It is this positive duty towards each other and our race beyond the seas which those who live in our island home have been slow in realising, and it has been a real blot on our educational system that such ideas as Imperial responsibility and Imperial necessities have not been inculcated in the young people in our schools and colleges. As an illustration, I may observe that it has been even debated and doubted in some responsible quarters in England whether the Union Jack should wave over our educational institutions on the days of national festivity and national observance.

To sum up. By these and other kindred means I would urge a closer educational touch between the Mother Country and the Empire at large.

Long ago a great Minister was able to say: "Our hold of the Colonies is in the close affection which grows from common names, from kindred blood, and from similar privileges. These are ties which, though light as air, are strong as links of iron."

But times have changed. To-day we are confronted with the problems of a vast and complicated Empire—great commonwealths, great dominions, sundered from each other by long seas and half a world, and however closely science has geographically brought them together, we cannot in soul and sympathy, nor ultimately in destiny, remain attached, affiliated as mother and children should be, unless we grapple to each other and understand each other in the greatest of all interests—the educational training which we give to our children in the one part of our Empire to make them suitable citizens in another.

In suggesting reforms and modifications in which this educational unity may best be expressed, forgive me if I have but touched, and touched inadequately, on the fringe of a great subject, the transcendent importance of which it requires no elaboration of mine to impress on the earnest attention of the people of this great Dominion—which great Dominion may I be allowed to salute, without flattery or favour, as the most favoured by natural beauty and by virgin wealth of all the children of our common Motherland? May I salute her in terms which formed the old toast with which the two greatest of our English public schools, Winchester and Eton, pledged each other when we met in our annual cricket contest: *Mater pulchra, filia pulchrior!*

GEOLOGY AT THE BRITISH ASSOCIATION.

IF the number of geologists from the British Isles who attended the meeting of Section C was somewhat limited, the number from the American continent was considerable, and it was greatly to them, and especially to those from Canada, that the markedly successful character of the sectional meetings was due. The Canadian geologists not only contributed a particularly interesting series of papers, but also arranged two excursions, which were largely attended.

The papers read before the section may be classified in four groups.

(1) *Stratigraphical Geology.*

Mr. J. B. Tyrrell's account of the geology of Western Canada, which followed the president's address, afforded an excellent introduction to the succeeding series of papers on local geology. *Pre-Cambrian geology* naturally occupied a good deal of the attention of the section, which had the advantage of hearing papers by Prof. A. P. Coleman on the bearing of pre-Cambrian geology on uniformitarianism, and by Prof. W. G. Miller on the pre-Cambrian rocks of Canada. Prof. Coleman described the somewhat complicated subdivision which Canadian geologists recognise in the pre-Cambrian rocks, and pointed out the varied nature of their origin, including as they do quartzites, sandstones sometimes passing into arkose, carbonaceous shale, limestone, igneous rocks both volcanic and intrusive, and metamorphic rocks in great variety. The most interesting point about Prof. Coleman's paper was the evidence he brought forward for the existence of glacial conditions in pre-Cambrian (Huronian) times, and the bearing of this on uniformitarianism. He exhibited stones which he had extracted from the pre-Cambrian conglomerate of the Cobalt district, the upper surface of which was scratched by the Pleistocene glaciation, while the lower (embedded) surface after extraction, also showed striæ which it was difficult to distinguish from those produced by the Pleistocene ice. In the subsequent discussion Drs. Fairchild, Strahan, Warren Upham, and Dwerryhouse expressed the opinion that Prof. Coleman had established his contention.

Prof. Miller's paper was chiefly directed to bringing into prominence the almost limitless mining possibilities of the Canadian pre-Cambrian rocks. He pointed out that although they have as yet been very imperfectly explored, they are already, in the Cobalt and Sudbury districts, the chief, or among the chief, world's source of nickel, cobalt, silver, and arsenic, while in the Michigan district their yield of copper and iron is one of the most important in the world. The same may be said with regard to the mica mines of Ontario.

The stratigraphy of the Palæozoic rocks of the British Isles was represented by the reports of several of the association's committees, including the following:—(1) Mr. E. S. Cobbold, on the Cambrian rocks of Comley, Shropshire; (2) Prof. S. H. Reynolds, on the igneous and associated rocks of the Glensaul district, Co. Galway; and (3) Dr. A. Vaughan, on the faunal succession of the Lower Carboniferous (Avonian) of the British Isles. The latter report included an important series of tables embodying Dr. Vaughan's latest views on the subdivision of the Lower Carboniferous rocks, and the correlation of the sequence in various parts of the British Isles. With the view of helping to bring Dr. Vaughan's work to the notice of Canadian geologists, Prof. S. H. Reynolds exhibited a series of lantern-slides of the two principal sections of the Bristol district, those of the Avon and of Burrington. He also contributed a paper on the lithology of the Burrington section. Another stratigraphical paper having reference to the Carboniferous rocks of the south-west of England was that by Mr. H. Bolton, on new faunal horizons in the Bristol coalfield, in which further evidence was brought forward of the occurrence of marine episodes in the Coal-measures of this part of the country. The only remaining stratigraphical paper was one by Dr. D. Woolacott, on the classification of the Permian rocks of the north-east of England.

