OBITUARY.

Henry Clifton Sorby. 1826–1908.

Plate XI.

Microscopical Science, as well as this Society, has suffered a serious loss by the death, on March 9, of Dr. Sorby. As President of the Society, in 1875–7, he contributed to our Journal two addresses of a very striking and suggestive character, while our own publications, as well as those of other scientific societies, contain many important communications from his pen, illustrating the enormous value of the Microscope as an instrument of scientific research.

Sorby's life was a singularly, and happily, uneventful one. Succeeding to a moderate fortune, and receiving a sound education in the grammar school of his native town, supplemented by private tuition, he, at a very early age, determined to devote his life to the study of science; and this devotion to scientific research was never interrupted by the duties owing to a family, by the cares of a business, or by the distractions of a profession. During his earlier years, Sorby's interest and activities were almost entirely confined to his native town of Sheffield and its scientific societies. In his later years, after the death of his widowed mother, he was in the habit of spending all the summer months on board his yacht, which, provided as it was with Microscopes and other apparatus for research, became a laboratory in which he carried on the multifarious investigations described in his numerous memoirs.

At the time that he was President of this Society, Sorby wrote as follows:—"My entire life has been spent either in scientific research or in preparation for it"—and this statement might have been justly repeated by him on his death-bed. For even during the last five years of his life, while confined to his bed by a series of accidents, he was actively engaged in completing and publishing the results of important investigations. Nor did the manifestations of his enthusiasm for research cease with the extinction of life itself—for a posthumous memoir of the highest value has just appeared in the Journal of the Geological Society; while, by the terms of his will, a large part of Sorby's fortune will go to the Sheffield University—in the foundation of which he took such an important part—and the Royal and Geological Societies receive bequests, to be devoted to the promotion of investigations of the same character as those which occupied the donor during his whole life.

A glance at the titles of more than two hundred and fifty papers published by Sorby will show how wide were his sympathies and how varied his scientific tastes. Scarcely any branch of physical or natural science escaped his attention, and he not unfrequently strayed into the domains of archæology, history, and art. Yet amid all this bewildering range of pursuits, one fact stands out conspicuously—his faith in and reliance upon the Microscope as a most potent aid in scientific research.

Sorby's contributions to microscopy may be classed under three heads:—1. Improvements in and additions to the Microscope, designed to increase its usefulness in scientific investigations. 2. Discoveries, often of the most curious and unexpected character, in relation to physics, natural history, and even to medicine, sanitation, and jurisprudence, achieved by the use of the Microscope. 3. The establishment of new methods of research by microscopic means, which have had the most profound influence on the progress of science and the improvement of technological methods.

1. Sorby's first work with the Microscope, commenced while he was very young, was devoted to the study of the minute shells from the Bridlington Crag. He tells us that he was pretty well versed in the use of polarised light, and that he had practised the art of drawing under the Microscope, and of representing objects in their true colours. He soon found, however, that to do useful work it was necessary, wherever possible, to obtain thin transparent sections of the objects studied; and having learned from Professor William Crawford Williamson how anatomists and botanists prepare thin sections of hard substances, it occurred to him that it would be possible by the same methods to make transparent sections of rocks. He at once set to work in this manner and in time introduced many improvements in the method. In employing such sections he was able to show that the polariscope, attached to the Microscope, is no mere toy, but a most powerful aid to scientific research.

On the announcement in 1860 by Bunsen and Kirchoff of their methods of spectrum analysis, Sorby at once directed his energies to the employment of the Microscope in this interesting field of research. Having devised a form of Microscope, with a spectroscopic attachment, he showed how in the most varied branches of scientific work important results were to be obtained by the use of the instrument.

The study of stony meteorites and of their chondritic constituents led Sorby in 1869 to employ the Microscope as an aid to blowpipe-analysis, and thus to furnish valuable aid to the chemist and mineralogist. By flattening blowpipe-beads while they were still hot, and then examining them under the Microscope, he showed that the characteristic crystals of various substances

formed in a bead could be recognised. In this way he to some extent foreshadowed the methods so beautifully developed by Bořický, Behrens and others, known as "Microchemical Analysis."

In the same way the examination of the polished and etched surfaces of the metallic meteorites—and subsequently of artificial irons and steels—led Sorby to devise that useful method of illumination, the parabolic reflector.

A method of determining the refractive index of substances had been devised more than a century ago by the Duc de Chaulnes. But it remained nothing more than an interesting suggestion till Sorby showed how, by adding a graduated circle to the fine-adjustment and the employment of suitable gratings, the Microscope could be converted into a refractometer of great value in identifying minerals in the thinnest rock-sections.

Subsequent devices, as shown in the pages of this Journal, enabled him to solve the problem of determining double refraction under similar conditions.

In successive editions of Dr. Lionel Beale's useful manual, "How to Work with the Microscope," Sorby supplied a series of brief instructions concerning the new methods he had introduced for making thin sections of rocks and minerals, for determining refraction and double refraction, and for studying absorption and other spectra with the Microscope.

2. It is an almost impossible task even to enumerate the highly curious, and often important, discoveries to which Sorby's ingenious instrumental appliances and original methods conducted their author.

