

rocks. In that case the date of their origin would have been thrown back to an area antecedent to the deposition of the Lower Silurian or Cambrian strata, although in reality they were formed in the Oolitic period, and altered at some subsequent and perhaps much later epoch.

*Alps of Switzerland.*—In the Alps, analogous conclusions have been drawn respecting the alteration of strata on a still more extended scale. In the eastern part of that chain, some of the primary fossiliferous strata, as well as the older secondary formations, together with the oolitic and cretaceous rocks, are distinctly recognizable. Tertiary deposits also appear in a less elevated position on the flanks of the Eastern Alps; but in the Central or Swiss Alps, the primary fossiliferous and older secondary formations disappear, and the Cretaceous, Oolitic, Liassic, and at some points even the Eocene strata, graduate insensibly into metamorphic rocks, consisting of granular limestone, talc-schist, talcose-gneiss, micaceous schist, and other varieties. In regard to the age of this vast assemblage of crystalline strata, we can merely affirm that some of the upper portions are altered newer secondary, and some of them even Eocene deposits; but we cannot avoid suspecting that the disappearance both of the older secondary and primary fossiliferous rocks may be owing to their having been all converted in the same region into crystalline schist.

It is difficult to convey to those who have never visited the Alps a just idea of the various proofs which concur to produce this conviction. In the first place, there are certain regions where Oolitic, Cretaceous, and Eocene strata have been turned into granular marble, gneiss, and other metamorphic schists, near their contact with granite. This fact shows undeniably that plutonic causes continued to be in operation in the Alps down to a late period, even after the deposition of some of the nummulitic or middle Eocene formations. Having established this point, we are the more willing to believe that many inferior fossiliferous rocks, probably exposed for longer periods to a similar action, may have become metamorphic to a still greater extent.

We also discover in parts of the Swiss Alps dense masses of secondary and even tertiary strata, which have assumed that semi-crystalline texture which Werner called transition, and which naturally led his followers, who attached great importance to mineral characters taken alone, to class them as transition formations, or as groups older than the lowest secondary rocks. (See p. 93.) Now, it is probable that these strata have been affected, although in a less intense degree, by that same plutonic action which has entirely altered and rendered metamorphic so many of the subjacent formations; for in the Alps, this action has by no means been confined to the immediate vicinity of granite. Granite, indeed, and other plutonic rocks, rarely make their appearance at the surface, notwithstanding the deep ravines which lay open to view the internal structure of these mountains. That they exist below at no great depth we cannot doubt, and we have already seen (p. 569) that at some points, as in the Valorsine, near Mont Blanc, granite and granitic