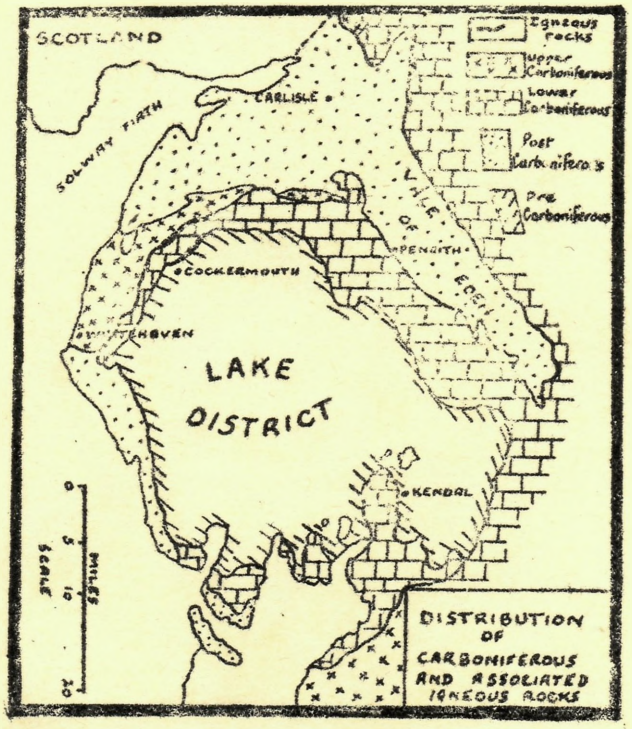
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THE CUMBERLAND GEOLOGICAL SOCIETY

President:

E. H. SHACKLETON, F.G.S.

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This is the fourth article of the series about celebrated geologists whose names are connected with the Lake District.

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HENRY ALLEYNE NICHOLSON

Henry Alleyne Nicholson was born at Penrith in the year 1844, and in view of his long and close associations with the geology of his native Lakeland, he may be regarded as one of its most distinguished sons.

His father, Dr. John Nicholson, was a distinguished Oriental Scholar, whilst his grandfather was President of a college out in Barbados. The young Alleyne, for one notices his own preference for this name, rather than Henry, received his early education from Francis Newman and later at Appleby Grammar School. From there he went to Göttingen University where he studied Zoology under Professor Keferstein. From 1862 to 1867 he studied Medicine at the University of Edinburgh, graduating as Bachelor of Medicine and Master of Surgery. He not only took first class honours in all his subjects but, more interesting to us, he obtained the University Gold Medal for his thesis "On the Geology of Cumberland and Westmoreland". This he dedicated to his great friend and co-worker in the field, Professor Harkness of Queen's College, Cork. It was subsequently published and is still well worth reading.

Beyond his strictly medical studies this remarkable man worked hard and earnestly at the Natural Sciences under Goodsir, Allman and Balfour, and graduated as Bachelor of Science. In 1866 he carried off the Baxter Scholarship in Natural Science, and took his degree as Doctor of Science in the following year. In 1869 he proceeded to the degree of Doctor of Medicine, and received at the same time the Ettles Medical Scholarship as the most distinguished student of the year.

His first post after this most brilliant student career was that of Lecturer in Natural History at the Extramural School of Medicine at Edinburgh, and for a short time he also practised medicine. In 1871 he was appointed to the Chair of Natural History at the University of Toronto, a post he held for three very full and exciting years. Not only did he carry out his professorial duties with success but, at the request of the Government of Ontario, he made a detailed investigation into the fauna dredged up from the bottom of the nearby lake. With equal enthusiasm he made detailed reports on the fossils of the Silurian and Devonian rocks of the Province. Figured and described by himself, these findings were published by the Government of Ontario. Meanwhile the State Geologist of Ohio, Dr. Newberry, asked him to describe the fossil corals and polyzoa of that State. Nicholson's report, accompanied by five quarto plates of figures drawn by himself appeared in the second volume of the "Palaeontology of Ohio".

During his residence in Toronto this indefatiguable man first produced his "Manual of Palaeontology" and the first part of his well known "Monograph of the British Graptolites". However Nicholson began to find Toronto a little isolated, and less favourable to the fulfilment of his special talent for research than would be a post within the British Isles, so perhaps not surprisingly he soon took the opportunity of returning homewards.

He first had in mind the Professorship in the Royal College of Science at Dublin, but before he reached that city he was offered the to him much more acceptable post of Professor of Biology in the University of Durham. For two sessions he lectured at Newcastle-upon-Tyne and then accepted the Chair of Natural Science in the University of St. Andrews.

Professor Nicholson remained at St. Andrews for seven years, and it can be said that there he created the study of Natural History. At the same time he took an active part in the extension of University teaching to Dundee. But all this did not prevent him from undertaking an immense amount of original research, particularly in the subject of fossil corals. He published two elaborate monographs, one "On the structure and affinities of the Tabulate Corals of the Palaeozoic Period" and the other "On the structure and affinities of the Genus Monticulipora". Yet another important monograph of this period was produced in collaboration with a Mr. R. Etheridge (Jun.) on the Silurian Fossils of the Girvan District in Ayrshire. As if all this were not enough, in 1879 he published a popular work on "The Ancient Life History of the Earth".

In 1882 Professor Nicholson accepted the appointment of Regius Professor of Natural History in the University of Aberdeen, a post he held for the remainder of his life. In addition to his official duties he still continued with unabated vigour his researches into fossil corals and contributed many papers on the subject to the science journals. Perhaps his most important work published at this time was his monograph on the British Stromatoporids published by the Palaeontographical Society in the years 1886-1892. To record all Nicholson's work would fill many pages but I now would like to turn to that part of his work which was directly concerned with Cumberland and Westmorland.

There can be no doubt that the departments of science which held the most attraction for the Professor were Field Geology and Invertebrate Palaeontology. For the study of the former, no scenes more favourable could be found than those surrounding his birthplace and boyhood in the Lake District; here he spent most of his holidays and obtained both rest and renewed vigour working out in detail the complicated structural geology, and collecting fossils from the rocks for subsequent study. Beside his graduation thesis already mentioned he had previously published, in conjunction with Professor Harkness, a paper of "Additional Observations on the Geology of the Lake Country", and also "On the Coniston Group" where he told of the discovery of a rich graptolite fauna in Sedgwick's Coniston Flags. Other papers between 1871 and 1877 were on "The Green Slates and Porphyries between Ullswater and Keswick", and on the Borrowdale Series and Coniston Flags. The 'green slates and porphyries' was the old name applied to what we now more generally call the Borrowdale Volcanic Series.

A very important paper was brought out in 1888 on the Stockdale Shales where the honours were shared with his great friend Professor J.E. Marr. It was in this paper that it was first shewn that the Stockdale Shales could be divided into a series of zones based on their lithological characters and on their contained fossils, mostly graptolites. This paper adduced additional evidence to emphasise the value of these organisms as a means of comparison of Lower Palaeozoic rocks in distant parts. At a later date the

same two authors dealt with the fossils in the various formations of the Cross Fell Inlier.

Professor Nicholson's researches into Invertebrate Palaeontology were concerned mainly with Graptolites, Corals, Monticuliporoids and Stromatoporoids, but he was primarily attracted to the Graptolites with which some strata in the Lake District were crowded. In describing the graptolites of the Skiddaw Slates it was he who first pointed out the close resemblance they bore to the forms in the Quebec Group of Canada. Besides many detached papers on various types of graptolite, he produced the first part of a detailed monograph on the Graptolites of Britain wherein he delineated the history, morphology, mode of existence, and distribution through geological time of the various genera in a most able way. Further work on this was interrupted by the Professor's residence in Canada, and it was never fully resumed, although he and Marr did publish a brief but important work on graptolite phyllogeny which appeared in the Geological Magazine in 1895. This task he relinquished passed to his friend Professor Lapworth.

