After the announcement of these conclusions, the abstracts of one hundred and sixty-seven cases are given. Among those from whom these cases are cited, Bramwell, Charcot-Pitres, Furstner, Petrina, Nothnagel, Boyer, and Bourneville are notable for the large number of cases contributed by them to this list. A full and comprehensive literature of the whole subject concludes the volume, which is rendered one of the most attractive contributions to our modern physiological literature, by the addition of twenty-five excellent plates, many of which are colored, while others contain photographs.

There is but a single point which the author seems to us to have laid insufficient stress on, and which yet might have furnished many interesting suggestions in support of the kind of localization which he appears to us to have established. We refer to the wonderful correspondence between his areas and the areas of particular types of cortical structure. Thus the visual area corresponds in its distribution to the area in which Meynert describes his eight-layered cortical type to occur in the greatest purity. The diffusion of the motor centers appears to harmonize with the discovery of cortical nests of large pyramids outside of the area where Betz first located them. The identity in locality of tactile with motor areas harmonizes with the notorious coincidence of a granular cortical layer, suspected to be sensory by Meynert, with the largest presumably motor pyramids in the fourth layer of the five-layered cortical type. There are other views of Meynert which acquire a strong support from Exner's researches; aside from the confirmation of Meynert's visual area, the latter's "speech field" is not only re-established but extended by the cautious compiler and critic whose valuable monograph we regret not having the space to present to our readers in a fuller abstract.

BOOKS RECEIVED.

VOLCANOES: WHAT THEY ARE AND WHAT THEY TEACH. By JOHN W. JUDD, F. R. S. Appleton & Co., New York.

"Vulcanologists have only just commenced those series of exact and continuous observations which are necessary to determine the conditions that regulate the appearance of volcanic phenomena. The study of the laws of volcanic action is yet in its infancy."

This astonishing and undeniable statement concerning a class of magnificent phenomena which have excited the admiration and awe, and been interwoven with the religious hopes and fears of the most intelligent portion of our race from the beginning of time, is a revelation of the inchoate state of natural science, notwithstanding its boasted progress in certain narrow fields. Every step in the modern search and study of distant worlds has been gained in large part by the invention and application of some new instrument, such as the telescope and spectroscope; and, in the same way, this new book on a very ancient subject, presents to us a similar anomaly in that one of the most efficient means for peering into the abysses of our own globe has been found in the use of the microscope. The merits of this excellent work must be obvious to the most cursory reader, so far at least as regards the fascinating nature of the subject, the clear and easy style, the avoidance of technical terms, and the use of familiar illustrations, wisely chosen in the main from a few historical and most thoroughly studied volcanic vents. To the expert as well, even in so limited and popular a condensation of the bulky literature of the subject, pleasure will be imparted by the careful classification and in general correct exposition of the principal facts and generalisations thus far gathered, by the avoidance of dogmatic over-statement (e. g., of invariability of the order of eruption of lavas, pp. 198–200)—by the simplification of the relationship and nomenclature of rocks (e, g., Chapter ix, pp. 247–269, etc.), in quiet protest against the minute sub-divisions of the laboratory-lithologists of Great Britain, and especially of Germany,—and by the prudent brevity and caution with which the more difficult, and indeed as yet inscrutable, themes of the last two chapters are discussed. The attention of American geologists might be particularly invited to the consideration of the evidences (pp. 240–242, etc.) of the sub-aerial and explosive character of probably nearly all the trap-overflows on this continent, now often regarded as quiet submarine or sub-terrestrial injections; and the time is soon coming for the recognition of the true nature of enormous accumulations of aerial volcanic deposits, tuffs, lapilli, etc., *in almost every part of our continent*, in spite of their long disguise through metamorphism and consolidation.

There are certain distinctions of importance made by the author, however, with which many students of petrography, both in this country and abroad, will not agree. One of these is the unguarded definition of granyte, gabbro, dioryte, etc., as merely conditions of lava, "crystalline varieties in masses which have cooled slowly at great depths" (pp. 58, 260, 265, 322, etc). That may be true in many instances, especially at the British localities, with which the author is most familiar, *e. g.*, the Volcano of Mull (p. 142). The popular student should, however, be advised that the same rocks abundantly occur elsewhere, particularly in that part of our continent which lies east of the Mississippi, in forms which are very similar to these, but not at all to be confounded with lavas, their derivation being entirely and unmistakably from the metamorphism of sediments: *e. g.*, the granitoid gneisses, gabbro-gneisses, and metamorphic diorytes and diabases of the Eastern United States.

