

for this solvent in a highly heated condition and at the necessary depths within the earth. Both from its parent mass and from the overlying rocks traversed by it, it may take the metals and gangue.

In the upward and especially in the closing journey, meteoric waters may mingle with the magmatic, and as temperatures and pressures fall, the precipitation of dissolved burdens takes place and our ore-bodies are believed to result. Gradually the source of water and its store of energy become exhausted; circulations die out and the period of vein-formation, comparatively brief, geologically speaking, closes. Secondary enrichment through the agency of the meteoric waters alone remains to influence the character of the deposit of ore. In brief, and so far as the process of formation of our veins in the western mining districts is concerned, this is the conception which has been gaining adherents year by year and which, on the whole, most fully accords with our observed geologic relations. It accords with them, I may add, in several other important particulars upon which I have not time to dwell.

In closing I may state, that speculative and uncertain as our solution of the problem of the metalliferous veins may seem, it yet is involved in a most important way, with the practical opening of the veins and with our anticipations for the future production of the metals. Every intelligent manager, superintendent or engineer must plan the development work of his mine with some conception of the way in which his ore-body originated, and even if he alternates or lets his mind play lightly from waters meteoric to waters magmatic, over this problem he must ponder. On its scientific side and to an active and reflective mind it is no drawback that the problem is yet in some respects elusive and that its solution is not yet a matter of mathematical demonstration. In science the solved prob-

lems lose their interest; it is the undecided ones that attract and call for all the resources which the investigator can bring to bear upon them. Among those problems which are of great practical importance, which enter in a far-reaching way into our national life and which irresistibly rivet the attention of the observer, there is none with which the problem of the metalliferous veins suffers by comparison.

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SCIENTIFIC BOOKS.

The Tower of Pelée: New studies of the great volcano of Martinique. By ANGELO HEILPRIN, F.R.G.S. Pp. 62 + 23 plates. Philadelphia, J. B. Lippincott Company. 1904.

In the past three years a good deal of literature has appeared concerning the West Indian eruptions of 1902. A part of this is a simple record of observed facts. Perhaps a greater portion is devoted to speculative inquiries into the cause and nature of the eruptions and attendant phenomena, especially those of Pelée, whose remarkable characteristics have excited the curiosity and interest of students in more than one branch of science. The solution of many of the problems is rendered extremely difficult through the lack of sufficient data upon which to support hypotheses, and geologists often are compelled to admit that certain of the problems must remain unsolved. It has been impossible, in many cases, to obtain much-needed information in the field in regard to many obscure matters on account of the continued activity of Pelée, and this must be taken into consideration when an unusual diversity of opinion appears in the views of different observers.

In the present work, which was published nearly at the same time as Lacroix's report, Professor Heilprin presents his views in regard to the origin and nature of the tower of Pelée. The book contains five short chapters, in the first of which the author describes his experiences and the impressions he received on the occasion of his fourth ascent of Pelée,

in June, 1903; the three following chapters are devoted to observations upon the remarkable tower of Pelée, and in chapter V. are 'some thoughts on volcanic phenomena suggested by the Antillean eruptions.'

Stated very briefly, Heilprin regards the tower, or spine, which has appeared from time to time above the summit, as 'the ancient core of the volcano that had been forced from the position of rest in which solidification had left it' (p. 33). After presenting a number of objections to Professor Lacroix's theory, he says, on page 34:

In assuming the tower to have been an ancient neck-core which under enormous pressure had been lifted from its moorings, we at least require no condition that is not provided for by volcanoes. There can be no objection to postulating the existence of such a core here, as in other volcanoes; and if existing, there would seem to be no reason why, under the gigantic force of Pelée's activity, it should not have been dislodged and pushed bodily outward. The reaction upon this contained mass of accumulating heat, and the infusion into it of steam and flows of new lava, would help to explain the 'burnt-out' and scraggy look which from the first had been a characteristic of the tower-rock.

It is, perhaps, unfair to compare this work with the report of Professor Lacroix, who devoted more than six months to a study of what might be termed the daily life of Pelée, and who was aided by a corps of able assistants, but one can not help being impressed and possibly influenced by the abundance of Lacroix's observations, the completeness of his records, and the lucid exposition of his theories; while, on the other hand, one hesitates to agree with certain of Professor Heilprin's views, not necessarily because they are new, but for the reason that they are not supported by sufficient evidence. Thus, in the statement of his opinion concerning the nature of Pelée's tower, he offers a number of somewhat theoretical objections to Lacroix's views and has little more than suppositions upon which to support his own hypotheses; in fact, he does not take into account many of his own observations. Furthermore, there seems to be some inconsistency in his arguments. After stating that in his opinion the tower represents

the old core of the volcano, he says, on page 34:

It can not be doubted that the tower was virtually solid to the core, and equally little need one doubt that its temperature was not such as to maintain a fluidal or semi-fluidal interior. Had the tower not been solid, or had it contained much incandescent fluidal matter, the numerous breakages, whether on the flanks or across the summit, which marked the tower's history, would have revealed these conditions many times.