The study of graptolites in this country has always been difficult on account of the compressed condition of preservation of the majority of specimens, and it is a great tribute to the patience and critical acumen of Alleyne Nicholson that he was able to decipher their characteristics so correctly. As far as can be ascertained the Professor was responsible for no less than 138 papers which were entirely his own work, as well as some 27 joint papers written in collaboration with such men as Etheridge, Foord, Murie, Harkness, Lapworth and Marr.

Professor Nicholson was elected a Fellow of the Geological Society in 1867, of the Linnaean Society in 1876 and the Royal Society in 1897. In 1879 the Geological Society awarded him the Lyell Fund, and in 1888 the Lyell Medal for "his valuable researches amongst the older Palaeozoic Rocks both in the Old and the New World, and of his continued and patient investigations into the organization of some of the obscurer forms of life at the period of deposition of these rocks."

If the Learned Societies appreciated Henry Alleyne Nicholson for the width and depth of his original researches, his students and fellow workers alike appreciated him more for his geniality and sympathetic disposition. His kindness and generosity knew no limits for he was always ready to impart to others the particular techniques which he himself had found most profitable, and he was ever ready to give others confidence and encouragement by associating them with himself in some original venture.

Professor Nicholson's capacity for work was enormous and he devoted himself to it without stint. It is to be feared that the impaired health of his last few years was due in part to the constant overstrain, both mental and physical, produced by his too persistent exertion. None of his friends suspected his critical condition, for within a week of the end he was still at his post at the University, and the news of his death on the 19th. of January 1899 came with startling suddenness.

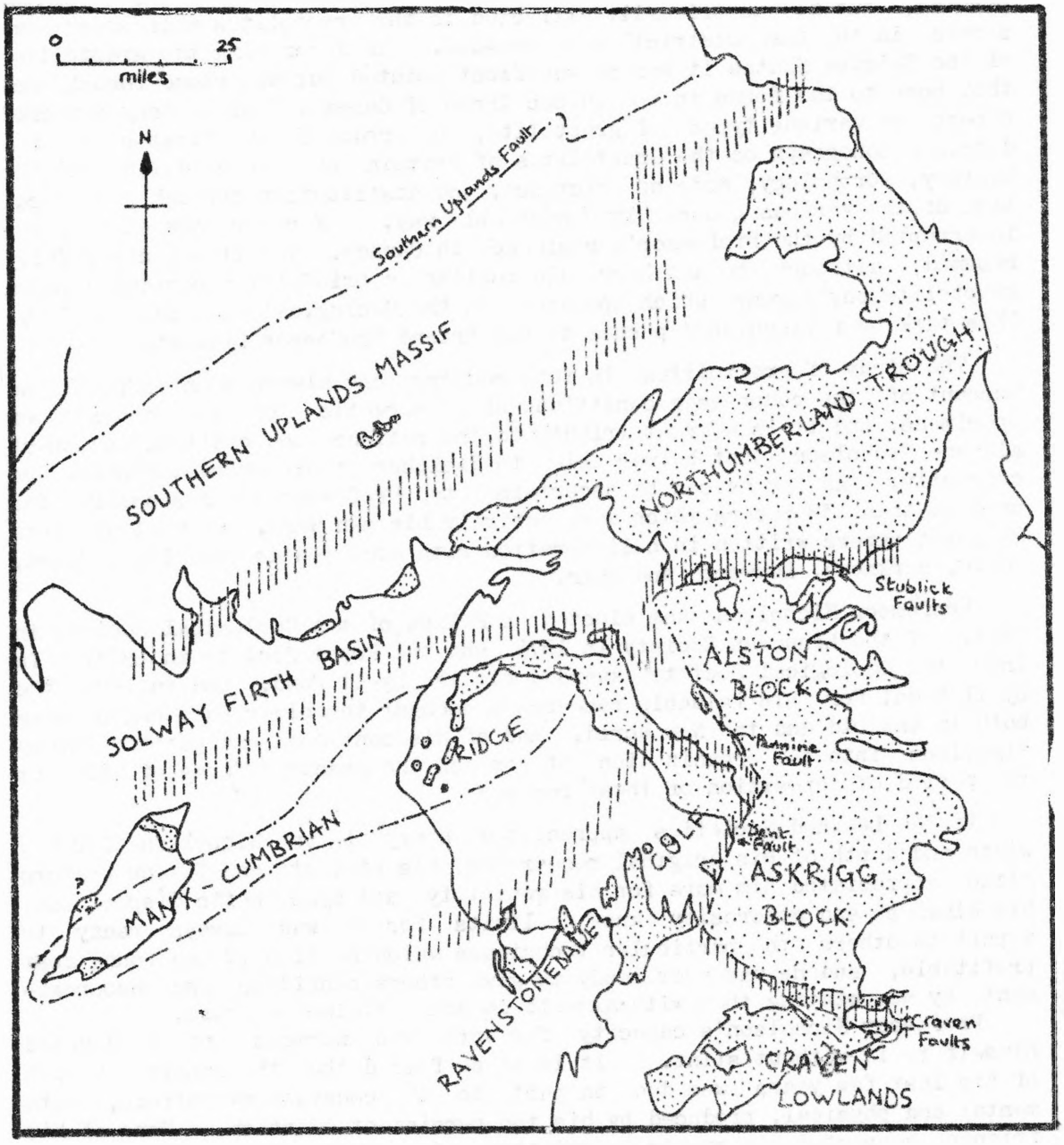
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In preparing this brief biography I would like to acknowledge with gratitude the kind assistance given me by the Library Staff of the Geological Society of London.

E. H. Shackleton.

FIGURE 1.

LATE VISEAN PALAEO-GEOGRAPHY



EXPOSED ROCKS OF LR. CARBONIFEROUS AGE

POSITION OF 2,000' ISOPACH, DOTTED WHERE UNCERTAIN

Mainly after George, T.N., (1958).

SOME RESULTS OF RECENT WORK ON THE CARBONIFEROUS LIMESTONE SERIES OF WEST CUMBERLAND

R. Stabbins, B.Sc.

Since 1965, when work was started on a sedimentological study of the Lower Carboniferous rocks (of Viséan age) between Egremont and Bothel (West Cumberland), members of the Cumberland Geological Society have given the author much useful advice and practical help. It is hoped that a progress report may in part repay this, and also be of general interest.

The palaeontological and stratigraphic foundations of the present research were laid by Edmonds (1922)[1] who described the area between Lamplugh and Egremont. A summary by E.H. Shackleton[2] of this work was published by the Society in 1962, mainly as a field guide for members. Edmonds' work was subsequently substantiated and extended by the Geological Survey into the Maryport and Cockermouth-Caldbeck districts[3,4,5], though the explanatory memoir of the Cockermouth Sheet has yet to be published. In the present study, most emphasis has been laid on the limestones, since these are well exposed and constitute the greater part of the succession, although the shales and sandstones (or clastics), which are less persistent, have not been neglected. It is surprising that the area has received so little attention from geologists since the early decades of the century, as it contains an unusual development of essentially shallow water limestone and clastic sediments with some thin coals. The upper part of this sequence is intermediate in character between the rhythmic alternations of limestones, shales, sandstones and occasional coals of the Yoredale-type successions of Alston[6] and Brampton[7] and the more massive Carboniferous Limestone deposits of the southern part of the Isle of Man[8] and the Kendal-Carnforth area south of the Lake District. The West Cumberland succession also bears a closer resemblance to the Lower Carboniferous succession of the northern Isle of Man[9] (the latter sequence is known only from boreholes and is without detailed palaeontological control) than it does to the geographically closer areas of Carboniferous Limestone on the north side of the Solway Firth. Anomalies such as these can be partly explained by a reconstruction of the geography of North West England in Upper Viséan times (Fig. 1).