By the microscopical study of coals and limestones he was led to highly important conclusions concerning the polymorphism of carbon and calcium carbonate; while his investigations of ironstones and dolomites showed how great a part is played by pseudomorphism in the determination of the characters of those rocks. When he came to study slates and schists in thin slices under the Microscope, the theories of cleavage and foliation, by which he will always be remembered by geologists, suggested themselves to his mind. And, in the end, his study of the minute cavities in the crystals of rocks with their liquid contents—including supersaturated alkaline solutions and carbon dioxide—resulted in his far-reaching generalisations concerning the conditions under which deep-seated and erupted igneous rocks must have consolidated.

An examination of the curious phenomenon of impressed pebbles was to Sorby the starting point in a series of ingenious speculations, which culminated in the doctrine enunciated in his Bakerian lecture, "On the Direct Correlation of the Mechanical and Chemical Forces."

In the same way the study of meteorites, by the aid of the Microscope, led him to many ingenious deductions concerning the

conditions under which these visitants to our globe must have been formed.

The invention of the "Microspectroscope" was signalised by a number of curious discoveries on the spectrum of the blood and the changes that blood undergoes in time, of the colours of hair in man and the lower animals, the colours of eggs, of insects, and of the leaves and flowers of plants, and their changes, of algæ, fungi, and many other organic bodies. The absorption spectra of gems, and the relations between absorption and fluorescence, were also studied by him, and ingenious methods based on these observations were devised for the analysis of organic substances and the detection of poisons.

In his later years, when he utilised his yacht for studies of marine organisms and their distribution, and when much of his time and attention was devoted to devising methods for preserving these organisms and preparing them for exhibition as lantern slides, we find him at all times utilising his Microscope in connection with his interesting work.

3. Sorby himself made the avowal that, throughout his career, he was always more concerned to seek out new and fruitful lines of research, than to pursue those already discovered to their ultimate development. It might perhaps be expected that, considering his wide range of interests, and the facility with which he abandoned old lines of investigation when attracted by new problems, the outcome of his labours would be varied, curious, and fascinating, rather than conducive to great advances in science or productive of valuable commercial results.

Nothing, however, could be further from the truth, for Sorby will always be honoured as the pioneer in one of the most important branches of geological science, and as the discoverer of a method which is having a most potent influence on the development of the industries of his native town.

At the recent centenary of the Geological Society, the geologists from every part of the globe united in hailing Sorby as the "Father of Microscopical Petrography"—for his early work resulted in the development of a method that has revolutionised the study of rocks. A large and ever-increasing yearly output of literature testifies to the importance which this branch of science has now assumed.

In the same way, the discoveries to which Sorby was led by his study of the metallic meteorites, concerning the nature of the compounds building up artificial irons and steels, have led to the recognition of the "sorbitic" method as one of the most important aids in investigating the causes of the strength or weakness of various products used in the industrial arts. And the use of the method has now extended to other branches of metallurgy.

Sorby's complete absorption in scientific labour and speculation

Yours very truly
H. C. Sorby

often rendered him completely oblivious to the ordinary interests of other men. This sometimes led to little peculiarities occasionally bordering on eccentricity, but always of the most amiable kind. His servants and sailors were devoted to him, and the few scientific friends who had the pleasure of knowing him intimately could not sufficiently admire the transparent simplicity and extreme loveableness of his character. Honours justly flowed to him from every quarter, but left him modest and undistracted from the research to which, in his youth, he determined to devote his life, and to which, in his old age, he remained so constant.*

JOHN W. JUDD.

[For the loan of the portrait we are indebted to the courtesy of the editor of the "Geological Magazine," Dr. Henry Woodward, LL.D. F.R.S. F.G.S. F.Z.S. F.R.M.S.—ED.]

CHARLES STEWART, 1840–1907.

CHARLES STEWART was born in 1840 at Plymouth, where his father and grandfather had been in practice. He received his medical education at St. Bartholomew's Hospital, taking the M.R.C.S. in 1862. In 1866 he obtained the post of Curator of the Museum at St. Thomas's Hospital, and was subsequently Lecturer on Comparative Anatomy and joint Lecturer on Physiology at that institution. In 1884 his connection with St. Thomas's Hospital ceased, owing to his appointment as Conservator of the Museum of the Royal College of Surgeons, a post he held till his death on September 27, 1907.

From 1866 Stewart was a Fellow of the Linnean Society, and from 1890 to 1894 held the office of President. He became a Fellow of the Royal Microscopical Society in 1867, and was joint Secretary with H. J. Slack from 1873 to 1878, and from 1878 to 1883 with Sir Frank Crisp. In 1896 he was elected to the Fellowship of the Royal Society, and three years later the University of Aberdeen conferred on him the degree of LL.D. (honoris causa).

Stewart was a great lecturer; his words came easily and eagerly, and he was able to communicate his ideas and facts not

* Interesting autobiographical reminiscences of Sorby will be found in his "Unencumbered Research: A Personal Experience," published in the "Essays on the Endowment of Research," 1876, and in a lecture before the Sheffield Literary and Philosophical Society in 1879, entitled "Fifty Years of Scientific Research." A list of his numerous papers is given in "The Naturalist" for 1906.