

## ALPINE GEOLOGY.

*Ein Geologischer Querschnitt durch die Ost Alpen.*—A Geological Transverse Section through the Eastern Alps.—By A. Rothpletz. (Stuttgart: Schweizerbart, 1894.)

THE title of this work at once announces its importance in Alpine geology. Most of us, young and old, are familiar with the section through the Eastern Alps which we owe to the veteran Austrian geologist Hofrath von Hauer. Since 1857, this section, from Passau to Duino, has held its place alone in atlas and text-book. In recent years, Swiss sections, more especially Heim's, have been placed side by side with it, but they only embrace the northern flanks and a part of the central chain. Dr. Rothpletz has given us in this volume the second complete section through the Alpine chain. He has laid the line of section farther east than von Hauer's, beginning at the Bavarian plain in the north, and traversing the Karwendel Mountains in the Bavarian Highlands and North Tyrol, the Tuxer and Zillertal Mountains, east of the Brenner Pass, the Seisser Alpe, Schlern Rosengarten and the Predazzo district in South Tyrol, and the Sette Comuni in the Italian Highlands.

The section, which is printed with colours, extends over a surface area 140 miles in breadth, and has the advantage of being drawn to true scale, vertical and horizontal (1:75000). So accustomed are we to exaggerated heights in Alpine sections, that this true-scale section conveys an impression of rather unimposing mountains and broad valleys. The eye misses also the familiar dotted lines connecting detached parts of the same geological strata, and helping one to a general appreciation of the author's conception of the whole section.

The absence of any such lines is almost a key-note to the character of the work. In the text, the author declares his opinion that (purposes of explanation, of course, excepted) geological sections should represent so far as possible only what has been actually observed, and should not suggest, by means of dotted lines or continued bands of colour, what may be, after all, only imaginary structural relations of the strata. The author's position in this respect is made very clear in the chapter on the "Glarner Double-Fold."

The bulk of the text is devoted to descriptive, stratigraphical, and tectonic details of the various districts surveyed by the author along the line of section, and is illustrated very fully by sketch-maps and sections. Rigid faithfulness of observation is a marked feature throughout. The same care and precision which may be traced in field-methods, has also been bestowed on the literary workmanship of the book. The treatment of the Bavarian Highlands is quite delightful. The drawings display so unmistakably the dependence of the main physical features on the strata, and the contrasts of landscape which tectonic disturbance has frequently produced. We read with equal interest of the synclinal fold, in which the Walchen lake and the Jachenau valley now find themselves, and of the transverse faults which divert the Loisach and the Isar rivers out of their easterly course

into a northern. On the other hand, in the case of the bend of the Inn Valley at Wörgl, it was a pre-Alpine oligocene basin whose soft strata guided the river northward to the Bavarian plain. Again, the author's powers of exposition are seen to advantage when he demonstrates the important fault-line between the Mesozoic limestones north of the Inn and the old crystalline rocks of the central massif. He proves also beyond dispute the geological independence of the Tuxer and Zillertal groups north and south of the Inner Pfitsch valley. But we confess to a feeling of disappointment that although the section passes through these groups, it has been able to do so little to clear away the difficulties of the Central Alps. Several important questions are discussed without advancing us far—for example, the age of the granite intrusion north of Brixen, the significance of the serpentine rocks in the "Tarnthal Köpfe," the constant occurrence of a rocklike "sernifit" at the unconformable succession of Permian and Mesozoic strata on the old Palæozoic and crystalline floor.

Strict adherence to the truths observed in nature, while in itself laudable, seems somewhat to cramp boldness and freedom of thought, and we are landed in a mist of possibilities hovering over a conjectured Triassic period of mountain movement in the Central Alps, which may just as well have been post-Neocomian for all that is proved to the contrary. A similar uncertainty envelops the age-relationships of the overthrust at Tristkogel (Karwendel Mountains), whose special misfortune it is to be directed to the south, whereas the overfolding and overthrusting elsewhere in the Northern Limestone Alps are northward. It seems just possible that the overthrusts in this district are not all told?

One of the most striking chapters in the first part of the book is that on the origin of the Schlern Dolomite in South Tyrol.

Part iii. leaves no doubt as to the author's conception of the form of Alpine structure elucidated by his complete section. In his ideas he differs considerably from the recognised tenets either of Suess or of the Swiss school represented by Heim. Dr. Rothpletz puts the actual areal contraction due to late tertiary folding in the Alps at a much lower figure than Heim did. He emphasises the importance of vertical faults and the great part played by previous Alpine movements in determining the occurrence of overthrusting and overfolding during Pliocene pressure. He finds Suess' theory of the causes of mountain-movement insufficient, and suggests that if the earth's cooling resulted in radial expansion instead of radial contraction, as Suess assumed, a quite as likely explanation could be given of the actual facts observed in crust-movements.

Even if we cannot accept the dicta as final, we must welcome the thoroughly scientific spirit in which the author analyses the various doctrines, and shows what part or parts are doctrines of faith only, and what of the remaining are, in his experience, tenable or untenable. His own opinions are fixed upon most points, but he never seeks to impose *opinions* on his reader; *facts* alone are taught; and there is no more thirsty soil for facts than Alpine geology.

MARIA M. OGILVIE.