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OF THE EARTH

BY
J. W. GREGORY

F.R.S., D.Sc.

PROFESSOR OF GEOLOGY AT THE UNIVERSITY
OF GLASGOW; AUTHOR OF "THE GREAT RIFT
VALLEY," "THE DEAD HEART OF AUSTRALIA,"
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Most of the literature dealing with the subjects considered in this book is technical and is scattered through various scientific serials.

The astronomical evidence as to the early history of the earth is popularly summarised in Sir Robert S. Ball's *The Earth's Beginning*, London, 1901, 384 pp. The theory of the meteoritic composition of the nebula was founded in Sir J. Norman Lockyer's *The Meteoritic Hypothesis*, London, 1890, 560 pp. The planetesimal theory was advanced in a series of memoirs by Profs. C. Chamberlin and Moulton, but has been most completely stated by the former in his joint work with Prof. R. D. Salisbury, *Geology—Earth History*, vol. ii, London, 1906, pp. 1-132.

A general summary of astronomical information regarding nebulae is given in the late Miss A. M. Clerke's *System of the Stars*, Second Edition, 1905, 403 pp.

Some of the interesting problems connected with the planetesimal theory have been discussed by Prof. E. H. L. Schwarz in his *Causal Geology*, London, 1910, 248 pp.

The problems connected with the formation of the primary rocks of the earth's crust are discussed in Dr. A. Harker's *The Natural History of Igneous Rocks*, London, 1909.

The tetrahedral theory of the earth was founded in W. L. Green's *Vestiges of the Molten Globe*, Part I, London, 1875, 59 pp.; Part II, Honolulu, 1887, 337 pp. This theory has been adopted with various modifications and developments by many geologists. Thus among French geologists it has been adopted and used by the late Prof. A. de Lapparent in his *Traité de Géologie*, Fourth Edition, vol. iii, 1900, pp. 1849-1853, and also in a paper "Sur la symétrie tétraédrique du globe terrestre," *Compt. Rend. Acad. Sci. Paris*, 1900, vol. 130, pp. 614-619; also by M. Bertrand in his memoir "Déformation tétraédrique de la terre et déplacement du pôle," *Compt. Rend. Acad. Sci. Paris*, vol. 130, 1900, pp. 449-464; and by A.

Michel-Lévy, "*Sur la Coordination et la Répartition des Fractures et des Effondrements de l'Écorce Terrestre en Relation avec les Épanchements Volcaniques*," Bull. Soc. Géol. France, Sér. 3, vol. xxvi, 1898, pp. 105-121. In Italy it has been adopted by Prof. F. Sacco of Turin in his *Essai sur l'Orogénie de la Terre*, 1895, and *Les lois fondamentales de l'Orogénie de la Terre*, Turin, 1906. Dr. B. K. Emerson advocated the theory in his Presidential Address to the American Geological Society—"The Tetrahedral Earth and Zone of the Intercontinental Seas," Bull. Geol. Soc. Amer., vol. xi, 1900, pp. 61-96. A statement of its main problems was given by the author in a paper to the Royal Geographical Society—"The Plan of the Earth and its Causes," *Geog. Journ.*, vol. xiii, 1899, pp. 225-251.

In recent years the most important contribution to the literature of the theory is in the work of Dr. T. Arldt, *Die Entwicklung der Kontinente und ihrer Lebewelt*, Leipzig, 1907, 729 pp., 23 maps, in which he discusses it in reference to the evolution of continents and the former distribution of life over the globe.

The distribution of land and water on the globe as due to a regularly arranged series of elevation and depressions was advocated by Prof. C. Lapworth in his Presidential Address to the Geological Section of the British Association in 1892, and in a lecture to the Royal Geographical Society published as a pamphlet, *The Face of the Earth*, Birmingham, 1894, 14 pp. This paper described only the results and not the causes. A mathematical explanation of the deformation of the crust of the earth has been advanced by Prof. A. E. H. Love. The theory is based on spherical harmonics, and shows how the arrangement of land and water can be explained by deformations of the earth causing alternate uplifts and depressions. According to Prof. Love the earth has an harmonic distribution of elevation and depression due to three causes—

- 1st, the centre of gravity being eccentric in position ;
- 2nd, the shape not being a sphere, but an ellipsoid with three unequal axes, like an egg flattened on two sides ;
- 3rd, different areas having different densities, the denser parts tend to fly outward in consequence of the rotation, and thus the surface becomes furrowed by the alternation of areas of elevation and depression.

Prof. Love shows that on such a body the arrangement of the continental elevations and oceanic depressions would

approximately correspond to those which exist upon the earth. He has clearly explained the theory in his Presidential Address to the Physical Section of the British Association at Leicester in 1907. The results correspond largely with those of the tetrahedral theory, which, however, offers a simpler, and perhaps more probable, explanation of the distribution of the elevations and depressions. His full memoir, entitled "The Gravitational Stability of the Earth," is published in the *Philosophical Transactions of the Royal Society*, vol. 207, 1908, pp. 171-241.

The theory that the distribution of land and water has always been essentially as at present has been well defended in Dr. A. Russel Wallace's *Island Life*, London, 1880, 526 pp.

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The author explained the absence of pre-Cambrian fossils as probably due to the absence of available lime, in an address to the British Association at Leicester (*Brit. Assoc. Rep.*, 1907, p. 492). Dr. R. A. Daly's paper, "The Limeless Ocean of Pre-Cambrian Time" (*Amer. Journ. Sci.*, 4th Series, vol. xxiii, 1907, pp. 93-115 and 393), was published earlier the same year.

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