for the eight millions or so of expenditure on the scheme, or, at any rate, meet the capital charges on the outlay, together with expenses of operation? For the moment, the supply is greatly in excess of the demand, which depends almost entirely on consumption for civic and domestic purposes. Even in regard to domestic application, the proposition is not very attractive to the potential consumer, who, as an Irishman, is notoriously conservative in his habits and unlikely to be won over to new methods unless they are accompanied by palpable saving in expense. The idea at first entertained of supplying current to the Dublin switchboards at a cost of about $\frac{1}{2}d.$ per unit has long since been abandoned, and critics of the scheme now hint at the imposition of rates which may well be considered prohibitive except to the well-to-do householder. Dublin, indeed, will be the chief customer; at present it takes something like four-fifths of the electric current produced in the Free State, largely for its tramways. But the Dublin tramways are already suffering from the competition of motor omnibuses, and the fate of tramway undertakings in Great Britain is not reassuring for a lengthy continuance of this channel of consumption. Practically, the question resolves itself into the problem of the creation or resuscitation of Irish industries requiring large supplies of power and the establishment of manufactories throughout the country; and on this issue few will dare to speak confidently.

Considered as an engineering enterprise, the scheme is a definite success, in that it has undoubtedly been carried to the point of effective realisation, and great credit attaches to those whose duty it has been to work out the manifold technical details associated with an undertaking of this magnitude. Not least among the difficulties have been the problems of transporting and handling heavy pieces of plant and huge quantities of material in localities not altogether favourable for such purposes. The total equipment for the electrical and mechanical part of the installation weighed 34,000 tons, and about 6000 tons of this had to be shipped from Germany, unloaded at Limerick or the vicinity, and transported to the power station and weir with rather inadequate facilities for handling. Excavation operations at the power station involved the removal of a quarter of a million cubic yards of earth and 200,000 cubic yards of blue limestone rock. The concrete dam at the base of the building contains 80,000 cubic yards of concrete. Constructional operations were in the hands of the Siemens-Bauunion, associated with the Siemens-Schuckwerke A.-G., the main contractors for the entire undertaking, to whom we are indebted for the photographs accompanying this article.

The Shannon installation is a convincing manifestation of the confidence of the Free State Government in the future commercial development of the country, and all well-wishers of the Emerald Isle will hope that its anticipations may be realised.

Graptolite Centenary, 1829-1929.

By Dr. HENRY M. AMI, Laboratory of Geology and Palæontology, Ottawa, Canada.

IT was in 1829 that Adolphe Brongniart first described 'graptolites', two of them, and both from the black carbonaceous shales of the Point Levis cliffs opposite the city of Quebec, Canada. Brongniart was a botanist, and although graptolites are marine animals of the hydroid type, these two forms went the rounds of the different museums of natural history in the Jardin des Plantes, Paris, and at last were described in the *Prodrome* for 1829 as plants. Plants they do certainly appear to resemble, giving leaf-like expansions, venations, moss-like characters, etc., all of which led early palæontologists to ascribe generic and specific names to the graptolites they described—*Phyllograptus angustifolius*, *Dipl. folium*, *Tetragr. bryonoides*, etc.

Graptolites are all extinct forms of life; they abounded all over, and in the waters of the Palæozoic ocean, when that continent 'Laurentia' first exposed its gneissic and granitic mass above the level of the waters, and graptolite remains, by tens of millions, in certain strata of palæozoic age comprising part of the earth's crust which was subjected to intense folding and accompanying distortion and dislocation. The very presence of graptolites in those rock-formations has helped so materially to unravel some of the knottiest problems in stratigraphy and chronological geology which presented themselves to the human mind in

many countries, that some notice of the rôle which they played might be considered timely. Thus, graptolites settled the age of the Bendigo goldfields of Australia; they settled the succession of the highly folded Shropshire and other rocks in western England, Wales, etc.; the 'Highland controversy'; the 'Quebec Group' of Logan in Canada; the 'Taconic controversy' of the New England states; and of similar problems in Scandinavia, Bohemia, France, and in the two Americas, north and south, all along that belt of Andean and Cordilleran mountain chains in which palæozoic strata, also carrying graptolites, occur from Patagonia (Argentina and Chile) to Alaska and the Yukon.

Canada is *par excellence* a paradise for graptolites; and graptolites in a remarkably fine state of preservation have attracted British and other palæontologists, whilst Hall's graptolites from Quebec are famous the world over. Canadian species are recognised in Australia, Europe, Africa, and the Americas. Sir Wm. Logan, T. Sterry Hunt, Elkanah Billings, Sir Wm. Dawson, Spencer, and others in Canada; Emmons, Vanuxém, Hall, Walcott, Weller, Ruedemann, and others in the United States, all attacked the difficult problems of the Lower Palæozoic, and graptolites had their say. The 'knights of the hammer' in Great Britain and Wales: Hicks, Ramsay, Aveline,

Jukes, Sir Archibald Geikie, Peach, Horne, Lapworth, Marr, and Watts, had many swords to cross before the true decipherings of the lower and upper zones of graptolites in the highly contorted strata were effected and orderly sequence recognised.

