H. B. WOODWARD F.R.S.

BY the death of Mr. Horace B. Woodward we have lost a geologist with an unrivalled experience of the stratigraphy of the British Isles. His father, Dr. S. P. Woodward, was engaged in the British Museum; and Horace, who was born in 1848, began his geological career at the age of fifteen in the employment of the Geological Society of London, as assistant in the Library and Museum. In 1867 he obtained an appointment on the Geological Survey under Sir Roderick Murchison, and continued in that department until the end of 1908. During the last seven-and-a-half years of his service he occupied the post of assistant director, and was in charge of the work in England and Wales.

In the course of this period of forty-one years Woodward did much towards developing the work of the Survey, in the direction of both precision and utility. The early surveying was carried out for the greater part of England and for all Wales on the Old Series 1-in. map. By no one were the difficulties of precise mapping on so small a scale and so obsolete a basis more successfully met than by Woodward, and it was not until his career as a member of the field-staff was drawing to a close that 6-in. ordnance maps became available. His duties lay at first in adding detail to the mapping of the Rhaetic and other secondary strata in the south-west, but later on he spent many years in Norfolk and the adjoining counties in mapping superficial deposits and the underlying Tertiary and Cretaceous strata.

Woodward was author of many valuable memoirs. The results of his early field-work are incorporated in the Geological Survey Memoirs on the East Somerset and Bristol Coalfields, on the Geology of Norwich, and the Geology of Fakenham. But the most important of his official publications were the three volumes on the Jurassic Rocks of Britain, which appeared in 1892–5. This work was the outcome of a project to bring together all that is known of each British formation. Yorkshire was otherwise provided for; but as regards the rest of the country, the heavy task of gathering all that was worth preserving from copious literature, of examining the principal sections throughout the country, and of presenting the whole in an intelligible form, was carried out single-handed by Woodward.

At this period of his official career he was temporarily engaged in Scotland in applying his knowledge of the Jurassic rocks of England to the elucidation of the occurrences in Raasay and Skye. The commercial development of the iron-ores of Raasay was due in the first place to his suggestion that there occurred there iron-ores of economic value on the same horizon as the Cleveland ores.

His more statistical memoirs, such as those on the water-supply of Lincolnshire, and of Bedfordshire with Northamptonshire, are valued as works of reference; but he showed, too, a happy facility for putting geological information into a form that was agreeable to the general reader in his account of Soils and Subsoils, and of the Geology of the London district.

Outside his official work his most important publication was the "Geology of England and Wales," first published in 1876, but revised and enlarged in 1887. An untiring industry and a wide experience of the subjects on which he was writing enabled the author to produce a work that is indispensable both to the student of the science and to those who are interested in its practical applications. No less useful in their respective subjects are his "Geology of Water-Supply," of "Soils, and Substrata," and his contributions to the Victoria County Histories.

In 1904, when the Geological Society was preparing for its centenary celebration in 1907, it was decided to prepare a volume in which the birth, development, and influence of the Society might be traced. It was felt that the writing of the historical part of such a volume could be safely entrusted to one who claimed close connection with the Society and its work for half a century.

Woodward was elected to the Geological Society in 1868, and was the recipient of the Murchison Fund in 1885, the Murchison Medal in 1897, and the Wollaston Medal in 1909. He was also one of the most active members of the Geologists' Association, and served as president in 1893–4. He was elected to the Royal Society in 1896.

His health had begun to fail at the time of his retirement from the Geological Survey, but he worked on with untiring industry until within a few hours of his death, on February 6, 1914.

COL. A. R. CLARKE, C.B., F.R.S.

IT is with more than usual regret that we record the death, on February 11, at eighty-five years of age, of Colonel Alexander Ross Clarke, one of the foremost geodesists of our time. Born in 1828, he was commissioned second lieutenant in the Corps of Royal Engineers in 1847, and was appointed to the Ordnance Survey in 1850. From this date onwards to his retirement in 1881 his energies were devoted to the work of the Survey with the exception of a three-year tour of service in Canada (1851–4). Throughout this period the work of the Ordnance Survey was in a most interesting stage, and it was fortunate that he was available to assist in the development of its scientific labours.

In 1856 Clarke took charge of the trigonometrical and levelling departments. The work of the Principal Triangulation was complete in the field, and in 1858 Clarke published the final results. The reduction of the observations by the method of least squares was in itself a laborious task, but in this volume is published in addition his first investigation into the figure of the earth.

In 1861 appeared, in two volumes, the abstracts

of spirit-levelling in England and Wales, and in Scotland, for which Clarke was mainly responsible. During this year he was appointed, with two others, to meet certain French officers and draw up a scheme for connecting the triangulations of England and France. In 1862 he observed at several of the English stations of the connection, and in 1863 published the account of the completed work.

