

New Geological Interpretation of the Rhyacian Barama-Mazaruni Greenstone Belt of Northern Guyana: Implications for Mineral Exploration

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The greenstone belts of Guyana, known as the Barama-Mazaruni Supergroup, comprise Rhyacian (2200–2100 Ma) volcano-sedimentary packages, enclosed by granitoids and gneisses deformed by the Trans-Amazonian Orogeny (2100–2080 Ma). Historically divided into three belts, the Barama, Cuyuni, and Mazaruni based on rock type, these units remain poorly characterized beyond the local scale. This study presents new results of the first comprehensive regional mapping campaign of these greenstone belts since the 1970s, integrating new LA-SS-MC-ICPMS U-Pb zircon ages from volcanic and sedimentary units. Field mapping across multiple river traverses, combined with whole-rock geochemistry, reveals six new geological domains across Northern Guyana which are clearly differentiated by age and rock composition. These domains span early mafic volcanic assemblages (2200–2180 Ma) to intermediate–felsic volcanic successions (2170–2120 Ma), as well as nearby sedimentary packages that are synchronous with or postdate volcanic activity (2150–2110 Ma). Notably, late alluvial/fluvial sediments are identified for the first time in Guyana (2105–2095 Ma). Lithogeochemical signatures with strong evidence of crustal contamination indicate a rift-related or back-arc origin. Detrital zircon populations in the syn to late volcanic sedimentary units suggest preexisting early Rhyacian or Siderian crustal sources, but they lack the Archean components of the nearby Imataca (Venezuela) or Amapa (Brazil) terranes. These findings have significant implications for mineral exploration in the region. The domain boundaries, interpreted as growth faults, outline the primary architecture of the greenstone belts. Their reactivation during Trans-Amazonian orogenesis (~2100–2080 Ma) likely played a critical role in the localization of many gold deposits.