not the only one available in the application of Rutherford's method of computing the age. There is quite as good evidence that the thorium series ends in an isotope of lead as there is for the same conclusion respecting the uranium series.

Now, in dealing with the atomic weight of the lead found in Ceylon thorite, Prof. Soddy recently carried out, on a large scale, a very careful chemical analysis of this mineral, and determined the quantity of lead present. When we calculate, on the basis of his results, the age of the mineral, we get about 140 millions of years. The rocks to which this determination applies are very ancient—certainly pre-Cambrian. The result is, therefore, in good agreement with the conclusion derived from denudation. Is this a mere coincidence?

Before this recent result it was known that the indications of thorium-derived lead were opposed to those of uranium-derived lead, and those who upheld the longer age urged that the lead derived from thorium must be unstable, and must turn into something else over geological time. But the view that thorium lead is not permanent is one beset with difficulties.

From this we see that the uranium and the thorium families of elements give, at the present time, contradictory evidence respecting the age of the earth. The latter apparently agrees in a remarkable manner with the indications of the surface changes of the globe; the former does not. And now the measurements of the uranium halo admit of the interpretation that they indicate the failure of uranium-derived lead as a true indicator of geological time. For if the range of U_1 was, indeed, in remote times longer than it now is, then we must suppose that its rate of decay was at that period faster than it is to-day. Or we may suppose that, however derived, in remote times relatively short-lived uranium isotopes existed which have died out during geological time. I am far from contending that this view is free from difficulties. On the other hand, our ignorance of the mode of origin of radio-activity and of its possibilities is very considerable.

If we have to admit that the evidence of the halo on the age problem is not yet complete, we can refer to a still more important matter upon which the testimony of the halo admits of no uncertainty. Until the radio-active origin of halos was ascertained it was impossible to pronounce on how far, in remote periods of earth-history, radio-activity might have affected the chemical elements. Thus it would have been a quite allowable speculation to suppose many of the elements to have been derived as end-products of radio-active families the activity of which has only comparatively recently become extinct. The halo enables a very general answer to be given to such speculations. A substance such as brown mica—and this is one of the most widely diffused of rock minerals—is sensitive to α radiation, and integrates its effects with the same certainty as the photosensitive plate integrates the effects of light. A mineral containing a minute trace of a radio-active substance beams, throughout the ages of geological time, upon the medium in which it is contained. If the medium is sensitive the accumulated effects in general persist for our inspection, and in the halo we are, in consequence, able to identify the presence of quantities of radio-active substances of almost inconceivable minuteness. Imagine that stellar magnitude which would be recorded upon a photographic plate exposed uninterruptedly for scores of millions of years!

We see from this that the *unaffected* plate of mica is evidenc for the absence of even the feeblest α radiation from surrounding or included elements, just as the blank photosensitive plate is proof of the absence of luminous influence. No definite halo-producing effects have been observed other than those which may be referred to the known radio-active elements.

Thus we find that the study of the conditions which call the halo into existence affords a criterion for determining the absence of any general elemental evolution during the period of geological time. When geological time began any earlier evolutionary process must have already come to an end, with the sole exceptions of the known families of radio-active substances. This result, which is *a priori* by no means evident, is of importance to our views on the physical history of the earth. Only from the minute hieroglyphics we have been considering could such information have been derived.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Rhodes trustees have decided to make a grant of 1000*l.* towards the fund which is being raised for the endowment of a permanent professorship of forestry in the University, and the trustees of the University Endowment Fund are allowing the payment of 250*l.* per annum, which they have hitherto made towards the payment of an assistant professor, to be carried this year to the professorship of forestry fund.

A CHAIR of zoology has been established in the University of Manitoba, Winnipeg, and applications for the filling of it are invited.

THE following bequests have been made to American educational institutions by Col. O. H. Payne:—200,000*l.* each to Yale University and the New York Public Library; 100,000*l.* each to the Cornell University Medical College and Phillips Academy, Andover, Mass.; 40,000*l.* each to Hamilton College, Clinton, N.Y., and the University of Virginia.

THE Ellen Richards research prize, value 200*l.*, is offered by the Naples Table Association for Promoting Laboratory Research by Women for the best thesis written by an American woman embodying new observations and new conclusions based on independent laboratory research in biology (including psychology), chemistry, or physics. The competing essays must be received before February 25 next. Application forms are obtainable from Mrs. A. W. Mead, 823 Wayland Avenue, Providence, R.I., U.S.A.

LORD HALDANE presided at a meeting of University Extension students at Oxford on August 6, and delivered an address in which he urged that in education, as in most other things, unless we have a devolution of powers to those who are able and willing to do the work in the various localities, we shall not make very much progress. He suggested the inauguration of from seven to ten educational provinces in Great Britain. The general object should be to break down the gulf between elementary and post-elementary education. They should be unified into one great organic whole of national education, and the universities should exert a permeating influence in every province—no province without a university at one extreme, and representatives of the local education authority at the other. The best men in the locality should be co-opted on the provincial councils, and the teachers, secondary and elementary, should also have an important place on them. The Board of Education should give as much latitude as possible to the provincial authorities. If we can get rid of the network of rigid regulations, we shall have got a great deal done.

