here since the formation of this beach. The beaches can be traced across all the larger alluvial fans surrounding the playa, and thus show that these fans were formed before the lake existed. Subsequent fan development has been feeble. The lake is believed to have existed in the last (Wisconsin) glacial stage.

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SCIENTIFIC BOOKS

Faraday's Diary. Vols. I and II. Edited by THOMAS MARTIN, M.Sc., and published by order of the Managers of the Royal Institution of Great Britain, with a Foreword by Sir William H. Bragg, O.M., K.B.E., F.R.S. G. Bell and Sons, Ltd., London.

AFTER Faraday's death the Royal Institution received as a bequest from him a manuscript record containing an account of the experimental work which had been done by him in the years from 1820 to 1862. This record the managers of the Royal Institution decided to publish as a fitting memorial of their most distinguished director. When the publication is complete there will be seven volumes, of which two are now at hand, and the others may be expected within two years. Only 750 copies of the work will be issued, and these will be sold in sets. The price of a set is twelve guineas.

The task of editing this work was undertaken by Thomas Martin, M.Sc., general secretary of the Royal Institution. It has been admirably performed. So far as one can judge without comparison with the original manuscript, the transcription of the text has been carried out with accuracy. The peculiarities of spelling and the abbreviations used by Faraday have been retained, and obvious errors have been noted, with proper reference to the editor. The diagrams and sketches with which the manuscript abounds have been with great judgment and good taste removed from the body of the text and inserted either on the wide exterior margins of the pages or at the bottom below the letterpress. In the latter case the paragraphs to which the diagrams pertain are indicated. The result is that, while the diagrams are immediately available, the text can be read with continuous comfort. An extensive table of contents is prefixed to each volume, and references are made in it to Faraday's published papers in which the matter of the text has been incorporated. An index or synopsis of the whole work is promised for the last volume of the set. The books are beautifully printed, in excellent legible type, on wide pages, with large margins, and are well bound. The publishers, Messrs. G. Bell and Sons, Ltd., should be congratulated on their contribution to the value of the work.

Faraday's first scientific paper was published in 1816, at a time when, as he says of himself, his fear was greater than his confidence, and both far greater than his knowledge; at a time also when he had no thought of ever writing an original paper on science. The favorable reception given to it emboldened him to undertake other researches in the time that was left him after the many duties of his position as assistant in the laboratory had been performed. After a few years he evidently felt that he would be able to carry on research in a sufficiently consecutive way to make regular entries of his experiments advisable, and in September, 1820, he began the notes of his work which ended only with the close of his scientific activity, forty-two years later. They present a complete record of the experiments which he carried out in the laboratory of the Royal Institution. The only important things which he did which do not appear there are his studies of alloys of other metals with iron and steel, carried out by him in collaboration with Mr. Stodart; his researches on the manufacture of glass for optical purposes; and the work which he did for nearly thirty years as scientific adviser of the Trinity House, for the improvement of the lighthouse service.

As was to be expected of an assistant of Sir Humphry Davy, Faraday was first interested in chemistry. With the exception of the invention in 1821 of apparatus to exhibit electromagnetic rotations, most of the entries for the first ten years are concerned with chemical matters. They record the experiments which led to the discovery of two compounds of chlorine with carbon (1820), they describe the liquefaction of chlorine and other gases (1822); and they present the long series of observations which led to the isolation of benzene from coal oil (1825). Many other observations are recorded which led to nothing or to results of minor importance. In 1831 appears the first study —with the exception noted above—of a purely physical subject, the vibrations of plates and the formation of Chladni's figures.

From time to time in these years Faraday had evidently had in mind the possibility of an inductive effect produced by an electric current in a neighboring conductor. On December 28, 1824, he tried the experiment of bringing up a strong magnet to a wire carrying a current, with the expectation that the current would be thereby modified; but no effect was shown on a magnetic needle placed under a distant part of the circuit. On November 28, 1825, he looked for a current in a wire set parallel to another wire carrying a current, but could perceive no action. Again on April 22, 1828, he endeavored to find an effect produced by a magnet pushed through a ring of copper wire, with no result. Why some of these experiments failed it is not easy to determine, unless it was that Faraday was looking for a steady effect, produced so long as the arrangement was maintained, and so either did not look for or did not notice the momentary effects produced while the magnet was moving or when the primary current was closed or broken. That this explanation is the true one may be supported by an entry made on August 29, 1831, the day on which his first successful observations of electromagnetic induction were made: "Hence effect evident but transient; but its recurrence on breaking the connection shews an equilibrium somewhere that must be capable of being rendered more distinct."

