which have hitherto been given of this difficulty, and quotes, on this point, the authority of Sir John Herschel. It then proceeds to prove, both theoretically and by observation, the existence of a slow downward current of air mingled with minute globules of water, the current itself being the effect of the rain, and originating in the cloud from which the rain proceeds. The twofold agency of this downward current in producing the paradoxical results is then explained; and the paper concludes with a numerical estimate, the object of which is to prove that the quantity of water which it is necessary to assume as being contained in a given volume of the atmosphere, *at a given time*, in order to account for even the more remarkable results on record, is too small to give rise to the appearance of cloud; and so, by proving this, to obviate what would otherwise have been a formidable objection to the proposed explanation of the phenomenon.

4. On the Structure of the Bark of *Araucaria imbricata*, with special reference to Palæontology. By John Hutton Balfour, A.M., M.D., F.R.S., Sec. R.S.E., Professor of Medicine and Botany.

The frost of December 1860 caused serious damage to trees and shrubs in the Botanic Garden of Edinburgh. On the morning of 24th December, Fahrenheit's thermometer stood at 6° below zero, according to the Kew standard. An account of the injury inflicted has been already published in the Transactions of the Botanical Society of Edinburgh. It has been stated that the great cold in the garden, as compared with other places near Edinburgh, may be accounted for by its low sheltered situation, and the descent of the heavy cold atmosphere from the more elevated localities around.

Among the plants which suffered were two very fine specimens of *Araucaria imbricata*, which had stood for upwards of thirty years, and one of which had attained the height of 24½ feet, with a circumference of 4 feet at the base of the stem, and with twenty whorls of branches. These trees, which were great ornaments of the lawn in front of the range of hothouses, have been cut down. An opportunity was thus afforded of examining the structure of their wood and bark. The former is very hard and heavy, and promises to be valuable timber. In regard to the latter, the scars

and markings, and their relation to the leaves, seem to deserve special notice. The sharp-pointed triangular hard and spirally arranged leaves are remarkably persistent. None of the plants in the garden have ever shed their leaves. They become sometimes of a brown colour; but even then they continue to adhere to the stem, and appear as unsightly appendages. In one of the plants cut down the leaves show a splitting at the base, apparently from distension in the parts underneath, similar to what takes place in the petioles of many palms before they are detached. It is possible that, in the *Araucaria*, the splitting of the basis of the leaves may sometimes be the precursor of their fall. From the lower part of the leaves prolongations extend along the surface of the bark, and give rise to peculiar markings, which are well seen when the leaves are cut off close to their union with the stem (fig. 1). The base of the

Fig. 1.

leaf remaining in the bark has the form of a narrow elongated ellipse, surrounded by cortical foliar prolongations. The markings on the bark, viewed externally, have a somewhat oblique quadrilateral form. The leaves, when examined by the microscope, show stomata on both surfaces, running in lines, not unlike the appearance presented by stomata in *Equiseta*.

On removing the epiphloeum or outer bark, and examining its inner surface, we remark a difference in the appearance presented at the lower and upper part of the stem. In the lower portions the markings have an irregular elliptical form, with a deep depres-

sion, and fissures where the leaves are attached (fig. 2). Higher up the epiphloeal markings assume rather more of a quadrilateral

Fig. 2.

form, with the depressions less deep, and the fissures for the leaves giving off prolongations on either side. Farther up the markings are smaller in size, obliquely-quadrilateral, and present circular dots along the boundary lines chiefly (fig. 3). Higher still the

Fig. 3.

quadrilateral form becomes more apparent, and the dots disappear (fig. 4). The epiphloeum thus presents differences in its markings at different heights on the stem.

The middle part of the bark, or mesophloeum, is well developed, and is of a spongy consistence. When examined microscopically it is seen to be composed of cells of various shapes—some elongated

fusiform, others rhomboidal, others with pointed appendages. The variety of forms is very great, and it is possible that this may be partly owing to the effects of frost on the cells. On the spontaneous

Fig. 4.

separation of the bark, the mesophlœum was seen to consist of distinct plates of a more or less quadrilateral form, with some of the edges concave and others convex, a part in the centre indicating the connection with the leaf, along with which it is detached. In Fig. 5 a leaf is shown with a mesophlœal plate attached.

Fig. 5.

