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## RESEARCH ARTICLE

### IVORY COAST: SPECULATION ON SOME OF THE PROBLEMS WHICH A BRITISH MINING COMPANY (AMARA MINING) MAY FACE IN 2017 DUE TO THE PRESENCE OF ARTISANAL MINERS

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#### ABSTRACT

According to the general research, approximately 35% of the national territory is rich in gold. The vast mineral potential in Ivory Coast (Cote d'Ivoire) could increase the mining sector's contribution to the national GDP in the future years beyond 5%. The political unrest due to the rebellion in 2002 and the post electoral crisis from December 2010 to April 2011 has been a brake on development of all economic activities in Ivory Coast, especially in the mining sector. Nowadays the government of Ivory Coast has begun to take an interest in the mining sector in order to diversify its economy since it had been all along based on agriculture. Although several mineral deposits remain undeveloped and unexploited, some mineral deposits such as Angovia, Tongon, Ity, Bonikro etc. have been detected and put into development. This paper is focused on some problems which the British mining company (Amara mining) in Angovia gold mines may face in 2017 due to the presence of thousands of artisanal miners across country.

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## INTRODUCTION

### General view on gold mines in Ivory Coast

The gold mine activities in Ivory Coast are classified into 3 categories: The Tongon Mine operated by the United Kingdom Company known as Randgold Resources Ltd. in the northern part of the country. It produces 7,800 kgs of gold per year with more than 1,500 employees and majority of them are national citizens. Ity Mine in the west being operated by a national company known as Société des Mines d'Ity (SMI) and Mancha Resources operated by a Canadian company which envisages to produce more than 2,000 kg of gold in the next few years (Fig. 2). And then Bonikro Mine operated by the Australian mining company known as Newcrest Mining Ltd. in the south-central. Agbaou gold mine operated by ENDEAVOR and Sissingue gold mine operated by OCCIDENTAL GOLD constitute the 2 developing gold mines and Afema gold ore is the only advanced mining project existing (Cluff Gold plc, 2012, Newcrest Mining Ltd., 2012, 2011, La Mancha resources Inc., 2012, 2011, Randgold resources Ltd., 2012, 2011) (Fig. 1).

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For several years in Ivory Coast, all above mentioned companies have been facing some problems during the mineral exploration. Today the steps taken by the Government to consolidate peace and to restore security are likely to attract mining exploration companies to the country. Gold production in Ivory Coast undergoes considerable increase each year and this is a good sign for the mining sector development and the national GDP growth (Fig.1). Several mining sites in Ivory Coast remain undiscovered or undeveloped and some exploited sites have sometimes been abandoned by the operators. The existence of many undeveloped mining sites is due to the lack of the high technology in the mining sector in Ivory Coast. The problem of security, land issues and the lack of enough funds are the main problems which lead to abandoning of the mining sites by operators. The Chinese mining company CGM (China National Geological and Mining Corp) which invested \$20 million and was in charge of exploiting the manganese at Lozhoua stopped the mining activities because of insecurity during the post-electoral crisis from 2010 to 2011. The Chinese workers have returned back to China and the locals lost their jobs. In fact the diamond of Ivory Coast was under UN embargo in 2005. Before the government of Ivory Coast did not pay much attention to the diamonds due to the fact that the diamond production is really minor in the national GDP compared to cocoa and coffee products.

The sector appeared neglected. As a result the rebels were involved in diamond trafficking. The local people, foreigners including children moved into the sector of the diamond-mining. The mineral was exploited illegally in the northern, western parts of Ivory Coast. Therefore, the diamond-mining sector generated a major security issue for Ivory Coast. According to the resolution of the UN and the requirements of the KP (Kimberley Process) the country was considered non-compliant. In order to ensure the safety of goods and people the UN had obtruded on Ivory Coast an embargo on the marketing of diamonds. (United Nations. Resolution 1528 (2004); United Nations. Resolution 2045 (2012); Ogwang Tom, 2011). Today, the UN embargo in 2005 on the marketing of diamonds has been lifted, which is an indication of an absolute peace in the country. This is due to the fact that the government's efforts to ensure the safety of goods and the people in Ivory Coast is effective and Conform to the principles of the Kimberley Process.(UN Security, 2014).

This has categorically changed their living standards. In most of the artisanal mining sites, the problem of race, religion and ethnicity does not matter, only the skills and the qualifications of miners are paramount. This easily explains the presence of several nationalities in artisanal gold sites (Bryceson and Jonsson 2009, Nyame et al., 2010). One major fact is that the miners are often not easily identified and even not regarded by the mining companies as some are there just periodically.