It has been suggested that a gulf or narrow area of sea ran approximately N.E.-S.W. from Northumberland, via Carlisle along the Solway Firth, passing slightly to the North of the Egremont-Bothel area and also North of the Isle of Man. This has been called the Solway Firth Basin[10] or Northumbrian Trough[11], depending on the geographic location. In this trough, between 20 and 40 miles wide, a sequence of sedimentary rocks up to 3,000 feet thick was laid down during the Upper Viséan while the Seventh to First Limestones were accumulating in West Cumberland. Where these are exposed they are found to be composed of deposits similar to those in our area, but with the shales, sandstones and coals much better developed. The Northumbrian Trough was probably an area of slightly deeper water than West Cumberland but never as deep as the greater thickness of sediments might suggest. During the same time interval, between 570 and 900 feet of sediments were laid down in the area of study, thickening towards the North East in an irregular fashion, This thickness change across the area is without sudden lateral variations in the rock-type being deposited at any one time, and

suggests that in the Northumbrian Trough and its westerly extension, the rate of accumulation of sediments generally kept pace with rapid subsidence so that the water never became very deep.

From the Northern part of the Lake District, reaching south-westwards to the North and Central parts of the Isle of Man, was the Manx-Cumbrian Ridge[11], an area of relatively slight Lower Carboniferous sedimentation, less than 1,000 feet, where limestone deposition commenced only in Upper S_2 times, and was frequently interrupted by erosional intervals and by sandstone and shale spreads. The clastic rocks are thought to be largely derived from an adjacent land area, probably of low relief, undergoing erosion, which provided sediments whose thickness and areal lithological variation was further modified by the shape of the basin into which they were deposited and by the distibution patterns of marine currents. There is some doubt as to whether the Central part of the Lake District was ever completely covered by Lower Carboniferous rocks, since residual patches of Carboniferous Limestone on the Lower Palaeozoics are rare. On the Western side of the Lake District only one is seen, at Wilton, near Egremont.

To the South and South-east of the Lake District in the Furness-Kendal-Ravenstonedale area and Craven Lowlands, thick sedimentary sequences again accumulated, bounded in part by the Craven Fault system and the Dent fault. These faults were active in Lower Carboniferous times, since they separate the thicker successions, partly of deeper water origin which occupy the Ravenstonedale Gulf[11] and Clitheroe region from the Yoredalian succession of the Askrigg Block (Fig.1). This latter area has a lithological sequence again comparable with that of West Cumberland. The succession in the Southern part of the Isle of Man has affinities with the Furness and Kendal areas. Though much thinner, it is an essentially massive formation, and deposition commenced in C_2 times. On the Manx-Cumbrian ridge and on the Alston and Askrigg Blocks, Lower Carboniferous deposition commenced later than in adjacent areas: the sea finally submerged the Askrigg Block during the upper part of the S_2 sub-zone (Lithostrotion n. minus sub-zone)[12], the Alston Block possibly in S_1 times, but more likely at a similar or only slightly earlier time than the Askrigg Block (Davidsonia carbonaria sub-zone)[6] and the flooding of the Ridge was accomplished during the upper S_2 (Lithostrotion n. minus) sub-zone[1]. Approximate net rates of deposition during the time interval in which the Seventh to First Limestones were deposited (S_2 until low Namurian, E_1; approximately eight million years), have been calculated for several areas of North West England. The successions all contain numerous minor stratigraphical breaks and erosional periods, and the rates are as follows:- 1 foot every 11,000 years in West Cumberland; for the thick sequence in the Northumbrian Trough, 1 foot per 2,700 years; Kendal-Carnforth area 1 foot per 4,000 years; and 1 foot every 7,300 years on the Alston Block. These figures should be treated with some caution, since at best they are crude approximations. They do, however, give an idea of relative depositional rates.

The information from other areas is important since it is helpful in placing the West Cumberland Carboniferous Limestone Series in its regional setting. The general picture of the succession thickening towards the North East is complicated by a slight but general thinning of some individual

limestones. The Seventh, Sixth and Fifth Limestones are not always well exposed to the North East of Lamplugh, but the available evidence suggests a slow thinning north-eastwards. The overall thickening of the succession is brought about by the increase in importance of the sandstones and shales towards the North East at a rate which more than compensates for the diminution of the limestones in this direction. The general thickening is parallelled by the incoming of thin coals to the North East and by their growing importance in number and thickness in a north-easterly direction. No coals have been found in the Egremont area during the course of the present work although one occurs beneath the First Limestone of Hensingham. At Broughton Craggs and Wardhall Guards Quarries two coals have been observed below the Junceum Limestones. Two substantial ones, up to 9 inches thick, and a thinner one are recorded for the first time from the Fifth Limestone at Clintz Quarry, Moota, as well as one 1-3 inches thick and several carbonaceous smears in the Fourth Limestone at Moota Hill. The changes in number and thickness of these coal seams are thought to indicate the direction in which the sediment-fill of the basin increased in thickness, particularly the sandstones and shales, although the arcuate outcrop pattern aligned S.W. - N.E. to beyond Cockermouth and then trending more E. - W. may have imposed on some lithological phenomena an apparent degree of regularity which is in fact illusory. Conversely, individual limestones would thin towards the deeper water of the basin mainly because bioclastic limestones (the most frequently encountered in West Cumberland and produced by the accumulation of the hard parts of calcareous marine animals) largely depend on shallow, clear, warm sea water for their development. Colder, deeper waters, those made turbid by fine-grained material in suspension, and those which do not provide sufficient nutrients, would all be unable to sustain a rich fauna and are unlikely to be the site of significant bioclastic limestone accumulation. Such unsuitable conditions are more likely to be found centrally within a sedimentary basin and might help to explain the complementary thickening of clastics and thinning of limestones.

Though not of great stratigraphical thickness, the discovery of a nodular anhydrite horizon near the top of the Seventh Limestone in a borehole just over a mile west of Egremont[13] is of some significance since it encourages comparison with recent shallow marine environments and throws new light on the depositional conditions and palaeogeography of the Carboniferous Limestone of the area. It is thought that the associated nodular and laminated limestones represent a short-lived period of intertidal and supratidal sedimentation such as might be found in a shallow, highly saline lagoon, the floor of which was partly exposed during low tides, and that the anhydrite formed in a flat, low-lying area of unconsolidated calcareous sediment which was not covered by high tides, i.e., supratidal. Such a situation lends some support to the presence of a nearby, low-lying land area, though it must be noted that limestones resembling those associated with the anhydrite, but no evaporitic material, have also been seen in the exposed limestones of the Moota area.

The correlation of potholed horizons (and other limestone surfaces indicative of erosional periods) shows that the greatest removal of previously deposited carbonate material took place in the more southerly part of the limestone outcrop. Examples of such dis-conformities and non-

sequences are by no means confined to the Egremont-Lamplugh district, and occur in the Cockermouth-Bothel district also. Potholes up to 6 feet deep, filled with sandstone, occur in the Fifth Limestone at Clintz Quarry, Moota (the smaller working quarry most distant from the Cockermouth-Carlisle Road), and a small remnant of fossil clint and grike topography, also overlain by sandstone, can be seen near the top of High Close Farm Quarry, near Plumbland.

It would thus appear that a reconstruction of the conditions of deposition is not quite as straightforward as at first seems possible; this idea being reinforced by a study of isopach maps prepared for each limestone and most clastic units, which show changing thicknesses of each stratigraphic interval in the disused part of the haematite ore-field. These maps have been compiled for the area between Egremont and Lamplugh, with some extra information from Ullock, and are based on the drillers' records of numerous boreholes put down many years ago in search of haematite. In the area outlined above nearly 350 boreholes penetrate enough of the succession to permit identification of lithological units, and at the same time are not disturbed by faults. The general picture of past conditions, while essentially true, is further complicated by apparent minor inequalities of the sea floor. These were probably caused by slight contemporaneous earth movements which affected wide areas of shallow water sedimentation in Northern England and elsewhere during upper Visean times.

The north-easterly pattern of thinning for the Seventh to Fifth Limestones shows several local vagaries which do not appear to maintain a consistent pattern through time. Of the intervening clastics no map has been prepared for the Basement Conglomerate and Seventh Shale because their contact with the underlying weathered Skiddaw Slates is poorly defined and often not recorded in drilling logs. An examination of those more recent and better annotated logs attempting a separation shows the distribution of conglomerate and shale to be extremely irregular, possibly related to topographic features produced by Devonian and Tournaisian subaerial erosion of the Lower Palaeozoic rocks. The Sixth Shale has been mapped as part of a larger unit which includes the overlying Sixth Limestone, since accurate separation is difficult in borehole records because of the gradational nature of their common boundary. The Fifth and Fourth Shales, both of which show complex lithological variation, have been mapped as single units, and indicate for the former a north-westerly thickening, and for the latter an irregular pattern of northwards thickening in the south, which swings eastwards in the Lamplugh area.

