

Marvine and myself, while a similar view has been advanced by S. F. Emmons to account for the origin and concentration of the Leadville ore-deposits.*

Had the copper been derived from the sandstones, then one would suppose that under them should be found the greatest supply of copper; but such is not the case. That the course of water depositing the copper was generally downward is indicated by the finding of spikes of copper and calcite that extend from one bed down into others, with the small end downward, like an icicle; by the fact that when the copper is not uniformly distributed throughout the bed or flow that is mined it is often, although not always, more abundant in its upper portion; and by the fact that the largest masses of copper have usually been found in the upper portions of the veins.

That the copper was deposited after the copper-bearing series was complete is shown by the fact that it is found in fissures extending across the beds that could only have been produced after the beds were in place; by the fact that the copper was deposited subsequently to the jointing of the lavas, owing to its now being found wrapped around the pieces formed by jointing; and by the extension of the copper from one flow down into another as a continuous mass.

The means by which the copper was concentrated and deposited as native copper, instead of occurring in the form of the usual copper ores, is an interesting and as yet unsolved problem that awaits the attention of the chemist who is willing to give his time and thought to the subject, although Pampelly advocates the idea that the principal agent is the oxide of iron. In this he has much to sustain him, and his view is generally adopted.†

The structure of Keweenaw Point may, then, be summarized as follows: A deposit of sandstone overlain by lava-flows mingled with more or less of interbedded conglomerates, and finally overlain by sandstones. Subsequently these beds suffered longitudinal and cross-fracturing and faulting. Later all

* Müller, *Verh. d. Natur. Gesell.*, Basel, 1854-57, pp. 411-438; Bauermann, *Quart. Jour. Geol. Soc.*, 1866, XII., 448-463; Wadsworth, *Notes on the Geology of the Iron and Copper Districts*, 1880, p. 126; Emmons, *Geology and Mining Industry of Leadville*, 1886, pp. 378, 379.

† *Geol. of Mich.*, 1873, I., part II, p. 44.