Lucretius or Kapteyn?

NONNE vides etiam diversis nubila ventis diversas ire in partis inferna supernis? Qui minus illa queant per magnos ætheris orbis æstibus inter se diversis sidera ferri? *De Rerum Naturâ*, v., 646–9.

See you not too that clouds from contrary winds pass in contrary directions, the upper in a way contrary to the lower? Why may not yon stars just as well be borne on through their great orbits in ether by currents contrary one to the other?

Munro's Translation.

E. J. M.

Semi-absolute.

THE biologist, even the most mathematical, envies and admires the greater precision of statement and language that is possible for the physicist, and the physicist in his turn is apt to plume himself on the fact that his sciences, as compared with those of the biologist, are the exact sciences. Some biologists interested in precision of terminology have been wondering what the physicist may mean by the term "semi-absolute"—a term which will be found applied to volts in the title of a paper recently read before the Royal Society (NATURE, December 25, 1913, p. 495, column 1). On the face of it, semi-absoluteness is no more easy to conceive than is semi-infinity, and one is therefore tempted to regard the phrase akin to the "quite all right" of the modern young lady, the "quite a few" of the American, and other such degeneracies of modern speech. That view must, of course, be wrong, but an explanation would be comforting to more than one ENQUIRER.

THE MAKING OF MOUNTAINS.[1]

THE object of the very attractive volume before us, as stated by its author, is to supply geographers with such a knowledge of geological processes as is necessary for understanding the origin of the orographic features of the earth's surface. With this purpose in view, technical details are—so far as is possible—avoided, while disputed and doubtful topics are, as a rule, kept in the background; while by vivid and picturesque descriptions, aided by admirable photographic illustrations and diagrams, the reader is made acquainted with the chief types of mountain forms and the agencies by which they have been produced.

