higher vantage ground opened to the mathematician by means of Peaucellier's discovery. The extent of our own obligation to him is great.

Not less are we indebted to Professor Kelland, whom we have known both as a teacher and a friend. The valuable hints and suggestions he has given us on this subject we are glad to take this opportunity of acknowledging.

3. Laboratory Notes. By Professor Tait.

(*a.*) On the Passage of the Electric Current from Amalgamated Zinc to Zinc Sulphate Solution. By J. G. MacGregor, M.A.

(*b.*) On the Thermo-Electric Properties of Cobalt, &c. By Messrs Knott, MacGregor, and C. M. Smith.

(*c.*) Measurements of the Potentials required for Long Sparks of a Holtz Machine. By Messrs Macfarlane and Paton.

4. Note on Orthogonal Isothermal Surfaces. By Professor Tait.

5. Notice of some recent Atmospheric Phenomena. By Professor Tait.

6. Report by the Society's Boulder Committee. (Plates II. and III.)

Mr David Milne Home gave in the Third Report of the Society's Boulder Committee, from which the following are extracts:—In November 1875, on the invitation of Sir John Douglas of Glenfinnart, the Convener went to visit him at that place, to have an opportunity of examining several remarkable boulders reported to the Committee as situated in that part of Argyllshire.

1. On the east side of Lochlong, opposite to Ardentinny, there is the farm of Peaton. On this farm, a burn descends from a steepish hill which faces the north. A gneiss boulder lies in a gorge cut by the burn through rocks of clay slate. The boulder

rests on the rocky sides of the burn, jammed in between the sides. The boulder has some local name like "Jenny Meullen," meaning "House on a knoll." The height of the boulder above the sea is about 226 feet. Its distance from the sea-beach is about three-quarters of a mile. The size of the boulder is about 24 × 18 × 12 feet. It is most probable that the boulder was transported across the loch from the north or north-west, and was arrested in its further progress southward by the hill, on the north side of which it stands.

Two sketches of this boulder are given on Plate II. figs. 1 and 2.

2. Between the site of this boulder and the sea-beach an old sea margin occurs at a height of about 45 feet above the sea (medium level). A number of boulders lie along the line of this sea margin. There is an old sea margin on the opposite or west side of the loch, at exactly the same height—viz., 45 feet.

3. Close to the beach in this part of Lochlong—*i.e.*, about 8 or 9 feet above high-water mark—at a place called "Letter," there lies another gneiss boulder, 12 × 8 × 8 feet. Its long diameter points N.W. by N.—viz., to Glenfinnart Valley.

4. Very near this boulder (about 100 yards to the north) the clay slate rocks have been ground down and smoothed. Their smoothed surfaces show numerous striæ pointing N., 2° or 3° W. (magnetic). The smooth surface dips towards the north at an angle of 3° or 4°.

5. On the hill above Carrick Castle, situated on Lochgoil, there is a boulder called "Clach udelain," or the "Stone nicely balanced." It is at a height of 1526 feet above the sea. This boulder is of gneiss, and lies on rocks of clay slate. It lies on a bare rock, the face of which slopes to N.N.E.—*i.e.*, towards Lochgoil. The boulder is within three or four yards of the edge of a precipitous rocky cliff, which goes vertically down about 500 or 600 feet. The block is of enormous size. Unfortunately the note taken of its dimensions has been lost. This boulder, from its position, could not have fallen from any hill. There is no hill near it from which it could have fallen.

A sketch of this boulder is given on Plate II. fig. 3.

6. The next boulder visited is about two miles to the eastward of the last-mentioned, and is within a quarter of a mile of Lochgoil,

near its junction with Lochlong. It is about 450 feet above the sea. It may be observed, that all the rocks in this district have their smooth faces towards the north, their rough faces towards the south. This boulder has received the name of the "Giant's Putting-Stone," from a legend which alleges that in former times there were giants who inhabited the district on both sides of Lochlong, and who were in the practice of amusing themselves by throwing these huge boulders across the loch. The rock on which it rests slopes gently N. by E. This rock presents a large surface, ground down and smoothed. The space of rock occupied by the superimposed boulder is only 18 inches by 12 inches. It would not be difficult for two men with strong levers to move the boulder from its narrow resting-place, in which case the boulder would probably roll down the steep hillside into the loch.

Two sketches of this boulder are given on Plate III. figs. 4 and 5.

7. To the north of Knap Farm-house, there is a small hill, on or very near the top of which eight or ten boulders are clustered. They suggest the idea that this hill has arrested or interrupted the body, whatever that body was, which transported the boulders, and caused them to be stranded here.

