subject would do for botany what Sir H. E. Roscoe has done for chemistry he would confer a great boon on teachers and young students. A. H.

Egyptian Figs.

MY attention has been called to a very obvious slip of the pen in my note on Egyptian Figs, in that I have written "Pliny" instead of "Theophrastus." The former, as all know, was a *Latin* author, but he simply copies from the latter. Having both authors before me at the time, I accidentally put one name for the others. The refs. are as follows:—Theoph. iv. 2; Dioscor. l. 1; Plin. xiii. 7. GEORGE HENSLOW.

A Palæozic Ice-Age.

I CANNOT understand how, when writing on this subject *ante*, p. 101), I overlooked the circumstance that the ancient boulder-beds of Australia, India, and South Africa received full notice in Prof. J. Prestwich's "Geology," vol. ii. pp. 143–146.
December 9. W. T. BLANFORD.

SCHEELE.

DURING this month Sweden commemorates the one hundred and fiftieth anniversary of the birth of one who has conferred an imperishable lustre on her annals. Carl Wilhelm Scheele—although a German by nationality, for he was born at Stralsund, the capital of Pomerania—spent practically the whole of his short life in Sweden, and is usually regarded as a Swede. The son of a tradesman, Joachim Christian Scheele, and the seventh child of a family of eleven, Scheele, as a boy, gave little promise of the genius and power which astonished the scientific world towards the close of the last century. It is perhaps indicative of a certain mental imperfection that he should have been wholly incapable of learning a foreign language; although he lived in Sweden during more than half his life his knowledge of Swedish was so imperfect that his memoirs, addressed to the Academies of Stockholm and Upsala, were invariably written by him in German and had to be translated by others before publication. By what influences he was led to the study of chemistry is unknown. There was nothing apparently in his home life, or in the mode or circumstances of his education to direct his inclination towards science. As a boy he began the study of pharmacy, and at his own wish was apprenticed to an apothecary at Göteborg named Bauch, with whom he remained eight years. Here he had access to the standard treatises on chemistry of that time, and he devoted all his leisure, often working far into the night, to the study of the works of Neumann, Lemery, Kunkel, and Stahl. Kunkel's Laboratorium was, indeed, his chief instructor in practical chemistry, and it was by diligently repeating, in the first instance, the experiments contained in that book that he acquired that extraordinary manipulative skill and analytical dexterity on which his success as an investigator ultimately rested.