In the Fourth Limestone the following units can usually be recognised in complete records:- White Limestones, Rough and Spotted Limestones (combined), Potholes Limestone, Saccamina Limestone, Junceum and Cherty Limestones (combined). For these the average number of control points is only 79 per unit, and a map based on so little information usually presents an oversimplified pattern. In the South-west all these limestones show an overall thickening to the North-West, North, or North-East which gives place in most cases (except the Potholes Limestones) to a less well defined northward thinning. The Fourth Limestone as a whole shows a very similar pattern. Individual shale and sandstone horizons within this Limestone are too thin and poorly documented to warrant special treatment, but a map

showing total clastics for the Fourth Limestone shows a pattern of sub-parallel alternating areas of greater and lesser thickness. Again, this assessment is based on only 75 boreholes, arranged in a linear belt nine miles from South West to North East. The Third Shale and combined First Shale and Little Whirlstone both thicken towards the North, whereas the thickest clastic unit in West Cumberland, the Orebank Sandstone Group, thins in a north-easterly direction with an accompanying reduction in the proportion of coarse sandy material relative to shales. These factors indicate a probable south-westerly source, a deduction which it is hoped to substantiate and amplify by a heavy mineral study.

The Third Limestone, which is thin over the entire area, thickens eastwards, whereas the Second and First Limestones thicken towards the North and North West. This pattern may indicate the re-establishment (or continuation) of the conditions established early in Fourth Limestone times, but the lack of good exposures beyond Cockermouth at this stratigraphic level does not permit facies changes to be studied in detail.

Note

Lithological details of all major quarries and exposures, and copies of the maps discussed above, will be found in a thesis entitled "The Depositional History of the Lower Carboniferous Rocks of West Cumberland" to be submitted to London University for Examination in early 1969, a copy of which will in due course be presented to the Society.

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EROSION AT WORK

SOME RECENT LAKE DISTRICT CHANGES

By E. H. Shackleton, F.G.S.

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Those of us who are fortunate enough to live in, or have easy access to the Lake District, have many opportunities for geological observation. I have been a student of Lake District Geology for more years than I care to remember and I wish, in this short account, to describe some of the major geological changes I have seen in the area of late.

Most people will, I think, recall that for several years we have had in the back end of the year periods of very heavy rainfall, followed on at least two occasions by roaring floods. In this respect Borrowdale springs at once to mind, but it was not only in Borrowdale that these torrents had their effect. During the past summer I have visited again quite a few sites of geological interest or importance, sites that I not only know well, but have known for a long time. The changes I found to have been brought about by the forces of erosion were remarkable and also very interesting.

The first place to which I would wish to draw attention is Sinen Gill, situated up the Glenderaterra Valley, behind Saddleback (NY302282). Here the changes are many and very varied. Below the waterfall exposing Skiddaw Granite many boulders have been swept down, and the white sand which was so striking a feature of the many pools has almost all gone. The white bank below the fall has lost much of its soft loose outer covering which was of course the source of the sand. Some one hundred and fifty paces below the fall there is now a small exposure of granite in the stream bed. I admit I have suspected this before, but it was impossible to be sure, so encumbered was the site with boulders. Now they have gone this further exposure of the granite is quite evident.

On comparing an old photograph of the waterfall itself with a more recent one taken from a similar viewpoint, it seems to me that the actual outline of the fall itself has to some extent changed, whilst above the fall, great changes in the granite exposure are obvious. For many yards the stream flows over a clean-swept granite pavement, but if you follow the northern bank up carefully it is here that the stream has done its most interesting work. In the bed of the stream below the bank the granite rises slightly and takes on a fine-grained texture. This is outlined towards the bank by a band of white quartz. Whilst above this in the bank highly metamorphosed country rock, cordierite hornfels, is seen in actual contact with the granite mass.

It would seem that here we have a clear illustration of a 'granite intrusion' in the old sense, for here is Skiddaw Granite in situ abutting against its baked Skiddaw Slate roof, with that roof clearly and well defined. Of course this does not preclude granitization for it may well be that deep down below the ancient anticline sialic sediment has been so changed and at a late stage caused to migrate under the pressures of earth movements. At any rate here we have a site where one can sit and contemplate the evidence in the field for granite formation and emplacement.

Next I would direct attention to the exposure at the foot of Low Nest on the main road from Keswick to Thirlmere. Just past the second milestone and opposite to where the road swings left (NY291220) there is a rough lay-by on the right hand side of the road. Here, hidden by the trees, a steep gill descends the hillside. A few yards up the stream course there is a small waterfall at a point where andesitic lava overlies Skiddaw Slate. I have known this exposure for some time and up to last summer it always rather puzzled me, for it never seemed quite to match up to the old geologists' enthusiastic descriptions of it. Now that the torrents have swept out much accumulated debris the story is clear enough. One can see where the lava has flowed quietly over the Skiddaw mud in a perfectly conformable sequence. Such an exposure is unusual, as most Skiddaw Slate-Borrowdale Volcanic junctions are demonstrably faulted or unconformable. But until we had these floods, not more than a few inches of Skiddaw Slate could be seen beneath the fall, whilst the right bank was almost completely obscured by earth creep. Unless one knows the long story of how this junction has been contested over the last hundred years by such eminent geologists as J. E. Marr and J. F. N. Green, to mention but two, it may be difficult to share my enthusiasm. However, the location is well worth a visit. A Word of warning though. This is so good and important an exposure that it was thought desirable to ask for a preservation order to protect it. Visit and examine it by all means, but please leave it strictly alone.

Lastly, Cat Gill (NY270209). Here great changes have taken place, many of them undoubtedly due to the weather. A great many boulders have been either swept away altogether or carried further downstream. Below the gorge the dark grey sedimentary ash band has completely gone, helped I fear by indiscriminate use of hammers, but there is now considerably more of the fine green volcanic ash shewing than before. The great boulder of flow-breccia now lies almost suspended, so many pieces have been washed out from beneath it; another real flood and it will be on its way. The parent out-crop lies a long way above in a very steep part of the gill. Above the purple breccia there is now exposed a bedding plane that looks suspiciously like the brecciated surface of No. 1 Lava. Whether top or bottom I could not ascertain in the time available, but at least it will provide a good excuse for another visit when the weather becomes a little more congenial.

That such great changes can take place in even so short a time is not only of great interest, but it might be taken as a warning. When reading accounts of field meetings or descriptions of localities one should keep in mind that the forces and agencies that mould the surface of the land have been constantly at work. The fact that field evidence is being incessantly modified makes it imperative that even well-documented and much-visited sites of geological interest should be re-assessed from time to time, as I have shown in the three examples cited.

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EXCURSION TO APPLETREEWORTH BECK, BROUGHTON MILLS, BROUGHTON-IN-FURNESS.

7th. July, 1968. Leader, The President.

---oooOooo---

On a delightful morning some forty members of the Society met at Duddon Bridge on the Cumberland-Lancashire border. After a little delay in marshalling the many cars, the party left for Appletreeworth to assemble at Hawk Bridge where the cars were parked.

Before setting off, the leader displayed fossils and rocks which he had collected in the area over the past few years and explained that owing to long periods of illness his work on the area had never been completed. In spite of this it was his intention to show members such locations as he himself knew and found of interest without attempting too much by way of interpretation of what is a far from straightforward bit of territory.

Leaving Hawk Bridge the party moved up the hill to enter the forest by the upper gate, and it was not long before outcrops of Borrowdale Volcanic rocks were encountered by the wayside. Pressed by the members, the President expressed his opinion that the rocks they were examining were andesitic lavas, but he warned of the difficulty of making field determinations from small exposures of the Borrowdale Series as it was not always easy to differentiate between some of the lavas and tuffs.

