

under several headings:—curvature, plication, crush, shear, cleavage, distortion of rock-material and of fossils. He opposes Thurmann's idea that the rocks are primarily plastic and remain so during the mountain-movements, and assumes that the rocks of our mountain-chains have been first consolidated and afterwards altered during the crust-movements; the alteration might be accompanied by fissures and faults or might take place without any fracture, both modes of transformation being quite independent of the physical and chemical constitution of the rocks. Alteration without fracture only occurred at great depths, and was most frequent in the older rocks. According to Heim, the essential conditions for such alteration are the presence of a heavy superincumbent load of rock, and the action of pressures from all sides upon the rock-particles, so that even the most brittle mass of rock would be converted into a state of latent plasticity. The work done by horizontal pressures is the great truth which Professor Heim seeks to inculcate. He brings forward numerous observations to prove the passive behaviour of the "Central Massives" during the upheaval of the present Alpine system. In opposition to Studer's idea that the massives had represented active local centres of disturbance, Heim points out that the crystalline rocks present in these areas themselves show deformation and alteration explicable only upon the assumption that they had suffered no less than the rocks in the northern and southern zones of the Alps from a system of horizontal pressures common to the whole Alps. In Professor Heim's opinion, the individual forms of the Central Massives as lenticular or fan-shaped arches or simple domes had been determined by modifying local influences during the epochs of Alpine upheaval, but had no connection with volcanic subterranean forces. On the contrary there is, according to Heim, no field evidence whatsoever that the igneous rocks of the Central Massives exerted forces of compression upon the sedimentary strata in contact with them.

Heim therefore agrees with the general results of Suess, and explains mountain-making as a consequence of nuclear contraction, crust-subsidence, and the complex action of horizontal strains through the layers of the crust. He calculates that the plication of the Alps has reduced the breadth of that portion of the crust by a distance of about seventy-four miles; hence the crust contraction would seem