OUR ASTRONOMICAL COLUMN.

A PARTIAL ECLIPSE OF THE MOON.—The moon will be in partial eclipse during the early morning hours of Saturday, July 15. The first contact with the shadow occurs at 3h. 19·3m. a.m., the angle from the north point being 40° to E. At Greenwich the moon sets at 3h. 59m. a.m. (one hour later in legal time), nearly 47 minutes before the middle phase.

A BRIGHT METEOR.—A notable meteor was observed at the Hill Observatory, Sidmouth, early on July 8. First seen at 1h. 5m. a.m. G.M.T. a little E. of N. about 15° above the sky-line, rising in the sky, it then passed not quite overhead and reached 30°–40° beyond the zenith. Unfortunately, although the sky was clear and the meteor considerably exceeded Jupiter in brightness, it left no visible trail. The meteor gave the illusory impression of coming quite near to the observer and not of describing a meridian, an effect no doubt largely due to its increasing brilliancy.

COMET 1916*b* (WOLF).—An investigation of the orbit of this comet has been carried out by Messrs. R. T. Crawford and Dinsmore Alter, of the Berkeley Astronomical Department (Lick Obs. Bull., No. 282). From this it appears that Prof. Barnard succeeded in identifying the comet on a photograph taken on April 24. The time of the observation indicates that it must be the same photograph on which a confusion of the minor planet 446 Æternitas with the new comet had been pointed out by the editors of the *Astronomisch Nachrichten* (No. 4845). The earliest position available to the American calculators was that derived from Prof. Barnard's plate. With this and other observations made at Yerkes, May 10 and May 23, the following differentially corrected parabolic orbit has been calculated:—

$$T = 1917 \text{ June } 16{\cdot}4806 \text{ G.M.T.}$$

$$\omega = 120^\circ\ 37'\ 07{\cdot}9'' \qquad \Omega = 183^\circ\ 16'\ 58{\cdot}8''$$

$$i = 25^\circ\ 40'\ 06{\cdot}4'' \qquad \log q = 0{\cdot}226855$$

These elements and the resulting ephemeris only differ slightly from the calculations by Prof. A. Berberich (NATURE, June 1). Numerous American observations, mostly made at Yerkes, are represented closely. The orbit resembles that of Wolf's periodic comet 1884, III., and consequently an elliptic orbit with a period of seven years was calculated; the differences, however, disproved identity. The faint luminosity and low altitude of the comet now probably put it out of reach until it becomes a morning star.

AREQUIPA PYRHELIOMETRY.—In consequence of the recommendations of the Committee of the International Union of Solar Research, measures of solar radiation have been made at Arequipa since 1912. Some of the results so far obtained have been published by C. G. Abbot (Smithsonian Miscellaneous Collection, vol. lxv., No. 9). Special attention has been given to the question of solar variability and atmospheric transmission. At Arequipa the chief factor in the latter connection is the amount of water vapour, and consequently the silver-disc pyrheliometer measures of radiation have been supplemented by a nearly simultaneous series of measures of atmospheric humidity. The monthly mean values show a close connection between the solar radiation and vapour pressure. This was represented by empirical formulæ which gave values of the solar constant in good agreement with the more rigorous values obtained at Mount Wilson and generally confirming the variability of the solar radiation.

The dust of the Katmai eruption (June, 1912) did not affect the Arequipa measures.

CANADIAN ECONOMIC GEOLOGY.[1]

THE White River District of Yukon extends east from the Alaskan-Canadian boundary, and its geology continues that of country well known by the work of the American geologists. Some Carboniferous rocks, resting on an Archean foundation, are followed by thick Mesozoic sediments which contain a few Cretaceous fossils. The Cainozoic is represented by land and fresh-water beds containing lignites. As in Alaska, there are two volcanic series, one of which was erupted during the world-wide disturbances between the Jurassic and Cretaceous, and the other is Upper Cainozoic and continued until very recent though pre-Glacial times. In the early Pliocene the country was uplifted and greatly fractured, the evidence of which is most distinct on the coast. The chief ores of the White River District are of gold and copper. The discovery of the placer deposits at Chisana in 1913 occasioned the greatest "stampede" or mining rush since that to Klondyke in 1897–98. The copper ores have long been worked by the Indians, and in 1891 the exaggerated reports of their quantity led to the first prospecting of the country. Mr. Cairnes's memoir is illustrated by some excellent maps and photographs.

