

to meet with a similar committee of the Research Council to consider how such co-operation can be made most effective."

Among the committees appointed by the Executive Committee may be mentioned those on Research in Educational Institutions, on Promotion of Industrial Research, and on a National Census of Research.

It was agreed that joint committees on research in various branches of science be formed in co-operation with the corresponding national scientific societies.

In addition to the officers mentioned, Dr. C. D. Walcott and Dr. Gano Dunn have been appointed vice-chairmen of the council.

MINERAL RESOURCES OF THE BRITISH EMPIRE.

A PAPER on "The Mineral Resources of the British Empire with regard to the Production of the Non-Ferrous Industrial Metals," by Dr. C. Gilbert Cullis, professor of economic mineralogy in the Imperial College of Science and Technology, was read before the Society of Engineers on December 11.

The particular metals dealt with were copper, lead, zinc, tin, and aluminium. The object was to demonstrate the Imperial position with regard to each of these, and to show in respect of which of them the Empire was, on one hand, self-sufficing, or, on the other, dependent upon foreign countries. In the latter case the extent of the dependence was indicated, and methods suggested by which it might be diminished.

The situation with regard to four out of the five metals was shown to be wanting in independence and security, and the necessity for a full investigation of the British mine- and smelter-production was insisted upon.

With regard to copper, not only were the ore resources, as at present exploited, deficient, but the smelting facilities also were seriously inadequate for the Empire's metal requirements. The production both of ores and metal could be substantially increased by suitable organisation and administration.

Lead and zinc ores, raised in British territory, had in the past been exported on a large scale to foreign countries, notably Germany and Belgium, for metal recovery, with the result that the Empire had been placed in an anomalous position of dependence which ought never to have arisen. The shortage of zinc, in the early days of the war, and the consequent jeopardising of supplies of cartridge-brass were referred to. The mine-production of lead and zinc was more than sufficient for the Empire's requirements, but the smelting facilities were lamentably deficient, especially in the case of zinc. It was urged that all the lead and zinc concentrates of Broken Hill should in future be smelted within the Empire.

In the case of aluminium, while the actual bauxite resources of the Empire were so small that dependence had to be placed upon the French or American deposits—which were being more and more utilised in their countries of origin—large potential supplies, in the form of laterite, had a very wide distribution in the tropical colonies, but were almost untouched and untried. The systematic examination of these and other potential sources of aluminium, with a view to their utilisation, was seriously needed.

The only metal with regard to which our position was really strong was tin. The British mine-production of tin in 1912 was 66,000 metric tons out of a world's total of 125,000, and the smelter-production 85,500. Estimating the consumption at 32,500 tons, there remained 53,000 tons available for export. Now that the German market for Bolivian tin ore was

closed, an opportunity had arisen of securing the whole of the Bolivian output for British smelting.

In a series of general conclusions, a plea was put forward for the elimination of wasteful methods in ore and metal recovery, for the fuller utilisation of by-products from ores, and for the adoption of large-scale operations of high engineering efficiency by which capital and labour might be advantageously used. The widespread export of raw or partially smelted materials, produced within the Empire, to foreign countries for the recovery of the finished products was condemned, and the promotion of industries making for independence as regards essential products advocated.

The expediting of geological and mineral surveys of all British territory, and the organisation of advance investigations with the object of improving current processes, or of discovering new ones by which geological materials hitherto unexploitable might be made productive, were urged.

The development of the mineral resources of the Empire had taken place in the past without any constructive Imperial policy; it had lacked co-ordination and control, and was in need of scientific and business-like administration, and the suggestion that a Government Department of Minerals and Metals should be established to foster and safeguard British mineral resources and to promote the welfare of related industries was strongly supported. If formed and properly conducted, such a department should do much to give security and order to what was now full of danger and disorder.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. A. SHEPARD CHURCHILL, who died on October 18, leaving estate of the value of 109,495*l.*, bequeathed 50,000*l.* to Harrow School for two scholarships, one on the classical and one on the modern side, of the clear yearly value of 150*l.* each, to be known as the "Shepard Churchill" scholarships, tenable at any college at Oxford for four years. In the election regard is to be had to literary and scholastic attainments, fondness and success in manly outdoor sports, such as cricket and football, qualities of manliness, courage, truthfulness, devotion to duty, sympathy with and readiness to protect the weak, kindness, unselfishness, and love of comrades; exhibition during school days of force of character and of instincts leading to the exercise of good and kindly influence over school-fellows. There are also to be founded four entrance scholarships of 120*l.* each for two modern and two classical students. The residue of the property is also left for the benefit of Harrow School in such manner as the governors, with the approval of the headmaster, shall direct. The total bequest is expected to amount to 100,000*l.*

In an important letter published in the *Electrician* for December 15, 1916, Mr. A. Gray, of Cornell University, points out that the American electrical engineering firms are in much closer touch with the teachers of electrical engineering than British firms desire to be according to Mr. J. Swinburne. The Westinghouse Electric Company takes in a large number of university graduates each year, and the officials of the company, in order to improve the graduates they receive, have instituted summer schools for teachers, of whom thirty are selected and assigned to special departments in which they work from 8 a.m. to 5 p.m. They are paid about 12*l.* for five weeks' service, and are allowed to visit any part of the works. In his department the teacher is generally given some problem to solve which has had to be put aside owing to the limited time at the disposal of the regular staff. The

evenings are occupied in discussions on points connected with the work of some department to which a visit has been previously paid by the whole body of teachers under the guidance of the engineers of the company. The arrangement appears to have benefited both teachers and company, and seems worthy of a trial in this country.

