

blende, and other minerals are found in it. Mica-schists occur extensively in Brittany, in the Vosges, in the Pyrenees. In all cases, as we approach the masses of granite, in these regions, the crystalline structure becomes more and more marked.

In describing the various facts relating to the metamorphism of rocks, we have said little of the causes which have produced it. The causes are, indeed, in the region of hypothesis, and somewhat mysterious.

In what concerns special metamorphism, the cause is supposed to admit of easy explanation—it is heat. When a rock is ejected from the interior of the earth in a state of igneous fusion, we comprehend readily enough that the strata, which it traverses, should sustain alterations due to the influence of heat, and varying with its intensity. This is clear enough in the case of *lava*. On the other hand, as water always exists in the interior of the earth's crust, and as this water must be at a very high temperature in the neighbourhood of volcanic fires, it contributes, no doubt, largely to the metamorphism. If the rocks have not been ejected in a state of fusion, it is evidently water, with the different mineral substances it holds in solution, which is the chief actor in the special metamorphism which is produced.

In general metamorphism, water appears still to be the principal agent. As it is infiltrated through the various beds it will modify their composition, either by dissolving certain substances, or by introducing into the metalliferous deposits certain new substances, such as may be seen forming, even under our eyes, in mineral springs. This has tended to render the sedimentary deposits plastic, and has permitted the development of that crystalline structure, which is one of the principal characteristics of metamorphic rocks. This action has been seconded by other causes, notably by heat and pressure, which would have an immense increase of power and energy when metamorphism takes place at a great depth beneath the surface. Dr. Holl, in an able paper descriptive of the geology of the Malvern Hills, read before the Geological Society in February, 1865, adopts this hypothesis as explanatory of the vast phenomena which are there displayed. After describing the position of this interesting and strangely-mingled range of rocks, he adds: "These metamorphic rocks are for the most part highly inclined, and often in a position nearly vertical. Their disturbance and metamorphism, their being traversed by granitic veins, and still later their invasion by trap-dykes and their subsequent elevation above the sea-level, were all events which must have occupied no inconsiderable period, even of geological time. I presume," he adds, "that it will not be main-