On page 18 the following occurs:

On the other hand, that the tower was rifted and had irregular passages through it, or through parts of it, into which lava was at times injected, is certain; and the members of the Lacroix mission on more than one occasion noticed areas and lines of incandescence in the basal portion of the core, which they associated with flowing lava-masses. On the night preceding my fourth ascent of the volcano, June 12, 1903, the southwest base of the tower was resplendently luminous, made so either by actually rising lava or by a partial remelting of that portion of the structure.

On page 20, in referring to the first appearance of the tower he says:

Indeed, I remark in my report ['Mont Pelée and the Tragedy of Martinique'], that it seemed to me likely that the two glowing masses of fire which shone from the summit, like red beacon-lights, in the morning of August 22, emanated from the two (incandescent) horns that capped the summit of the mountain.

Although these statements are not flatly contradictory, they at least leave a somewhat hazy impression on the reader's mind.

It will be difficult, even for those geologists who hesitate to accept all of Lacroix's brilliant reasoning and explanation in regard to the physical manifestations of Pelée's eruptions, to agree with Professor Heilprin's views, largely because the manner in which they are presented must in many cases fail to convince the reader.

In chapter IV. various observations on the eruptions are summarized; among them are references to the electro-magnetic disturbances, propagation of sound- and shock-waves, etc., together with more local phenomena. In chapter V. the broad questions concerning the cause of vulcanism in cases of such regional

disturbances as those of the West Indies are discussed, and the view is expressed 'that a subsidence of the floor of the Caribbean Basin, causing displacements of equilibrium and forcing molten and other material to the surface, was the inciting cause of the Antillean eruption' (p. 50). The later paragraphs are devoted to an inquiry in regard to the source of volcanic steam, and the two theories, the penetration of sea water, and of land water, are discussed. The author concludes with a statement favoring the theory that hydrated rocks and the magma of the earth's interior supply the water from which the steam of volcanoes is derived. Twenty-three excellent half-tone plates of the tower of Pelée, eruptions, etc., complete the volume.

ERNEST HOWE.

THE BELGIAN ANTARCTIC EXPEDITION.

Resultats du voyage du S. Y. 'Belgica' en 1897-98-99, sous le commandement de A. de Gerlache de Gomery. Rapports scientifique: Zoologie. Organogénie des Pinnipèdes. I., Les extrémités, par H. LEBOUQC. December, 1904. Pp. 20, pl. I.-II. Botanique. Champignons par Mmes. E. BOMMER et M. ROUSSEAU. April, 1905. Pp. 15, pl. I.-V.

Two more numbers of the fine series of Antarctic reports from the Belgian Expedition have been received. In the first we have a discussion of the nepionic stages of the development of the extremities in the Antarctic seals, *Lobodon carcinophaga* and *Leptonychotes weddelli*, deduced from a series of unborn young. Of these twelve belonged to *Lobodon* and four to *Leptonychotes*. None of the specimens was embryonic, ranging in length from fifteen centimeters upward. Nevertheless, a study of the progressive development or gradual reduction of the phalanges, nails and hair in such a well-preserved series is far from uninteresting, and this is what M. Leboucq offers, together with some comparisons with known data relating to other seals and some cetaceans.

The fungi collected by the *Belgica*, with one exception, were obtained in Tierra del Fuego, where ten species and forms new to science

were obtained. The Antarctic form was found among the culms of the sole Antarctic grass, *Aira antarctica*, in the state of mycelium, which offers analogies with that of *Collybia racemosa*, and it is possible that it belongs to an *Agaric* related to that species. It comes from Danco Land. The Fuegian forms number fifteen and are fully illustrated by admirably executed plates.

W. H. DALL.

SCIENTIFIC JOURNALS AND ARTICLES.

THE December number (volume 12, number 3) of the *Bulletin of the American Mathematical Society* contains the following articles: Report of the October Meeting of the American Mathematical Society, by F. N. Cole; Report of the September Meeting of the San Francisco Section, by G. A. Miller; 'Note on Loxodromes,' by C. A. Noble; 'Stolz and Gmeiner's Function Theory' (Review of Stolz and Gmeiner's *Einleitung in die Functionentheorie, Abteilung I.*), by Oswald Veblen; 'Cesàro-Kowalewski's Algebraic Analysis and Infinitesimal Calculus' (Review of Cesàro's *Elementares Lehrbuch der Algebraischen Analysis und der Infinitesimalrechnung*), by C. L. E. Moore; Shorter Notices; Notes; New Publications.

The January number of the *Bulletin* contains: 'On a Familiar Theorem of the Theory of Functions,' by Edmund Landau; 'Rational Plane Curves Related to Riemann Transformations,' by H. S. White; 'On Lamé's Six Equations Connected with Triply Orthogonal Systems of Surfaces,' by J. E. Wright; 'Certain Surfaces Admitting of Continuous Deformation with Preservation of Conjugate Lines,' by Burke Smith; 'The New Calculus of Variations,' by E. R. Hedrick; 'Granville's Differential and Integral Calculus' (Review), by E. B. Van Vleck; 'The Foundations of Science' (Review of Poincaré's *Science et Hypothèse*), by E. B. Wilson; 'La Mécanique Statistique' (Review of Gibbs's *Statistical Mechanics*), by Jacques Hadamard; Notes; New Publications.

The American Naturalist for December contains the following articles: 'Ecology of