

corals, and other calcareous relics of living species, these relics of the seas have been ground up, as now in coral and shell-growing seas, and made into limestones; for limestones are for the most part fragmental rocks.

The metamorphic crystalline rocks, as already stated, are only fragmental rocks metamorphosed or crystallized. The alteration in some mountain-making epochs has changed fragmental formations thousands of feet in thickness over many thousands of square miles in area. The borders of such areas are usually less altered than the interior portions; and hence in many places the transition may be passed over, in the course of a score or two of miles, from the simply solidified strata of the outskirts and the faintly crystalline slates and limestone, to the thoroughly crystalline mica schist, gneiss, and marble; and sometimes to granite in masses or veins as an extreme effect.

Chemical deposits, or deposits from solution in fresh or salt waters, have added sparingly to the stratified series, and the outflows of igneous rocks from fissures or volcanic rents have made other large additions. Part of such ejections go to make independent conical mountains; but the larger part are in successive sheets interstratified or overlying other formations.

Of these materials, all are of superficial origin excepting the igneous; these are contributions to the surface from the earth's interior.

Besides stratified terranes, there are also vertical or obliquely placed sheets of rock cutting across the former. They are the fillings of opened cracks or fissures made across the terranes, and comprise *dikes* and *veins*. They have great geological and economical importance because of the gems and ores which veins and dikes have made accessible to man, and because dikes are the inferior portions of great igneous outflows, and reveal something as to the earth's interior. But they are of small extent compared with the stratified terranes, and will be considered under Dynamical Geology.

Formations. — From the explanations that have been given it is apparent that any group in the series of stratified rocks, whether large or small, may be called a *formation*, if the parts are related in period or time of origin; as, for example, the *Devonian formation*, or those of the Devonian era; the *Chemung formation*, or those of the Chemung period under the Devonian; and so on. The term is also used for a group of rocks of similar constitution; as a *calcareous formation*, a *siliceous formation*, etc. The term *terrane* (from the Latin *terra*, *earth*, and the French *terrain*) has essentially the same signification as formation. Formation is commonly used for stratified terranes.

STRATIFIED FORMATIONS.

1. *Structure and Characteristics.*

The series of stratified formations over the globe has a maximum thickness of about 30 miles. But the existing thickness in any one place is seldom even 10 miles. Since rocks are mostly water-made, and for the larger part originated in oceanic waters of moderate depth, wherever any