ONE of the most important changes which the war has brought about in our educational institutions has been the rapid conversion of the engineering laboratories of our universities, colleges, and schools into training centres for munition-makers or into munition works. The number of those trained who are now doing work of national importance must be very large. According to a report of the Education Committee of the London County Council the institutions under its control train 3000 per annum, while the output of gauges from the institutions employed in their manufacture exceeds 30,000 per annum. Between one and two hundred woodwork instructors in the employ of the council have become proficient in metalwork, and the remarkable results which have been obtained by sending men and women without any previous experience of metalworking through a five or six weeks' training have taught the committee the desirability of devoting much more attention to instruction in workshop processes and production in educational institutions after the war. Hitherto such training has been left to the factories, but recent experience has shown that it ought to form a more intimate part of the work of the technical schools. It is of importance to ascertain to what extent the experience of authorities in other parts of the country agrees with that of London.

WE have received from Delhi a copy of the report of a conference held in January last of the directors of public instruction for the various provinces of India (see NATURE, March 8, p. 38). The conference was opened by the Viceroy, Lord Chelmsford, who, in the course of his inaugural address, urged the directors in their work of developing technical education in India not to overlook the claims of agricultural and commercial education. He said the great advance made by scientific agriculture during the last half century justifies us in pressing forward with a policy of agricultural education in India, and though the directors would not claim to speak as experts on the agricultural side, their educational experience qualifies them to give useful hints with regard to an advance along this road. Again, on the commercial side of education, he expressed surprise to find how little has been done in spite of India's large and growing commerce. Compared with a technical institution, a commercial school is a relatively cheap institution, and one would think that there was a great opening in the big towns of India for good commercial schools. In technical training in its narrower sense he said sight must not be lost of workshop practice in outside works. Laboratory training, however good, is no real substitute for the discipline of the workshop. The directors discussed, among other subjects, the teaching of science in the secondary schools of India. It appears that in the higher classes of Madras schools elementary science is obligatory. In Bombay science is compulsory in Government high schools, and the University demands a study of science from matriculation candidates, though it conducts no examination in science at this stage. In the provinces which come under the Calcutta matriculation the position of science teaching is not satisfactory. In Bengal there is practically no science teaching whatever in schools for Indian pupils. One of the optional subjects for the matriculation examination is elementary mechanics, but very few candidates offer this subject. Geography is also an optional subject for matriculation. Otherwise, no provision whatever is made in the Calcutta University matriculation for the teaching of science. Looking to the peculiar difficulties which underlie the educational problem in Bengal, it was thought practical science should be made obligatory and be included in the school-leaving certificate.

THE Association of Headmasters, which, it will be remembered, is concerned with secondary education, has adopted and circulated an "educational policy" which may be taken to embody the considered opinion of the headmasters of the secondary schools in this country as to what are desirable educational changes to meet the conditions which will follow the declaration of peace. Their policy insists, among other points, that elementary education should be considered as a preliminary or preparatory stage. It is not yet possible to require that no one shall be allowed to leave school in order to earn money before the age of eighteen; but it is possible to provide that no child's education shall wholly cease on its leaving the elementary school, and that up to the age of eighteen education shall never be wholly subordinated to the ability to earn wages. There must be a considerable increase (1) in the number of secondary schools—*i.e.* schools which provide some form of whole-time general education as distinct from technical training up to the age of eighteen, and (2) in facilities for part-time education. The chief needs in respect of secondary education enumerated by the policy are:—(*a*) More extensive and more varied provision for children capable of profiting by a definite course of education up to the age of eighteen. (*b*) The encouragement and assistance of a much larger number of children to take full advantage of such provision. This involves the lengthening of school life by means of (1) the provision of adequate scholarships and maintenance allowances; (2) the requirement that all pupils who enter a secondary school shall continue in attendance at some such school until the age of sixteen. (*c*) As in the case of elementary schools, the expenditure of much more money in attracting competent persons into the teaching profession. With reference to the curriculum it is stated that one of the most serious dangers to secondary education lies in the overcrowding of the time-table through the conflicting demands of an ever-increasing number of subjects. In framing curricula the first consideration should be to guard against this overcrowding, and to ensure that sufficient time is available for the adequate treatment of the subjects which are taught. No boy should be allowed to specialise until he has attained a satisfactory standard of general education. This standard should be that which a boy of ordinary ability may be expected to reach at the age of sixteen. The subjects of a general education should include as a rule Scripture, English, history, geography, mathematics, science, and ordinarily two languages other than the pupil's own—in most cases these should be French and Latin.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 9.—M. Ed. Perrier in the chair.—L. **Maquenne** and E. **Demoussy**: The influence of mineral matter on the germination of peas. Peas have been germinated in sand moistened with distilled water containing varying known amounts of metallic salts and the length of the roots measured after six days' germination. Twelve metals were used in these experiments, details being given of the results obtained with each one. Calcium would appear to be the only element which, in the absence of any other, is capable of producing normal germination, and the amounts required are extraordinarily small. The growth of the stem will be the object of further researches.—E. **Ariès**: The sign of the specific heat of saturated vapour in the neighbourhood of the critical state.—A. **Thybaut**: Tautochrone curves.—G. L. le **Cocq**: All known systems of hyperstatic suspension bridges are