When twenty-three years of age Scheele removed to Malmö, and some years afterwards to Stockholm, where he superintended the shop of an apothecary named Scharenberg. It was about this time that his career as a discoverer began, by the isolation of tartaric acid from cream of tartar. He ascertained many of the characteristic properties of this acid and prepared and examined a number of tartrates. These early efforts met, however, with a somewhat untoward reception. It seems that Scheele drew up an account of his observations and forwarded it to Bergman, who then filled the chair of chemistry in the University of Upsala as the successor of Wallerius. Bergman failed to appreciate the significance of the work of the young and unknown apothecary and by some mischance the manuscript was lost. The importance of the discovery was, however, recognized by Retzius, who induced Scheele to write a second account of his work and to submit it to the Academy of Sciences at Stockholm, by whom it was eventually printed. In 1771 Scheele published his memorable essay, "On Fluor Mineral and its Acid," in which he first demonstrated the true composition of fluor-spar, showing that it "consists principally of calcareous earth saturated with a peculiar acid," named by him "fluor-acid." Although he found that the "fluor-acid" (hydrofluoric acid) dissolved "siliceous earth," he failed to recognize the change thereby produced in the "fluor-acid" and was thus led to an erroneous conception of its real nature. He was in fact led astray by the circumstance that his experiments were for the most part made in glass vessels, and hence the fluor-acid was contaminated with more or less silica and hydrofluosilicic acid. The origin of the silica in the acid prepared by Scheele was first clearly indicated independently by Wiegleb and Meyer. In 1773 Scheele went to Upsala as pharmaceutical assistant to Mr. Lokk, in whose shop he chanced to meet the chemist Gahn. Lokk and Gahn were speculating on the cause of the different mode of action of distilled vinegar on nitre before and after fusion. This was explained by the young assistant, who pointed out the nature of the change effected on nitre by fusion; and the fact that it is converted into a salt (potassium nitrite) from which a peculiar acid, different from true "spirit of nitre," can be obtained by treatment with distilled vinegar. Gahn, struck with the sagacity of the young pharmacist, offered to introduce him to Bergman. The invitation was at first declined; Scheele had not forgotten the unfortunate incident of the tartaric acid memoir. Eventually he allowed himself to be convinced that Bergman's action was due more to inadvertence than to indifference, and the acquaintance which followed rapidly ripened into a strong friendship. In 1774 Scheele, at the suggestion of Bergman, published his well-known memoir "On Manganese, Manganesium, or Magnesia Vitrariarum." This essay, although marred and in part obscured by the phlogistic conceptions of the period, will for ever remain one of the classics of chemistry. In it Scheele not only established the nature of "pyrolusite" or "wad," but, in studying the action of acids upon the mineral, he was led to the discovery of baryta and of chlorine, the properties of which he minutely describes. In 1775 appeared his memoir on arsenic acid which he prepared in several ways; he discovered many of the more striking properties of this body and obtained a number of its salts. In the course of the investigation he discovered arseniureted hydrogen, and the well-known pigment Scheele's Green. In the same year he published his essay on benzoic acid, the "flowers of benzoin" of the apothecary. After a stay of two years in Upsala Scheele was appointed by the Medical College *provisor* of the pharmacy at Köping, a small town on the north shore of Lake Mälar. Instead of the prosperous business he had been led to expect he found nothing but discomfort and disorder, and the remainder of his life was spent in a constant struggle with privation and debt, relieved at length, to some extent, by a grant, at Bergman's instigation, from the Stockholm Academy. Of this money Scheele set aside one-sixth for his personal necessities, and devoted the remainder to his researches. In 1777 he took over the business of the pharmacy from the widow of the former proprietor, but it was only by unremitting industry that he was able to discharge the obligation he thereby incurred. Not a year passed, however, without Scheele publishing two or three memoirs, every one of which contained a discovery calculated to enhance his reputation as the greatest experimenter of his time. This untiring devotion to science at length began to tell upon a frame constitutionally weak and doubtless further enfeebled by privation, and by the worry

of debt and difficulties. He struggled on, however, a martyr to rheumatism and suffering from a complication of internal disorders until he was struck down in the spring of 1786. Some time before his fatal illness he had formed the resolution of marrying the widow of his predecessor so soon as his circumstances should permit: on his death-bed he carried out this project, bequeathing to his wife such property as he had been able to acquire. Two days afterwards (May 21, 1786) he died at the age of forty-four.

The eleven years during which Scheele lived at Köping were fruitful in investigations of the highest importance in every department of chemistry. In that time he discovered molybdic, tungstic, and arsenic acids among the inorganic acids; and lactic, gallic, oxalic, citric, malic, mucic, and uric among the organic acids. He also discovered glycerin, determined the nature of Prussian blue, and prepared hydrocyanic acid. He demonstrated that plumbago is nothing but carbon associated with more or less iron, and that the black powder left on the solution of cast-iron in mineral acids is essentially the same substance. He determined the chemical nature of sulphuretted hydrogen, discovered arseniureted hydrogen, and invented new processes for preparing ether, powder of algaroth, calomel, and *magnesia alba*. He made numerous analyses of air by absorbing the oxygen with a mixture of iron filings and sulphur. He concluded that "our atmosphere contains always, though with some little difference, the same quantity of pure or fire air [oxygen] viz. $\frac{9}{33}$ which is a very remarkable fact; and to assign the cause of it seems difficult, as a quantity of pure air [oxygen] in supporting fire, daily enters into a new union; and a considerable quantity of it is likewise corrupted or changed into aerial acid (carbon dioxide) as well by plants as by respiration; another fresh proof of the great care of our Creator for all that lives."