Again, the origin of the "red clay" which is found to cover the bottom of the ocean over its abyssal areas can be only in part assigned to the cause accepted by the author, the disintegration of volcanic dust and oxidation of their content of magnetite (p. 74); the studies of Thomson, Nelson, Buchanan and others have shown the high probability of its partial increment as an insoluble residue from the solvent action of the carbon dioxide in seawater upon the calcareous globigerina-ooze, etc.

The origin of the interesting filamentous variety of volcanic glass of the crater of Kilauea in Hawaii, called "Pélé's Hair," which is apparently attributed to the upward impulsion of particles of liquid glass into the air by the passage of steam (p. 71), is explained with more probability by Dana, through the conveyance and drawing out of such particles by the winds.

It is true that fine crystals and concretions of minerals of certain groups, especially leucite, the zeolites, agate, etc., owe their origin in general, directly or indirectly, to volcanic action (p. 148–9), but the most ardent Huttonian must confess that there is no prevailing connection between "great masses of fused volcanic rock" and the sediments which now enclose "diamonds, rubies, sapphires, emeralds, topazes, garnets," etc.: the list is characteristic of metamorphic strata, and the author has evidently pressed his point too far.

Exception may well be taken also to the little attention paid by the author to the remarkable volcanic chain in the West India islands, still comprising six active vents (p. 228), notwithstanding his recognition of the significant fact of the vast depths in the neighboring portion of the Atlantic, ascertained by the deep-sea soundings of the Challenger (p. 242). In very opposition to this fact and disregard of its meaning, he considers this volcanic group merely as a secondary branching chain of minor importance (p. 233), connecting the great band of volcanoes of

the western border of the American continent with that which traverses the Atlantic and properly pertaining to the latter band (pp. 228-235). A better acquaintance with the volcanic vents, active and extinct, both of the West Indies and of the eastern border of the American continents will find in these a fifth band, additional to the four enumerated (pp. 228-235), marked by the Alleghany axis along the eastern border of North America and that of the Highlands of Guiana and Brazil, in South America; while the sharply defined intermediate chain, traversing the great subsided continent which lies beneath the Caribbean sea, still retains a few active vents. May their present partial activity be an indication of the commencement of an era of renewed elevation over that now deeply sunken area?

The work presents also a few minor blemishes which might be easily corrected in another edition. Only in the vague phrase—"a high power of the microscope," (p. 53)—can the reader, unfamiliar with the subject, find a clue to the magnification employed in those figures of the frontispiece representing the excessively minute structures found in the vitreous and crypto-crystalline rocks. The same objection applies to the figures and descriptions of the minute liquid cavities detected in the crystals of rocks (fig. 7, p. 61). In one figure, part of the reference letters have been obliterated (fig. 36, p. 118). The desire to avoid the appearance of a text-book has led to the omission of all sub-divisions of the text, such as headings or marginal references, within the twelve chapters: the consequence has been a series of apparently abrupt and even violent changes of the subject without assistance to the eye, which at first produces a rather puzzling impression on one's succession of thought, and, without resort to the index—which is excellent—renders difficult a later reference or return to any desired paragraph. The wood cuts are abundant, well chosen, and in general so well executed as to render the coarseness of one of the full page illustrations (fig. 41) somewhat unpleasant to the eye. May not even the scientist, the vulcanologist, be an æsthete? May not even his hard trappean intellect crave, beyond the dry facts shown in this rough sketch the finer lines which may suggest the balmy atmosphere which rests over this isle in the Mediterranean, the tender green upon its hillsides, the delicious blue of the heavens above and of the waters beneath?

