

English and French. Its three chief officials are Sir J. D. Parry (Great Britain), Admiral Phaff (Netherlands), and Captain Müller (Norway), the first-named being president. It confines itself to hydrography in the strictly nautical sense of the word, and one of its chief objects at present is the international standardisation of practice in relation to many maritime matters. For example, in relation to charts, among the questions which arise are those of the type of projection, the scale, the choice of units for depth and distance, the mode of delineation of soundings, the symbols and abbreviations, and the geographical names to be used. Lists of lights, sailing directions, and distance tables are other matters on which more uniformity and co-operation would be advantageous. It may be noted that most countries now use metric units for depth, Japan being one of the latest formally to adopt this system, though it has not yet actually introduced it. Great Britain and America are now the only States which exclusively use the fathom and foot, but the change to

the metric system is one which they are as yet unwilling to make, because of the great difficulty and cost of altering the copper plates from which are printed the exceptionally large number of charts which these countries produce.

The Bureau has recently started a journal, the *Hydrographic Review*, of which the first number appeared in March last. It is bilingual, all its contents being duplicated in English and French, on opposite pages. A large part of the first issue is devoted to the history of the inception of the Bureau, and other official matters. The chief original articles consist of two reports on aerial photography as applied by the French and Netherlands services to hydrographic surveying and the discovery of shoals and covered rocks. There is also a discussion of the visibility of lights, considering the chances which a sailor has of sighting a given light in different circumstances at various distances, and a brief report on echo sounding as practised by the United States hydrographic department.

The Age of the Earth.¹

SINCE the advent of our knowledge of radioactive processes, the old controversy over the age of the earth has been revived, and although there is now a marked change of opinion in favour of the longer estimates, it remains unfortunately true that there still appear to be tantalising discrepancies between the results from different methods. These discrepancies may be mitigated or exaggerated by special pleading, but they still stand in the way of an unequivocal settlement of the problem.

Twenty years ago various attempts were made to squeeze geological history into the narrow limits imposed by Kelvin and Tait. The discovery of radioactivity, and more recent advances in the study of stars and tidal friction, have destroyed the value of the older physical evidence, leaving various geologists committed to what are now seen to be absurdly low figures. In the last decade the geological methods have in turn been widely criticised, and the present tendency is greatly to extend the estimates formerly favoured. All the methods adopted depend on the rate of processes at present in operation. In order that the different lines of evidence should converge, it is necessary to suppose either that the rates of geological processes are at present too high, or that those of radioactive processes are too low, to justify integration over the whole duration of geological time.

In the symposium under consideration, held in Philadelphia on April 22 last year, the chief feature of interest is Chamberlin's spirited attempt to show how the geological estimates may be brought into harmony with the revised deductions from radioactivity and astronomy. The period required for the deposition of the whole of the sedimentary column or for the accumulation of salt in the oceans is easily arrived at from existing data on the assumption that present rates provide a characteristic average. There is now little doubt that this assumption is deceptive, and it certainly can no longer be admitted. De Geer's work on the yearly deposits from glacial waters in Sweden, though an exceptional case, suggests to Chamberlin a Glacial epoch fully twenty times as long as that assigned by the old methods. He further expresses the conviction that breaks in the continuity of more normal sediments, the time-values

¹ From the Geological View-point. By T. C. Chamberlin. From the Paleontological View-point. By J. M. Clarke. From the Point of View of Astronomy. By E. W. Brown. The Radioactive Point of View. By W. Duane. (Proc. Amer. Phil. Soc., vol. lxi., No. 4, pp. 247-88, 1922. Philadelphia.)

of which are best judged by comparison of the faunas above and below, must, when finally interpreted, greatly extend the simple arithmetical estimates. It has frequently been shown how denudation and deposition must be quickened up by human activities, and the effects of cultivation and excavation have been ably analysed by Dr. Sherlock in his recent "Man as a Geological Agent." Existing conditions also naturally favour a high rate of denudation, since continental elevation and breadth are both exceptional, and to these may be added the further consideration that broad areas are strewn with easily removable glacial deposits. So variable are the factors involved that there is no means of arriving at average rates which would properly include long periods of sea-transgression and base-leveling, periods when denudation was brought almost to a standstill.

The validity of the method based on the accumulation of salt in the oceans depends partly on the rate at which the present streams are carrying sodium down to the sea—a rate which must be too high for reasons already mentioned—and partly on the irreversibility of the process. It has, of course, been generally recognised that sodium returns to the land in interstitial solutions held by sediments and as wind-borne salt, but other possibilities have been less emphasised. Actually it is found that the data used are inconsistent among themselves unless other cyclic processes are involved. The most serious discrepancy is found in the ratio of sodium to chlorine, which in igneous rocks is about 30 : 1 and in the oceans about 1 : 1.8. When volcanic exhalations are taken into consideration this enormous difference is reduced but by no means wiped out. Clarke and Washington have given figures which include the whole of the atmosphere and hydrosphere, and the discrepancy still remains as high as 20 : 1.

There can be only one explanation: that chloridised sodium plays a far greater part in cyclic action than has yet been detected. In the case of potassium such circulation is all-important and is effected by its greater retention by muds and soils. Dr. Milton Whitney writes, "Ocean shore deposits would undoubtedly absorb NaCl up to the point where the colloids were in equilibrium with sea water," but as to the relative efficiency of this and analogous processes there is still no exact knowledge. The sodium method is thus, as Chamberlin says, "not yet ready to render a verdict." As to the sedimentation method,

he concludes that the cumulative effects of present-day conditions need not be strained to bring the older estimates up to the same order as those required by current deductions from radioactive minerals.