8. There is another hill lower down the valley of Knap (about 480 feet above the sea), the top of which consists of clay slate rocks, rounded and smoothed by some agent passing over from the north. It has received the popular name of the "Pig's Back." Several boulders lie on this ridge. The largest rest on a very small portion of rock.

A sketch of this ridge of rock, with boulders on it, is given on Plate III. fig. 6.

9. Pulag boulder is near the top of a hill to the west of Glenfinnart, about 824 feet above the sea. It is a large block of gneiss, about 7 feet high. There are many other smaller boulders lying near it. The large boulder is almost on the edge of a precipice which goes down at least 200 feet. It could not have been rolled or pushed to its present position. The levels of the district show the greatest openings towards the north—a circumstance which suggests that the boulder came from the north. Moreover, its south end rests on a smaller boulder, which seems to have stopped its progress further south.

A sketch of this boulder is given on Plate III. fig. 7.

10. Along various parts of the hills in this district where their highest ranges are seen against the sky, and at a height of about 2000 feet above the sea, boulders are discernible from a distance, lying on the ridges. It would be very desirable to obtain particular accounts of boulders at so high an elevation.

11. In the last Report of the Committee, notice was taken of a boulder in Ayrshire called the "Hunterston Boulder." Along the same coast, and especially on the property of Mr Alexander of Boydstone, several very large boulders may yet be seen. One, called the "Boydstone Rock or Stone," is situated about two miles north-west of Ardrossan. Some chips of the boulder, sent to the Convener in a letter, show that it is porphyritic. The rocks on this part of the coast are Old Red Sandstone. The boulder is in length about 19 feet, and in breadth about the same. It is partly buried in the mud of the shore. Its highest point is 9½ feet above the shore. It is said to contain 40 cubic yards above the shore line. It is supposed that the boulder is buried to the depth of 5 feet. The tide at high water leaves about 3 feet of the boulder visible. This boulder has inspired the poetic genius of an Ayrshire letter-carrier (Malcolm Kerr, post-messenger between Ardrossan and West Kilbride), who, through Mr Weir of Kirkhall, has sent to the Convener the following stirring address:—

To the Great Boulder on the shore opposite to the lands of Boydstone, two miles north of Ardrossan, Ayrshire.

"Can'st thou speak, old grey stone,
Unto me?
List thou to the ocean's moan,
I to thee:
Music sweet! Spirits string
Wild ditties, as they cling
To the big waves which swing
Around thee.

Stranger! whence didst thou come
To this shore?
Art thou an Arctic crumb,
Which of yore

On some huge iceberg side
From thy first home did glide,
A wanderer on the tide,
To this shore?

Many eyes with wonder,
Ages gone,
Looked on thee! What number
Yet unknown,
Will gaze with curious eye,
Seeking to know thy history,
And solve a hidden mystery,
Old grey stone."

Besides the boulder which inspired these verses, there are two others, also on Mr Alexander's property—one of them, as Mr Weir states, "even larger than the big stone at Brigurd, at Hunterston." This larger one it was proposed to split up for building purposes at Ardrossan; but Mr Alexander interfered, and saved it. There are many other boulders along the Ayrshire sea-coast, but none so large as the Boydstone boulder. A chip of one of these sent, shows that it is of gneiss, indicating a northern origin.

12. A report has been received of a gneiss boulder near Dunblane, on the property of Cromlix, belonging to the Hon. Captain Drummond. The length of the boulder is stated to be 17½ feet, its breadth (on an average) 10, its height about 5 feet. Its longer axis lies in a direction south-west and north-east. At its south end it dips into the ground at an angle of 45°. Its weight above ground is estimated at 34 tons. Its height above the sea is about 450 feet. It is about four miles south from the Grampians. The same reporter (Henry Wilkie, Ashfield Works, Dunblane) refers to a group of four boulders in the parish of Redgorton, at the west end of a gravel ridge on the farm of Bertha, the property of Murray Graham, Esq. of Murrayshall. Three of these Redgorton boulders are within an area of 30 yards. They are angular; flat on the top, and some of them square. They seem to be Silurian rocks. They are distant about twelve miles from the Grampians.

