ered into fissures, and amygdaloidal and other cavities disseminated through the amygdaloidal rock; and under such conditions they have been mined in the Keweenaw copper region to the great depth mentioned.

At Leadville, and other like regions, the liquid lavas were in part the carriers of the ores and vapors to the surface; but the chief part of the concentration of the ores and the corrosion of the limestone may have taken place during the cooling of the lavas. The solid rocks of the globe take in their small percentage of moisture from the waters that become subterranean, and then hold it; a flow of such waters downward through such rocks, and a draining out of their ores, cannot take place, except as complete decomposition is produced; and the small depth to which decomposition extends in most igneous rocks shows that the process is extremely slow. The processes of decomposition and concentration were long kept in progress by the vapors that continued to rise from below after the eruption had ceased. Finally, the infiltration into the vein, or vein-masses, of cold waters from above has carried on further the work of alteration and corrosion, and this work is still in progress.

3. *Ore deposits of doubtful origin occurring in limestone.* — Great lead deposits occur in Paleozoic limestones of the Mississippi Valley in Wisconsin, northern Illinois, and Iowa, and in Missouri and bordering parts of Kansas and Arkansas. They occupy cavities or caverns in various limestones from the Cambrian to the Subcarboniferous. The mines of Wisconsin and Illinois are in the Galena limestone (or the upper part of the Trenton limestone) of the Lower Silurian; those of southeastern Missouri, in the Third Magnesian limestone, of Cambrian age; those of southwestern Missouri, in the Keokuk limestone of the Subcarboniferous period, and to a small extent in the Cambrian; those of central Missouri, chiefly in the Cambrian limestone, but partly in the Subcarboniferous limestone.

The lead ore, galena, is associated with pyrite, marcasite; the zinc ores, calamine (zinc silicate) and smithsonite (zinc carbonate); lead carbonate, malachite, barite, and in some places with black cobalt and an ore of nickel.

The ore, in each of the regions mentioned, occurs in cavities or caverns in the different limestones. From the resemblance between the various deposits, it is concluded that the time of origin was the same for all, and not earlier than the Subcarboniferous period, the age of the latest of the limestones.

As first made known in the geological report of Wisconsin by J. G. Percival (1858), the ore-bearing cavities follow the courses of the joints (or system of fractures) in the limestone, and are most extensive along the larger joints, which are sometimes the lines also of faults. This fact has been confirmed by later observations.

In the Transactions of the St. Louis Academy of Science for 1875, A. Schmidt announced the conclusion that the ore-containing cavities in the Missouri limestones were made when the alterations of the galena took place, producing the associated minerals, and principally in the more porous