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The world-class Wona-Kona gold deposit, Burkina Faso

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ABSTRACT

The world-class >4 Moz Wona-Kona gold deposit is hosted within the Paleoproterozoic Birimian Houndé greenstone belt which is the most important gold mineralized belt in the western part of Burkina Faso, with a cumulative reserve of ~11 Moz. The mineralization consists of a pervasive silicification with disseminated pyrite–arsenopyrite crosscut by quartz–carbonate veinlets (1 to 10 cm wide) forming a vertical, thick (up to 40 m) and laterally extensive (5 km) northeast trending orebody hosted within a large (200 m wide) shear zone of regional extent. Gold occurs in association with 3 generations of pyrite and 2 generations of arsenopyrite. Free gold, interpreted as the last mineralizing event, occurs as late fracture filling in the pervasive silicification zone.

1. Exploration and exploitation history

The world-class Wona-Kona gold deposit, one of the largest gold deposits in Burkina Faso (Augustin, 2011), is located within the Houndé greenstone belt (HGB) situated about 260 km from Ouagadougou (Fig. 1). Exploration by SEMAFO Inc. (Société d'Exploration Minière en Afrique de l'Ouest) on the Mana property started in October 1997. The Wona prospect was discovered with trenches in 2000 following a BLEG (bulk leach extractable gold) regional soil geochemistry program that yielded isolated and weak anomalies (>20 ppb including a peak anomaly of 64 ppb). Detailed work on the target started in 2001 with gradient IP (induced polarization), trenches, RC (reverse circulation) holes, RAB (rotary air blast), CIL (carbon in leach) tests on RC drill hole material and a first resource estimate. Results confirmed the extension of the Wona structure over a 1.6 km strike length open in a NE trend. As a result, an application for the Kona permit to the northeast was reached in 2001. Certification of the Wona resources was completed in 2003. A formal feasibility and environmental impact study was initiated in 2004, and positively completed in 2006. Production started on February 15, 2008, and the first gold bar was poured on March 31, 2008. At this time, estimated mine life was 8 years from the start of operations in early 2008 (SGS, 2008).

Since 2008, the Wona-Kona gold deposit has produced 1,160,700 oz, and at the end of 2014, the Wona-Kona reserves stood at 13,275,500 t at a grade of 2.27 g/t Au for 970,100 oz (www.semafo.com). Measured and indicated resources stand at 1,787,000 oz (Table 1). All these gold ounces were defined only for the first 150 m of depth for a very long deposit, hence justifying the "world-class" classification.

Intensive mapping, auger, diamond and reverse circulation drilling, trench sampling and geophysical surveys over the years, have provided a better understanding of the structural control and origin of gold mineralization at the Wona-Kona deposit at property scale. This methodology has been successful for SEMAFO Inc. with the discovery of many other gold deposits in the Mana district: Nyafé (1999), Maoula (2000), Fofina (2010), Fobiri (2010), Yaho (2011: Sinaré, 2012) and Siou (2012).

2. Regional geology

The Wona-Kona gold deposit is located in the Paleoproterozoic Baoulé-Mossi domain of the West African Craton in the northwest branch of the Birimian Houndé greenstone belt (HGB) (western Burkina Faso). The HGB is a north to northeast trending structure comprising a basal unit of tholeiitic basalt and gabbro and interbedded greywacke–siltstone–shale units (Baratoux et al., 2011). These are overlain by andesites and volcanic rocks, composed of massive, pillowed, brecciated and tuffaceous facies, which occur in the central and southern part overlaying the tholeiitic unit (Baratoux et al., 2011). Abundant layers of cherts (ferruginous and manganiferous) and quartz veins injections are associated with the volcano-sedimentary rocks. The basalt mafic unit is bound to the east by the Boni shear zone, which defines the contact with the late Tarkwaian-type sediments (Baratoux et al.,

