MINERAL VEINS.

The importance of a correct theory concerning mineral veins cannot be overestimated, particularly on this coast where prospecting for the precious metals is so common. The absence of proper knowledge has disappointed the hopes of many, who, deceived by small pocket finds or partial strikes, waste their means in the attempt to develop an illusion. In the hope of satisfying many inquiries concerning the apparently controverted subject of mineral veins, we find in Le Conte's "Geology," published by D. Appleton & Co., N. Y., a clear illustration of the system:

All rocks, but especially metamorphic rocks in mountain regions, are seamed and scarred in every direction, as if broken and again mended, as if wounded and again healed. All such seams and scars, of whatever nature and by whatever process formed, are often called by the general name of *veins*. It is better, however, that dikes and so-called granite veins, or all cases of fissures filled at the moment of formation by igneous injection, should be separated from the category of veins. True veins, then, are accumulations, mostly in fissures, of certain mineral matters usually in a purer and more sparry form than they exist in the rocks. The accumulation has in all cases taken place *slowly*.

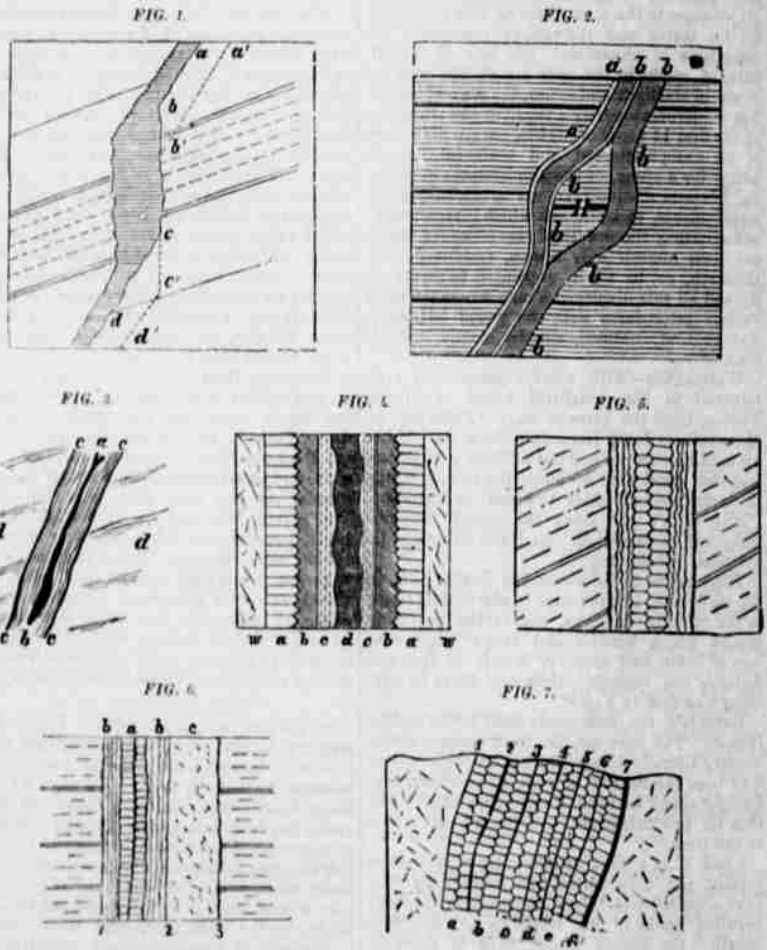
Thus limited, veins are of three kinds. *Veins of segregation, veins of infiltration* and great *fissure veins*. These three, however, graduate into each other in such wise that it is often difficult to determine to which we must refer any particular case. Some writers make many other kinds.

In veins of segregation the vein matter does not differ greatly from the inclosing rock. Such are the irregular lines of granite in granite, the lines differing from the inclosing rock only in color or texture; also irregular veins of feldspar in granite or in gneiss. Under the same head belong also the irregular streaks, clouds and blotches, so common in marble. In these cases there seems to be no distinct line of separation between the vein and the inclosing rock—*no distinct wall to the vein*. The reason is, these veins are not formed by the filling of a previously existing fissure, but by the segregation of certain materials, in certain spots and along certain lines, from the general mass of the rock, either when the latter was in plastic condition from heat and water, or else by means of percolating water, somewhat as *concretions* of lime, clay, iron ore and flint, are formed in the strata.