The remaining papers call for little comment. Palæontology presents faint hope of arriving at a trustworthy or even approximate conclusion as to the age of the earth, for no measure of the rate of vital processes has yet been devised. The endurance of an index species provides no firm basis for a definite calculation of the duration of a zone, or *phase*. Astronomical considerations have recently afforded support to the figures suggested by radio-activity for the age of the earth, but there is here no discussion of the work and views of Eddington, Jeffreys, or Shapley. Similarly the paper on the "Radioactive Point of View" omits to mention the interesting speculations of Joly, which are so ingenious that they will demand a thorough discussion in the future, even though in the present stage of knowledge they may be coldly regarded by physicists.

ARTHUR HOLMES.

University and Educational Intelligence.

CAMBRIDGE.—Dr. P. Kapitza, Trinity College, has been elected to the Clerk Maxwell Scholarship.

THE London County Council's programme for 1923-24 of lectures and classes for teachers comprises some 600 items-grouped under the headings art, domestic subjects, economics and political science, languages and literature, geography, handicrafts, history, mathematics, music, pedagogy, phonetics, physical education, science, miscellaneous. The science group includes 52 items, namely, wireless, 5 (Prof. J. A. Fleming); history of science, 10 (Dr. C. Singer); psychology of vocational guidance, 5, and the neurotic child, 5 (Dr. Cyril Burt); bacteria, moulds, and yeasts, 5 (Dame Helen Gwynne-Vaughan); mental deficiency, 6; British weather, 6 (Sir Napier Shaw); animal parasites and pests, 5 (Dr. Philippa Esdaile); and Kew Gardens, 5 (Major Chipp). Moreover, the pedagogy group includes no lectures on the teaching of science. The lectures "are designed to bring London teachers in touch with the latest developments in educational technique and to give them opportunities, as well, for coming into touch with expert opinion on questions of national and civic importance. The lectures largely reflect therefore those questions which are the subject of topical discussion." The choice of subjects is limited by the fact that the scheme has to be self-supporting, and this may be the reason why no provision is made for lectures on civics, home-economics (except a course on domestic handicraft), nature-study, or general science. The lectures are open to all teachers actually employed in teaching within London at a fee of one shilling or less per lecture, and to teachers from outside at rates 50 per cent. higher. The attendance last year was 20,000. Several scientific societies place at the disposal of the London County Council a certain number of tickets of admission to their ordinary meetings for distribution to teachers of science in London schools.

BRITISH women students wishing to spend the coming academic year studying in Paris may like to know that three residence scholarships for British graduates studying at the Sorbonne or other institution of higher learning in Paris are offered by the American University Women's Club, 4 Rue de

Chevreuse. The value of each scholarship is 350 francs per month for nine months, and the rates charged by the Club are such that each scholar would need to pay an additional 500 francs a month, *i.e.* about 60*l.* for the nine months. Applicants for these scholarships should send their names, stating their age, academic qualifications and proposed course of study, to the Secretary, International Federation of University Women, 92 Victoria Street, S.W.1, not later than September 15. Each application should be supported by at least two references permitted to persons well acquainted with the candidate's career.

THE use of the local environment of the school as a starting-point and source of material and interest in that school without exploiting it for vocational training is discussed in Rural School Leaflet No. 11 of the United States Bureau of Education, in which an attempt is made to show in detail how this principle should be applied in agricultural districts. It appears that in 17 states the teaching of "agriculture" in the elementary schools throughout the state has been prescribed by law somewhat precipitately, without regard to the fact that teachers with the requisite special training are not available and without any clear definition of objectives or methods. Such precipitation is, the writer points out, the more to be deprecated in view of the exceeding complexity of agriculture alike on the side of natural science, every branch of which it lays under contribution, and on the side of practice, wherein it involves not only a great variety of arts but a mode of living. At the same time this very complexity makes a naïve experience of agricultural happenings invaluable as a starting-point and source of material and interest. Dealing with the social and economic aspects of the subject, he contends that even in the elementary schools teachers should not fail (as they have failed in the past) to emphasise the necessity of the organisation of farmers as a means of economy in distribution and self-preservation in the struggle for existence in competition with other organised groups.

DEVELOPMENTS in medical education in the United States during the past 20 years, and especially during the years 1920-22, are summarised by Dr. N. P. Colwell in Bulletin 18 of 1923 of the U.S. Bureau of Education. Since 1904, when the American Medical Association started a campaign for raising educational standards, the developments in respect of medical school admission requirements, laboratory and library equipment, number and calibre of whole-time professors, and arrangements for clinical instruction, have been such that these standards, formerly lower than those of the principal European countries, can now challenge comparison with any in the world. Simultaneously the number of schools has been reduced by one-half—from 162 to 81—and the number of students from 28,000 to 13,000 in 1919, since when they have increased to 18,000. Of 81 schools, 66, rated as class A, require two years of college work as a condition precedent to entry on their four-years' course. Although students' fees, which formerly covered the cost of maintenance of the schools, have been largely increased, they amount now to little more than one-third of the cost. Along with improvement in medical schools has gone a corresponding advance in the standard of qualifications required by state medical licensing boards, but the laws on the subject have to some extent been stultified by the existence of sectarian "schools" with low educational standards, which have not been made subject to medical practice laws although their graduates assume the responsibility of undertaking to heal the sick.