

heat, were the source of the larger part of the fissures, and the origin of their great diversity in form and positions. The heat varied, therefore, from 212° F. and below, to, in extreme cases, the temperature nearly of fusion; and it slowly declined as the epoch of metamorphism closed, thus making the same region to pass through conditions of high-grade heat and low-grade heat, and, therefore, through conditions for different sorts of veins. All the transfer and transformation processes through superheated steam engaged in metamorphism were at work in vein-making with like efficiency — those of low heat for filling fissures with quartz, and those of higher for making feldspathic or coarse granitic veins, and other kinds. Moreover, the heat so derived continued long, and disappeared with extreme slowness; so that the filling of veins was usually slow, and the crystallizations going on had almost indefinite time for growing, and generally became coarse. The gigantic crystals of beryl, mica, and other species mentioned on page 331 were thus made.

With the heat so widely diffused, it was not necessary that the opened spaces for veins should be continuous. An interrupted series of openings in the upturned strata, as well as the spaces between the leaves of slates and the thinner schists, would have become as readily filled by materials supplied from the rocks, as they would if they had been united along continuous fissures.

The hot-vapor solutions, everywhere at work, would have varied their results according to the temperature, the moisture, and the kinds and contents of adjoining rocks. If the fissures penetrated rocks having veins or deposits of ore, or sparsely disseminated ores, the ores would be as readily transferred to the veins as the stony minerals; and the hot vapors, widely distributed, might gather them in from a wide region either side of the fissure, whether at its lowest or highest depths. The vapors, being under great pressure, would find the fissures escape-ways, and the transfer of material would therefore begin as soon as they were opened. Veins of lead ore (galena), copper ores, tin ore, and other kinds are common in the same rocks that elsewhere have their granite veins. Moreover, veins would be likely to contain ores at their intersections with some of the rocks they cross when not at other intersections. As gold occurs commonly in quartz veins, and in those of the feebly crystalline schists, as chlorite schist and hydromica schist, no great amount of heat was required for their formation, and the rocks near by or below must have afforded the gold.

Igneous rocks often have fissures intersecting them (due to contraction on cooling, or to subterranean action) and cavities (amygdaloidal) within them, that were filled, in vein-like style, from materials brought in laterally, and mostly while the rock was slowly cooling, as explained on page 298. The permeating hot moisture takes silica, alumina, soda, and lime from the feldspar of the rock, and makes zeölites (hydrous silicates, related to the feldspar) in the fissures and cavities; and takes silica, lime, magnesia, and iron from the pyroxene to make, with some alumina, the dark green chlorite; and sets free the excess of silica for making quartz crystals.