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LOCH TREIG AND ITS NEIGHBOURHOOD.

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ONE of the most attractive spots in the Scottish Highlands is to be found at Loch Treig in Inverness-shire. Not only is the scenery very grand, but there is a combination of remarkable features that lends an additional interest to the locality. We have here an example of a lake that seems to have been formed by the action of a glacier scooping out a long narrow basin by the erosive action it exerts on the rocky floor of the valley along which it moves. Most people have probably never thought of asking themselves how lakes came to be formed, but the question is one which has been much debated among geologists. Many of our Scottish lakes appear to have originated in the way I have mentioned. In such cases we find that the lake occupies a deep hollow space in the rocky bottom of the valley, along which a glacier moved during the age of ice. Now what could have formed such a basin? Running water could not do it. Rivers in the long course of ages can carve out valleys, but a river cannot dig out a basin hundreds of feet deeper than the ground at the lower end of it. Some of our lakes have been formed by accumulations of moraine-debris left by the old glaciers, acting as a dam, which has blocked the exit of the water from the valley above. But in other cases no such block is to be found, for the stream flowing out of the lake is seen to pass along a rocky channel much higher than

the deep bed of the lake. Furthermore, when we come to consider the general distribution of lakes, we are struck by the fact that they abound chiefly in regions that were formerly overspread by the ice, and are especially numerous in countries that are known to have been occupied by glaciers, such as Scandinavia, Switzerland, Scotland, and the lake district of north England; while they are comparatively absent in tropical regions. No doubt, however, there are lakes that have been formed in other ways, such as by a sinking of the ground caused by subterranean movements; but such lakes are far less numerous, and generally of greater dimensions and wider in shape. The great prevalence of lakes in valleys that are known to have been formerly occupied by glaciers is a suggestive fact pointing to a connection between the two. Robert Chambers seems to have been the first to maintain that ice had been the agent in carving out the hollows in which our lakes lie. When travelling through Sutherlandshire about sixty years ago, he was much impressed by what he saw there, and he read a paper on the subject at the meeting of the British Association at Glasgow in 1855, and contributed an article to the *Edinburgh New Philosophical Journal* about the same time. "We find," he says, "along the mountain sides, and on the gneissic platform whereon the [sandstone] mountains rest, ample memorials of the work of ice, in longitudinal hollows containing *lakes*, all in the same direction as the major axes of the hills, in smoothings, scratches and transported boulders. A geologist acquainted with the glacial phenomena sees that ice has been the agent here. He is forced to own that what his science calls denudation has been wrought on a great scale, not by water as heretofore supposed, but by ice. It required water invested with the increased mechanical powers which it derives from congelation to carve out those prodigious gaps, and sweep away so much of the disengaged matters."—(*Edinburgh Papers,—Ice and Water*. p. 9—1861)

Chambers, however, did not pursue the subject, and it attracted little attention, so far as lakes were concerned, until Professor Ramsay took up the question in a very

interesting paper to the Geological Society of London in 1862, after which it became the theme of much discussion in geological circles.

Loch Treig is a beautiful specimen of a Highland lake, and is a very deep one. This is shown by the fact that it never freezes, but I am not aware whether its actual depth has been properly ascertained yet. At its lower end there is a great quantity of gravelly debris which helps to retain the water, but is not sufficient to account for the deep basin occupied by the lake itself. Much of this gravel has probably been ground out of the bottom of the rocky basin by the ice. Loch Treig is about five miles long in a north-south direction, and about a mile broad at its widest part. Near its outlet into Glen Spean it tapers to a narrow point owing to the near approach of the mountains, which are about 3,000 feet high on each side. A glacier therefore filling the basin of the lake would, on issuing out into Glen Spean, be very much compressed by the narrowness of the gorge, and consequently would act more powerfully on the rocks over which it had to force its way, so that here we might expect to find some tokens of its former presence. Accordingly we observe that the rocks all round the outlet on both sides have a character that attracts attention even at a great distance, being ground down into rounded masses well scored in many places by the action of the ice. One bare surface of gneiss which I observed, about thirty yards long, was beautifully smoothed and covered with parallel scratches, scores and flutings, all running straight from end to end. The preservation of these markings, however, it is right to mention, is exceptional; for in most places only a few of the ruder scores remain, and often none at all. On the angle of the hill at the west side of the lake this ice-worn character of the rock is well marked up to a height of more than 1,000 feet above the lake, and I traced it up to 1280 feet (by aneroid). Not that I can affirm this to be the upper limit, for on the mountain on the opposite or east side of the gorge I found the scoring fade away so gradually at these great heights, owing to the weathering of the rocks, that I was unable to satisfy myself where it ended, perched

boulders and rounded surfaces occurring much higher; and even up to the top, which I made out to be 3,055 feet high, the gneiss rock, although it runs in nearly vertical stratification, is nevertheless so free from any loose fragments on its surface, and is so rounded in outline, as to indicate that the denuding agent had flowed over even it. Nowhere have I seen such impressive evidence of intense abrading force as these rocks present all about the outlet of Loch Treig. The rounded masses are so extensive as to form hills several hundred feet high, and are so smooth and bare that over large spaces even the moss and heather have completely failed to get a footing on their surface.

Agassiz, the Swiss geologist, who first made known to us the former existence of glaciers in this country, and who visited this scene in company with Dr. Buckland, was so struck by what he saw here that he says, "I do not believe a locality exists where the facts indicate in a more special manner the cause which has produced them."

There is, however, still more convincing evidence pointing to the same conclusion in a remarkable series of fine moraines left by the Treig glacier when it issued out into Glen Spean, and these the tourist should not omit to see.

