Now, Bütschli's famous vesicular theory of protoplasm argues for a physico-chemical interpretation of protoplasmic activities. Believing that he had discovered a fundamental vesicular structure, Bütschli held that amœboid movements, the phenomena of cell division, and even contractility, may be interpreted as results of osmotic interchanges, surface tensions and extension currents amongst the lifeless lamellæ of this structure. He admits, however, "I find myself unable * * to apply the same physical explanation to the finer formations, such as the free filose formations * *." Further, that "the morphological method, so fruitful in research amongst multicellular organisms, fails in our research into the essential nature of the elementary organism—the cell."

Compare the following from 'The Living Substance.'

(1) "The vital phenomena of protoplasm were seen to be not so much manifestations of the vesicular form of the substance, as upon, or through, this," p. 67. (2) "The co-existence of a stable and perfect structure of Bütschli, with a host of metamorphosing activities of the substance as such; this forms one of the strongest reasons I would urge for preferring optical research upon the living material," p. 68. (3) "It is the free filose formations, not amœboid flow, which I find to be most universal, most characteristic and most fundamental in the living substance," p. 78. (4) "It is then, not that compound of cells whose multiplication we have watched with such breathless interest that is the true organism, but the continuous substance, by whose local deposits of specific materials these cells and their nuclear machinery are built up * * * . And within the organism's limits, the protoplastic substance as such retains, one must now believe, all those protoplastic powers which are seen in free Heliozoa—all those tactile and selective and sensitively irritable, and contractile, functions that protoplasm exhibits when placed externally to cells, areas, or masses. On this protoplastic substance the race habit depends, and in it are rooted all other habits of organisms," p. 170. (5) "Organs no longer appear as compounds of certain different sorts of cells, but as a complex of minute substance organs," p. 151. (6) "The organism as we have known it, is secondary, incidental to the life-history of the protoplastic, continuous substance of the living being; is result, rather than cause, of substance habit," p. 171. (7) "We are not denied an ultimate return to purely physical interpretations * * * but we are bidden for the time to a physiological standpoint as more immediately fruitful," p. 119. Under Areal Differentiation, Striation and Activities, hundreds of radically new facts prove that any present application of physico-chemical explanations, by means of vesicular structure, to either contractility or cell division is not possible.

The rest of F. A. D's article bears out the beginning, is a crescendo of similar blunders and guesses—personal in tone, hysteric in timbre, and unsupported by a single quotation; but in view of the cardinal absurdity of wholly ignoring the text of the book 'criticised,' one's sense of humor vetoes further analysis.

G. F. ANDREWS.

SCIENTIFIC LITERATURE.

La face de la terre (Das Anlitz der Erde). EDOUARD SUESS. Translated from the German with the approval of the author and annotated under the direction of EMM. DE MARGERIE, with a preface by PROFESSOR MARCEL BERTRAND. Paris, Armand Colin et Cie. 1897. Vol. I. Pp. 835. With two maps in colors and 122 figures.

The first part of *Das Anlitz der Erde* appeared in 1895. The author set himself the task of marshalling the movements of the earth's crust into a system. The work gives the result of his studies of mountain systems and of the adjacent plateaus and plains. From its scope and the radical views of the author, the treatise takes a place in geological literature with the famous Notices sur les systems des montagnes of De Beaumont, published in 1852.

De Beaumont gave us, perhaps, the first clear statement of the contraction hypothesis in its relation to mountain building. In his treatise on mountains he sought to establish the principle that mountain chains of the same age are parallel to the same great circle. In attempting to defend his thesis, De Beaumont made

use of his own personal knowledge and when that gave out resorted to the bibliographic method of research. Suess had no small share in the recognition of the wonderful overthrust phenomena of the Alps. He thus came into possession of knowledge of earth movements which were still unperceived, except by a few individuals, in the time when De Beaumont wrote of the 'pentagonal network.' Following up his own investigations in the field about the eastern Mediterranean with a study of the literature, Suess worked out a system of movements in the earth's crust, which is, to say the least, possessed of the merit of novelty.

Suess has arranged his facts and the interpretations which he has placed upon them in a classification of crustal movements. He recognizes one group of movements which result from tangential pressure. In this category he places the overthrusts, or essentially horizontal movements on horizontal surfaces, and 'decrochements,' or horizontal displacements along vertical planes. These movements he finds taking place in regions of folded rocks, such as the great mountain chains of Europe and Asia.

