

Validating a Structural Model Across Scales and Data Types, From Regional to Deposit – Example From the Merian Mine, Suriname

Catalina Luneburg¹, Jeffrey Bigelow¹, German Escorza¹, William Gerber^{1,3}, Calvin Li^{1,2}, Raysree Patadien¹, Thomas Tsiboah¹, Jannet Zeta¹

¹Newmont, Denver, United States, ²Barrick Mining, Kibali Mine, Democratic Republic of Congo, ³Self-employed, Vancouver, Canada

Coherent structural frameworks and models, integrated across all scales, are essential for accurately defining mineralization controls and informing exploration strategies. Structural models are commonly constructed at the deposit scale from a limited, scale-dependent structural inventory and associated specific datasets, making integration with the broader regional tectonic framework often challenging. Each dataset provides only a partial and resolution-dependent representation of the structural architecture, requiring a comprehensive structural framework that is rigorously validated across multiple spatial scales and data types to ensure a high-quality ore-system characterization.

This study examines the Newmont Merian Mine in Suriname, where gold mineralization is hosted within Paleoproterozoic sedimentary rocks of the Marowijne greenstone belt, metamorphosed to sub-greenschist facies. The orogenic gold system is positioned within the Transamazonian fold-and-thrust belt of the Guiana Shield. Regional-scale lithostructural mapping, integrating geophysical and geochemical datasets and geological mapping, reveals a complex polyphase structural evolution reflecting a Transamazonian subduction-related back-arc basin development, inversion under oblique transpression, major strike-slip domains and regional megaboudins, and subsequent overprinting by large-scale refolding.

At Merian deposit-scale characterization has been refined through detailed pit mapping in combination with blasthole, core log, televiewer, and geochemistry data. These datasets collectively document a structural regime dominated by reverse faulting, isoclinal folding, and multiple vein generations. Deep-feeder faults, anticlinal traps and timing of mineralization were interpreted by integrating the structural concepts learned from the regional lithostructural interpretation

Each dataset and observational scale highlights distinct elements of the structural framework and mineralization controls, therefore it is critical to develop a comprehensive structural model that is consistent across the scales and data sets. Inconsistencies need to be critically assessed to distinguish true structural complexity from limitations related to data resolution or interpretative scale. A coherent and internally consistent framework strengthens confidence in our ore system characterization and supports effective exploration and model update decisions.