The course of Faraday's progress in the discovery of the induced current was entirely different from that of his exposition of the discovery in his "First Series of Researches" read before the Royal Society on November 24, 1831. His first successful observation was made with an iron ring wound with two coils of wire, one of which was joined with a galvanometer, the other to a battery. When the battery circuit was made or broken, a temporary current appeared in the galvanometer. This experiment is the same as that reported by Joseph Henry as made by him before he had any knowledge of Faraday's method. On September 24 Faraday records his obtaining the induced current in a coil wound around an iron bar when the ends of the bar were in contact with the opposite poles of two bar magnets and the other ends of these magnets were brought together or separated. "Here distinct conversion of Magnetism into Electricity."

The first record of an induced current produced in a circuit by making or breaking a current in a neighboring circuit "without the presence of iron" was made on October 1. It was not until October 18 that this effect was confirmed not only with the galvanometer but by using the induced current in a helix to magnetize needles. This observation is the one with which Faraday begins his exposition.

The observation described by him in §18 of the production of the induced current in a circuit made in the shape of a large W, to which another similar circuit carrying a current was moved up or from which it was removed is not recorded in the diary until December 26. This note is evidently misdated, for the observation recorded in it is described in the paper of November 24, and in the following paragraph it is taken as evidence of the existence of an electrotonic state, a hypothesis which Faraday abandoned in his Bakerian Lecture, dated December 21. These two paragraphs belong somewhere in October, if the course of Faraday's thought can serve as a guide.

Volume I closes with this discovery and its elaboration. Faraday evidently felt that he was justified in expecting to succeed in obtaining other important results, for he published this work as his "First Series of Experimental Researches in Electricity" and began numbering the paragraphs consecutively. In the new folio volume of the diary which he opened on August 25, 1832, he also introduced this consecutive numbering of the paragraphs, which is continued until March, 1860.

Volume II opens with the record of many experiments made to show the identity of electricity from different sources. Most of the volume is taken up with the study of electrochemical decomposition, which led to the discovery of the laws of electrolysis. In October, 1835, Faraday left this subject for a while to study the phenomena presented by the induction of a circuit on itself. In this he had been anticipated by Joseph Henry. Before the close of the year he started work on electrostatic induction and the electric discharge, the result of which was his proof of the equality of the positive and negative charges and his discovery of specific inductive capacity. Volume II closes before the account of these researches is complete. He also for a while reverted to chemistry by the examination of the properties of fluorine.

With the work on electrostatic induction closes what Dr. Bence-Jones calls the first period of Faraday's experimental researches. He had for some time been weary and oppressed with giddiness and loss of memory, and shortly after this work was done he was forced to give up his studies altogether and rest. The famous discoveries of the magnetic rotation of the plane of polarized light and of diamagnetism, which were made after he returned to work, together with his speculations and philosophical views on the action of the medium in maintaining and determining the magnetic and electric fields will appear in the later volumes. The two now issued contain a large part of Faraday's experimental achievements.

It is interesting to notice that he tried (May 2, 1833) to obtain an effect on a beam of polarized light by passing it through an electrolyte which was transmitting a current, and also (May 6, 1833) by passing the beam through a piece of his borate of lead glass while it was in a strong electrostatic field (the Kerr effect), but with no positive results. He also (September 19, 1833) observed the same effect as that afterwards applied in the Groves' gas battery, without appreciating its meaning. Probably other hints of future discoveries could be found by a careful study of his records.

On a general view of these volumes one is struck with Faraday's astonishing industry. This is especially noticeable in the earlier years covered by the record. The number of chemical experiments made in one day while he was studying the compounds of chlorine, involving heating the mixtures and measuring the volumes of the gases produced from them, is amazing. Perhaps the most striking example is given by the two days (October 28, November 4, 1831) in which he experimented on electromagnetic induction at Mr. Christie's with the great magnet of the Royal Society. On the first of these days he records no less than 27 separate experiments, and on the second 29, many of which were tried over and over. The number of tests made in one day with the electrolytic cells during his study of electrolysis in 1833 and 1834 is even more astonishing.

