

mastered by a few months' residence in a neighbouring country, whilst the other had done more to develop true culture than almost all other writings since. It is not proposed simply to substitute German or French for Greek, the advantages to be derived from which are now fully absorbed into the spirit of the nation, but, by the change, to leave a sufficient time, in addition to the education in modern languages, for the study of the Natural Sciences during the school-boy period. That the dead languages form an excellent mental training no one doubts, but that Physics and Chemistry do the same is daily becoming more certain; and the time is not far hence when the facts and methods of Physiology and Comparative Anatomy will be so well known and assorted, that they may be placed in the same category.

THE SOUTHERN UPLANDS OF SCOTLAND*

THE range of hills, which in Scotland extends from the German Ocean to the Irish Sea, having a N.E. and S.W. direction, has been aptly designated the Southern Uplands. This range is nearly parallel in its course to that of the Highlands proper. It exhibits hills, some of which attain to an elevation approaching nearly 3,000 feet; but its physical features, although marked in many localities with scenes of great beauty, are devoid of the stern and rugged grandeur which characterises the more northerly mountains of Scotland. The hills of this range usually consist of rounded and grass-covered undulations, or long tracts of plateaux. They have been specially named the "pastoral district of Scotland," and their scenes have furnished subjects for many a pastoral song, and many a border ballad.

The Southern Uplands of Scotland are cut deeply into by some of the streams which flow into the Solway Firth, the Esk, the Annan, the Nith, the Urr, and the Dee being the most important of them. They are drained on the southward side by the Cree and the Luce; on the northward side they are the sources of the Ayr; and the Tweed and its tributaries drain a large portion of their north-east area.

In the early period of Scotch geology, the days of Playfair and Hutton, the Southern Uplands were regarded as affording no traces of the evidence of life in the rocks which compose them; and these rocks were referred to the "primary" group. It was not until the discovery of fossils in a limestone which occurs at Wrea in Peeblesshire, in their higher portion, by Sir James Hall, that the rocks which formed these hills were assigned to the "transition" age. The terms "primary" and "transition" have now ceased to be applicable to the nomenclature of geology; and the discovery by Prof. James Nicol in 1840, in the flaggy beds of Greiston in Peeblesshire, of graptolites, indicated the Silurian age of the strata here. Since the discovery of Nicol, several geologists have added greatly to our knowledge of the rocks which compose the Southern Uplands. Other bands of graptolites have been found richer in fossil contents than those first discovered; and these, along with a few other forms of organic remains, have still further confirmed the Silurian age of the

great mass of strata which make up the hilly country in the South of Scotland.

The result of the observations made on the rocks of the Southern Uplands up to the period when they came under the notice of the Geological Survey of Scotland led to the conclusion that the lowest strata exhibited were referable to the Llandeilo age. That these Llandeilo rocks were succeeded by deposits containing fossils, as in the case of the Wrea limestone, indicating the horizon of the Bala or Caradoc rocks, was also known—and certain rocks which occur near the north-western margin of the area in the neighbourhood of Girvan in Ayrshire, have been referred by Sir Roderick Murchison to a still higher position in the Silurian series.

The labours of the Geological Survey of Scotland have not only confirmed these conclusions, but have added greatly to our knowledge of the nature of the Silurian rocks of the South of Scotland. They have also furnished subdivisions of these rocks, and a more ample account of their arrangement and fossil contents.

Every geologist familiar with the lower portions of the Silurian rocks of the Southern Uplands, the Llandeilo strata, had experienced great difficulty in recognising horizons, in this series, such as would enable him to divide these rocks into distinct portions. It is true that bands of anthracitic shale abounding in graptolites were, as regards their petrological nature, very distinct from the rocks in which they were intercalated. The great mass, however, of the Llandeilo beds of the Southern Uplands consist of rocks known in old petrological nomenclature as "greywackes"—a name which is still retained for want of a better—and as these rocks differed only in coarseness, and sometimes in colour, this circumstance rendered the division of the South of Scotland Silurian rocks into separate groups extremely difficult. And when it is added to this that contortions have greatly folded and denudations have largely planed off the edges of these rocks, the difficulty of making out distinct horizons among the Llandeilo strata of the South of Scotland becomes very apparent. It is only by a careful, continuous, and long series of observations recorded in maps large enough to show all the contortions, the ins and outs of the strata, that these rocks could be brought into subdivisions enabling them to be recognised. Such have been the work of the officers of the Geological Survey of Scotland; and now we have in the explanatory notes to some of the sheets which have been published, the results of their work recorded, and the subdivision of these Llandeilo rocks indicated.

