Thursday, 27 December 1869.

ARCHIBALD GEIKIE, Esq., F.R.S., President, in the Chair.

The following Gentleman was elected a Fellow of the Society :--

CHARLES LAPWORTH, Teacher, Galashiels.

The following Communications were read :—

- I. *Observations on the Structure of the North-West Highlands.*
By Sir RODERICK I. MURCHISON, Bart., K.C.B., F.R.S., Patron
of the Society.*

Being desirous to contribute, in however small a degree, to the well-being of the Edinburgh Geological Society, I have great pleasure in laying before it the result of a visit to my friend Mr John Fowler, the eminent engineer, who has become the proprietor of a large extent of Highland country at the western end of Loch Broom, in Ross-shire. Possessing a small steam-yacht, he enabled me to make excursions in very fine weather to points which I had before only seen very imperfectly, and in storms.

In this tract, *i.e.*, from the numerous low Summer Isles, which crowd the outermost or western portion of the Sound, the Priest and others of them are composed chiefly of the fundamental gneiss, which in 1859 I paralleled with the Laurentian rocks of North America. Also on one of the promontories of the southern mainland, called Cailleach, this Laurentian gneiss is seen to throw off on its broken edges patches of the coarse reddish brown grit and conglomerate which constitute the southern shore of Loch Broom; the Cambrian grits being thrown off at various steep angles.

Generalised Section from the Summer Isles up Loch Broom to Braemore.

On the northern side of the loch, however, the same Cambrian rocks constitute the whole of the lofty mountain of Ben

* This was the last Geological paper ever written by Sir Roderick Murchison.

More, the strata of which are clearly seen from the water to constitute a succession of terraces very slightly inclined to the east, and thus exhibiting a thickness of several thousand feet. Some of the lowest portions of the Cambrian rocks consist of hard schists.

As a whole these rocks are precisely similar to those of the same age which I had formerly described in Suilvein and Queenaig,* and other mountains of the Assynt region in Sutherland. Their lithological characters are also similar. Thus, the Laurentian gneiss, at the point of Cailleach, is like that of Loch Inver, essentially a hornblendic, tough, thick-bedded gneiss of highly crystalline aspect and more or less of dull greenish colour, occasionally quite finely laminated, and showing by the arrangement of the quartz and felspar within it, a bedded character, with small crystals of garnets occasionally disseminated. At this locality it only differs from the bottom rocks of Sutherland and the Lewis in being less granitic and with fewer interpolations of pure granite.

The Cambrian rocks which overlie transgressively that Laurentian gneiss are essentially, as in western Sutherland, coarse grits, in parts conglomeratic, and made up of the materials of the older gneiss, *i.e.*, of quartz, hornblende, and felspar, but, like the parent rock from which they have been derived, they contain little or no mica. These sandstones and grits, for the most part of a chocolate reddish brown colour, are those which were formerly identified with the Old Red Sandstone, from which, as I have shown elsewhere by transverse sections and descriptions, they are separated by the whole series of Lower Silurian rocks in a crystalline form. The lowest members of these Lower Silurian rocks are white and grey quartz rocks, regularly stratified with intercalated bands of limestone.

This lower portion of the Silurian series overlaps quite unconformably on the Cambrian rocks on both sides of Loch Broom, and these relations are well and clearly seen near Ullapool, where the overlying quartzites assume a much higher inclination than the sandstones on which they rest.

I had too little time at my disposal (and my days for fossil-hunting are past) to enable me to find any organic remains, but I commend my young friends of the Edinburgh Geological Society to visit Ullapool by sea, and there try in the limestones, which occur about two miles north of the village, to detect some organic remains, which, if found, will assuredly be like those of Assynt and Durness, on the same geological horizon.

In ascending Loch Broom to its western extremity at the mouth of the river Broom, nothing can be clearer than the

* See *Siluria*, Frontispiece, including Queenaig.

underlie of all the rocks hitherto mentioned to the Upper gneiss of the region in which is situated the glen of the river Broom, with the mountains on either side of it.

There is, however, one intermediate spot above Ullapool where the loch narrows, and where the promontories on either side (one of which is called Loggie) consist of diversified rocks, apparently the result of separate intrusion and metamorphism. In these I met with dark diorites passing into serpentinous rocks, light green granular felspathic lumps, and here and there compact felspar rocks of pinkish hue. These convulsed and broken spots, where the hard rocks have resisted denudation, and consequently form the narrows of the loch, require to be more thoroughly examined. This, however, is certain, that these peculiar rocks are perfectly distinct from all the older rocks hitherto mentioned, and are entirely unlike any portion of the Upper gneiss, with which my little sketch terminates.

This Upper gneiss or Lower Silurian gneiss is at once distinguished from the fundamental or Laurentian and non-micaceous gneiss, by its flag-like character, and by containing such an abundance of mica as to be in parts almost a mica schist. It is, however, the grey quartzose variety of the gneiss of Macculloch, and is distinctly seen to overlie all the previously described rocks, no one of which does it in any way resemble. It has been usefully turned to building purposes by Mr Fowler, who has erected out of it the mansion of Braemore. It is regularly bedded and dipping to the E.S.E. at small angles, ranges into lofty mountains which extend to Glen Fannich in the west, and to Ben Derrig in the south. It is occasionally traversed by small granite and white quartz veins, and in such cases is often charged with crystals of iron pyrites. In its extension to the S.E. the rock is traversed also by large bosses of red granite, and then rolls over in undulations from the valley of the Blackwater, until it occupies the greater part of Ben Wyvis, the loftiest mountain in Ross-shire. Their order of superposition and the unconformity of these Lower Silurian rocks, whether quartz rocks and limestone, or the Upper gneiss, is perfectly clear and unmistakable; and when we couple this fact with the striking diversity of mineral character between the Lower or Laurentian and this upper flaggy micaceous quartzose gneiss, and see that they are separated by mountain masses of Cambrian sandstone, the only wonder is that it was left to me in my old days to indicate this order. It was, therefore, a great pleasure during the last summer to see the phenomenon so well sustained by a fresh appeal to the successive rock formations on the north and south flanks of Loch Broom.