

two ends of the spectrum, fourteen displayed a marked difference which is stated to be very great in some cases. In every case the star which is relatively faint at the violet end of the spectrum is the star of small proper motion. Mr. Adams points out that the evidence of this small amount of material is too slight to warrant any extended discussion on its application to the problem of the absorption of light in space.

WHO'S WHO IN ASTRONOMY.—The very excellent book, entitled "Astronomical Observations and Astronomers," and published under the auspices of the Royal Observatory of Belgium, which first appeared in the year 1907, is well known to most of the readers of this column, and no doubt has been found a very useful book of reference. The work was from the pens of the astronomers at the Royal Observatory of Belgium, and the task of collecting and arranging the information was no light one. It is now proposed to bring the contents thoroughly up to date, and with this intention circulars have been widely distributed requesting that the printed forms be filled in. These forms ask for a brief statement as to *personnel*, instruments, researches, and publications of observatories, and it is hoped that everyone will do his best to make the volume as complete as possible, and so render more light the labours of M. P. Stroobant and his co-workers.

WORK OF THE VIENNA RADIUM INSTITUTE.¹

OF the seventeen papers before us, from the Radium Institute at Vienna, five by Drs. von Hevesy and Paneth, both of whom are well known in this country, contain notable advances in our knowledge of the chemistry of the radio-active elements. The chemical identity of the several members of a group of isotopic elements has been further put to the proof and extended to include the electro-chemical properties. An elegant application of this new phenomenon of isotopy has been made in analytical chemistry in the determination of the solubility of such excessively insoluble compounds as lead chromate, sulphide, &c. The principle of the method is to add to the common element its radio-isotope in unweighable, but intensely radio-active, amount, and to estimate the distribution of the former after any chemical operation from the experimental distribution of the latter by radio-active measurements. Thus radium D, derived from the decay of radium emanation, is added to lead before its precipitation by potassium chromate. Radium D being isotopic with lead, the ratio of the lead and radium D must remain unchanged by the precipitation. The quantity of lead in the filtrate is, of course, analytically undetectable, but the quantity of radium D is easily estimated. In this way the solubility of lead chromate in water at 25° was found to be 0.012 mg. per litre, or twelve parts in a thousand million.

Another important direction, in which these investigators are extending, is in the application of colloid-chemistry to the radio-elements. Often, as they and Godlewski in France have independently concluded, even these extremely attenuated solutions of the radio-elements behave as colloids rather than as electrolytes and their transport under the electric current is due to electrophoresis rather than to electrolysis. Polonium is the centre of interest in many of these researches, for it is a new element, in the sense

that it is isotopic with no previously known one, and occupies a separate place in Mendeléeff's table, so that its properties cannot, like those of the majority, be exactly determined by proxy.

V. F. Hess describes a convenient method of determining quantities of radium by the γ -ray method, the quantity being read off by the constant deflection of an Elster-Geitel single quartz-thread electrometer, in conjunction with one of N. R. Campbell's high resistances of xylol and alcohol. A long attempt to arrange a standard measuring instrument, calibrated once for all, which would give the quantity of radium without the necessity of employing a radium standard, might have been more successful if the author had been acquainted with A. S. Russell's work on the measurement of γ rays and the necessity, if disturbances from secondary rays are to be avoided, of using lead, not brass, for the walls of the electroscope. In the same field Flamm and Mache continue the account of their attempts to measure the radium emanation quantitatively by the absolute value of the ionisation current in a guard-ring plate condenser.

Hess has continued his determinations of the penetrating radiation of the upper atmosphere by means of balloon ascents, and arrives at the startling conclusion that above 2000 metres there is a rapid increase in the intensity of the penetrating rays. At these heights the penetrating rays from the earth itself would be absolutely negligible, whilst that from the radium emanation in the air, which has its origin in the earth and is of limited life, must be, at any rate, less than at the surface. The conclusion that a great part of the penetrating radiation cannot come from the known radio-active constituents of the earth and atmosphere is one that must evoke general interest, and calls for the further radio-active exploration of the upper atmosphere.