At the opposite corner of Canada, on the southern shore of the Northumberland Strait, is an area strikingly unlike the White River District. It was one of the first Canadian districts geologically investigated; it was settled during the latter part of the eighteenth century, and the names Arisaig, Knoydart, Moydart, Lismore, etc., show that the pioneers were the expatriated exiles from the western Highlands. The district is composed of Palæozoic rocks ranging from the Ordovician to the Upper Carboniferous, with some Ordovician rhyolite lavas and Upper Palæozoic diabase dykes. The surveys of recent years have supplemented and in some respects corrected the earlier results of Dawson and Honeyman. Thus there is a full Silurian sequence, as the Moydart beds represent the Wenlock series, which had been considered absent. The Devonian is represented by the Knoydart series, which is correlated with the British Lower Old Red Sandstone. The absence of the Middle and Upper Old Red Sandstone is attributed to great faulting, that corresponds to that which caused the absence of the Middle series from south-western Scotland. The Carboniferous is represented, as in Britain, by a lower marine series and an upper continental series.

The most interesting economic deposits in this district are the Silurian oolitic ironstones, which the author infers from their special fauna were laid down under unusual conditions, during which the sea contained much ferruginous material. This view is not adequately explained, and there is no proof that the ores were not due to a partial replacement of an oolitic limestone. The report is accompanied by two clear geological maps.

The oil discoveries in the United States in the early 'sixties stimulated research for oil in eastern Canada. Oil was found, though in comparatively small quantities, and some of the districts continued to yield ever since. This oil belt extends from Lake Huron to the Gaspe peninsula, south of the mouth of the St. Lawrence. The most important fields are in the south-western peninsula of Ontario, south of a line from the southern end of Lake Huron to the western end of Lake Ontario. The oils come from various hori-

[1] D. D. Cairnes: Upper White River District, Yukon. Canada, Department of Mines, Geol. Surv. Mem. 50, Geol. Ser., 51, 1915, iv. Pp. 191+xvii plates+3 maps.
M. Y. Williams: Arisaig-Antigonish District, Nova Scotia. *Ibid.*, Mem. 60, Geol. Ser., 47, 1914, vi. Pp. 173+2 maps.
W. Malcolm: The Oil and Gas Fields of Ontario and Quebec. *Ibid.*, Mem. 81, Geol. Ser., 67, 1915, ii. Pp. 248.

zons. There are traces in the Trenton (Ordovician); small quantities are obtained from four distinct Silurian series. The largest quantity of oil comes from the Onondaga beds, which are Devonian. The author mentions both the organic and inorganic theories of the origin of petroleum; he expresses no definite preference, but appears to be inclined to the latter, and some of the facts stated in the memoir indicate why some Canadian geologists are firmly attached to that view. The most interesting evidence is based on the uniform composition of the associated natural gas, which is advanced as incompatible with its local origin; but the balance of the evidence stated seems difficult to reconcile with the inorganic hypothesis.

Each of the three memoirs is a useful contribution to Canadian geology. J. W. G.

RADIO-ACTIVITY AND PLANT GROWTH.

FOR some time past Mr. Martin Sutton has been making experiments on the effects of radio-active ores and residues on plant growth. A preliminary account of the experiments was given in NATURE for October 7, 1915, and the detailed report now to hand, issued as Bulletin No. 7, from Messrs. Sutton, of Reading, confirms the conclusions then drawn. The experiments were soundly conceived and well carried out; the results showed that radium compounds have no sufficient effect on plant growth to justify any hopes of practical application in horticulture or agriculture.

