

thus produced have masked the proof of the mechanical deformations that preceded or accompanied them. It is in the main to the light thrown on the subject by the microscopical investigation of the minute structures of the metamorphosed masses that we are indebted for the recognition of the important part played by pressure and stretching in the production of the more essential and characteristic features of metamorphic rocks. Many chemical rearrangements may undoubtedly take place apart from any such dynamical stresses, but none of these stresses appears to have affected the metamorphic rocks without being accompanied by chemical and mineralogical readjustments.

The mineral transformations observable in regional metamorphism "may consist (1) in the breaking up of one molecule into two or more with but little replacement of substance, as in the formation of saussurite from labradorite; (2) in a reaction between two contiguous minerals, each supplying a part of the substance necessary to form a new compound of intermediate composition, more stable for the then existing conditions than either, as in the formation of a hornblende zone between crystals of olivine or hypersthene and plagioclase; or (3) in more complicated and less easily understood chemical reactions, like the formation of garnet or mica from materials which have been brought together from a distance, and under circumstances of which it is at present impossible to state anything with certainty."⁴⁸ The following transformations especially deserve attention.

Micasization—the production of mica as a secondary mineral from feldspars or other original constituents. One of the

⁴⁸ G. H. Williams, Bull. U. S. Geol. Survey, No. 62, p. 50. This admirable essay, with its copious bibliography, will well repay the careful perusal of the student. I am indebted to it for the abstract of metamorphic processes above given.