Paper Number: 3354

A review of the Birimian Supergroup- and Tarkwaian Group-hosted gold deposits of Ghana

Smith, A.J.B.[1], Henry, G.[1] and Frost-Killian, S.[2]

[1]DST-NRF CIMERA, Department of Geology, University of Johannesburg, PO Box 524, Auckland Park, South Africa, 2006, bertuss@uj.ac.za
[2]The MSA Group, 20B Rothesay Avenue, Craighall Park, South Africa, 2196.

Ghana is the largest producer of gold in West Africa, a region with over 2,500 years of history with regards to gold production and trade. Modern exploration for and mining of gold in Ghana dates from 1874 with the establishment of the British Gold Coast Colony, which was followed in 1957 by the independence of Ghana and increased gold production since the early 1980s through Ghana's Economic Recovery Plan. At the time of writing, gold production (108.2 tonnes or 3.48 million ounces [Moz] in 2014) accounted for approximately one-third of Ghana's export revenues, with 36% of gold production coming from small-scale mining.

The majority of the gold occurs in two styles of mineralisation, namely mesothermal quartz vein-hosted and -associated gold in metavolcanics and metasediments and modified paleoplacer gold in conglomerates. These styles of mineralisation occur in the Paleoproterozoic Birimian Supergroup and Tarkwaian Group that make up Ghana's mainly southwest to northeast trending Birimian belts. Significant gold resources also occur as hydrothermal mineralisation in basement-type granitoids which show some geological association with the Birimian Supergroup-hosted mesothermal mineralisation. The majority of the gold mineralisation is believed to have formed between approximately 2.15 and 2.06 Ga during the Eburnean orogeny.

The mesothermal quartz vein gold mineralisation is usually confined to tectonic corridors within the Birimian belts and is strongly associated with shear zones and fault systems. The quartz veins show multiple stages of formation and are steeply dipping with the gold mineralisation occurring either as free gold within fractures in the veins or as invisible gold within disseminated sulphides in the host rocks surrounding the veins. The vein- and sulphide-hosted gold is strongly associated with deformational fabrics formed by the Eburnean extensional and compressional events, respectively, suggesting that disseminated sulphide mineralisation predates quartz vein-hosted mineralisation. The fluid from which the gold precipitated is believed to have been of metamorphic origin and carbon dioxide (CO_2) dominated with lesser water (H_2O) and nitrogen (N_2) and minor methane (CH_4). Gold precipitation was likely caused by decrease in pressure, temperature and CO_2-H_2O immiscibility at depths between 7 and 11 km.

The paleoplacer gold mineralisation shows some hydrothermal modification and occurs mostly within the conglomerates and to a lesser extent within the interbedded quartzite of the Banket Series of the Tarkwaian Group. The gold occurs as free gold in the matrix of the conglomerates and as intergrowths and overgrowths on and inclusions in other heavy mineral grains. Based on strong evidence for paleoplacer mineralisation, the gold was likely deposited with the conglomerates in alluvial fans and braided tributary channels. Because the Eburnean compressional event associated with the Birimian Supergroup-hosted mesothermal gold mineralisation also overprinted the gold-bearing Banket

conglomerates, the former gold occurrences could not have acted as the source for the paleoplacer gold.

Hydrothermal gold mineralisation occurs in the Paleoproterozoic belt and basin granitoids that intrude the Birimian belts, as well as in the sedimentary basins occurring between the belts. Gold mineralisation within the granitoids occurs as micro-inclusions in sulphides in small, steeply dipping stockworks and as sulphide disseminations concordant with regional faults and shears. A gold-bearing fluid similar to that for the Birimian Supergroup-hosted quartz vein gold mineralisation, but with a larger H_2O component, is proposed to have formed the granitoid-hosted gold mineralisation.