south to the south pole remain unobserved. For many years it has been my desire to organize an expedition to the southern hemisphere for the purpose of measuring the velocity of these stars. With the approval and endorsement of the president, the subject was brought to the attention of Mr. D. O. Mills, who most generously offered to provide funds for constructing the instruments, for defraying traveling expenses, and for paying the salaries of the astronomers engaging in the work.

For this work, a Cassegrain reflecting telescope is nearing completion. The parabolic mirror of thirty-six and one half inches clear diameter and the convex mirror of nine and four tenths inches are being constructed by the John A. Brashear Company.

A powerful three-prism spectrograph, designed by the director for use with the reflecting telescope, is completed. The delicate parts of the mounting were constructed by our instrument-maker, and the optical parts by the John A. Brashear Company. Mr. Wright has submitted the whole spectrograph to severe tests. Its performance appears to be superior even to that of the original Mills spectrograph. A modern steel dome was built for the expedition by the Warner and Swasey Company. The minor pieces of apparatus required have all been provided. It is planned to select a suitable observing station in the vicinity of Santiago, Chili. It is confidently hoped that this work will be at least as fruitful as that carried on with the Mills spectrograph attached to the thirty-six inch equatorial.

The director wishes to make full acknowledgment of the enthusiastic support afforded him by the members of the observatory staff. Every man has been ready to make the most of the opportunities supplied by the splendid instruments, by the unexcelled climatic conditions, and by the excellent policy inaugurated for the observatory by the officers of the University of California.

W. W. Campbell,
Director of the Lick Observatory.

SCIENTIFIC BOOKS.

Der Hercynische Florenbezirk. Grundzüge der Pflanzenverbreitung im mitteldeutschen Berg- und Hügellande vom Harz bis zur Rhön, bis zur Lausitz und dem Böhmer Walde. Von O. Drude. Leipzig, Engelmann. 1902. Pp. xix + 671.

This is the sixth volume in the series of monographs of Engler and Drude under the general title of 'Vegetation der Erde.' Having been specially elaborated by Dr. Drude, it may be taken to represent the standard adopted and the principles which it is designed to embody as the work progresses farther. The region covered includes central Germany, and is familiar to the author, as he tells us, through thirty years of field and herbarium work.

As indicated in previous volumes, the scope of the general work is a study of the vegetation of the earth from the standpoint of geological development, on the one hand, and adaptations to environment, on the other. By a natural division of material and labor, two lines of work have been developed, namely, floristic observations and the study of biological relations. It is to the first of these that the present volume is mainly, though not exclusively, devoted.

The discussion of geographical and climatological data is followed by a brief statistical résumé, in which it appears that, within the limits of the Hercynian region, 1,564 vascular plants occur, besides some 645 species of bryophytes, and possibly 2,000 or more thallophytes. The flora is a composite in which occur numerous Baltic elements associated with northern Alpine forms, and in which north Atlantic species as well as circumpolar Arctic ones are also represented. There are in the whole region but few, and these not strongly marked, species that do not occur in

neighboring regions. The greatest floral contrast exists between the Hercynian flora and that of northwestern Germany; closer relations are manifest toward the east, south and west.

The species composing the German flora are referred to eleven natural areas of distribution, among which are the boreal, Alpine, Ural, Pontic, Atlantic and Arctic. A detailed study of the present distribution of species belonging to these various areas renders possible a discussion of the paths along which the existing floral elements of Germany have migrated at different periods. Naturally, the degree to which the elements from a particular area become dominant determines more or less the tone of the landscape in any given district.

The body of the work is devoted to an account of plant societies, of which thirty-two are distinguished, and to the distribution of these societies and their character species in fourteen natural districts of central Germany The descriptions and enumerations are sc definite and inclusive as to present for every one of these districts a satisfactory picture of floristic relations. The author's contributions and methods in this direction are so well known as to render their present discussion unnecessary.

The fifth and last division of the book is devoted to a consideration of the causes, past and present, that have contributed to the establishment and characteristics of the Hercynian flora as it is to-day. As a matter of fact, 'Hercynia' does not suggest a simple unity as a vegetation region; the unity is rather geographical, and there are included within it a number of vegetation regions which may lie alongside of each other in the plain, and above one another on the mountains. Immigrations have been controlled in the first place by orographic structure and edaphic conditions, determined by the substratum, which consists of crystalline rocks, basalt, and, especially in the west, of Triassic limestone. Climatic factors, in themselves alone, and in connection with physiographic features, and the chances of immigration along natural favorable routes are also all tc be taken into account. It is particularly difficult to form an exact estimate of purely climatic influences on the delimitation of Hercynian districts and landscapes. Westward from the Harz, for example, Atlantic species have settled, favored by the greater amount of moisture, while in the same latitude eastward there is a great development of Pontic groups on the dry triassic soils. The same *Ilex* that grows wild in the neighborhood of the Weser is more likely to freeze in severe winters to the southeast of the Harz. Certain cereals sensitive to excess of precipitation, such as the finer varieties of barley, yield the best harvests along the lower Saale, but all these and numerous other well-known facts are the result of a complex of causes in which general climatic relations must be recognized but are by no means the exclusive factor.