But perhaps the most serious defect of the book, at least for American readers, for whose benefit this volume of "The International Scientific Series" has been largely prepared, lies in the almost entire absence of illustrations, either in the text or figures, taken from the volcanic localities on this continent, whose descriptions now abound in all the current literature, ready to Prof. Judd's hands. Derision is well expressed in Chapter I, at the absurd views prevalent not only among the ancients but in modern school manuals, concerning the nature of volcanoes. But here is a new book, just issued by an American publishing house, to teach the American public "what a volcano is," with an almost complete disregard of the volcanic materials, upon and into and among which American feet and hands are walking and digging and climbing every day! It was well to give prominence to the work of Scrope, Hamilton, Möhl, and, above all, Palmieri, and the excellent Italian school of vulcanologists, but the value of such a book, for popular and "International" purposes, would have been largely augmented by less meagre references to the grand instances of volcanic outbursts in this hemisphere, whose descriptions we owe to the laborious study of Dana, Newberry, Hayden, Gilbert, Endlich, Dutton, and many others. The little hills of England, Wales and Scotland afford excellent illustrations of extinct volcanic vents for the British public; but why, O why, should not discreet reference be vouchsafed to transatlantic localities for the benefit of Prof. Judd's thirty odd millions of cousins? For example, for volcanic activity in Cambro-Silurian times (p. 274), to the vast outflows on the present borders of Lake Superior: for its cessation in this hemisphere during a vast subsequent period, to the scarcity or entire absence of such outflows in all our Devonian and Carboniferous basins: and for its resumption here, during the repose of the European vents, to the enormous eruptions of trap through the Triassic beds along the whole Atlantic seaboard, and, still later, throughout the Western Cretaceous plateaus.

It is shown (p. 227), and will doubtless prove a surprise to many an American reader, that "the American Continent contains a greater number of volcances than the divisions of the Old World. There are twenty in North America, twenty-five in Central America, and thirty-seven in South America," *i. e.*, eighty-two great volcanic vents in action on our continents, to only thirty-five in Europe, Asia and Africa. But, more than this, the same great band "contains, with its branches, nearly a hundred active volcanoes," and this fact, taken in connection with the vast volcanic outflows from ancient vents which overspread the Western plateaus, indicates that America is the grandest field in the world for the study of volcanic phenomena; and this little book, excellent as it is, with the limited field of observation from which it has been mainly written, gives a suggestion of the magnificent monograph on this subject which is yet to come from some American hand.

ALEXIS A. JULIEN.

THE GREAT PRIMORDIAL FORCE.

By Dr. H. Raymond Rogers.

Continued.

The existence of other affections of the primordial force, in addition to those already recognized as the "Great Physical Forces," has been more than suspected by distinguished scientists. HUMBOLDT pertinently asks: "who will venture to affirm that we have discovered the whole number of forces which pervade the universe?"

Among the non-recognized affections which are legitimately entitled to a position in that category, we now take the liberty of including

WIND.

According to present conceptions and teachings concerning the *modus-operandi* of wind-production, wind is due to the creation by the sun's heat of a warm, light atmosphere, or rarified atmosphere which rises, the colder surrounding air rushing in from all sides to restore the equilibrium. The equatorial regions, being most highly heated, are the grand theatre of this complex movement. The equatorial air rising, the air both north and south moves forward to make good the deficiency. This new air, in its turn is heated and rises, and thus a constant upward current is established, and at the same time two opposite lateral surface currents. Add now to this movement the motion of the earth on its axis to modify these lateral currents and we have the great ærial currents as now existing, as for example, the trade-winds. Periodical and occasional storms originate in differences of temperature produced likewise by the sun's heat, which causes a movement for the restoration of a disturbed equilibrium. The regular or prevailingwinds of our temperate zone are produced by the meeting of equatorial and polar currents.

Such is the main theory. But yet in explaining the details of the theory there is such a lack of unanimity as to render the whole theory doubtful. The rotary theory of DOVE, the centripetal, or in-blowing theory of ESPY, and the theory of BLASIUS which antagonizes both, evince the existing uncertainty and dissatisfaction. If we allow BLASIUS to begin a storm, REDFIELD to manage the middle of it, and ESPY to finish it up, we may get a plausible theory.

However, upon thoughtful consideration, there are