

allowing life to go on much as usual in other parts of the globe, there is no reason why the drift should not have taken place in Mesozoic and Kainozoic times; but, according to Jeffreys, the want of fluidity in the upper zones of the earth would then have rendered the separation impossible. Another objection to such an hypothesis is that there have been, during Palæozoic times and the long ages of the pre-Cambrian era, repeated occurrences on a large scale of mountain-building, folding, thrust- and slip-faults, and igneous intrusions and extrusions; so that there must have been repeated previous transformations similar to those that we can trace with greater distinctness in the immediate past. We cannot explain each of these by the birth of a satellite, for there is only one now existing.

There seems, however, to be a simpler hypothesis, which I will briefly indicate. The earth, as we know, contains a dense core surrounded by lighter material, the upper portion of which constitutes the sima. The sial is of course of comparatively insignificant thickness. It has been contended¹⁸ that in the early history of the earth, when the resistance to compression and the rigidity were less, the heavy core was, on account of the earth's rotation, in a state of unstable equilibrium, and that, as a result, its centre of gravity probably does not now exactly coincide with that of the earth as a whole. Consequently, at that point on the equator to which the core is nearest gravitation is at a maximum. As, however, the attraction of the moon and sun results in friction which tends to retard the rotation of the earth's higher layers more than the interior, the former must have a slow movement relatively to the latter. We have seen that there is reason to suppose that in Palæozoic times the continental masses of sial were more or less con-

¹⁸ J. H. Jeans, *Phil. Trans. Roy. Soc., ser. A, vol. 201 (1903), p. 157*; W. J. Sollas, *Q.J.G.S., vol. 59 (1903), p. 180*; A. E. H. Love, *Phil. Trans. Roy. Soc., ser. A, vol. 207 (1908), p. 171*; and *NATURE, vol. 76 (1907), p. 327*.

centrated round what is now Africa, forming the "Ur-Kontinent" of Wegener. This may well have been due to the fact that the maximum of gravity was then situated in that part of the earth. If then, during Mesozoic times, the movement of the higher layers of the earth had brought the centre of the Pacific into the position of maximum gravitation, the former great Palæozoic continent would tend to break up and drift apart towards the Pacific, and this is what appears to have actually happened. Similar changes may have occurred more than once in the earth's history since the remote time when the sial was spread over the whole globe.

It has been urged that the forces developed by the tidal action of the sun and moon, although large enough to cause a slow movement of the earth's crust as a whole, would not suffice to drive masses of sial through the sima, especially in the presence of the much larger compressive forces developed in the crust by the contraction of the earth's interior; still less to ruck up the earth's crust to form mountains tens of thousands of feet in height. It seems probable that this objection could also be urged against the adequacy for the same purposes of the forces developed by the variation of gravity from point to point on the globe, or against any combination of these two hypotheses.

To deal fully with this difficulty would involve the consideration of the principles of crustal compression and mountain-building, which I hope to discuss on another occasion. It will, I think, be at present sufficient to remark that, according to my view, it is precisely by the forces of compression that the crust has been folded and overthrust and the great mountain-chains raised up, but that the immediate result is the exhaustion, for the time being, of these forces and the simultaneous local destruction of the powers of resistance of the earth's crust, and that it is then and then only that the forces tending to cause the drifting of continental masses become free to act.

Obituary.

DR. F. E. BEDDARD, F.R.S.

ZOOLOGY has lost a distinguished and devoted servant in the death of Frank Evers Beddard, which occurred at his home at Hampstead on July 14. He will be remembered best, perhaps, as the prosector of the Zoological Society: a post which he held for more than thirty years. He succeeded to great traditions, and worthily upheld them during his long term of office. Those who were privileged to listen to his discourses, at the scientific meetings of the Society, will ever remember his extraordinary facility of expression and the clear and rapid way in which he laid abstruse points before his audience. Few, probably, who were listening had ever made the dissections he was describing, yet so admirable was his presentation of the facts he had gleaned, that they could not fail to grasp the essential points laid before them. He had no rival in this regard.

Beddard's work on vertebrate anatomy covered a wide field, and though it may have been marked by no epoch-making discoveries, it maintained a high level of excellence. He has left, in the pages of the Proceedings

of the Zoological Society, a rich storehouse of information for future investigators. His contributions to science, in the form of original work, were, however, by no means confined to the vertebrates. He wrote a memoir on the Isopod Crustacea collected by the *Challenger* Expedition; and a fine monograph on the Oligochaeta, issued by the Clarendon Press. This was, perhaps, his favourite group, and embraces some of his best work.

In his books Beddard did himself less than justice. His volume on whales, for example, was good, but he could have given us a much better book. The same may be said of his volume on the classification of birds, and that on the coloration of animals. In these he seems to have shirked the labour of coming to a decision on the very vexed and controversial points which these two themes presented. He nowhere commits himself to a definite opinion as to whether he does or does not agree with the conclusions arrived at by others, whose views he sets forth without comment. His pages are almost too dispassionate to be helpful.

Beddard was elected a fellow of the Royal Society in 1892, and was the recipient of the Gold Medal of the

Linnean Society. For some years he was lecturer on biology at Guy's Hospital, and he also acted in the capacity of examiner in morphology at Oxford, and in zoology and comparative anatomy in the University of London. Finally, he was a man of great personal charm, who was always willing to put his wide knowledge and experience as a zoologist at the service of others.