Veins of infiltration originate in metamorphic rocks which have probably been subjected to powerful horizontal pressure. Besides the wide folds into which such rocks are thus thrown and the great fissures thus produced, the strata are often broken into small pieces by means of the squeezing and crushing. The small fissures thus produced are often filled by *lateral secretion* from the walls, or else by slowly percolating waters holding in solution the more soluble matters contained in the rocks. The process is similar to the filling of cavities left by imbedded organisms, and still more to the filling of air blebs in traps and lavas, and the formation of agates and carnelian amygdules. In veins of this kind, therefore, a beautiful *ribbon structure* is often produced by the successive deposition of different colored materials on the walls of the fissure. Veins of this kind also, since they are the filling of a previously existing fissure, have *distinct walls*. The filling consists most commonly of silica or of carbonate of lime.

Fissure veins are fillings of the great fissures produced by movements of the earth's crust. When these fissures are filled at the time of formation by igneous injection they are called *dikes*; but if subsequently with mineral matter, by a different process, to be discussed hereafter, they are *fissure veins*. These veins, therefore, like dikes, outcrop over the surface of the country often for many miles, 50 or more. Like dikes also they are often many yards in width, and extend to unknown but certainly very great depths. Like dikes and fissures also they occur in parallel systems.

The most obvious characteristics of the veins of this class are their size, their continuity for great distances and to great depths, and their occurrence in parallel systems. As the vein is a filling of a previously existing fissure, the distinction between the vein and the wall-rock is usually quite marked. In many cases, in fact, the vein-filling is separated from the wall-rock by a layer of earthy or clayey matter called a *selvage*, as if the sides of the open fissure had become foul by percolating waters carrying clay, before the fissure was filled with mineral matter. The contents of fissure veins are also



THEORY OF MINERAL VEINS, ILLUSTRATED.

far more varied than those of other classes.

Although more regular than other kinds, yet fissure veins are also often quite irregular—sometimes branching, sometimes narrowing or pinching out in some parts and widening in others (Fig. 1), sometimes dividing and again coming together, and thus inclosing a portion of the wall-rock (Fig. 2). Such an inclosed mass of country rock in the midst of a vein is called a "*horse*." Many of these irregularities are probably the result of movements after the fissure was formed, or even after it was filled. Thus, if *a b c d* (Fig. 1) be one wall of an irregular vein, then it is probable that *a' b' c' d'* was the original position of this wall; but, before it was filled, it slipped up to its present position. Again, movements may reopen a fissure after it is filled. In such cases, if the adhesion of the filling to the wall is strong, portions of the wall-rock are torn away; and if a second filling takes place, a "horse" is formed. Thus *a a a* and *b b b* (Fig. 2) represent the two original walls of an irregular vein; but subsequent movement reopened the fissure to *b' b' b'* and tore away the horse *H*, after which the vein was again filled.

Veins, of course, usually intersect the strata; but in some cases where strata-planes, or else cleavage-planes, are highly inclined, the opening is between these planes, and the veins are, therefore, conformable with them.

Some metals, particularly iron, occur principally in great beds, being accumulated by a process already described. Others, especially lead, often accumulate in flat cavities between the strata, especially of limestone. But most metals occur in veins. All the kinds of veins mentioned above may contain metals, but the segregative veins are usually too irregular and uncertain, and the infiltrative veins too small, to be profitable. True, profitable metalliferous veins are almost always great fissure veins.

The contents of metalliferous veins are of two general kinds, viz., *vein-stuffs* and *ores*. The principal vein-stuffs are quartz, carbonate of lime (calc-spar), carbonate of baryta, carbonate of iron, sulphate of baryta (heavy spar), and fluoride of calcium (fluor-spar). By far the most common of these is quartz, and next is calc-spar. Often, however, the vein-stuff is an aggregate of minerals forming a true rock. Nearly the whole of a vein consists usually of vein-stuff. The ore exists in comparatively small quantities, sometimes forming a central rib or sheet, as is deposited last (Fig. 3); sometimes in irregular isolated masses called bunches or pockets, or in small strings, or grains, irregularly scattered through the vein-stuff and extending often a little way into the wall-rock.

The chemical forms in which metals occur are very various; sometimes they occur as pure metal (as always in the case of gold and platinum, and sometimes in the case of silver and copper), but more commonly in the form of metallic sulphides, metallic oxides and metallic