

heat as an essential agent ; for this agency will explain some facts in the history of veins and dikes, which, on the common theory of fusion from dry heat, were inexplicable. Thus, when we find veins not thicker than writing paper (and those of granite, epidote, etc., are sometimes as thin, and some of trap are less than half an inch), it is difficult to see how they could have been filled by injection of melted rock, especially if the walls were not very hot ; but by means of water the materials could be introduced wherever that substance would penetrate. Again, in the Silurian rocks of Vermont, on the shores of Lake Champlain, we find numerous dikes, both of greenstone and feldspathic rock, either trachytic or feldstone porphyry. These dikes are in some cases partially filled with a conglomerate, or breccia, composed of limestones, sandstones, gneiss, quartz, and granite ; of the rocks, in fact, that occur in the region. Now the limestone fragments have lost none of their carbonic acid. But this would have been driven off, as in a lime kiln, if the dike had ever been heated to redness, or to 1000° of Fahrenheit ; for carbonates are decomposed below that temperature. This is all consistent if the partial plasticity of the dike was aqueo-igneous ; but inexplicable if dry heat alone were concerned. Moreover, such dikes must have been filled mechanically from above, and this might have been done by the currents of an ocean, sweeping into the crevices on its bottom the rounded pebbles accumulated there.

8. *The facts of metamorphism teach us that most rocks have undergone several entire changes since their original production.—Take the unstratified rocks. These have all been cooled and most of them crystallized from a state of fusion, either entirely igneous, or aqueo-igneous. Here is one change ; but from the vertical movement of the isothermal line in the earth's crust, and the erosions at the surface, probably all the original igneous rock has been remelted and recooled, much of it perhaps several times. If any mass has escaped this second fusion, we know not where it is to be found.*

Take the stratified rocks. These being derived by abrasion from the unstratified, have, of course, passed through the same changes. But abrasion has brought them under another, a mechanical change, and water has collected the fragments together at the bottoms of lakes and oceans. Subsequently, by consolida-