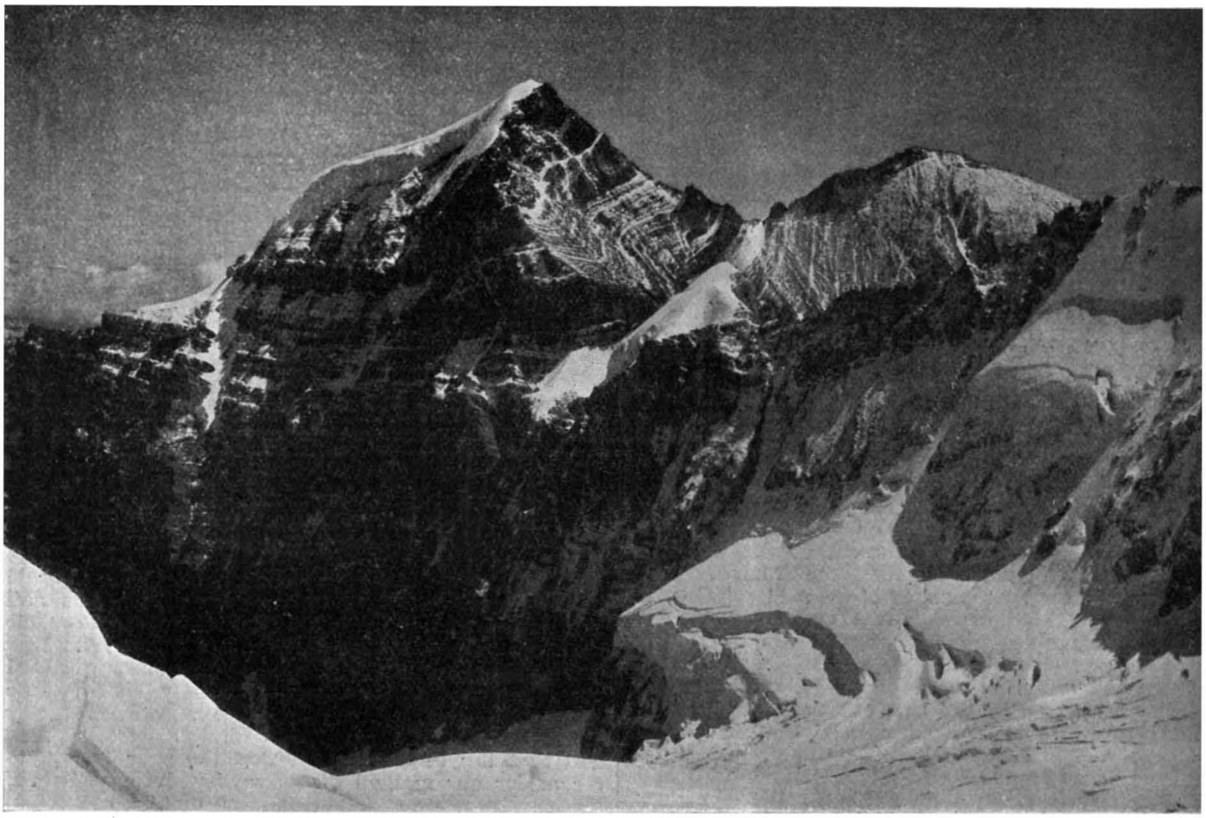

Photo.] [*Wehrli, Zürich.*

FIG. 1.—The Bifertenstock and Frisal, seen from the Firn plateau of the Tödi. Eocene and Mesozoic strata resting upon Gneiss. From "Mountains: their Origin, Growth, and Decay."

The great majority of the elevations of the land are classed as "original or tectonic," the building-up of these structures being due to many diverse agencies; only a small residue of the relief-forms are grouped as "subsequent or relict" mountains, being the result of operations that, by removing the surrounding materials, have left great upstanding masses behind.

First among the tectonic mountains are included those of volcanic origin, grouped by the author as "débris cones," which are made up of fragmental materials, usually of igneous origin but often accompanied by detritus from aqueous

[1] "Mountains: their Origin, Growth, and Decay." By Prof. James Geikie, F.R.S. Pp. xix+311+lxxx plates. (Edinburgh: Oliver and Boyd, London: Gurney and Jackson, 1913.) Price 12s. 6d. net.

and metamorphic rocks; in the second place, we have "lava-cones" built up entirely by outwelling streams of liquid rock from a fissure; and, thirdly, "composite cones" built up by alternating ejections of fragmental materials and lavas. The varied slopes of cones, as determined by the nature of the fragmental materials or the degree of liquidity of the lavas, are well explained and illustrated. The very graceful forms assumed by some volcanoes—which is so conspicuously illustrated by the representation of the famous Japanese mountain Fujiyama—are explained by the author as being due to the larger ejected fragments accumulating nearest to the crater, but it may be in part also due to central subsidence. Such subsidence is admitted by the author to have from the ocean-floor to a height of 30,000 ft., while, so gentle are their slopes, they have diameters of more than 80 miles. At the other end of the scale, and as a supplement to the catalogue of volcanic mountains, geyser-cones and mud-volcanoes ("air volcanoes" of the author) are noticed.

In contrast to the elevations produced by the heaping up of materials brought from below the earth's surface we have "epigene types," formed by superficial detritus piled up either by glacial or æölian agencies. To the former class belong moraines of all kinds—sometimes forming hills more than 800 ft. in height—with the less conspicuous but more extended terrestrial features known as drumlins and eskers. As the result of

Photo.] [*Detroit Pub. Co.*

FIG. 2.—Mount Rainier (or Tacoma), Washington, U.S.A. An extinct composite volcano—snow capped and supporting glaciers. From "Mountains: their Origin, Growth, and Decay."

taken place in the formation of some volcanic craters like that of the celebrated "Crater-lake" of Oregon. The results of denudation on volcanic cones is well illustrated. In describing the manner in which younger volcanic cones rise within old craters, the author unfortunately speaks of "cone-in-cone" structure, a term which has already been appropriated by geologists for a totally different phenomenon. As illustrating the vastness of the agencies by which volcanic mountains are built up, the author justly points out that the great cones of the Hawaiian Islands must be regarded as the grandest orographic feature on the globe, seeing that these cones rise wind-action, we have the sand dunes of sea-coasts and the far more extensive structures of the same kind characteristic of deserts.

In passing from the comparatively simple "mountains of accumulation" to the opposite class, to which he gives the name of "deformation mountains," our author approaches, as he himself admits, the most difficult part of his task. He commences by giving an outline of the history of the development of our knowledge of the subject, in which he justly lays stress on the important effect of Lyell's protest against the orographic theories of de Beaumont; and he goes on to indicate the value of the subsequent work of the brothers Rogers in the Appalachian mountains of the United States. The great majority of the "deformation mountains" are shown to be undoubtedly "folded mountains," and, as may be expected in a work of this kind, the important light thrown upon mountain-origin by the study of the Scottish Highlands, as a mountain chain dissected by denudation, is admirably explained, though we miss any reference to the value of the labours of Nicol and Lapworth in this connection. The varieties of folding and the relations between folding and "thrusts" find full illustration; and the theoretical views of Heim, Steinmann, Suess, and other continental authors on the nature, extent, and results of the great complexities exhibited in the Alps, with their possible causes, are fairly stated though not fully discussed. The influence of jointing and weathering in producing the various types of alpine scenery rightly occupies a very important place in the work.