Of all the men, however, who threw light upon graptolites and their value as horizon-markers, there came one—Charles Lapworth—as if sent in the nick of time, who, with his assistants in Mason College and the University of Birmingham, Prof. W. W. Watts, Miss E. M. R. Wood (now Dame Shakespeare), and Miss Gertrude Elles, established a school for studies in graptolites, completely revolutionising the situation the world over. Lapworth's discovery of the 'sacula', the remains of the old free-swimming zoïd, and the part it plays in the economy of the group was a revelation. The modes of budding, the precise angles and directions taken, was a key which opened the door to rational interpretation of this remarkably useful type of life in deciphering difficulties in tectonics. Suffice it to say that Lapworth has left behind him many monuments, but his contributions to science in his systematic and satisfactory classification of the graptolites and their contemporaries, the

Rhabdophora, his monographs in the Palæontographical Society's memoirs, together with whole volumes of as yet unpublished manuscripts on the graptolites and graptolite zones of Canada, mark him out as a great 'light', a true naturalist in the highest sense of the word. In her "Evolution of the Graptolites", also, Miss Elles, of Newnham College, Cambridge, on whose shoulders Lapworth's mantle naturally fell, has co-ordinated the development of graptolites in time with the zones of their occurrence in the earth's crust. In critical regions of great geological complexity, the very presence of a graptolite was and is the signal for great rejoicing among structural geologists.

The greatly folded strata of Scotland, western England and Wales, of the St. Lawrence Valley in Canada, or of the Hudson River Valley in the United States, or those of the Scandinavian palæozoics (where Linnarsson, Brögger, Törnquist, Tullberg, Holm, Wiman, and others have wrought), or of other parts of the earth which held many 'nuts to crack', have been the witnesses of intensely interesting discussions in which graptolites played a most conspicuous part, humble yet important types of life, the centenary of which is marked by the present year 1929.

News and Views.

HIS MAJESTY THE KING has approved of the following awards this year by the president and council of the Royal Society in respect of the two Royal medals: A Royal medal to Prof. J. E. Littlewood, for his work on mathematical analysis and the theory of prime numbers. A Royal medal to Prof. R. Muir, for his contributions to the science of immunology. The following awards have also been made by the president and council: The Copley medal to Prof. Max Planck, of the University of Berlin, for his contributions to theoretical physics, and especially as the originator of the quantum theory. The Davy medal to Prof. G. N. Lewis, of the University of California, for his contributions to classical thermodynamics and the theory of valency. The Hughes medal to Prof. Hans Geiger, of the University of Kiel, for his invention and development of methods of counting alpha and beta particles.

THE following is a list of those recommended by the president and council for election to the council of the Royal Society at the anniversary meeting on Nov. 30:—*President*: Sir Ernest Rutherford; *Treasurer*: Sir Henry Lyons; *Secretaries*: Dr. H. H. Dale and Dr. F. E. Smith; *Foreign Secretary*: Lord Rayleigh; *Other members of council*: Dr. E. J. Allen, Dr. C. Bolton, Prof. A. E. Boycott, Prof. C. G. Darwin, Dr. C. G. Douglas, Sir Alfred Ewing, Prof. E. W. Hobson, Sir Frederick Hopkins, Dr. W. H. Mills, Prof. E. A. Milne, Sir Peter Chalmers Mitchell, Prof. J. C. Philip, Dr. A. B. Rendle, Mr. A. A. C. Swinton, Prof. W. W. Watts, Prof. C. T. R. Wilson.

DISQUIETING news concerning the conditions of scientific workers in Russia have again reached Great Britain in the shape of newspaper reports to the effect that Prof. S. F. Oldenburg, the well-known

orientalist and the second oldest member of the Leningrad Academy of Sciences, who has been its permanent secretary for twenty-five years, has been dismissed by the Soviet Government. The reason for this extraordinary action is purely political; for Prof. Oldenburg is officially charged with concealing from the Government, on the premises of the Academy, some important documents, in particular, the original act of abdication by the Tsar, and accounts of several pre-revolutionary political organisations, thus wilfully depriving the Government of material that could be helpful in tracing counter-revolutionary plots. It is stated that a police-raid has been carried out on the premises of the Academy on the information supplied by one of the new 'red' academicians, elected by order of the Government some months ago. Several of the old academicians then protested against this order, but Prof. Oldenburg, always one of the most loyal supporters of the present Government, insisted on carrying it out to the letter. The effect of admitting politicians into a scientific institution on a party basis has soon become apparent.

IN the House of Commons on Nov. 6, Lieut.-Col. Fremantle had down the question, "To ask the Prime Minister if it is the intention of His Majesty's Government, in appointing the Royal Commission on the Civil Services, to review the status and functions of the large body of scientific and technical experts engaged in the Civil Services, with a view to the furtherance of scientific knowledge, methods, and research of those services; and if, seeing that there is no representative of science nor anyone engaged in the application of science to the needs of the community, he will consider the addition to the Royal Commission