

the structures found in the Appalachians are equally characteristic of the Alps, and the more denuded mountain chains of Central and Northern Europe. In explaining the causes of regional or mechanical metamorphism, Dr. Reyer fully appreciates the importance of the experimental researches of Tresca, Daubrée, and Spring; while he fails not to point out the important additions and confirmation of the theory of "mechanical metamorphism," which are furnished by the microscopical investigations of Lossen, Lehmann, and other recent authors on the subject.

Seismology, the study of earthquake phenomena, is usually treated by the writers of text-books as a branch of vulcanological science; but we agree with the author in regarding it rather as connected with the great movements of earth-masses. It finds an appropriate place in this work between the chapters dealing with dislocations of the earth's crust, and those devoted to the great secular movements of the earth's surface.

In a work like the present, devoted to a discussion of problems of the greatest difficulty, many of which are far from ripe for solution, some of the views of the author will be sure to challenge criticism and others to provoke dissent. Every unprejudiced reader will admit, however, that Dr. Reyer's presentation of his views upon these problems is characterized not only by much originality of thought, but by a studious fairness of manner. The citation of original authorities in every case is a most praiseworthy feature of the work, and those writers from whom the author differs have no cause to complain, as is too often the case, that he has not even tried to understand their arguments. Nowhere does there exist such a rich storehouse of facts and observations bearing upon the great questions of geology as in the volume before us, and we cannot doubt that the completion of Dr. Reyer's important work will mark an epoch in the history of the science, and at the same time constitute an important starting-point for further advances.

J. W. J.

A GUIDE TO THE LICK OBSERVATORY.

Hand-book of the Lick Observatory of the University of California. By Edward S. Holden, LL.D. (San Francisco: The Bancroft Company, 1888.)

THERE are two classes of readers to whom this little book ought to be especially welcome—namely, those who propose to visit California, and those who do not so propose. Travellers will miss from it no useful item of information. They are told where to lodge, what to wear, how to get themselves conveyed to their destination, what to look at and admire. They are put, moreover, in the proper frame of mind for approaching an astronomical sanctuary. The coldest and dullest can hardly under such guidance remain utterly apathetic and unintelligent. The general interest of the work, on the other hand, is sufficiently attested by a glance at the table of contents. It includes a "Sketch of the Life of James Lick," the founder of the Observatory, a history of the institution, descriptions of the buildings and instruments, with sections on "The Work of an Observatory," "Telescopes," "Astronomical Photography," "Clocks and Time-keeping," and "The Principal Observatories of the World."

On none of these subjects are there many, on some there is no one entitled to speak with greater authority than Prof. Holden. Nor is there a second astronomer in the world whose utterances—so far as they are an index to his intentions—are at present of higher moment to science. The future course of observation largely depends upon his use of the vast opportunities placed in his hands. A colossal experiment is being tried at Mount Hamilton; its upshot will lay down the lines of astronomical effort for many a decade to come. For results govern the star-gazing, no less than every other section of mankind.

Prof. Holden vainly, we fear, seeks to disabuse the public of its fixed idea that "an astronomer's business is to watch the heavens go by and to 'make discoveries.' Exactly what these discoveries are," he goes on to say, "is usually not stated, but unless a sufficient number are forthcoming the astronomer is held to be blameworthy." The Lick Observers, however, possess a unique advantage in the value of their negative results. "What we cannot see with our telescope, the most powerful of all, in our elevated situation, the best in the world, need not be looked for with inferior telescopes in less favoured situations."

Celestial photography is evidently designed to be vigorously prosecuted on Mount Hamilton. "One of the principal objects of the Observatory," we are told, "will be to make a photographic map of the heavens, by means of the large telescope and its photographic objective." If carried out on the scale which appears to be indicated, this will indeed be a gigantic undertaking. Its plan is doubtless not yet definitely laid down, but exposures of three hours are spoken of. On Mount Hamilton, two hundred nights in the year—just double the low-level allowance—can be counted on as fit for such work; yet even so, twenty-five years should elapse before the whole sky could be *once* covered by plates each embracing four square degrees, and exposed during three hours. And the resulting priceless record would lose, unless obtained in duplicate, great part of the value properly belonging to it.

The time-service of the Lick Observatory has been for some time completely organized. Every railway-clock in the Southern Pacific States is now regulated from Mount Hamilton. Any watch in San Francisco can be set by the beats of the Lick standard clock, rendered audible by telephone at a distance of sixty miles. The time distributed is the "Pacific standard," which is 6m. 34.3s. faster than the Mount Hamilton local time. Numerous plans and illustrations enhance the usefulness of the "Guide to the Lick Observatory." A. M. C.

OUR BOOK SHELF.

Curve Pictures of London for the Social Reformer. By Alex. B. Macdowall, M.A. (London: Sampson Low, 1888.)

THIS little volume ought to be of great service to all who interest themselves practically in questions relating to social reform in London. It presents by means of diagrams a large amount of trustworthy information about population; density of population; birth, marriage, and death rates; early marriages; death by disease; suicides; drunkenness; licensed houses; apprehensions; felonies;