The explanation to Sheet 15, published in 1871, which includes, among other matters, a description of the Llandeilo rocks occurring in that portion of the Southern Uplands occupied by the north-west part of Dumfriesshire, the south-west portion of Lanarkshire, and the south-east portion of Ayrshire, contains the results of the labours of the Survey among these rocks. There do not appear, in any portion of the South of Scotland Silurian strata, any rocks which appertain to an age older than the Llandeilo; and these Llandeilo rocks are referable only to the Upper Llandeilo series, the Lower Llandeilo or Shelve rocks of Murchison, the Arenig rocks or Skiddaw slates of Sedgwick, being unknown in the district. This Upper Llandeilo series exhibits itself in the

* Memoirs of the Geological Survey of Scotland, Sheets 1, 2, 3 and 15, &c. Explanations of, 1871, 1872, 1873;

form of an anticlinal axis near the southern border of the Silurian area. This axis can be well seen in Roxburghshire and Dumfriesshire, having a north-east and south-west direction. It has also been recognised by the officers of the Geological Survey in Wigtonshire; and the rocks which it exhibits, which are the lowest in the Southern Uplands, have been designated by Prof. Geikie the "Ardwell group." This group is made up of "hard, well-bedded greywackes and grits, with bands of hard shale or slate. These rocks have a prevailing reddish or brownish hue, especially on weathered surfaces."

As seen in Dumfriesshire and Roxburghshire these low rocks have the same aspect and nature. They have afforded, both in Wigtonshire and Dumfriesshire, markings which have considerable resemblance to the fossil described by McCoy as *Protovirgularia*, and in Roxburghshire they have yielded crustacean tracks, but no other traces of organic remains have been obtained from them.

Above the Ardwell group the officers of the Geological Survey recognise a mass of strata to which they have given the name of the "Lower or Moffat Shale group." This group is composed of "flaggy greywacke and grey shales," which are distinguished by the occurrence in them of several bands of black carbonaceous shales. These strata are well developed in the neighbourhood of Moffat, Dumfriesshire, from whence they derive their name. The black carbonaceous shales are very persistent, having been traced by the officers of the Survey from near Melrose to the western shores of Wigtonshire, "a distance of more than 100 miles." Three bands of carbonaceous shales can frequently be made out, but occasionally they come together so as to form one thick band. These bands are very prolific in graptolites. They have, from their carbonaceous aspect, induced many persons, under the guidance of "practical miners," to expend large sums of money in search after coal, and some of the spots where they have been worked are known under the name of "coal heughs."

Although the Moffat group is well developed through the greater portion of the Southern Uplands, it is on the coast of Wigtonshire that the best sections of the series can be seen. Here they are recognised resting on the Ardwell group, having at their base "grey and reddish shales, and clays, with calcareous bands and nodules, and enclosed bands of black shale, the lowest members being hard and flaggy." The second member of the Moffat group, as seen on the Wigtonshire coast, consists of black shales with intercalated clays, like the fire-clays of the coal-measures. Calcareous nodules and lenticular bands are also associated with the black shales, the whole being so intensely plicated as to render an attempt to determine their thickness extremely difficult. Upon the black shales well-bedded greywacke and grits occur with occasional shaly partings. These are succeeded by black shales so much jumbled and jointed, that their thickness cannot be made out. The next sequence consists of grey flagstones, flaggy sandstones, and grits, in beds of varying thickness up to 3 or 4 ft., with abundant partings of grey shale. To these succeed a thick band of finely laminated grey shale, 3 or 4 ft. Black shales, bands 12 to 18 ft. in thickness, occur next, and the highest members of the group consist of fissile shales.

