

ciples, which is said to be in successful operation in France, whereby the ores of silver, lead, and copper are reduced without the use of mercury. This ingenious theory bids fair to solve many perplexing enigmas relating to metallic veins, and to prove that some of them may even now be in a course of formation.

5. M. Neckar and Dr. Buckland suggest that some mineral veins may have been filled by the sublimation of their contents into fissures and cavities of the superincumbent rocks, by means of intensely-heated mineral matter beneath. Thus it has been shown that by heating galena in a tube, and causing its vapor to unite with that of water, a new deposition of that mineral was produced in the upper part of the tube; and in a similar manner boracic acid, which by itself does not sublime, may be carried upward and deposited anew.

Probably it will be necessary to call in the aid of all the preceding hypotheses to explain the complicated phenomena of mineral veins. The third and fifth of these hypotheses meet with the greatest favor with geologists at the present day.

### MINING.

*Preliminary Operations.*—Valuable veins may be discovered by attentively observing the fragments of rock strewed over the surface. Their sources will be either upon the sides of the valleys in which they are scattered, or in the direction of the drift current. Ravines and steep hill-sides in the neighborhood should be carefully explored for traces of veins, which are usually prominently marked, either by elevation above the enclosing rock, depression below it, or by peculiar products of decomposition.

When these means are not available, *shoading* or *costeaning* must be tried. This consists in digging a series of narrow pits, a few feet deep, at right angles to the supposed course of the lodes. If the course of the lodes can not be satisfactorily conjectured, there should be two series of pits at right angles to each other; and these should be connected by underground galleries, that no traces of ore may be overlooked.

If a productive lode has been discovered, the first operation, if the situation requires it, is to drive an *adit level*. This is a gallery intersecting the lode as far as possible below the surface, and yet secure the draining of the mine.

The second operation is to sink a pit or shaft intersecting the lode at a

Fig. 415.