The next exposures encountered were of Coniston Limestone which here was of the dark muddy type, and although search was made for a junction, this was not found. The director pointed out that hereabouts the succession from Borrowdale Volcanics to Coniston Limestone was generally unconformable with pebble beds often found at the junction, thus indicating that there had been late-Ordovician earth movements with consequent exposure and erosion of the upper B.V.S. before deposition of Coniston Limestone. In the warm sunshine it was pleasant to examine the long exposures of the limestone laid bare by Forestry Commission road-building. Many fossils were noted and collected, one bedding plane being almost covered with fossil shells, Orthids and Strophomenids predominating. One member was fortunate enough to find a good example of chain coral, Halysites. Lunch was taken near the limestone, and some enthusiasts were observed actively searching, hammer in one hand, sandwich in the other.

After lunch the party was led past the road that goes down to the river for about 200 yards up to where an old wall runs down through the trees towards the beck. Here, the leader explained, was a repetition of the sequence to be found at Ashgill, Appletreeworth Beck having eroded its course along the strike of the beds. On a little rocky mound above the beck the Mucronatus Beds were exposed where specimens of both Dalmanites and a much bigger unidentified trilobite were soon found. Beneath the mound in the steep bank running down to the beck the Ashgill Beds were exposed, whilst across the beck the Skelgill Beds rose in a steep cliff in which there was an old adit, in part flooded, but of some interest because it was described by that intrepid old wanderer John Bolton in his "Geological Fragments". Another old adit, with barytes and chalcopyrites, was pointed out some 250 yards above the old farm buildings. After passing the

old ruins the party came to what the leader described as the most difficult part of the exposures. Firstly a purple ashy shale was encountered in the bank of the stream to the north west. One interesting feature was the many fine specimens of dendritic manganese to be found. The leader suggested that the exposure was in all probability the ash bed occurring between the limestone and the Mucronatus Beds in the type section at Ashgill. The present extensive exposure was new, for it seemed that the Forestry Commission had been quarrying it for use as a road material. Below this exposure the stream makes a sudden right-angled bend and it is at this point that the most difficult exposures occur. In the south bank dark shales of the Skelgill Beds crop out, but these fail to show on the opposite bank of the stream. Besides the strong strike fault which is usually present at the base of the Skelgills, the Appletreeworth exposures are cut by repeated dip faults, and in all probability, the sudden right-angled bend is occasioned by one of these. The dark shales were examined and many poorly-preserved graptolites were found, but identification was made well nigh impossible by the strongly developed cleavage.

Mr. Grieve, one of our Barrow members, pointed out that in examining these beds with Mr. C.V. Knipe they had found, some fifty feet above the foot of the exposure, a highly fossiliferous band with a marked green streak. Not far removed there are two other green streaks. This, the director pointed out, was a major difficulty as at Skelgill, the type locality, all the green streaks occur low down in the sequence, the composite ones near the base being in the Dimorphograptus confertus Bed. So what has happened here? Are the beds in fact inverted? What has become of the Browgill Beds, at least 200 to 250 feet of which ought to overlie the Skelgills?

After a short distance the stream makes another right-angled bend and reverts to the strike of the beds. These beds, clearly exposed in the course of the stream were explained by the leader to be the lower members of the Brathay Flags. This led to some argument, but the President was able to clinch his point by leading the party to an exposure in the eastern bank where he claimed Cyrtograptus could be found, along with Monograptids of the colonus type, all preserved in the solid. The party fell to with enthusiasm to seek these specimens and it was not very long before well-preserved Cyrtograptids were being found, along with several specimens of Monograptus vomerinus.

In the beautiful sunshine of the summer afternoon the time passed all too quickly and as the party began to move back to Hawk Bridge, all agreed that it had been a very pleasant and worthwhile visit.

THE DEGLACIATION OF SOUTH WEST CUMBERLAND - EXCURSION REPORT.

Saturday, September 28th., 1968. Director, Dr. R.A. Smith.

---oooOooo---

The excursion, which was intended as a follow-up to the article in the last issue of these Proceedings, was to study glacial features on Muncaster Fell and in the Corney/Bootle areas of South West Cumberland. Many features in these areas, particularly the systems of glacial drainage channels, seem capable of re-interpretation. (Vide Proceedings of the Cumberland Geological Society, Vol. 2, Part 2 (1967) pp. 76-83.)

Some general points on the glaciation of South West Cumberland.

The whole area was heavily glaciated by both Lakeland and Irish Sea ice - ice from the westward facing Lakeland valleys joining up with southward and eastward pressing ice from the sea. Many parts of this area show signs of erosion - e.g., the summits of Muncaster Fell, Birkby and Waberthwaite Fells.

Deglaciation was accomplished largely by a gradual melting down and thinning of the ice sheets, the relief gradually emerging as the ice became confined to valley glaciers and stagnant patches.

Meltwater movement was generally southwards, most of the water flowing

KEY TO FIG. 1.



GLACIAL DRAINAGE CHANNELS.



ILL-DEFINED CHANNELS.

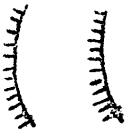


GLACIALLY ERODED AREAS.



MAJOR SPREADS OF FLUVIO-GLACIAL DEPOSITS (SANDS AND "SCALE DELTAS").

ICE SIDE



ICE FRONTS SUGGESTED BY THE GEOLOGICAL SURVEY I-VI (GOSFORTH MEMOIR, FIG. 15, p. 98.)



CONTOURS AT 100' INTERVALS.

