During this work, Barrande found a number of beautifully preserved fossils, in Middle Cambrian shales, in the neighbourhood of Skryj and of Tejšovice. By these discoveries he confirmed his view, that strata exist in Bohemia similar to those which Murchison had studied in Wales and Scotland. When the first part of the latter's "Silurian System" appeared in 1839, Barrande decided to investigate systematically all the so-called Transition Strata and their fauna in Bohemia, being certain that the Silurian formation of Bohemia was the same as that in Britain.

Finally, after many years of investigation and collection, Barrande began the publication of his "Système silurien de la Bohême" (1852), a work which even to-day is the only one of its kind in palaeontological bibliography. The author published between 1852 and 1881 twenty-two big quarto volumes, partly containing text, partly plates. The treatise contains more than 6,000 pages of descriptions and 1,160 plates of fossils. The first volume, in which he deals with trilobites, forms, together with the supplementary parts, the most important and best account of these extinct crustaceans in general. Barrande also gives a careful description and illustration of the geological conditions in the older Palaeozoic rocks of Bohemia. He divides the "Silurian" into eight series, indicated by the letters A to H. He determines the order of succession, the relations of deposit, and the fossiliferous contents of all his stages, based on their palaeontological connexion with the British Silurian. In this and in the following volumes of his work, the author describes in turn the other crustaceans besides trilobites, and the fishes, cephalopods, brachiopods and lamellibranchs known up to that time in Bohemia.

It is clear from his palaeontological work that Barrande was a convinced believer in the constancy of species (being a pupil of Baron Cuvier), and therefore an opponent of the theory of evolution. It is well known that his objections were among

the most weighty of those which were ever expressed against that theory.

While issuing his chief work and several lesser publications, Barrande spent much time in defending his theory of so-called 'colonies', which were supposed to be intercalations of parts of a later geological fauna in strata containing an older geological fauna, the result of migrations. Barrande, from 1861 until 1881, was at war with many well-known geologists, and to the day of his death was never shaken in his opinion of such migrations of faunas. He defended his view by the publication of polemical articles, letters and longer works, which were gathered into five parts and entitled "Défense des Colonies". The chief opponents of Barrande's views were Prof. J. Krejčí, the father of Bohemian geology, V. M. Lipold, the Viennese geologist, and J. E. Marr, the English geologist, who explained these phenomena as due to faulting of the strata.

Barrande also took part victoriously in the dispute concerning the independence of the so-called Taconic System in North America, ending a discussion of many years by proving that the fauna which was discovered by Emmons and Marcou represented his primordial Cambrian fauna.

Meanwhile, great uncertainty prevailed both in the Bohemian National Museum and in the Czech University as to what would be the fate of the huge collections of fossils made by Barrande. Various negotiations took place, letters were written to Barrande, and a promise was obtained that his collections would be installed in the new building of the National Museum. When Barrande's will was opened, it was discovered that the National Museum had become the heir of all his collections, of all his manuscripts, and of his scientific library. By this splendid bequest, the National Museum of Prague has become the owner of one of the greatest collections of older Palaeozoic fossils, and as such is the most important goal of all geologists and palaeontologists who study the oldest fossiliferous rocks.

Obituary

PROF. SVEN ODÉN

IT was with the deepest regret that we heard of the death of Sven Odén. He had for some time been in failing health, but his friends still clung to the hope that his vigorous vitality might win. Unfortunately this was not to be, and he died on January 16 in his forty-seventh year.

Odén was trained under Svedberg and was soon recognised as an exceptionally able colloid chemist. His first investigation, published in 1910, was on the coagulation of colloidal sulphur, and it brought out the important fact that small variations in the hydrogen ion concentration of the solution greatly influenced the critical concentrations of electrolytes that just brought about coagulation. This group of problems interested him throughout the whole of his life and he constantly reverted to it.

In 1911 he began an important series of investigations on the size of the particles in the suspension, determining the mass of the particles lying between successive size limits. This led him to a study of fractional coagulation. All this work he pursued with great ingenuity, using as his materials such varied substances as clays, deep sea deposits, cements and various precipitated substances. Having an unusually wide outlook, he was able to apply his results not only to problems in the pure science of colloids, but also to problems of applied science.

