VOLCANIC ACTION IN THE BRITISH ISLES.

AT the anniversary of the Geological Society, held on the 19th inst., the retiring President, Sir Archibald Geikie, gave the annual address, which was devoted to a continuation of the subject treated of by him last year. He now dealt with the history of volcanic action in this country from the close of the Silurian period up to older Tertiary time. The remarkable volcanic outbursts that took place in the great lakes of the Lower Old Red Sandstone were first described. From different vents over central Scotland, piles of lava and tuff, much thicker than the height of Vesuvius, were accumulated, and their remains now form the most conspicuous hill-ranges of that district. It was shown how the subterranean activity gradually lessened and died out, with only a slight revival in the far north during the time of the Upper Old Red Sandstone, and how it broke out again with great vigour at the beginning of the Carboniferous period. Sir Archibald pointed out that the Carboniferous volcanoes belonged to two distinct types and two separate epochs of eruption. The earlier series produced extensive submarine lava-sheets, the remains of which now rise as broad terraced plateaux over parts of the lowlands of Scotland. The later series manifested itself chiefly in the formation of numerous cones of ashes, like the *puys* of Auvergne, which were dotted over the lagoons and shallow seas in central Scotland, Derbyshire, Devonshire, and the south-west of Ireland. After a long quiescence, volcanic action once more reappeared in the Permian period; and numerous small vents were opened in Fife and Ayrshire, and far to the south in Devonshire. With these eruptions the long record of Palæozoic volcanic activity closed. No trace has yet been discovered of any volcanic rocks intercalated among the Secondary formations of this country, so that the whole of the vast interval of the Mesozoic period was a prolonged time of quiescence. At last, when the soft clays and sands of the Lower Tertiary deposits of the south-east of England began to be laid down, a stupendous series of fissures was opened across the greater part of Scotland, the north of England, and the north of Ireland. Into these fissures lava rose, forming a notable system of parallel dykes. Along the great hollow from Antrim northwards between the outer Hebrides and the mainland of Scotland, the lava flowed out at the surface and formed the well-known basaltic plateaux of that region.

The address concluded with a summary of the more important facts in British volcanic history bearing on the investigation of the nature of volcanic action. Among these Sir Archibald laid special stress on the evidence for volcanic periods, during each of which there was a gradual change of the internal magma from a basic to an acid condition, and he pointed out how this cycle had been repeated again and again even within the same limited area of eruption. In conclusion, he dwelt on the segregation of minerals in large eruptive masses, and indicated the importance of this fact in the investigation, not only of the constitution and changes of the volcanic magma, but also of the ancient gneisses where what appear to be original structures have not yet been effaced.

THE CENTENARY OF MURCHISON.

ON February 19, 1792, Roderick Impey Murchison was born at Tarradale, in Ross-shire. By a curious and appropriate coincidence, the anniversary of the Geological Society, the date of which is fixed by statute, fell this year on the 19th of the present month, the hundredth anniversary of the birth of the illustrious author of the "Silurian System." It was a further remarkable conjuncture that the President of the Society, who had to give the annual address, and take notice of the centenary, was Murchison's literary executor, who was designated by him as the first Professor of Geology in the chair which he founded in the University of Edinburgh, and who now fills the office which he held for so many years—that of Director-General of the Geological Survey. In referring to the doubly interesting features of this anniversary, Sir Archibald Geikie spoke of his great chief with warm admiration. The twenty years which have passed since Murchison's death enable geologists to make a truer estimate of Murchison's real achievements than was possible at the time when his commanding presence filled so prominent a place in the scientific world of his day. They have been able to correct some of his observations and discard some of his generalizations, yet the solid mass of original work done by him remains as a lasting memorial of his genius and industry. In the broad basis of facts, and in the skilful marshalling of these facts in their ordered relations, which distinguished his work among the Silurian rocks, the hand of a consummate master of geological investigation is to be traced. His name has become a household word in geology, and will go down to future ages as that of one of the great pioneers of the science.

