

N.E. of Duniva House, and one and a half or two miles N.W. of Comrie; and it is considered desirable to place additional instruments at Duniva, and in the neighbourhood, with the view of approximating still nearer to the exact spot of emanation.

The additional instruments for indicating earthquake shocks, lately sent out, are seven in number. 1. Four of these are on the principle of the watchmaker's noddy, explained in last year's Report.—2. Another instrument consists of four horizontal glass tubes slightly turned up at each end, and filled with mercury. These tubes are laid down on the solid floor of a room, according to the points of the compass; and it is expected that when a shock takes place the mercury will flow out of one or more of these tubes. If there is no horizontal movement, but an inclination of the ground only, the mercury will flow out of the tube or tubes affected by the inclination. This instrument was made by Mr. Newman, of London, under the directions of Professor Wheatstone and Mr. D. Milne.—3. The two remaining instruments are intended exclusively to indicate vertical movements of the ground. They consist of a horizontal bar, fixed to a solid wall, by means of a strong flat watch-spring, and are loaded at the opposite end. If the wall suddenly rises or sinks, the loaded end of this horizontal rod remains from its *vis inertiae* nearly at rest, and thus can move any light substance (as paper or a straw) brought against it by the vertical movement of the ground; the light substance being so adjusted as to remain fixed wherever the rod moves it.

Beside the above instruments, a barometer, a double thermometer, and a rain-gauge, have been sent to Mr. Macfarlane, of Comrie, in order that the state of the atmosphere at the time of the shocks, and the nature of the weather generally, during their occurrence, may be ascertained. The Committee, however, think it desirable to procure instruments much more sensitive than any which they yet possess; and they particularly call attention to the importance of carrying on meteorological observations at Comrie, as there seems to exist strong grounds for the opinion entertained by many, of an intimate connexion between earthquake shocks and the state of the weather, or rather the various agents which affect the weather. The Committee have not yet attempted the registration of earthquake shocks in any part of the country except Perthshire; but as the primitive districts of Cornwall and Wales have often experienced shocks, they propose also to send instruments and establish observations in those parts of the country.

Dr. BUCKLAND recommended the establishment of observations along various lines known to be affected by earthquake shocks, such as the Chichester line of fault, Swansea, and Falmouth. The electric state of the earth would probably be found to influence the atmosphere much more powerfully than the air would affect the earth; the earthquake shocks were most frequent in the autumn and winter, and it was worth inquiry how far the rains of that period would affect strata under different electric conditions, such as those brought in contact by the faults and trap dykes of Comrie, and thus, perhaps, afford some clue to the origin of the shocks.—Mr. SEDGWICK believed that the small amount of evidence as to movement, which had been or could be obtained in Britain, was not likely to throw much light on the origin of earthquakes, or on their connexion with atmospheric conditions. When regular observations could be established abroad, in regions frequently and powerfully influenced by such movements, we might hope to arrive at the conditions of their occurrence. Atmospheric conditions ought certainly to be noticed, and the coincidence of the shocks in Scotland with particular seasons of the year, well deserve remark. Perhaps the phenomenon was not more remarkable than the fact, that meteors showed themselves in greatest abundance during the passage of the earth through particular portions of its orbit. In saying this, however, Mr. Sedgwick did not mean to express his belief that atmospheric conditions could have any great effect on the deep-seated phenomena of earthquakes.—Sir W. T. DE LA BECHIE stated, that as a general rule the earthquakes of South America and Jamaica were felt most severely along the strike of the strata; in some instances, houses built on ranges of solid rock were affected by the shocks, whilst others only a quarter of a mile distant, built on gravel, entirely escaped. In all the published relations of the effects produced by earthquakes, much allowance was to be made for the excited feelings of the spectator. Thus the earthquakes which destroyed Port Royal had been described in all the exaggerated language inspired by terror; the real history was very simple; the town was built on a sand bank, encircling a number of small detached coral reefs; the violence of the waves, aided and accompanied by the concussion of the earthquake, washed away all this sand, and with it the houses, those on the coral reefs remaining as strong as before, whilst loose masses of stone, amongst the craggy rocks of the interior, naturally fell down from the effect of the same vibration.—Mr. NICHOLSON, of Kendal,

described a slight earthquake, which had occurred on the 13th of the present month, on the shores at Morecambe Bay. The shock, which was sudden and violent, took place at 2 A.M.; there had been six weeks of drought previously, and on the day before the shock the thermometer stood at 94° in the shade, being 9° higher than it had risen in that neighbourhood since the year 1826. At 2 P.M., of the same day, the rain set in heavily. This earthquake was felt for ten miles round Kendal.

