

Paleoproterozoic Gold Deposits Hosted by Albite- and Carbonate-Altered Tonalite in the Chirano District, Ghana, West Africa

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Abstract

Paleoproterozoic Birimian Supergroup rocks of southwest Ghana host numerous mesothermal lode gold deposits, including the >38 million ounce (Moz) Ashanti deposit at Obuasi and other multimillion ounce deposits at Bogoso, Konongo, Prestea, Bibiani, and in the Yamfo-Sefwi region. Gold deposits of the Chirano district are localized along the Chirano lode horizon, a 9-km segment of the Chirano, and related shear zones on the southeast margin of the Sefwi-Bibiani belt. Economically significant mineralization at Chirano is largely hosted by altered tonalite intrusions. Weaker alteration and subparts per million gold grades extend into adjacent Birimian mafic igneous rocks and Tarkwaian Group sedimentary rocks. Pink albite alteration (albite-quartz-pyrite-hematite-rutile \pm leucoxene-chalcocopyrite \pm gold) and later pale carbonate alteration (ankerite-sericite-quartz-pyrite-hematite-gold (fineness 910–940)-Ag-Au-telluride) characterize the gold deposits of the Chirano district. Alteration assemblages and the Bi, Te, and Mo contents of the mineralized rocks at Chirano are more typical of lode gold deposits than orthomagmatic gold deposits.

Alteration assemblages at Chirano contrast with the graphite-carbonate-pyrite-arsenopyrite-pyrrhotite assemblages that dominate the lode gold deposits in southwest Ghana, which are hosted by graphitic shear zones and Birimian sedimentary rocks. Differences between alteration assemblages at Chirano and those in graphitic shear zones may reflect the different wall-rock assemblages with which the hydrothermal fluid equilibrated rather than different fluid sources.

Mineralization in the Chirano district formed during a relatively late episode of small-displacement, brittle cataclasis on the Chirano lode horizon after reverse ductile shearing associated with regional-scale shortening. This structural history is similar to that documented at the larger Ashanti and Bogoso deposits on the opposite side of the Kumasi basin. Timing relationships are compatible with all three deposits, forming during a single mineralizing event late in the Eburnean 2 orogeny. At Chirano limited fault-vein geometric relationships imply a component of reverse movement during mineralization, whereas sinistral strike-slip movement accompanied mineralization at Ashanti and Bogoso. No consistent correlation was observed between the asymmetry of bends and splays in the strike of the Chirano lode horizon and the location or style of individual gold deposits, unlike at Ashanti and Bogoso. The structural settings of deposits in the Chirano district indicate that an exploration strategy, which assumes mineralization occurred during sinistral offset in the host structures, similar to relationships at Ashanti and Bogoso, may result in significant targets being ignored.

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