Murchison, during all his scientific career, was closely associated with the Geological Society, and took a keen personal interest in its welfare. By his will he left a sum of money to found a medal and fund to be given annually for the reward and encouragement of geological research. This year the medal was awarded to Prof. A. H. Green, of Oxford, and the balance of the fund to Mr. Beeby Thomson. An interesting proof of the affectionate regard entertained for Murchison's memory was afforded by an announcement made by the President. He stated that, a few days before the meeting, an old friend of Murchison, who desired to remain unknown, had come to him and asked to be allowed to offer a slight tribute in remembrance of the man and his work, on his centenary, at the anniversary meeting of the Society. The President was requested to select two geologists (by preference Scotsmen) who were carrying on geological work in Murchison's spirit, and seeking to advance the special branches of research to which he devoted himself, and to present to each of them a cheque for £50, with a framed portrait of the author of the "Silurian System." Sir Archibald Geikie said that the task assigned to him was made comparatively easy by the terms of the generous gift. He had no doubt that the Society would agree with him that there were pre-eminently two Scottish geologists marked out as recipients of this benefaction, who were disciples of Murchison, and were carrying on his work, but with no slavish obedience to the opinions of their master, and who, by their conjoint work, alike with hammer and pen, well deserved this unexpected and appropriate reward—Mr. B. N. Peach and Mr. John Horne. As a touching addition to this pleasing incident, we have since learnt that while the anniversary was being held at Burlington House, the faithful friend who had made this offering to Murchison's memory was engaged in the cemetery at Brompton carefully brushing and washing his tomb. Driving snow was falling at the time from a gloomy sky, in strange contrast with the glow of affection that was piously renovating the inscription that records the name and resting-place of one of the great leaders of modern geology.

H. W. BATES, THE NATURALIST OF THE AMAZONS.

HENRY WALTER BATES was a native of Leicester, and was engaged in his father's warehouse when, about the year 1845, he made the acquaintance of Alfred Russel Wallace, then English master in the Collegiate

School of that town. Bates was at that time an ardent entomologist, while Wallace was chiefly interested in botany; but the latter at once took up beetle-collecting, and after he left Leicester the following year kept up an entomological correspondence with his friend. Two years later Wallace proposed a joint expedition to Para in order to collect insects and other natural objects, attracted to this locality by the charming account of the country in Mr. W. H. Edwards's "Voyage up the Amazon," a choice confirmed by the late Edward Doubleday, who had just received some new and very beautiful butterflies collected near the city of Para. The two explorers sailed from Liverpool in April 1848, in a barque of 192 tons burthen, one of the very few vessels then trading to Para, and the results of their journey are well known to naturalists. They made joint collections for nearly a year while staying at or near Para, but afterwards found it more convenient to take separate districts and collect independently. Bates spent eleven years in the country, divided pretty equally between the lower and the upper Amazon, and he amassed a wonderful collection of insects. Returning home in 1859, he devoted himself to the study of his collections, and in 1861 read before the Linnean Society his remarkable and epoch-making paper on the Heliconidæ of the Amazon Valley. In this paper, besides making important corrections in the received classification of this group and its allies, he discussed and illustrated in the most careful manner the wonderful facts of "mimicry," and for the first time gave a clear and intelligible explanation of the phenomena, their origin and use, founded on the accepted principles of variation and natural selection. In spite of countless attacks—usually by persons who are more or less ignorant of the facts to be explained—this theory still holds its ground, and notwithstanding the constant accumulation of new facts, and its discussion by new writers, it has never been more clearly or more fully explained than by its original discoverer.

So early as March 1860, Mr. Bates commenced a series of papers for the Entomological Society, under the title of "Contributions to an Insect Fauna of the Amazon Valley." These were at first devoted to the Diurnal Lepidoptera, and in one of them he gave a new classification of the whole group, founded chiefly on the structure of the legs, and leading to the conclusion that the Papilionidæ formed one of the lowest families, while the Nymphalidæ were the highest. This classification has been very generally adopted by entomologists, though there are a few dissentients, who hold that the principle adopted to determine the rank or grade of the respective families is an unsound one. Later on he wrote many papers on the various groups of Longicorn beetles; and finding that his circumstances and the time at his disposal did not allow him to keep up and study two such extensive groups as the Coleoptera and Lepidoptera, he parted with his fine collection of South American butterflies to Messrs. Salvin and Godman, and thereafter devoted himself exclusively to the study of Coleoptera. Later still, he almost confined his attention to the Carabidæ, on which important group he became a recognized authority. His largest works in this direction were his contributions to the "Biologia Centrali-Americana": Vol. I., Part 1 (Geodephaga); Vol. II., Part 2 (Pectinicornia and Lamellicornia); Vol. V. (Longicornia). A supplement to the Geodephaga has since been published in the Transactions of the Entomological Society of London for 1890 and 1891; and a supplement to the Longicornia was in course of preparation, but not finished at the time of his death.

