

and structure furnish a scale by which the subsequent mutations of the rocks may be traced and measured.*

Metamorphism is manifested in two distinct phases. 1st, *Local* (the metamorphism of contact or of juxtaposition), where the change has been effected only within a limited area, round some eruptive mass, beyond which the ordinary condition of the altered rocks can be seen. 2d, *Regional*, where the change has taken place over a large tract without reference to visible eruptive masses, the original characters of the altered rocks being more or less completely effaced. Between the results of local and regional metamorphism, no sharp line can be drawn; they insensibly graduate into each other and may arise from one common cause.

§ i. *Local Metamorphism* (metamorphism of contact or juxtaposition)

In this kind of alteration two fundamental conditions have to be considered: 1st, the nature, mass, temperature, and composition of the eruptive rock; and, 2d, the composition and structure of the rocks through which the intrusive material has been injected. With regard to the first of these conditions, it is obvious that a large intrusion will produce more alteration than a small intrusion of the same rock. The areole of metamorphism round a great boss of granite or of diorite will be broader and the metamorphism itself more intense than round a mere vein or dike. But the case is different when we compare intrusions of altogether unlike materials. The temperature of granite appears to have been comparatively low (p. 524). We never meet with cases of

* Jahrb. Preuss. Geol. Landesanst. 1884, p. 620. See also, for an early study of the influence of contact-metamorphism on augitic igneous rocks Allport, Q. J. Geol. Soc. xxxii. 1876, p. 418.