water taken from the crater appeared to consist of sea-water holding in suspension a fine dust, together with filaments resembling vegetable fibres, which the author supposes to have been derived from sea-weed drawn into the water. The saline ingredients of this water differed from that of the Mediterranean, chiefly in containing more sulphate of lime, and a little alumina, oxide of iron, and a trace of oxide of manganese; all these in combination with an acid, probably the sulphuric or muriatic, and a notable portion of hypersulphite of lime and magnesia. He could not detect in it any free acid or alkali, or the presence, even in combination, of any potash or ammonia, or nitric acid, nor the slightest trace of bromine or iodine. The gas emitted by the volcano appeared, as far as could be determined from an examination of two specimens, to consist chiefly of carbonic acid, with a trace of sulphuretted hydrogen.

The author observes in conclusion, that the results of his inquiry are almost entirely of a negative kind; and in this respect correspond with those obtained by Sir Humphry Davy, with respect to Vesuvius, and which are described in his paper "On the Phænomena of Volcanos," published in the Philosophical Transactions for 1828. They accordingly tend to corroborate the simple hypothesis there adopted in explanation of the phænomena of volcanic action; namely, that of the existence of an ignited nucleus of fluid matter, occasionally forced through the cooled crust of the earth by the expansive power of steam and gas: and they militate strongly against the hypothesis of the chemical origin of volcanos, and of their being attended by a decomposition of water by the metallic bases of the earths and alkalies.

A drawing of the volcano in its active state of eruption accompanied the paper, together with a plan, and views of the island.

January 12, 1832.

JOHN BOSTOCK, M.D. Vice-President, in the Chair.

The Bakerian Lecture for 1832, entitled "Experimental Researches in Electricity—Second Series," by Michael Faraday, Esq. F.R.S. was read.

The success of the author in exhibiting the evolution of electricity by induction from ordinary magnets, led him to conclude that similar effects might be obtained from the magnetism of the earth, and even to an extent that might render it available in the construction of new electrical machines. These expectations have been fully realized; and the researches which establish the influence of terrestrial induction in giving rise to electrical currents, form the subject of this second paper.

Whenever a hollow helix, the terminal wires of which were connected with those of a galvanometer, and which inclosed a cylinder of soft iron, was held with its axis in the line of the magnetic dip, and suddenly inverted, the evolution of electric currents was immediately rendered sensible by the deflection of the needle of the galvanometer; a deflection in the contrary direction being produced the moment the helix was again inverted, so as to recover its first

position. The same effect resulted from the simple introduction of the iron cylinder into, or its removal out of, the helix; evidently in consequence of the magnetism acquired by position with relation to the magnetic poles of the earth. When a cylindric magnet was substituted for the soft iron, the same phænomena, obviously ascribable to terrestrial induction, were in either case observed. Similar but more feeble indications of the same effect were obtained by inverting the helix alone, without its association with any ferruginous body whatever.

The influence of terrestrial magnetism in eliciting electricity from revolving metallic bodies was next made the subject of investigation. A copper plate was made to rotate in a horizontal plane, one of the wires of the galvanometer being brought into contact with its axis, and the other attached to a leaden conductor pressing against the amalgamated edge of the plate. The needle of the galvanometer was immediately deflected, either to the east or west, according to the direction of the rotation; and by successively changing this direction, and accommodating it to the oscillations of the needle, the arc of its vibrations was soon made to extend to 50° or 60°. When the plane of rotation passed through the line of dip, the galvanometer was not affected. A copper plate, revolving in a plane perpendicular to the line of dip, thus composes a new electrical machine, differing from the common plate machine in the circumstance of the material of which it is formed being the most perfect conductor, while in the latter it is the most perfect non-conductor. Insulation, which is essentially required in the latter, is fatal to the efficacy of the former. The quantity of electricity produced by the metallic machine does not appear to be inferior to that evolved by the glass machine, although differing much in its intensity. On employing copper wires of greater thickness, more powerful effects were obtained. The author expects that the effects may be still further increased by certain combinations of superposed plates, alternately revolving in opposite directions.

The author proceeds to show by experiment the manner in which terrestrial magneto-electric induction produces phænomena similar to those observed by Messrs. Barlow and Christie when ferruginous bodies are in rapid rotation, and which have been ascribed to a change in the ordinary disposition of the magnetism of the ball. He found that the rotation of a copper ball on an axis either horizontal or otherwise inclined to the line of dip, gave rise to a circulation of electric currents in a plane perpendicular to that of revolution, and in exact conformity with the law already deduced by the author in the first part of this paper. This law is illustrated in a very simple manner by the following experiment.—A copper wire, eight feet long, had its two ends fastened, each respectively to the ends of the wires of the galvanometer, so as to form with them one uninterrupted circuit. Upon moving the copper wire to and fro over the galvanometer, whilst the lower part remained steady, the magnetic needle was immediately deflected, in a direction regulated by the relative position of the wire and the direction of its motion.

It is a further consequence of this law, that the rotation of the globe of the earth itself must tend to induce electric currents in its own mass, passing in each hemisphere from the equatorial to the polar regions; so that if one set of conductors could be applied at the equator, and another at the poles, negative electricity would be collected by the former, and positive electricity by the latter. The electricity of metalliferous veins in the mines of Cornwall (of which an account has been given by Mr. Fox, in a paper lately published in the Philosophical Transactions,) does not appear, however, to be referrible to magneto-electric induction. It may be a question whether the phænomena of the Aurora Borealis and Australis may not arise from the discharge of this induced electricity consequent on the earth's rotation.

As it appeared probable that there exists some natural difference in the intensity of these electric currents induced by magnetism in different conducting bodies, the author endeavoured to determine what effects might arise from this difference in the case of iron and copper. For this purpose he joined together the ends of wires of each of these metals, each 120 feet in length, extended in the direction of the magnetic meridian. The copper wire was then divided in the middle and examined by a delicate galvanometer, but no evidence of any electrical current was obtained. The same negative result attended trials with wires of these metals, twisted together, and passed between the poles of a powerful magnetic battery. Similar experiments tried with other metals, and also with a circuit composed of copper and sulphuric acid, afforded in like manner no indications of electric currents. Hence it appears that when metals or other conductors of different kinds are equally subjected to magneto-electric induction, they exhibit equal powers with respect to the currents induced in them.

By another experiment the author shows that these effects of magneto-electric induction are not owing to the motion of the magnet and conductor relatively to each other, but that they take place to an equal degree when the two are united so as to revolve together, and when, consequently, they are relatively at rest. Electric currents are produced also in the substance of the magnet itself, simply by revolution on its own axis while floating on mercury, and the circuit completed by wires making a communication between the mercury and the axis of the magnet.

The author has comprised the phænomena here related in the following general formula. Referring to the pole of the magnet as the centre of action, if all the parts of the metallic conductor move in the same direction and with the same angular velocity, no electric currents are produced: but if one part cut the magnetic curves while another part is stationary, or if the motion of the whole be in one direction, but its angular velocity relatively to the pole of the magnet be different, then, in either case, currents will be produced; the maximum effect taking place when different parts move in different directions across the magnetic curves.