In 1864, he was appointed Assistant Secretary to the Royal Geographical Society, an appointment he held till his death. Besides editing the Journal and Proceedings, and carrying on an immense correspondence with travellers and others in every part of the world, he had practically the entire management of the large establishment of the Society, and the chief burden of the arrangements for the various meetings, as well as those for the Geographical Section of the British Association. There can be little doubt that it was the confinement and constant strain of this work that weakened his constitution and shortened a valuable life.

When we consider the originality and clearness of exposition in his first great paper on "Mimicry," the accuracy and fulness of knowledge displayed in his systematic and descriptive work, and the power of observation and felicity of style which characterizes "The Naturalist on the Amazons," we cannot but regret that circumstances should have compelled him to devote so much of his time and strength to the mere drudgery of office work, and be thereby to a great extent debarred from devoting himself to those more congenial pursuits in which he had shown himself so well fitted to excel.

His high reputation, both as a hard-working entomologist and philosophic naturalist, led to his being twice chosen President of the Entomological Society of London, first in 1869, and again in 1878; while he was elected a Fellow of the Royal Society in 1881. His somewhat rugged features, quiet, unassuming manners, and thoughtful utterance, must be familiar to all who have attended the evening meetings of the Royal Geographical Society during the last twenty-seven years. Rarely has any Society had a more efficient secretary, who not only carried on its work with accuracy and judgment, but also gained the respect and esteem of all who came in contact with him. He died on Febuary 16, at the age of sixty-seven.

A. R. W.

THOMAS ARCHER HIRST.

WE regret to have to record the death of Dr. Hirst, the well-known mathematician. He was the youngest of the three sons of Mr. Thomas Hirst, a woolstapler, and was born at Heckmondwike, in Yorkshire, on April 22, 1830. In 1844 he became an articled pupil of Mr. Richard Carter, land agent and surveyor at Halifax; but afterwards he went to Germany, and studied at several Universities, taking the degree of Doctor of Philosophy at Marburg in 1852. His intercourse with Steiner, at Berlin, gave a strong impulse to his studies, and ultimately determined their character. Dr. Hirst on his return to England filled the vacancy at Queenwood College caused by Tyndall's appointment to the Professorship of Natural Philosophy in the Royal Institution. The work at Queenwood occupied most of his time, so that during the three years for which he held the post his only original paper was a note "On the Existence of a Magnetic Medium" (R.S. Proc., vii., 1854).

Towards the close of 1854 he married, and in consequence of his wife's delicate health he passed the winter of 1856–57 in the south of France. During this period he wrote two papers "On Equally Attracting Bodies" (*Phil. Mag.*, xiii., xvi.).[1] On the return journey Mrs. Hirst died (1857) in Paris. After this sad event Dr. Hirst spent six weeks with Prof. Tyndall on the *mer de glace* (cf. "Glaciers of the Alps"): he then returned to Paris, and attended the lectures of Chasles, Liouville, Lamé, and Bertrand. At this time he translated Poinsot's famous memoir "On the Percussion of Bodies," and contributed a paper, "Sur le Potentiel d'une Couche infiniment mince comprise entre deux Paraboloides Elliptiques" (Liouville, *J. de M.*, ii., 1859).[2] The winter of 1857–58 was spent in Rome. Here was written for Tortolini's *Annali* the memoir "Sur la Courbure d'une Série de Surfaces et de Lignes" (vol. ii., 1859), an abstract of which was subsequently published in the *Quarterly Journal of Mathematics*. In these stirring times Dr.

[1] Cf. Chasles, "Rapport sur les Progrès de la Géométrie," p. 144.
[2] Chasles, "Rapport," p. 303.