

World-Class Greenstone Gold Deposits and their Exploration

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Greenstone terranes have been a major historical source of gold and remain attractive exploration environments today, as illustrated by recent successes in Tanzania and West Africa. However, finding world-class deposits in greenstone terranes is increasingly challenging and must rely on refined models and exploration criteria.

Several styles of mineralization, with recurring geologic characteristics, can be defined among world-class greenstone gold deposits. These include, in approximate order of decreasing abundance, quartz-carbonate vein, disseminated sulfide, stockwork veinlet, massive sulfide and carbonate-rich vein styles. A number of world-class deposits combine more than one style of mineralization, in a few cases clearly overprinting each other. In addition, there is now clear evidence for the existence of multiple ages of gold mineralization in greenstone terranes, based on both field and geochronologic constraints. A majority of quartz-carbonate vein deposits have formed late in the history of the belts, but many examples of the other deposit styles show evidence of overprinting by metamorphism and significant deformation, indicating their formation during earlier stages of greenstone belts evolution.

Several models have been proposed for gold deposits in greenstone terranes. The orogenic (mesothermal) model accounts well for quartz-carbonate vein deposit. However, other models such as gold-rich massive sulfide, shallow-marine epithermal and intrusion-related (porphyry-style) models, best explain deposits of the other styles and the early timing of some deposits. Consideration of multiple models requires different sets of exploration criteria. Depending on the model pursued, efforts will be focused on different features of greenstone belts and will call on different exploration techniques.