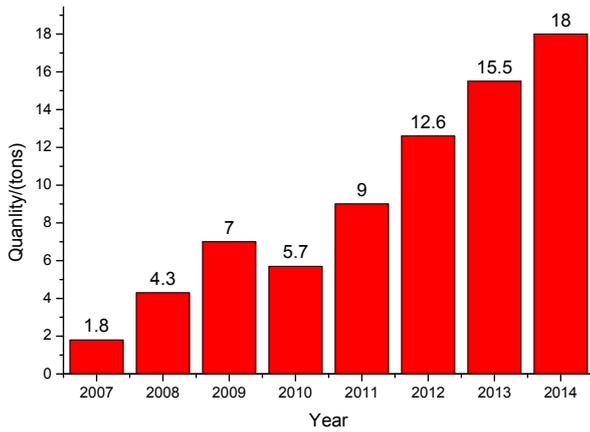
The majority of those gold miners in the west (Ity Gold mines) and the northeast (Tongon gold mines) like in others countries (Ghana, Guinea, Burkina Faso, Mali...) are traders and farmers (e.g. Cartier and Bürge 2011, Maconachie 2011). The high fertility rate in Africa (Cote d'Ivoire nearly 80% in 2018) and the increasing poverty rate of the population are the basis of the presence of young children in the artisanal gold mines. These children who were made orphans during the rebellion in 2002 and the post electoral crisis find the daily bread and fondness in gold mining sites.



Fig.1. Some gold mines in Ivory Coast (Mines, 2014) (Mines, 2013)

The artisanal gold mining in western Africa (Ivory Coast, Mali, Guinea, Ghana...) has become a key menace. Young, minors and the old, all engaged in these activities that although reported better than agricultural activity, it is still a high-risk activity because of pollution and environmental degradation and the loss of human life; about ten people die each year in the gold mines (Bolay, 2013). Recently, extensive studies have shown that gold miners have increased in number because of the artisanal mining activities.

Throughout Africa, most of these children are the bread winners of their families (African Economic Outlook, 2013, Carisch, 2012). Like all other precious metals, Gold is used for Jewelry and manufacturing in Ivory Coast (SODEMI, 2013) and today the production of gold in Ivory Coast is on ascendancy, it reached 18 tons in 2014 (Fig. 2) and it will reach 20 tons next year (Economie Jeune Afrique, 2014). After reviewing above literature we have come to know that artisanal gold mines activities phenomenon does exist all over the



**Fig. 2. Gold mine Production in Ivory Coast (Source SODEMI, Mieu, 2014)**

world, and a good new mining code can be an efficient tool in mining exploration, therefore the main objective of this study is to explore and find out how the Amara mining company which is going to operate the Agbovia gold mine in 2017 will solve unemployment, health, poverty, conflict problems in the mining sector.

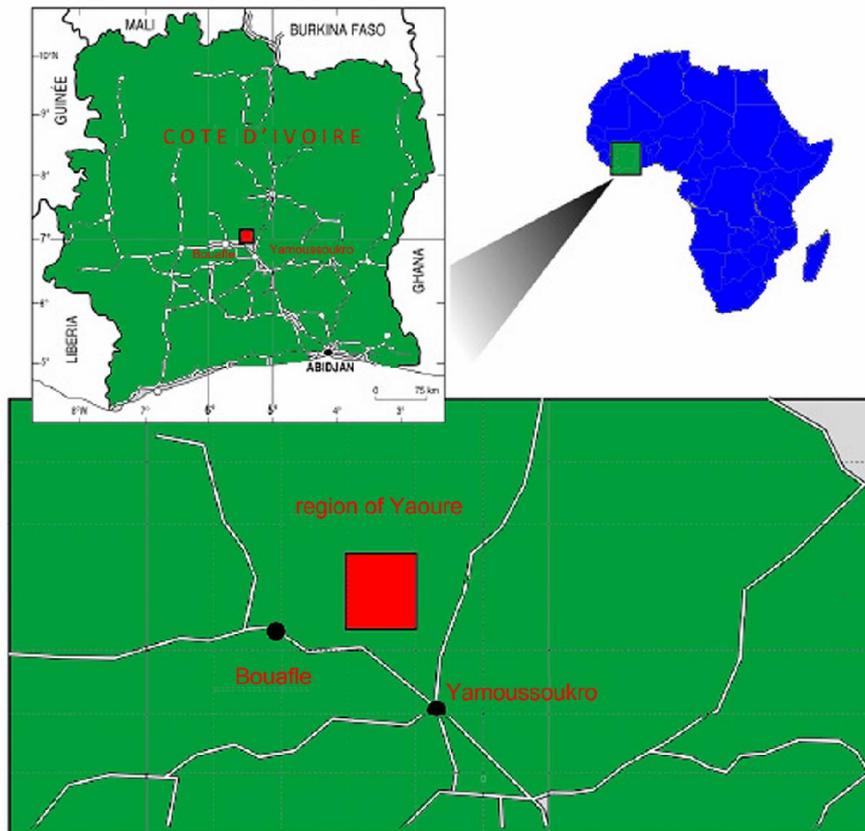
**Description of Angovia gold mine site**

The Angovia gold mine which is the main interest in this paper was detected due to the actively effort of the government of Ivory Coast supported by some organs such as the CURAT (University Centre for Research and Application in Remote Sensing) and CMA (Africa Mining Company).