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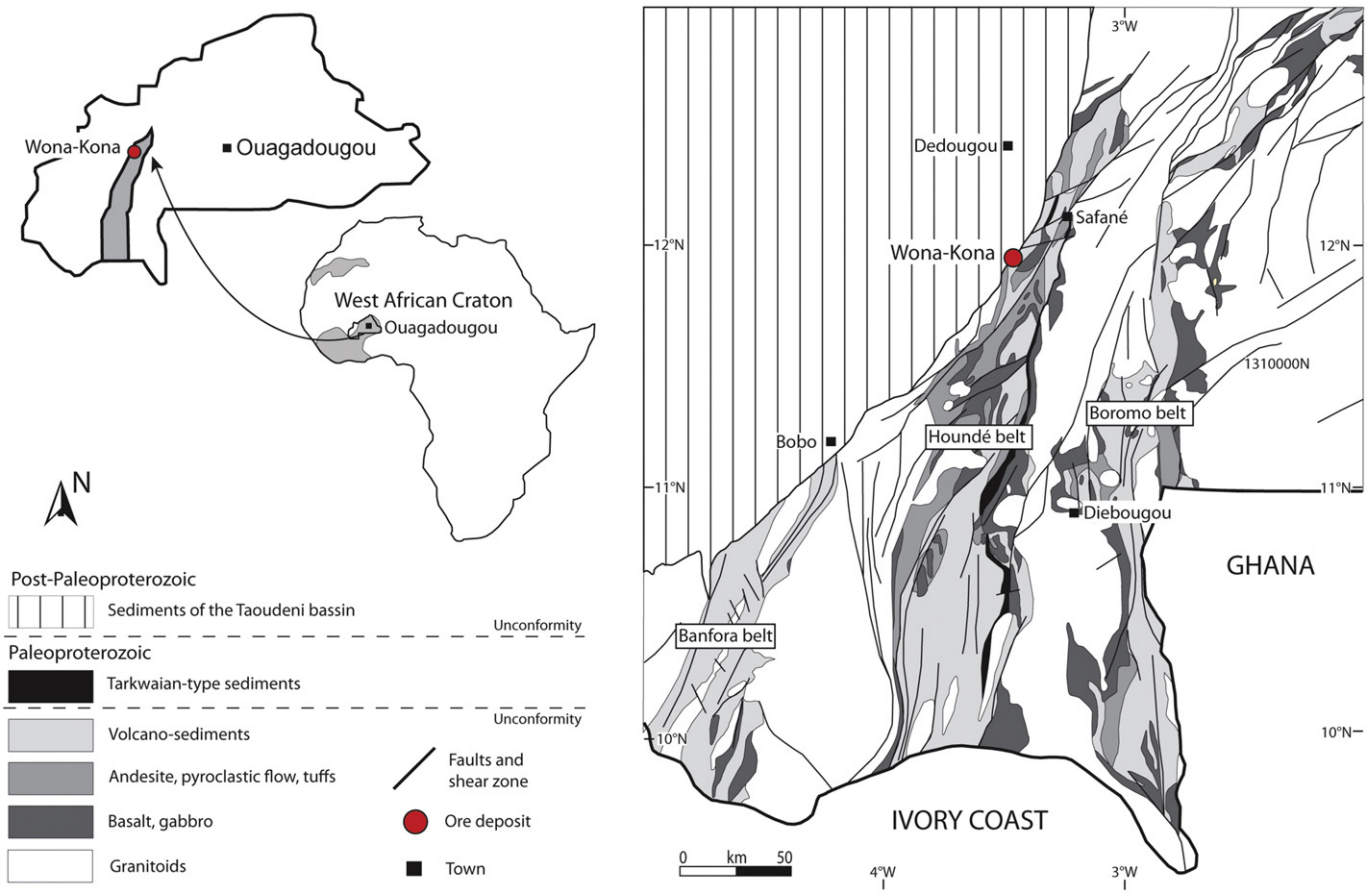

Fig. 1. Regional geology of western Burkina Faso showing major shear systems and Wona-Kona deposit. Modified from Baratoux et al. (2011).

2011) with a maximum deposition age between 2171 ± 7 to 2113 ± 23 Ma (Bonkoungou, 1994; Bossière et al., 1996). In the West, the Birimian basement is unconformably overlain by Neoproterozoic sediments of the Taoudeni basin (Deynoux, 1983; Bertrand-Sarfati et al., 1990).

The tectonometamorphic evolution is polycyclic with at least three deformation events; greenschist-facies metamorphism with amphibolite facies assemblages locally occur in contact with some granitoids. The principal deformation imprint of the Eburnean orogenesis (2160–2110 Ma, Baratoux et al., 2011) is related to the first and second deformation phases (D1–D2). The D1 event resulted in E–W to WNW oriented compression characterized by isoclinal folds and local shear zones (Baratoux et al., 2011). The D2 event consisted of regional sinistral N–S trending or dextral ENE-trending anastomosing shear zones. Late-Eburnean or perhaps even Pan-African D3 deformation is recorded in some lithologies (post 2109 Ma; Baratoux et al., 2011).

The HGB is intruded by multiple episodes of granitoid intrusions including a tonalite–trondhjemite–granodiorite suite (TTG) and granitic intrusions. Late swarm doleritic and gabbro dykes transect all of the present lithologies and are currently dated at 215 ± 15 Ma (Hottin and Ouedraogo, 1992).

Table 1
Production and location summary of the Wona-Kona deposit.

Deposit name	Wona-Kona
Commodity of exploitation	Au
Longitude	−3.413360
Latitude	11.990166
Geographic location	The project is situated in Western Burkina Faso at 260 km west of Ouagadougou
Geological location	West African Craton; Leo-Man Shield; Baoulé-Mossi domain; NE-striking Houndé greenstone belt
Deposit status	Mined since 2008
Deposit type	Shear zone-hosted quartz–carbonate veins and silicification; volcano-sedimentary rock/tholeiitic basalt/granodiorite hosted
Current owner	Semafo Inc.
Average grade	2.27 g/t
Proven and indicated	2.8 Moz proven and indicated resource (2014)
Past production	1.2 Moz (2008 to 2014)

3. Host rocks and hydrothermal alteration

The Wona-Kona gold deposit is situated along the contact between a granodiorite batholith (Wona intrusion) and an assemblage of tholeiitic basalt and volcano-sedimentary rocks. The tholeiitic basalt has an aphanitic texture with various proportions of epidote, chlorite, actinolite and albite. The volcano-sedimentary rocks are constituted by interbedded mafic volcanoclastic rocks and graphitic black shales rich in sulfides. They are crosscut by felsic to intermediate dyke swarms (Augustin, 2011, Fig. 2). Felsic porphyry dykes contain quartz and plagioclase feldspar porphyroblasts (1 to 3 mm) in a quartz–muscovite matrix. Dioritic dykes include plagioclase feldspar, chlorite and ankerite.

The Wona-Kona orebody is hosted along a major northeast trending and steeply dipping shear zone. Three deformation events (D1–D3) can be distinguished. The first deformation (D1) is characterized by a main vertical planar fabric trending NNE–SSW related to the regional shortening associated with the accretion during the D1 Eburnean orogeny. D2 is evident in a S2 fabric with a shallow plunging stretching lineation oriented NE–SW and the geometry of sigmoidal dipping quartz veins indicating dextral shear movement. D3 is characterized by an E–W trending subvertical cleavage (S3) only developed in highly strained