

defence research is another matter; but, as he rightly points out, this involves not just the consideration of the ways in which science affects the material things of man's existence, but also the way in which man's philosophy of life affects his interpretation—or misinterpretation—of the teachings of science. Scientific workers in difficulties on this point might well turn to the essay of Walter Bagehot on the metaphysical basis of toleration, which is as relevant to our present problem as to the time in which it was written seventy-five years ago.

Dr. Bush himself believes that the task of strengthening the institutions, including the military power, of the democracies must be based on a faith and a philosophy that will match those of totalitarian States, and in such a faith the belief in the freedom and dignity of man are factors which will help to build up a strength far beyond that which can be created and maintained by any regimented dictatorship. Here, however, Dr. Bush enters the political field and, as already noted, tends to over-simplify the issues.

It is almost obvious to suggest that the strength of the Western nations must always be exerted in the manner that will bring the greatest return. Exactly what that manner may be is a problem which should be occupying the urgent attention of our most alert and creative minds in the scientific and technological as well as in the political, economic and military spheres.

JAMES HUTTON (1726-97)

James Hutton, 1726-1797

Commemoration of the 150th Anniversary of his Death. (*Proc. Roy. Soc. Edin.*, B, 63, Pt. 4.) Pp. v+351-402+4 plates. (Edinburgh and London: Oliver and Boyd, Ltd., 1950.) 12s. 6d.

JAMES HUTTON, the founder of modern geology, was born and died in Edinburgh. In 1947, the one hundred and fiftieth anniversary of his death was commemorated in his native city and his native land. On November 3 of that year, a memorial tablet, appropriately cut from granite, was unveiled in Greyfriars Churchyard by the Lord Provost of Edinburgh¹, and, on the same day, Sir Edward Bailey delivered an address² on Hutton's work before the Royal Society of Edinburgh—the Society that in 1785 first heard the presentation of the immortal "Theory of the Earth". Sir Edward Bailey's address and other tributes laid before the Edinburgh Geological Society and the Geological Society of Glasgow, together with related contributions, now appear collected in a part of the *Proceedings of the Royal Society of Edinburgh*. The frontispiece of this commemoration is Raeburn's portrait of Hutton; among other fitting illustrations are one depicting the unveiling of the memorial tablet and another of Sligh Houses farmhouse in Berwickshire, where Hutton introduced the new husbandry. Two most excellent memorials to a great man of science are thus provided; the tribute would be completed by the reprinting of the "Theory", for there can exist at the present day no more than three dozen copies of this great classic of science.

In the first address, delivered by Dr. Murray Macgregor before the Geological Society of Glasgow,

Hutton is presented as a great figure in a great age, taking his share in the intellectual renaissance of his country with such peers as David Hume, James Boswell, Adam Smith, Ferguson and Dugald Stewart the philosophers, Black the chemist, Adam the architect, and many another.

The second address, that by Sir Edward Bailey, considers three main topics selected from the "Theory of the Earth"—the igneous origin of granite and basalt, uniformitarianism and the importance of subaerial erosion. Besides giving a survey of his work as a geologist and an estimate of his stature as a man, Sir Edward summarizes Hutton's two-volume MS., "Principles of Agriculture", now in the custody of the Edinburgh Geological Society. In this work Hutton's treatment of agriculture fits in with his general proposition that the earth is a flawless machine.

Next follows a paper by Dr. G. W. Tyrrell dealing with Hutton's geological researches in Arran. Hutton considered that lovely island to be a field "proper to try the Theory of the Earth". He gave a summary of Arran geology that is astoundingly modern in some of its detail. As always, he insisted on the importance of the timing of geological events.

Mr. V. A. Eyles contributes a bibliographical study in which it is shown that the earliest publication of Hutton's "Theory" was in the form of an "Abstract" issued in 1785, the year of its reading.

The commemoration publication ends with a fascinating study by Dr. S. I. Tomkeieff of Hutton's contribution to the philosophy of geology reprinted from the *Transactions of the Edinburgh Geological Society*. Dr. Tomkeieff shows that there are two main aspects of Hutton's work, one known to all and concerned with scientific results, and a second, unrealized even by Playfair, Hutton's great interpreter, that constitutes the innermost core of the "Theory"—a core consistent with the philosophical concepts of Hutton's age. First, Hutton brought time into geology; he was profoundly interested in processes and not in matter—"material is the result of operations". He saw that there must be a balance between the destructive and constructive processes of the globe. In modern terms, his earth-machine was a cycle of magmatism, elevation of continents, folding, weathering, denudation, deposition and consolidation leading back to magmatism. This proposal of a cycle of changes in the earth led to the brilliant syntheses of Charles Lyell which, in turn, influenced the development of the modern theory of evolution by Darwin and others. To-day, it underlies the whole science of geology.

The second aspect of Hutton's "Theory", overlooked by the historians of science, was in keeping with the thought of his time. A fundamental pattern was manifest in microcosm and macrocosm. Hutton transferred the pattern in the organism to the earth as a whole; this, says Dr. Tomkeieff, is the real "Secret of Hutton". There is a hierarchy of individuals from minerals through plants and animals to man. The quintessence of Hutton's thought is presented in the following passage from the "Theory": "we are thus led to see a circulation in the matter of this globe, and a system of beautiful economy in the works of nature. This earth, like the body of an animal, is wasted at the same time that it is repaired." He saw the earth as an organic unity.

H. H. READ

¹ Eyles, V. A., "James Hutton (1726-97) and Sir Charles Lyell (1797-1875)", *Nature*, 160, 694 (1947).

² "James Hutton: Geologist and Agriculturist", *Nature*, 160, 727 (1947).