The mining companies mentioned above had actively defined a research focused on mining. The geographic information systems (GIS) and the modern remote sensing were the different tools which had been used to evaluate the mineral potential in the region of Yahoure (Mines, 2013). The CMA has the main dream to find several other important mining deposits before closing the first open pit gold mine which started operating since 1998 in Angovia. Therefore many geological researches will be done on the gold mining site by the companies. Feybesse in 2000 had detected the existence of the gold ore after research at Angovia and that gold is concentrated in North-South direction (NS).

This remains insignificant; more researches should be deeply done to discover the real mining potential in this area. Angovia is located in central part of Ivory Coast, close to the political capital Yamoussoukro (Fig. 3). Angovia is part of the “Reigion des Lacs” in the district of Yaouré. Bouaflé is the sub-prefecture of Angovia. The vegetation of Angovia is composed of savannah and forest. Due to the fact that most of the local population of Angovia are farmers, the forest of Angovia has been highly deteriorated.

The cultivation of cocoa, coffee, yams and bananas is very intense in this region. The relief of Angovia comprises of two types. A mountainous part known as “Yaoure Mountain” is a block with several hills and a flat part. The altitudes of the hill are varying between 180 m and 400 m. The river Bandama is one of the natural gifts in this area which led to mining transportation facilities. And the government of Ivory Coast building the hydroelectric dam called Koussou.



**Fig. 3. The location of Angovia (Mines, 2014)**

## Discussion- Angovia gold mine (Ivory Coast)

Ivory Coast in the western part of Africa is a privilege destination for artisanal miners. Thousands foreigners and citizens are involved into the artisanal and Small-scale mining (ASM). In Ivory Coast, artisanal and Small-scale Mining (ASM) can be seen as “illegal gold mining” due to the fact that most of the miners involved into the ASM don't have proper required licenses. Foreigners and indigenou are mining illegally in many parts of the country by communities, groups or even individuals. Due to the fact that miners are using physical labour and unsophisticated techniques instead of high technology or maximum machinery, this informal mining activity (ASM) has lot consequences such as death of miners and recurrent conflict between miners and local people. The main problem is how the government and the British mining company (Amara mining) can deal with the artisanal miners who are mining at ANGOVIA region in order to do not affect the operations of gold mining by Amara mining.

### Local people and abject poverty

The high rate of poverty and unemployment in Ivory Coast is one of the main reasons that many people rely on ASM for income and better life (Bavier, 2015). Recently populations especially farmers are moving from the cocoa plantations or selling their plantations to the artisanal gold mining because the ASM is more lucrative. The current price of gold in Ivory Coast is around 14000 CFA like \$25 per gram (\$1-550 CFA (Reuters, 2015). The price of cocoa and coffee is too low comparing to the gold mine price, 2038 F CFA (\$3.5) per gram for cocoa and 987 F CFA per gram (\$1.7) for coffee. In order to encourage the local people and farmers to go back to their cocoa and coffee plantations, the government should increase the price of agricultural products. And also solve the repartition of lands problem. The mines close to the river and road can be granting the Amara mining company due to ease of transportation. The favorable part agricultural will be destined to the farmers. As long as the price of agricultural products will be increased and stable, the poverty of local people will be reduced then they will not be involved into artisanal mining activities because they are conscientious of the diverse risks of being in illegal mining sites.

### Marketing issue

The government has to promote the importance of the British mining company (Amara mining) in Angbovia. Population will see the immediate and further benefit of this new modern mining company because some problems including environmental protections, health care and unsafe measures, the mortality rate in mines will greatly reduce and the problems according to land issues will be will be solved. Roads, hospitals, schools will be built in the region. The mortality rate in mines will greatly reduce. Children will leave illegal mining activities to schools; some local people can be occasional or seasonal workers and learn the new advanced mining technology. The local people will not be in conflict with the company's staffs as Amara mining company will get the required licenses and permits in due process The lifetime of the mines in Angovia is estimated to be around 12 years but Amara would like that the exploitation phase be 20 years.

This extending of 8 years is possible. And Amara's gold mines will be able to stay as long as it is possible to exploit gold in Ivory Coast to mining due to the good relationship between miners and local people. Amara's mining company in angbovia gold mine will therefore rely on establishing the geological maps for further discoveries of natural resources in Ivory Coast. The operations process and activities in Angovia will lead to a high evolution in Ivory Coast's mining industry due to the transparency. All the transactions will be transparent and efficient. Amara mining company will stay and involve itself in the Ivory Coast mining sector for several years. The government of Ivory Coast will benefit from taxes and royalties to increase the national GDP. The government will grant to issue many licenses. The mining sector will be revaluated. The artisanal mining since the country Independence's Day in 1960 will be changed into modernized sector like the other developed countries such as Australia, Canada, and USA etc...

