"The Museums Association, at its annual conference in Hull, 1913, declares itself in cordial sympathy with the proposal to make provision in the grounds of the Crystal Palace for a British Folk-Museum on the open-air plan, and expresses the hope that the Right Hon. the Lord Mayor of London will use every endeavour to carry the proposal into effect."

The conference concluded its business by electing Mr. Charles Madeley, director of the Warrington Museum, to be president for the 1914 meeting, which is to be held at Swansea.

THE ELECTRIC FURNACE SPECTRUM OF IRON.

IN NATURE for April 24 (p. 200) we gave a brief account of the researches carried on by Mr. A. S. King, of the Mount Wilson Solar Observatory, upon the variations of the spectrum of titanium in the electric furnace. Mr. King has now concluded an investigation of the variation with temperature of the electric furnace spectrum of iron, an account of which is published in No. 66 of the Contributions from the Mount Wilson Solar Observatory.

This communication, like others of his on a similar subject, is of great interest, because it shows that the spectrum of a substance is not the same for any temperature. By knowing what spectrum is given at a known temperature it is possible to determine the temperature of stars or portions of the sun, and so utilise these laboratory researches for stellar and solar spectroscopy.

While a great amount of work has already been done in the case of iron, one of the earliest being the differentiation of temperatures by the short- and long-line method of Lockyer, Mr. King has all the advantages of the latest form of furnace and method of determining accurately the varying temperatures for the lower stages of temperature.

One of the great problems in these investigations is to determine whether the changes described are due to temperature or to electrical or chemical conditions which are present in different degrees in the sources of heat.

In a brief summary like this it is not possible to state all the conclusions which the research has led Mr. King to deduce, but the more important may be briefly summarised. In the first place, he has been able to divide into six classes the relative intensities of the iron lines in the visible spectrum for three furnace temperatures and the arc, basing them on the temperature at which a line appears in the furnace, and its rate of growth as the temperature increases. In passing from the furnace to the arc the changes in relative intensity may generally be accounted for by a difference in conditions equivalent to a large temperature difference. The ultra-violet was found a rich region for lines, and it was noted that increase of temperature corresponded to an extension of the line spectrum towards shorter wave-length. The increase in intensity of lines from the outer vapours into the core of an iron arc was found usually to resemble the rate of growth shown by the same lines with rising furnace temperature, and this the author suggests renders it unlikely that chemical reactions in the outer vapours affect the relative intensity of arc lines in any large degree.

So far as the visible region is concerned the enhanced iron lines are above the furnace stage, no lines being observed in the furnace spectrum. The furnace spectra at low and medium temperatures were found, except perhaps in the ultra-violet, to be very similar to those of the several flames.

The author concludes that while there is no definite proof that temperature radiation in a strict sense takes place, the position of temperature as the exciting and regulating agent in furnace phenomena seems to be clear.

ANTARCTIC LICHENS.[1]

LICHENS form a quite exceptional group of plants with many peculiar features, the chief among which is the fact that they are compound organisms, a lichen consisting of a fungus individual and numerous alga individuals—the fungus with its branched and interlacing threads has grown around the alga cells and enclosed them in a nest. The result is that the lichen can grow in places which would be quite unsuitable for the independent existence of either the fungus or the alga of which it is composed. Algæ grow in water or in moist places, while most fungi are extremely sensitive to cold and drought, but lichens can thrive in the bleakest positions and in the most severe climates, as on bare mountain rocks and in the farthest circumpolar regions reached by explorers—provided that the land surface is not covered by perpetual snow. In alpine and arctic regions, lichens do important pioneer work, helping to break up the hardest rock surfaces and prepare soil on which other plants can grow; while on steeply inclined and bare rock, lichens, along with minute algæ, are in general the first colonists.

These pioneer lichens are of the flat crustaceous and foliose types, the former attached closely to the substratum by their entire underside, the latter clinging more loosely, and being therefore detachable without chipping off bits of the rock itself in order to obtain specimens. On less steeply inclined parts, where the vegetation is older, the shrubby or fruticulose lichens are added; these are fixed at the base only, and show much greater variety of form than is found among the encrusting and leafy types.

In his report on the lichens of the Swedish Antarctic expedition, 1901–3, under Dr. O. Nordenskjöld, which has recently been published, Dr. O. V. Darbishire adds to his descriptions of the new species an interesting summary and discussion of the distribution of lichens in the arctic and antarctic regions generally. Unfortunately the good ship *Antarctic* was crushed by ice in January, 1903, and a large portion of the plants collected during her cruise along the coast of Graham Land had to be abandoned when she sank a month later; but though doubtless a considerable amount of material was lost in this disaster, a rich harvest was brought back by the botanical members of the Swedish expedition. This includes no fewer than 145 species of lichens, of which thirty-three are new.

An analysis of the results of antarctic expeditions up to and including Charcot's (1905) shows that at present 106 lichen species are known from the land which lies strictly within the antarctic limits, and that of these thirty-two also occur in subantarctic America, twenty-five in New Zealand, and sixteen in South Georgia, showing a very close affinity between the antarctic lichen flora, on one hand, and the American and New Zealand floras, on the other—the difference to the disadvantage of the latter being accounted for by the greater nearness of the subantarctic American region to the extreme limit of the southern drifting pack-ice. The lichens of subantarctic America and New Zealand are also very nearly allied, for out of 133 lichens in the former flora, 113 are found in New

[1] "The Lichens of the Swedish Antarctic Expdition." By Otto Vernon Darbishire. Wissensch. Ergebn. der schwedischen Südpolar-Expedition. 1901–1903. Band iv., Lief. 11. Pp. 1–73+3 plates. (London Dulau and Co., Ltd., 1912.) Price 8s. (Subscription price 6s.)