There is a footpath or pony road going eastward from the mouth of Loch Treig along the foot of the hill towards Laggan. Go along this track for a mile and a half from Fersit and you will find yourself at the summit level of the road where it crosses these moraines. Here they start out from the hill into the low wide moor that occupies the bottom of Glen Spean, and from this point they may also be traced slanting far up the slope of the hill towards the gorge of Loch Treig, showing plainly how the pent up ice had dilated on issuing from the narrow outlet between the two mountains that border the lake. These traces should be followed up to the shoulder of the hill, and a wonderfully curious sight it is; but for the present I would ask the traveller, who has come along the base of the hill to the point I have mentioned, to cast a glance out over the moor, Sliabh Lorgach, and he will observe two long narrow mounds running far out into the plain with a gentle

curve. These are the moraines left by the right flank of the Treig glacier as it debouched into Glen Spean. Outside these a series of older hillocks of similar origin may be traced for a considerable distance, showing that the glacier had been at one time of still greater extent, but the two I have mentioned are so large, so continuous, and so well defined as to indicate a long abode of the ice at their margin. The outer one is the larger, rising in some places sixty or seventy feet above its base, and forming a narrow steep-sided mound like a railway embankment. Big stones of all sizes, up to fourteen feet in length, stick out of its surface, mixed with smaller debris of mica-schist and gneiss. The inner moraine runs alongside this one, in some places approaching so close as to mingle with it, in others receding 200 yards or more. It contains less small debris, and is often wholly composed of large blocks of stone, many of them five to ten feet, some fifteen to twenty-five, in length, which give it a very striking appearance, forming a long pile of stones like a ruined pier or breakwater. These two moraines range far out into the moor, becoming gradually less regular, and merging into the boulder covered surface. Their curve seems to indicate that the right flank of the glacier must have crossed the channel of the Spean near a place called Gortain, its front pressing on to the base of the hills on the north side of the Spean, where there are two crescent-shaped moraine mounds running eastward from the spur of Creag Dhubh to near Beinn a' Chaoruinn, apparently a continuation of the two lines I have described, the whole forming a great horseshoe curve several miles in length. These fine moraines, together with the iceworn rocks at the mouth of the lake, afford about as good evidence of the former existence of the Treig glacier as a fossil skeleton does of the former existence of the living animal.

The moraines on the shoulder of the hill at the east side of the Treig particularly attracted the attention of Agassiz. He could never forget, he says, the impression he felt at the sight of these terraced mounds of blocks. "It seemed to me as if I was looking at the numerous moraines in the neighbourhood of Tines in the valley of Chamounix."

Any one who wishes to satisfy himself as to the former existence of glaciers in this country cannot do better than betake himself to Loch Treig, and study the evidence to be found in that neighbourhood. The district has been well mapped by the Ordnance Survey, and a special survey was made of the fine moraines I have been describing. These will be found laid down on sheet 142 of the six inch scale map of Inverness-shire "with gravel beds and lines of boulders."

The line of railway which runs along the side of Loch Treig gives facilities now for reaching the district, which formerly lay rather out of the way of tourists. Many of the corries and glens between Loch Treig and Ben Nevis are of a wonderfully wild and savage nature, almost unequalled in that respect by anything in Scotland; of these I may mention Coire Laire on the west side of Loch Treig. The upper end of this corrie where it meets the Larig Glen is a very fine sight; and so is the Larig Leachach farther west, and still more so Coire an Eoin on the east side of Aonach Mor. These are too little known, and will well repay exploration. And here I may mention that the best time for visiting these western localities is during the end of spring or in early summer, when dry east winds prevail; for during autumn the weather is often dreadfully wet there, especially when south-westerly gales occur.

The lowest of the three parallel roads of Glen Roy extends into Glen Spean, and may be described running along the side of Beinn Chlinaig and past Inverlair on to the Treig, where it has left its mark on the gravel hillocks of Fersit and that neighbourhood. It may also be traced along the front of Creag Dhubb, on the opposite side of the valley. It in fact extends all the way eastward to Loch Laggan, and beyond it to the col or watershed at Makoul, where the outlet of the old glacier lake finally was, as Sir Thos. Dick Lauder first pointed out. Owing, however, to the rough broken nature of the ground, and the circumstance of its being little above the bottom of the valley, the parallel is difficult to trace in its eastward extension beyond the Treig. Here then we have another remarkable feature at

Loch Treig in the occurrence of this parallel road along the exit from it. But there are other circumstances which combine to render the locality one of surpassing interest to the geologist at least. The great Treig glacier not only protruded right across Glen Spean, but rose to a great height on the hills along the north side of that valley. The explanation of this is to be found not in the relative height of the mountains, but in the meteorology of the district. The rainfall and precipitation of snow are much heavier on Ben Nevis and the drainage basin that feeds Loch Treig, than they are on the hills along the north side of Glen Spean and the Loch Laggan district. Hence in the age of ice the result was bigger glaciers, which encroached on and invaded the drier district to the north-east, and left tokens of their former presence in the big stones which they brought along with them and dropped after the ice melted. There is a tract of syenitic greenstone that was swept by the right flank of the Treig glacier, and which has given off an immense quantity of great blocks which the glacier has left along its track. Many of them lie on the north side of the Spean, on Meall Clachach, which means "the hill of stones," no doubt so called from this circumstance. They are also to be found on Creag Dhubh, where there is one big fellow, fifteen feet long, on the very brow of the hill, which may be descried from the Bridge of Roy four miles off. The mineral nature of these fragments being different from that of the rocks on which they now lie, shows that they have been transported for some distance, and enables us to track the course of the agent which carried them, just as the granite blocks on the Jura mountains of Switzerland show the former spread of the Rhone glacier.