is actually a vein-formation. Granite eruptions have no more metamorphic power over the adjoining rocks than those of trachyte; for granite in the melted state is identical, essentially, with melted quartz trachyte, and conforms to the same principles as regards cooling. The walls of the dike, or mass, will rapidly chill against the cold inclosing rock, and fail of the coarse crystalline texture of granite; and the dike, or mass, will take the coarse texture only under conditions as to thickness of mass that admit of extreme slowness of cooling. The crystallizing of adjoining rocks to any great distance by ejected granite is as improbable as the same by ejected trachyte. The alleged examples of such change in which the walls retain their coarse crystallization but little altered (when at all), and where the metamorphic schists adjoining are supposed to afford an example of what ejected granite can do, are, probably, either examples of cotemporaneous metamorphism, and the contact minerals some of the products made by the process in the transition region between the terranes or strata; or of metamorphism in overlying beds that were upturned and thrust against the preëxisting range of granite, and which became altered or crystalline as a consequence of the friction.

Regional Metamorphism.

Regional metamorphism is here considered under the following heads: —

(1) Incipient metamorphism, that of the lower or incipient stages; (2) Crystallinic, or that in which there is simply change in crystallization; (3) Paramorphic, or that of a change in crystalline form and not in composition, as when pyroxene is changed to hornblende, or aragonite to calcite; (4) Metachemic, in which there is change in chemical constitution (also styled *metasomatic*, which means change in the *body* of the rock, a general fact under metamorphism); (5) Endo-crystallic, or effects of pressure in modifying the structure of crystals, or in fracturing them. Finally, after considering the metamorphic effects produced in uncrystalline rocks, those occurring in crystalline rocks are described.

The *general effects* of metamorphism are the following: —

In the lower or incipient stage it discolors, dries, consolidates. In higher stages it crystallizes the constituents of rocks; it often produces also chemical changes, making new minerals in the mass; and, as a result, obliterates fossils. Under the high temperature, which may attend it, all the methods of mineral chemistry in nature have a chance for work according to the conditions. The heat may reach that of fusion, producing effects that cannot be distinguished from those of fusion from heat of other sources.

The obliteration of fossils comes in an early part of the changes; for shells are seldom a twentieth of an inch thick, while the grains rendered crystalline by the change are seldom so small as this. Large crinoid stems have the best chance among calcareous fossils for preservation. But no calcareous fossils can withstand the chemical action of siliceous solutions at high temperatures; for even strata of limestone are thinned down by it. Trilobites, and other fossils whose tests are phosphatic, resist longer than the calcareous.

The uncrystalline rock-materials that undergo regional metamorphism. — It has been stated that fragmental rocks are the chief kinds. But it is to be