The Moffat group, as represented in Wigtonshire, has a thickness of about 1,000 ft., of which more than half consists of flaggy greywacke beds. The underlying series, the Ardwell group, probably attains to a much greater thickness.

The third member of the Upper Llandeilo rocks of the Southern Uplands of Scotland, like the second, derives its name from Dumfriesshire. It is well exhibited in the hill called Queensberry, and has been designated the Queensberry grit group. The characters of this third member, as they are seen in Wigtonshire, "consist of greywacke and grits in massive courses, with occasional bands of grey and greenish shales." Massiveness and regularity of bedding and jointing are the characters of this group. The sandstones are often coarse; and sometimes even coarse conglomerates appear, in which some of the embedded fragments are sometimes from 2 ft. to 3 ft. in diameter, a feature which distinguishes the Queensberry group from all the other members of the Upper Llandeilo rocks of the South of Scotland. Fossils appear to be absent from this group, no trace of them having been met with in the three parallel bands which traverse Wigtonshire.

In the Dumfriesshire portion of the Upper Llandeilo area of the South of Scotland, there have been recognised, above the Queensberry grit group, black shales with graptolites, the thickness of which have not yet been ascertained. To these black shales the name of Hartfell group has been given. As the typical area where these rocks occur is in the higher part of the Annandale district, the sheets of which have not yet been published, we have at present no account of this group from the Geological Survey.

The Hartfell group is succeeded by the Daer group, which is made up of hard blue and purplish greywacke, and grey shales. It derives its name from a stream flowing from the north side of Queensberry into the Clyde. Its strata are greatly folded, and no reliable estimate can be formed of the thickness of the Daer group.

The Hartfell shales of the Daer group seem to thin out towards the south-west. They have not been distinctly recognised in Wigtonshire, where the Dalveen group, which in Dumfriesshire succeeds the Daer group, is seen resting conformably upon the Queensberry grits.

In Dumfriesshire the Dalveen group consists of fine blue and grey greywacke, and shales having no features distinguishing them from other members of the upper Llandeilo rocks. Their estimated thickness is about 2,900 ft. They are well exposed in Dalveen Pass, Dumfriesshire, whence their name, and in Dinabid Linn they are seen passing under a coarse pebbly rock, "Haggis Rock."

In Wigtonshire the lower part of the Dalveen group is seen overlying the Queensberry rocks south of Corsewell Lighthouse. Here its lower portion is remarkably shaly, but thick masses of greywacke also occur. Among the shaley beds are some bands worked at Cairn Ryan for slates. These slates have long been known as affording graptolites; and another thin band of black shale also containing the same fossils appears in this group in Wigtonshire.

In Dumfriesshire above the Dalveen group a series of

coarse and fine grits and greywacke, having red and green bands of flinty mudstone, conglomerate, and occasional breccia associated with them, occur—a persistent band of conglomerate containing quartz-rock pebbles, Lydian stone, and jasper characterise this group. The conglomerate, being locally known as “Haggis Rock,” has furnished the name to the series, which is about 1,800 feet thick. The Haggis group in Dumfriesshire is seen striking across the river Afton, also, along the N.W. flanks of the Lowther hills, and elsewhere in this county. More to the north it can be recognised along the north-western margin of the Silurian area in Crawfordjohn, Lanarkshire. The Haggis rock is not persistent in its character. To the N.E. this conglomerate becomes much finer in grain, and passes “into a gritty greywacke.” This group has hitherto yielded no fossils. In Wigtonshire the Haggis rock cannot be distinguished as a distinct series; its characteristic conglomerate being, as already seen, of local occurrence, it does not appear to manifest itself in the Silurians in the S.W. of Scotland.

(To be continued.)

