem to be clearly made out. It is not unlike certain forms of *Æglina binodosa*, and perhaps some of the differences observable between our fossil and that species may be attributed quite as much to the effects of distortion as to any original differences of form of real specific value. (J. G. G.)

FIG. 20.—Body elongated oval, length eight-tenths, and width four-tenths, of an inch. The cephalic shield, which is somewhat indistinct, occupies nearly half the entire length of the body: the front margin of the glabella is slightly pointed, and there is a small triangular projection in the centre of the posterior margin, which partly overlaps the first thoracic segment. The cheeks are small, and the outer angle of the posterior margin seems to be furnished with a minute spine. The front portion of the axis is three times the width of the pleuræ, but it tapers with a rapid curve, and terminates in a slender needle-like spine, which reaches nearly to the posterior margin of the caudal shield; there are eight segments on the axis, but five only appear to belong to the thorax, and the remaining three to the pygidium. The segments of the pleuræ curve faintly backwards, and increase in length towards the pygidium, in proportion as the axis decreases in width, so that the entire width of the body is maintained until it terminates in a semi-circular caudal shield. (J. P.)

Locality—Randel Crag. From Mr. Dover's cabinet.

This is very much like one of the forms of *Æglina rediviva* figured by Barrande, 'Tril. Bohemia,' Vol. I, Sup., pl. xiv, fig. 11, wherein the prominent ribbing on the pygidium and the spine-like ornament are both indicated. (J. G. G.)

FIG. 22.—This specimen consists of the impression of a large

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and very beautiful trilobite, representing part of the left pleuræ, of the axis, and possibly part of the pygidium, in a fair state of preservation, but the remainder of the body is partly imperfect, partly covered by overlying slate, and partly obliterated. The thoracic portion of the axis is faintly rounded, and measures an inch and nine-tenths in length, and an inch and a half in width : it appears to maintain its width to the third segment, and then to taper rapidly towards the pygidium : the right axial furrow is partly covered, but the left is clearly defined. Body-segments, eight, smooth and well-rounded ; thoracic portion of pleuræ about half the width of axis, segments pointed and curved upwards at the tip, and with a deep furrow along the middle of each. The pygidium is obscure, except the left margin, which consists of segments similar to those of the pleuræ, but they extend three-tenths of an inch beyond it, showing that this part of the animal must have been unusually large. Cephalic shield entirely obliterated.

Locality—Randel Crag, on the north-west side of Skiddaw. This specimen is from my own cabinet. (J. P.)

Not much can be made of this. It is something like part of a large *Ogygia*; but there is nothing to show its exact affinities. (J. G. G.)

FIG. 23.—In general form this species is broadly oval, but the specimen is so much weathered that its distinctive features are almost obliterated. The oval disc and axis, however, are clearly defined. Length three inches and four-tenths, and width two inches and seven-tenths. The axis is well-rounded ; it measures one inch and a tenth at the front part, and tapers to half an inch at the caudal extremity, which is about two-tenths of an inch from the posterior margin of the pygidium ; on the front portion it shows distinct traces of seven segments. Axial furrows deeply cut and quite straight, except the outward curve at the margin of the carapace. The head appears to have been unusually small, measuring only half an inch from the front segment, but in all probability the latter may have belonged to the cephalic shield, and the remaining six would be thoracic segments. The distinguishing features of the pleuræ and caudal shield cannot be made out.

Locality—Randel Crag. From Mr. Harrison's cabinet. (J. P.)

This obscure specimen presents hardly any features that will enable one to do more than make a guess at its affinities. It

looks very much as if the cephalic shield had been thrust backwards, or "faulted" over the thorax. It is somewhat like some forms of *Barrandeia*, or *Homalopteon*, but it is in vain even to guess with such materials as these. (J. G. G.)

The deposition of the slate at Randel Crag must have been under conditions unusually favourable for the growth and development of animal life, and also for the fossilization of their remains, as many of the best-developed and most perfectly-preserved trilobites and graptolites have been found there.

The fossil remains of trilobites differ very much from those of the graptolites occurring in the same beds; the latter, when obtained in relief, always consist of iron pyrites, which has replaced the original chitinous shell of the organism, and the shell appears to have been of equal hardness on every side; but the remains of trilobites almost invariably consist of slate of the same type as that in which they are enclosed, and it is the dorsal surface alone that has been fossilized. It is evident, therefore, that the shell on the ventral surface of the body has been of a very fragile character, and that in almost every case it has perished, together with the legs, swimming appendages, and internal organs of the creature, the dorsal shell alone being sufficiently hard to retain its form until the fine mud of which the Skiddaw Slate is formed became solidified above and beneath it; hence, when the slate breaks up along the bedding planes, we find a cast only of the whole or a part of the internal or external surface of the shell. The shell itself, which would probably be formed of carbonate of lime, has, no doubt, in most cases, been removed at a later period, thus causing an additional line of weakness in the slate, owing to which, the subsequent exposure of the cast is very often due. (J. P.)

In addition to the trilobites just passed in review four other species are often mentioned as occurring in the Skiddaw Slates. These are *Ogygia selwyni*, *Æglina binodosa*, *Æ. caliginosa*, and *Trinucleus gibbsii*. With the doubtful exception of the second I have been unable to meet with authentic specimens of these from the Skiddaw Slate. They are all figured in outline in Plate IX, mostly from well-known figures in the Memoirs of the Geological Survey. Prof. H. A. Nicholson, of Aberdeen, informs me that the trilobite referred to *Trinucleus gibbsii* was found by him in the area of Skiddaw Slates at the foot of Ullswater; but as the specimen could not be got at for examination, and Prof.

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Trilobites from the Skiddaw Slates.

J. G. Goodchild, fecit.

G. & T. Coward, Imp.

Nicholson did not feel sure of its correct identification, it has been deemed better to notice it only by an outline figure. (J. G. G.)

The trilobite fauna of the Skiddaw Slates, then, so far, may be stated as follows :—

Phacops nicholsoni, Salter.

Cybele ovata, Etheridge.

? *Calymene brevicapitata*.

? *Remopleurides* sp.

? *Olenus* sp.

? *Trinucleus gibbsii*.

New genus, represented by No. 1.

? *Ogygia Schwyni*.

? *Ogygia* sp.

Barrandea falcata, n.s., P. & G.

Niobe doveri, Eth.

Eurymetopus cumbrianus, n.g. & n.sp., P. & G.

Eurymetopus harrisonii, n.g. & n.sp., P. & G.

Æglina ? *rediviva*, Barr.

Æglina ? *binodosa*.

Æglina obtusicaudata, Hicks.

Æglina ? *caliginosa*.

Agnostus morei, Salt.

OBSERVATIONS UPON THE STRATIGRAPHICAL RELATIONS OF THE SKIDDAW* SLATES.

By J. G. GOODCHILD, H.M. Geol. Survey, F.G.S., F.Z.S.

From the days of Jonathan Otley down to within the last few years, Otley's views in regard to the geological position of the Skiddaw Slates in relation to the other rocks of the Lake District have been accepted unquestioned by geologists. Of late, however, chiefly since the results of Dr. Hicks's researches amongst the Archæan Rocks have been made known, many geologists seem to have been struck with the remarkably close resemblance in lithological character between the "Green Slates and Porphyries" of the Lake District and the Pebidian Rocks of the St. David's area and elsewhere. They have thence been led to inquire whether there might not be something more than a mere resemblance between the two

* In deference to established usage I here adopt the customary spelling of Skiddaw; otherwise I should prefer to write Skidda.—J. G. G.