Zealand, 32 in the Antarctic, and 31 in South Georgia, the latter being evidently, from the phytogeographic point of view, a half-way house on the road from subantarctic America to the true antarctic area. Moreover, practically half of the antarctic species are common also to the arctic regions.

Of the 106 antarctic lichens, sixty-nine are crustaceous, eighteen foliaceous, and nineteen fruticulose species; of these, the numbers found in subantarctic America are respectively sixteen, five, and eleven. Of the sixty-seven species found only in the true antarctic area, forty-nine are crustaceous, ten foliaceous, eight fruticulose. The subantarctic American lichen flora includes 366 species, while 740 species have been enumerated for New Zealand; of the species common to the two regions 50 per cent. are fruticulose, 30 per cent. foliaceous, and only 20 per cent. crustaceous. The affinity of the subantarctic American and New Zealand lichen floras lies mainly in the fruticulose lichens, which are the oldest and probably the least variable forms. The encrusting species are more variable and have adapted themselves more readily to local conditions, thus giving rise to new species. An interesting point arises from a comparison with northern lichen floras. The arctic area had nearly 500 lichens, of which 72 per cent. are found in Tyrol. Thus the relation of arctic to alpine lichens is much greater than that of subantarctic American to New Zealand species, indicating that the latter are further from the point of common origin.

Dr. Darbishire raises the interesting question of the resistance of cold by lichens, and suggests some simple experiments which might be made on lichens in the very coldest regions. For instance, it would be of the greatest importance to determine the amount of water contained in the lichen thallus at various times and seasons. In what condition are lichens during the long winter? At what temperature does assimilation commence? It is of little use to try experiments on plants in warmer climates, if we wish to ascertain how these small plants can live under the adverse conditions prevailing in the arctic and antarctic regions.

Lichens are found everywhere on the outer limits of vegetation, and their chief ecological distribution factor is their power to become quite dry and yet remain alive. No doubt it is this property which enables them to spread slowly but surely into the bleakest and most inhospitable regions. They are making their way towards the north and south poles, and so far they have been beaten in their race only by the perpetual covering of snow. There is little doubt that if bare rocks are found in the neighbourhood of the poles themselves, lichens will be found growing there.

Dr. Darbishire's memoir is illustrated by three double plates of beautifully reproduced photographs, depicting the new species brought back by the expedition. F. C.

APPLICATIONS OF POLARISED LIGHT.[1]

ON November 30, 1812, just above 100 years ago, the French physicist Biot communicated to the Institute of France a memoir "on a new kind of oscillation which the molecules of light experience in traversing certain crystals." In this paper, which extends over 371 pages of the printed memoirs, the phenomenon of "rotatory polarisation" was described for the first time. This phenomenon depends on the property which certain substances possess of taking a beam of polarised light and imparting a twist to the plane of polarisation: the beam of light enters with all the vibrations compressed, say, into a vertical plane; it emerges apparently unchanged, but careful examination shows that the component vibrations are no longer vertical, but inclined either to the right or to the left. The importance of this discovery to physicists and to crystallographers was immediately obvious. In our own generation its fertility has been realised also by chemists, who have found in the polarimeter an instrument which promises to render to the science services not less notable than those which have been accomplished with the help of the spectroscope.

A.—*Sources of Polarised Light.*

If one were to ask what progress had been made in the facilities for applying polarised light to the study of chemical and physical problems, the answer would be twofold. On one hand it must be acknowledged that the "Iceland spar," by means of which Huyghens in 1678 first detected the polarisation of light, is still the best substance for producing this effect. But the increasing demand for the spar has not been accompanied by any corresponding increase in the supply, and large clear pieces of the mineral are becoming increasingly difficult to procure. It may indeed be doubted whether large polarising prisms such as those which have been handed down as heirlooms at the Royal Institution could now be purchased at any price, in view of the "spar-famine" which has prevailed for some years.

Considerable advance has, however, been made in the direction of improved methods of illumination. The solar light, which figured so largely in the experiments of the earlier workers, is too precarious to satisfy the ardent worker of to-day, and in any case could render no direct assistance in illustrating a Friday evening discourse. When Faraday, on Friday, January 23, 1846, delivered his discourse on the magnetisation of light to an audience of 1003 persons, the source of light in the experiments which he described was an Argand gas-burner. Prof. Silvanus Thompson in 1889 was able to use the electric arc, which was then just beginning to come to the front as a commercial illuminant. With this unrivalled source of light he was able to show for the first time in a public lecture a large number of the properties of polarised light which had been reserved hitherto for individual observation in the laboratory. The remarkable effects which are seen when light of one single colour or wave-length is substituted for white light were shown by Spottiswoode in 1878, with the help of a powerful sodium-lamp which had been devised by Sir James Dewar. His lecture was aptly described as "A Nocturne in Black and Yellow."

During several years I have taken a special interest in seeking to discover other sources of monochromatic light for use, in experiments on polarisation, and have been particularly concerned to proclaim the merits of the mercury arc as an illuminant for everyday use in optical investigations.

The Mercury Arc.

The spectrum of the light produced by passing an electric discharge through mercury vapour was described by Wheatstone in 1835 in a report to the British Association on the prismatic decomposition of electric light; but it was not until twenty-five years later that a real mercury-lamp was invented by Prof. Way. This consisted of an intermittent jet of mercury which was directed into a cup half an inch below. The current from a battery of Bunsen cells was passed through the jet and developed an intense light. The spectrum of the light was examined by Dr. J. H. Gladstone, and described in a paper on the electric

[1] Discourse delivered at the Royal Institution on Friday, April 18, by Dr. T. M. Lowry.