

*THE LOST VOLUME OF HUTTON'S THEORY OF THE EARTH.*

*Theory of the Earth, with Proofs and Illustrations.* In four parts. By James Hutton, M.D. and F.R.S.E. Vol. iii. Edited by Sir Archibald Geikie, D.C.L., F.R.S. (Geological Society, Burlington House, 1899.)

AS we learn from Sir Archibald Geikie in his interesting preface, the history of the later portion of James Hutton's great work on the "Theory of the Earth" is a perplexing question. In 1795 the well-known two volumes appeared, containing the first and second parts, but the title-page bears the words "in four parts." Of those two the first is little more than a reprint of the essay on the same subject read to the Royal Society of Edinburgh in 1785. The second part, dealing with the operation of natural causes on the surface of the globe—or dynamical geology, as it is now sometimes called—was new matter. These volumes are without preface or preliminary sketch, so that no clue is given to the plan of the remainder of the work, while the fact that Hutton ends his second volume with an elaborate summary suggests that he contemplated a pause of some duration before issuing the remainder. At his death, in 1797, the third volume, according to Playfair, was practically complete; and we do not know why his friends did not publish it. Perhaps, as Sir A. Geikie suggests, they waited for certain illustrations, which Mr. John Clerk, Hutton's great friend, had promised to furnish. Gaps are left for these in the text; but, at any rate, Playfair and Lord Webb Seymour quote from the manuscript in a paper on Glen Tilt, read to the Royal Society of Edinburgh in 1814. It was then lost sight of—the earlier portion, including three chapters, has vanished; the other was a parting gift from Lord Webb Seymour to Leonard Horner, and was presented by him to the Geological Society of London in 1856. In its charge it has remained, forgotten by most of the Fellows, till Sir Archibald Geikie urged its publication on the Council, promising to take upon himself the laborious task of editing. Needless to say, this has been admirably done. The manuscript is printed as though it had followed on the preceding volumes. A few small lacunæ or matters needing explanation are dealt with in explanatory notes, which are models of terseness and a great help to the reader, who, in addition, has to thank the editor for an index, not only to this volume, but also to the two others.

This fragment of a geological classic is well worth the cost of publication. Three of its six chapters are more or less controversial, and are thus, to some extent, obsolete, though it is always interesting to see how difficult problems were viewed by the greater intellects in the infancy of the science. But the other three chapters, descriptive of geological journeys in the Highlands (including the famous examination of Glen Tilt), in the Southern Uplands, and in the Isle of Arran, retain their vivacity and freshness though a full century has passed since they were penned. They also demonstrate Hutton's power as a field geologist, and thus help to refute the reproach which has sometimes been levelled at him of being a mere speculator. Besides this, they show that he could describe accurately and reason profoundly in the

ordinary English tongue; and this is not the least charm in days when geological writing is apt to become a conglomerate of scientific jargon unintelligible to all but specialists. Fragment though it be, this volume has an interest and value all its own, and our best thanks are due to both the learned editor and the Council of the Geological Society, for "The Theory of the Earth" is one of the chief foundation stones of modern geology. We trust that the attention thus drawn to "Volume iii." may bring about the discovery of the manuscript which is still missing.

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OUR BOOK SHELF.

*Animals in Motion. An Electro-photographic Investigation of Consecutive Phases of Progressive Movements.* By E. Muybridge. Pp. 264 + 1600 half-tone Pictures. (London: Chapman and Hall, Ltd., 1899.)

MR. MUYBRIDGE'S book, "Animals in Motion," with its numerous illustrations, offers a most interesting study, not only to the physiologist, the man of science, and to lovers of animal nature, but also to the artist and archæologist. Mr. Muybridge's attention was first directed to the movements of animals in the year 1872, while directing photographic surveys of the United States Government on the Pacific coast, by a controversy concerning animal locomotion which was being carried on in San Francisco. Mr. Muybridge tells us that according to Plato the same subject was warmly argued by the ancient Egyptians. (This statement is not verified by a reference, and it is improbable that the point is mentioned by Plato.) Mr. Muybridge determined to settle the question whether, in trotting, the horse ever had the four feet simultaneously off the ground. By an ingenious arrangement of electrically controlled cameras, Mr. Muybridge discovered and definitely proved that the trotting horse, in certain phases of his movements, has all four feet off the ground at the same time.

Mr. Muybridge became so fascinated with the new subject, namely animal locomotion, that he studied and photographed the movements of men, women, children, lions, tigers, and other animals both wild and domestic, and also the flight of birds. His book contains a series of most beautiful and interesting pictures, each illustrating some feature of movement. Of these, probably the most instructive are those of the child crawling (p. 69) and the baboon walking (p. 75). The pictures he obtained show the exact positions of the legs and feet of the animals at certain definite times. The other motions of the horse, namely the amble, the trot, the canter, the gallop, and some more, are carefully analysed by the electro-photographic method. In the fourteen series pictures of the trot, 2 and 19 (p. 107) show the four feet off the ground at the same time; these are the pictures which entirely settled the question which fortunately started Mr. Muybridge on his excellent work; the series was photographed at Palo Alto in 1879. The series on p. 229 of the mule "Ruth," bucking and kicking, show that the animal adds marked rotation of the hind-quarters to movements which, in themselves, must be terrible to the rider. In addition to the electro-photographic analysis of the movement of animals, the author devised an instrument whereby a series of pictures was recombined, and by it a life-like picture of a moving animal was projected on to a screen. The instrument is called the Zoöpraxiscopes; it is in a large degree similar to the old Phenakistiscope, made by Dubosq of Paris, by means of which moving pictures were projected on to a screen at the old Polytechnic Institution ("Play-book of Science," by J. H. Pepper, 1864). From beginning to