

Grade Control and Deleterious Materials in Polymetallic Deposits

Raymond Goldie¹

1. Independent Analyst and Director, Toronto, Ontario, Canada M2J 2B6
Email: raymondgoldie@outlook.com

Mine operators use grade control to determine the destination of each block of material in the mine. In polymetallic mines, grades are best expressed in dollars: the Net Smelter Return, NSR, per tonne. To estimate NSRs, geologists can develop a model for each geometallurgical domain in the mine. Metallurgists can make important contribution to this process by assisting geologists to incorporate, into each model, regression analyses that relate mineralogical compositions and assay results to metallurgical parameters such as the rates of recovery of each economic metal to each of the concentrates produced; the compositions of those concentrates; and the payability, by the smelter that receives them, of the metals in each concentrate.

The models should also estimate the recoveries of deleterious materials to each concentrate, and the resulting penalties that would be imposed by the smelter. Deleterious materials comprise mostly halogens and amphoteric elements, both of which reduce the efficiency of smelters. Furthermore, many amphoteric elements, such as antimony and arsenic, are poisonous to people. The penalties that result from the presence of deleterious materials may reduce NSRs by tens of percent, possibly to levels below the cut-off grade. Thus, mine geologists should monitor, not only the economic metals in mined material, but also the presence of deleterious materials. Maintaining NSR models and continually updating the regression analyses that are contained within them requires strong communication of the mine geologist with the mill operators, with the people who market the mine's concentrates; and, should there be a risk of encountering toxic levels of deleterious materials, with the mine's health, safety and environmental officers.