Other papers deal with chemical decomposition produced by radium rays and ultra-violet light (Kailan), the solubility of radium emanation and other gases in liquids (Stefan Meyer and Martin Kofler), the variation in the ranges of the individual α particles through the probability variations in the number of molecules they encounter in their path (Freidmann), and the life periods of uranium and radium (Stefan Meyer). The latter research treats critically the known data from which these constants can be derived, and leads to the result that there is complete agreement among values obtained by independent methods. The most probable values for the periods of average life of radium and uranium respectively are 2500 and 7.23×10^9 years. Incidentally, it may be pointed out, this makes the perennial problem of the origin of actinium more of a mystery than ever, for there should be no such agreement among the methods, if, as is supposed, some 8 per cent. of the uranium atoms branched off into actinium at some point before radium is arrived at. But it may still be doubted whether some of the data chosen, particularly the equilibrium ratio between radium and uranium, are not at fault.

F. S.

SMOKE AND SMOKE PREVENTION.

"A BIBLIOGRAPHY of Smoke and Smoke Prevention," prepared by Mr. E. H. McClelland, has been published by the University of Pittsburg, Pa. (Bulletin 2, 1913, pp. 164; price 50 cents). The bibliography has been compiled for the use of the Melton Institute of Industrial Research, consisting of a body of scientific experts, who are about to embark on an inquiry, the nature and extent of which is set forth in the first bulletin issued by the institute ("Outline of the Smoke Investigation"). It contains an apparently complete

¹ Mitteilungen aus dem Institut für Radium-forschung, xxxviii-lij. Ueber Neuerungen und Erfahrungen an den Radium-messungen nach der γ -Strahlenmethode. By V. F. Hess (*Verh. D. Physikal. Ges.*, 1913, xv, Nr. 20).

list of publications dealing with smoke, its cause, effects, and prevention. In looking through the bibliography, we are struck by the extent and varied sources of the literature, a fact which clearly indicates that the smoke nuisance has no mere "local habitation," but possesses a widespread interest. English, American, German, and French volumes predominate, and if we were to estimate the extent of the nuisance in these countries by the number of publications England would stand easily first. Still, it is some consolation to think that we do not suffer alone. The question then arises, how long will the present state of apathy on the part of the public authority continue, and when will the limit to public endurance be reached? It is true that we have the smoke clauses of the Factory Acts; but a perusal of these will immediately dispel any faith in their efficacy. We have also local bylaws; but experience will teach the most casual observer that in most industrial centres atmospheric purification has undergone little change. Indeed, in some of the most notoriously bad localities average convictions do not exceed one a year. There is, we believe, a Bill to be introduced into the House of Commons, and promoted by a large and influential body of citizens connected with various industrial centres, which, it is hoped, will find its way to the statute-book. In the meantime, there is no question that demands more immediate and drastic treatment than the smoke problem owing to its effects on the health, cleanliness, and general comfort of the community.

ANTARCTIC PROBLEMS.¹

The Problem of the Antarctic Andes and the Antarctic Horst.

AS the Weddell Sea will be the objective this year of no fewer than three Antarctic expeditions, some of its features as bearing on the above problem may be discussed first.

The continuity of Coat's Land, discovered by Dr. W. S. Bruce in the *Scotia* in 1904, with Prince Regent Luitpold Land, discovered by Dr. Filchner in the *Deutschland* in 1912, has still to be traced. Filchner sighted three Nunataks of dark rock rising from the inland ice to the south of "Vahsel Bucht," thereby proving indisputably the existence of land under the inland ice. The inland ice there rose gently from its shore cliff of from 25 ft. to 65 ft. high, up to more than 3000 ft. at a distance from the shore of about thirty miles. Of far greater importance is the tracing inland of the unknown coast to the south of Luitpold Land.

This is one of the greatest of the geographical problems which the Shackleton Expedition should solve. Amundsen, on his journey to the south pole in 1911, proved that the south-easterly trend of the Queen Alexandra Range, discovered by Shackleton at the Beardmore Glacier, is not maintained in the Queen Maud Ranges, but that the latter ranges bend to the right as one follows a great circle from the Beardmore Glacier to Graham Land. So far, this favours the theory of Penck that Antarctica is divided into a West and East Antarctica respectively, by a strait connecting the Ross Sea with the Weddell Sea, for the trend of the Queen Maud Ranges, if continued farther north in the western hemisphere, would carry it to Luitpold Land.

