

under the direction of the late Sir William Ramsay, and those of Canada were also examined, but in both cases the efforts were unsuccessful. The dangers attending hydrogen-filled aircraft were obvious from the fate of many of the German Zeppelins, so that the possibility of extracting sufficient quantities of an incombustible gas such as helium (admirably suited in every way to the peculiar requirements of lighter-than-air machines) was too important to be ignored.

In the United States the help of certain commercial firms, employing the Linde and Claude processes of gas liquefaction for the treatment of air, was solicited, and in 1918 two plants were in operation at Fort Worth, Texas, ultimately giving an average production of 5000 cb. ft. of gas per day, yielding on purification up to 93 per cent. of helium. Although the effect of the armistice was to check military requirements, the development of commercial aviation keeps this use of helium very much in the foreground, and in view of this and also of the far-reaching scientific problems involved the United States Geological Survey has just published, from the pen of G. Sherburne Rogers, a most valuable monograph on "Helium-bearing Natural Gas" (Professional Paper 121, 1921).

The chief region from which commercial supplies of helium are obtained is that of the Mid-Continent oilfields, more especially from two areas, one in North Texas and the other in North Oklahoma and South Kansas; gas in both these areas yielded up to 0.5 per cent. of helium, in some cases the amount being as much as 2 per cent. One would naturally expect helium-rich gas to show a high nitrogen content with consequent low calorific value; generally speaking this is found to be so, though in one instance a gas with 14 per cent. of nitrogen yielded 0.35 per cent. of helium. On the other hand, a high nitrogen content is not necessarily a criterion of a high helium yield, and Rogers cites several examples of this. The nitrogen-helium ratio in natural gas in thirteen samples quoted ranges from 11.4 to 20; the conclusion to be drawn from this, and also from a careful study of several other available analyses, is that a low (N_2/He) ratio implies a low helium content.

The richest helium-bearing gas in America is obtained from comparatively shallow depths in the Pennsylvanian beds, and it is interesting to note that gas emanating from younger beds, such as the

Cretaceous or Tertiary of Texas and Louisiana, is low in helium content. Bearing in mind Czakó's contention that the radio-activity of a gas is an index of its helium content, and also Holmes's work on radio-activity as a measurement of geological time, it is thus not difficult to appreciate the reason of the low helium content of European natural gas, derived for the most part from Tertiary strata. Evidence is not forthcoming as to the radio-activity of the gas from the Pennsylvanian beds, but McLennan's researches in Ontario (NATURE, vol. 70, p. 151, 1904) demonstrated the tendency of decreased radio-activity with increased depth, and this may reasonably be correlated with the marked decrease in helium yield with increase in depth from which the gas is obtained in the present case.

The origin of the helium in the gas affords a wide ground for speculation, though in the present state of our knowledge it would be very unsafe to dogmatise. Rogers discusses this at some length, but of the several possible theories he favours two, more particularly the first—that the helium is generated from uranium or thorium deposits disseminated through the beds proximate to the natural gas horizons, or that it is primordial and comes from abyssal sources. His arguments in favour of the former theory are very sound, though, as he admits, it assumes the occurrence of radio-active deposits of which we have no knowledge, more particularly in the upper palæozoic rocks of the Mid-Continent region, or in some of the buried igneous masses occurring as subterranean uplifts.

It is interesting to note that in the case of the three principal occurrences of natural gas in this country, at Calvert, Buckinghamshire, at Middlesbrough, Durham, and at Heathfield, Sussex, the nitrogen contents were 19.5 per cent., 16.8 per cent., and 0.9 per cent. respectively; in the first case the source of the gas is doubtful, but it is presumably from pre-Liassic beds; in the second case it is obtained from the Magnesian Limestone, and at Heathfield it is unquestionably derived from the Kimmeridge Clay. If the nitrogen evaluation is any indication of helium-bearing gas, as it would seem to be in the United States, it is extremely unlikely that helium occurs in those gases in amount greater than 0.5 per cent. (if as much as that) at Calvert and Middlesbrough, while at Heathfield it is probably absent altogether.

Obituary.

LORD BRYCE, O.M., F.R.S.

IT can be but seldom, when a man's life has been prolonged to well over eighty years, that his death is generally felt as a serious public loss. Lord Bryce's sudden, if happy, death on January 22, in his eighty-fourth year, is a shock which will be felt equally here and in the United States, where only last summer he had been engaged both by lecturing and in social intercourse in spreading a better understanding of the problems of Great Britain and

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Europe. Years ago, by his great work on "The American Commonwealth," and at a later date by his tact and manifold activities while our Ambassador at Washington (he was reputed to have visited every State in the Union), Lord Bryce had made himself a living link between the two peoples. In the United States he was not only trusted by statesmen and appreciated by the leading men in thought and literature, but he was also an idol of the crowd. When he came into a popular assembly the proceed-

ings were apt to be interrupted and the whole audience would stand up and give three cheers for "good old Bryce." Among themselves the Americans to the last habitually called him "our Mr. Bryce." American citizens of all classes believed in his thorough goodwill towards their country, and he thus achieved what seemed almost the impossible in inducing them to bear kindly with criticism they felt to be both honest and friendly. For if Lord Bryce knew no better form of government than democracy, he was, as his recent work has shown, keenly alive to its imperfections and crudities both in the States and in Australia.

