Journal of African Earth Sciences 57 (2010) 423–430

Contents lists available at ScienceDirect

Journal of African Earth Sciences

journal homepage: www.elsevier.com/locate/jafrearsci

On the occurrence of gold mineralizations in southeastern Ivory Coast

E. Kadio, Y. Coulibaly *, M.E. Allialy, A.N. Kouamelan, K.B.K. Pothin

Laboratoire de Géologie du Socle et de Métallogénie, UFR STRM, Université de Cocody-Abidjan, 22 BP 582, Abidjan 22, Côte d'Ivoire

ARTICLE INFO

Article history:
Received 10 July 2008
Received in revised form 22 September 2009
Accepted 17 November 2009
Available online 22 November 2009

Keywords:
Gold
Hydrothermalism
Tectonics
Shear zone
Birimian
Aféma (Ivory Coast)

ABSTRACT

Gold mineralizations are known to occur in the Paleoproterozoic (Birimian) formations of the Aboisso area, southeastern Ivory Coast. These formations, which have been structured during the Eburnean orogeny, mainly consist of volcanic, volcaniclastic and sedimentary rocks intruded by granitic, basic and ultrabasic plutons. Exploration of these terranes has revealed numerous gold mineralizations, the most significant of which are located in the Aféma shear zone. Four distinct types of mineralizations can be distinguished based on the typology of the host rocks. These include mineralizations enclosed in highly silicified volcanic rocks (type 1), mineralizations closely related to intense silicification of metasedimentary rocks (type 2), mineralizations associated with silicified polygenic conglomerates (type 3), and mineralizations encountered in brecciated and silicified zones within a metadiorite sill (type 4). Gold is observed either as free gold, or in association with pyrite, arsenopyrite, sphalerite, chalcopyrite, ±pyrrhotite, ±galena, ±anatase, ±monazite, ±magnetite. Gold and the various sulfides are mostly of hydrothermal epigenetic origin. The fact that the gold mineralizations occurs in brecciated and silicified zones around granitoid intrusions clearly indicates that post-magmatic hydrothermal activity and tectonics exerted a major control during the mineralization process.

1. Introduction

The gold fields of the Aboisso region in southeastern Ivory Coast are located within a 4570 km^2 area, which is limited to the North and South by the 5°45′N and 5°15′N parallels, and to the West and East by the 3°25′W and 2°45′W meridians (Fig. 1). The region of Aboisso has long been known for its gold occurrences. This is testified by the numerous vestiges of artisanal workings which can be found in almost each village of the area. The first of these workings date back to the early 18th century (Perrot, 1978). The first surveys and exploitation tests were carried out between 1895 and 1914 (Bonnault, 1934). The mineralized lode of Akressi, exploited between 1905 and 1908, produced ca. 25 kg of gold (Sonnendrucker, 1967). Continued exploration from 1934 on resulted in the exploitation of several gold deposits by the *Société des Mines d'Aféma* (SOMIAF) between 1991 and 1998 and the production of ca. 4 tons of gold (Pothin et al., 2003; Assié, 2008). From an economic point of view, the most significant deposits are located in the Aféma shear zone. The purpose of the present paper is to summarize the results of recent investigations on these gold deposits.

2. Geological setting

The Aboisso region (Fig. 2) belongs to the Baoulé-Mossi domain of the Man shield (Bessoles, 1977), which primarily consists of Paleoproterozoic formations of Birimian age. These formations correspond to a mixture of variably metamorphosed volcanic, plutonic, and sedimentary rocks which have been formed over a relatively short period of time (2.25–2.05 Ga) during a period of crustal growth known as the Eburnean orogeny (e.g. Abouchami et al., 1990; Liégeois et al., 1991; Boher et al., 1992; Hirdes et al., 1992, 1996; Taylor et al., 1992). Birimian formations generally occur as highly deformed rocks, and are affected by overthrusts and fault folds (e.g. Junner, 1935). Such highly deformed rocks occur in the Aféma shear zone, while the other geological formations of the area have been affected to a lesser degree. Kinematic indicators such as schistosity, lineations and striations recorded in metasediments and along contact zones between metasediments and metavolcanites reveal that the main displacement along the shear zones was a vertical movement along reverse faults with minor sinistral lateral throw. The polycyclic characters of the Birimian orogenic belts have been established by Milési et al. (1989, 1992) which defined three tectonic phases D_1, D_2, and D_3:

- the first collisional tectonic phase D_1 (dated at about 2100 Ma) is characterized by a first schistosity (S_1) related to initially flat-lying isoclinals faults;
- the D_2 deformation is marked by a second schistosity (S_2) which is subvertical with a NE-SW trend, and is associated with regional anticlinal and synclinal folding. The D_2 deformation is marked by N-S to NNE-SSW sinistral strike-slip faults which are locally associated with SE-verging thrust zones;

* Corresponding author. Tel./fax: +225 22 48 38 03.
E-mail address: yacoulib@hotmail.fr (Y. Coulibaly).

