The Bryophytes are dismissed with a short chapter which is in harmony with the fact that they constitute one of the least-known groups among fossil plants.

Attention appears to have been concentrated chiefly upon the vascular plants, of which the author presents a well-chosen selection of types and among which he seems well at home. The most noteworthy feature of this section of the work, and one which gives it special prominence in advance of previous publications, is the recognition for the first time, of the recently established Cycadofilicinæ which marks the most important advance in paleobotany within recent years, and at once indicates the nature of the data which a further study of fossil plants may be expected to contribute to our knowledge of the evolution of plant life.

The value of the book is greatly enhanced for the purposes of the working botanist or the student, by the superior character of the illustrations. Taken either by itself or in connection with Seward's more elaborate work, which it largely supplements, it affords a hand book of considerable utility.

D. P. Penhallow.

Montreal, Sept., 1900.

La spéléologie, ou science des cavernes. Par E. A. Martel. I volume, 8 vo., pp. 126, avec 10 figures. Prix 2 francs. Collection Scientia Série Biologique, No. 8. (Georges Carré et C. Naud, Editeurs, 3, rue Racine, Paris.)

A series of small volumes is being issued under the direction of MM. Milne-Edwards, Gaudry, Filhol, Balbiani, and other members of the Institute of France; one of the most recent of them being a hand-book on caverns and their contents. Its title, 'La spéléologie,' is coined from two Greek words, and means the Science of Caverns. This term is an improvement on the German 'Hœhlenkunde,' long in use in Austria, for the reason that the latter does not recognize the scientific claim on which emphasis is now laid; 'kunde' being the synonym of intelligence, or news, rather than of a classified knowledge. La Société de Spéléologie, of which M. Emilé Riviere is now president, and M. Edouard A. Martel the general secretary, is in the sixth year of its existence, numbers many eminent scientists among its members, with its headquarters at No. 7 rue des Grands-Augustins, Paris, whence it issues a regular bulletin telling the latest news from all parts of the known subterranean world, and publishing special contributions of scientific value. Important service has thus been done to geologists, archeologists, zoologists, hydrologists, mining engineers and hygienists. M. Martel has for many years devoted his summers to the exploration of caves in France, Spain, Greece, Switzerland, Austria, Belgium, Great Britain and elsewhere; and no man is better qualified than he to treat of the Science of Caverns, as he has so successfully done in the work under consideration.

'La spéléologie' is divided into sixteen chapters. The first chapter defines terms, corrects certain errors and prejudices, traces the history of under-ground exploration, gives a succinct bibliography of cave literature for a century, and indicates the many ways in which this branch of study has aided mankind. The second chapter deals with the causes producing caverns; which are mainly, first, pre-existing fissures in the rocks, due to earthquakes, volcanic eruptions, and other means by which the earth's crust has been rent asunder; and secondly, rain-water, charged with acids from the atmosphere and the soil, which seeks the fractures, faults and diaclases thus made, and enlarges them by erosion, corrosion, and hydrostatic pressure. This triple process is more fully explained in several successive chapters. Corrosion is exemplified by the destruction of gypsum and rock salt, and other soluble formations. Evidences of erosion abound in marine grottoes and volcanic caves. Columns of water weighing many atmospheres often stand in deep pits, or flow through secret conduits, bringing tremendous pressure upon the rocky strata before which they must yield.

The author deplores the prevalent confusion of nomenclature employed to describe the phenomena and results of aqueous agency. On pages 32 and 33 he spreads before the reader an elaborate table of the names by which pits, chasms, and other exterior and interior openings are designated in different countries of Europe and America; also offering suggestions as to unification or simplification of terms.

Ordinarily corrosion, erosion and hydrostatic pressure work simultaneously in cave-making. The acids eat into the softer portions of rock, leaving the harder parts as gravel, or sand, which the whirling or flowing water uses to grind a channel for drainage to an outlet.

M. Martel finds limited subterranean reservoirs, and also sheets of water held by saturation in mellow soils and porous strata, but denies the existence of vast bodies of water ('nappes d'eau'), such as are insisted on by certain ancient and modern authorities—even as recently as 1897—in order to explain the phenomena of artesian wells. He describes the sinking and resurgence of streams; and also a system of siphonage, which, as he remarks, belongs to hydrology rather than to speleology. Certain caves, however, are really but the channels of underground rivers whose waters have found some other bed.

The chapter on 'Abimes,' or natural pits, is peculiarly interesting, although, as the author admits, their origin has been an occasion of 'interminable controversy.' We cannot now follow him through his elaborate discussion of the theories of glacial grinding, of geyser chimneys, of interior excavation, the 'théorie du jalonnement' (*i. e.*, that they are drainage outlets for ancient lakes), and other theories. For this and much other interesting material the reader is referred to Martel's great work, 'Les abimes,' pp. 576, Paris, 1894. The theory finds favor that the abimes are generally due to exterior causes, working downward from the surface, rather than to interior forces. This is especially evident in the 'avens' that pierce the vast limestone plateaus, known as 'causses'—a term derived from the Latin 'calx.' Some of these avens drop vertically for from 200 to 700 feet, and then expand into vast chambers, occasionally with bodies of water, but often ending in numerous fissures of drainage.