(2) *Glacial Geology.*

Glacial geology naturally had much attention paid to it by the section when meeting in Canada, and the members were to be congratulated on hearing from Dr. Warren Upham an account of the glacial Lake Agassiz, in connection with which his name is so well known. At its maximum extent, according to Dr. Upham, it covered an area of about 110,000 square miles, exceeding the combined areas of the five great lakes tributary to the St. Lawrence. Lake Winnipeg forms its reduced representative at the present day. Dr. Upham's paper was followed by an interesting discussion, in which many leading Canadian and American geologists took part. Members of the section had, further, the opportunity of seeing some of the glacial and other deposits of Lake Agassiz on excursions which were made to Stony Mountain and Bird's Hill.

Prof. A. P. Coleman, in a paper on the extent of the ice sheets in the Great Plains, pointed out that while boulders from the Archæan region to the east are spread over the great plains as far west as Calgary, further to the west an older drift, derived from the Rocky Mountain region, is met with, this sometimes passing below the eastern drift. In places boulders from the eastern drift are found stranded 5000 feet up on the sides of the Rocky Mountains. These Prof. Coleman believes were stranded from ice-dammed lakes at a time when the Rocky Mountain region stood at a lower level than it does at present.

Glacial geology was further represented by a paper by Dr. A. Strahan, on the glacial geology of South Wales; by a lantern lecture by Dr. A. R. Dwerryhouse, on the glacial geology of Britain, as illustrative of the work of the committee on erratic blocks, and by the report of the committee for the investigation of the fossiliferous drift at Kirmington, Lincolnshire, and elsewhere.

(3) *Economic Geology.*

This subject, as might have been expected, was well to the fore, a series of most interesting papers on the ore deposits of Canada being given by Canadian geologists, Prof. W. G. Miller dealing with the gold, silver, and iron

ores, Prof. A. P. Coleman with copper and nickel, Mr. J. B. Tyrrell with placer mining, and Prof. T. L. Waller with the rare metals. Prof. Miller prefaced his description of the gold and silver mining with a general account of mining in Canada. He pointed out that, until a few years ago, the central part of Canada was regarded as purely agricultural. The discovery of the rich ore deposits of Sudbury and Cobalt in 1908 completely changed this, and the value of the mineral produce rose from about a million dollars in 1901 to eighty-seven million dollars in 1908. The most interesting feature of the mineral wealth of Canada is its great variety. Canada is now the largest producer in the world of nickel, cobalt, asbestos, and corundum. As regards the immediate subject of his paper, Prof. Miller stated that the output of gold from the Archæan districts was not great, but it was found in British Columbia and the Yukon, the latter district standing third in the world's output. Gold is found also in Nova Scotia, and has recently been discovered at Prince Albert, in Saskatchewan. The great silver-producing region is Cobalt. The Canadian production of iron is as yet comparatively unimportant.

Prof. Coleman pointed out that copper is found in many parts of Canada, and in British Columbia some very low-grade ores are worked to a profit. Most of the copper of Ontario is found associated with nickel, the great locality for these substances being Sudbury, where the deposits occur in the marginal portion of a laccolitic mass of norite intruded between the Upper Huronian and the Animikie.

In dealing with placer mining, Mr. J. B. Tyrrell pointed out that it was almost confined to the mountainous region of the west, and that the industry had gradually spread along the river valleys from California northwards until eventually the Klondyke deposits were met with. These owed their value rather to exceptional conditions of erosion than to special richness. Mr. Tyrrell estimated that the Yukon district had yielded hitherto about six million ounces of gold, and might yield another four million.

Prof. T. L. Waller concluded the series of papers on the mineral resources of Canada with a description of the rare metals. Platinum and palladium are found in small quantities in the native state in placer workings at various points. Platinum has also been found combined with arsenic in the decomposed superficial deposits of the Sudbury district. Canada is also rich in undeveloped deposits of molybdenum and tungsten.

(4) *Palaeontology and other Subjects.*

In addition to the president's masterly address on the evolution of vertebrate life as shown by fossils, vertebrate palæontology was represented by two short papers, also by the president, recording the discovery of dinosaurian remains in the Cretaceous rocks of Australia and the Trias of Brazil, and by the report of the committee appointed to investigate the footprints of the Trias of Great Britain.