1464-343X/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jafrearsci.2009.11.008

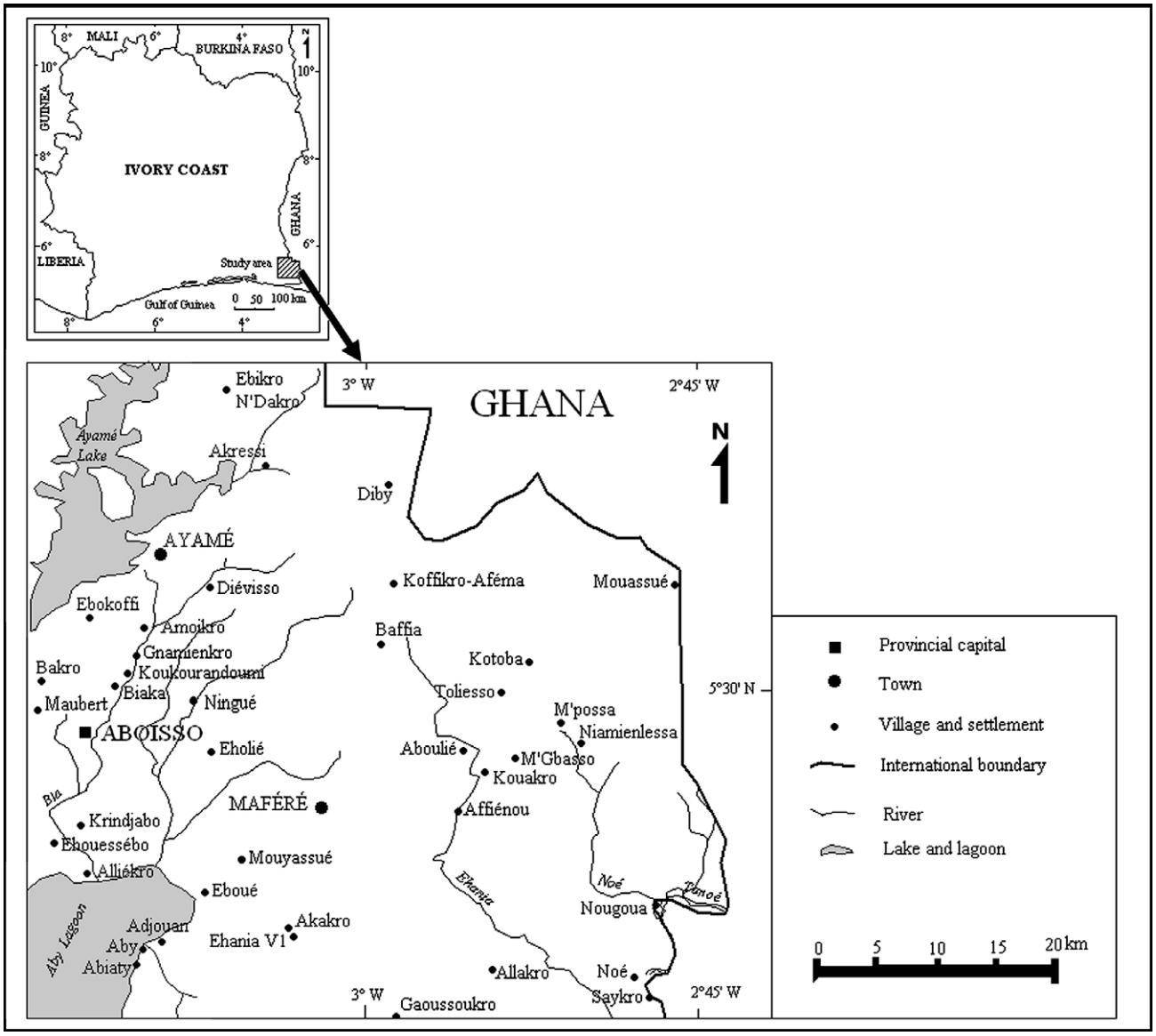

Fig. 1. Location of the study area.

– the D_3 deformation is related to NE-SW dextral strike-slip faults.

The Aféma gold district is characterized by three NE-SW tectonic belts, which are respectively occupied by the Tanin, Bia and Asupiri rivers, all of which are tributaries of the Ehania river. The geology of the area essentially consists of volcanic, volcaniclastic and sedimentary rocks, intruded by granitic, basic, ultrabasic and doleritic plutons (Delor et al., 1992). From West to East, the volcaniclastic rocks are successively represented by fine-grained biotitic and amphibole-bearing gneisses, tuffaceous schists grading into graphitic schists (ampelites), and chloritic and amphibolic orthoschists. The main characteristics of these volcaniclastic rocks are the following:

– the biotitic and amphibole-bearing gneisses are of sedimentary origin. They correspond to fine-grained arenaceous, siliceous, and conglomeratic beds. The pebbles in the conglomerates consist either of quartz or of fragments of metadiorite. The major constituent minerals of these gneisses include biotite, muscovite and hornblende. In addition, garnet, sillimanite, staurolite as well as cordierite are observed in the vicinity of the Aboisso granodiorite intrusion;
– the tuffaceous schists correspond to detrital arenaceous rocks which are interbedded with graphitic beds. The latter probably derived from pyritic clays rich in organic matter. These tuffaceous schists outcrop in the eastern part of the Aféma shear zone and increase in thickness further east towards the border with Ghana;
– the orthoschists correspond to dark green metavulcanites, rich in chlorite, hornblende and biotite, and outcropping in the western part of the Aféma shear zone near Akressi and Bouègne;
– the granitic plutonites are represented by the amphibole-bearing granodiorite of the Aboisso region, which outcrops over a 20 km × 15 km area between Ayamé in the North and Aboisso in the South, where it disappears under the Tertiary cover (Fig. 3). The rock appears dark, with a grain size changing from medium to coarse or porphyritic. The granodi-