Scheele's greatest work, however, is unquestionably his treatise on "Air and Fire," which appeared in 1777 with a preface by Bergman, who, according to Thomson, superintended its publication. This elaborate essay shows Scheele at his best and at his worst; it testifies to his genius as an experimentalist and to his weakness as a theorist. No one can read this, or indeed any other of Scheele's memoirs, without being impressed by his extraordinary insight, which at times amounted almost to divination, and by the way in which he instinctively seizes on what is essential and steers his way among the rocks and shoals of contradictory or conflicting observations. No man was ever more staunchly loyal to the facts of his experiments, however strongly these might tell against an antecedent or congenial hypothesis. Had Scheele possessed that sense of quantitative accuracy which was the special characteristic of his contemporary Cavendish, his work on "Air and Fire" would inevitably have effected the overthrow of phlogistonism long before the advent of Lavoisier. His memoir is essentially an essay on oxygen, of which he was an independent discoverer, in its relations to life and combustion. It is perhaps idle to speculate on the causes which prevented his clear recognition of the full truth. It may have been that he was essentially a *preparateur* like Priestley, and that quantitative chemistry had few attractions for him; it is far more probable that the character of his work was determined by the circumstances of his position, by his poverty, his lack of apparatus, and his want of assistance. As it is, it remains one of the most remarkable circumstances in the history of human knowledge that a man working under such adverse conditions in a small village on the shore of a Scandinavian lake should have been able to change the entire aspect of a science.

It was stated by Crell, the editor of the well-known *Neue Entdeckungen* and *Annalen*, in which many of Scheele's papers first appeared, that the great Swedish chemist was invited to this country with the offer of an easier and more lucrative position than that which he had at Köping; but that his partiality for Sweden and his love of quiet and retirement delayed his acceptance of the offer until a change in the English ministry put a stop to the negotiations. Thomson, the author of the "History of Chemistry" in mentioning this circumstance, expresses his doubts as to its truth, and states that he made enquiries of Sir Joseph Banks, Cavendish, and Kirwan, but none of them had ever heard of such negotiation. Indeed the circumstance is intrinsically improbable. "I am utterly at a loss," says Thomson, "to conceive what one individual in any of the ministries of George III. was either acquainted with the science of chemistry or at all interested in its progress. . . . What minister in Great Britian ever attempted to cherish the sciences, or to reward those who cultivate them with success? . . . If any such project ever existed, it must have been an idea which struck some man of science that such a proposal to a man of Scheele's eminence would redound to the credit of the country. But that such a project should have been broached by a British ministry, or by any man of great political influence, is an opinion that no person would adopt who has paid any attention to the history of Great Britain since the Revolution to the present time."

T. E. THORPE.

WERNER VON SIEMENS.

ERNST WERNER SIEMENS was the eldest son of Christian Ferdinand Siemens and Eleonore Deichmann; he was born in 1816 at Lenthe in Hanover, where his father was engaged in the business of agriculture and forestry.

From his very childhood the subject of this memoir learnt the lessons of self-control and responsibility, for owing to his mother's delicate health and his father's occupations, the care of his younger brothers and sisters devolved on himself and his sister Mathilde; in these younger days he also learnt tact, and his father taught him that difficulties had to be faced and overcome, and that duties must never be avoided.

In 1823, a few months after the birth of his brother William (whose lamented death occurred here nine years ago), the family removed to Menzendorf near Lübeck, in the Grand Duchy of Mecklenburg. In the Gymnasium of Lübeck Werner was educated up to his eighteenth year, when, by the advice of his father—who with rare prescience saw in Prussia the nucleus of German Unity and Empire—he went to Magdeburg to volunteer for service in the Prussian Army. For three years he studied in the Military School of Berlin, and in 1838 received his commission as a lieutenant in the artillery, and returned to Magdeburg; he was soon transferred to the Technical Division of the Artillery at Spandau, and afterwards to Berlin.

In July, 1839, his mother died, and six months afterwards his father; and then, at only twenty-three years of age, he became the veritable guardian of his younger brothers and sisters.

In 1842 he took out a patent in Prussia for electro-plating and gilding, and having established a factory in Berlin for putting his invention into practice, he urged his brother William to devote his attention to the subject. This the younger brother did; and the story of his enterprise and success in this country then and ever since has been told by Dr. William Pole in his most interesting biography of him; to this volume and to the works of Dr. Werner von Siemens, the first volume of a translation of which has recently been published by Mr. Murray, we are indebted for much of the information contained in this short notice.