"These considerations serve to shew our ignorance of the origin of species; nor am I confident that the problem will ever be solved, notwithstanding the prediction of Horace:

~~sine congressu~~

'*Quidquid sub terra est in apricum proferet ætas, Defodiet condetque nitentia.*'

In English:—

'Whatever is underground time will bring to light; It will bury and conceal glittering things.'

"The latter part of the prediction, however, is more likely to be fulfilled than the former.

"Ladies and gentlemen, let me now express my best thanks for your patient attention to this unreasonably long address. I promise that the next address, if I should have to give it, will be much shorter and I hope less wearisome."

Dr. Byett then said that he had very great pleasure in proposing that the best thanks of the Society be accorded to the President for his anniversary address. He was sure that they would all accord this vote of thanks most willingly and most heartily, for he never had the pleasure of listening to such a learned address as the present one. When he saw in the paper that Dr. Gwyn Jeffreys was going to take evolution for his subject, he thought that he would have proved to be a great advocate of that doctrine, because it was a very fashionable doctrine and scientific thought was running that way. But the line the President had followed had quite taken him by surprise, and he was glad to find that as much was said in favour of evolution, there were many learned reasons on the other side.

Mr. J. E. Littleboy briefly seconded the resolution, which was carried unanimously.

The President, in returning thanks, said that there had been and always were different opinions on scientific subjects, and every scientific man ought to appreciate the views of others. There was no one whose views, principles, and thorough honesty he appreciated more than he did those of his friend Mr. Darwin. He had had a great deal of correspondence and friendship with him for the last thirty years.

It was then announced that the next meeting would be on Tuesday, the 24th February, at Hertford, when Mr. Henry Gilbertson would read a paper on "Our Local Interest in Sponges."

"The Formation of Vegetable Mould, through the Action of Worms, with Observations on their Habits. By Charles Darwin, LL.D., F.R.S. London: John Murray."

Western Daily Mercury
Plymouth

THE ACTION OF WORMS.*

Dr. Darwin has again produced a work which will excite the interest of every thoughtful and intelligent person. He has, for half a century, been a persevering student of the habits of worms, and the object of the present volume is to make known the share which worms have taken in the formation of the layer of vegetable mould which covers the whole surface of the land in every moderately humid country. As far back as in the year 1837, Dr. Darwin read a paper before the Geological Society of London "On the Formation of Mould," in which it was shown that small fragments of burnt marl, cinders, &c., which had been thickly strewed over the surface of several meadows, were found, after a few years, lying at the depth of some inches beneath the turf, but still forming a layer. Ever since that period, the action of worms, and the part they play in Nature's operations, have been the subject of careful study by Dr. Darwin. He has pursued his study, not only by the watching of the animals in their places in the garden and the field, but also while kept in a sort of confinement in pots, where their actions could be investigated and carefully noted. While so keeping them, Dr. Darwin says he became interested in them, and wished to learn how far they acted consciously, and how much mental power they displayed. Although they are probably the lowest animals possessing sense-organs, yet there are abundant proofs given throughout the book that they work very much on system, and display intelligence in the manner in which they protect themselves with leaves in their burrows, and in other ways.

The extent to which earthworms are distributed over the humid parts of the globe is marvellous. They abound in England, and their castings may be seen in extraordinary numbers on commons and chalk-downs; but they are shown to be as numerous where the grass grows well, and the soil appears rich. They abound in paved court-yards close to houses, and Dr. Darwin shows how almost universal they are in their occupation of the soil which they do so much themselves to create. They are found in the soil at great elevations,—on some hills near Turin at 3,000 feet above the sea. They are, as most of us know, nocturnal in their habits, and as they lie near the surface of the soil they are subject to the predatory habits of birds, who draw them in the early morning in astonishing numbers from their burrows. Few persons know how complex is the structure of a worm. The body of a large worm consists of from one hundred to two hundred almost cylindrical rings, each furnished with minute bristles. "The muscular system is well developed. Worms can crawl backwards as well as forwards, and by the aid of their affixed tails can retreat with extraordinary rapidity into their burrows." There is a picture of a worm shown in its structure. The mouth is situated at the anterior end of the body, and is provided with a little projection which is used for prehension. The other parts of the body show several distinct purposes of its organism. It has no eyes. The two sexes are united in the same individual, but two individuals pair together. Dr. Darwin describes with much completeness the course that he has adopted to discover their senses as to light and feeling. They do not possess any sense of hearing, but are extremely sensible to vibrations in any solid object. The whole body of a worm is sensible to contact. Their sense of smell, apparently, is confined to the perception of certain odours, and is feeble. Their mental qualities come under consideration, and, indeed, these have had a large share of the author's attention, for we are told that their sexual passion is strong enough to overcome their dread of light, and they have a trace of social feeling, for they are not disturbed by crawling over each other's bodies, and they sometimes lie in contact; in their food they are omnivorous. They swallow an enormous quantity of earth, out of which they extract any digestible matter which it may contain. This subject is most elaborately treated, for the work of the worm—its uses in nature—seems to be mostly in its vast capacity for feeding, for the store that it takes in and digests, and for the castings that it is constantly ejecting from its system. Dr. Darwin shows that the worm secretes a powerful viscid fluid, which operates upon leaves in a remarkable manner, for it quickly kills and discolours them. All these matters have been the subject of continuous observation, and the information that Dr. Darwin gives of the habits, the burrowing, and the feeding of the worm is most interesting, and very curious. He treats of their manner of prehension, the protection of their burrows in order to keep themselves warm, and their intelligence. It is not many persons who, looking casually at a worm, would think that they worked upon system, yet Dr. Darwin shows by minute care, in his observations, that they have the habit of drawing leaves into their burrows to stop them up by the apex end in the great majority of cases. They do it systematically, and where they act otherwise it is contrary to rule, and is done for some special reason that influences them in their action. Their burrows are also objects of care, for upon their proper construction depends their future comfort or life. The distribution of earth worms is shown to extend to all parts of the world, and some engravings of their castings are given as they may be found nearly three feet in height in Calcutta and elsewhere in India.

