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MR DARWIN'S NEW BOOK.*

Everyone has observed the tiny, curly, worm-like heaps of earth which cover the ground in many parts, and everyone has doubtless a vague idea that they are somehow caused by worms. Few, however, we believe, have any clear notion as to how the worms produce these casts, and fewer still dream of the momentous part played by worms and their casts in modifying the surface of our earth. To shed light on this subject Mr Darwin has written his latest book—a book which is really the result of something like half-a-century's investigation. "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 is the subject of the present volume." The subject certainly seems at first a most unpromising one. Worms have hitherto been regarded almost universally as mere cumberers of the ground, as loathsome pests, whose sole use is to bait a hook. A study of Mr Darwin's book will change all this, and lead the reader to doubt with the author "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." What, then, is the wonderful work they do? If a paved or stony path is left for any time untended, not only does it get overgrown with grass, but it seems actually to sink in the ground. Every farmer knows that if lime or manure is spread over the ground, or if stones are placed on the surface and left undisturbed, in course of time they disappear below the surface. This the farmer attributes to a natural tendency of things to sink. Even large stones, like those that have fallen at Stonehenge, sink in process of years more or less underneath the earth; and entire ruined buildings, and even towns like the old Roman towns of Silchester and Uriconium, have in the lapse of centuries become buried under several feet of earth. This, no doubt, is partly due to wind-driven dust, and to earth washed down the slope of the ground by rain, but mainly, as Mr Darwin shows in his interesting book, to the unceasing excavation of myriads of worms. These humble creatures are constantly busied in boring their burrows. They eat their way under the ground, casting up the earth above-ground, and this accounts for the many worm-like casts seen on all undisturbed places where any earth is to be found. When nothing else, moreover, is to be had, the worms feed on the earth itself, extracting what nourishment they can therefrom, and throw the refuse out on the surface. The whole earth beneath our feet, from a depth varying from an inch or two to four and even more feet, is riddled with their holes. It is calculated, on a very low average, that there are something like 30,000 worms in every acre of land. These are continually boring their holes and throwing up the earth, with the general result, it is calculated, of adding to the surface earth brought from beneath and passed through their bodies equal all over to one-fifth of an inch annually, and weighing several tons to the acre. So that, in the course of five years, a fresh layer of earth, one inch in depth, is spread over the surface wherever worms can find shelter, and that is nearly everywhere where there is sufficient moisture. This has been going on for untold ages. Mr Darwin's book almost entirely consists of instance upon instance of the work thus performed by worms in all parts of the world. Experiments he has been making for many years in his own house and grounds, friends have made experiments and observations in various localities for him, and he has sought and obtained information from all quarters. Other investigators besides himself have been working at the subject in recent years, and the result is a mass of evidence that is irresistible. Certainly some of the examples he adduces of the stupendous results achieved by these tiny creatures, such as the entombment of ruined buildings and cities, seem at first incredible enough, but he so surrounds us with evidence that we are shut up to only one conclusion. "When we behold a wide, turf-covered expanse, we should remember that its smoothness, in which so much of its beauty depends, is mainly due to all the inequalities having been slowly levelled by worms. It is a marvellous 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." We have said that Mr Darwin's work is the result of 50 years' investigations. To show how cautiously and patiently he goes to

work, we may mention that something like 40 years ago he had a field of his own covered over with chalk for the purpose of observing the result; he waited about 20 years for this, and when the ground was treached the chalk was found in a uniform layer many inches below the surface, with abounding evidence that the result was the work of the worms. Well may he call these hitherto despised and rejected creatures nature's ploughmen. Probably more than any other natural agency have they been the means of fertilising the earth. Not only, as we have seen, do they completely renew the soil in the course of a few years, and fertilise it by passing it through their bodies, but they drag down from the surface tons of leaves, and refuse of all kinds, partly to be used as food and partly to line their burrows with. For these they construct with great care and ingenuity, lining them sometimes with finely triturated soft and smooth earth, and sometimes even with a mosaic of fragments of leaves; all serving as a natural manure. Even the very soil itself, which should be called animal, rather than vegetable mould, often owes its existence to their persevering labours. Mr Darwin shows that they have the power of penetrating and triturating rocks of wonderful hardness; and this process continued for thousands of years must have produced results of stupendous magnitude. Some people, however, seem incapable of forming a conception of how such apparently inadequate causes can produce such results, looking as they do only at the present and the individual. "Here," Mr Darwin remarks, "we have an instance of that inability to sum up the effects of a continually recurrent cause which has often retarded the progress of science, as formerly in the case of geology, and more recently in that of the principle of evolution." And speaking of geology, he shows that worms must have played no inconsiderable part in the process of denudation that is continually going on all over the surface. Their action on the ground and even on rocks, in loosening the surface and throwing up casts, places it in a condition favourable to be acted on by wind and rain, and thus they become an important agent in geology. And so he piles instance on instance to prove that these lowly creatures, without sight or hearing, and with the simplest and apparently feeblest organisation—these slimy creeping things, that are looked upon as the type of all that is grovelling and despicable and useless, are after all the benefactors of humanity. Mr Darwin has already done more than any single man to enable us to see nature in a true light; he has introduced into science a principle of unsurpassed fertility; he has altered the whole course and tendency of modern thought; but we venture to think that his marvellous genius for observation has achieved no greater triumph than in the work embodied in his latest book. Not only has he elevated the lowliest of creeping things to a lofty place in the economy of nature, but he shows that even they work with some degree of intelligence, and know how to adapt means to ends. The book is one which any child may read with interest, and provides matter for serious thought to all, scientific and unscientific. Like all Mr Darwin's books, it marks a new departure in science.

* The Formation of Vegetable Mould through the Action of Worms, with Observations on their Habits, By Charles Darwin, LL.D., F.R.S. With illustrations. London: John Murray. 1881.