Nothing better illustrates the genius of Odén for attacking a difficult problem than the automatic balance he made for use in sedimentation investigations. By its means he was able for the first time to construct curves showing the mass

distribution of particles between any desired limits of size in a mixture of various sizes. Readers in Great Britain are familiar with some of these curves, especially those in his paper in the *Proceedings of the Royal Society of Edinburgh* in 1911 on the size of the particles in deep sea deposits, and in the *Proceedings of the Royal Society* of 1924 when, along with a group of Rothamsted workers, his colleagues during a period of extended leave spent at Rothamsted in 1923, he developed more fully this automatic balance and worked out typical distribution curves for clay particles of different sizes. The subject is discussed fully in Dr. B. A. Keen's monograph, "Physical Properties of the Soil". Later work at Rothamsted showed certain unforeseen sources of error not yet overcome which detract from the strict quantitative interpretation of the results. Whether they can be avoided or not, the work stands out as the first and best study of distribution of clay particles according to size.

A second group of investigations in which Odén achieved marked success dealt with peat. He began about 1916, and by 1919 was able to publish his monograph "Die Huminsäuren", one of the best that has ever appeared on that particularly difficult and elusive group of mixtures. Applying for the first time the methods of modern physical chemistry to the black sticky mixture of humus substances soluble in alkalis and reprecipitated by acids, he gave for the first time definite proof that the so-called humic acid really is an acid and he was able to assign to it fairly definite properties including tentative molecular and equivalent weights. Considerable discussion has followed, and there has been in consequence of his work much clearing up of a very involved subject. In addition to these physico-chemical investigations he also studied the possibilities of obtaining fertilisers by the use of peat: its use as a source of ammonium chloride and for rendering mineral phosphates soluble.

Another investigation in organic chemistry made by Odén, in conjunction with E. Fischer, was the synthesis and study of sugar derivatives having molecular weights ranging up to 8,000.

Up to this time Odén had been working at Uppsala, first (from 1913) as lecturer in chemistry; and later, in 1920, as professor of inorganic chemistry at the Technical Institute of Engineering. In 1925 he became head of the Chemical Department of the Central Experimental Agricultural Station, Experimentalfältet, which post he held until his death. Here he turned his attention to the exchangeable bases in the soil, which he studied by electrodialysis. His last papers were on the application of electric light to the furtherance of plant growth, and the relations of certain organic compounds and the growing plant.

Odén was not only a brilliant investigator but also a delightfully human personality, a man one loved to meet and talk to; full of ideas, overflowing with energy and vitality. Whatever he

touched he illuminated, and the more difficult the subject the more it attracted him and stimulated his inventive powers. Sweden has lost a distinguished son and science a brilliant worker.

E. J. RUSSELL.

DR. LILIAN CLARKE

THE death of Dr. Lilian Jane Clarke, at the age of sixty-eight years, marks the passing of the pioneer of the best modern methods of the teaching of botany and Nature study in schools. The subject early attracted her and having gained the gold medal of the Apothecaries' Society for botany and entered University College, London, in the session 1887-88, she took her B.Sc. degree in 1893-94, after studying botany under Prof. F. W. Oliver. She was appointed science mistress at James Allen's Girls' School, Dulwich, in January 1896, and from that time onwards devoted herself whole-heartedly to developing her own ideas of botanical teaching.

The 'laboratory' Dr. Clarke found in 1896 at James Allen's was a tray of apparatus on the hall platform; the laboratory she left was a well-equipped building for botany and other scientific subjects, with a greenhouse for biological experiments, and a large area of land laid out in the botanical gardens for which the school is justly famous, and with which Dr. Clarke's name will always be associated. These gardens started with a few natural order beds, but as her method of direct teaching of Nature study was developed, more land was gradually acquired for the study of plant physiology and ecology. At first the financial difficulty was great, but eventually the value of the gardens was recognised by a small grant which permitted further extensions. The work throughout was done almost entirely by the voluntary labour of the school pupils in their spare time, and with their aid Dr. Clarke built up a range of gardens unparalleled elsewhere. Order beds, plots for genetical and physiological experiments, shingle bank, bog garden, pond, a lane with its hedgerows and even an oak wood were all finally acquired, and provide a wealth of material for teaching purposes. The value of her pioneer work in this direction was recognised in 1902 by the award of the degree of D.Sc.(Lond.), and in 1905 she was one of the first women admitted as a fellow of the Linnean Society.

Somewhat of a martinet in her laboratories, Dr. Clarke instilled habits of carefulness and accurate working into her pupils, which many of us have since fully appreciated. The secret of her success was unbounded enthusiasm and driving power, coupled with the ability of interesting individual students in particular details of the work, making even the drudgery appear worth while. Compulsory retirement under the age limit went sorely against the grain, but to the end she maintained her interest in the work of James Allen's School and of many of her old students, whose careers she followed closely.