**S5**

## Links Between Local Fluid Sinks (orebodies) and Regional Fluid Flow Paths: Formation of Gold-Quartz Reefs of the Barberton Mines, South Africa

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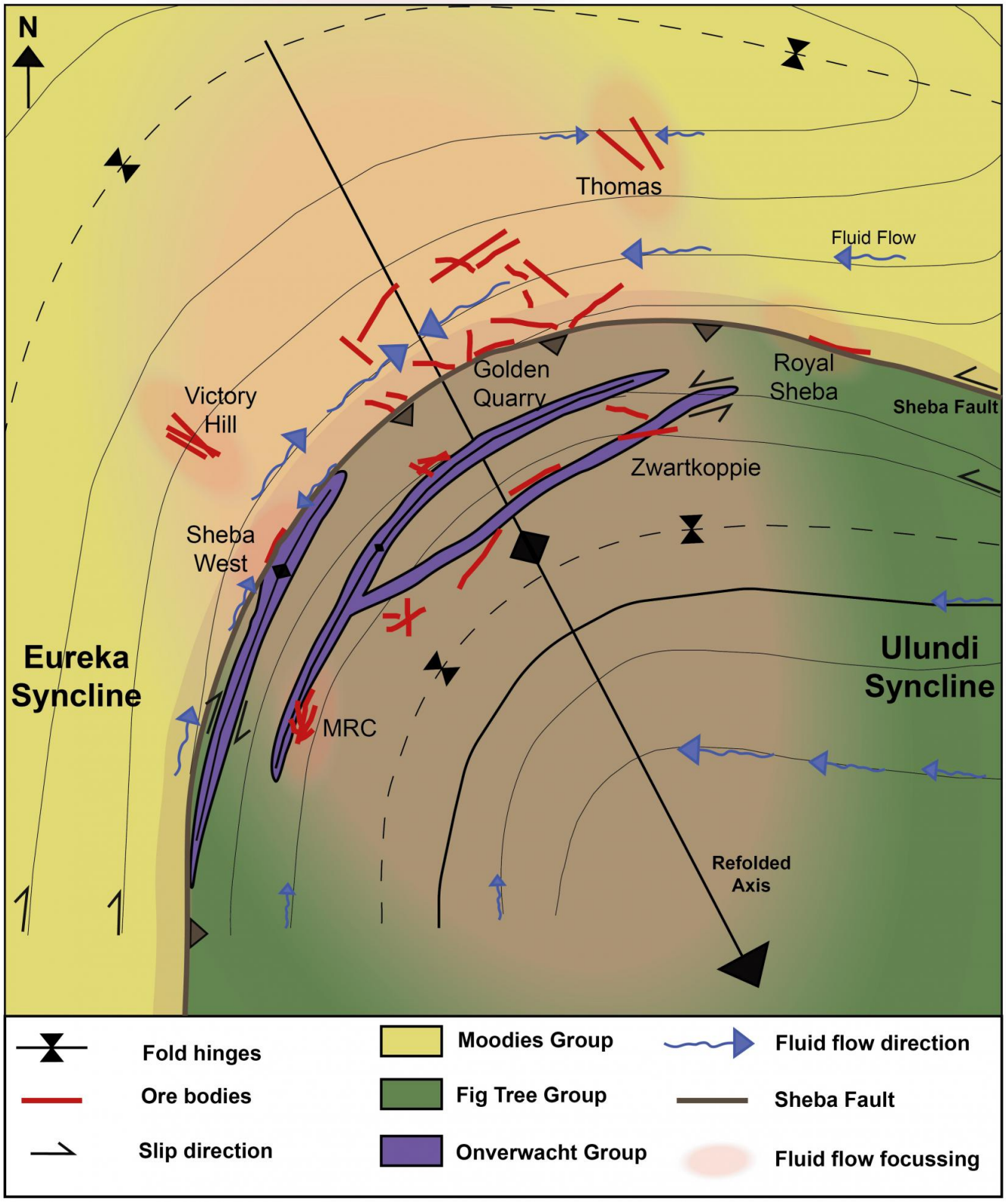
High-grade gold-quartz-carbonate-sulphide orebodies of the Sheba-Fairview Mining Complex (SFC) in the Barberton Greenstone Belt highlight the controls and relationships between localized, high-permeability fluid sinks (economic-grade gold mineralization) and regional, pervasive fluid flow patterns. Gold mineralization (>350 t) in the SFC is hosted by a thick (>5 km), lithologically heterogeneous, well-bedded, low-grade metasedimentary sequence and minor ultramafic rocks (serpentinites and talc-carbonate schists) of the Onverwacht Group, greywacke-shale packages of the Fig Tree Group, and quartzite-conglomerate of the Moodies Group. The metasedimentary rocks are preserved in two complexly refolded, distinctly arcuate regional-scale synclinal structures, separated by the central Sheba Fault. Vein-type quartz-sulphide orebodies (reefs) are developed along the brittle (-ductile) faults of variable orientation and kinematics with the bulk of the mineralization (>85% of orebodies) confined to the hinge region of the late-stage arcuation.

Three main controls of mineralization can be distinguished. (1) Quartz-carbonate stockworks, with commonly free gold, are developed along and in the immediate footwall of the central Sheba Fault in competent Moodies quartzites. The fault crosscuts strata at low angles, and pervasive carbonatization of the siliceous Moodies wall rocks testifies to extensive fluid channelling in the fractured (veined) damage zone of the Sheba Fault. Pods and shoots of economic-grade mineralization (Golden Quarry and Royal Sheba) occur in gentle fault undulations, corresponding to dilational jogs and zones of fluid focussing. (2) Quartz-carbonate-sulphide (± graphite), typically shoot-like orebodies occur along lithological contacts between Fig Tree Group metaturbidites and Onverwacht Group ultramafics in the hanging wall of the Sheba Fault. These orebodies form as a result of strain localization and subsequent fluid focussing during late-stage refolding and flexural slip along lithological contacts with pronounced rheological contrasts. (3) Volumetrically small, but high-grade, sharply bedding-discordant, low-angle thrusts or steep reverse faults in both Moodies and Fig Tree Group rocks are far removed from the central Sheba Fault. The typically highly silicified brittle structures accommodate progressive shortening of the controlling fold structures past the fold lock-up stage.

The localization of orebodies in the hinge zone of the refolded synclines illustrates regional, more pervasive fluid flow paths following regional hydraulic gradients, from the limbs into the hinge zone during refolding of the large-scale folds. Bedding-parallel quartz veinlets, sulphide mineralization, and alteration are ubiquitous and testify to this pervasive fluid flow being mainly accommodated along bedding planes, promoted by bedding slip during flexural-slip folding. This renders crosscutting structures, such as the Sheba Fault, or high-angle thrusts and reverse faults, ideally orientated to tap into this regional-scale fluid flow pattern. Lithological contacts between ultramafic and metasedimentary rocks present slip horizons where strain has been localized as a result of pronounced rheological contrasts. The results also highlight that the controls of gold mineralization in the SFC shares many similarities with Phanerozoic turbidite-hosted gold deposits rather than the commonly greenstone-hosted gold of many Archaean greenstone belts.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Thomas
Fluid Flow
Victory Hill
Golden Quarry
Royal Sheba
Sheba Fault
Zwartkoppie
Sheba West
Eureka Syncline
Ulundi Syncline
MRC
Refolded Axis
Fold hinges
Ore bodies
Slip direction
Moodies Group
Fig Tree Group
Onverwacht Group
Fluid flow direction
Sheba Fault
Fluid flow focussing