

has often been an intimate connection between metalliferous veins and hot springs holding mineral matter in solution, yet we must not on that account expect that the contents of hot springs and mineral veins would be identical. On the contrary, M. E. de Beaumont has judiciously observed that we ought to find in veins those substances, which, being least soluble, are not discharged by hot springs,—or that class of simple and compound bodies which the thermal waters ascending from below, would first precipitate on the walls of a fissure, as soon as their temperature began slightly to diminish. The higher they mount towards the surface, the more will they cool, till they acquire the average temperature of springs, being in that case chiefly charged with the most soluble substances, such as the alkalis, soda, and potash. These are not met with in veins, although they enter so largely into the composition of granitic rocks.*

To a certain extent, therefore, the arrangement and distribution of metallic matter in veins may be referred to ordinary chemical action, or to those variations in temperature, which waters holding the ores in solution must undergo, as they rise upwards from great depths in the earth. But there are other phenomena which do not admit of the same simple explanation. Thus, for example, in Derbyshire, veins containing ores of lead, zinc, and copper, but chiefly lead, traverse alternate beds of limestone and greenstone. The ore is plentiful where the walls of the rent consist of limestone, but is reduced to a mere string when they are formed of greenstone, or "toad-stone," as it is called provincially. Not that the original fissure is narrower where the greenstone occurs, but because more of the space is there filled with veinstones, and the waters at such points have not parted so freely with their metallic contents.

"Lodes in Cornwall," says Mr. Robert W. Fox, "are very much influenced in their metallic riches by the nature of the rock which they traverse, and they often change in this respect very suddenly, in passing from one rock to another. Thus many lodes which yield abundance of ore in granite, are unproductive in clay-slate, or killas, and *vice versa*. The same observation applies to killas and the granitic porphyry called elvan. Sometimes, in the same continuous vein, the granite will contain copper, and the killas tin, or *vice versa*."† Mr. Fox, after ascertaining the existence at present of electric currents in some of the metalliferous veins in Cornwall, has speculated on the probability of the same cause having acted originally on the sulphurets and muriates of copper, tin, iron, and zinc, dissolved in the hot water of fissures, so as to determine the peculiar mode of their distribution. After instituting experiments on this subject, he even endeavored to account for the prevalence of an east and west direction in the principal Cornish lodes by their position at right angles to the earth's magnetism; but Mr. Henwood and other experienced miners have pointed out objections to

* Bulletin, iv. p. 1278.

† R. W. Fox on Mineral Veins, p. 10.