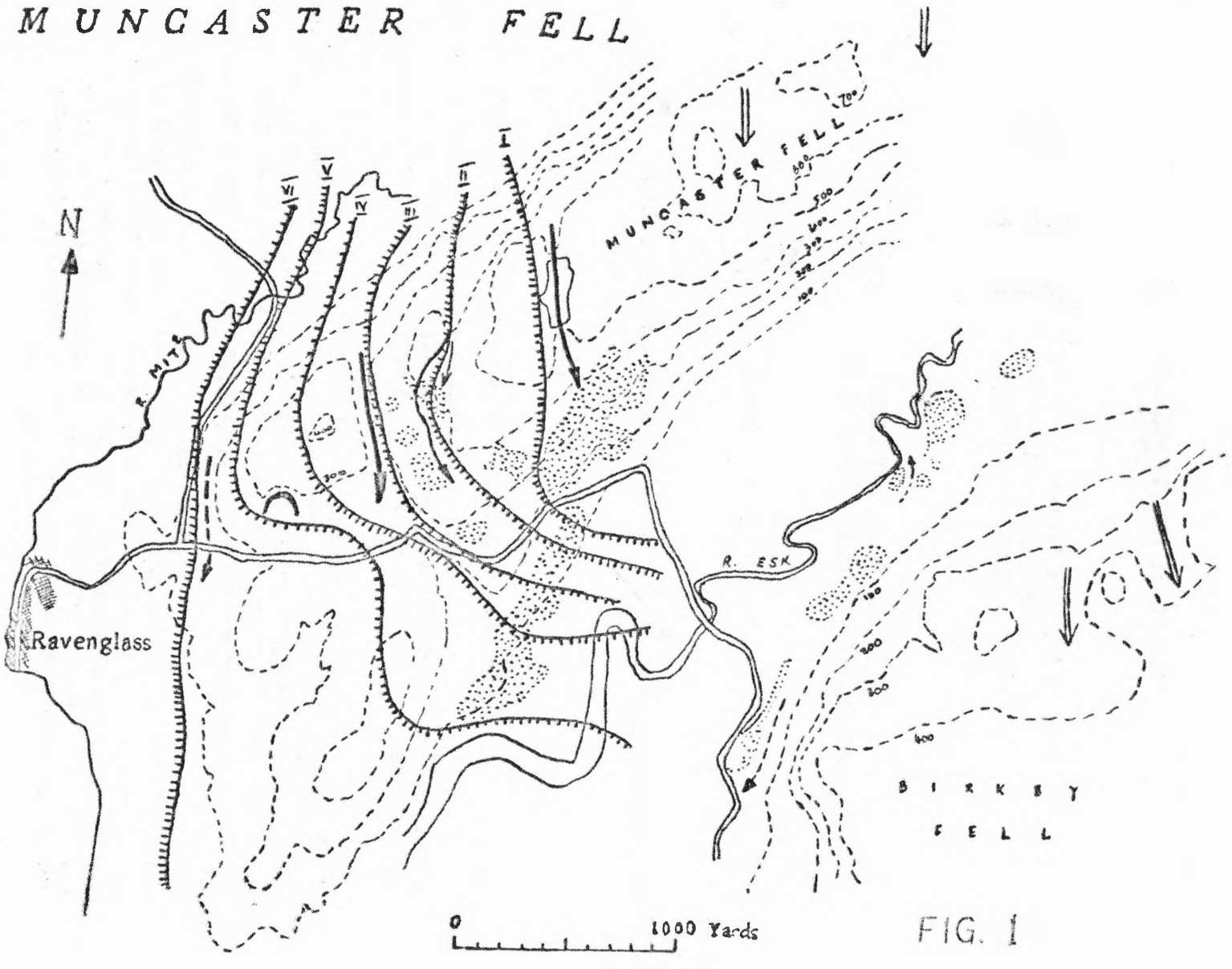

MUNCASTER FELL
N
R. MITE
MUNCASTER FELL
R. ESK
Ravenglass
BIRKBY FELL
0
1000 Yards

FIG. 1

in channels beneath, through or over the ice. Large pro-glacial lakes were not impounded (i.e., Lakes Wasdale, Eskdale, etc.), although it is likely that minor temporary lakelets did exist. The passage of both ice and meltwaters southwards was noticeably affected by the westward pointing mass of the Black Coombe Fells.

Muncaster Fell (Fig. 1).

This must have emerged as a nunatak as the surrounding ice sheets downwasted. All the channels on the Fell flow southwards falling steeply downslope. They would appear to have been produced by meltwaters plunging southwards down the fell slopes and then burrowing into or beneath the ice. The 'scale delta' features on the southern face of the Fell generally lack true deltaic bedding and would appear to have been deposited sub-glacially. The high col channels on the crest of the Fell could be superimposed features.

Corney/Bootle Area (Proceedings 1967, pp. 78-9, Figs. 1 & 2.)

The pattern of glacial channels here is very complex, much more complicated than mapped by earlier workers. The channels appear to have been cut sub-glacially, probably close to the margins of the ice. The evidence for this can be summarised as follows:-

(a) General lack of evidence of large ice-dammed lakes - shorelines, deltas, deposits, etc.

(b) Height difficulties of the intake and outfall ends of many of the channels.

(c) The system is too complex to be explained in terms of oscillations of ice fronts.

(d) The pattern of channels - multiple intakes, cross-cut channels, rapid changes in direction.

(e) Channel gradients - considerable variation, possible sections of uphill gradients.

(f) Existence of extensive glacial deposits on the higher slopes of the Waberthwaite Fells.

About a dozen members (a disappointingly small turn out for what was to be an excellent excursion) met Dr. Smith at the Memorial at Ravenglass. The channels on Muncaster Fell were visited first, surprise being expressed at the depth and abruptness of the major ones. The Home Farm 'in-and-out channel' aroused considerable interest.

After lunch the Corney system was followed from north to south, the director commenting on possible causes and interrelationships in the system and pointing out depositional features on Waberthwaite Fell. The last area to be visited was the inlier of Borrowdale Volcanics on the fellside east of Bootle. Some striking channels, with crosscuts, are to be seen here, the steep and often craggy sides showing the great erosive power of the meltwater and the flat and boggy floors containing small, misfit streams.

In conclusion, the thanks of the members were accorded to Dr. Smith for a carefully prepared and well conducted day's fieldwork.

Further field meetings were held during the year as outlined below, but the editor regrets that no reports of these have been received.

Saturday 6th. April, 1968. Visit to new exposures of Skiddaw Slates on the Forestry Commission roads of the Knock Murton area.

Tuesday 7th. May, 1968. Visit to a United Steels Company mobile drilling rig near Calderbridge.

Tuesday 2nd. July, 1968. Visit to Rowrah Quarry, Carboniferous Limestone.

Late July, 1968. Weekend camping excursion, Carrock Fell area.

Although a short report was offered of the visit to the Ennerdale Granophyre held on Sunday 19th. May, 1968, the director intimated that a paper on the area was in course of preparation. In view of this and the fact that a previous visit to the area was reported in Proceedings 1962 No. 2, pages 3-5, a report seemed inappropriate at this stage.

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LECTURE PROGRAMME

The November meeting of the Society was held at Whitehaven College of Further Education. The lecturer was Mr. R. Kay, B.Sc., F.G.S., of the National Coal Board, his subject being "The Geological Search for Coal in the Alston Area of Cumberland".

Mr. Kay introduced his subject with a brief resume of the ideas about the formation of coal, and the alteration of peaty material to lignite, bituminous coal and anthracite as water and volatiles were lost. This led to an explanation of the rank of coal, depending on the oxygen content. The smaller the amount of oxygen in a coal the higher its rank, and it is this factor that determines the use to which coal may be put and the commercial value of a coalfield. Generally coals of lower rank are used as domestic fuels, and those of higher rank used industrially.

The lecturer then went on to demonstrate that the principal factors determining the rank of a coal are Overburden and Tectonics, and here it has been proved that increased pressure has a more profound effect than thickness of overburden. Other factors are the early effects of bacteria and the age of the coal. Mr. Kay quoted numerous facts to illustrate his points, one of which was that the increase of temperature with depth in the continent of Europe averages 50°C. per mile, and that the ranks of coals increase in proportion to depth.

The National Coal Board was exploring the Alston area for anthracite, Mr. Kay being one of the team of geologists. He explained that the N.C.B. was in this "thoroughly mined" area for two main reasons. The first was that anthracite was in short supply, and the Alston Moor area showed much

evidence of numerous small deposits of good quality coal suitably situated for opencast mining. Secondly the proximity of the Pennine Granites which have had the effect of raising the rank of coals in the area.

Mr. Kay concluded his lecture by mentioning that the programme of exploration in West Cumberland had resulted in very satisfactory reserves of opencast coal being found, so much so that the team had practically worked themselves out of a job in the area. This had led to their present work of a more specialised nature in the Alston area.

The December meeting of the Society was held at Workington College of Further Education, the speaker being Dr. T.I. Elliott, B.Sc., Ph.D., the mining engineering geologist at the Solway Chemicals Anhydrite Mine.

With the aid of photographs and drawings shown to the audience with the epidiascope, Dr. Elliott detailed the development of the mine, the proved reserves of which promise a life of at least 200 years at the present rate of extraction of 650,000 tons per annum.

British deposits of anhydrite, which have only been exploited within recent years, are really vast. There is, for instance, a huge deposit some thirty miles wide extending beneath Yorkshire. The deposits near Whitehaven have been proved to extend some three miles beneath the Irish Sea, and down the coast as far as Barrow in Furness. The anhydrite whose commercial value is due to its sulphur content is used in the manufacture of sulphuric acid, the process being rendered economic by the marketing of clinker residues in the form of cement. The mineral has resulted from the drying out of an inland sea under extremely hot arid conditions in Permian times. Evidence of this Permian desert is further seen in bands of blown sand occasionally found in the anhydrite.

The Solway Chemicals Mine is working near the shoreline of this ancient Permian sea, with plans to work towards the centre of the basin, out under the Irish Sea - a familiar pattern of mining in the Whitehaven area. From relatively small beginnings and using primitive equipment by present day standards, the mine has developed into a highly mechanised and efficient undertaking. The anhydrite is blasted to form a grid of tunnels, unworked pillars of the mineral supporting the roof. It is loaded mechanically into giant diesel transporters which convey it to the underground primary crushing plant and thence to the surface by continuous belt.

Plans for the future include the underground mining of shale, necessary in the cement-making process, at present obtained from an adjacent quarry inthe factory area.

At the January meeting of the Society, held at Whitehaven College of Further Education, Mr. J. R. Rodgers, B.Sc., F.G.S., of the Queen Elizabeth Grammar School, Penrith, gave a very entertaining lecture entitled "The Geology of South East Norway". With the aid of some beautiful colour slides the lecturer showed how a team from Reading University had mapped this very lovely area of the country.