PROF. ARNOLD WALL, of Canterbury College, has published "A Plea for a System of Internal Examination in the New Zealand University" (Christchurch: Whitcombe and Tombs, Ltd.; price 1s.). The University at present possesses the unique disability that its examination papers are set and the answers marked in exactly the opposite part of the globe—in London—a plan originally introduced in order to enable the University to maintain a standard identical with that prevailing in Great Britain. The system has the disadvantage as at present worked that the professors and teachers have no voice in the setting of the papers, nor are their opinions from personal knowledge of the candidates available for the guidance of those who mark the scripts. We hope Prof. Wall will succeed in introducing some reform which will bring teachers and examiners into closer touch with each other. At the same time the system which he proposes has proved to be a failure in at least one university in this country, and it cannot be said that it is altogether satisfactory to have examinations conducted by a board in which both the external and internal examiners are in a minority, and the majority are teachers interested in other colleges or in other subjects than the one under examination.

A COPY of the calendar of the University of Sheffield for the session 1916-17 has been received. The arrangement of the contents follows the plan of previous years, and detailed particulars are given of the courses of work arranged for students who desire to graduate in the various faculties of the University. It will be remembered that, as in the case of other of our more modern universities, there is at Sheffield a very comprehensive faculty of applied science, and the degrees of bachelor, master, and doctor may be gained both in the various branches of engineering and in metallurgy. There is a department of glass technology which provides facilities for systematic study and research in the manufacture and general technology of glass, and students who attend and qualify in a full-time course may obtain a diploma in the subject. The mining department of the University, under arrangement with the West Riding County Council, provides courses of extension lectures in mining science, and inspects and examines local mining classes in the southern portion of the West Riding. Similar instances could be multiplied of the successful efforts being made by the University authorities of Sheffield to keep in touch with the industries of the area served by the University, and to give local manufacturers the benefit of the assistance of expert advice on scientific matters.

READERS who have copies, which they may be willing to spare, of advanced text-books, models, specimens, and apparatus for the study of geology are invited to communicate with the British Prisoners of War Book Scheme (Educational) at the Board of Education, Whitehall, S.W. A request has just reached the committee of that war charity from Ruhleben for about fifty books, etc., to enable the camp school there to establish a general course in dynamic geology and crystallography. The class will be conducted by two of the prisoners, who are (to quote the letter) "professionally engaged in geology"; and more than a dozen students, mostly engineers, have already given in their names. The following books

are specially asked for, and they may serve as an indication of the scope of the classes at this camp and of the type of book desired:—Haug, "Traité de Géologie"; Launay, "Traité de Métallogénie"; Hobbs, "Earthquakes"; Murray and Hjort, "The Depths of the Ocean"; Dana, "System of Mineralogy"; Groth, "Physikalische Krystallographie" (or any other good English book of the kind); Braune, "Chemische Mineralogie"; Rosenbusch, "Microscopische Physiographie der Mineralien und Gesteine"; Harker, "Petrology for Students." Among the requirements for the equipment of the classes are a microscope, slides for crystal, mineral, and rock specimens, crystal models, mineral powders and apparatus for blow-pipe analysis, and goniometers. A detailed list of the requirements may be obtained from the chairman of the Book Scheme, Mr. A. T. Davies, at the Board of Education, Whitehall, S.W., to whom all offers (accompanied by a detailed list) should be addressed. Books in almost every subject are urgently needed to meet the steadily increasing demands which are daily being received from British prisoners interned in enemy or neutral countries.

THE report on the work of the Department of Technology of the City and Guilds of London Institute for the session 1915-16 has been published by Mr. John Murray. The work of the department has been carried on with some difficulty during the year. Half of the office staff has joined the Army, and the secretary of the department himself is serving in the Army in France. Whereas the number of classes registered in technological subjects in the session 1913-14 was 5049, in 1915-16 the number had fallen to 3961. The students in attendance in these two years numbered 55,996 and 35,203 respectively. The report points out that recognition is due to the authorities and teachers of technical schools for the successful efforts which they have made to carry on the work of their classes uninterrupted, notwithstanding the absence of members of their staffs on active service, and many other difficulties due to the war. Valuable help has been given to the Ministry of Munitions by the technical schools in general, either by directly manufacturing articles and gauges for munitions of war, or by undertaking special work and training men in it. In connection with the examiners' reports on the results of the examinations, it is again put on record that candidates frequently enter upon their technical instruction very poorly equipped in the matter of general elementary education, ability to do simple calculations, or even to write simple English correctly. The institute goes so far as to endorse the opinion of one examiner that "the standard of general education of the candidates is not improving." The report concludes by insisting that, speaking generally, employers must change their attitude towards technical training, so that those who foster the education of their younger employees should become the great majority instead of the minority, and so that attendance at continuation schools and day schools, or, if this be too much to expect, at least at evening technical classes, should become the rule. Nothing short of a strong national movement in this direction can prove adequate to meet the requirements of the case.

SOCIETIES AND ACADEMIES.

LONDON.

Aristotelian Society, December 18, 1916.—Dr. H. Wildon Carr, president, in the chair.—A. N. Whitehead: The organisation of thought. Science is a thought organisation of experience. The most obvious aspect of the field of actual experience is its disorderly character. It is for each person a *continuum*, fragmentary,