change into other elements. The parent form disintegrates and throws off a portion of its substance, leaving a residue which undergoes a further change of a like explosive character, and so on, until a form of matter is reached in which no other change is possible. The explosion differs from that of a body like fulminate of mercury in that it does not gather strength with the mass of matter present, but is confined entirely to the individual atoms. All the effects observable in connection with radio-activity are referable to the α particles: thus fluorescence is excited in certain bodies by impact; the ionisation of a gas is brought about by the collision of these particles with the neutral molecules of the gas, whereby they are torn asunder into ions; the warmth of a mass of a radio-active substance is due to its being bombarded by its own α rays. As the process of disintegration continues, certain stages are reached in which the substances produced are of the nature of chemical elements, though differing from the ordinary conception of an element in that their existence is merely temporary. To these transition forms Prof. Rutherford and Mr. Soddy have applied the term "metabolons," and the duration of these is a specific property, depending on the nature of their aggregation. Thorium, for example, gives off an emanation which changes its character in so short a time as 87 seconds; the form of matter to which radium owes its power of exciting radio-activity in other bodies endures for about 43 minutes; that to which thorium owes a similar property lasts about 16 hours; the radium emanation for 5 days 8 hours; the uninvestigated next product of the disintegration of thorium, called thorium X, has a life of 5 days 19 hours; uranium X of about 4 weeks; polonium of 16 months; radium of 1300 years; uranium and thorium of about 10^9 years.

The atoms of ordinary chemistry represent the forms with longest life, and they exist to-day because they have survived a process of evolution in which those physically unfit have disappeared. The transition forms represent the elementary forms of matter unfitted to survive, but they are brought within our powers of knowledge because they constitute the temporary halting places through which matter is passing in a scheme of slow continuous evolution from the heavier to the lighter forms. During the whole existence of the metabolon, whether long or short, it behaves like an ordinary atom. No indication whatever seems to be given of its approaching end, but suddenly, by some internal cataclysm, the cause of which is at present almost beyond conjecture, it flies to pieces and ceases to exist in the form previously assumed. A new world is thus opened out in which the atom is not the unit, in which the forces are not chemical, and in which common physical conceptions such as temperature are without meaning.

The operation of separating the transition forms from the parent element by chemical means does not in any way affect the progress of disintegration. Left to itself, the parent element steadily accumulates a fresh crop of the transition forms separated, while the quantities originally separated disappear as such by further change. As the activity of the parent element recovers to its maximum or equilibrium value, that of the transition forms decays to zero, and the sum total is always the same as if the separation had not been effected. On this view the products of disintegration must have been steadily accumulating through past ages, and the discovery of helium by Sir W. Ramsay in 1895 was the first definite proof that such was really the case. Helium is only known in association with the radio-active elements, and its inert character is one of the reasons for supposing that it is a final product of disintegration. Sir W. Ramsay and Mr. Soddy, during last summer, examined radium with the view of discovering whether or not it resolved itself into helium, and after weeks of waiting were able to establish that this is really the case. A very minute bubble was all that could be obtained, and its slow disappearance, probably by absorption into the glass, was not unexpected. Indeed, glass which has been subjected to bombardment by the α rays, when powdered and heated, has been shown to give off helium, so that the supposition is confirmed. All kinds of glass, however, do not behave in the same manner, the absorption in some cases being much more rapid than in others.

Viewed in relation to their length of life, it seems probable that radium, actinium, and polonium are merely slow-changing transition forms produced in the disintegration of the parent element uranium. Since the activity of polonium decays to half value in about a year, it follows that its existence in pitchblende at the present time is due to its continuous production in the mineral. Applying the same argument to radium, it must also be in a state of equilibrium, the amount produced in any given time being balanced by its rate of decay to inferior forms in that time. The lecturer had endeavoured to discover whether a quantity of uranium, originally free from radium, would grow a crop of that element, but a lengthy period must elapse before a definite conclusion can be reached. There is also an unknown factor in these considerations, viz. actinium, and until this element has been further investigated even speculation must be withheld. Pushing the matter back to its limits, we are face to face with the question, How and when did the universe originate? According to orthodox notions, it is tending to a state of exhaustion in which all change must cease. If, however, a constructive influence is at work, opposing this process, the whole system may turn out to be a conservative one, limited with respect neither to the future nor to the past, but proceeding through continuous cycles of evolution. This would be possible if a gradual and continuous accretion of atomic mass could take place, such as that by which the stable elements were originally formed. At present, however, all such views belong to the realm of pure conjecture.