In 1860 the Russian Government invited the co-operation of the Governments of Prussia, Belgium, France, and England to cooperate in the measurement of the European longitudinal arc from Orsk to Valencia. A necessary preliminary was the intercomparison of the standards of length of the various countries affected. At the instigation of the English Government these standards were sent to Southampton, where they were compared by Clarke in a specially designed and built bar room. The result of this undertaking was published in 1866, and included in the series were 10-ft. bars for India and Australia. At the end of this volume is the second investigation which Clarke made as to the shape of the earth. In 1867 he published a pamphlet on the positions of the Feaghmain and Haverfordwest observatories, also in connection with the longitudinal arc.

In 1874 two standard yards were made for the United States of America by Messrs. Troughton and Simms, and at the express desire of the United States Government, Clarke carried out the determination of their lengths. In 1880 appeared his "Geodesy," a subject on which he had already contributed an article for the "Encyclopædia Britannica." This work has been translated into several languages.

In 1881 he retired as Lieut.-Colonel, after thirty-four years' service. Clarke's retirement was brought about by a sudden and unexpected order from the War Office to hold himself in readiness to proceed at short notice to Mauritius, and sever his connection with the Ordnance Survey. The national survey never suffered a severer loss. It took many years to recover.

The extent of the work done during those thirty-four years can only be appreciated by a study of the books he published, for they contain a mass of calculation which evidence great mathematical ability as well as great energy.

In 1883 Colonel Clarke was appointed delegate to the International Geodetic Congress in Rome in conjunction with the Astronomer Royal. In 1870 he was made a Companion of the Order of the Bath, and in 1887 he received the Royal Medal of the Royal Society, of which he was a Fellow. He was also a Fellow of the Royal Society of Edinburgh, of the Royal Astronomical Society, honorary member of the Cambridge Philosophical Society, and corresponding member of the Imperial Academy of Sciences of St. Petersburg.

Although he had for many years ceased to take an active part in the prosecution of his favourite subject, his name still remains, and will remain, a constant stimulus to a younger generation.

H. S. L. WINTERBOTHAM.

NOTES.

WE regret to announce the death on February 13, in the sixty-first year of his age, of M. Alphonse Bertillon, director of the anthropological department of the Prefecture of Police in Paris. M. Bertillon, following the custom of his family, devoted himself to the study of human races. At the beginning of his career he paid particular attention to those characters of the body which might be used for the purposes of identification. In 1885, when he was in his thirty-second year, he published the first draft of his famous system of identification and registration of criminals under the name of "Instructions signalétiques." The principle on which his system rests is that no two individuals are alike in all their bodily measurements and proportions. In 1893 Bertillon's system was introduced to British prisons. The system which, in the hands of Bertillon himself and of his pupils, worked satisfactorily, proved to be untrustworthy when applied by a heterogeneous body of observers. Even in the hands of experts, exact measurement of the living body is difficult of attainment. Hence in 1901 Bertillon's system was replaced in this country by one founded on finger imprints, a method which had been developed in India by Sir Edward Henry. It is popularly supposed that M. Bertillon invented the system of identification by finger-prints, but this is an error. Dr. Henry Faulds, in NATURE of October 28, 1880, indicated how finger-prints might be applied to ethnological classification; and his was the first printed communication upon the subject, though public and official use of finger-prints had been made by Sir William Herschel in India some years before. M. Bertillon added the finger-print method to his own about 1891, after its advantages had been urged by Sir Francis Galton. Although Bertillon's system has proved defective in practice, still the merit of realising that a scientific system of measurements and observations could be elaborated to serve the purposes of the State will always stand to his credit. Under his system an enormous number of observations of the utmost scientific value have been accumulated and placed at the disposal of anthropological students.

THE first Guthrie Lecture of the Physical Society will be delivered by Prof. R. W. Wood, of Johns Hopkins University, Baltimore, at the Imperial College of Science, on Friday, February 27. The subject of the lecture will be "Radiation of Gas Molecules Excited by Light."

WE understand from Messrs. Gurney and Jackson that Major Barrett-Hamilton's lamented death, referred to last week (p. 667), will not cause any break in the publication of his valuable work on "British Mammals," as Mr. Martin C. Hinton has agreed to continue and complete the work.

ON Saturday, February 28, Sir J. J. Thomson will begin a course of six lectures at the Royal Institution on recent discoveries in physical science. On Tuesday, March 3, Sir J. H. Biles will deliver the first of three lectures on modern ships: (1) "Smooth-water Sailing," (2) "Ocean Travel," (3) "The War