ascending waters rich in oxygen, in which the temperature and pressure would have continually been on the increase. Decrease of temperature and relief of pressure were probably the dominant factors in the precipitation of the pyrite from the ascending solutions.

In regard to the valley ores, the primary segregation of pyrite by artesian waters as the first stage in the formation of the present ore bodies is less definitely known. The massive pyrite found in the lower levels of the Friedensville zinc mines and the increase of pyrite with depth in many of the limonite valley-ore mines indicate the presence of pyrite beneath the brown ores in certain places, although the data are too meager to warrant the conclusion that a zone of pyrite is everywhere present. In a brown iron ore mine near Breinigsville, Lehigh County, enough pyrite was obtained in the lower levels to be profitably marketed. In most places, however, the mines were not worked deep enough to determine whether pyrite commonly underlies the limonite ores or not. The increase of sulphur in the ore caused some mines to become unprofitable, but the excess of water and the slumping of the clay banks were the principal causes for other mines closing before a zone of pyrite was reached. Nevertheless, the facts at hand warrant the conclusion that many of the great limonite deposits of the region are underlain by considerable pyrite, which, however, may be and probably is as a rule too greatly disseminated to be of any economic importance.

Part of the precipitation took place in open fissures in the limestones, but much of it was in the nature of replacement of the rocks that constitute the walls of the fissures. This feature was plainly shown in the Friedensville zinc mines, where the limestones were extensively replaced by pyrite.

The brown iron ores are invariably associated with a large amount of clay representing the residuum of shaly strata interbedded with the limestones and sandstones. These impervious shaly beds undoubtedly, to a large degree, furnished favorable conditions for the primary segregation of the pyrite through assisting the concentrated flow of the mineralized underground waters, and the places where the shaly strata were present were therefore most suitable for the deposition of the minerals that were carried in solution.

The presence of pyrite in the lower workings in considerable quantities seems to indicate that the ores cannot have been formed entirely by descending waters that have brought the iron in solution to these places, as is generally supposed. The abundance of pyrite invalidates the explanation of other writers who believed that the ores were deposited in the Cambro-Ordovician sea as limonites or that they represent the oxidation in place of iron carbonate ores that were de-