LIEUT.-GENERAL C. A. McMAHON, F.R.S.

CHARLES ALEXANDER McMAHON, son of Captain Alexander McMahon, of the East India Co.'s Service, belonged to an old Irish family, and was born near Highgate on March 23, 1830. Educated as a soldier, he went to India in 1847 as Lieutenant in the Madras Native Infantry, and served for eight years in the 39th Regiment. In 1856 he was appointed a Commissioner in the Punjab, and was engaged for thirty years in various districts, including Lahore.

While politics and educational questions occupied much of his time, he became greatly interested in geology, and especially in the crystalline rocks and glacial phenomena of the western Himalayas. In his earlier work he was impressed with the intrusive character of the central gneiss of the great mountain range, and his enthusiasm was so aroused that he took the opportunity, while on furlough in 1879–80, of attending the courses at the Royal School of Mines, so as to be initiated in the latest methods of petrological research. Returning to India he worked with renewed zeal at the igneous and metamorphic rocks, and the results of his observations were mostly published in the records of the Geological Survey of India.

In 1885 he retired from service with the rank of colonel, and settled in London. He had been elected a fellow of the Geological Society in 1878, and he now took an active part in the work of the society, serving

on the council in 1888 and in subsequent years, and for a time as vice-president.

His attention was in 1887 attracted to the geology of the Lizard, and there his observations led him to maintain the igneous origin of many of the foliated crystalline rocks. He dealt also with the granite of Dartmoor, and showed that it presented the ordinary features of an intrusive igneous rock.

In 1894 he was elected president of the Geologists' Association for the usual two years, and in his addresses he summarised the results of some of his Indian work. He sought to dispel the popular notion that the Himalayas were upraised in late Tertiary times—they had, of course, a pre-Tertiary history, although there was a general absence of crushing and contortion prior to the Miocene, and these disturbances were due to the intrusion of the gneissose granite.

General McMahon was elected a fellow of the Royal Society in 1898, and in the following year the Lyell medal was awarded to him by the Geological Society. The president (Mr. Whitaker), in addressing him on that occasion, remarked, "Labouring under the disadvantage of taking to the study of geology comparatively late in life, you have attacked it with the energy of a British soldier, and have fought your way into the foremost rank of our petrologists."

In 1902 he contributed to the *Geological Magazine* (with Mr. Hudleston) an important paper on the fossils from the Hindu Khoosh. In the autumn of the same year he took duty as president of Section C of the British Association at Belfast. Since that date his health had gradually declined, and he died from heart failure on February 21. Personally he was endeared to all who knew him by his sterling character and by his genial and courteous nature. H. B. W.

THE NEW EDUCATION AUTHORITY FOR LONDON.

WE have received the following memorial referring to the proposed constitution of the Education Committee for London. An article upon the scheme adopted by the London County Council appeared in our issue of February 11.

To the Secretary of the Board of Education.

February 22, 1904.

Sir,

Having carefully considered the scheme proposed by the London County Council for the constitution of its Education Committee, which has been submitted for the approval of your Board, we, without bias towards any political party, desire to draw the attention of your Board to certain defects in the scheme which must seriously impair the efficiency of the committee in its work of coordinating and developing all varieties of education in London.

The Education Committee will have to undertake not only the work of elementary instruction hitherto carried out by the School Board, but it will also have the more difficult task of supplying and aiding the supply of secondary, technical, and higher education, and of promoting the coordination of all forms of education in London. The present backward educational position of this country is especially marked in those branches designated "secondary" and "higher." To develop the resources of London in these respects, to raise the standard of secondary education, to provide for the training of teachers for both primary and secondary schools, to organise and support the facilities for university training, and finally to organise a great technical high school in the university and the more strictly technical instruction of the polytechnics, so that the whole may be one educational edifice crowned by the University of London, will be a task of great magnitude, and will require the assistance of persons specially skilled in and acquainted with the needs and conditions of these various grades of education.