The rocks are Pre-Cambrian, metamorphosed sediments which have been brought up to the surface by faulting and erosion. No reasonable topographical maps were available for the team to start with, so a method of dividing the area into a grid with the aid of aerial photographs was evolved. The process proved to be extremely interesting, for example a fault could be clearly followed in a photograph shown by Mr. Rodgers. Similar photographs of the Lake District would be revealing; for example an aerial view of the fault line holding the central lakes and ending up against Great Calva would make very interesting viewing.

The rocks being mapped by Mr. Rodgers were mainly garnetiferous quartzites, anciently metamorphosed sandstones and clays. There had also been some volcanic activity, and several small volcanic bosses were found, themselves showing evidence of metamorphism. Many veins of pegmatite were found formed by invasion of overlying rocks by superheated fluids and thought to be late Pre-Cambrian in age.

At the present time the countryside of South East Norway is heavily wooded, making mapping difficult, but certainly providing some beautiful scenery.

R. E. O. P.

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The Editor wishes to remind members that the next issue of the Proceedings is due to be printed early in 1970, and material for inclusion should be forwarded to the General Secretary not later than October 31st. 1969.

Reports of Field Meetings should be sent to the Excursion Secretary.

ANNUAL GENERAL MEETINGS

In order to save space shortened reports of the Annual General Meetings of the Society held on February 13th. 1968 at Whitehaven College of Further Education and in February 4th. 1969 at Workington College of Further Education are given below.

The General Secretary's Report

From my notes of previous Annual General Meetings I see that I have always commenced in the same manner, by commenting on the growth of the Society. This is my eighth report to the Society as General Secretary and I would again emphasise that the Society has increased its membership by leaps and bounds. For instance, there were 164 members in 1964, by 1967 membership had grown to 265 and it is confidently expected that we shall soon have over 300 members. The Society now enjoys a nationwide reputation with the Proceedings and other publications in considerable demand. This growth of the Society from a small "Geology Group" under the leadership of the late Charles Edmonds and our President, Mr. Shackleton is due in no small way to the efforts of the Officers and Council of the Society. It is a fact, I feel sure you will all agree, that a largely amateur Society such as this could not continue to function without the countless hours of work done by the Officers on its behalf.

This preamble leads me to make the inescapable point that the size and scope of the Society has greatly enlarged, but the number of people willing to help out with the organisation and planning is still as small as it was eight years ago. I do appeal to ordinary members of the Society to offer to take a more active part in the running of the Society. The Editor is finding difficulty in persuading members to write for the Proceedings. The Excursion Secretary cannot be expected to think up, organise and run all the many excursions. I feel it is high time I was replaced. Not that we are losing interest in the Society, but we realise that the surest way for any organisation to stagnate is to have the running of it confined to too few people for too long. I do therefore urge members to come forward with offers to lead excursions, or to deliver lectures, or to help in any way.

The Officers and Council Members are:

President,	Mr. E.H. Shackleton, F.G.S.
Vice President,	Mr. H. Bland.
General Secretary,	Mr. R. E. O. Pearson.
Excursion Secretary,	Mr. R. H. Hewitt.
Treasurer,	Mr. H. A. White, B.A.
Publications Secretary,	Mr. K.R. Baker, succeeded by Mr. W. E. Harrison, B.A.
Editor,	Mr. T. Shipp, B.Sc.
Librarian,	Mr. M. F. Burton.
Members of Council,	Miss D. Slater, Messrs. H.H. Walmsley, G. S. Gowing, M.A., F.G.S., G. Wood.
Associate Members' Representative,	Mr. Launder.
Auditor,	Mr. M. B. Dodd, M.A.

Our thanks are extended to the retiring council member, Miss E. Pimblett.

The indoor meetings of the Society have followed the usual pattern with two evenings of geological films, an informal "soirée" held at Cleator School by the kind invitation of the Headmaster. Here members were able to see the progress being made by the Schools' Geology group organized by Mr. Walmsley, and to inspect the mineral collection. The evening was made even more enjoyable by the provision of refreshments by some of the lady members of the Society. Less informally, well attended lectures were given on the proving of coal deposits, the mining of anhydrite and the geology of S.E. Norway. The 1968 Annual Dinner, held at the Skiddaw Hotel, Keswick, saw a break with tradition. It was an informal affair with no guest speaker but instead a showing of members' colour slides arranged by Mr. H. H. Walmsley. To the 1969 Annual Dinner, at the same venue, we welcomed Dr. and Mrs. A.W. Woodland as our guests.

The excursions have been well run and fairly well attended.

The finances of the Society are in a healthy state, thanks to the careful work done by the Honorary Treasurer, Mr. White, who has undertaken the additional task of handling membership applications and keeping the records of membership up to date.

The publications have sold extremely well, and our thanks are due to Mr. Baker who is the retiring Publications Secretary for the hard work he and his family have done in duplicating, assembling and distributing our publications.

The "Proceedings" are going to be late this year. I suspect the reason is largely due to the lack of material to publish. It is unfair to expect the Editor to write excursion and lecture reports, as well as to deal with articles of general interest. Members can and should help him by submitting reports of activities, preferably before the end of October so that the "Proceedings" can be made ready for issue by the beginning of January.

In conclusion I would like to extend the Society's thanks to the Principals of Whitehaven and Workington Colleges of Further Education who have kindly allowed us to use their premises, as well as to all lecturers, directors of excursions, projectionists and others who help to promote the activities of the Cumberland Geological Society.

R.E.O. Pearson.

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The Honorary Treasurer's Report for 1967

It is pleasant to report that the financial affairs of the Society are in a satisfactory condition. Our income from subscriptions received during 1967 amounted to £98 compared with £76 in the previous year and with £52 in 1965. This reflects a steady increase in membership. It would appear that the subscription income is adequate to cover the expenses of running the Society, including the production of the annual "Proceedings".

The entry under "Donations" includes the gift made annually under Covenant by Sir Frank Schon as well as generous gifts made by several members.

Sales of publications total almost exactly the same sum as in 1966. We are indebted for this part of our income very largely to the efforts of the

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 2nd. JANUARY 1968

1966 £.	EXPENDITURE				1966 £.	INCOME			
(49)	Stationery, stencils & materials for publications	43	4	1	(99)	Balance at Bank on 2nd. January 1967	73	7	2
(28)	Postages	39	16	3	(76)	Subscriptions: Arrears, 5 Members, 2 Institutions & 1 Associate 3 15 0			
(6)	Subscriptions to other Societies: Geol. Assoc.	4	0	0		1967, 89 Members 44 10 0			
	L. D. Nat. Trust Ltd.	1	1	0		40 Associates 10 0 0			
	W. Cumb. Tech.Soc.	3	10	0		6 Institutions 3 0 0			
(--)	"Amateur Geologist"(2)		5	6		In Advance,			
(--)	Typewriter	15	0	0		51 Members 25 10 2			
(--)	Fees for projectionist (Workington College)	3	0	6		39 Associates 9 15 0			
(31)	Annual Dinner	50	12	0		3 Institutions 1 10 0			
	Cheque Book		5	0			98	0	2
	Bank Charges		12	6	(11)	Donations	10	1	9
(73)	Balance at Bank on 2nd. January 1968.	120	17	2	(53)	Sales of publications including postages	53	5	11
					(27)	Annual Dinner	47	5	0
					(--)	Refund of postages		4	0
		£282	4	0			£282	4	0

STATEMENT OF ASSETS AND LIABILITIES AT 2nd. JANUARY 1968.