Suess makes a second group of dislocations, including effects due, as he thinks, solely to gravity. He states that everything in this group of dislocations behaves as if the parts of the earth's crust affected by them "fell under the influence of their own weight into large open cavities below, or as if the surface of the globe sank into a soft base yielding under pressure." It is in respect to this view that the conception of crustal deformation entertained by Suess is in most striking contrast to the generally received interpretation of faults coming in his second group. Where several fault blocks divide, for instance, a table-land, into masses standing at different levels with reference to each other, Suess postulates an invariable downward movement for the blocks which stand relatively low. He does not suppose that uplift has taken place in the case of the blocks which stand relatively high. To account for this falling-in of the crust, Suess postulates a radial force as one of the components of the force of contraction.

The present volume consists of a number of essays in which, in one way or another, the effects of these several dislocations of the crust are shown and traced with great detail. The opening chapter is a most entertaining discussion of the Deluge, a subject which geologists have, perhaps wisely, neglected since the time of that masterful romancer, Burnet, and his school. The story of the Deluge is told in the light of the Chaldean account of Genesis. An abstract of this chapter has already been presented to the readers of Science by Professor Emerson (see Vol. IV., 1896. pp. 335–344). Suffice it to state here that Suess finds an explanation of the disaster in the valley of the Euphrates in the conjunction of an earthquake and a cyclone. Many circumstances, as, for instance, the boat of Xithrusos being carried inland instead of out to sea, go to show, he thinks, the effects of a great marine invasion. He concludes that the "traditions of other people do not authorize us in any manner to suppose that the Deluge passed the limits of the lower basin of the Euphrates and of the Tigris, and still less to state that it extended over the whole earth." The legend appears to have been introduced by our author to show that some of the dislocations and falling-in of fault blocks in that part of Eurasia took place within the memory of man.

The chapter on earthquakes is an attempt to establish the existence of lines of fracture and earth movement, and incidentally to show that these movements are not of an elevatory kind. Admitting that there are earthquakes which have a local point of origin, there are other earthquakes, he states, which cannot be traced to one small place, but are due to the simultaneous movement of an extended portion of the earth's surface. He selects for discussion four areas in which shocks are held to be of a different character. These may be briefly summarized: 1st. The Alps of the Northeast, without volcanoes. In this region, near Vienna, shocks have been propagated at right angles to the chains of mountains, indicating horizontal movements on cross-fractures ('decrochements' or 'Blatten.') 2d. Southern Italy, with volcanoes, but these without alignment. Here there is a circular line of areas of earthquake shock passing from Calabria into Sicily and having the Lipari Isles at center. It is thought that within the area limited by the

periphery thus marked out the earth's crust sank, for instance in 1783, in the form of a basin, and at the same time there were developed radial cracks converging in the Lipari Isles. Near the center these lines are beset with points of eruption. The perennial and isolated volcanoes, such as Ætna, he thinks, are located on the crossing of these radial fractures with the peripheral line of faulting. 3rd. Central America, where earthquakes are frequent though not well studied, but where the disposition of volcanoes is held to indicate great fractures. These volcanoes may be placed in two groups, or alignments, which join at an obtuse angle in the Bay of Fonseca, between San Salvador and Nicaragua. The shifting of vents here is towards the Pacific Ocean. Suess thinks the fractures have opened downwards and that this region is sinking. 4th. The western coast of South America, made classical by the writings of Darwin. Darwin has been for half a century the authority for the belief that, during the earthquake of 1835, the western coast of South America was elevated at least nine feet. Suess's thesis leads him to attack Darwin's conclusions. Our author quotes contemporaneous records, known to Darwin but set aside in his time, to show that no elevation took place. Much of the testimony is of a purely negative character. Modern observers are cited to show no existing evidence of the supposed change of level, and Lyell's admission that the coast appears to have subsided to near its former level is used to make it appear doubtful if there was any uplift whatever. It is suggested that the throwing up of jetsam by a seaquake wave would give all the appearances of an elevated beach which Fitz Roy and Darwin describe. It is further pointed out that Darwin mistook a kitchen-midden for an elevated beach and may have been mistaken in his observations concerning the elevated beaches of 1835. The statement by Darwin that barnacles were found attached to the rocks at the elevation claimed is not considered by Suess. Altogether this section of the work does not convince one that Darwin was mistaken in his belief that the coast was elevated nine feet, however much it may have sunk since 1835.

Space does not permit a reference to all the questions which Suess discusses. Concerning deep-seated masses of igneous rocks, such as laccolites, it is only necessary to remark that he regards these as coming into the crust under the influence of tangential pressures or as filling cavities produced by the rupture of the crust in the direction of one of its radii.

