

bon, and this carbon acts as a carrier of the atmospheric oxygen, first introducing it among the plants and rocks as carbonic acid, and leaving it by other combinations to escape again. These atmospheric agents operate quietly, but the amount of disintegration exhibited almost everywhere by the rocks show that the work is a mighty one. The atmosphere, which, as we breathe it, seems so bland and inefficient, is, in fact, silently crumbling down the solid rocks, we know not how deep, with a power compared with which the effects of the quarryman and the miner are mere infinitesimal blows.

A fourth metamorphic agency at work in the earth is galvanism. All chemical changes do, indeed, imply the presence of this force; but we know of no other agency which, in rocks but partially plastic, could transfer ingredients from one part of the mass to another, as seems to have been done and to be now doing. Thus, a vein of copper ore has been divided by a transverse crack, so that the two ends were separated some inches. But the fissure was subsequently filled with sand, and after some years it was found that the vein was continued across the opening by the introduction of copper ore. Again, how but by galvanism can we explain the production of cleavage, foliation, and joints? These have required a polarizing force, and galvanism is such a force.

Having pointed out the most important agents of metamorphism, we proceed to enumerate their effects as they have been traced out in nature.

1. *Plasticity of the older rocks subsequent to their consolidation.*

This has not hitherto been laid down as an admitted principle: but satisfactory proofs of its truth have fallen under our notice, which its importance leads us briefly to state:

1. It is admitted generally by geologists that the stratified rocks were deposited from water, and consequently with the exception of a very few, perhaps, that crystalized at once from solution, they must have been in a soft state. In fact, they must have been mere accumulations of materials more or less ground down and brought together by mechanical agency.

2. These materials must subsequently have hardened into rock, in order to form shales, sandstones, conglomerates, and fossiliferous, earthy and compact limestones. Though the cementing material of such rocks must have been under the influence of chemical agency, yet the grains and fragments of the body of the rock remain nearly unchanged, bearing decided marks of the mechanical forces by which they were crushed, rounded, and comminuted.

3. But subsequently these rocks must have been brought into a state more or less plastic. This was indispensable in order to produce the following effects, which we find these rocks to have experienced.

1. Their texture has been more or less changed from mechanical into crys-