

sedimentary strata, must be attributed; and in accordance with these views the age of each metamorphic formation may be said to be two-fold, for we have first to consider the period when it originated, as an aqueous deposit, in the form of mud, sand, marl, or limestone; secondly, the date at which it acquired a crystalline texture. The same strata, therefore, may, according to this view, be very ancient in reference to the time of their deposition, and very modern in regard to the period of their assuming the metamorphic character.

*No proofs that these crystalline rocks were produced more abundantly at remote periods.* — Several modern writers, without denying the truth of the Plutonic or metamorphic theory, still contend that the crystalline and non-fossiliferous formations, whether stratified or unstratified, such as gneiss and granite, are essentially ancient as a class of rocks. They were generated, say they, most abundantly in a primeval state of the globe, since which time the quantity produced has been always on the decrease, until it became very inconsiderable in the Oolitic and Cretaceous periods, and quite evanescent before the commencement of the tertiary epoch.

Now the justness of these views depends almost entirely on the question whether granite, gneiss, and other rocks of the same order ever originated at the surface, or whether, according to the opinions above adopted, they are essentially subterranean in their origin, and therefore entitled to the appellation of *hypogene*. If they were formed superficially in their present state, and as copiously in the modern as in the more ancient periods, we ought to see a greater abundance of tertiary and secondary than of primary granite and gneiss; but if we adopt the hypogene theory before explained, their rapid diminution in volume among the visible rocks in the earth's crust in proportion as we investigate the formations of newer date, is quite intelligible. If a melted mass of matter be now cooling very slowly at the depth of several miles beneath the crater of an active volcano, it must remain invisible until great revolutions in the earth's crust have been brought about. So also if stratified rocks have been subjected to Plutonic action, and after having been baked or reduced to semi-fusion, are now cooling and crystallizing far under ground, it will probably require the lapse of many periods before they will be forced up to the surface and exposed to view, even at a single point. To effect this purpose there may be need of as great a development of subterranean movement as that which in the Alps, Andes, and Himalaya has raised marine strata containing ammonites to the height of 8000, 14,000, and 16,000 feet. By parity of reasoning we can hardly expect that any hypogene rocks of the tertiary periods will have been brought within the reach of human observation, seeing that the emergence of such rocks must always be so long posterior to the date of their origin, and still less can formations of this class become generally visible until so much time has elapsed as to confer on them a high relative antiquity. Extensive denudation must also combine with upheaval before they can be displayed at the surface throughout wide areas.