W. P. P.

WHILE many can speak of Dr. F. E. Beddard's zoological work in general, there must be few who knew his special work on the Oligochæta so well as myself. For upwards of a quarter of a century we were in constant correspondence, exchanging papers, specimens or notes. It is forty years since he began to publish on the subject of annelids. Alongside of his professional work he had already spent at least ten years on the oligochæts before his *magnum opus* was issued by the Clarendon Press ("A Monograph of the Order Oligochæta," 1895). In the bibliography appended to this work no fewer than eighty-five items are recorded as his own, while Benham and Friend are each credited with twenty. Beddard did not profess to pay special attention to the British annelids, and very few of the species described in his monograph have indications that they may be found in Great Britain. His own material came from every part of the globe, but the tropical worms were perhaps those he knew best. What he did for Asia in particular largely paved the way for the splendid work which Stephenson has done and is still doing. When I took up the work in 1890, Beddard, together with Dr. Benham, gave me every possible help; and as my work on British annelids, and particularly that on the Enchytræids, grew, he regarded that department as mine, and left me an open field. He was ever ready to recognise the work of others, and never looked askance at one who worked as an amateur in the provinces with all the odds against him.

In 1912 Beddard issued a little volume on "Earthworms and their Allies," but his output was so enormous that he had no time for cultivating a fine literary style. If he has left behind little, however, that would make worms popular with the general public, his monographs and memoirs will always remain as a tribute to his industry, and as a mine of wealth for the specialist. He will long be remembered as England's foremost authority on the Oligochæta.

HILDERIC FRIEND.

DR. S. T. DARLING.

AN eloquent appreciation, from the pen of Prof. R. W. Hegner, of the life and work of Dr. Samuel Taylor Darling, of the League of Nations Malaria Commission, appears in a recent issue of *Science*. Dr. Darling, it will be remembered, was killed, with two other members of the Commission, on May 20 in a motor-car accident near Beirut in Syria. He is described by Prof. Hegner as "one of the foremost American students of tropical medicine, especially in the field of medical zoology."

Dr. Darling was born in 1872 and chose medicine as his career. In 1903 he went to the Ancon Hospital in the Panama Canal Zone and three years later he was appointed chief of the laboratories of the Isthmian Canal Commission, a post which he held until 1915.

During this time he took up the study of parasitic organisms causing diseases in man and animals and of malaria, and published some noteworthy papers on histoplasmosis, sarcosporidia, the malarial organism and its mosquito vectors, trypanosomiasis in horses, leishmaniasis, endamecæ, and similar subjects. In 1913-1914, Dr. Darling accompanied General Gorgas on a sanitary mission to the Rand mines and Rhodesia and in 1915 he joined the staff of the International Health Board of the Rockefeller Foundation. As head of a medical mission of the Board he spent two years studying the causes of anæmia among the peoples of Malaya, Java, and Fiji. Some of the results of this mission appeared in a report, of which Dr. Darling was part author, on "Hookworm and Malaria Research in Malaya, Java, and the Fiji Islands." He was then sent to Sao Paulo, Brazil, where he established a laboratory for teaching and investigation on these subjects, and in 1922, when the International Health Board decided to found a field laboratory for the study of malaria at Leesburg, Georgia, Dr. Darling was chosen as the first director. Here, according to Prof. Hegner, he did some of his best work as an investigator and as a teacher, training men who were afterwards sent out on malaria control campaigns.

Dr. Darling was an honorary fellow of the Royal Society of Tropical Medicine and Hygiene, president in 1924-25 of the American Society of Tropical Medicine, a member of many other American and foreign learned societies, and of the National Malaria Committee. His widow has presented his library to the Department of Medical Zoology of the School of Hygiene and Public Health, Johns Hopkins University, Baltimore, and it will be known as the Samuel Taylor Darling Library.

WE regret to announce the following deaths:

Dr. Charles W. Burrows, formerly head of the magnetic section of the U.S. Bureau of Standard, who was distinguished for his work on magnetic testing and on the magnetic properties of alloys of iron, on May 2, aged fifty years.

Dr. David T. Day, for twenty years head of the department of mining and mineral resources of the U.S. Geological Survey, who made a special study of the constitution of petroleum and its derivatives, on April 16, aged sixty-five years.

Prof. Louis Gentil, professor of physical geography at the Sorbonne, Paris, and member of the Paris Academy of Sciences, distinguished for his exploration work in Morocco and other parts of northern Africa, on June 12, aged fifty-six years.

Dr. J. Guilmarmood, a distinguished Swiss geographer and explorer and the author of several works on the Himalaya, on June 6, aged fifty-seven years.

Dr. I. Minis Hays, secretary general of the International Medical Congress held at Philadelphia in 1876, and secretary since 1897 of the American Philosophical Society, on June 6, aged seventy-seven years.

Prof. F. R. Japp, F.R.S., emeritus professor of chemistry in the University of Aberdeen, on August 1, aged seventy-seven years.

Dr. E. J. McWeeney, professor of pathology and bacteriology in University College, Dublin (National University of Ireland), and bacteriologist to the Local Government Board, on June 20, aged sixty-one years.