Politics, historical and literary studies, and travel were the main occupation of Lord Bryce's life. His career in the two former branches of activity has been fully dealt with in the general Press. Here we may more appropriately confine ourselves to the last. Lord Bryce, without being in any strict sense a man of science, though he was elected a fellow of the Royal Society, under the special rule, in 1893, took the keenest interest in several branches of natural science. His father had been a geologist, and he himself was apt to record the geological features of the countries he passed through. In botany he was an eager student, with a keen eye for rarities. In his walks near his home at Ashdown Forest he would frequently stop to recognise some relatively rare growth, and so long ago as 1859 he wrote a manual on "The Flora of the Island of Arran."

When he visited Peking the attachés at the British Legation, who were prepared to give information on Chinese politics, were dismayed to find themselves called on to answer questions as to the local flora. In his "Impressions of South Africa" he discusses at some length the vegetation of the country, and records that he brought home fifty-four plant specimens, eleven of which were pronounced at Kew to be new to science. Wherever he went he was as keenly interested in the natural aspects and features of the country visited as in its inhabitants and their politics, and he delighted to trace the interaction between the two. His descriptive talent was exceptional, and was aided by the almost unique opportunities for comparison given him by the extent of his travels. Take at hazard this vivid sketch of Lake Titicaca:—

"The blue of Titicaca is peculiar, not deep and dark, as that of the tropical ocean, nor opaque, like the blue-green of Lake Lemana, nor like that warm purple of the Ægean which Homer compares to dark red wine, but a clear, cold, crystalline blue, even as is that of the cold sky vaulted over it. Even in this blazing sunlight it had that sort of chilly glitter one sees in the crevasses of a glacier; and the wavelets sparkled like diamonds."

The shortest way to indicate the extent of Lord Bryce's travels might possibly be to give a list of the regions he had *not* visited. During the three years (1899-1901) when he was president of the Alpine Club it was noted that whatever distant range might be under discussion the ubiquitous chairman was sure to begin his remarks with, "When I was out there." I believe "The Mountains of the

Moon" was one of the few places where the author of the paper had the advantage of him.

Of these many years' wanderings and holidays in a busy life (continued until last spring by a trip to Morocco) the public have had the results in three solid works. Of these, the first, "Transcaucasia and Ararat" (1877) was in the main not a mountaineering record, but a study of the Caucasian isthmus and its peoples, as seen by a passing visitor. But the account of an ascent of Mount Ararat, in which Lord Bryce reached the top without his companions, fixed public attention and had some singular consequences. In a rash moment he wrote of a piece of wood he picked up near the top, a relic of a previous Russian ascent, that he was not able to state it might not be gopherwood. When in the United States he had frequent applications from out-of-the-way local museums for the smallest fragment of this invaluable relic of Noah's Ark!

Lord Bryce's two solid volumes on South Africa and South America are, apart from their political importance, admirable pictures of the regions described. In their pages he unites the power of observation which makes a good traveller with that of generalisation which is called for in a geographer. And he carries his readers on from one topic to another by a lively style which reflects the quickness and versatility of the author's mind. Lord Bryce was engaged at the time of his death in a collection of "Memories of Travel," which we trust will be found in a state sufficiently advanced to admit of publication.

It must be added that if Lord Bryce had one hobby, or taste, stronger than another, it was for mountains and mountain climbing. He habitually found time to attend the meetings of the Alpine Club, and to take a share in its discussions. He followed the doings of its members with the keenest interest. The chief ornament of a study which was usually a chaos of proofs, letters, and presentation volumes, was a photograph of the most beautiful of snowpeaks, the Himalayan Siniolchum.

DOUGLAS W. FRESHFIELD.

SIR JOHN KIRK, G.C.M.G., K.C.B., F.R.S.

By the death of Sir John Kirk at the advanced age of ninety, the world has lost the last survivor of the heroic pioneers of African exploration, the founder of the British position in Eastern Equatorial Africa, and a botanist whose contributions to African natural history were of first-rate importance.

Sir John Kirk was born in the Manse of Barry, near Arbroath, in 1832. He entered Edinburgh University at the age of fifteen, and obtained the degree of M.D. in 1854. In 1855 he went to Turkey with the Volunteer Medical Corps in connection with the Crimean War and served in a hospital on the Dardanelles. In 1857 he was recommended by "Woody Fibre" Balfour as physician and naturalist to Livingstone's second expedition, in which he served from 1858 until he was invalided home in 1863. On that expedition, which was the least successful of Livingstone's three, Kirk gained a higher reputation than any other of its members. His unflinching good humour, tact, and great gift of