Under the scheme sent in by the County Council, it seems to us that no guarantee is afforded that the Council will have at its disposal any sufficient number of persons of experience in education and acquainted with the needs of the various kinds of schools in London. We would therefore urge on the Board of Education the desirability of amending the scheme so that the Education Committee may include persons who would be universally recognised as authorities on the needs of the university, the technical institutes, and the elementary and secondary schools.

While trusting that the Board of Education will take all possible means to secure the improvement of the scheme along the lines indicated above, we would earnestly deprecate any action of the Board that would lead to the postponement of the appointed day, on which, by the provisions of the Education Act, the administration of a unified system of education for London is to begin.

We have the honour to remain, Sir,

Your obedient Servants,

(Signed),

List of Signatures.

Dr. W. H. Allchin, senior physician to the Westminster Hospital, member of the Senate of the University of London; Dr. Henry E. Armstrong, F.R.S., professor of chemistry, Central Institute of City and Guilds; Right Hon. Lord Avebury, F.R.S., president of the Associated Chambers of Commerce; Sir J. Wolfe Barry, chairman of Executive Committee, City and Guilds Institute; Dr. Horace T. Brown, F.R.S.; Sir Lauder Brunton, F.R.S.; Dr. Henry T. Butlin, Dean of the Faculty of Medicine of the University of London; Prof. D. S. Capper, professor of mechanical engineering, King's College; Sir William Crookes, F.R.S.; Prof. Hugh L. Callendar, professor of physics, Royal College of Science; Mr. R. F. Charles, chairman of the Central Branch of the Teachers' Guild; Sir W. S. Church, Bart., president of the Royal College of Physicians; Prof. J. D. Cormack, professor of mechanical engineering, University College; Prof. G. Carey Foster, F.R.S., principal of University College, London; Mr. J. Easterbrook, headmaster of Owen's School, Islington; Prof. Ernest A. Gardner, professor of archæology, University College; Mr. Herbert B. Garrod, General Secretary of the Teachers' Guild; Sir William R. Gowers, F.R.S.; Prof. W. D. Halliburton, F.R.S., professor of physiology, King's College; Prof. M. J. M. Hill, F.R.S., professor of mathematics, University College, London; Rev. Arthur C. Headlam, principal of King's College, London; Sir Henry G. Howse, member of Senate of London University; Prof. W. P. Ker, professor of English, University College; Dean of the Faculty of Arts, University of London; Sir Norman Lockyer, K.C.B., F.R.S., president of the British Association; Sir Philip Magnus, fellow and member of Senate of University of London; Dr. Charles J. Martin, F.R.S., director of the Lister Institute of Preventive Medicine; Rev. J. Arbuthnot Nairn, headmaster of the Merchant Taylor's School; Prof. Karl Pearson, F.R.S., professor of applied mathematics, University College; Sir E. C. Perry, member of Senate, London University; Prof. John Perry, F.R.S., professor of mathematics, Royal College of Science; Sir William Ramsay, K.C.B., F.R.S., professor of chemistry, University College, London, president of the Society of Chemical Industry; Sir Owen Roberts; Dr. R. P. Scott, Incorporated Association of Head Masters; Mrs. S. T. D. Shaw, late lecturer at Newnham College, and at the Training College for Secondary Teachers; Dr. H. J. Spencer, headmaster of University College School; Prof. E. H. Starling, F.R.S., professor of physiology, University College; Miss L. M. Strong, head mistress of Baker Street High School for Girls; Dr. T. E. Thorpe, C.B., F.R.S., director of Government Laboratories, London; Prof. William A. Tilden, F.R.S., Dean of the Faculty of Science, University of London, president of the Chemical Society; Prof. Fred. T. Trouton, F.R.S., professor of physics, University College; Dr. John Tweedy, president of the Royal College of Surgeons; Dr. A. D. Waller, F.R.S., director of the physiological laboratory, University of London; Sir W. H. White, K.C.B., F.R.S., president of the Institution of Civil Engineers; Sir H. T. Wood, secretary, Society of Arts; Mrs. E. Woodhouse, head mistress of the Clapham High School.