LOCAL SCIENTIFIC SOCIETIES

IN very many ways has the general advance of intelligence, elevation of taste, and spread of education been shown during the present century, and more especially during the last thirty years; one of these ways is undoubtedly the increasingly rapid spread of Local Scientific Societies. What we mean by a “Local Scientific Society,” as distinguished from the large Societies of London, is an association of individuals in a particular locality for the common study of one or more branches of science, by the reading of original papers, and what is perhaps of more importance, the actual investigation of the natural history—geology, zoology, botany, meteorology—and archæology of its district. Of the societies established within the last thirty years, nearly all are marked by these characteristics; such at all events is their professed object, and we are glad to say that, to judge from the special reports which we have received, and the numerous printed “Proceedings” of greater or less pretensions which are sent us from time to time, a very large proportion creditably carry out their programme.

In a number of the principal towns of England and Scotland associations exist, dating, some of them, from the end of last century, known as “Literary and Philosophical Societies,” or by some similar title. These are generally comparatively wealthy, possessed of good buildings containing a library, museum, reading-rooms, lecture-hall, &c., with a large body of members belonging to the middle and upper classes. These, however, so far as their original objects are concerned, with one or two exceptions, scarcely come under the category of Local Scientific Societies, in the sense of the definition given above, though many of them, stimulated by the growing taste for Science, have recently added to their usual courses of lectures on literary subjects, others on subjects connected with Science, and have even organised classes for the study, under competent lecturers or teachers, of one or more branches of Science. In some instances, moreover, a few of the members of these respec-

table old associations have united to form societies of a kind which entitle them to be regarded as Local Scientific Societies, and even Field-Clubs. Still, all these older societies, as they existed previous to 1830, differed in many essential respects from the Local Societies and Field-Clubs which began to spring up about that time; even the well-known Literary and Philosophical Society of Manchester, quite on a par with some of the best London Societies, and which has produced original work of the highest value, has been all along confined to the learned and professional men of the city and neighbourhood, who have made use of the meetings of the Society for the purpose of making known the results of their independent scientific investigations.

So far as can be ascertained, the society just mentioned is the oldest provincial society which can be considered as in any way scientific, having been established in 1784, for the purpose of diffusing “literary and scientific intelligence, and of promoting the literary and scientific inquiries of learned men in the town and neighbourhood.” “The results of its labours,” Sir Walter Elliott says, in his valuable address to the Edinburgh Botanical Society, in 1870, on this subject, “were published in ‘Memoirs,’ the first volume of which appeared in 1785, at which time James Massey was president, and Thomas Barnes, D.D., and Thomas Henry, F.R.S., were Secretaries. Five volumes had appeared up to 1802. In 1805 a second series commenced under the Rev. John Walker, President, and John Hall and John Dalton, Secretaries, which had extended to five volumes more in 1860. A third series was commenced in 1862, and has reached volume xiii. The second series is enriched with many papers by Dalton, including the first development of the atomic theory.” In 1858 a microscopical and natural history section was established; the latter, however, we regret to say, is since defunct.

The next society of this class in order of time was instituted at Perth in 1781, as the Perth Literary and Antiquarian Society; we need not say that, so far as eminence is concerned, it was never to be compared with the Manchester Society. It has never done scientific work of any value, though it possesses a handsome building, with a museum, devoted mostly to antiquities, but having a fine natural history collection as well, and a good library. Like many other societies of a similar kind, its building serves as a kind of meeting-place or club, where those members who have nothing to do can meet and have a gossip, and read the papers. This society has published only one volume of “Transactions” (in 1827), but so far as we know, they have now no transactions to record. A few years ago, as will be seen from our list in Vol. viii. p. 521, a Natural Science Society was established in the county, with Perth as its headquarters, which gives promise of being one of the best working Local Scientific Societies in the kingdom.

In 1801 a society of a similar kind was established in the sister kingdom, the Literary Society of Belfast, which has never done anything to call for note here. Previous to this, however, in 1793, the Newcastle-on-Tyne Literary and Philosophical Society was established, which, although it has published only one volume of memoirs, and is little more than the owner of an excellent public library, does good work by providing educational courses of lectures for in-