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## Perkins Discontinuities: Structurally Controlled Grade Patterns Diagnostic of Epigenetic Mineralization at the Deposit-Scale

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Our research seeks to rejuvenate the investigation into mineralization timing by examining deposit-scale grade patterns that are discernible solely through the analysis of assay data obtained from drilling, without the need for any specialized analytical equipment other than a 3D viewing software. It builds on the observation and significance of mineralization asymmetry made by pioneering economic geologists as far back as the nineteenth century. The asymmetrical mineralization patterns identified by these pioneers at small scales have largely been overlooked by contemporary economic geologists since the 1960s. However, they are crucial for determining mineralization timing, and Perkins employed this technique to determine the epigenetic timing of sphalerite mineralization at Mt Isa. Despite the unequivocal conclusion reached by Perkins, his observations and conclusions are actively ignored by modern economic geology researchers who continue to assert that Pb-Zn mineralization at Mt Isa is syngenetic.

These asymmetrical mineralization patterns, which terminate laterally against planar boundaries, are termed Perkins Discontinuities in recognition of the significant scientific contribution made by Perkins. These discontinuities are observed across a wide range of commodities at the deposit-scale from hundreds of meters to many kilometers leading us to conclude that the processes responsible for these geometries are independent of commodity types. In fact, they are readily modelled as subtle contrasts in permeability during ore deposition. Perkins Discontinuities form at the late stages of orogenesis, cross-cutting earlier formed folds, therefore diagnostic of epigenetic deposits, yet they are also observed in deposits traditionally interpreted as syngenetic, such as volcanic massive sulfide (VMS), sedimentary exhalative (SEDEX), and nickel sulfide deposits. Previous interpretations of these later deposits as syngenetic are challenged based on the observable presence of Perkins Discontinuities.