13. Notice has been received by the Convener from Mr Robertson, C.E., who is in charge of the Albert New Docks at Leith, that boulder clay was found in excavating for the docks beneath the shore line, to the depth of about 70 feet. The clay was full of

large blocks. Some of these were of sandstone, weighing 10 or 12 tons, and appeared to be of the same rock as that worked at Granton and Craigleith Quarries to the westward. Beneath the boulder clay, there was found what the engineers call a "running sand" lying over strata of shale and sandstone.

Before concluding, the Committee may advert to the circumstance that a part of the district comprehended in this Report was many years ago described by an eminent Scotch geologist—the late Charles M'Laren—and with reference to the very matters embraced in this report. Mr M'Laren read papers in this Society, in the years 1846–47, describing the boulders then existing on the shores of the Gairloch, and on the hills between that loch and Lochlong. Even then the destruction of boulders in that quarter had begun, being appropriated, as Mr M'Laren states, to building purposes; and probably by this time they have all been annihilated. Mr M'Laren in these papers described also the striation and smoothings of the rocks, which he found from the sea-shore up to the tops of the ridges, between the Gairloch and Lochlong, at heights of about 1000 feet above the sea. It is due alike to the memory of our Associate, and to the interests of geological science, to mention, that the boulders referred to by him, as found on the Gairloch, consisted of grey granite, of which he counted above a hundred, one-third of them exceeding 30 tons in weight; as also mica slate, which, though less numerous, had had among them blocks of 60 and 80 tons in weight. As the rocks of the Gairloch *in situ*, are of a more recent kind—viz. clay slate—Mr M'Laren justly inferred that the boulders were of northern origin. For those of granite, he pointed to Ben Cruachan, a mountain exceeding 3000 feet in height, situated to the N.N.W., and distant about thirty miles. The mica slate hills are also in the same direction, somewhat more distant. From his study of the boulders and other phenomena in this district, Mr M'Laren drew two important conclusions. One conclusion was, that the boulders must have been brought to the district from the parent mountains, across valleys and ranges of hills, on ice floating on a sea which stood from 1500 to 2000 feet above the present sea-level, and in which a strong current had prevailed from the N.W. This conclusion, it will be noticed, is confirmed by the facts specified in the

present Report, and also in former Reports by the Committee. The numerous instances given in these Reports of huge boulders shown by their composition to be of northern rocks, clustered frequently on the summits or peaks of hills, at heights of 1500 and 2000 feet above the present sea-level, seem to leave no doubt regarding the soundness of *that* conclusion to which Mr M'Laren had come to thirty years ago.

The other conclusion to which Mr M'Laren came, and which many good geologists of the present day hold, was this, that local glaciers had at one time existed in all those valleys. This he inferred from observing, that the striations on the rocks were all, as he thought, exactly parallel with the axis of the valley, and which here generally runs in a direction north-west and south-east; and also from discovering accumulations of gravel and clay in the form of elongated embankments—some across the valleys, others parallel with the valleys, reminding him of the lateral and terminal moraines of Switzerland.

As to the soundness of this second conclusion, or the correctness of the observations on which it was founded, the Committee give no opinion. None of the members of the Committee have visited the localities, and their function as a Committee has been chiefly to collect facts connected with the boulders. But it may not be out of place to record the fact, that another of our Associates, the late Robert Chambers, who had also given much attention to this branch of geological science, went to examine the districts referred to by Mr M'Laren, and expressed doubts regarding these last-mentioned views. In two papers read by him in this Society in December 1852, Chambers states, that on the rocky ridge between Lochlong and Holy Loch, at a height of 600 feet above the sea, the direction of the striations was not parallel with the valley, but "slanting over the hill;" and as the striations were not merely on the sides of the valleys, but on the tops of the hilly ranges dividing the valleys, he thought they were more probably due to a general glaciation of the country than to local glaciers. Chambers quotes also the opinion of Sir Roderick Murchison, "that there is no imaginable centre for the issue of glaciers of the ordinary kind down the Gairloch." On this point the Committee offer no opinion, and wish only to advert to the investigations of eminent Scotch geolo-

gists who in former days attempted a solution of these difficult questions. The Committee would venture to suggest a re-examination of the localities, as the fuller knowledge now possessed on these subjects may possibly throw a clearer light on the phenomena.

The Committee wish only to add, that if any geologists, whether fellows of this Society or not, happen, in the course of their rambles through the country, to fall in with or hear of any boulders remarkable for size, position, or composition, not yet mentioned in the Committee's Reports, the Convener will be happy to receive a notice of them.

After some conversation, in which Mr Ferguson of Kinmundy, Dr Bryce, the Rev. T. Brown, and others took part, the Report was adopted, and the proceedings terminated.