Other papers read before the section were by Mr. E. Dixon, on unconformities on limestone and their contemporaneous pipes and swallow-holes; by Prof. E. F. Chandler, on the rainfall run-off ratio in the prairies of Central North America; and by Dr. Tempest Anderson, on the volcano of Metavanu, in the Samoa Islands. The eruptive phenomena of this volcano closely resemble those of Kilauea, in the Sandwich Islands; but while the latter volcano, according to Dr. Anderson, is in its old age, the former shows the same phenomena with the exuberance of youth. A further interesting point in Dr. Anderson's paper was his confirmation by actual observation of the subaqueous production of the "pillow" structure in lavas.

The reports of the following committees were also presented:—on South African strata, by Prof. J. W. Gregory; on topographical and geological terms in South Africa; on geological photographs, this taking the form of an exhibition of lantern-slides illustrating certain aspects of British scenery; on the crystalline rocks of Anglesey; on the composition of the Charnwood rocks; on further excavations on Neolithic sites in north Greece; and on the salt lakes of Biskra. This latter report, which was represented merely by the title, refers to the work upon which the late recorder of Section C, Mr. Joseph Lomas, was engaged at the time of his lamented death.

ENGINEERING AT THE BRITISH ASSOCIATION.

THE proceedings in Section G consisted largely of papers by Canadian engineers on a closely related group of subjects, determined by the conditions of Winnipeg. Winnipeg occupies a peculiar geographical position, similar in some respects to Singapore or Buenos Ayres, as the gate of a great productive area. This position, and the bearing on it of the communications to the section, are most easily explained by recalling the geography of the country. Canada consists roughly of five sections.

(1) The Laurentian area, the so-called shield of Canada, is defined by the St. Lawrence and the chain of lakes which extends through Winnipeg, Athabasca, and the Great Slave and Bear Lakes to the polar regions. This vast district lying round Hudson's Bay is in the main a wilderness of lakes, rocks, and forests, swept clean of all cultivable soil by Glacial ice, except in certain areas where later Palæozoic rocks have been left over the Laurentian.

(2) The rich agricultural country between the Laurentian area and the Rocky Mountains. This, the modern provinces of Manitoba, Saskatchewan, and Alberta, is the northern section, reaching to 60° N. lat., of that geographical area of which the southern section is the basin of the Mississippi.

(3) The mountain region between the eastern foothills of the Rockies and the Pacific, a strip 400 miles wide extending up the whole coast.

(4) The fertile lands along the south of the St. Lawrence, New Brunswick, Nova Scotia, and the peninsula between Erie and Huron.

(5) The Arctic regions of tundra and ice.

To these five sections must be added for administrative purposes another of equal importance.

(6) The navigable route of St. Lawrence and the lakes.

Winnipeg is the gate between (2) and (6).

This section (2), 1200 miles long from north-west to south-east, and from 300 to 500 miles wide, is of extraordinary fertility, and especially adapted for growing wheat. The isothermals take a strong bend upwards in this region, and wheat has been ripened as far north as the Great Slave Lake, in 62° N. lat. The fertility of the soil is such that wheat can be grown remuneratively for many years in succession, and where the practice has obtained of allowing the land to be fallow one year in four to prevent exhaustion, it has to be sparsely tilled in the seasons following the fallow years to prevent the crops choking themselves by their own exuberance. Of this area, only 5 per cent. is yet cultivated, but in 1908 this produced 30 million quarters of grain, and carried nearly 4 million head of stock.

So long as the United States grows enough wheat for her own consumption, and until a new route is opened to the Atlantic by the Nelson or Churchill rivers on Hudson's Bay, the main trade of the provinces must pass east between Lake Winnipeg and Lake of the Woods. Here on the Red River, where the fertile lands end and the Laurentian wilderness begins, is Winnipeg, on the site of an old Hudson Bay Co.'s fort, Upper Fort Garry. A better site would have been at Selkirk or Lower Fort Garry, lower down the river and nearer the lake, but the site of the great depôt was ultimately fixed by the Canadian Pacific Railway for indirect reasons.

The great engineering questions of the city are to find the best means to develop the agricultural industry of the north-west, and to improve the trade routes, especially to the Atlantic. The papers presented to the Engineering Section dealt largely with these two subjects. Two papers on the grain industry, each of considerable length, were contributed by Mr. John Miller, an official at the experimental farm at Indian Head, Saskatchewan, and by Mr. George Harcourt, Deputy Minister of Agriculture of the Province of Alberta. The latter of these, especially, was a paper of exceptional ability and interest, the author being intimately acquainted with his subject and an admirable lecturer. He exhibited a map showing some of the extreme points in which wheat has been successfully ripened, and the area of potential grain-growing country. The subjects of these papers were not strictly those of engineers, but the urgent need for improved communications with which other papers dealt could hardly have been realised without