

or more ingredients, as in the remarkable contact zones round certain intrusive bosses. It is obvious, however, that each of these three kinds of metamorphism may be included in the changes which have been superinduced upon a given mass of rock. .

The conditions that appear to be mainly concerned in metamorphism have been already stated (p. 542). It may be added here that these conditions may in different cases be supplied: 1st, by the action of heated subterranean water carrying carbonic acid and mineral solutions (p. 519); 2d, by the action of hot vapors and gases upon underground rocks (pp. 388, 518, 977); 3d, by mechanical movements, particularly those which have resulted in the crushing and shearing of rocks (p. 529); 4th, by the intrusion of heated eruptive rocks, sometimes containing a large proportion of absorbed water, vapors, or gases (pp. 392, 944, 950, 957); 5th, occasionally and very locally by the combustion of beds of coal.

When the term "metamorphism" was originally proposed by Lyell it applied to rocks having a schistose or foliated structure which were regarded as altered sediments. For many years afterward it continued to be used in the same sense, and not until comparatively recently did geologists recognize that rocks originally of eruptive origin but interposed among sedimentary strata were necessarily affected by the changes which the latter underwent in the processes of metamorphism. It is now well established that igneous rocks no less than aqueous have been metamorphosed, and, as Lossen has pointed out, they furnish in some respects even a better starting-point from which to attack the problem of metamorphism, inasmuch as their original definite mineral aggregation, chemical composition,