There can be little doubt that this Queen Maud Range is bounded by heavy fractures, of the order of several thousands of feet, for geological reasons which will be stated presently; and that these trend lines

are, perhaps, as strongly pronounced as are any in the world. If, therefore, the ranges, to which they give origin, extend towards Luitpold Land, they are certain to be strongly marked, and should be capable of accurate delineation by the Transantarctic party of the new expedition. If, on the other hand, as seems more probable, the Queen Maud Ranges, when traced into the Weddell Quadrant, bend back towards Graham Land, and become continuous with Charcot Land and King Oscar II. Land, then Shackleton's other party, operating from his main base at the head of Weddell Sea, should be able to solve this all-important problem. With its length already proved of no fewer than 1400 miles, and its height of from 8000 to 15,000 ft, its stupendous fracture lines, involving displacements of 5000 to 6000 ft., and its profound influence on the meteorological conditions of Antarctica, and probably of the southern hemisphere, it is not the least important of the mountain ranges of the world, and certainly yields to none in its geological interest and the extreme difficulty of the problems which it presents.

At the Graham Land end of Antarctica, Arctowski, Nordenskjöld, Gunnar Andersson, Charcot, and Gourdon have proved that petrographically and tectonically the rocks are distinctly Andean. Granodiorites, and Andesitic rocks, in which zoned soda-lime felspars are characteristic, are there predominant. Boulders of gneissic rocks present in Tertiary strata at Seymour Island suggest a pre-Cambrian foundation complex at no great distance. Recently Dr. W. T. Gordon has identified well-preserved Archæocyathinæ in a large block of limestone dredged up by Dr. W. S. Bruce in the *Scotia*, from lat. 62° 10' S., long. 41° 20' W., from a depth of 1775 fathoms, near the South Orkney Islands, and specimens of *Pleurograptus ceratiocaris* and *discinocaris*, previously described by Pirie, from the collections by Bruce in the South Orkneys, proves the existence there of Ordovician rocks. The sedimentary rocks are largely formed of Jurassic plant-bearing strata, with one of the richest known fossil floras of that age in the southern hemisphere. In the west and central parts of Graham Land these have been strongly folded, and mostly overfolded to the east, as has been the case with the greater part of the formations developed in the South American Andes. Farther east in James Ross Island, Snow Hill, and Seymour Islands, &c., there is a gently inclined series of marine Cretaceous rocks, followed by Middle Tertiary rocks (Upper Oligocene to Older Miocene) with fossil leaves of *Fagus*, *Araucaria*, &c., a geological structure recalling that of East Patagonia and southern Argentina, as compared with the folded highlands of west Patagonia and southern Chile.

Then the zone of active or dormant volcanoes, which intermittently characterises the Andean Chain, is met with on both sides of Graham Land, in Bridgman, Paulet, and Deception Islands, on the west, and in Lindenberg, Christensen, Sarsee, and the Seal Island volcanoes on the east side. If now a comparison of the broad structural features of West Antarctica be made with those of East Antarctica in the Ross region it will be noticed that a great volcanic zone stretches along the western shore of Ross Sea from at least so far south as Mounts Erebus, Morning, and Discovery, to so far north as Cape Adare. This main volcanic zone of the Ross Sea region is crossed by lesser zones trending more or less east and west, like the Mounts Terror, Terra Nova, Erebus, and Dry Valley zone, the zone of the Balleny Islands, &c. If, however, this Ross Sea volcanic zone with the adjacent mountains be compared with the ranges and volcanic zones of West Antarctica, the fact at once becomes obvious that the ranges of the Ross area are entirely devoid of folding, and are of a block-faulted plateau type,

¹ Summary of a paper read before the Royal Geographical Society on February 9 by Prof. Edgeworth David, C.M.G., F.R.S.