'On the Structure and Mode of Formation of Glaciers,' by James Stark, M.D.—The author stated that he employed the word glacier to signify the entire icy masses which filled the upper as well as lower valleys of snow-covered mountains, and extended downwards to the cultivated valleys or sea shore. He was induced to overlook the artificial division of these masses into *Firn*, *Mer de Glace*, &c. believing such divisions did not exist in nature, and were inapplicable to the glaciers of the Polar regions. From an examination of the accounts given by Sausure, Auldjo, Desor, and others, Dr. Stark was of opinion that there existed no constant differences in the crystalline structure of the ice in different parts of glaciers; perfect glacier ice, both as to purity and compactness, occurred at all heights; from which he inferred, that after the crystalline particles of snow became once consolidated into compact ice, no farther change, or enlargement of those particles, occurred till the mass was finally dissolved. The ice of glaciers had always been described as arranged in regular layers, but their position and mode of formation, as explained even by the latest writers, was stated by Dr. Stark to be so obscure, that having carefully examined the facts, he had formed conclusions, of which, as they differed from those usually entertained, he proceeded to give a summary, classifying the differences observable in the structure of glacial masses under the following divisions:—1. *Horizontal strata*. The author remarked that this was usually termed *banded structure*, and seemed to be confined to the upper regions of the mountains. The planes invariably coincided with the surface of the glacier, the layers being usually 1 to 3 feet in thickness. They were mentioned by almost all writers on glaciers, and represented in the plates of M. Agassiz's work. Most writers considered them as marking the annual additions to the glacier; but as the amount of snow falling on the average during the six winter months would produce a much greater thickness of ice than the horizontal layers indicated, Dr. Stark considered that each band denoted a separate fall of snow, unless it should appear that snow and ice wasted with nearly as much rapidity in the upper as in the lower regions.—2. *Longitudinal and vertical strata*. Dr. Stark stated that this structure had been described by Gruner in 1760, by Desmarest in 1779, Scoresby in 1824, and other authors, and during the last winter had been claimed as a new discovery by Prof. Forbes, who styled it ribboned or banded structure. These layers he described as always of great tenuity, forming planes more or less vertical, but always parallel with the length of the glacier or its retaining walls. The explanation of this structure offered by Dr. Stark is as follows:—During the spring and summer months it is probable that glaciers advance from 1½ to 3 feet daily, and as the valleys occupied by them generally widen as they recede from the higher regions, every movement would leave a space between them and their containing walls; these fissures would continually fill up with fresh snow and ice, increasing the breadth of the glaciers, and forming a new series of vertical planes. The frequent occurrence of mud, gravel, and fragments of rock in the same planes, was considered by Dr. Stark to be much in favour of this explanation of their origin. This structure, he remarked, was likely to be found wherever pillars and needles of ice were met with, since fissures and crevices generally divided glaciers transversely; and in passing over rough ground, the unequal pressure on a combination of transverse fissures and longitudinal lamellæ would break up the ice into vertical prismatic columns.—3. *Horizontal combined with longitudinal and vertical strata*. Although no such combination as this had hitherto been described, Dr. Stark thought it must exist. Horizontally stratified ice was confined to elevated regions, where the thickness of glaciers was three or four times greater than in lower valleys. Dr. Stark inferred that these

beds gradually wasted away as the glacier descended, until only the lower, or vertically stratified, portion remained.—4. *Inclined strata*. This structure Dr. Stark endeavoured to explain as one superinduced, after the accidental destruction of the lines of stratification which formerly existed. In conclusion, Dr. Stark observed, that all the above forms of stratification might be expected to occur in the extent of a single glacier.

Dr. RICHARDSON observed, that snow constantly disappeared in great quantities without melting; in dry frosty air, with a temperature below zero, it would disappear rapidly by insensible evaporation. The prismatic form of ice, which occurs on lakes where it has attained a thickness of six or eight feet, takes place only in the spring when it begins to melt; the particles were considered to undergo a new arrangement when the temperature of the mass was elevated to the melting point.—Col. SABINE had seen the ribboned structure of glacial ice mentioned by Prof. Forbes, but doubted whether it had ever been seen in polar ice; he had never met with it, and did not think it would have escaped his observation.

SECTION D.—ZOOLOGY AND BOTANY.

President—The Hon. and Very Rev. Wm. HERBERT, L.L.D.
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Sir W. JARDINE, Bart., The Bishop of NORWICH.
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A Report was read, 'On the present state of the Ichthyology of New Zealand,' by John Richardson, M.D.—The desirableness of a report on the Zoology of that country is very great, on account of its becoming so rapidly populated, and there can be but little doubt that many of the present animal inhabitants will disappear entirely, and others will be driven from their native localities. Of the mammalia, only the dog and rat have been seen, and no snakes. This report is confined to the fishes. Very little has been added to what was made known by those who accompanied Captain Cook in his first and second voyages. They figured or described upwards of sixty-three species, to which nine have been added by Cuvier and Valenciennes, and five by other writers, making in all seventy-seven. Some of these exhibit strange forms and habits. Many are strictly littoral progeny of the minute crustacea which deposit their spawn in such localities. The *Boleophthalion* even ascend the beach, like little lizards, to pursue their prey. The *Plectognathi* are adapted for living in rough seas; their powers of swimming are small; some are protected with hard spines, like a hedgehog or sea urchin, and have a power of distending their skins with air or with water, according to circumstances. Marsupial animals characterize the animal kingdom of New Holland, and the same influence seems to have acted on fish to produce a character amongst them as remarkable as the kangaroo amongst mammalia. As their organization seems to fit them for districts with little water, so does that of these fishes. During the season that the water dries up, various species of *Batrachi*, *Gobiodes*, *Cyprini*, and *Apodes*, bury themselves in the mud, and like the *Lepidosiren* of the Gambia, remain in an inert state till the rain falls. The sources from whence the information in this Report was obtained, are chiefly the manuscripts of Solander, with the drawings of Forster and Parkinson, now in the British Museum. A list of the species accompanied the Report, with remarks by the reporter on the more rare and singular species.

Dr. BATEMAN hoped that something more than information got from books would be laid before the Society, so that the existing species of animals might be referred to modern systems of classification.—Mr. BABINGTON stated, that the object of the Report was to gain what information was scattered amongst previous writers, for the purpose of assisting future investigators.

Mr. PATTERSON read the substance of two Reports—the one, results of dredging at depths varying from 50 to 145 fathoms, off the Mull of Galloway, by Captain Beechey, R.N., drawn up by W. Thompson, Esq.; the other, results of dredging off the Mull of Cantyre, by Mr. Hyndman, and off Ballygally, county Antrim, by Mr. Patterson.