The endophlœum, liber or inner bark, is of a fibrous nature, and consists of elongated woody tubes.

The appearances presented by the outer and middle bark of *Araucaria imbricata* bear a marked resemblance to those exhibited by certain fossils included in the genera *Sigillaria* and *Lepidodendron*. The sculpturesque markings on the stems of these fossil plants have induced geologists to look upon them as allied to the ferns and lycopods of the present epoch. But it is evident, from the specimens of *Araucaria* now laid before the Society, that much caution is required in making this determination. Other points of structure must be examined before a proper decision can be formed; when, for instance, the presence of scalariform tissue, or of punctated woody tissue has been satisfactorily shown under the microscope, we are entitled to

hazard an opinion as to the affinities of the fossils. In many instances, however, external appearances are the only data on which to rely for the determination of fossil genera and species; and rash conclusions have often been drawn by geologists who have not been conversant with the structure of plants.

The *Araucaria* markings point out the need of care in drawing conclusions, and their variation at different parts of the bark indicate the danger of a rash decision as to species. There can be no doubt that in vegetable palæontology the number of species has been needlessly multiplied—any slight variation in form having been reckoned sufficient for specific distinction. We can conceive that the *Araucaria* bark markings in a fossil state might easily supply several species of *Sigillaria*, or of *Lepidodendron*. The geologist, with little knowledge of the present flora of the globe, ventures often to decide on an isolated fragment, which a well-informed botanist would hesitate to characterise. Hence the crude descriptions of fossil vegetable forms, and the confusion in which Palæophytology is involved. Every geologist who examines fossil plants ought to be well acquainted with the minute structure of living plants, the forms of their roots, stems, leaves, fronds, and fructifications; the markings on the outer and inner surfaces of their barks, on their stems, and on their rhizomes; the localities in which they grow, and the climates which genera and species affect in various parts of the world.

The following Gentlemen were elected Ordinary Fellows:—

EDWARD FRANCIS MAITLAND, Esq., Advocate, Solicitor-General for Scotland.

REV. ROBERT BOOG WATSON, late Chaplain to the Forces.

The following Donations to the Library were announced:—

Proceedings of the Royal Society of London. Vol. XI. No. 48.
8vo.—*From the Society.*

The Journal of the Chemical Society. Vol. XV. Part 3. 8vo.—
From the Society.

Proceedings of the Royal Horticultural Society. Vol. II. No. 4.
8vo.—*From the Society.*

The Assurance Magazine and Journal of the Institute of Actuaries. No. XLVII. 8vo.—*From the Institute.*

- Almanaque Náutico para el año 1863. Calculado de órden de S. M. en el Observatorio de Marina de la Ciudad de S. Fernando. Cadiz, 1861. 8vo.—*From the Director of the Observatory.*
- Pocket Diagram of Mean Pressures of Expanding Steam. By W. J. Macquorn Rankin, C.E., LL.D.—*From the Author.*
- London University Calendar for 1862. 12mo.—*From the University.*

Monday, 21st April 1862.

PROFESSOR CHRISTISON, V.P., in the Chair.

The following Communications were read :—

1. On the Theory of Numbers. By H. Fox Talbot, Esq.
2. On the Carboniferous Volcanic Rocks of the Basin of the Forth. By Archibald Geikie, Esq., F.R.S.

After referring to a previous communication to the Society, in which the author had given an outline of the chronology of the igneous rocks of Scotland, he proceeded in the present paper to describe in detail the character of the volcanic phenomena in one district—that of the carboniferous system of the Forth basin. The igneous rocks of this district consist partly of doleritic and felspathic lava-form masses, and partly of various kinds of ash or trap-tuff. These materials present a considerable diversity in their modes of arrangement. But the author had found that all the volcanic hills of the district might be reduced to three types of structure :—1. A simple cone of ash, round and over which the ordinary sedimentary accumulation of the carboniferous period had been deposited. 2. A cone of ash with the crater filled up by a neck or plug of basalt. 3. Sheets of different lavas with intercalated ash or sedimentary matter.

He described in detail the succession of volcanic phenomena in the Lothians and in Fife, pointing out how local and limited the eruptions had been as a whole. They were confined to the earlier half of the carboniferous period, no interbedded igneous rock having yet been found in the formations that overlies the carboniferous limestone. The whole of this district appears to have been dotted