This leads naturally to a discussion of geological relations, which, though brief, is highly suggestive, and is of the more value in that the author, with such abundant data at his disposal, attempts only in the most conservative way theoretical constructions that have often proved of seductive interest. He holds that there is no ground for the assumption that Germany was ever in the condition of Greenland of the present day. Relicts, such as *Hymenophyllum* and various other genera, prove that the last time of glaciation in the Hercynian hill country did not destroy all the remnants of the preceding period. A historical succession may be recognized in which Arctic tundra are followed by a northern steppe flora, which in its turn gives place to forest. Relicts of these different periods are still living together, and in some places have formed remarkably mixed societies.

Drude discusses in some detail the traces of the ice age in subalpine heaths and moors of the Hercynian Mountains, showing that, with the advance of the ice, alpine species as well as the old stock of Scandinavian forms were driven southwards, that finally along the border of the inland ice stretching from the Elbe northeast through Prussia there must have been an exchange of such species, so that hill country, such as that of Hercynia,

lying in the line of this interchange would be settled by Scandinavian, boreal-Ural and alpine-Carpathian plants. Naturally, also, during the fluctuations of the last glaciation, and especially during the retreat of the ice, a mixture of the highest forest and lowest subalpine societies would take place.

Traces of the steppe period, exemplified in the dry hill and rock plants, correspond with the 'præalpine' societies that occur on the limestone and dolomite slopes of the northern Alps. If we picture to ourselves the time when, after the warm interglacial period, a later glaciation took place, it must be taken for granted that the præalpine grove and rock plants were driven down before the ice and settled on other limestone hills at a lower level. These afterwards mixed in various places with plants of Pontic origin, which also chose dry marl and calcareous soils to settle on. These Pontic elements came in from the east along paths which may still be traced with a considerable degree of assurance. Thus along the Elster, the plants of the Saale (including various præalpine and Pontic species) are not most thickly distributed simply where there is the greatest extent of limestone rocks, but rather in places that these plants could most easily reach, and this depends on the position of valleys free from forests. Along the shortest line from the Saale to the Elster extends a plateau of muschelkalk, and it is exactly in this direction to the eastward that the hills on the Elster reproduce most fully on their south and west sides the flora of the hills along the Saale. Thus the natural geographical paths for post-glacial settlement have been reinforced by favorable edaphic and climatic conditions, and all of these must be taken into consideration in attempting to account for the history of the present Hercynian flora. But until the geological history is more fully and certainly known it is impossible to construct, with any hope of accuracy, such a system as, for example, that attempted by Schulz, who assumes four periods of warmth alternating with as many of glaciation, and undertakes to trace the periods and course of immigration for single species.

Since the glacial period the orographic features of Hercynia have not been essentially altered, and then, as now, climatic and edaphic factors were together determining the immigrations of plants. It is very probable that at the time of the Pontic invasion the region of the lower Saale had a more distinctly steppe climate than other parts of Hercynia, and that the triassic soils which to-day favor the plants inhabiting them offered corresponding advantages to such settlers then. In manifold other ways the continuity of present with past physiographic conditions becomes increasingly obvious, and the present study is a noteworthy recognition of the necessity of admitting this principle to the fullest extent in attempting to construct a satisfactory picture of the historical succession of plant societies. The attainment of such an ideal, though beset with extraordinary difficulties, is being brought nearer through the indefatigable labor embodied in this and the companion volumes of the 'Vegetation der Erde.' V. M. Spalding.

The Archeological History of Ohio. By Gerard Fowke. Columbus, O. Published by the Ohio State Archeological and Historical Society, 1902. 8, XVI.

Mr. Fowke's book is not written, so he claims, for scientists or specialists, but to give laymen an idea of the extent and characteristics of the prehistoric remains found within the borders of the state of Ohio. It fulfils its mission and presents in its 760 pages a complete résumé of all the antiquities of the state, and also refers to nearly every publication upon the subject. The work is well done, and as Mr. Fowke compassed a task which required a great deal of time, and would not have been possible to any person who had not studied the Ohio field, as he has, for twenty years, he is deserving of our meed of praise.

But while the above is true, the book itself may not further the study of archeology in the United States. Unfortunately the author is even more than controversial, he is dogmatic, and to most of the writers and authorities on Ohio antiquities, he is unjust. Such a book as this is, evincing years of study in