The experiments were made with tomatoes, potatoes, radishes, lettuces, vegetable marrows, carrots, onions, and spinach beets; some of the plants were grown in pots, and others in the open ground. Pure radium bromide was used in some experiments, and radium ores in others. In order to eliminate the effect of substances other than radium present in the ores, a mixture of these was made and applied to some of the plants. In certain cases small increases in growth over the unmanured plants were obtained, but nothing approaching the increases given by artificial fertilisers or farmyard manure.

A number of rather extravagant claims are thus disposed of, including one to the effect that radium treatment caused plants to take on certain flavours that they do not naturally possess. Thus a previous investigator had claimed that vegetable marrows grown in presence of radium compounds assume the flavour of pineapples; Mr. Sutton's marrows were cooked and tasted by a distinguished exponent of horticultural science, whose tastes in these matters are recognised as being beyond reproach, and were found to be indistinguishable from the others. Mr. Sutton has rendered good service by disposing of this and other of the hares started in the field of horticulture that were distracting attention from the larger problems with which the horticulturist has to deal.

THE ORGANISATION OF INDUSTRIAL SCIENTIFIC RESEARCH.[1]

I.

IF one attempted to formulate the common belief concerning the origin and development of modern technical industries, it would probably be found that stress would be laid upon financial ability or manufacturing skill on the part of the founders; but if, instead, we were to make a historical survey of the subject, I think that we should find that the starting and development of most manufacturing businesses depended upon discoveries and inventions being made by some individual or group of individuals who developed their original discoveries into an industrial process. Indeed, if the localities in which various industries have developed be marked on the map, they will often be found to have far more relation to the accidental location, by birth or otherwise, of individuals than to any natural advantages possessed by the situation for the particular industry concerned. The metallurgical industries, of course, are situated chiefly near the sources of the ores or of coal, but why should the chief seat of the spinning industry be in Lancashire or of modern optical industry in Jena, except that in those places lived the men who developed the processes which are used in the industry? And, moreover, industries are frequently transferred from one locality to another, and even from one country to another, by the development of new processes, generally by new individuals or groups of workers.

The history of many industries is that they were originated and developed in the first place by some man of genius who was fully acquainted with the practice of the industry and with such theory as was then known; that his successors failed to keep up with the progress and with the theory of the cognate sciences; and that sooner or later some other genius working on the subject has rapidly advanced the available knowledge, and has again given a new spurt to the development of that industry in another locality.

Thus, in the early days of the technical industries the development of new processes and methods was often dependent upon some one man, who frequently became the owner of the firm which exploited his discoveries. But with the increasing complexity of industry and the parallel increase in the amount of technical and scientific information, necessitating increasing specialisation, the work of investigation and development which used to be performed by an individual has been delegated to special departments of the organisation, one example of which is the modern industrial research laboratory.

The triumphs which have already been won by these research laboratories are common knowledge. The incandescent lamp industry, for instance, originated in the United States with the carbon lamp, but was nearly lost to the United States when the tungsten filament was developed, only to be rescued from that danger by the research laboratory of the General Electric Company, who fought for the prize in sight and developed, first, the drawn-wire filament, and then the nitrogen lamp; and we may be sure that if the theoretical and practical work of the research laboratory of the General Electric Company were not kept up the American manufacturers could by no means rest secure in their industry, as, undoubtedly, later developments in electric lighting will come, and the industry might be transferred, in part, if not completely, to the originators of any improvement. Manufacturing concerns, and especially the powerful, well-organised companies who are the leaders of industry in this country, can, of course, retain their leadership for a number of years against more progressive but smaller and less completely organised competitors, but eventually they can ensure their position only by having in their employ men who are competent to keep in touch with, and themselves to advance, the subject, and the maintenance of a laboratory staffed by such men is a final insurance against eventual loss of the control of its industry by any concern.

There was a time when the chief makers of photographic lenses were the British firms, the owners of which had been largely instrumental in developing the early theory of lens optics, but that position was lost entirely as a result of the scientific work of the German opticians, led by Ernst Abbe; in a smaller divi-

[1] An address delivered at Columbia University by Dr. C. E. Kenneth Mees, director of the Research Laboratory, Eastman Kodak Co., Rochester, N.Y.