

the present volume not only for the interest of its subject-matter, but as an example of the masterly application of the only method which in these inquiries can lead to sure results.

THE KARWENDEL ALPS.

Das Karwendelgebirge. Von A. Rothpletz. Separat-Abdruck aus der *Zeitschrift des Deutschen und Oesterreichischen Alpenvereins*. With Map. (München, 1888.)

THE Karwendel Alps are a mountain mass lying to the north of the valley of the Inn, between Innsbruck and Jenbach, and bounded on the east by the Achensee, on the north and west by the upper valley of the Isar, and on the south roughly by a line drawn along the Hinterautal (the highest part of the valley of that river) to Schwaz, in the Innthal. This region has been explored and mapped by Herr Rothpletz, with the assistance of other workers, and it is described as consisting of three roughly parallel ranges. Though their peaks do not attain to a very great elevation, the higher summits ranging from 6500 feet to rather over 8200 feet, their grand cliffs of cream-coloured limestone and their pine-clad slopes afford very beautiful scenery.

In this part of the Alps the mountain masses are wholly composed of sedimentary deposits which range from the Trias to the Neocomian. The oldest are the *Werfener Schichten*, a mass of sandy shales and sandstones, often containing numerous flakes of biotite, indicative, in all probability, of the denudation of the crystalline masses which form the floor of the Mesozoic rocks in the Alpine region. They correspond in age roughly with the upper part of the Bunter in Germany and England. Then comes the remainder of the Trias, including the *Muschelkalk*, followed by the representatives of the Rhætic, the Lias, and other Jurassic deposits, and a part of the Neocomian, a marine series from top to bottom. Neither the last nor the Jurassic system attains to a great thickness, but both the Rhætic and the Trias are represented by great masses of rock. In the one, the *Haupt-dolomit* occasionally attains to a thickness of 500 metres; in the other, one member, the *Myophorienschichten*, is said to be equally important. Careful descriptions of each subdivision, with lists of the more characteristic fossils, are given in the memoir. Neither Cretaceous nor Tertiary strata occur to bridge over the interval between the Neocomian and the superficial Glacial or post-Glacial deposits.

The physical history of these ranges is made the subject of an elaborate discussion. Herr Rothpletz is of opinion that, at some epoch after the Neocomian and before the commencement of the folding process by which the existing Alpine ranges were upraised, the region was affected by movements which produced a system of faults. In consequence of these, a zone of upheaval was bordered on either side by one of depression. These caused important modifications in the great east and west folds, to which the Eastern Alps are due; the rocks in the two troughs were crushed together; the upheaved tracts were upthrust. A folding plate represents an ideal section of the region after the "pre-

Alpine" movements, side by side with one which shows its present state.

There can be no doubt that, in explaining the physical structure of the Alps, we have to take account of much more than the later Tertiary foldings to which the formation of the mountain-chain is due, such as the old irregularities of the pre-Mesozoic land-surface; and any important system of faults could not fail to produce very marked effects. Also, it seems indubitable that there were interruptions to the downward movement in parts of the Alpine area during the later Mesozoic and the earlier Tertiary times, which may, very probably, have caused faults such as are described by Herr Rothpletz. These, it may be noticed, appear to run obliquely to the general trend of the main folds.

Herr Rothpletz, in conclusion, expresses an opinion adverse to those geologists who consider that glaciers have played an important part in the erosion of valleys, and calls especial attention to the Soiersee, a small lake lying in a fold of the *Plattenkalk*, which, in his opinion, indicates that "the movement of flexure acted in this case with greater rapidity than the erosive action of streams or glacier."

The geological map is on a scale of 1 : 50,000; the separate memoir, of octavo size, contains 76 pages, with 9 plates and 29 smaller illustrations. It also includes a full list of works bearing on the district. So far as we can judge, it is an elaborate and valuable contribution to the knowledge of a region but little known to English travellers, who, however, occasionally pass very near to it along the margin of the beautiful Achensee.

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OUR BOOK SHELF.

Graphical Statics. Two Treatises on the Graphical Calculus and Reciprocal Figures in Graphical Statics. By Luigi Cremona. Translated by Thomas Hudson Beare, Professor of Engineering and Applied Mechanics, Heriot-Watt College, Edinburgh. (Oxford: Clarendon Press, 1890.)

TREATISES on this and allied subjects of the Graphical Calculus are not uncommon in our language; but, although nowadays indispensable for engineering purposes, the subject does not flourish in our theoretical courses of instruction.

The theorems of Graphics once stated—that is, drawn out carefully on the drawing-board—are obvious, or at least do not lend themselves to verbal written demonstration, so that for purposes of competitive examination, the controlling influence of modern education, the subject of Graphical Statics and Calculation is useless.

Geometrical drawing is not taught in our public schools and Universities; and the student in a technical college only requires the bare minimum of Graphics, sufficient to enable him to pass on to practical developments; so that we fear the elegant abstract theorems on the use of signs in Geometry, as applied to lines and areas, graphical multiplication, division, involution and evolution, solution of equations, centroids, rectification and graphical analysis generally, will receive but slight attention.

There is a note of defiance in the Author's Preface to the English edition of "Reciprocal Figures in Graphical Statics" (the second treatise): "At a time when it was the general opinion that problems in engineering could be solved by mathematical analysis only, Culmann's genius suddenly created Graphical Statics, and revealed how many applications graphical methods and the theories of modern (projective) geometry possessed," &c.