M. Martel gives a list of abimes actually measured and known to be more than 200 meters in depth. The deepest of all is a perilous pit named in honor of its discoverer, M. David Martin, and located near Saint Disdier, amid the Hautes Alpes, at a point about 5,000 feet above the sea. Martel descended more than 1,000 feet vertically, and estimated the entire depth at about 1,600 feet. The writer of this review had the satisfaction personally, in 1897, of witnessing Martel's exploration of the Aven Armand, in Lozére, a pit more than 600 feet deep. The rope ladders, portable telephones and other apparatus made a striking display. In other pits that were intersected by streams a curious plan was taken for tracing the waters by discoloration by flourescein.

After describing stalactites, stalagmites and other forms of drip-stone, whose tendency is to obliterate caverns, and whose rate of growth has been recorded as indicating the age of the excavations in which they exist, M. Martel states the difficulties of the problem fairly, and concludes that it is impossible to affirm, in the actual state of our knowledge concerning subterranean channels, just when they began to exist; but he suggests the middle of the Tertiary epoch.

Particular attention is paid to the temperature of caverns, the purity or impurity of cave atmosphere, and the contamination of springs and subterranean reservoirs in relation to the public health. Natural ice-houses, and the theories of their formation, furnish material for an interesting chapter. Four causes are assigned, namely, the shape of the cavities, free access of snow in winter, altitude, and evaporation by currents of air. In this connection researches and adventures amid Alpine snow-pits are described. Cavern minerals are diversified. Among those mentioned are the various metallic ores, clays, carbonates, phosphates, and salts. Brilliant colors are often given to stalactites by copper and other metals.

Recent prehistoric explorations have been richly rewarded by relics found in cliff-dwellings and subterranean temples. Still more ancient are the remains of the paleolithic, neolithic and bronze ages. Many of the most noted of the inhabited caves and grottoes are mentioned by name. Living troglodytes are described, and also underground cemeteries, from which hundreds of human skeletons have been exhumed. Discoveries in the United States are by no means overlooked, particular mention being made of those in Pennsylvania, Indiana, Kentucky and Tennessee.

Subterranean fauna and flora, their origin,

habitats, and the modification of their organs by adaptation to environment, fill the concluding chapter of this remarkable little volume. Directions are given for hunting cave animals and observing their habits. Authorities are conscientiously and carefully quoted, with fewer mistakes than might have been anticipated in a work of this comprehensive nature, and with evident intention to give due credit to investigators on both sides of the Atlantic.* In conclusion, we accept M. Martel's handbook as an admirable and timely contribution to current scientific literature.

HORACE C. HOVEY.

The Criminal: His Personnel and Environment. A Scientific Study. By AUGUST DRÄHMS, with an introduction by C. LOMBROSO. New York, The Macmillan Co. 1900. 8vo. Pp. 402.

In a brief introduction to this book Professor Lombroso congratulates the author on his 'lucid exposition' and 'profound and original thought,' stating, further, that he has seldom met with so clear an exposition of his own views. This testimonial is not altogether calculated to carry weight, for even those who acknowledge a discriminating admiration for Lombroso's genius are well aware that a sound critical faculty is not one of the elements of that genius. It is possible that even the author himself may have been surprised at the excess of this appreciation; for Mr. Drähms is by no means so much in sympathy with Lombroso, as Lombroso is with Mr. Drähms. In his preface the latter states that "the strictly anthropological features here brought out have been accepted mainly as the properly accredited data of trained writers, the latchets of whose shoes I am not worthy to unloose, but whose conclusions nevertheless are taken under a general demurrer; in which respect, however, I have the consolation of knowing that I am in excellent company." Any one who carefully studies this statement will know how far this book is likely to prove useful to him; in its vague phraseology and its non-committal deference to people of all views, it is characteristic of the author's attitude throughout. He attempts to cover the whole field of criminal anthropology and criminal sociology. But not only do the original facts he has brought forward scarcely occupy a couple of pages; his acquaintance with the facts brought forward by others is nearly all second-hand, derived from sources already easily accessible in English, nor is any reference made to even the more important investigations of recent years, such as Winkler's attempt to deal with the data of criminal anthropology on a mathematical basis, or Steinmetz's studies of the evolution of punishment. He loosely discusses views to which he never gives precision by definite citation of authorities, and when he mentions authorities he is unable in a large proportion of cases even to spell their names. It is not impossible for a prison chaplain to do good work in this field, as Mr. W. D. Morrison has shown in England. But Mr. Drähms reveals no signs of that clear vision and intellectual grip which enable a man to conquer defects of scientific training. He takes a sane common-sense view of things, and as regards the treatment of criminals this leads him sometimes even to an advanced position, as when he advocates an unrestricted indeterminate sentence. But the possession of average sanity and common-sense is an inadequate equipment in writing a book which is prominently announced as 'a scientific study.'

It is necessary to state this clearly even at the risk of hurting the feelings of an amiable and well-intentioned writer. In the more abstract sciences there is no temptation to careless work; but in the anthropological and psychological sciences there is a temptation, even for an honest writer, to mask his scientific ineffectiveness under the human interest of his subject matter. In so far as he succeeds he discredits the science with which he occupies himself. The study of the criminal has suffered severely from this cause, and a book on

* On page 114 M. Martel inadvertently attributes to another my discovery of the prehistoric quarries of jasper and alabaster in Wyandot Cave, Indiana. My exploration was originally made in 1855, and my account of the quarries was published in the *Am. Jour. of Science and Art*, in 1878; whereas the account quoted from the *Proceedings* of the American Phil. Society did not appear till 1895.