The notes exhibit, even better than his published work, the marvelous fertility of Faraday's mind. Every page, nay, nearly every paragraph contains a new thought, often unimportant, occasionally in error, but sometimes, when good fortune and inspiration combine, rising to the highest flights of the scientific imagination. From the best of these he constructed the great scientific poems of his published papers.

It also appears very plainly that a great deal of Faraday's work was done in his mind and is not recorded in his notebooks. To perceive this we need only compare the notes of his discovery of the induced current, with the beautifully ordered presentation of the subject in his first paper and in the Bakerian Lecture, or consider the notes on the phenomena of self-induction before, as Faraday says, he begins to see light. After he saw the light his experiments became more systematic and show how he worked when led by a guiding principle.

This publication constitutes a noble memorial to one of the greatest leaders in experimental science. Its value as a history of the way in which an honest, industrious and powerful mind operates on the facts of nature is inestimable. The thanks of the scientific world should be given to the managers of the Royal Institution and to any others who may have cooperated with them to make it possible.

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SOCIETIES AND MEETINGS

THE TEXAS ACADEMY OF SCIENCE

THE Texas Academy of Science held its annual meeting on November 11 and 12 in Houston, Texas. The number of papers appearing on the program was large and well distributed over the field of science. To bring together papers of like interests, five sections were in session throughout the meeting.

The section devoted to geological sciences was very popular. The notable papers included: "The Big Springs of Texas," by R. E. Ryan, of Houston; "The Salt Domes and Gulf Coast Oil Fields," an illustrated lecture by Marcus Hanna, of Houston; "Leaves of Geologic History from the Topography around Houston," Donald C. Barton. Among the twelve other papers, one by W. T. Carter, of the U. S. Soil Survey, on the "Relationship of Texas Soils to the Geological Formations" was considered as an outstanding piece of work. The Section of Zoological Sciences contained twelve papers. Several of these were abstracts of longer papers, which are to be printed. Of outstanding worth was the paper "The Fleas of Texas and their Economic Importance," by M. A. Stewart, of the Rice Institute, and of unique purport was the paper by Karl Bleyl, of the Sam Houston State Teachers College, in which he describes a new remedy for snake bite, which is a serum taken from the snake itself. The Botany Section was largely given over to papers on the technical side of investigation into the relationships of cotton. Several papers on regional ecology in Texas were given.

The Physical and Chemical Sciences gave papers ranging from the chemical contents of grapefruit, a study in vitamins; a description of a gigantic permanent magnet, and up to cosmic rays. L. M. Mott-Smith, and L. G. Howe, of Rice Institute, told of measuring this mysterious ray at the altitude of twelve thousand feet in an airplane. The Educational Section was given over to archeology; papers on the present social and financial conditions of the world; on mental operations accompanying emotions and including papers on the comparison of the Texas Academy of Science with other state academies, by S. W. Bilsing, representative to the American Association for the Advancement of Science, and one by Clyde T. Reed, College of Arts and Industries, on "Science Clubs and the Junior Academy." The annual lecture, given at the banquet, was "Genetical Views of the Origin of Life," by Edgar Altenberg. Just before Dr. Altenberg's lecture, H. Y. Benedict, president of the University of Texas and also of the academy, made an announcement relative to the new McDonald Observatory which is to be built by the university somewhere in the state of Texas. The last session was the annual business meeting. Seventy-five new members were taken in and five new fellows created. It was announced by F. B. Plummer, of the publication committee, that Volume XV of the *Transactions* would be ready for distribution in a few weeks, and P. L. Turner, representative of the Southwest Press, stated that "The Bird Life of Texas" had reached the point where subscriptions were asked for. The new officers are: E. N. Jones, Baylor University, *president;* F. B. Plummer, *executive vice-president;* H. A. Wilson, Rice Institute, *vice-president of Section 1;* Colonel M. L. Crimmins, *vice-president of Section 3;*