Having treated of the construction of the worm, Dr. Darwin then proceeds to show the part that the worm plays as the great ploughman, whose labours are always going on. The grass-fields are constantly being covered by the castings of worms, and to this action he believes that antiquaries are indebted not only for ancient coins being covered, but even for the burial of some of the ancient cities that have been discovered, deeply covered, in modern times. How great, how incessant, is their action is shown by a large number of instances, drawn from different parts of the world. Indeed, the felicity of his illustrations, the carefulness of observation, and the deductions from ascertained facts, are the charm of the author's writings. It is marvellous how the burrowing of worms has led to the covering up of houses and even of cities. Great stones have been sunk by the action of worms, and to this cause Dr. Darwin traces the prostration of some of the outer Druidical stones at Stonehenge. Abundant evidence is given, showing that small objects left on the surface of the land where worms abound soon get buried, and large stones sink slowly through the same cause.

Dr. Darwin next proceeds to show what a vast number of worms live, unseen by us, beneath our feet, and the actual weight of earth which they bring up to the surface within a given space and within a given time. Hensen, a German, calculated that there must be 53,767 in an acre of pasture ground, though these be probably less than the number in an acre of ordinary soil. Two chapters are devoted to an account of the action of worms in the denudation of the land, and there is much curious information as to the mode in which they digest the food which they take into their stomachs. In all this there is much that will interest the geologist, whose theories as to the action of animals extending over millions of years will be found to be supported in the theories and calculations of Dr. Darwin.

Before bringing our notice of this valuable contribution to science to a close, we must express our gratification that Dr. Darwin has placed before the world so important an essay upon a subject which has not usually had much popular attention. The careful reader of this work will come to regard the earth-worm with much more respect than he has been accustomed to accord to it, and he will recognise in its labours one of the wonders of Almighty Power in the world's work through the instrumentality of the apparently lowest of the animals. From the summary of the volume dealing with the part which worms have played in the history of the world we will quote a passage, which will be especially interesting to the farmer, showing as it does that worms prepare the soil for the growth of plants:—

"Worms prepare the ground in an excellent manner for the growth of flowering plants and for mosses of all kinds. They particularly expose the soil to the air, and sift it so that no stones remain in it, except those which they can swallow and eject in their castings. By this process, and by the continued deposition of castings, as well as by the remains of animal substances, as well as for the roots of herbaceous plants. The bones of dead animals, the woody fibres of leaves, the shells of land-mollusca, leaves, twigs, &c., are thus soon buried beneath the accumulated castings of worms, and are thus brought in a more or less decayed state within reach of the roots of plants. Worms likewise drag an infinite number of dead leaves and other vegetable matter into their burrows, partly for food and partly for plugging them up; and this matter, when partly decayed, serves as food for many kinds of animals, and likewise for the roots of plants. The leaves which are thus drawn into the burrows are often first partially softened, and then torn to pieces by the muscular gizzard of the worm, and are mingled with much earth. Finally, the whole is thrown out as fine dark-coloured, rich humus, which forms a layer that covers the surface of the land with a fairly uniform mantle. Von Haxthausen placed two pieces of slate on a pasture-field, which was filled with worms, and on which fallen leaves were strewed; and these were soon dragged into their burrows to a depth of 3 inches. After about six weeks an almost uniform layer of fine mould, 1 centimeter (·4 inch) in thickness, was collected on the slates, humus having passed through the alimentary canals of these two worms. It is believed by some persons that worm-burrows, which often penetrate the ground perpendicularly to a depth of five or six feet, sometimes to a depth of 14 in its drainage; notwithstanding that the shell-marl and cinders were pulled over the mouths of the burrows previous to the rain-water directly entering them. Worms likewise allow the air to penetrate deeply into the ground. They also greatly facilitate the downward passage of roots of moderate size; and these will be nourished by the humus with which the burrows are lined. Many seeds owe their germination to having been covered by worm-castings, and others buried to a considerable depth beneath accumulated castings lie dormant, until at some future time they are accidentally uncovered and germinate.

When we behold a wide, turf-covered expanse, we should remember that its smoothness, on which so much of its beauty depends, is mainly due to all the inequalities having been slowly levelled by worms. It is a remarkable reflection that the whole of the superficial mould over any such expanse has passed, and will again pass, every few years through the bodies of worms. The plough is one of the most ancient and most valuable of man's inventions; but long before he existed the land was in fact regularly ploughed, and still continues to be thus ploughed by earth-worms. It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organised creatures.

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