

we bear in mind how often fossils are obliterated, wholly or in part, even in tertiary formations—how often vast masses of sandstone and shale of different ages, and thousands of feet thick, are devoid of fossils—how certain strata may first have been deprived of a portion of their fossils when they became semi-crystalline, or assumed the *transition* state of Werner—and how the remaining portion may have been effaced when they were rendered metamorphic. Rocks of the last-mentioned class, moreover, must have sometimes been exposed again and again to renewed plutonic action.

CHAPTER XXXVIII.

MINERAL VEINS.

Werner's doctrine that mineral veins were fissures filled from above—Veins of segregation—Ordinary metalliferous veins or lodes—Their frequent coincidence with faults—Proofs that they originated in fissures in solid rock—Veins shifting other veins—Polishing of their walls or "slicken-sides"—Shells and pebbles in lodes—Evidence of the successive enlargement and reopening of veins—Fournet's observations in Auvergne—Dimensions of veins—Why some alternately swell out and contract—Filling of lodes by sublimation from below—Chemical and electrical action—Relative age of the precious metals—Copper and lead veins in Ireland older than Cornish tin—Lead vein in lias, Glamorganshire—Gold in Russia, California, and Australia—Connection of hot springs and mineral veins—Concluding remarks.

THE manner in which metallic substances are distributed through the earth's crust, and more especially the phenomena of those nearly vertical and tabular masses of ore called mineral veins, from which the larger part of the precious metals used by man are obtained,—these are subjects of the highest practical importance to the miner, and of no less theoretical interest to the geologist.

The views entertained respecting metalliferous veins have been modified, or rather, have undergone an almost complete revolution, since the middle of the last century, when Werner, as director of the School of Mines, at Freiburg in Saxony, first attempted to generalize the facts then known. He taught that mineral veins had originally been open fissures which were gradually filled up with crystalline and metallic matter, and that many of them, after being once filled, had been again enlarged or reopened. He also pointed out that veins thus formed are not all referable to one era, but are of various geological dates.

Such opinions, although slightly hinted at by earlier writers, had never before been generally received, and their announcement by one of high authority and great experience constituted an era in the science. Nevertheless, I have shown, when tracing in another work, the history and progress of geology, that Werner was far behind some of his predecessors in his theory of the volcanic rocks, and less enlightened than his