A second class of "dislocation mountains" includes curious types recognised in recent years by the geologists of the United States, with the "horsts" of German geologists. In all of these, extensive faulting—like that by which the mountains of Moab are left in relief by the great Dead-Sea fault—has been the chief agency concerned in their formation.

The mountains carved by denudation out of great igneous masses (the so-called "laccolites" and "batholites") constitute the author's third class of "deformation mountains," and are illustrated by the Henry mountains of North America and the Red Hills and Coolin Hills of Skye. It is here that we detect a little want of consistency in the classification adopted by the author. In describing his volcanic mountains he rightly refers not only to the denuded remains of small cones—commonly called "necks"—but to masses of lava, like the North Berwick Law, or of lava and tuffs like Largo Law, which are so conspicuous in the Scottish Lowlands as forming the denuded cones of great volcanoes. But the similar masses in Skye and the other islands of the Inner Hebrides do not differ from these in anything but their greater dimensions, and it seems scarcely justifiable to place them in a totally different class.

The final chapter of the book is devoted to the examples which the older geologists styled "mountains of circumdenudation," but which the author designates "subsequent or relict" mountains, of which we have such striking British examples in the great stacks of Torridon sandstone in western Sutherland and Ross.

Not less instructive than the text of this excellent work is the selection of eighty photographic plates which illustrate it. One-half of these is taken from the admirable series prepared by the Geological Survey of Scotland, and they show how rich our country is of examples of mountain structure; the other half consists of pictures supplied by photographers of Switzerland and the United States.

J. W. J.

ZONAL STRUCTURE IN PLANTS AND ANIMALS.[1]

WHEN a drop of strong silver nitrate is placed on a thin layer of 5–10 per cent. gelatine containing about 0·1 per cent. of potassium bichromate, remarkable phenomena are observed. The gelatine under the drop is coloured red-brown by the abundant precipitation of silver chromate. The nitrate spreads gradually by diffusion into the gelatine, the rusty brown area of precipitation enlarges, it forms at its periphery a dull whitish seam, and further outwards in the gelatine a system of numerous concentric rings is developed, spreading like rings on the surface of a quiet pool. These are the well-known Liesegang's rings or zones, and the central idea of Prof. Küster's investigation is that these throw light on zoned structure in cells and tissues. He has made numerous experiments with the diffusion zones formed in colloidal media *in vitro*, and he seeks to utilise the phenomena observed in the interpretation of organic structures—such as cross-striping in leaves, annular and other markings in cells and vessels, the layers in starch-grains, the markings on diatoms, the lines on butterflies' wings, on shells, on feathers, on porcupines' quills, and what not.

Ostwald's explanation of Liesegang's rings is not unanimously accepted, but no one doubts that the phenomenon will be cleared up in terms of laws of diffusion, concentration, precipitation, and the like. Prof. Küster does not go into that; his object is to make zoned structure in organisms more intelligible by bringing it into line with Liesegang's rings. He is aware of the risks of arguing from the conditions of inorganic processes to those of organic processes, of mistaking similarity for sameness—and he quotes the wise advice that Roux has given in connection with this kind of argument.

Prof. Küster admits that his suggestion is only at the stage of hypothesis, for we do not know much about the active substances the diffusion of which in cells may induce zoned structure. We cannot isolate them and experiment with them. On the other hand, Prof. Küster points out that organisms are largely built up of colloid material, and that his experiments *in vitro* were with colloidal material, that artificially induced modifications of Liesegang's rings find their parallel in organic structure, and that the zoned structure occurs in the most diverse kinds of plants. His experiments show that "rhythmic structure may arise without any rhythmic influence from the outer world, and that even simple diffusion processes can give rise to rhythmic structures." Is it not probable that analogous occurrences take place in the formation of zoned organic structure? It may be said that in living creatures the rhythms are characteristically dynamic, but our author replies to this by referring to Bredig's "pulsating

[1] "Ueber Zonenbildung in kolloidalen Medien." By Prof. Ernst Küster Pp. 111+53 figs. (Jena: Gustav Fischer, 1913.) Price 4 marks.