Possible Causes for Significant Variations in Chemical and Mineralogical Compositions Between the Major Ore Districts in the Mississippi Valley: Tri-State Zinc District, Southeast Missouri Lead District, and Southern Illinois-Kentucky Fluorite District

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Ore deposits of the major ore districts in the Mississippi Valley proper, Tri-State, southeast (SE) Missouri, and southern Illinois, share a similar geological character and contain most of the same minerals, but the abundance of certain minerals is significantly different. The purpose of this communication is to emphasize those differences and speculate on possible causes.

The Tri-State and SE Missouri Districts both contain galena and sphalerite as their main economic minerals, but Tri-State is especially dominated by zinc, whereas SE Missouri is markedly dominated by lead. The ore fluids in the Tri-State District appear to have been generated within and traversed through mainly zinc-containing sedimentary rocks and had little or no interaction with Precambrian rocks. Although the ore fluids in the SE Missouri District were generated within and traversed through zinc-bearing sedimentary rocks, they also had significant interaction with lead-bearing feldspar in Precambrian igneous basement rocks and with feldspar in overlying sedimentary Lamotte sandstone that was derived partly from the Precambrian basement rocks.

Tri-State contains very abundant quartz, mostly as jasperoid, in contrast to the SE Missouri ores that contain only minor local jasperoid. The much greater silica content of the Tri-State ore fluids may be due to leaching of silica during their traverse of the very cherty Mississippian limestones.

The SE Missouri District contains much chalcopyrite, and copper is sufficiently abundant to be recovered at most mines in the Viburnum Trend. Cobalt and nickel also are relatively abundant, mostly as siegenite, and locally cobalt is sufficiently abundant to be recovered as a separate concentrate. The abundant Cu, Co, and Ni in the Viburnum Trend could be due the ore fluids leaching of those elements from copper-bearing iron deposits in the Precambrian basement.

Although fluorite is especially abundant in the southern Illinois-Kentucky District, it is totally absent from the Tri-State and SE Missouri districts. Hicks Dome in the southern Illinois District contains deep fluorite ores that may be of carbonatite origin. As speculated by Reynolds et al. (1997), MVT basinderived lead-zinc-bearing ore fluids may have received significant fluorine contributions from mixing with fluorite-bearing carbonatite-derived fluids.

To summarize, it is speculated that the causes for significant variations in mineralogy between the three major MVT districts in the Mississippi Valley is the result of (1) metals present at the sites of ore fluid generation, (2) metals present in rocks and ore deposits traversed by the ore fluids en route to the sites of deposition, and (3) intermixing of the ore fluids with other fluids during transport.