In the second part of this volume the author describes the general geology of the country in front (north) of and in the rear (south) of the Alps, defining the foreland as the area towards which the mountain-built rocks have been pushed. He shows that the folded strata of the Carpathians have advanced upon the rocks of the 'platform of Russia.' Farther west, in Franconia and Swabia, the country is broken up into fault-blocks, the parts which stand up forming 'horsts.' In the case of the Ries and and Höhgau circular areas of depressed rocks occur as if the crust had there been punched downward. Such areas are supposed to be bounded by several lines of faulting rather than by a single circular fault.

The direction of the Alpine system is found to be that of a flattened down S, including the Carpathians, the Alps, the Apennines, Sicily, the Atlas range of northern Africa, the Pillars of Hercules and the mountains of the south coast of Spain. The plateau of Bohemia, the region of the Adriatic and the western Mediterranean are held to be comparable areas characterized by depression. Special chapters are devoted to the evidence of their structural likeness. So much of this evidence is found in the region of the Mediterranean Sea that an essay, one of the most instructive in the work, is devoted to the geological history of this water-body. Its several stages of enlargement and curtailment of area, and the changes of level it has undergone, with its variations in salinity, are fully treated, together with a synopsis of the several groups of deposits marking its development.

One of the astonishing results of the author's studies is his conclusion that in the second stage of the Mediterranean its shore-line was from 440 to 450 meters above the present sea-level. This stage corresponds in age with the Upper Miocene. The reason Suess assigns for this conclusion is apparently found in the statement (p. 412),

concerning certain beds of this stage, that 'between Brünn and Olmutz (in Moravia) there exists a large number of these outliers in the form of isolated buttes, of which the upper plateau, formed of limestone with Lithothamnium, attains very uniformly the altitude of from 350 to 355 meters. Nevertheless at Ruditz, not far from Brünn, this formation occurs as high up as 435 meters, and at an elevation of 429 meters at Abtsdorf, towards the bottom of the great gulf of Bohemia. If we assume, as Suess does, that broad sheets of flat strata cannot have been elevated to their position, they must have been deposited at that or a higher level. Hence, the adjacent lower lying deposits of the same stage, together with the sea-level, have been depressed.

Two chapters are devoted to the great desert plateau of the Sahara and to the fragments of the Indian continent, or Gondwana-land. The lands of these areas are held to be the oldest in the eastern hemisphere. The geological knowledge concerning this district is fairly well summarized, the faults and evidences of change of level by displacement being particularly set forth. In the sequel of this work Suess promises to consider whether the sinking of continents so vast as the lost areas of Gondwana-land has been able to produce a general lowering of the shore-lines and so determine the emergence of plateaus like that of Sahara and Arabia.

Two long chapters are devoted to a description of the mountain chains of India and Central Asia, presenting a good summary of the geology of these regions. North and South America then come in for discussion and comparison with typical Alpine areas. Concerning the earthquakes of the South American coast, Suess holds them to be 'the index of some great tectonic phenomenon of the present epoch, the nature of which is unknown.'

Closing the first volume is a chapter on The Continents. Our author, admitting the difficulty which arises in deciding upon characters which should be accepted in defining the age of a continent, thinks it best to fix its birth 'from the time when the sea has definitely abandoned the large depressions in its area.' In this light North America is held to be no older than the Laramie. In this same point of view, Gondwana-land is much older than America.

Many interesting questions, which the above outline of Suess's views will raise in the mind of the physical geologist, will best be deferred for discussion in connection with the promised second volume of the work, in which it is understood they are to be treated by the author himself.

The first volume is accompanied by a list of contents and is well printed. The pages bristle with footnotes and bibliographic references, the larger part of which are due to the comprehensive grasp of the current literature of geology which M. De Margerie has more than once displayed. As a key to the geology of a large part of the globe the book is invaluable on this account alone. The illustrations are few in number, but good. Many points in the distribution of geological formations on which the argument so often depends might be made clearer to a large class of students by the addition of a few more maps. An atlas as detailed as Stieler's Hand-Atlas is really necessary for following some of the descriptions in an intelligent way. While one closes the book without being convinced that the author's point of view and his interpretation of certain fields are necessarily the only or the right ones, he does so with a feeling of renewed interest in the geology of large areas and in the great physical problems of the earth. Every advanced geological student should read the book for information, for suggestion, for a broadening of his view and to see how a master in the art of writing marshals facts from one of the widest and most varied fields of natural science.

J. B. Woodworth.

A Classified Catalogue, with Localities, of the Land Shells of America, North of Mexico. By H. A. Pilsbry. Philadelphia, April, 1898. Pp. 35.

The appearance of a new catalogue of North American land mollusca is a matter of interest, not merely to malacologists, but to all students of geographical distribution. Mainly through the efforts of Mr. Pilsbry, our snails have been newly classified in recent years, more nearly in accordance with their relationships than heretofore. At the same time, the genera have been divided into subgenera and sections, while