### Security issue

The government has to control and secure all the national territory especially in the region of Angbovia in order to ensure the safety of goods and miners. In this part of Ivory Coast all illegal miners must be identified and registered. The local people must connive with the current government to track the people who are mining illegally. As a result Amara mining will operate in a cordial environment and even some farmers will be educated and integrated into mining activities. The exploitation of minerals will be easy because the new technology will replace the old equipment. The children will not be allowed to participate in mining activities but rather more schools will be put in place for these children to attend to. Amara mining company will respect the rights of people.

2.3 Low cost of gold production. An another pertinent problem revealed by Amara mining in Angovia gold mines is about the low cost of the mineral product. Currently the price of gold is around \$ 1,217 an ounce, but the cost of gold production of the Angovia gold mine will be around \$ 1,000 an ounce. The problem has a great concern due to the poor quality of the gold produced (Randgold resources Ltd., 2012, 2011, Ministère des Mines, du Pétrole et de l'énergie, 2012).

**Table 1. Full mud cyanidation test results**

Ore type	Raw ore gold grade (g / t)	Gold grade of leached dust(g / t)	Gold leaching rate (%)
Oxidized ore	2.59	0.55	78.46
Primary ore	1.02	0.19	72.99

**Table 2. Measurement Results of Gold Mineral Contents**

Gold mineral	Free gold	Electrum	Total
Relative content (%)	93	7	100.00

The main metal minerals in the ores are limonite, jarosite and the main vein mineral is quartz, according to several process mineralogy studies. Ore oxidation rate is 78.46% and gold content is 2.59/t. The mineral species of gold in ores is mainly free gold, accounting for 72.99% (Table 1 and 2).

The analysis of gold mineral composition and purity at Angbovia (Ivory Coast) shown that the main composition of gold mineral in the ores is free gold, which accounts for 93%. The average purity of gold is 893.2‰; electrum is in the second place, accounting for 7% and its average purity is 681.5‰. Measurement results of gold mineral composition are listed in Table 2, beneficial to improve the further production of gold. The extensive research will reach to locate some other places around Angbovia where the gold is good quality and this will lead to increase in the purchase price. The annual gold production and the cost of the gold will be greatly estimated during the exploration and developing phases of the mining operation into the evaluation of the mining condition.

## RESULTS

As result, the Gold product in Ivory Coast will attract the buyers. The buyers will not hesitate to invest much funds in the country's gold production. Ivory Coast can be the largest gold producer in West Africa and will rank a great position among the whole of Africa. The economy of Ivory Coast will be greatly boosted. The government will use the funds from the mining sector to solve some main problems such insecurity, poor health care conditions, poor education etc... The local people will have better standards of living because most of the workers who will work in the mining sector will be indigenous as notified in the new mining code. The mining sector will actively be interested in the developed countries' investors. There will be an invasion of foreign investors into the Ivory Coast mining Industry. The economy of Ivory Coast will grow rapidly like China. The local people who lost their jobs during the political unrest will be reintegrated. The Abject poverty will be reduced. The ASM can negatively affect the operation of many foreign investors especially Amara mining but a good management structure of the new mining code with its well-designed, implemented and maintained will play an essential role in the success of any mining operation in Ivory Coast. The current government should carry out the new mining code because it leads to a proper exploration development and will increase the mining activities in Ivory Coast and especially will help Amara mining company which had already invested \$400 million in Angovia gold mine to solve further problems (Mines, 2013).

## Conclusion

Angovia gold mine is the largest gold mining company in Ivory Coast. The discovery of this gold deposit will actively play a main role in the country's economy. Our suggestions of managing the ASM in the present paper showed that Amara mining company can definitely stay in Ivory Coast and explore many other undiscovered or undeveloped gold mine deposits. New extension gold deposits will be located. The costs of Ivory Coast's gold will be higher than \$1,000 an ounce. Some major problems such as poor education, land conflicts, environment degradation, abject poverty of local population, etc. will be reduced. The region of Angovia will be one of the rich parts of Ivory Coast. Specifically, we were recommended that the current government Ivory Coast needs to strengthen staff training, carry out the new mining code and if possible build modern geological infrastructures and create a Mineral

Resources processing company in Ivory Coast. This is exactly what this paper suggests to the government of Ivory Coast to do in the mining sector because vast area and many mining deposits are unexplored. The government should put a considerable part of the borrowed money and the country's income into the basic research. The Government itself, the vibrant scientific community and the local people of Ivory Coast will benefit greatly from the advantages.

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