

PROCEEDINGS
OF THE
ROYAL SOCIETY OF EDINBURGH.

VOL. VIII.

1873-74.

No. 89.

NINETY-FIRST SESSION.

Monday, 2d March 1874.

SIR WILLIAM THOMSON, President, in the Chair.

The following Communications were read:—

1. On the Parallel Roads of Glen Roy. By the
Rev. Thomas Brown, F.R.S.E.

(Abstract.)

After describing the general appearance of these terraces, the author referred to the discussions which had taken place as to their formation. More than fifty years ago it was conclusively proved by Dr Macculloch* and Sir Thomas Dick Lauder,† that these parallel roads are the margins of ancient lakes, and since then the question has been whether these were freshwater or sea lochs. Mr Darwin, Dr Robert Chambers, Professor Nichol, and others, have contended that they were marine; while Agassiz, Dr Milne Home, Mr Jamieson, and others, have maintained that they were freshwater.

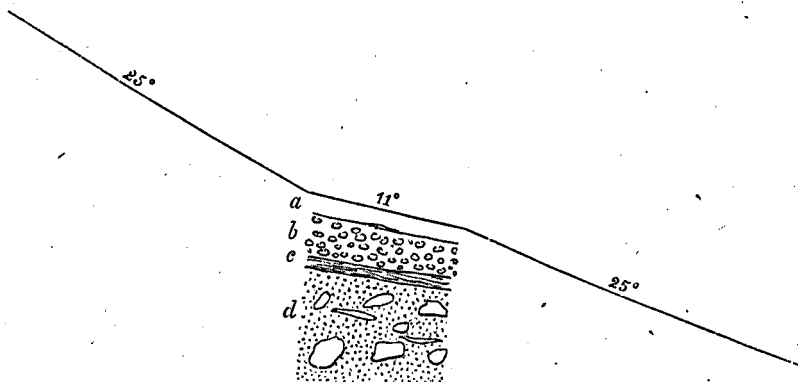
As the problem is confessedly one of some difficulty, it seemed desirable to obtain, if possible, the evidence of fossils. It has been ascertained, indeed, that the deposits contain no shells nor similar remains, and Mr Darwin has suggested that they may have been destroyed by the carbonic acid gas absorbed by the rain-water which for ages has percolated through the beds. This, however, could not have taken place with the valves of diatoms, which are siliceous, and

* Geol. Trans., ser. 1, vol. iv.

† Edin. Roy. Soc. Trans., vol. ix.

on which, therefore, carbonic acid could produce no effect. They have this further advantage, that the marine and freshwater species each keep to their own distinct localities, and if any such fossils, therefore, could be found in the parallel roads, they might give important assistance in deciding between the marine and freshwater theories.

Accordingly, in the autumn of 1872, and again in 1873, an attempt was made to obtain fossil diatoms from these deposits. It was found that in Glen Roy there were a good many points where the parallel roads were cut through and laid open. Four of these



- | | |
|--|---|
| a, Humus—peaty, | 8 in. to 1 foot. |
| b, Stones with clay, | 2 to 3 feet. |
| c, Finely stratified sand and clay, | 3 in. to 8 in. |
| d, Clay with boulders indistinctly stratified, with thin irregular courses of sand,* | } about 20 feet going down to the rock. |

sections were examined with some care, and one was especially fixed on lying high and dry on the hill side, where the internal structure of the lowest terrace was distinctly shown. The object was to obtain specimens of diatoms which may have been alive when the terraces were formed, and which were then included in the deposits; but to secure this, various precautions were necessary. The nature of the different beds composing these terraces will be

* It may be a question whether this bed *d* really belongs to the time of the lowest shelf, or whether it is not some anterior formation—the sloping bottom of the lake, perhaps, at some earlier time.

understood from the preceding diagram representing the section just referred to.

In searching for diatoms, it was necessary to avoid the bed *a*, which has been formed since the time of the parallel roads. It was thought safer also to throw out of view the bed *b*, the upper surface of which is in contact with *a*. Attention was therefore confined to the beds *c* and *d*. The outside weathered portion of the bed was in each case removed, and part of the internal contents of the bed cut cleanly out—that from *d* being about 10 feet below the surface. The material thus obtained was washed in distilled water and microscopically examined. It was found that the search required much patience. Diatoms were ascertained to be present scattered very rarely through the material, but at last a series of specimens were got. These were sent to Professor Dickie, of Aberdeen, one of our highest authorities in this department of natural history, and the following species were determined by him:—

Pinnularia viridis.

Diatoma vulgare.

Himantidium undulatum.

Surirella panduriformis?

Of these the first three were got from bed *c*, and the first two and the last from bed *d*.

Now these are all freshwater species, and their evidence is strengthened by the fact that there is the entire absence of any marine diatom or other organism. This would indicate that it was an old freshwater lake which had these parallel roads for its margins. Freshwater diatoms might, indeed, have been brought down into it even if it had been a sea loch, but the important fact is, that while freshwater species are found, it has been impossible to detect a single trace of anything marine.

It is indeed true that it is only a single locality which has been searched in this way, and it would be going too far to hold the results as at once conclusive. Enough, however, has been done to show that this method of approaching the solution of the problem deserves to be followed out. Search should be made at other points along these parallel roads where they are laid open. They have been a kind of battle-field fought over by rival theorists for the last fifty years, and it will be strange if all the time multitudes

of witnesses have been lying shut up in the deposits, only waiting to be called into court to give decisive evidence. So far as the investigation has gone, it is in favour of the Freshwater Theory.

2. Note on the Perception of Musical Sounds.

By John G. M'Kendrick, M.D.

Certain individuals appear to be incapable of appreciating musical sounds. They cannot distinguish one melody from another; and if by many repetitions of the melody in their hearing, they at last appear to know it, the addition of one or more of the parts of the harmony again renders the music unrecognisable to them. The question naturally arises, Is this defect owing to any peculiarity in the structure of the internal ear of persons so constituted which prevents them hearing certain sounds, or is it to be referred to the condition of the brain? On the other hand, many have what is termed a "fine ear," by which we understand the faculty of appreciating, remembering, and, in some cases, of successfully imitating musical sounds. Have those individuals the organ of hearing more delicately developed?

This physiological problem does not, in the present state of our knowledge of the minute structure of the organ of hearing in man, permit of being examined histologically. We would not probably find any appreciable histological difference between the internal structure of the ear of a genius in music and that of a person who could not distinguish one melody from another. So far as this method of inquiry is concerned, differences may exist, but the minute size of the ultimate recipients of sound-waves, and the vagueness of our present knowledge of the number of these in the depths of the cochlea, would prevent any one from noticing those differences.

It, therefore, occurred to me to examine this question by testing experimentally whether those individuals who profess to be unable to know music were incapable of hearing certain musical sounds, limited as regards pitch, within the extreme keys on the key-board of a piano. I have examined ten cases of this kind.

In a musical sound three elements have to be considered,—1st, loudness or intensity, which depends on the extent of vibration;