LIABILITIES				ASSETS			
Subscriptions for 1968 & 1969 paid in advance	36	15	0	Balance at Bank 2/1/68	120	17	2
Reserve for Postages for 1967 Proceedings	10	0	0	Duplicator	15	0	0
Sundry creditors	50	0	0	Stocks of stencils & styli	3	10	0
				Stocks of publications (nominal price, less 50%)	70	0	0
				Typewriter	10	0	0
Balance, being excess of assets over liabilities	148	12	2	Sundry debtors	26	0	0
	245	7	2		245	7	2

THE CHARLES EDMONDS MEMORIAL FUND

	INCOME	EXPENDITURE
Balance at Bank on 2nd. January, 1967	7 14 9	
Interest for one year on 3½% War Stock (nominal value £146 4 11)	5 2 4	
Charles Edmonds Memorial Prize awarded in 1967		4 4 0
Balance at Bank on 2nd. January 1968		8 13 1
	£12 17 1	£12 17 1

AUDITOR'S CERTIFICATE, dated 28th. January 1968.

I hereby certify that I have examined the accounts, the bank statements and cheque books, cash books and receipt books and other financial documents of the Cumberland Geological Society. I further confirm that I have found them in good order and correct in every particular.

(signed) M. B. Dodd
Honorary Auditor.

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continued:

Editor in preparing the stencils from which our publications are printed, and of the Publications Secretary in duplicating, binding and despatching them.

On the expenditure side of the accounts there is little need for comment. The purchase of an excellent secondhand typewriter was designed to assist the General Secretary.

It is satisfactory to note that the balance at the Bank was £120 at the end of the year compared with £73 at the beginning, but it should be remembered that large quantities of materials needed for the printing of the "Proceedings" were received towards the end of the year and bills for these had not been sent to us before the accounts were made up.

The Charles Edmonds Memorial Fund account does not call for much explanation. The Principal is invested in 3½% War Stock and yields interest of £5 2 4 each year. During 1967 the first award of a Charles Edmonds Memorial Prize was made.

The Statement of Assets and Liabilities shows that the chief assets are the duplicator, typewriter and stocks of publications. All these are subject to depreciation and are probably worth more than the book value shown. The item "Sundry Debtors" refers to stocks of our publications held by book sellers and other customers and not yet paid for. The final figure of estimated assets over liabilities, £148, is almost identical with that at the end of 1966.

H.A. White.
Honorary Treasurer.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDING 1st. JANUARY 1969

1967 £	EXPENDITURE				1967 £	INCOME			
(43)	Stationery, stencils & materials for publications	64	8	3	(73)	Balance at Bank on 2nd. January 1968		120 17	2
(40)	Postages	31	18	5	(98)	Subscriptions			
(9)	Subscriptions to other Societies: Geol. Assoc.	4	0	0		Arrears 3 0 0			
	L. D. Nat. Trust Ltd.	1	1	0		1968 91 members 45 10 0			
(--)	Hire of room at Whitehaven Library		5	0		53 associates 13 5 0			
(3)	Projectionist fees at Workington College	1	8	0		5 institutions 2 11 2			
(--)	Soirée at Cleator School		10	6		In advance			
(6-)	Caretakers' gratuities		12	6		27 members 13 10 0			
(--)	Refund of subscription		10	0		22 associates 5 10 0			
(--)	Travelling expenses	2	0	0		1 institution 10 0			
(--)	Purchase of hammer		18	0				83 16	2
(--)	Hire of films	2	5	0	(10)	Donations		10 10	9
(1)	Bank Charges		18	0	(--)	Sale of hammer		1 3	0
(121)	Balance at Bank on 1st. January 1969	206	10	6	(53)	Sales of publications including postages		100 18	1
		317	5	2				317 5	2

STATEMENT OF ASSETS AND LIABILITIES AT 1st. JANUARY 1969

LIABILITIES				ASSETS			
Subscriptions for 1969 & 1970 paid in advance	19	10	0	Balance at Bank on 1st January 1969	206	10	6
Reserve for materials to produce Proceedings for 1968	40	0	0	Duplicator	10	0	0
Reserve for postages for 1968 Proceedings	10	0	0	Typewriter	7	10	0
				Stocks of stencils & styli	1	0	0
				Stocks of duplicating paper	3	0	0
Balance being excess of assets over liabilities	222	10	6	Stocks of publications at nominal price, less 50%	64	0	0
	292	0	6		292	0	6

THE CHARLES EDMONDS MEMORIAL FUND

Balance at Bank on 2nd. January 1968 (including 2s. 4d. Bank Interest for 1967)	8	15	5
Interest for 1 year on 3½% War Stock (nominal value £146 4 11)	5	2	4
Bank Interest for 1968		10	5
	14	8	2

AUDITOR'S CERTIFICATE, dated 23rd. January 1969.

I hereby certify that I have examined the accounts, the bank statements and cheque books, cash books and receipt books and other financial documents of the Cumberland Geological Society. I further confirm that I have found them in good order and correct in every particular.

(signed) M. B. Dodd. (Honorary Auditor).

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The Honorary Treasurer's Report for 1968.

Financially the affairs of the Society continue to be in a very satisfactory state. It will be seen from the accounts that we ended the year with a balance of £206, compared with £121 at the corresponding time at the end of 1967. Two factors, however, must be kept in mind which qualify this apparently satisfactory position.

One is that the "Proceedings" for 1968 have yet to be produced, and the cost of materials will be considerable. In the Statement of Assets and Liabilities a sum of £40 has been set aside to cover this and a further sum of £10 for postages.

The second factor to be borne in mind is that the rise in our bank balance is mainly the result of a striking increase in sales of publications. These brought in £100 as compared with £53 in the previous year but most of this was due to a single large order which is hardly likely to be repeated, and which may in fact be regarded as in the nature of a windfall. The recently formed Association of Teachers of Geology decided to supply each of its members with a copy of our 1967 "Proceedings" as an example of the type of publication a small society like ours is able to produce.

It will be seen that income from members' subscriptions is somewhat reduced as compared with 1967, but broadly our subscription income is quite adequate to cover our expenditure, though costs of materials and postages continue to rise.

The item "Donations" is chiefly made up of the generous gift made under covenant by Sir Frank Schon and now continued by the Marchon Chemical Company.

The Statement of Assets and Liabilities shows a healthy position, since in spite of depreciations, the balance has increased over the year by £74 to £222.

H. A. White.
Honorary Treasurer.

BOOK REVIEW

RAYNER, Dorothy H. The Stratigraphy of the British Isles. Cambridge University Press, 1967. (x + 450pp.) 70/-.

This book should be in the possession of every amateur who has a really keen interest in Geology. It will enable him to understand how his local rocks compare with rocks of similar age in other parts of the country and will enable him further to find out about the geology of any area in the British Isles where he may wish to spend a holiday.

While it is, of course, primarily a text-book for serious students, the author has, as she states in her preface, aimed (and there is little doubt that she has succeeded) in "making the subject intelligible to those with little previous knowledge of it, but some acquaintance with the broad principles of Geology. Such an acquaintance can be gained from Read and Watson's Introduction to Geology, Vol. 1 (1962) or Holmes' Principles of Physical Geology (2nd. edn., 1965) - to name but two recently published works."

There is no doubt that this book can be readily understood by the intelligent layman (given some grounding as is suggested) and the book is in a different class from the "popular" books aimed at such people, many of which are over-simplified and sometimes not too accurate in their details. Too often such books are written by geographers and others with no very profound knowledge of geology. What the amateur geologist wants is exactly what this book is, a text-book, written by a geologist for students, but written in a language that the layman can understand.

Being completely up to date, it is a book invaluable for consultation when reading, for example, such a book as the reprinted Marr, Geology of the Lake District, in order to make sure that any ideas expressed by an older author are not now outdated.

Naturally it makes no attempt to pinpoint exposures of rocks that the author is discussing, but the numerous sketch-maps show one what to expect in a surprising number of areas throughout the country.

Since it is a text-book of stratigraphy, it takes one, chapter by chapter through the stratigraphical sequence starting with the Pre-Cambrian and ending with the Pleistocene. It therefore makes it easy to find out where rocks of any particular are are to be found in different parts of the country. The last chapter is devoted to a resume of such subjects as Palaeogeography, Palaeoclimates and Continental Drift. There is a useful appendix showing stratigraphical divisions and the zones into which they are divided on fossil evidence. There are some 15 pages of references and a thoroughly adequate index running to another 20 pages.

G. S. G.